



# Advanced Excel Functions

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## About the Tutorial

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This Microsoft Excel tutorial teaches you how to create and use Excel functions. You can use Excel functions to perform various mathematical, statistical, logical calculations. This tutorial takes you step-by-step through the process.

## Audience

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This tutorial is intended for people who use Excel but are intimidated by the concept of formulas and functions.

## Prerequisites

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This tutorial assumes your familiarity with basic formulas for calculations in Excel.

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# Compatibility Functions

# 1. Compatibility Functions – Overview

In Excel 2010 or later, the functions listed in this category were replaced with new functions that provide improved accuracy and have names that reflect their usage better. The new functions can be found in Statistical functions and Math and trigonometry functions. If backward compatibility is not required, you should start using the new functions.

You can still use these earlier versions of functions for compatibility with earlier versions of Excel. If you are using Excel 2007, you will find these functions in the Statistical or Math & Trig categories on the Formulas tab.

## Compatibility Functions

The following table lists all the Compatibility functions-

S. No.	Function and Description
1	BETADIST Returns the cumulative beta probability density function
2	BETAINV Returns the inverse of the cumulative beta probability density function
3	BINOMDIST Returns the individual term binomial distribution probability
4	CEILING Rounds a number to the nearest integer or to the nearest multiple of significance
5	CHIDIST Returns the one-tailed probability of the chi-squared distribution
6	CHIINV Returns the inverse of the one-tailed probability of the chi-squared distribution
7	CHITEST Returns the test for independence
8	CONFIDENCE Returns the confidence interval for a population mean
9	COVAR Returns covariance, the average of the products of paired deviations
10	CRITBINOM Returns the smallest value for which the cumulative binomial distribution is less than or equal to a criterion value
11	EXPONDIST Returns the exponential distribution
12	FDIST Returns the F probability distribution

S. No.	Function and Description
13	FINV Returns the inverse of the F probability distribution
14	FLOOR Rounds a number down, toward 0
15	FTEST Returns the result of an F-Test
16	GAMMADIST Returns the gamma distribution
17	GAMMAINV Returns the inverse of the gamma cumulative distribution
18	HYPGEOMDIST Returns the hypergeometric distribution
19	LOGINV Returns the inverse of the lognormal distribution
20	LOGNORMDIST Returns the cumulative lognormal distribution
21	MODE Returns the most common value in a data set
22	NEGBINOMDIST Returns the negative binomial distribution
23	NORMDIST Returns the normal cumulative distribution
24	NORMINV Returns the inverse of the normal cumulative distribution
25	NORMSDIST Returns the standard normal cumulative distribution
26	NORMSINV Returns the inverse of the standard normal cumulative distribution
27	PERCENTILE Returns the kth percentile of values in a range
28	PERCENTRANK Returns the percentage rank of a value in a data set
29	POISSON Returns the Poisson distribution
30	QUARTILE Returns the quartile of a data set
31	RANK Returns the rank of a number in a list of numbers
32	STDEV Estimates standard deviation based on a sample, ignoring text and logical values

S. No.	Function and Description
33	STDEVP Calculates standard deviation based on the entire population, ignoring text and logical values
34	TDIST Returns the student's t-distribution
35	TINV Returns the inverse of the student's t-distribution
36	TTEST Returns the probability associated with a student's t-Test
37	VAR Estimates variance based on a sample, ignoring logical values and text
38	VARP Calculates variance based on the entire population, ignoring logical values and text
39	WEIBULL Returns the Weibull distribution
40	ZTEST Returns the two-tailed P-value of a z-test

## 2. BETADIST Function

The BETADIST function replaces the BETA.DIST function from Excel 2010.

### Description

This function returns the cumulative beta probability density function. The beta distribution is commonly used to study variation in the percentage of something across samples.

### Syntax

```
BETADIST(x,alpha,beta,[A],[B])
```

### Arguments

Argument	Description	Required /Optional
X	The value between A and B at which to evaluate the function.	Required
Alpha	A parameter of the distribution.	Required
Beta	A parameter of the distribution.	Required
A	A lower bound to the interval of x.	Optional
B	An upper bound to the interval of x.	Optional

### Notes

- If any argument is nonnumeric, BETADIST returns the #VALUE! error value.
- If alpha ≤ 0 or beta ≤ 0, BETADIST returns the #NUM! error value.
- If x < A, x > B, or A = B, BETADIST returns the #NUM! error value.
- If you omit values for A and B, BETADIST uses the standard cumulative beta distribution, so that A = 0 and B = 1

### Example

Function Usage			Results		
A	B	C	A	B	C
2	x	10	2	x	10
3	Alpha	0.08	3	Alpha	0.08
4	Beta	0.03	4	Beta	0.03
5	A	7	5	A	7
6	B	14	6	B	14
7	Beta Distribution Value	=BETADIST(C2,C3,C4,C5,C6)	7	Beta Distribution Value	0.27
8			8		

### 3. BETAINV Function

The BETAINV function replaces the BETA.INV function from Excel 2010.

#### Description

The function returns the inverse of the cumulative beta probability density function for a specified beta distribution. i.e.

If  $\text{probability} = \text{BETADIST}(x...)$ , then  $\text{BETAINV}(\text{probability}\dots) = x$

The beta distribution can be used in project planning to model probable completion times given an expected completion time and variability.

#### Syntax

```
BETAINV (probability,alpha,beta,[A],[B])
```

#### Arguments

Argument	Description	Required /Optional
Probability	A probability associated with the beta distribution.	Required
Alpha	A parameter of the distribution.	Required
Beta	A parameter of the distribution.	Required
A	A lower bound to the interval of x.	Optional
B	An upper bound to the interval of x.	Optional

#### Notes

- If you omit values for A and B, BETAINV uses the standard cumulative beta distribution, so that A = 0 and B = 1
- If any argument is nonnumeric, BETAINV returns the #VALUE! error value.
- If alpha ≤ 0 or beta ≤ 0, BETAINV returns the #NUM! error value.
- If probability ≤ 0 or probability > 1, BETAINV returns the #NUM! error value.
- Given a value for probability, BETAINV seeks that value x such that BETADIST(x, alpha, beta, A, B) = probability. Hence, precision of BETAINV depends on precision of BETADIST

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Probability	0.27	2	Probability	0.27
3	Alpha	0.08	3	Alpha	0.08
4	Beta	0.03	4	Beta	0.03
5	A	7	5	A	7
6	B	14	6	B	14
7	x	=BETAINV(C2,C3,C4,C5,C6)	7	x	10
n					

## 4. BINOMDIST Function

The BINOMDIST function replaces the BINOM.DIST function from Excel 2010.

### Description

The function returns the individual term binomial distribution probability. Use BINOMDIST in problems with a fixed number of tests or trials, when the outcomes of any trial are only success or failure, when trials are independent, and when the probability of success is constant throughout the experiment.

### Syntax

```
BINOMDIST (number_s,trials,probability_s,cumulative)
```

### Arguments

Argument	Description	Required /Optional
Number_s	The number of successes in trials.	Required
Trials	The number of independent trials.	Required
Probability_s	The probability of success on each trial.	Required
Cumulative	A logical value that determines the form of the function. <ul style="list-style-type: none"><li>• If cumulative is TRUE, then BINOMDIST returns the cumulative distribution function, which is the probability that there are at most number_s successes</li><li>• If cumulative is FALSE, then BINOMDIST returns the probability mass function, which is the probability that there are number_s successes</li></ul>	Required

### Notes

- Number\_s and trials are truncated to integers.
- If number\_s, trials, or probability\_s is nonnumeric, BINOMDIST returns the #VALUE! error value.
- If number\_s < 0 or number\_s > trials, BINOMDIST returns the #NUM! error value.
- If probability\_s < 0 or probability\_s > 1, BINOMDIST returns the #NUM! error value.

- If  $x = \text{number\_s}$ ,  $n = \text{trials}$ , and  $p = \text{probability\_s}$ , then the binomial probability mass function is-

$$b(x; n, p) = \binom{n}{x} p^x (1-p)^{n-x}$$

Where  $\binom{n}{x}$  is  $\text{COMBIN}(n, x)$ .

- If  $x = \text{number\_s}$ ,  $n = \text{trials}$ , and  $p = \text{probability\_s}$ , then the cumulative binomial distribution is:

$$B(x; n, p) = \sum_{y=0}^x b(y; n, p)$$

## Example

Function Usage			Results		
	B	C		B	C
1			1		
2	No. of Trials	1500	2	No. of Trials	1500
3	Number of Successes	135	3	Number of Successes	135
4	Probability of Success in each Trial	0.1	4	Probability of Success in each Trial	0.1
5	Cumulative	TRUE	5	Cumulative	TRUE
6	Binomial Probability	=BINOMDIST(C3,C2,C4,C5)	6	Binomial Probability	10.48%
7			-		

# 5. CEILING Function

## Description

The CEILING function returns a number rounded up, away from zero, to the nearest multiple of significance.

## Syntax

```
CEILING (number, significance)
```

## Arguments

Argument	Description	Required /Optional
Number	The value you want to round.	Required
Significance	The multiple to which Number is to be rounded.	Required

## Notes

- Regardless of the sign of number, a value is rounded up when adjusted away from zero. If the number is an exact multiple of significance, no rounding occurs.
- If the number is negative, and significance is negative, the value is rounded down, away from zero.
- If the number is negative, and significance is positive, the value is rounded up towards zero.
- If either argument is nonnumeric, CEILING returns the #VALUE! error value.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016.

## Example

Function Usage			Results		
	A	B		A	B
1				1	
2	Number	Rounded To	2	Number	Rounded To
3	2.1	=CEILING(B3,1)	3	2.1	3
4	1.5	=CEILING(B4,1)	4	1.5	2
5	-1.5	=CEILING(B5,1)	5	-1.5	-1
6	150	=CEILING(B6,30)	6	150	150
7	25	=CEILING(B7,30)	7	25	30
8	40	=CEILING(B8,30)	8	40	60
9	-25	=CEILING(B9,30)	9	-25	0
10	-25	=CEILING(B10, 1)	10	-25	-25
11	-25	=CEILING(B11,0)	11	-25	0
12	-25	=CEILING(B12, -30)	12	-25	-30
13	10	=CEILING(B13, -30)	13	10	#NUM!
14	10	=CEILING(B14, "C")	14	10	#VALUE!
15					

# 6. CHIDIST Function

The CHIDIST function replaces the CHISQ.DIST.RT function from Excel 2010.

## Description

The function returns the right-tailed probability of the chi-squared distribution. The  $\chi^2$  distribution is associated with a  $\chi^2$  test. Use the  $\chi^2$  test to compare the observed and the expected values. By comparing the observed results with the expected ones, you can decide whether your original hypothesis is valid.

## Syntax

```
CHIDIST(x,deg_freedom)
```

## Arguments

Argument	Description	Required /Optional
X	The value at which you want to evaluate the distribution.	Required
Deg_freedom	The number of degrees of freedom.	Required

## Notes

- CHIDIST is calculated as  $\text{CHIDIST} = P(X > x)$ , where X is a  $\chi^2$  random variable.
- If deg\_freedom is not an integer, it is truncated.
- If either argument is nonnumeric, CHIDIST returns the #VALUE! error value.
- If x is negative, CHIDIST returns the #NUM! error value.
- If deg\_freedom < 1 or deg\_freedom > 10^10, CHIDIST returns the #NUM! error value.

## Example

Function Usage			Results
A	B	C	
1			
2	X	Deg of Freedom	
3	10	4	
4	Right-tailed Probability	=CHIDIST(B3,C3)	
A	B	C	
1			
2	X	Deg of Freedom	
3	10	4	
4	Right-tailed Probability	0.04	
=			

# 7. CHIINV Function

The CHIINV function replaces the CHISQ.INV.RT function in Excel 2010.

## Description

The function returns the inverse of the right-tailed probability of the chi-squared distribution.

If probability = CHIDIST(x...), then CHIINV (probability...) = x

Use this function to compare the observed results with the expected ones in order to decide whether your original hypothesis is valid.

## Syntax

```
CHIINV (probability,deg_freedom)
```

## Arguments

Argument	Description	Required /Optional
Probability	A probability associated with the chi-squared distribution.	Required
Deg_freedom	The number of degrees of freedom.	Required

## Notes

- If deg\_freedom is not an integer, it is truncated.
- If either argument is nonnumeric, CHIINV returns the #VALUE! error value.
- If probability < 0 or probability > 1, CHIINV returns the #NUM! error value.
- If deg\_freedom < 1, CHIINV returns the #NUM! error value.
- Given a value for probability, CHIINV seeks value x such that CHIDIST(x, deg\_freedom) = probability. Hence, precision of CHIINV depends on precision of CHIDIST. CHIINV uses an iterative search technique. If the search has not converged after 100 iterations, the function returns the #N/A error value.

## Example

Function Usage			Results		
	A	B		A	B
1				1	
2	Probability	0.04	2	Probability	0.04
3	Deg of Freedom	4	3	Deg of Freedom	4
4	Chi-Square Value	=CHIINV(C2,C3)	4	Chi-Square Value	10

## 8. CHITEST Function

The CHITEST function replaces the CHISQ.TEST function in Excel 2010.

### Description

The function returns the test for independence. CHITEST returns the value from the chi-squared ( $\chi^2$ ) distribution for the statistic and the appropriate degrees of freedom. You can use  $\chi^2$  tests to determine whether hypothesized results are verified by an experiment.

### Syntax

```
CHITEST (actual_range,expected_range)
```

### Arguments

Argument	Description	Required /Optional
Actual_range	The range of data that contains observations to test against expected values.	Required
Expected_range	The range of data that contains the ratio of the product of row totals and column totals to the grand total.	Required

### Notes

- The  $\chi^2$  test first calculates a  $\chi^2$  statistic using the formula-

$$\chi^2 = \sum_{i=1}^r \sum_{j=1}^c \frac{(A_{ij} - E_{ij})^2}{E_{ij}}$$

Where-

$A_{ij}$  = actual frequency in the i-th row, j-th column

$E_{ij}$  = expected frequency in the i-th row, j-th column

$r$  = number of rows

$c$  = number of columns

- A low value of  $\chi^2$  is an indicator of independence. As can be seen from the formula,  $\chi^2$  is always positive or 0, and is 0 only if  $A_{ij} = E_{ij}$  for every i,j.
- CHITEST returns the probability that a value of the  $\chi^2$  statistic at least as high as the value calculated by the above formula could have happened by chance under the assumption of independence. In computing this probability, CHITEST uses the  $\chi^2$  distribution with an appropriate number of degrees of freedom, df. If  $r > 1$  and  $c > 1$ , then  $df = (r - 1)(c - 1)$ . If  $r = 1$  and  $c > 1$ , then  $df = c - 1$  or if  $r > 1$  and  $c = 1$ , then  $df = r - 1$ . ( $r = c = 1$ ) is not allowed and #N/A is returned.
- If actual\_range and expected\_range have a different number of data points, CHITEST returns the #N/A error value.

- Use of CHITEST is most appropriate when the values of  $E_{ij}$  are not too small. Some statisticians suggest that each  $E_{ij}$  should be greater than or equal to 5.

### Example

Function Usage					Results				
A	B	C	D	E	A	B	C	D	E
1					1				
2	Actual Range		Expected Range		2	Actual Range		Expected Range	
3	3738	4704	3461	4981	3	3738	4704	3461	4981
4	1494	2827	1771	2550	4	1494	2827	1771	2550
5	5232	7531	5232	7531	5	5232	7531	5232	7531
6	Test for Independence		=CHITEST(B3:C5,D3:E5)		6	Test for Independence		7.92589E-25	

# 9. CONFIDENCE Function

## Description

The CONFIDENCE function returns the confidence interval for a population mean, using a normal distribution.

The confidence interval is a range of values. Your sample mean,  $x$ , is at the center of this range and the range is  $x \pm \text{CONFIDENCE}$ . For any population mean  $\mu_0$ , in this range, the probability of obtaining a sample mean further from  $\mu_0$  than  $x$  is greater than alpha.

For any population mean,  $\mu_0$ , not in this range, the probability of obtaining a sample mean further from  $\mu_0$  than  $x$  is less than alpha.

In other words, assume that we use  $x$ , standard\_dev, and size to construct a two-tailed test at significance level alpha of the hypothesis that the population mean is  $\mu_0$ . Then we will not reject that hypothesis if  $\mu_0$  is in the confidence interval and will reject that hypothesis if  $\mu_0$  is not in the confidence interval.

The confidence interval does not allow us to infer that there is probability  $1 - \alpha$  that our next package will take a delivery time that is in the confidence interval.

## Syntax

```
CONFIDENCE (alpha,standard_dev,size)
```

## Arguments

Argument	Description	Required /Optional
Alpha	The significance level used to compute the confidence level. The confidence level equals $0.05*(1 - \alpha)\%$ , or in other words, an alpha of 0.05 indicates a 95 percent confidence level.	Required
Standard_dev	The population standard deviation for the data range and is assumed to be known.	Required
Size	The sample size.	Required

## Notes

- If we assume Alpha equals 0.05, we need to calculate the area under the standard normal curve that equals  $(1 - \alpha)$ , or 95 percent. This value is  $\pm 1.96$ . The confidence interval is therefore-

$$\bar{x} \pm 1.96 \left( \frac{\sigma}{\sqrt{n}} \right)$$

- If Size is not an integer, it is truncated.

- If any argument is non-numeric, CONFIDENCE returns the #VALUE! error value.
- If Alpha is  $\leq 0$  or  $\geq 1$ , CONFIDENCE returns the #NUM! error value.
- If Standard\_dev  $\leq 0$ , CONFIDENCE returns the #NUM! error value.
- If Size < 1, CONFIDENCE returns the #NUM! error value.

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Alpha	0.05	2	Alpha	0.05
3	Population Standard Deviation	22	3	Population Standard Deviation	22.00
4	Sample Size	16	4	Sample Size	16
5	Confidence Interval	=CONFIDENCE(C2,C3,C4)	5	Confidence Interval	10.78

# 10. COVAR Function

The COVAR function in Excel 2013 replaces the COVARIANCE.P function in Excel 2010.

## Description

The function returns covariance, the average of the products of deviations for each data point pair in two data sets. Use covariance to determine the relationship between two data sets.

## Syntax

```
COVAR (array1, array2)
```

## Arguments

Argument	Description	Required /Optional
Array1	The first cell range of integers.	Required
Array2	The second cell range of integers.	Required

## Notes

- Covariance is given by-

$$Cov(X,Y) = \frac{\sum(x - \bar{x})(y - \bar{y})}{n}$$

- Where  $\bar{x}$  and  $\bar{y}$  are the sample means of AVERAGE (array1) and AVERAGE (array2), and n is the sample size.
- The arguments must be either numbers, names, arrays, or references that contain numbers.
- The values of an array or reference argument containing text, logical values, or empty cells are ignored. However, cells with the value zero are included.
- If array1 and array2 have different numbers of data points, COVAR returns the #N/A error value.
- If either of the arrays, array1 or array2 is empty, COVAR returns the #DIV/0! error value.

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Array1	Array2	2	Array1	Array2
3	30	19	3	30	19
4	25	17	4	25	17
5	40	45	5	40	45
6	55	50	6	55	50
7	75	16	7	75	16
8	Result	=COVAR(B3:B7,C3:C7)	8	Result	26

# 11. CRITBINOM Function

The CRITBINOM function replaces the BINOM.INV function in Excel 2010.

## Description

The function returns the smallest value for which the cumulative binomial distribution is greater than or equal to a criterion value. Use this function for quality assurance applications.

## Syntax

```
CRITBINOM (trials,probability_s,alpha)
```

## Arguments

Argument	Description	Required /Optional
Trials	The number of Bernoulli trials.	Required
Probability_s	The probability of a success on each trial.	Required
Alpha	The criterion value.	Required

## Notes

- If trials is not an integer, it is truncated.
- If any argument is nonnumeric, CRITBINOM returns the #VALUE! error value.
- If trials < 0, CRITBINOM returns the #NUM! error value.
- If probability\_s is < 0 or probability\_s > 1, CRITBINOM returns the #NUM! error value.
- If alpha < 0 or alpha > 1, CRITBINOM returns the #NUM! error value.

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Trials	6	2	Trials	6
3	Probability of Success	0.5	3	Probability of Success	0.5
4	Alpha	0.75	4	Alpha	0.75
5	Result	=CRITBINOM(C2,C3,C4)	5	Result	4

# 12. EXPONDIST Function

The EXPONDIST function in Excel 2013 replaces the EXPON.DIST function in Excel 2010.

## Description

The function returns the exponential distribution. Use EXPONDIST to model the time between events, such as how long an automated bank teller takes to deliver cash.

## Syntax

```
EXPONDIST(x,lambda,cumulative)
```

## Arguments

Argument	Description	Required /Optional
X	The value of the function.	Required
Lambda	The parameter value.	Required
Cumulative	A logical value that indicates which form of the exponential function to provide.  If cumulative is TRUE, EXPONDIST returns the cumulative distribution function.  If cumulative is FALSE, EXPONDIST returns the probability density function.	Required

## Notes

- If x or lambda is nonnumeric, EXPONDIST returns the #VALUE! error value.
- If x < 0, EXPONDIST returns the #NUM! error value.
- If lambda ≤ 0, EXPONDIST returns the #NUM! error value.
- The equation for the probability density function is-

$$f(x; \lambda) = \lambda e^{-\lambda x}$$

- The equation for the cumulative distribution function is-

$$F(x; \lambda) = 1 - e^{-\lambda x}$$

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	x	0.17	2	x	0.17
3	Lambda	20	3	Lambda	20
4	Cumulative	TRUE	4	Cumulative	TRUE
5	Exponential Distribution Value	=EXPONDIST(C2,C3,C4)	5	Exponential Distribution Value	0.97

# 13. FDIST Function

The FDIST function replaces the F.DIST.RT function in Excel 2010.

## Description

The function returns the (right-tailed) F probability distribution (degree of diversity) for two data sets. You can use this function to determine whether two data sets have different degrees of diversity.

## Syntax

```
FDIST(x,deg_freedom1,deg_freedom2)
```

## Arguments

Argument	Description	Required /Optional
X	The value at which to evaluate the function.	Required
Deg_freedom1	The numerator degrees of freedom.	Required
Deg_freedom2	The denominator degrees of freedom.	Required

## Notes

- FDIST is calculated as

$$\text{FDIST} = P(F > x)$$

Where F is a random variable that has an F distribution with deg\_freedom1 and deg\_freedom2 degrees of freedom.

- If deg\_freedom1 or deg\_freedom2 is not an integer, it is truncated.
- If any argument is nonnumeric, FDIST returns the #VALUE! error value.
- If x is negative, FDIST returns the #NUM! error value.
- If deg\_freedom1 < 1 or deg\_freedom1 ≥ 10^10, FDIST returns the #NUM! error value.
- If deg\_freedom2 < 1 or deg\_freedom2 ≥ 10^10, FDIST returns the #NUM! error value.

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	X	2.6	2	X	2.60
3	Degrees of Freedom1	19	3	Degrees of Freedom1	19
4	Degrees of Freedom2	19	4	Degrees of Freedom2	19
5	F Probability	=FDIST(C2,C3,C4)	5	F Probability	0.02

# 14. FINV Function

The FINV function replaces the by F.INV.RT function in Excel 2010.

## Description

The function returns the inverse of the (right-tailed) F probability distribution.

If  $p = \text{FDIST}(x\dots)$ , then  $\text{FINV}(p\dots) = x$ .

The F distribution can be used in an F-test that compares the degree of variability in two data sets.

## Syntax

```
FINV (probability,deg_freedom1,deg_freedom2)
```

## Arguments

Argument	Description	Required / Optional
Probability	A probability associated with the F cumulative distribution.	Required
Deg_freedom1	The numerator degrees of freedom.	Required
Deg_freedom2	The denominator degrees of freedom.	Required

## Notes

- If any argument is nonnumeric, FINV returns the #VALUE! error value.
- If probability < 0 or probability > 1, FINV returns the #NUM! error value.
- If deg\_freedom1 or deg\_freedom2 is not an integer, it is truncated.
- If deg\_freedom1 < 1 or deg\_freedom1  $\geq 10^{10}$ , FINV returns the #NUM! error value.
- If deg\_freedom2 < 1 or deg\_freedom2  $\geq 10^{10}$ , FINV returns the #NUM! error value.
- FINV can be used to return critical values from the F distribution.
- Given a value for probability, FINV seeks that value of x such that  $\text{FDIST}(x, \text{deg\_freedom1}, \text{deg\_freedom2}) = \text{probability}$ . Hence, precision of FINV depends on the precision of FDIST. FINV uses an iterative search technique. If the search has not converged after 100 iterations, the function returns the #N/A error value.

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Probability	0.05	2	Probability	0.05
3	Degrees of Freedom1	19	3	Degrees of Freedom1	19
4	Degrees of Freedom2	19	4	Degrees of Freedom2	19
5	Right Tailed F-Value	=FINV(C2,C3,C4)	5	Right Tailed F-Value	2.17
-			-		

# 15. FLOOR Function

## Description

The FLOOR function rounds number down, toward zero, to the nearest multiple of significance.

## Syntax

```
FLOOR (number, significance)
```

## Arguments

Argument	Description	Required /Optional
Number	The numeric value you want to round.	Required
Significance	The multiple to which you want to round.	Required

## Notes

- If the sign of number is positive, a value is rounded down and adjusted toward zero.
- If the sign of number is negative, a value is rounded down and adjusted away from zero.
- If number is an exact multiple of significance, no rounding occurs.
- If either of the arguments is nonnumeric, FLOOR returns the #VALUE! error value.
- If number is positive and significance is negative, FLOOR returns the #NUM! error value.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
	A	B		A	B
1				1	
2				2	
3	Number	Rounded Down		3	1.5
4	1.5	=FLOOR(B3,1)		4	2.3
5	2.3	=FLOOR(B4,1)		5	2.9
6	2.9	=FLOOR(B5,1)		6	3.2
7	3.2	=FLOOR(B6,1)		7	3.2
8	3.2	=FLOOR(B7,2)		8	-3.2
9	-3.2	=FLOOR(B8,2)		9	-3.2
10	-3.2	=FLOOR(B9,-2)		10	3.2
11	3.2	=FLOOR(B10,-2)		11	#NUM!
12	123	=FLOOR(B11,50)		12	123
13	150	=FLOOR(B12,50)		13	150
	175	=FLOOR(B13,50)			175

# 16. FTEST Function

The FTEST function replaces the F.TEST function in Excel 2010.

## Description

The function returns the result of an F-test. An F-test returns the two-tailed probability that the variances in array1 and array2 are not significantly different. Use this function to determine whether two samples have different variances.

## Syntax

```
FTEST (array1, array2)
```

## Arguments

Argument	Description	Required /Optional
Array1	The first array or range of data.	Required
Array2	The second array or range of data.	Required

## Notes

- The arguments must be either numbers or names, arrays, or references that contain numbers.
- If an array or reference argument contains text, logical values, or empty cells, those values are ignored. However, cells with the value zero are included.
- If the number of data points in array1 or array2 is less than 2, or if the variance of array1 or array2 is zero, FTEST returns the #DIV/0! error value.
- The F-test value that is returned by the LINEST function differs from the F-test value that is returned by the FTEST function. LINEST returns the F statistic, whereas FTEST returns the probability.

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Array1	Array2	2		
3	6	20	3	6	20
4	7	28	4	7	28
5	9	31	5	9	31
6	15	38	6	15	38
7	21	40	7	21	40
8	F-Test Value	=FTEST(B3:B7,C3:C7)	8	F-Test Value	0.64832
n			n		

# 17. GAMMADIST Function

The GAMMADIST function replaces the GAMMA.DIST function in Excel 2010.

## Description

The function returns the gamma distribution. You can use this function to study variables that may have a skewed distribution. The gamma distribution is commonly used in queuing analysis.

## Syntax

```
GAMMADIST(x,alpha,beta,cumulative)
```

## Arguments

Argument	Description	Required/Optional
X	The value at which you want to evaluate the distribution.	Required
Alpha	A parameter to the distribution.	Required
Beta	A parameter to the distribution. If beta = 1, GAMMADIST returns the standard gamma distribution.	Required
Cumulative	A logical value that determines the form of the function. If cumulative is TRUE, GAMMADIST returns the cumulative distribution function. If cumulative is FALSE, GAMMADIST returns the probability density function.	Required

## Notes

- The equation for the gamma probability density function is-

$$f(x; \alpha, \beta) = \frac{1}{\beta^\alpha \Gamma(\alpha)} x^{\alpha-1} e^{-x/\beta}$$

- The standard gamma probability density function is-

$$f(x; \alpha) = \frac{x^{\alpha-1} e^{-x}}{\Gamma(\alpha)}$$

- When alpha = 1, GAMMADIST returns the exponential distribution with:

$$\lambda = \frac{1}{\beta}$$

- For a positive integer n, when alpha = n/2, beta = 2, and cumulative = TRUE, GAMMADIST returns (1 - CHIDIST(x)) with n degrees of freedom
- If x, alpha, or beta is nonnumeric, GAMMADIST returns the #VALUE! error value.

- If  $x < 0$ , GAMMADIST returns the #NUM! error value.
- If  $\alpha \leq 0$  or if  $\beta \leq 0$ , GAMMADIST returns the #NUM! error value.
- When  $\alpha$  is a positive integer, GAMMADIST is also known as the Erlang distribution.

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	x	3	2	x	3
3	Alpha	2	3	Alpha	2
4	Beta	1	4	Beta	1
5	Cumulative	TRUE	5	Cumulative	TRUE
6	Gamma Distribution Value	=GAMMADIST(C2,C3,C4,C5)	6	Gamma Distribution Value	0.80

# 18. GAMMAINV Function

The GAMMAINV function replaces the GAMMA.INV function in Excel 2010.

## Description

The function returns the inverse of the gamma cumulative distribution.

If  $p = \text{GAMMADIST}(x, \dots)$ , then  $\text{GAMMAINV}(p, \dots) = x$

You can use this function to study a variable whose distribution may be skewed.

## Syntax

```
GAMMAINV (probability,alpha,beta)
```

## Arguments

Argument	Description	Required /Optional
Probability	The probability associated with the gamma distribution.	Required
Alpha	A parameter to the distribution.	Required
Beta	A parameter to the distribution. If beta = 1, GAMMAINV returns the standard gamma distribution.	Required

## Notes

- If any argument is text, GAMMAINV returns the #VALUE! error value.
- If probability < 0 or probability > 1, GAMMAINV returns the #NUM! error value.
- If alpha ≤ 0 or if beta ≤ 0, GAMMAINV returns the #NUM! error value.
- Given a value for probability, GAMMAINV seeks that value of x such that  $\text{GAMMADIST}(x, \alpha, \beta, \text{TRUE}) = \text{probability}$ . Hence, precision of GAMMAINV depends on precision of GAMMADIST. GAMMAINV uses an iterative search technique. If the search has not converged after 100 iterations, the function returns the #N/A error value.

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Probability	0.8	2	Probability	0.80
3	Alpha	2	3	Alpha	2
4	Beta	1	4	Beta	1
5	x	=GAMMAINV(C2,C3,C4)	5	x	3
a					

# 19. HYPGEOMDIST Function

The HYPGEOMDIST function replaces the HYPGEOM.DIST function in Excel 2010.

## Description

The function returns the hypergeometric distribution. HYPGEOMDIST returns the probability of a given number of sample successes, given the sample size, population successes, and population size.

Use HYPGEOMDIST for problems with a finite population, where each observation is either a success or a failure, and where each subset of a given size is chosen with equal likelihood.

## Syntax

```
HYPGEOMDIST (sample_s,number_sample,population_s,number_pop)
```

## Arguments

Argument	Description	Required /Optional
Sample_s	The number of successes in the sample.	Required
Number_sample	The size of the sample.	Required
Population_s	The number of successes in the population.	Required
Number_pop	The population size.	Required

## Notes

- The equation for the hypergeometric distribution is-

$$P(X = x) = h(x; n, M, N) = \frac{\binom{M}{x} \binom{N - M}{n - x}}{\binom{N}{n}}$$

Where-

x = sample\_s  
n = number\_sample  
M = population\_s  
N = number\_population

- HYPGEOMDIST is used in sampling without replacement from a finite population.
- All arguments are truncated to integers.
- If any argument is nonnumeric, HYPGEOMDIST returns the #VALUE! error value.
- If sample\_s < 0 or sample\_s is greater than the lesser of number\_sample or population\_s, HYPGEOMDIST returns the #NUM! error value.

- If `sample_s` is less than the larger of 0 or (`number_sample - number_population + population_s`), `HYPGEOMDIST` returns the #NUM! error value.
- If `number_sample ≤ 0` or `number_sample > number_population`, `HYPGEOMDIST` returns the #NUM! error value.
- If `population_s ≤ 0` or `population_s > number_population`, `HYPGEOMDIST` returns the #NUM! error value.
- If `number_population ≤ 0`, `HYPGEOMDIST` returns the #NUM! error value.

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	No. of Successes in Sample	2	2	No. of Successes in Sample	2
3	Sample Size	8	3	Sample Size	8
4	Number of Successes in Population	15	4	Number of Successes in Population	15
5	Population Size	100	5	Population Size	100
6	Result	=HYPGEOMDIST(C2,C3,C4,C5)	6	Result	0.2468

# 20. LOGINV Function

The LOGINV function replaces the LOGNORM.INV function in Excel 2010.

## Description

The function returns the inverse of the lognormal cumulative distribution function of  $x$ , where  $\ln(x)$  is normally distributed with parameters mean and standard\_dev.

If  $p = \text{LOGNORMDIST}(x, \dots)$ , then  $\text{LOGINV}(p, \dots) = x$

Use the lognormal distribution to analyze logarithmically transformed data.

## Syntax

```
LOGINV (probability, mean, standard_dev)
```

## Arguments

Argument	Description	Required /Optional
Probability	A probability associated with the lognormal distribution.	Required
Mean	The mean of $\ln(x)$ .	Required
Standard_dev	The standard deviation of $\ln(x)$ .	Required

## Notes

- The inverse of the lognormal distribution function is-  
$$\text{LOGINV}(p, \mu, \sigma) = e^{[\mu + \sigma \times (\text{NORMSINV}(p))]}$$
- If any argument is nonnumeric, LOGINV returns the #VALUE! error value.
- If probability  $<= 0$  or probability  $>= 1$ , LOGINV returns the #NUM! error value.
- If standard\_dev  $<= 0$ , LOGINV returns the #NUM! error value.

## Example

Function Usage			Results		
	A	B		A	B
1			1		
2	Probability	0.001	2	Probability	0.001
3	Mean	10	3	Mean	10
4	Standard Deviation	2.5	4	Standard Deviation	2.5
5	x	=LOGINV(C2,C3,C4)	5	x	9.72

# 21. LOGNORMDIST Function

The LOGNORMDIST function replaces the LOGNORM.DIST function in Excel 2010.

## Description

The function returns the cumulative lognormal distribution of  $x$ , where  $\ln(x)$  is normally distributed with parameters mean and standard\_dev.

Use this function to analyze data that has been logarithmically transformed.

## Syntax

```
LOGNORMDIST(x,mean,standard_dev)
```

## Arguments

Argument	Description	Required /Optional
X	The value at which to evaluate the function.	Required
Mean	The mean of $\ln(x)$ .	Required
Standard_dev	The standard deviation of $\ln(x)$ .	Required

## Notes

- The equation for the lognormal cumulative distribution function is-

$$\text{LOGNORMDIST}(x,\mu,\sigma) = \text{NORMSDIST}\left(\frac{\ln(x)-\mu}{\sigma}\right)$$

- If any argument is non-numeric, LOGNORMDIST returns the #VALUE! error value
- If  $x \leq 0$  or if Standard\_dev  $\leq 0$ , LOGNORMDIST returns the #NUM! error value

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	x	9.21	2	x	9.21
3	Mean	10	3	Mean	10
4	Standard Deviation	2.5	4	Standard Deviation	2.5
5	Lognormal Distribution Value	=LOGNORMDIST(C2,C3,C4)	5	Lognormal Distribution Value	0.000929487

## 22. MODE Function

The MODE function replaces the MODE.SNGL function in Excel 2010.

### Description

The function returns the most frequently occurring, or repetitive, value in an array or range of data.

### Syntax

```
MODE (number1,[number2],...)
```

### Arguments

Argument	Description	Required /Optional
Number1	The first number argument for which you want to calculate the mode.	Required
Number2, ...	Number arguments 2 to 255 for which you want to calculate the mode. You can also use a single array or a reference to an array instead of arguments separated by commas.	Optional

### Notes

- The MODE function measures the central tendency, which is the location of the center of a group of numbers in a statistical distribution.
- Arguments can be either numbers or names, arrays, or references that contain numbers.
- If an array or reference argument contains text, logical values, or empty cells, those values are ignored; however, cells with the value zero are included.
- Arguments that are error values or text that cannot be translated into numbers cause errors.
- If the data set contains no duplicate data points, MODE returns the #N/A error value.

## Example

Function Usage						Results								
	A	B	C	D	E	F	G	A	B	C	D	E	F	G
2		Numbers				Mode		2		Numbers				Mode
3		20	50	10	10	40	=MODE(B3:F3)	3	20	50	10	10	40	10
4		40	20	40	10	40	=MODE(B4:F4)	4	40	20	40	10	40	40
5		10	10	99	20	20	=MODE(B5:F5)	5	10	10	99	20	20	10
6		20	20	99	10	10	=MODE(B6:F6)	6	20	20	99	10	10	20
7		10	20	20	99	10	=MODE(B7:F7)	7	10	20	20	99	10	10
8		10	20	30	40	50	=MODE(B8:F8)	8	10	20	30	40	50	#N/A

# 23. NEGBINOMDIST Function

The NEGBINOMDIST function replaces the NEGBINOM.DIST function in Excel 2010.

## Description

The function returns the negative binomial distribution. NEGBINOMDIST returns the probability that there will be number\_f failures before the number\_s-th success, when the constant probability of a success is probability\_s.

This function is similar to the binomial distribution, except that the number of successes is fixed, and the number of trials is variable. Like the binomial, trials are assumed independent.

## Syntax

```
NEGBINOMDIST (number_f,number_s,probability_s)
```

## Arguments

Argument	Description	Required /Optional
Number_f	The number of failures.	Required
Number_s	The threshold number of successes.	Required
Probability_s	The probability of a success.	Required

## Notes

- The equation for the negative binomial distribution is-

$$nb(x; r, p) = \binom{x+r-1}{r-1} p^x (1-p)^{r-x}$$

Where-

x is number\_f, r is number\_s, and p is probability\_s.

- Number\_f and number\_s are truncated to integers.
- If any argument is nonnumeric, NEGBINOMDIST returns the #VALUE! error value.
- If probability\_s < 0 or if probability\_s > 1, NEGBINOMDIST returns the #NUM! error value.
- If number\_f < 0 or number\_s < 1, NEGBINOMDIST returns the #NUM! error value.

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	No. of Failures	10	2	No. of Failures	10
3	Threshold No. of Successes	5	3	Threshold No. of Successes	5
4	Probability of a Success	0.25	4	Probability of a Success	0.25
5	Result	=NEGBINOMDIST(C2,C3,C4)	5	Result	0.05504866

# 24. NORMDIST Function

The NORMDIST function replaces the NORM.DIST function in Excel 2010.

## Description

The function returns the normal distribution for the specified mean and standard deviation. This function has a very wide range of applications in statistics, including hypothesis testing.

## Syntax

```
NORMDIST(x,mean,standard_dev,cumulative)
```

## Arguments

Argument	Description	Required /Optional
X	The value for which you want the distribution.	Required
Mean	The arithmetic mean of the distribution.	Required
Standard_dev	The standard deviation of the distribution.	Required
Cumulative	A logical value that determines the form of the function. If cumulative is TRUE, NORMDIST returns the cumulative distribution function. If cumulative is FALSE, NORMDIST returns the probability mass function.	Required

## Notes

- The equation for the normal density function (cumulative = FALSE) is-  
$$f(x; \mu, \sigma) = \frac{1}{\sqrt{2\pi}\sigma} e^{-\left(\frac{(x-\mu)^2}{2\sigma^2}\right)}$$
- When cumulative = TRUE, the formula is the integral from negative infinity to x of the given formula.
- If mean = 0, standard\_dev = 1, and cumulative = TRUE, NORMDIST returns the standard normal distribution, NORMSDIST
- If mean or standard\_dev is nonnumeric, NORMDIST returns the #VALUE! error value.
- If standard\_dev ≤ 0, NORMDIST returns the #NUM! error value.

**Example**

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	X-score	7	2	X-score	7
3	Mean	3.47	3	Mean	3.47
4	Standard Deviation	2.05	4	Standard Deviation	2.05
5	Cumulative	TRUE	5	Cumulative	TRUE
6	Probability	=NORMDIST(C2,C3,C4,C5)	6	Probability	0.96

# 25. NORMINV Function

The NORMINV function replaces the NORM.INV function in Excel 2010.

## Description

The function returns the inverse of the normal cumulative distribution for the specified mean and standard deviation.

## Syntax

```
NORMINV (probability,mean,standard_dev)
```

## Arguments

Argument	Description	Required /Optional
Probability	A probability corresponding to the normal distribution.	Required
Mean	The arithmetic mean of the distribution.	Required
Standard_dev	The standard deviation of the distribution.	Required

## Notes

- If any argument is nonnumeric, NORMINV returns the #VALUE! error value.
- If probability <= 0 or if probability >= 1, NORMINV returns the #NUM! error value.
- If standard\_dev ≤ 0, NORMINV returns the #NUM! error value.
- If mean = 0 and standard\_dev = 1, NORMINV uses the standard normal distribution (see NORMSINV).
- Given a value for probability, NORMINV seeks that value x such that NORMDIST(x, mean, standard\_dev, TRUE) = probability. Hence, precision of NORMINV depends on precision of NORMDIST. NORMINV uses an iterative search technique. If the search has not converged after 100 iterations, the function returns the #N/A error value.

**Example**

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Probability	0.648027292424163	2	Probability	0.648
3	Mean	54.3	3	Mean	54.3
4	Standard Deviation	15	4	Standard Deviation	15
5	X	=NORMINV(C2,C3,C4)	5	X	60

# 26. NORMSDIST Function

The NORMSDIST function replaces the NORM.S.DIST function in Excel 2010.

## Description

The function returns the standard normal cumulative distribution function. The distribution has a mean of 0 (zero) and a standard deviation of one. Use this function in place of a table of standard normal curve areas.

## Syntax

```
NORMSDIST (z)
```

## Arguments

Argument	Description	Required /Optional
Z	The value for which you want the distribution.	Required

## Notes

- The equation for the standard normal density function is-

$$f(z) = \frac{1}{\sqrt{2\pi}} e^{-\frac{z^2}{2}}$$

- If z is nonnumeric, NORMSDIST returns the #VALUE! error value.

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	z	1.5	2	z	1.5
3	Standard Normal Distribution	=NORMSDIST(C2)	3	Standard Normal Distribution	93.3%

# 27. NORMSINV Function

The NORMSINV function replaces the NORM.S.INV function in Excel 2010.

## Description

The function returns the inverse of the standard normal cumulative distribution. The distribution has a mean of zero and a standard deviation of one.

## Syntax

NORMSINV (probability)

## Arguments

Argument	Description	Required /Optional
Probability	A probability corresponding to the normal distribution.	Required

## Notes

- If Probability is nonnumeric, NORMSINV returns the #VALUE! error value.
- If Probability <= 0 or if Probability >= 1, NORMSINV returns the #NUM! error value.
- Given a value for Probability, NORMSINV seeks that value z such that NORMSDIST(z) = probability. Hence, precision of NORMSINV depends on precision of NORMSDIST. NORMSINV uses an iterative search technique. If the search has not converged after 100 iterations, the function returns the #N/A error value.

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Standard Normal Distribution	0.93	2	Standard Normal Distribution	0.93
3	z	=NORMSINV(C2)	3	z	1.5

# 28. PERCENTILE Function

The PERCENTILE function replaces the PERCENTILE.INC function in Excel 2010.

## Description

The function returns the k-th percentile of values in a range. You can use this function to establish a threshold of acceptance.

## Syntax

```
PERCENTILE (array,k)
```

## Arguments

Argument	Description	Required /Optional
Array	The array or range of data that defines relative standing.	Required
K	The percentile value in the range 0...1, inclusive.	Required

## Notes

- If k is not a multiple of  $1/(n - 1)$ , PERCENTILE interpolates to determine the value at the k-th percentile.
- If k is nonnumeric, PERCENTILE returns the #VALUE! error value.
- If k is < 0 or if k > 1, PERCENTILE returns the #NUM! error value.

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Array		2	Array	
3	0.04	0.05	3	0.04	0.05
4	0.14	-0.08	4	0.14	-0.08
5	0.08	0.01	5	0.08	0.01
6	0.03	-0.04	6	0.03	-0.04
7	-0.04	0.11	7	-0.04	0.11
8	-0.07	-0.08	8	-0.07	-0.08
9	0.1	0.08	9	0.10	0.08
10	-0.13	-0.05	10	-0.13	-0.05
11	0.04	-0.16	11	0.04	-0.16
12	0.02	0.02	12	0.02	0.02
13	0.08	0.1	13	0.08	0.10
14	0.1	-0.03	14	0.10	-0.03
15	Percentile		15	Percentile	
16	=PERCENTILE(B3:C14,0.95)		16	0.11	

# 29. PERCENTRANK Function

The PERCENTRANK function replaces the PERCENTRANK.INC function in Excel 2010.

## Description

The function returns the rank of a value in a data set as a percentage of the data set. This function can be used to evaluate the relative standing of a value within a data set.

## Syntax

```
PERCENTRANK (array,x,[significance])
```

## Arguments

Argument	Description	Required /Optional
Array	The array or range of data with numeric values that defines relative standing.	Required
X	The value for which you want to know the rank.	Required
Significance	A value that identifies the number of significant digits for the returned percentage value. If omitted, PERCENTRANK uses three digits (0.xxx).	Optional

## Notes

- If x does not match one of the values in array, PERCENTRANK interpolates to return the correct percentage rank.
- If array is empty, PERCENTRANK returns the #NUM! error value.
- If significance < 1, PERCENTRANK returns the #NUM! error value.

**Example**

Function Usage			Results			
A	B	C	A	B	C	
1	<b>Array</b>			<b>Array</b>		
2	0.04	0.05	3	0.04	0.05	
3	0.14	-0.08	4	0.14	-0.08	
4	0.08	0.01	5	0.08	0.01	
5	0.03	-0.04	6	0.03	-0.04	
6	-0.04	0.11	7	-0.04	0.11	
7	-0.07	-0.08	8	-0.07	-0.08	
8	0.1	0.08	9	0.10	0.08	
9	-0.13	-0.05	10	-0.13	-0.05	
10	0.04	-0.16	11	0.04	-0.16	
11	0.02	0.02	12	0.02	0.02	
12	0.08	0.1	13	0.08	0.10	
13	0.1	-0.03	14	0.10	-0.03	
14	<b>Percentile</b>			<b>Percentile</b>		
15	<code>=PERCENTRANK(B3:C14,0.01)</code>			0.39		
16						

# 30. POISSON Function

The POISSON function replaces the POISSON.DIST function in Excel 2010.

## Description

The function returns the Poisson distribution. A common application of the Poisson distribution is predicting the number of events over a specific time.

## Syntax

```
POISSON(x,mean,cumulative)
```

## Arguments

Argument	Description	Required /Optional
X	The number of events.	Required
Mean	The expected numeric value.	Required
Cumulative	A logical value that determines the form of the probability distribution returned. If cumulative is TRUE, POISSON returns the cumulative Poisson probability that the number of random events occurring will be between zero and x inclusive. If cumulative is FALSE, POISSON returns the Poisson probability mass function that the number of events occurring will be exactly x.	Required

## Notes

- POISSON is calculated as follows-
  - For cumulative = FALSE,

$$POISSON = \frac{e^{-\lambda} \lambda^x}{x!}$$

- For cumulative = TRUE,

$$CUMPOISSON = \sum_{k=0}^x \frac{e^{-\lambda} \lambda^k}{k!}$$

- If x is not an integer, it is truncated.
- If x or mean is nonnumeric, POISSON returns the #VALUE! error value.
- If x < 0, POISSON returns the #NUM! error value.
- If mean < 0, POISSON returns the #NUM! error value.

**Example**

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	x	35	2	x	35
3	Mean	40	3	Mean	40
4	Cumulative	TRUE	4	Cumulative	TRUE
5	Poisson Distribution Value	=POISSON(C2,C3,C4)	5	Poisson Distribution Value	0.24

# 31. QUARTILE Function

The QUARTILE function replaces the QUARTILE.INC function in Excel 2010.

## Description

The function returns the quartile of a data set. Quartiles often are used in sales and survey data to divide populations into groups.

## Syntax

QUARTILE (array,quart)
------------------------

## Arguments

Argument	Description	Required /Optional
Array	The array or cell range of numeric values for which you want the quartile value.	Required
Quart	Indicates which value to return. Look at the Quart Table below.	Required

## Quart Table

Quart	QUARTILE returns
0	Minimum value
1	First quartile (25th percentile)
2	Median value (50th percentile)
3	Third quartile (75th percentile)
4	Maximum value

## Notes

- If quart is not an integer, it is truncated.
- MIN, MEDIAN, and MAX return the same value as QUARTILE when quart is equal to 0 (zero), 2, and 4, respectively.
- If array is empty, QUARTILE returns the #NUM! error value.
- If quart < 0 or if quart > 4, QUARTILE returns the #NUM! error value.

## Example

Function Usage					Results						
	A	B	C	D	E		A	B	C	D	E
1						1					
2		Values				2		Values			
3		817	104	640	767	3		817	104	640	767
4		748	756	369	703	4		748	756	369	703
5		372	993	294	261	5		372	993	294	261
6		487	384	185	491	6		487	384	185	491
7		140	607	894	182	7		140	607	894	182
8						8					
9		Quart		Result		9		Quart		Result	
10		0			=QUARTILE(B3:E7,B10)	10		0			104
11		1			=QUARTILE(B3:E7,B11)	11		1			285.75
12		2			=QUARTILE(B3:E7,B12)	12		2			489
13		2.7			=QUARTILE(B3:E7,B13)	13		2.7			489
14		3			=QUARTILE(B3:E7,B14)	14		3			750
15		4			=QUARTILE(B3:E7,B15)	15		4			993
16		-1			=QUARTILE(B3:E7,B16)	16		-1			#NUM!
17		5			=QUARTILE(B3:E7,B17)	17		5			#NUM!
18		1			=QUARTILE(D9:E13,B18)	18		1			#NUM!

## 32. RANK Function

The RANK function replaces the RANK.EQ function in Excel 2010.

### Description

The function returns the rank of a number in a list of numbers. The rank of a number is its size relative to other values in a list.

If you sort the list, the rank of the number would be its position.

### Syntax

```
RANK (number,ref,[order])
```

### Arguments

Argument	Description	Required /Optional
Number	The number whose rank you want to find.	Required
Ref	An array of, or a reference to, a list of numbers. Nonnumeric values in ref are ignored.	Required
Order	A number specifying how to rank number. If order is 0 (zero) or omitted, Microsoft Excel ranks number as if ref were a list sorted in descending order. If order is any nonzero value, Microsoft Excel ranks number as if ref were a list sorted in ascending order.	Optional

### Notes

- RANK gives duplicate numbers the same rank. However, the presence of duplicate numbers affects the ranks of subsequent numbers.
- For some purposes, one might want to use a definition of rank that considers ties. This can be done by adding the following correction factor to the value returned by RANK. This correction factor is appropriate both for the case where rank is computed in descending order (order = 0 or omitted) or ascending order (order = nonzero value).  
$$\text{Correction factor for tied ranks} = [\text{COUNT}(\text{ref}) + 1 - \text{RANK}(\text{number}, \text{ref}, 0) - \text{RANK}(\text{number}, \text{ref}, 1)]/2$$

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Values	Ranking Position High to Low	2	Values	Ranking Position High to Low
3	7	=RANK(B3,B3:B7)	3	7	4
4	4	=RANK(B4,B3:B7)	4	4	5
5	25	=RANK(B5,B3:B7)	5	25	1
6	8	=RANK(B6,B3:B7)	6	8	3
7	16	=RANK(B7,B3:B7)	7	16	2
8			8		
9	Values	Ranking Position Low to High	9	Values	Ranking Position Low to High
10	7	=RANK(B10,B10:B14,1)	10	7	2
11	4	=RANK(B11,B10:B14,1)	11	4	1
12	25	=RANK(B12,B10:B14,1)	12	25	5
13	8	=RANK(B13,B10:B14,1)	13	8	3
14	16	=RANK(B14,B10:B14,1)	14	16	4

# 33. STDEV Function

The STDEV function replaces the STDEV.S function in Excel 2010.

## Description

The function estimates standard deviation based on a sample. The standard deviation is a measure of how widely values are dispersed from the average value (the mean).

## Syntax

```
STDEV (number1,[number2],...)
```

## Arguments

Argument	Description	Required /Optional
Number1	The first number argument corresponding to a sample of a population.	Required
Number2, ...	Number arguments 2 to 255 corresponding to a sample of a population. You can also use a single array or a reference to an array instead of arguments separated by commas.	Optional

## Notes

- STDEV uses the following formula-

$$\sqrt{\frac{\sum(x - \bar{x})^2}{(n-1)}}$$

Where x is the sample mean AVERAGE (number1,number2,...) and n is the sample size.

- STDEV assumes that its arguments are a sample of the population. If your data represents the entire population, then compute the standard deviation using STDEVP
- The standard deviation is calculated using the "n-1" method.
- Arguments can be either numbers or names, arrays, or references that contain numbers.
- Logical values and text representations of numbers that you type directly into the list of arguments are counted.
- If an argument is an array or reference, only numbers in that array or reference are counted. Empty cells, logical values, text, or error values in the array or reference are ignored.

- Arguments that are error values or text that cannot be translated into numbers cause errors.
- If you want to include logical values and text representations of numbers in a reference as part of the calculation, use the STDEVA function.

## Example

Function Usage					Results							
	A	B	C	D	E	F	A	B	C	D	E	F
1							1					
2		Numbers			Result	2		Numbers			Result	
3	10	10	9	10	=STDEV(B3:E3)	3	10	10	9	10	0.5	
4	10	10	11	10	=STDEV(B4:E4)	4	10	10	11	10	0.5	
5	10	11	9	12	=STDEV(B5:E5)	5	10	11	9	12	1.2909944	

# 34. STDEVP Function

The STDEVP function replaces the STDEV.P function in Excel 2010.

## Description

The function calculates the standard deviation based on the entire population given as arguments. The standard deviation is a measure of how widely values are dispersed from the average value (the mean).

## Syntax

```
STDEVP (number1,[number2],...)
```

## Arguments

Argument	Description	Required /Optional
Number1	The first number argument corresponding to a population.	Required
Number2, ...	Number arguments 2 to 255 corresponding to a population. You can also use a single array or a reference to an array instead of arguments separated by commas.	Optional

## Notes

- STDEVP assumes that its arguments are the entire population. If your data represents a sample of the population, then compute the standard deviation using STDEV
- For large sample sizes, STDEV and STDEVP return approximately equal values.
- The standard deviation is calculated using the "n" method.
- Arguments can be either numbers or names, arrays, or references that contain numbers.
- Logical values and text representations of numbers that you type directly into the list of arguments are counted.
- If an argument is an array or reference, only numbers in that array or reference are counted. Empty cells, logical values, text, or error values in the array or reference are ignored.
- Arguments that are error values or text that cannot be translated into numbers cause errors.

- If you want to include logical values and text representations of numbers in a reference as part of the calculation, use the STDEVPA function.
- STDEVP uses the following formula-

$$\sqrt{\frac{\sum (x - \bar{x})^2}{n}}$$

Where x is the sample mean AVERAGE (number1,number2,...) and n is the sample size.

### Example

Function Usage					Results					F	
A	B	C	D	E	A	B	C	D	E	F	
<b>Numbers</b>					<b>Result</b>						
2	10	10	9	10	=STDEVP(B3:E3)	3	10	10	9	10	0.433012702
3	10	10	11	10	=STDEVP(B4:E4)	4	10	10	11	10	0.433012702
4	10	11	9	12	=STDEVP(B5:E5)	5	10	11	9	12	1.118033989

# 35. TDIST Function

The TDIST function replaces the T.DIST.2T & T.DIST.RT functions in Excel 2010.

## Description

The function returns the Percentage Points (probability) for the Student t-distribution where a numeric value (x) is a calculated value of t for which the Percentage Points are to be computed. The t-distribution is used in the hypothesis testing of small sample data sets. Use this function in place of a table of critical values for the t-distribution.

## Syntax

```
TDIST(x,deg_freedom,tails)
```

## Arguments

Argument	Description	Required /Optional
X	The numeric value at which to evaluate the distribution.	Required
Deg_freedom	An integer indicating the number of degrees of freedom.	Required
Tails	Specifies the number of distribution tails to return. If Tails = 1, TDIST returns the one-tailed distribution. If Tails = 2, TDIST returns the two-tailed distribution.	Required

## Notes

- If Tails = 1, TDIST is calculated as  $TDIST = P(X > x)$ , where X is a random variable that follows the t-distribution. If Tails = 2, TDIST is calculated as  $TDIST = P(|X| > x) = P(X > x \text{ or } X < -x)$
- The Deg\_freedom and Tails arguments are truncated to integers.
- If any argument is non-numeric, TDIST returns the #VALUE! error value.
- If Deg\_freedom < 1, TDIST returns the #NUM! error value.
- If Tails is any value other than 1 or 2, TDIST returns the #NUM! error value.
- If  $x < 0$ , then TDIST returns the #NUM! error value.
- Since  $x < 0$  is not allowed, to use TDIST when  $x < 0$ , note that  $TDIST(-x, df, 1) = 1 - TDIST(x, df, 1) = P(X > -x)$  and  $TDIST(-x, df, 2) = TDIST(x, df, 2) = P(|X| > x)$

## Example

A	B	C	D
		A	B
<b>Mean</b>	118.5	124.233333333333	
<b>Standard Deviation</b>	12.1503736134889	18.7132321492377	
<b>Significance Level</b>	0.05		
<b>t-Test: Two-Sample Assuming Equal Variances</b>			
		A	B
<b>Observations</b>	20	30	
<b>Variance</b>	147.631578947368	350.185057471263	
<b>Pooled Variance</b>	270.007638888888		
<b>Hypothesized Mean Difference</b>	0		
<b>Degrees of Freedom</b>	=C8+D8-2		
<b>t Calculated</b>	=ABS(C3-D3)/SQRT((C10*(1/C8+1/D8)))		
<b>t Critical Value</b>	=TINV(2*C5,C12)		
<b>P(T&lt;=t) one-tail</b>	=TDIST(C13,C12,1)		
<b>t-Test: Two-Sample Assuming Equal Variances</b>			
		A	B
<b>Observations</b>		20	30
<b>Variance</b>		147.63	350.19
<b>Pooled Variance</b>		270.01	
<b>Hypothesized Mean Difference</b>		0	
<b>Degrees of Freedom</b>		48	
<b>t Calculated</b>		1.209	
<b>t Critical Value</b>		1.677	
<b>P(T&lt;=t) one-tail</b>		0.116	

**Function Usage**

**Results**

# 36. TINV Function

The TINV function replaces the T.INV.2T function in Excel 2010.

## Description

The function returns the two-tailed inverse of the student's t-distribution.

## Syntax

```
TINV (probability,deg_freedom)
```

## Arguments

Argument	Description	Required /Optional
Probability	The probability associated with the two-tailed Student's t-distribution.	Required
Deg_freedom	The number of degrees of freedom with which to characterize the distribution.	Required

## Notes

- TINV returns the value  $t$ , such that  $P(|X| > t) = \text{probability}$  where  $X$  is a random variable that follows the t-distribution and  $P(|X| > t) = P(X < -t \text{ or } X > t)$
- If  $\text{deg\_freedom}$  is not an integer, it is truncated.
- A one-tailed t-value can be returned by replacing  $\text{probability}$  with  $2 * \text{probability}$ . For a probability of 0.05 and degrees of freedom of 10, the two-tailed value is calculated with  $\text{TINV}(0.05, 10)$ , which returns 2.28139. The one-tailed value for the same probability and degrees of freedom can be calculated with  $\text{TINV}(2 * 0.05, 10)$ , which returns 1.812462
- In some tables,  $\text{probability}$  is described as  $(1-p)$
- If either argument is nonnumeric, TINV returns the #VALUE! error value.
- If  $\text{probability} \leq 0$  or if  $\text{probability} > 1$ , TINV returns the #NUM! error value.
- If  $\text{deg\_freedom} < 1$ , TINV returns the #NUM! error value.
- Given a value for  $\text{probability}$ , TINV seeks that value  $x$  such that  $\text{TDIST}(x, \text{deg\_freedom}, 2) = \text{probability}$ . Hence, precision of TINV depends on precision of TDIST. TINV uses an iterative search technique. If the search has not converged after 100 iterations, the function returns the #N/A error value.

## Example

A	B	C
1		
2	<b>Population Mean</b>	3.47
3	<b>Sample Mean</b>	4.2
4	<b>Count</b>	20
5	<b>Standard Deviation</b>	2
6	<b>Significance Level</b>	0.05
7		
8	<b>t calculated</b>	=ABS(C3-C2)/(C5/SQRT(C4))
9	<b>t critical value</b>	=TINV(2*C6,C4-1)
10	<b>Decision</b>	=IF(C8<C9,"Do not reject null hypothesis","Reject null hypothesis")
11		
8	<b>t calculated</b>	1.632
9	<b>t critical value</b>	1.729
10	<b>Decision</b>	Do not reject null hypothesis

**Function Usage**

**Results**

# 37. TTEST Function

The TTEST function replaces the T.TEST function in Excel 2010.

## Description

The function returns the probability associated with a Student's t-Test.

Use TTEST to determine whether two samples are likely to have come from the same two underlying populations that have the same mean.

## Syntax

```
TTEST (array1, array2, tails, type)
```

## Arguments

Argument	Description	Required /Optional
Array1	The first data set.	Required
Array2	The second data set.	Required
Tails	Specifies the number of distribution tails. If tails = 1, TTEST uses the one-tailed distribution. If tails = 2, TTEST uses the two-tailed distribution.	Required
Type	The kind of t-Test to perform. Look at the t-Test Table given below.	Required

## t-Test Table

Type	t-Test to Perform
1	Paired
2	Two-sample equal variance (homoscedastic)
3	Two-sample unequal variance (heteroscedastic)

## Notes

- TTEST uses the data in array1 and array2 to compute a non-negative t-statistic. If tails=1, TTEST returns the probability of a higher value of the t-statistic under the assumption that array1 and array2 are samples from populations with the same mean. The value returned by TTEST when tails=2 is double that returned when tails=1 and corresponds to the probability of a higher absolute value of the t-statistic under the "same population means" assumption.
- The tails and type arguments are truncated to integers.

- If array1 and array2 have a different number of data points, and type = 1 (paired), TTEST returns the #N/A error value.
- If tails or type is nonnumeric, TTEST returns the #VALUE! error value.
- If tails is any value other than 1 or 2, TTEST returns the #NUM! error value.

## Example

Function Usage			Results		
	A	B		A	B
1			1		
2	<b>Array1</b>	<b>Array2</b>	2	<b>Array1</b>	<b>Array2</b>
3	15.4	19	3	15.4	19.0
4	37.2	38.7	4	37.2	38.7
5	18.4	26.7	5	18.4	26.7
6	17.2	24.7	6	17.2	24.7
7	34.1	22.2	7	34.1	22.2
8	24.6	27.6	8	24.6	27.6
9	40.7	45.4	9	40.7	45.4
10	27.1	43.8	10	27.1	43.8
11	19.4	28.1	11	19.4	28.1
12	33.4	35.6	12	33.4	35.6
13	<b>Tails</b>	1	13	<b>Tails</b>	1
14	<b>Type</b>	1	14	<b>Type</b>	1
15	<b>Tails</b>	2	15	<b>Tails</b>	2
16	<b>Probability one-tail</b>	=TTEST(B3:B12,C3:C12,C13,C14)	16	<b>Probability one-tail</b>	0.043
17	<b>Probability two-tail</b>	=TTEST(B3:B12,C3:C12,C15,C14)	17	<b>Probability two-tail</b>	0.086

# 38. VAR Function

The VAR function replaces the VAR.S function in Excel 2010.

## Description

The function estimates variance based on a sample.

## Syntax

```
VAR (number1,[number2],...)
```

## Arguments

Argument	Description	Required /Optional
Number1	The first number argument corresponding to a sample of a population.	Required
Number2, ...	Number arguments 2 to 255 corresponding to a sample of a population.	Optional

## Notes

- VAR uses the following formula:

$$\frac{\sum (x - \bar{x})^2}{(n - 1)}$$

- Where  $x$  is the sample mean AVERAGE (number1,number2,...) and  $n$  is the sample size.
- VAR assumes that its arguments are a sample of the population. If your data represents the entire population, then compute the variance by using VARP.
- Arguments can be either numbers or names, arrays, or references that contain numbers.
- Logical values and text representations of numbers that you type directly into the list of arguments are counted.
- If an argument is an array or reference, only numbers in that array or reference are counted. Empty cells, logical values, text, or error values in the array or reference are ignored.
- If you want to include logical values and text representations of numbers in a reference as part of the calculation, use the VARA function.
- Arguments that are error values or text that cannot be translated into numbers cause errors.

## Example

Function Usage					Results							
1	A	B	C	D	E	F	A	B	C	D	E	F
2		Values			Variance		2		Values			Variance
3		10	10	9	10	=VAR(B3:E3)	3	10	10	9	10	0.25
4		10	10	11	10	=VAR(B4:E4)	4	10	10	11	10	0.25
5		10	11	9	12	=VAR(B5:E5)	5	10	11	9	12	1.666666667

# 39. VARP Function

The VARP function replaces the VAR.P function in Excel 2010.

## Description

The function calculates the variance based on the entire population.

## Syntax

```
VARP (number1,[number2],...)
```

## Arguments

Argument	Description	Required /Optional
Number1	The first number argument corresponding to a population.	Required
Number2...	Number arguments 2 to 255 corresponding to a population.	Optional

## Notes

- The equation for VARP is-

$$\frac{\sum (x - \bar{x})^2}{n}$$

Where  $x$  is the sample mean AVERAGE (number1,number2,...) and  $n$  is the sample size.

- If you want to include logical values and text representations of numbers in a reference as part of the calculation, use the VARPA function.
- VARP assumes that its arguments are the entire population. If your data represents a sample of the population, then compute the variance by using VAR.
- Arguments can be either numbers or names, arrays, or references that contain numbers.
- Logical values and text representations of numbers that you type directly into the list of arguments are counted.
- If an argument is an array or reference, only numbers in that array or reference are counted. Empty cells, logical values, text, or error values in the array or reference are ignored.
- Arguments that are error values or text that cannot be translated into numbers cause errors.

## Example

Function Usage					Results						
A	B	C	D	E	A	B	C	D	E		
1						1					
2	Values			Variance	2	Values			Variance		
3	10	10	9	10	=VARP(B3:E3)	3	10	10	9	10	0.1875
4	10	10	11	10	=VARP(B4:E4)	4	10	10	11	10	0.1875
5	10	11	9	12	=VARP(B5:E5)	5	10	11	9	12	1.25

# 40. WEIBULL Function

The WEIBULL function replaces the WEIBULL.DIST function in Excel 2010.

## Description

The function returns the Weibull distribution. Use this distribution in reliability analysis, such as calculating a device's mean time to failure.

## Syntax

```
WEIBULL(x,alpha,beta,cumulative)
```

## Arguments

Argument	Description	Required /Optional
X	The value at which to evaluate the function.	Required
Alpha	A parameter to the distribution.	Required
Beta	A parameter to the distribution.	Required
Cumulative	Determines the form of the function.	Required

## Notes

- The equation for the Weibull cumulative distribution function is-

$$F(x; \alpha, \beta) = 1 - e^{-(x/\beta)^\alpha}$$

- The equation for the Weibull probability density function is-

$$f(x; \alpha, \beta) = \frac{\alpha}{\beta^\alpha} x^{\alpha-1} e^{-(x/\beta)^\alpha}$$

- When alpha = 1, WEIBULL returns the exponential distribution with-

$$\lambda = \frac{1}{\beta}$$

- If x, alpha, or beta is nonnumeric, WEIBULL returns the #VALUE! error value.
- If x < 0, WEIBULL returns the #NUM! error value.
- If alpha ≤ 0 or if beta ≤ 0, WEIBULL returns the #NUM! error value.

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	x	1320	2	x	1320
3	Alpha	14.71	3	Alpha	14.71
4	Beta	1243.44	4	Beta	1243.44
5	Cumulative	TRUE	5	Cumulative	TRUE
6	Weibull Distribution Value	=WEIBULL(C2,C3,C4,C5)	6	Weibull Distribution Value	0.91
-			-		

# 41. ZTEST Function

The ZTEST function replaces the Z.TEST function in Excel 2010.

## Description

The function returns the one-tailed probability-value of a z-test. For a given hypothesized population mean,  $\mu_0$ , ZTEST returns the probability that the sample mean would be greater than the average of observations in the data set (array) — that is, the observed sample mean.

## Syntax

```
ZTEST (array,x,[sigma])
```

## Arguments

Argument	Description	Required /Optional
Array	The array or range of data against which to test x.	Required
X	The value to test.	Required
Sigma	The population (known) standard deviation. If omitted, the sample standard deviation is used.	Optional

## Notes

- ZTEST is calculated as follows when sigma is not omitted-

$$ZTEST(array, \mu_0) = 1 - NORMSDIST((\bar{x} - \mu_0) / (\text{sigma} / \sqrt{n}))$$

Alternatively, when sigma is omitted-

$$ZTEST(array, \mu_0) = 1 - NORMSDIST((\bar{x} - \mu_0) / (s / \sqrt{n}))$$

Where,

x is the sample mean AVERAGE(array),

s is the sample standard deviation STDEV(array).

n is the number of observations in the sample COUNT(array).

- ZTEST represents the probability that the sample mean would be greater than the observed value AVERAGE (array), when the underlying population mean is  $\mu_0$ . From the symmetry of the Normal distribution, if AVERAGE (array) <  $\mu_0$ , ZTEST will return a value greater than 0.5
- The following Excel formula can be used to calculate the two-tailed probability that the sample mean would be further from  $\mu_0$  (in either direction) than AVERAGE(array), when the underlying population mean is  $\mu_0$ -

$$=2 * MIN (ZTEST (array,\mu_0,sigma), 1 - ZTEST(array,\mu_0,sigma))$$

- If array is empty, ZTEST returns the #N/A error value.

**Example**

Function Usage		Results	
A	B	A	B
1		1	
2	Array	2	Array
3	4	3	4
4	5	4	5
5	5	5	5
6	4	6	4
7	5	7	5
8	4	8	4
9	4	9	4
10	2	10	2
11	2	11	2
12	6	12	6
13	=ZTEST(B3:B12,4)	13	0.4029
..		..	

# Cube Functions

## 42. Cube Functions – Overview

The Excel Cube functions enable data from OLAP cubes to be brought into Excel to perform calculations. These functions are supported with a connection to Microsoft SQL Server 2005 Analysis Services or later data source.

As PowerPivot creates a data source, which is compatible with OLAP cubes, it can also be used with these functions.

### Cube Functions

The following table lists all the Cube functions-

S. No.	Function and Description
1	<b>CUBEKPIMEMBER</b> Returns a key performance indicator name, property, and measure, and displays the name and property in the cell.
2	<b>CUBEMEMBER</b> Returns a member or tuple in a cube hierarchy.
3	<b>CUBEMEMBERPROPERTY</b> Returns the value of a member property in the cube.
4	<b>CUBERANKEDMEMBER</b> Returns the nth, or ranked, member in a set.
5	<b>CUBESET</b> Defines a calculated set of members or tuples by sending a set expression to the cube on the server.
6	<b>CUBESETCOUNT</b> Returns the number of items in a set.
7	<b>CUBEVALUE</b> Returns an aggregated value from a cube.

# 43. CUBEKPIMEMBER Function

## Description

The function returns a Key Performance Indicator (KPI) property and displays the KPI name in the cell.

## Syntax

```
CUBEKPIMEMBER (connection, kpi_name, kpi_property, [caption])
```

## Arguments

Argument	Description	Required / Optional
connection	Name of the connection to the cube - A text string	Required
kpi_name	Name of the KPI in the cube - A text string	Required
kpi_property	The KPI component returned and can be one of the given Enumerated Constants as given in the Table below	Required
caption	An alternative text string that is displayed in the cell instead of kpi_name and kpi_property	Optional

The KPI component returned-

Integer	Enumerated constant	Description
1	KPIValue	The actual value
2	KPIGoal	A target value
3	KPIStatus	The state of the KPI at a specific moment in time
4	KPITrend	A measure of the value over time
5	KPIWeight	A relative importance assigned to the KPI
6	KPICurrentTimeMember	A temporal context for the KPI

If you specify KPIValue for kpi\_property, only kpi\_name is displayed in the cell.

## Notes

A KPI is a quantifiable measurement, such as monthly gross profit or quarterly employee turnover that is used to monitor an organization's performance.

The CUBEKPIMEMBER function is supported only when the Workbook is connected to a Microsoft SQL Server 2005 Analysis Services or later Data Source.

- When the CUBEKPIMEMBER function evaluates, it temporarily displays a "#GETTING\_DATA..." message in the cell before all of the data is retrieved.
- To use the KPI in a calculation, specify the CUBEKPIMEMBER function as a member\_expression argument in the CUBEVALUE function.

- If the connection name is not a valid workbook connection that is stored in the workbook, CUBEKPIMEMBER returns a #NAME? Error value. If the Online Analytical Processing (OLAP) server is not running, not available, or returns an error message, CUBEKPIMEMBER returns a #NAME? Error value.
- CUBEKPIMEMBER returns a #N/A error value when kpi\_name or kpi\_property is invalid.
- CUBEKPIMEMBER may return a #N/A error value if you reference a session-based object, such as a calculated member or named set, in a PivotTable when sharing a connection and that PivotTable is deleted or you convert the PivotTable to formulas. (On the **Options** tab, in the **Tools** group, click **OLAP Tools**, and then click **Convert to Formulas**).

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Power PivotTable			Function Usage
A	B	C	D
1			
2	Row Labels	Region Sales Goal	=CUBEKPIMEMBER("ThisWorkbookDataModel","Region Sales",3)
3	South	5000	=CUBEKPIMEMBER("ThisWorkbookDataModel","Region Sales",3,"Goal Met")
4	Grand Total	5000	10875
		Region Sales Status	Results
		Goal Met	

# 44. CUBEMEMBER Function

## Description

The CUBEMEMBER function returns a member or tuple from the cube. Use this function to validate that the member or tuple exists in the cube.

## Syntax

```
CUBEMEMBER (connection, member_expression, [caption])
```

## Arguments

Argument	Description	Required / Optional
connection	Name of the connection to the cube - A text string	Required
member_expression	A multidimensional expression (MDX) that evaluates to a unique member in the cube - A text string OR A tuple, specified as a cell range or an array constant	Required
caption	A text string displayed in the cell instead of the caption, if one is defined, from the cube. When a tuple is returned, the caption used is the one for the last member in the tuple.	Optional

## Notes

- When the CUBEMEMBER Function evaluates, it temporarily displays a "#GETTING\_DATA..." message in the cell before all of the data is retrieved.
- When you use CUBEMEMBER as an argument to another CUBE Function, the MDX expression that identifies the member or tuple is used by that CUBE Function, not the displayed value in the cell of the CUBEMEMBER Function.
- If the connection name is not a valid workbook connection stored in the workbook, CUBEMEMBER returns a #NAME? Error value. If the Online Analytical Processing (OLAP) server is not running, not available, or returns an error message, CUBEMEMBER returns a #NAME? Error value.
- If at least one element within the tuple is invalid, CUBEMEMBER returns a #VALUE! error value.
- If member\_expression is longer than 255 characters, which is the limit for an argument to a function, CUBEMEMBER returns a #VALUE! Error value. To use text strings longer than 255 characters, enter the text string in a cell (for which the limit is 32,767 characters), and then use a cell reference as the argument.

- CUBEMEMBER returns a #N/A error value when-
  - The member\_expression syntax is incorrect
  - The member specified by the MDX text string does not exist in the cube.
  - The tuple is invalid because there is no intersection for the specified values. (This can occur with multiple elements from the same hierarchy.)
  - The set contains at least one member with a different dimension than the other members.
- CUBEMEMBER may return a #N/A error value if you reference a session-based object, such as a calculated member or named set, in a PivotTable when sharing a connection. The PivotTable is deleted or you can convert the PivotTable to formulas. (On the Options tab, in the Tools group, click OLAP Tools, and then click Convert to Formulas).

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Power PivotTable					Function Usage	Results
A	B	C	D	E	G	F G
1						
2						
3	Sum of Total Amount	Column				
4	Row Labels	January	February	March	Grand Total	
5	East	1690	1950	700	4340	=CUBEMEMBER("ThisWorkbookDataModel",A5)
6	Albertson, Kathy	925	1375	350	2650	
7	Post, Melissa	765	575	350	1690	
8	North	1140	1720	300	3160	=CUBEMEMBER("ThisWorkbookDataModel",A8)
9	Thompson, Shannon	1140	1720	300	3160	
10	South	3110	3975	3790	10875	=CUBEMEMBER("ThisWorkbookDataModel",A10)
11	Davis, William	1100	235	600	1935	
12	Flores, Tia	1655	985	1925	4565	
13	Walters, Chris	355	2755	1265	4375	
14	West	3150	1515	525	5190	=CUBEMEMBER("ThisWorkbookDataModel",A14)
15	Brennan, Michael	2750	550	400	3700	
16	Dumlao, Richard	400	965	125	1490	
17	Grand Total	9090	9160	5315	23565	

# 45. CUBEMEMBERPROPERTY Function

## Description

The CUBEMEMBERPROPERTY function returns the value of a member property from the cube. Use this Function to validate that a member name exists within the cube and to return the specified property for this member.

## Syntax

```
CUBEMEMBERPROPERTY (connection, member_expression, property)
```

## Arguments

Argument	Description	Required /Optional
connection	Name of the connection to the cube. - A text string	Required
member_expression	A multidimensional expression (MDX) of a member within the cube. - A text string	Required
property	The name of the property returned or a reference to a cell that contains the name of the property. - A text string	Required

## Notes

- When the CUBEMEMBERPROPERTY function evaluates, it temporarily displays a "#GETTING\_DATA..." message in the cell before all of the data is retrieved.
- If the connection name is not a valid workbook connection stored in the workbook, CUBEMEMBERPROPERTY returns a #NAME? Error value. If the Online Analytical Processing (OLAP) server is not running, not available, or returns an error message, CUBEMEMBERPROPERTY returns a #NAME? Error value.
- If the member\_expression syntax is incorrect or if the member specified by member\_expression does not exist in the cube, CUBEMEMBERPROPERTY returns a #N/A error value.
- CUBEMEMBERPROPERTY may return a #N/A error value if you reference a session-based object, such as a calculated member or named set, in a PivotTable when sharing a connection. The PivotTable is deleted or you can convert the PivotTable to formulas. (On the Options tab, in the Tools group, click OLAP Tools, and then click Convert to Formulas.)

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

```
=CUBEMEMBERPROPERTY ("Sales","[Time].[Fiscal].[2004]",$A$3)  
=CUBEMEMBERPROPERTY("Sales","[Store].[MyFavoriteStore]","[Store].[Store  
Name].[Store Sqft]")
```

# 46. CUBERANKEDMEMBER Function

## Description

The CUBERANKEDMEMBER function returns the nth, or ranked, member in a set.

Use this function to return one or more elements in a set, such as the top sales performer or the top 10 students.

## Syntax

```
CUBERANKEDMEMBER (connection, set_expression, rank, [caption])
```

## Arguments

Argument	Description	Required /Optional
connection	The name of the connection to the cube. - A text string.	Required
set_expression	A set expression. - A text string, E.g. " {[Item1].children } ". OR The CUBESET function. OR A reference to a cell that contains the CUBESET function.	Required
rank	An integer value specifying the top value to return. E.g.: 1 - Returns the top value, 2 - Returns the second top value, etc. To return the top 5 values, use this Function five times, specifying a different rank, 1 through 5, each time.	Required
caption	A text string displayed in the cell instead of the caption, if one is defined, from the cube.	Optional

## Notes

- When the CUBERANKEDMEMBER function evaluates, it temporarily displays a "#GETTING\_DATA..." message in the cell before all of the data is retrieved.
- If the connection name is not a valid workbook connection stored in the workbook, CUBERANKEDMEMBER returns a #NAME? Error value. If the Online Analytical Processing (OLAP) server is not running, not available, or returns an error message, CUBERANKEDMEMBER returns a #NAME? Error value.
- CUBERANKEDMEMBER returns a #N/A error value when the syntax of set\_expression is incorrect or when the set contains at least one member with a different dimension than the other members.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Power PivotTable		
A	B	C
1 Month	January	
2		
3 Row Labels	Sum of Total Amount	Slicers
4 North	1140	=CUBESET("ThisWorkbookDataModel",Slicer_Region,"Region")
5 Thompson, Shannon	1140	
6 South	3110	Ranked Member
7 Davis, William	1100	=CUBERANKEDMEMBER("ThisWorkbookDataModel",C4,2)
8 Flores, Tia	1655	
9 Walters, Chris	355	Ranked Member
10 Grand Total	4250	South

**Function Usage**

**Results**

# 47. CUBESET Function

## Description

The CUBESET function defines a calculated set of members or tuples by sending a set expression to the cube on the server, which creates the set, and then returns that set to Microsoft Excel.

## Syntax

```
CUBESET (connection, set_expression, [caption], [sort_order], [sort_by])
```

## Arguments

Argument	Description	Required /Optional
connection	Name of the connection to the cube. - A text string	Required
set_expression	A text string of a set expression that results in a set of members or tuples. OR A cell reference to an Excel range that contains one or more members, tuples, or sets included in the set.	Required
caption	A text string that is displayed in the cell instead of the caption, if one is defined, from the cube.	Optional
sort_order	The type of sort, if any, to perform and can be one as given in the Table below.	Optional
sort_by	A text string of the value by which to sort. <b>Example</b> To get the city with the highest sales, set_expression would be a set of cities, and sort_by would be the sales measure. To get the city with the highest population, set_expression would be a set of cities, and sort_by would be the population measure. If sort_order requires sort_by, and sort_by is omitted, CUBESET returns the #VALUE! Error message.	Optional

The type of sort to perform, if sort\_order Argument is specified-

Integer	Enumerated constant	Description	Argument - Sort_by
0	SortNone	Leaves the set in existing order.	Ignored
1	SortAscending	Sorts set in ascending order by sort_by.	Required
2	SortDescending	Sorts set in descending order by sort_by.	Required
3	SortAlphaAscending	Sorts set in alpha ascending order.	Ignored

4	Sort_Alpha_Descending	Sorts set in alpha descending order.	Ignored
5	Sort_Natural_Ascending	Sorts set in natural ascending order.	Ignored
6	Sort_Natural_Descending	Sorts set in natural descending order.	Ignored

The default value is 0. An alpha sort for a set of tuples sorts on the last element in each tuple.

## Notes

- When the CUBESET function evaluates, it temporarily displays a "#GETTING\_DATA..." message in the cell before all of the data is retrieved.
- If the connection name is not a valid workbook connection stored in the workbook, CUBESET returns a #NAME? Error value. If the Online Analytical Processing (OLAP) server is not running, not available, or returns an error message, CUBESET returns a #NAME? Error value.
- If the set\_expression syntax is incorrect or the set contains at least one member with a different dimension than the other members, CUBESET returns a #N/A error value.
- If set\_expression is longer than 255 characters, which is the limit for an argument to a function, CUBESET returns a #VALUE! Error value. To use text strings longer than 255 characters, enter the text string in a cell (for which the limit is 32,767 characters), and then use a cell reference as the argument.
- CUBESET may return a #N/A error value if you reference a session-based object, such as a calculated member or named set, in a PivotTable when sharing a connection and that PivotTable is deleted or you convert the PivotTable to formulas. (On the Options tab, in the Tools group, click OLAP Tools, and then click Convert to Formulas.)

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Power PivotTable			Function Usage
A	B	C	
3 Row Labels	Sum of Total Amount	Slicers	
4 North	1140	=CUBESET("ThisWorkbookDataModel",Slicer_Region,"Region")	
5 Thompson, Shannon	1140	=CUBESET("ThisWorkbookDataModel",Slicer_Salesperson,"Sales Person")	
6 South	3110	Slicers	
7 Davis, William	1100	Region	
8 Flores, Tia	1655	Sales Person	
9 Walters, Chris	355		Results
10 Grand Total	4250		

# 48. CUBESETCOUNT Function

## Description

The CUBESETCOUNT function returns the number of items in a set.

## Syntax

```
CUBESETCOUNT (set)
```

## Arguments

Argument	Description	Required /Optional
set	A text string of a Microsoft Excel expression that evaluates to a set defined by the CUBESET function. OR The CUBESET function. OR A reference to a cell that contains the CUBESET function.	Required

## Notes

When the CUBESETCOUNT function evaluates, it temporarily displays a "#GETTING\_DATA..." message in the cell before all of the data is retrieved.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Power PivotTable		Function Usage
A	B	C
1 Month	January	
2		
3 Row Labels	Sum of Total Amount	<b>Slicers</b>
4 North	1140	=CUBESET("ThisWorkbookDataModel",Slicer_Region,"Region")
5 Thompson, Shannon	1140	=CUBESET("ThisWorkbookDataModel",Slicer_Salesperson,"Sales Person")
6 South	3110	
7 Davis, William	1100	<b>Result</b>
8 Flores, Tia	1655	=CUBESETCOUNT(C4)
9 Walters, Chris	355	=CUBESETCOUNT(C5)
10 Grand Total	4250	
11		<b>Results</b>

# 49. CUBEVALUE Function

## Description

The CUBEVALUE function returns an aggregated value from the cube.

## Syntax

```
CUBEVALUE (connection, [member_expression1], [member_expression2], ...)
```

## Arguments

Argument	Description	Required /Optional
connection	The name of the connection to the cube. - A text string	Required
member_expression	A text string of a multidimensional expression (MDX) that evaluates to a member or tuple within the cube. OR A set defined with the CUBESET function.	Optional

- Use the Argument member\_expression as a slicer to define the portion of the cube for which the aggregated value is returned.
- If no measure is specified in member\_expression, the default measure for that cube is used.

## Notes

- When the CUBEVALUE function evaluates, it temporarily displays a "#GETTING\_DATA..." message in the cell before all of the data is retrieved.
- If a cell reference is used for member\_expression, and that cell reference contains a CUBE function, then member\_expression uses the MDX expression for the item in the referenced cell, and not the value displayed in that referenced cell.
- If the connection name is not a valid workbook connection stored in the workbook, CUBEVALUE returns a #NAME? Error value. If the Online Analytical Processing (OLAP) server is not running, not available, or returns an error message, CUBEVALUE returns a #NAME? Error value.
- If at least one element within the tuple is invalid, CUBEVALUE returns a #VALUE! Error value.
- CUBEVALUE returns a #N/A error value when:
  - The member\_expression syntax is incorrect
  - The member specified by member\_expression doesn't exist in the cube

- The tuple is invalid because there is no intersection for the specified values. (This can occur with multiple elements from the same hierarchy).
- The set contains at least one member with a different dimension than the other members.
- CUBEVALUE may return a #N/A error value if you reference a session-based object, such as a calculated member or named set, in a PivotTable when sharing a connection. The PivotTable is deleted or you convert the PivotTable to formulas. (On the Options tab, in the Tools group, click OLAP Tools, and then click Convert to Formulas.)

### **Issue: Null values are converted to zero-length strings**

- In Excel, if a cell has no data because you never changed it or you deleted the contents, the cell contains an empty value. In many database systems, an empty value is called a **Null** value. An **empty** or **Null** value literally means "No value." However, a formula can never return an empty string or Null value. A formula always returns one of three values-
  - A number value
  - A text value, which may be a zero-length string
  - An error value, such as #NUM! or #VALUE
- If a formula contains a CUBEVALUE function connected to an Online Analytical Processing (OLAP) database and a query to this database results in a Null value, Excel converts this Null value to a zero-length string, even if the formula would otherwise return a number value. This can lead to a situation where a range of cells contain a combination of numeric and zero-length string values, and this situation can affect the results of other formulas that reference that range of cells.
- For example, if A1 and A3 contain numbers, and A2 contains a formula with a CUBEVALUE function that returns a zero-length string, the following formula would return a #VALUE! Error-

=A1+A2+A3

- To prevent this, you can test for a zero-length string by using the ISTEXT function. You can use the IF function to replace the zero-length with a 0 (zero) as follows-

```
=IF(ISTEXT(A1),0,A1)+IF(ISTEXT(A2),0,A2)+IF(ISTEXT(A3),0,A3)
```

- Alternatively, you can nest the CUBEVALUE function in an IF condition that returns a 0 value if the CUBEVALUE function evaluates to a zero-length string as follows-

```
=IF(CUBEVALUE("Sales","[Measures].[Profit]","[Time].[2004]","[All Product].[Beverages]")="",0,CUBEVALUE("Sales","[Measures].[Profit]","[Time].[2004]","[All Product].[Beverages]"))
```

**Note:** The **SUM** function does not require this test for a zero-length string because it automatically ignores zero-length strings when calculating its return value.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Power PivotTable					Function Usage	Results
A	B	C	D	E	G	G
Sum of Total Amount	Column Label					
Row Labels	January	February	March	Grand Total		
East	1690	1950	700	4340	=CUBEVALUE("ThisWorkbookDataModel", "[Measures].[Sum of Total Amount]", "[Sales].[Region].&[East]")	4340
Albertson, Kathy	925	1375	350	2650		
Post, Melissa	765	575	350	1690		
North	1140	1720	300	3160	=CUBEVALUE("ThisWorkbookDataModel", "[Measures].[Sum of Total Amount]", "[Sales].[Region].&[North]")	3160
Thompson, Shannon	1140	1720	300	3160		
South	3110	3175	3790	10875	=CUBEVALUE("ThisWorkbookDataModel", "[Measures].[Sum of Total Amount]", "[Sales].[Region].&[South]")	10875
Davis, William	1100	235	600	1935		
Flores, Tia	1655	985	1925	4565		
Walters, Chris	355	2755	1265	4375		
West	3150	1515	525	5190	=CUBEVALUE("ThisWorkbookDataModel", "[Measures].[Sum of Total Amount]", "[Sales].[Region].&[West]")	5190
Brennan, Michael	2750	550	400	3700		
Dunlap, Richard	400	965	125	1490		
Grand Total	9090	9160	5315	23545		

# Database Functions

# 50. Database Functions – Overview

The Excel Database functions work with an Excel Database. This typically takes the form of a large table of Data, where each row in the table stores an individual record. Each column in the Worksheet table stores a different field for each record.

The Database functions perform basic operations, such as Sum, Average, Count, etc., and additionally use criteria arguments, that allow you to perform the calculation only for a specified subset of the records in your Database. Other records in the Database are ignored.

## Database Functions

The following table lists all the Database functions-

S. No.	Function and Description
1	<b>DAVERAGE</b> Averages the values in a column of a list or database that match conditions you specify.
2	<b>DCOUNT</b> Counts the cells that contain numbers in a column of a list or database that match conditions you specify.
3	<b>DCOUNTA</b> Counts the nonblank cells in a column of a list or database that match conditions you specify.
4	<b>DGET</b> Returns a single value from a column of a list or database that matches conditions you specify.
5	<b>DMAX</b> Returns the largest number in a column of a list or database that matches conditions you specify.
6	<b>DMIN</b> Returns the smallest number in a column of a list or database that matches conditions you specify.
7	<b>DPRODUCT</b> Multiplies the values in a column of a list or database that match conditions you specify.
8	<b>DSTDEV</b>

S. No.	Function and Description
	Estimates the standard deviation of a population based on a sample by using the numbers in a column of a list or database that match conditions you specify.
9	DSTDEV Calculates the standard deviation of a population based on the entire population, using the numbers in a column of a list or database that match conditions you specify.
10	DSUM Adds the numbers in a column of a list or database that match conditions you specify.
11	DVAR Estimates the variance of a population based on a sample by using the numbers in a column of a list or database that match conditions you specify.
12	DVARP Calculates the variance of a population based on the entire population by using the numbers in a column of a list or database that match conditions you specify.

# 51. DAVERAGE Function

## Description

The DAVERAGE function returns the average of the values in a column of a list or database that match the conditions specified.

## Syntax

```
DAVERAGE (database, field, criteria)
```

## Arguments

Argument	Description	Required /Optional
database	The range of cells that makes up the list or database. A database is a list of related data in which rows of related information are records, and columns of data are fields. The first row of the list contains labels for each column.	Required
field	Indicates for which column the Average is calculated. Enter the column label enclosed between double quotation marks, such as "Age" or "Yield," or a number (without quotation marks) that represents the position of the column within the list: 1 for the first column, 2 for the second column, and so on.	Required
criteria	The range of cells that contains the conditions you specify. You can use any range for the criteria argument, as long as it includes at least one column label and at least one cell below the column label in which you specify a condition for the column.	Required

## Notes

- You can use any range for the criteria argument, as long as it includes at least one column label and at least one cell below the column label for specifying the condition.
- For example, if the range G1:G2 contains the column label Income in G1 and the amount 10,000 in G2, you could define the range as MatchIncome and use that name as the criteria argument in the database functions.
- Although the criteria range can be located anywhere on the worksheet, do not place the criteria range below the list. If you add more information to the list, the new information is added to the first row below the list. If the row below the list is not blank, Excel cannot add the new information.
- Make sure the criteria range does not overlap the list.

- To perform an operation on an entire column in a database, enter a blank line below the column labels in the criteria range.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

The diagram illustrates the use of the DAVERAGE function in Excel. It shows a main data table (labeled 'Data') and a criteria table (labeled 'Criteria'). The DAVERAGE function is used to calculate the average quantity of Air Conditioners sold (27.8) and the average quantity of Samsung Air Conditioners sold (31).

**Data:**

	A	B	C	D	E	F	G
1							
2		<b>Product</b>	<b>Brand</b>	<b>Quantity</b>			
3		Air Conditioner	Voltas	40			
4		Refrigerator	Samsung	15			
5		Television	Samsung	5			
6		Washing Machine	Whirlpool	25			
7		Air Conditioner	Samsung	45			
8		Television	Samsung	10			
9		Television	Samsung	15			
10		Washing Machine	Whirlpool	10			
11		Air Conditioner	Samsung	35			
12		Refrigerator	Samsung	20			
13		Air Conditioner	Samsung	10			
14		Air Conditioner	Voltas	25			
15		Air Conditioner	Samsung	25			
16		Air Conditioner	Samsung	40			
17		Air Conditioner	Voltas	10			
18		Air Conditioner	Voltas	20			

**Criteria:**

	F	G
Brand	Samsung	
Product	Air Conditioner	

**Function Usage:**

- Average Quantity of Air Conditioners sold  
=DAVERAGE(B2:D18,D2,G3:G4)
- Average Quantity of Samsung Air Conditioners sold  
=DAVERAGE(B2:D18,D2,F3:G4)

**Results:**

- Average Quantity of Air Conditioners sold  
27.8
- Average Quantity of Samsung Air Conditioners sold  
31

## 52. DCOUNT Function

### Description

The DCOUNT function returns the count of the cells that contain numbers in a column of a list or database that match conditions you specify.

### Syntax

```
DCOUNT (database, field, criteria)
```

### Arguments

Argument	Description	Required /Optional
database	The range of cells that makes up the list or database. A database is a list of related data in which rows of related information are records, and columns of data are fields. The first row of the list contains labels for each column.	Required
field	Indicates which column is used in the function. Enter the column label enclosed between double quotation marks, such as "Age" or "Yield," or a number (without quotation marks) that represents the position of the column within the list: 1 for the first column, 2 for the second column, and so on. If this Argument (field) is omitted, this Function (DCOUNT) counts all records in the database that match the criteria.	Optional
criteria	The range of cells that contains the conditions that you specify. You can use any range for the criteria argument, as long as the argument includes at least one column label and at least one cell below the column label in which you specify a condition for the column.	Required

### Notes

- You can use any range for the criteria argument, as long as it includes at least one column label and at least one cell below the column label for specifying the condition.
- For example, if the range G1:G2 contains the column label Income in G1 and the amount \$10,000 in G2, you could define the range as MatchIncome and use that name as the criteria argument in the database functions.
- Although the criteria range can be located anywhere on the worksheet, do not place the criteria range below the list. If you add more information to the list, the new information is added to the first row below the list. If the row below the list is not blank, Microsoft Excel cannot add the new information.

- Make sure that the criteria range does not overlap the list.
- To perform an operation on an entire column in a database, enter a blank line below the column labels in the criteria range.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

	A	B	C	D	E	F	G		E	F	G
1											
2		Product	Brand	Quantity			Criteria				
3	Air Conditioner	Voltas	40								
4	Refrigerator	Samsung	15								
5	Television	Samsung	5								
6	Washing Machine	Whirlpool	25								
7	Air Conditioner	Samsung	45				Number of Times Air Conditioners sold				
8	Television	Samsung	10				=DCOUNT(B2:D18,D2,G3:G4)				
9	Television	Samsung	15								
10	Washing Machine	Whirlpool	10				Number of Times Samsung Air Conditioners sold				
11	Air Conditioner	Samsung	35				=DCOUNT(B2:D18,D2,F3:G4)				
12	Refrigerator	Samsung	20								
13	Air Conditioner	Samsung	10				Number of Times Samsung Products sold				
14	Air Conditioner	Voltas	25				=DCOUNT(B2:D18,D2,F3:F4)				
15	Air Conditioner	Samsung	25								
16	Air Conditioner	Samsung	40				Number of Times Samsung Products sold				
17	Air Conditioner	Voltas	10				=DCOUNT(B2:D18,"Quantity",F3:F4)				
18	Air Conditioner	Voltas	20								

Data                      Function Usage                      Results

# 53. DCOUNTA Function

## Description

The DCOUNTA function returns the count of the nonblank cells in a column of a list or database that match conditions you specify.

This function is similar to the DCOUNT function, except that the **DCOUNTA** function counts all non-blank cells. The DCOUNT function counts only the cells containing numerical values.

## Syntax

```
DCOUNTA (database, field, criteria)
```

## Arguments

Argument	Description	Required /Optional
database	The range of cells that makes up the list or database. A database is a list of related data in which rows of related information are records, and columns of data are fields. The first row of the list contains labels for each column.	Required
field	Indicates which column is used in the function. Enter the column label enclosed between double quotation marks, such as "Age" or "Yield," or a number (without quotation marks) that represents the position of the column within the list: 1 for the first column, 2 for the second column, and so on. If this argument (field) is omitted, this Function (DCOUNTA) counts all records in the database that match the criteria.	Optional
criteria	The range of cells that contains the conditions that you specify. You can use any range for the criteria argument, as long as it includes at least one column label and at least one cell below the column label in which you specify a condition for the column.	Required

## Notes

- You can use any range for the criteria argument, as long as it includes at least one column label and at least one cell below the column label for specifying the condition.
- For example, if the range G1:G2 contains the column label Income in G1 and the amount \$10,000 in G2, you could define the range as MatchIncome and use that name as the criteria argument in the database functions.

- Although the criteria range can be located anywhere on the worksheet, do not place the criteria range below the list. If you add more information to the list, the new information is added to the first row below the list. If the row below the list is not blank, Excel cannot add the new information.
- Make sure that the criteria range does not overlap the list.
- To perform an operation on an entire column in a database, enter a blank line below the column labels in the criteria range

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

The screenshot shows an Excel spreadsheet with three main sections: Data, Function Usage, and Results.

**Data:** A table in columns A, B, C, and D. Column A contains row numbers from 1 to 18. Columns B, C, and D contain data for products: Air Conditioner, Refrigerator, Television, Washing Machine, Air Conditioner, Television, Television, Washing Machine, Air Conditioner, Refrigerator, Air Conditioner, Air Conditioner. The 'Status' column has values like Volta, Samsung, Sold, Whirlpool, etc.

**Function Usage:** A table in columns F, G, and H. Column F contains criteria ranges: Brand (F3:F4), Product (F5:F6), and Status (F7:F8). Column G contains formulas: =DCOUNTA(B2:D18,D2,G3:G4) for Air Conditioners, =DCOUNTA(B2:D18,D2,F3:G4) for Samsung Air Conditioners, =DCOUNTA(B2:D18,D2,F3:F4) for Samsung Products, and =DCOUNTA(B2:D18,"Status",F3:F4) for Sold products.

**Results:** A table in columns E, F, and G. Column E contains results: 4 for Air Conditioners, 2 for Samsung Air Conditioners, 4 for Samsung Products, and 4 for Sold products.

# 54. DGET Function

## Description

The DGET function returns a single value from a column of a list or database that matches the conditions you specify.

## Syntax

```
DGET (database, field, criteria)
```

## Arguments

Argument	Description	Required /Optional
database	The range of cells that makes up the list or database. A database is a list of related data in which rows of related information are records, and columns of data are fields. The first row of the list contains labels for each column.	Required
field	Indicates which column is used in the function. Enter the column label enclosed between double quotation marks, such as "Age" or "Yield," or a number (without quotation marks) that represents the position of the column within the list: 1 for the first column, 2 for the second column, and so on.	Required
criteria	The range of cells that contains the conditions that you specify. You can use any range for the criteria argument, as long as the argument includes at least one column label and at least one cell below the column label in which you specify a condition for the column.	Required

## Notes

- If no record matches the criteria, DGET returns the #VALUE! Error value.
- If more than one record matches the criteria, DGET returns the #NUM! Error value.
- You can use any range for the criteria argument, as long as it includes at least one column label and at least one cell below the column label for specifying the condition.
- For example, if the range G1:G2 contains the column label Income in G1 and the amount \$10,000 in G2, you could define the range as MatchIncome and use that name as the criteria argument in the database functions.
- Although the criteria range can be located anywhere on the worksheet, do not place the criteria range below the list. If you add more information to the list, the new information is added to the first row below the list. If the row below the list is not blank, Microsoft Excel cannot add the new information.

- Make sure that the criteria range does not overlap the list.
- To perform an operation on an entire column in a database, enter a blank line below the column labels in the criteria range.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

**Data**

Product	Brand	Month	Quantity
Air Conditioner	Voltas	March	40
Refrigerator	Samsung	March	15
Television	Samsung	April	5
Washing Machine	Whirlpool	March	25
Air Conditioner	Samsung	March	45
Television	Samsung	April	10
Television	Samsung	May	15
Washing Machine	Whirlpool	April	10
Air Conditioner	Samsung	April	55
Air Conditioner	Samsung	May	10
Air Conditioner	Voltas	April	25
Air Conditioner	Samsung	June	25
Air Conditioner	Samsung	July	10
Air Conditioner	Voltas	June	20
Air Conditioner	Voltas	July	10

**Criteria**

Brand	Product	Month
Samsung	Air Conditioner	April

Brand	Product	Month
Samsung	Refrigerator	April

**Function Usage**

Number of Samsung Refrigerators sold in April
=DGET(B2:E17,E2,G6:I7)

Number of Samsung Air Conditioners sold in April
=DGET(B2:E17,E2,G3:I4)

**Results**

Number of Samsung Refrigerators sold in April
15

Number of Samsung Air Conditioners sold in April
55

# 55. DMAX Function

## Description

The DMAX function returns the largest number in a column of a list or database that matches the conditions you specify.

## Syntax

```
DMAX (database, field, criteria)
```

## Arguments

Argument	Description	Required /Optional
database	The range of cells that makes up the list or database. A database is a list of related data in which rows of related information are records, and columns of data are fields. The first row of the list contains labels for each column.	Required
field	Indicates which column is used in the function. Enter the column label enclosed between double quotation marks, such as "Age" or "Yield," or a number (without quotation marks) that represents the position of the column within the list: 1 for the first column, 2 for the second column, and so on.	Required
criteria	The range of cells that contains the conditions that you specify. You can use any range for the criteria argument, as long as the argument includes at least one column label and at least one cell below the column label in which you specify a condition for the column.	Required

## Notes

- You can use any range for the criteria argument, as long as it includes at least one column label and at least one cell below the column label for specifying the condition.
- For example, if the range G1:G2 contains the column label Income in G1 and the amount \$10,000 in G2, you could define the range as MatchIncome and use that name as the criteria argument in the database functions.
- Although the criteria range can be located anywhere on the worksheet, do not place the criteria range below the list. If you add more information to the list, the new information is added to the first row below the list. If the row below the list is not blank, Microsoft Excel cannot add the new information.
- Make sure that the criteria range does not overlap the list.

- To perform an operation on an entire column in a database, enter a blank line below the column labels in the criteria range.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

The diagram illustrates the use of the DMAX function in Excel across four main sections:

- Data:** A table of product sales data from row 2 to 17, spanning columns A, B, C, D, and E.
- Criteria:** A table of search criteria in columns F and G, spanning rows 3 to 7.
- Function Usage:** Three examples of the DMAX function being used to find maximum values based on specific criteria.
- Results:** The output of the DMAX function, showing the maximum quantity sold for each brand.

Annotations provide the formulas used in the Function Usage section:

- Max Number of Samsung Air Conditioners sold  
=DMAX(B2:D17,D2,F3:G4)
- Max Number of Voltas Air Conditioners sold  
=DMAX(B2:D17,D2,F6:G7)
- Max Number of Samsung Air Conditioners sold  
45
- Max Number of Voltas Air Conditioners sold  
40

# 56. DMIN Function

## Description

The DMIN function returns the smallest number in a column of a list or database that matches the conditions you specify.

## Syntax

```
DMIN (database, field, criteria)
```

## Arguments

Argument	Description	Required /Optional
database	The range of cells that makes up the list or database. A database is a list of related data in which rows of related information are records, and columns of data are fields. The first row of the list contains labels for each column.	Required
field	Indicates which column is used in the function. Enter the column label enclosed between double quotation marks, such as "Age" or "Yield," or a number (without quotation marks) that represents the position of the column within the list: 1 for the first column, 2 for the second column, and so on.	Required
criteria	The range of cells that contains the conditions that you specify. You can use any range for the criteria argument, as long as the argument includes at least one column label and at least one cell below the column label in which you specify a condition for the column.	Required

## Notes

- You can use any range for the criteria argument, as long as it includes at least one column label and at least one cell below the column label for specifying the condition.
- For example, if the range G1:G2 contains the column label Income in G1 and the amount \$10,000 in G2, you could define the range as MatchIncome and use that name as the criteria argument in the database functions.
- Although the criteria range can be located anywhere on the worksheet, do not place the criteria range below the list. If you add more information to the list, the new information is added to the first row below the list. If the row below the list is not blank, Microsoft Excel cannot add the new information.
- Make sure that the criteria range does not overlap the list.

- To perform an operation on an entire column in a database, enter a blank line below the column labels in the criteria range.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

The screenshot illustrates the use of the DMIN function in Excel. On the left, there is a data table (labeled 'Data') with columns 'Product', 'Brand', and 'Quantity'. The data includes various products like Air Conditioner, Refrigerator, Television, and Washing Machine from brands like Volta and Samsung. A blank row is present between the header and the first data row. To the right, under the heading 'Criteria', there are two rows: one for Samsung Air Conditioners and another for Volta Air Conditioners. Below these criteria, three formulas are shown: 'Min Number of Samsung Air Conditioners sold =DMIN(B2:D17,D2,F3:G4)', 'Min Number of Volta Air Conditioners sold =DMIN(B2:D17,D2,F6:G7)', and the resulting values '10' and '10' respectively. The labels 'Function Usage' and 'Results' are placed near their respective sections.

A	B	C	D	E	F	G					
1					Criteria						
2	Product	Brand	Quantity		Brand	Product					
3	Air Conditioner	Volta	40		Samsung	Air Conditioner					
4	Refrigerator	Samsung	15								
5	Television	Samsung	5		Brand	Product					
6	Washing Machine	Whirlpool	25		Samsung	Air Conditioner					
7	Air Conditioner	Samsung	45		Volta	Air Conditioner					
8	Television	Samsung	10								
9	Television	Samsung	15								
10	Washing Machine	Whirlpool	10								
11	Air Conditioner	Samsung	35								
12	Air Conditioner	Samsung	10								
13	Air Conditioner	Volta	25								
14	Air Conditioner	Samsung	25								
15	Air Conditioner	Samsung	40								
16	Air Conditioner	Volta	10								
17	Air Conditioner	Volta	20								

Function Usage

Results

# 57. DPRODUCT Function

## Description

The DPRODUCT function returns the product of the values in a column of a list or database that match the conditions you specify.

## Syntax

```
DPRODUCT (database, field, criteria)
```

## Arguments

Argument	Description	Required /Optional
database	The range of cells that makes up the list or database. A database is a list of related data in which rows of related information are records, and columns of data are fields. The first row of the list contains labels for each column.	Required
field	Indicates which column is used in the function. Enter the column label enclosed between double quotation marks, such as "Age" or "Yield," or a number (without quotation marks) that represents the position of the column within the list: 1 for the first column, 2 for the second column, and so on.	Required
criteria	The range of cells that contains the conditions that you specify. You can use any range for the criteria argument, as long as the argument includes at least one column label and at least one cell below the column label in which you specify a condition for the column.	Required

## Notes

- You can use any range for the criteria argument, as long as it includes at least one column label and at least one cell below the column label for specifying the condition.
- For example, if the range G1:G2 contains the column label Income in G1 and the amount \$10,000 in G2, you could define the range as MatchIncome and use that name as the criteria argument in the database functions.
- Although the criteria range can be located anywhere on the worksheet, do not place the criteria range below the list. If you add more information to the list, the new information is added to the first row below the list. If the row below the list is not blank, Microsoft Excel cannot add the new information.
- Make sure that the criteria range does not overlap the list.

- To perform an operation on an entire column in a database, enter a blank line below the column labels in the criteria range.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

**Data**

	A	B	C	D	E	F	G		E	F	G
1											
2	Product	Brand	Quantity								
3	Air Conditioner	Voltas	40								
4	Refrigerator	Samsung	15								
5	Television	Samsung	5								
6	Washing Machine	Whirlpool	25								
7	Air Conditioner	Samsung	45								
8	Television	Samsung	10								
9	Television	Samsung	15								
10	Washing Machine	Whirlpool	10								
11	Air Conditioner	Samsung	35								
12	Air Conditioner	Samsung	10								
13	Air Conditioner	Voltas	25								
14	Air Conditioner	Samsung	25								
15	Air Conditioner	Samsung	40								
16	Air Conditioner	Voltas	10								
17	Air Conditioner	Voltas	20								

**Criteria**

Brand	Product
Samsung	Air Conditioner

Brand	Product
Voltas	Air Conditioner

**Function Usage**

Product of the Number of Samsung Air Conditioners sold  
=DPRODUCT(B2:D17,D2,F3:G4)

Product of the Number of Voltas Air Conditioners sold  
=DPRODUCT(B2:D17,D2,F6:G7)

**Results**

Product of the Number of Samsung Air Conditioners sold  
15750000

Product of the Number of Voltas Air Conditioners sold  
200000

# 58. DSTDEV Function

## Description

The DSTDEV function estimates the standard deviation of a population based on a sample by using the numbers in a column of a list or database that match conditions you specify.

## Syntax

```
DSTDEV (database, field, criteria)
```

## Arguments

Argument	Description	Required /Optional
database	The range of cells that makes up the list or database. A database is a list of related data in which rows of related information are records, and columns of data are fields. The first row of the list contains labels for each column.	Required
field	Indicates which column is used in the function. Enter the column label enclosed between double quotation marks, such as "Age" or "Yield," or a number (without quotation marks) that represents the position of the column within the list: 1 for the first column, 2 for the second column, and so on.	Required
criteria	The range of cells that contains the conditions that you specify. You can use any range for the criteria argument, as long as the argument includes at least one column label and at least one cell below the column label in which you specify a condition for the column.	Required

## Notes

- You can use any range for the criteria argument, as long as it includes at least one column label and at least one cell below the column label for specifying the condition.
- For example, if the range G1:G2 contains the column label Income in G1 and the amount \$10,000 in G2, you could define the range as MatchIncome and use that name as the criteria argument in the database functions.
- Although the criteria range can be located anywhere on the worksheet, do not place the criteria range below the list. If you add more information to the list, the new information is added to the first row below the list. If the row below the list is not blank, Microsoft Excel cannot add the new information.
- Make sure that the criteria range does not overlap the list.

- To perform an operation on an entire column in a database, enter a blank line below the column labels in the criteria range.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

The screenshot shows an Excel spreadsheet with three main sections: Data, Function Usage, and Results.

**Data:** A table in columns A, B, and C with rows 3 through 17. The columns are labeled Product, Brand, and Quantity. The data includes various products like Air Conditioner, Refrigerator, Television, and Washing Machine, with brands like Voltas, Samsung, and Whirlpool, and quantities ranging from 5 to 45.

**Function Usage:** This section contains two formulas in boxes:

- Standard Deviation: Sample Samsung Air Conditioners sold**  
=DSTDEV(B2:D17,D2,F3:G4)
- Standard Deviation: Sample Voltas Air Conditioners sold**  
=DSTDEV(B2:D17,D2,F6:G7)

**Results:** This section displays the results of the formulas:

- For Samsung Air Conditioners: Standard Deviation = 13.9
- For Voltas Air Conditioners: Standard Deviation = 12.5

Yellow arrows point from the labels "Data", "Function Usage", and "Results" to their respective sections in the spreadsheet.

A	B	C	D	E	F	G	E	F	G
1					Criteria				
2	Product	Brand	Quantity		Brand	Product		Brand	Product
3	Air Conditioner	Voltas	40		Samsung	Air Conditioner		Samsung	Air Conditioner
4	Refrigerator	Samsung	15		Voltas	Air Conditioner		Voltas	Air Conditioner
5	Television	Samsung	5						
6	Washing Machine	Whirlpool	25						
7	Air Conditioner	Samsung	45						
8	Television	Samsung	10						
9	Television	Samsung	15						
10	Washing Machine	Whirlpool	10						
11	Air Conditioner	Samsung	35						
12	Air Conditioner	Samsung	10						
13	Air Conditioner	Voltas	25						
14	Air Conditioner	Samsung	25						
15	Air Conditioner	Samsung	40						
16	Air Conditioner	Voltas	10						
17	Air Conditioner	Voltas	20						

Function Usage

Results

**Data:** Points to the main data table.

**Function Usage:** Points to the formula boxes.

**Results:** Points to the output cells.

# 59. DSTDEVP Function

## Description

The DSTDEVP function calculates the standard deviation of a population based on the entire population, using the numbers in a column of a list or database that match conditions you specify.

## Syntax

```
DSTDEVP (database, field, criteria)
```

## Arguments

Argument	Description	Required /Optional
database	The range of cells that makes up the list or database. A database is a list of related data in which rows of related information are records, and columns of data are fields. The first row of the list contains labels for each column.	Required
field	Indicates which column is used in the function. Enter the column label enclosed between double quotation marks, such as "Age" or "Yield," or a number (without quotation marks) that represents the position of the column within the list: 1 for the first column, 2 for the second column, and so on.	Required
criteria	The range of cells that contains the conditions that you specify. You can use any range for the criteria argument, as long as the argument includes at least one column label and at least one cell below the column label in which you specify a condition for the column.	Required

## Notes

- You can use any range for the criteria argument, as long as it includes at least one column label and at least one cell below the column label for specifying the condition.
- For example, if the range G1:G2 contains the column label Income in G1 and the amount \$10,000 in G2, you could define the range as MatchIncome and use that name as the criteria argument in the database functions.
- Although the criteria range can be located anywhere on the worksheet, do not place the criteria range below the list. If you add more information to the list, the new information is added to the first row below the list. If the row below the list is not blank, Microsoft Excel cannot add the new information.
- Make sure that the criteria range does not overlap the list.

- To perform an operation on an entire column in a database, enter a blank line below the column labels in the criteria range.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

The screenshot shows an Excel spreadsheet with the following structure:

- Data:** A table from row 2 to 17 containing columns for Product, Brand, and Quantity.
- Function Usage:** A section where the DSTDEVP function is used to calculate standard deviation for different brands. It includes formulas like =DSTDEVP(B2:D17,D2,F3:G4) for Samsung and =DSTDEVP(B2:D17,D2,F6:G7) for Voltas.
- Results:** The calculated standard deviations for each brand: 12.4 for Samsung and 10.8 for Voltas.

	B	C	D	E	F	G	E	F	G
1						Criteria			
2	Product	Brand	Quantity		Brand	Product	Brand	Product	
3	Air Conditioner	Volta	40		Samsung	Air Conditioner	Samsung	Air Conditioner	
4	Refrigerator	Samsung	15		Volta	Air Conditioner	Volta	Air Conditioner	
5	Television	Samsung	5						
6	Washing Machine	Whirlpool	25						
7	Air Conditioner	Samsung	45						
8	Television	Samsung	10						
9	Television	Samsung	15						
10	Washing Machine	Whirlpool	10						
11	Air Conditioner	Samsung	35						
12	Air Conditioner	Samsung	10						
13	Air Conditioner	Volta	25						
14	Air Conditioner	Samsung	25						
15	Air Conditioner	Samsung	40						
16	Air Conditioner	Volta	10						
17	Air Conditioner	Volta	20						

**Data:** A table from row 2 to 17 containing columns for Product, Brand, and Quantity.

**Function Usage:**

- Standard Deviation Population: Samsung Air Conditioners sold  
=DSTDEVP(B2:D17,D2,F3:G4)
- Standard Deviation Population: Volta Air Conditioners sold  
=DSTDEVP(B2:D17,D2,F6:G7)

**Results:**

- Standard Deviation Population: Samsung Air Conditioners sold  
12.4
- Standard Deviation Population: Volta Air Conditioners sold  
10.8

# 60. DSUM Function

## Description

The DSUM function adds the numbers in a column of a list or database that match conditions you specify.

## Syntax

```
DSUM (database, field, criteria)
```

## Arguments

Argument	Description	Required /Optional
database	The range of cells that makes up the list or database. A database is a list of related data in which rows of related information are records, and columns of data are fields. The first row of the list contains labels for each column.	Required
field	Indicates which column is used in the function. Enter the column label enclosed between double quotation marks, such as "Age" or "Yield," or a number (without quotation marks) that represents the position of the column within the list: 1 for the first column, 2 for the second column, and so on.	Required
criteria	The range of cells that contains the conditions that you specify. You can use any range for the criteria argument, as long as the argument includes at least one column label and at least one cell below the column label in which you specify a condition for the column.	Required

## Notes

- You can use any range for the criteria argument, as long as it includes at least one column label and at least one cell below the column label for specifying the condition
- For example, if the range G1:G2 contains the column label Income in G1 and the amount \$10,000 in G2, you could define the range as MatchIncome and use that name as the criteria argument in the database functions
- Although the criteria range can be located anywhere on the worksheet, do not place the criteria range below the list. If you add more information to the list, the new information is added to the first row below the list. If the row below the list is not blank, Microsoft Excel cannot add the new information
- Make sure that the criteria range does not overlap the list

- To perform an operation on an entire column in a database, enter a blank line below the column labels in the criteria range

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

The screenshot shows an Excel spreadsheet with three main sections: Data, Function Usage, and Results.

**Data:** A table in the range B2:D17 containing columns for Product, Brand, and Quantity. The data includes items like Air Conditioner, Refrigerator, Television, etc., with their respective brands and quantities.

**Function Usage:** A section showing the usage of the DSUM function. It contains two examples:

- Total Number of Samsung Air Conditioners sold  
=DSUM(B2:D17,D2,F3:G4)
- Total Number of Volta Air Conditioners sold  
=DSUM(B2:D17,D2,F6:G7)

**Results:** The results of the DSUM functions are displayed in the range E2:F10. The results are:
 

- Total Number of Samsung Air Conditioners sold: 155
- Total Number of Volta Air Conditioners sold: 95

# 61. DVAR Function

## Description

The DVAR function estimates the variance of a population based on a sample by using the numbers in a column of a list or database that match the conditions you specify.

## Syntax

```
DVAR (database, field, criteria)
```

## Arguments

Argument	Description	Required /Optional
database	The range of cells that makes up the list or database. A database is a list of related data in which rows of related information are records, and columns of data are fields. The first row of the list contains labels for each column.	Required
field	Indicates which column is used in the function. Enter the column label enclosed between double quotation marks, such as "Age" or "Yield," or a number (without quotation marks) that represents the position of the column within the list: 1 for the first column, 2 for the second column, and so on.	Required
criteria	The range of cells that contains the conditions that you specify. You can use any range for the criteria argument, as long as the argument includes at least one column label and at least one cell below the column label in which you specify a condition for the column.	Required

## Notes

- You can use any range for the criteria argument, as long as it includes at least one column label and at least one cell below the column label for specifying the condition.
- For example, if the range G1:G2 contains the column label Income in G1 and the amount \$10,000 in G2, you could define the range as MatchIncome and use that name as the criteria argument in the database functions.
- Although the criteria range can be located anywhere on the worksheet, do not place the criteria range below the list. If you add more information to the list, the new information is added to the first row below the list. If the row below the list is not blank, Microsoft Excel cannot add the new information.
- Make sure that the criteria range does not overlap the list.
- To perform an operation on an entire column in a database, enter a blank line below the column labels in the criteria range.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

	B	C	D	E	F	G		
1					Criteria			
2	Product	Brand	Quantity		Brand	Product	Brand	Product
3	Air Conditioner	Voltas	40		Samsung	Air Conditioner	Samsung	Air Conditioner
4	Refrigerator	Samsung	15					
5	Television	Samsung	5		Brand	Product	Brand	Product
6	Washing Machine	Whirlpool	25		Voltas	Air Conditioner	Voltas	Air Conditioner
7	Air Conditioner	Samsung	45					
8	Television	Samsung	10					
9	Television	Samsung	15					
10	Washing Machine	Whirlpool	10					
11	Air Conditioner	Samsung	35					
12	Air Conditioner	Samsung	10					
13	Air Conditioner	Voltas	25					
14	Air Conditioner	Samsung	25					
15	Air Conditioner	Samsung	40					
16	Air Conditioner	Voltas	10					
17	Air Conditioner	Voltas	20					

Data

Function Usage

Results

Variance: Sample Samsung Air Conditioners sold  
 $=DVAR(B2:D17,D2,F3:G4)$

Variance: Sample Voltas Air Conditioners sold  
 $=DVAR(B2:D17,D2,F6:G7)$

Variance: Sample Samsung Air Conditioners sold  
 192.5

Variance: Sample Voltas Air Conditioners sold  
 156.25

## 62. DVARP Function

### Description

The DVARP function calculates the variance of a population based on the entire population by using the numbers in a field (column) of records in a list or database that match the conditions you specify.

### Syntax

```
DVARP (database, field, criteria)
```

### Arguments

Argument	Description	Required /Optional
database	The range of cells that makes up the list or database. A database is a list of related data in which rows of related information are records, and columns of data are fields. The first row of the list contains labels for each column.	Required
field	Indicates which column is used in the function. Enter the column label enclosed between double quotation marks, such as "Age" or "Yield," or a number (without quotation marks) that represents the position of the column within the list: 1 for the first column, 2 for the second column, and so on.	Required
criteria	The range of cells that contains the conditions that you specify. You can use any range for the criteria argument, as long as the argument includes at least one column label and at least one cell below the column label in which you specify a condition for the column.	Required

### Notes

- You can use any range for the criteria argument, as long as it includes at least one column label and at least one cell below the column label for specifying the condition.
- For example, if the range G1:G2 contains the column label Income in G1 and the amount \$10,000 in G2, you could define the range as MatchIncome and use that name as the criteria argument in the database functions.
- Although the criteria range can be located anywhere on the worksheet, do not place the criteria range below the list. If you add more information to the list, the new information is added to the first row below the list. If the row below the list is not blank, Microsoft Excel cannot add the new information.
- Make sure that the criteria range does not overlap the list.

- To perform an operation on an entire column in a database, enter a blank line below the column labels in the criteria range.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

A	B	C	D	E	F	G	H	I	J	
1					Criteria					
2	Product	Brand	Quantity		Brand	Product		Brand	Product	
3	Air Conditioner	Voltas	40		Samsung	Air Conditioner		Samsung	Air Conditioner	
4	Refrigerator	Samsung	15		Voltas	Air Conditioner		Voltas	Air Conditioner	
5	Television	Samsung	5		Standard Deviation Population: Samsung Air Conditioners sold =DVARP(B2:D17,D2,F3:G4)				Variance Population: Samsung Air Conditioners sold 154.0	
6	Washing Machine	Whirlpool	25		Standard Deviation Population: Voltas Air Conditioners sold =DVARP(B2:D17,D2,F6:G7)				Variance Population: Voltas Air Conditioners sold 117.2	
7	Air Conditioner	Samsung	45							
8	Television	Samsung	10							
9	Television	Samsung	15							
10	Washing Machine	Whirlpool	10							
11	Air Conditioner	Samsung	35							
12	Air Conditioner	Samsung	10							
13	Air Conditioner	Voltas	25							
14	Air Conditioner	Samsung	25							
15	Air Conditioner	Samsung	40							
16	Air Conditioner	Voltas	10							
17	Air Conditioner	Voltas	20							

Data                      Function Usage                      Results

# Date & Time Functions

# 63. Date & Time Functions – Overview

Excel Date and Time functions can be used to extract information from, and perform operations on, Excel Dates and Times.

Some of the Excel Date & Time functions are new to Excel 2010 or Excel 2013, so are not available in earlier versions of Excel. You can find this information in the applicability section of the function.

## Date & Time Functions

The following table lists all the Date & Time functions-

S. No.	Function and Description
1	DATE Returns the serial number of a particular date.
2	DATEDIF Calculates the number of days, months, or years between two dates.
3	DATEVALUE Converts a date in the form of text to a serial number.
4	DAY Converts a serial number to a day of the month.
5	DAYS Returns the number of days between two dates.
6	DAYS360 Calculates the number of days between two dates, based on a 360-day year.
7	EDATE Returns the serial number of the date that is the indicated number of months before or after the start date.
8	EOMONTH Returns the serial number of the last day of the month before or after a specified number of months.
9	HOUR Converts a serial number to an hour.
10	ISOWEEKNUM Returns the number of the ISO week number of the year for a given date.
11	MINUTE Converts a serial number to a minute.
12	MONTH Converts a serial number to a month.

S. No.	Function and Description
13	<b>NETWORKDAYS</b> Returns the number of whole workdays between two dates.
14	<b>NETWORKDAYS.INTL</b> Returns the number of whole workdays between two dates (international version).
15	<b>NOW</b> Returns the serial number of the current date and time.
16	<b>SECOND</b> Converts a serial number to a second.
17	<b>TIME</b> Returns the serial number of a particular time.
18	<b>TIMEVALUE</b> Converts a time in the form of text to a serial number.
19	<b>TODAY</b> Returns the serial number of today's date.
20	<b>WEEKDAY</b> Converts a serial number to a day of the week.
21	<b>WEEKNUM</b> Returns the week number in the year.
22	<b>WORKDAY</b> Returns the serial number of the date before or after a specified number of workdays.
23	<b>WORKDAY.INTL</b> Returns the serial number of the date before or after a specified number of workdays using parameters to indicate which and how many days are weekend days.
24	<b>YEAR</b> Converts a serial number to a year.
25	<b>YEARFRAC</b> Returns the year fraction representing the number of whole days between start_date and end_date.

# 64. DATE Function

## Description

The DATE function returns the serial number of a particular date.

## Syntax

```
DATE (year, month, day)
```

## Arguments

Argument	Description	Required /Optional
year	The value of the year argument can include one to four digits. Excel interprets the year argument according to the date system your computer is using. By default, Microsoft Excel for Windows uses the 1900 date system. See Notes below.	Required
month	A positive or negative integer representing the month of the year from 1 to 12 (January to December). See Notes below.	Required
day	A positive or negative integer representing the day of the month from 1 to 31. See Notes below.	Required

## Notes

Excel stores dates as sequential serial numbers so that they can be used in calculations. January 1, 1900 is serial number 1, and January 1, 2008 is serial number 39448 because it is 39,447 days after January 1, 1900.

### year

Microsoft recommends using four digits for the year argument to prevent unwanted results. For example, "07" could mean "1907" or "2007." Four digit years prevent confusion

- If **year** is between 0 (zero) and 1899 (inclusive), Excel adds that value to 1900 to calculate the year. For example, DATE (108, 1, 2) returns January 2, 2008 (1900+108)
- If **year** is between 1900 and 9999 (inclusive), Excel uses that value as the year. For example, DATE (2008, 1, 2) returns January 2, 2008
- If **year** is less than 0 or is 10000 or greater, Excel returns the #NUM! Error value

## month

- If **month** is greater than 12, month adds that number of months to the first month in the year specified. For example, DATE (2008, 14, 2) returns the serial number representing February 2, 2009
- If **month** is less than 1, month subtracts the magnitude of that number of months, plus 1, from the first month in the year specified. For example, DATE (2008,-3, 2) returns the serial number representing September 2, 2007

## day

- If **day** is greater than the number of days in the month specified, day adds that number of days to the first day in the month. For example, DATE (2008, 1, 35) returns the serial number representing February 4, 2008.
- If **day** is less than 1, day subtracts the magnitude that number of days, plus one, from the first day of the month specified. For example, DATE (2008, 1, -15) returns the serial number representing December 16, 2007.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage				Results			
A	B	C	D	A	B	C	D
1				1			
2	Day	Month	Year	2	Day	Month	Date
3	25	8	2015	=DATE(D3,C3,B3)	3	25	2015
4	25	8	2015	=DATE(D4,C4,B4)	4	25	2015
5	32	8	2015	=DATE(D5,C5,B5)	5	32	2015
							Notes
							08/25/15 Default Format
							25-Aug-15 Cells Formatted
							September 1, 2015 with Date Option

# 65. DATEDIF Function

## Description

The DATEDIF function calculates the number of days, months, or years between two dates. This function is provided for compatibility with Lotus 1-2-3.

## Syntax

```
DATEDIF (start_date,end_date,unit)
```

## Arguments

Argument	Description	Required /Optional
Start_date	A date that represents the first, or starting, date of the period. Dates may be entered as text strings within quotation marks (E.g. "2001/1/30"), as serial numbers (E.g. 36921, which represents January 30, 2001, if you are using the 1900 date system), or as the results of other formulas or functions (E.g. DATEVALUE ("2001/1/30")).	Required
End_date	A date that represents the last, or ending, date of the period.	Required
Unit	The type of information that you want returned. Look at the Unit Table given below.	Required

## Unit Table

Unit	Returns
"Y"	The number of complete years in the period.
"M"	The number of complete months in the period.
"D"	The number of days in the period.
"MD"	The difference between the days in start_date and end_date. The months and years of the dates are ignored.
"YM"	The difference between the months in start_date and end_date. The days and years of the dates are ignored
"YD"	The difference between the days of start_date and end_date. The years of the dates are ignored.

## Notes

- Excel stores dates as sequential serial numbers so that they can be used in calculations. January 1, 1900 is serial number 1, and January 1, 2008 is serial number 39448 because it is 39,447 days after January 1, 1900
- The DATEDIF function is useful in formulas where you need to calculate age.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage		Results
A	B	C
1		
2	Birth Date : 29632	15-Feb-81
3		
4	Years =DATEDIF(C2,TODAY(),"y")	35
5	Months =DATEDIF(C2,TODAY(),"ym")	1
6	Days =DATEDIF(C2,TODAY(),"md")	23
7		
8	Age of Today	
9	=CONCATENATE("Age is ",C4," Years , ",C5," Months , ",C6," Days")	
--		

# 66. DATEVALUE Function

## Description

The DATEVALUE function converts a date in the form of text to a serial number (Excel's date-time code).

The DATEVALUE function converts a date that is stored as text to a serial number that Excel recognizes as a date. For example,

=DATEVALUE ("1/1/2008")

returns 39448, the serial number of the date 1/1/2008.

**Note:** Your computer's system date setting may cause the results of a DATEVALUE function to vary from this example.

The DATEVALUE function is helpful in cases where a worksheet contains dates in a text format that you want to filter, sort, or format as dates, or use in date calculations. To view a date serial number as a date, you must apply a date format to the cell.

## Syntax

DATEVALUE (date\_text)

## Arguments

Argument	Description	Required /Optional
date_text	Text that represents a date in an Excel date format, or a reference to a cell that contains text that represents a date in an Excel date format. For example, "1/30/2008" or "30-Jan-2008" are text strings within quotation marks that represent dates. See Notes below.	Required

## Notes

- date\_text Argument
  - Using the default date system in Microsoft Excel for Windows, the date\_text argument must represent a date between January 1, 1900 and December 31, 9999
  - This function returns the #VALUE! Error value if the value of the date\_text argument falls outside this range.
  - If the year portion of the date\_text argument is omitted, this function uses the current year from your computer's built-in clock. Time information in the date\_text argument is ignored.

- Excel stores dates as sequential serial numbers so that they can be used in calculations. By default, January 1, 1900 is serial number 1, and January 1, 2008 is serial number 39448 because it is 39,447 days after January 1, 1900.
- Most functions automatically convert date values to serial numbers.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Date	=DATEVALUE(B3)	2	Date	
3	8/22/2015		3	8/22/2015	42238
4	25/12/2015	=DATEVALUE(B4)	4	25/12/2015	#VALUE!
5	25-dec-2015	=DATEVALUE(B5)	5	25-dec-2015	42363

# 67. DAY Function

## Description

The DAY function returns the day of a date, represented by a serial number. The day is given as an integer ranging from 1 to 31.

## Syntax

```
DAY (serial number)
```

## Arguments

Argument	Description	Required /Optional
serial number	The date of the day you are trying to find. Dates should be entered by using the DATE function, or as results of other formulas or functions. For example, use DATE (2008,5,23) for the 23rd day of May 2008. Problems can occur if dates are entered as text.	Required

## Notes

- Microsoft Excel stores dates as sequential serial numbers so they can be used in calculations. By default, January 1, 1900 is serial number 1, and January 1, 2008 is serial number 39448 because it is 39,448 days after January 1, 1900
- Values returned by the YEAR, MONTH and DAY functions are Gregorian values regardless of the display format for the supplied date value. For example, if the display format of the supplied date is Hijri, the returned values for the YEAR, MONTH and DAY functions will be values associated with the equivalent Gregorian date.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

**Example**

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Date	Day	2	Date	Day
3	42363	=DAY(B3)	3	25-Dec-15	25
4	=DATE(2016,4,8)	=DAY(B4)	4	8-Apr-16	8
5	=TODAY()	=DAY(B5)	5	8-Apr-16	8
-			-		

# 68. DAYS Function

## Description

The DAYS function returns the number of days between two dates.

## Syntax

```
DAYS (end_date, start_date)
```

## Arguments

Argument	Description	Required /Optional
End_date	Start_date and End_date are the two dates between which you want to know the number of days.	Required
Start_date	Start_date and End_date are the two dates between which you want to know the number of days.	Required

## Notes

- Excel stores dates as sequential serial numbers so that they can be used in calculations. By default, Jan 1, 1900 is serial number 1, and January 1, 2008 is serial number 39448 because it is 39447 days after January 1, 1900
- If both date arguments are numbers, DAYS uses EndDate-StartDate to calculate the number of days in between both dates.
- If either one of the date arguments is text, that argument is treated as DATEVALUE(date\_text) and returns an integer date instead of a time component.
- If date arguments are numeric values that fall outside the range of valid dates, DAYS returns the #NUM! error value.
- If date arguments are strings that cannot be parsed as valid dates, DAYS returns the #VALUE! error value.

## Applicability

Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Start Date	End Date	2	Start Date	End Date
3	42370	42430	3	1/1/2016	3/1/2016
4	42430	42370	4	3/1/2016	1/1/2016
5	42370		5	1/1/2016	
6		42370	6		1/1/2016
7	11/2016	42430	7	11/2016	3/1/2016
		=DAYS(C3,B3)			#VALUE!
		=DAYS(C4,B4)			
		=DAYS(C5,B5)			
		=DAYS(C6,B6)			
		=DAYS(C7,B7)			

# 69. DAYS360 Function

## Description

The function DAYS360 returns the number of days between two dates based on a 360-day year (twelve 30-day months), which is used in accounting calculations.

## Syntax

```
DAYS360 (start_date,end_date,[method])
```

## Arguments

Argument	Description	Required /Optional
Start_date	The two dates between which you want to know the number of days.	Required
end_date	If start_date occurs after end_date, the DAYS360 Function returns a negative number. Dates should be entered by using the DATE Function, or derived from the results of other formulas or functions. Problems can occur if dates are entered as text.	Required
Method	A logical value that specifies whether to use the U.S. or European method in the calculation. Look at the Method Table below.	Optional

## Method Table

Method	Defined
FALSE or omitted	U.S. (NASD) method. If the starting date is the last day of a month, it becomes equal to the 30th day of the same month. If the ending date is the last day of a month and the starting date is earlier than the 30th day of a month, the ending date becomes equal to the 1st day of the next month; otherwise, the ending date becomes equal to the 30th day of the same month.
TRUE	European method. Starting dates and ending dates that occur on the 31st day of a month become equal to the 30th day of the same month.

## Notes

- Excel stores dates as sequential serial numbers so that they can be used in calculations. By default, January 1, 1900 is serial number 1, and January 1, 2008 is serial number 39448 because it is 39,447 days after January 1, 1900
- If either of the specified start\_date or end\_date arguments is a numeric value, but not recognized as valid date, DAYS360 returns the #NUM! error value.

- If either of the specified start\_date or of end\_date arguments is a text value that cannot be interpreted as date, DAYS360 returns the #VALUE! error value.
- If the specified method argument is non-numeric, DAYS360 returns the #VALUE! error value.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	<b>StartDate</b>	<b>EndDate</b>	2	<b>StartDate</b>	<b>EndDate</b>
3	42370	42374	3	1-Jan-16	5-Jan-16
4	42370	42374	4	1-Jan-16	5-Jan-16
5	42374	42370	5	5-Jan-16	1-Jan-16
6	42370	42401	6	1-Jan-16	1-Feb-16
7	42370	42401	7	1-Jan-16	1-Feb-16
8	42370	=DATE(2016,3,31)	8	1-Jan-16	31-Mar-16
9	42370	=DATE(2016,3,31)	9	1-Jan-16	31-Mar-16
10	42095	=DATE(2016,3,31)	10	1-Apr-15	31-Mar-16
11	42095	=DATE(2016,3,31)	11	1-Apr-15	31-Mar-16

# 70. EDATE Function

## Description

The EDATE function returns the serial number that represents the date that is the indicated number of months before or after a specified date (the start\_date).

Use EDATE to calculate maturity dates or due dates that fall on the same day of the month as the date of issue.

## Syntax

```
EDATE (start_date, months)
```

## Arguments

Argument	Description	Required /Optional
Start_date	A date that represents the start date. Dates should be entered by using the DATE function, or as results of other formulas or functions. Problems can occur if dates are entered as text.	Required
Months	The number of months before or after start_date. A positive value for months yields a future date; a negative value yields a past date.	Required

## Notes

- Microsoft Excel stores dates as sequential serial numbers so they can be used in calculations. By default, January 1, 1900 is serial number 1, and January 1, 2008 is serial number 39448 because it is 39,448 days after January 1, 1900.
- If months is not an integer, it is truncated.
- The result will normally be expressed as a number that can be formatted to represent a Date with Format Cells.
- If start\_date is not a valid date, EDATE returns the #VALUE! error value.
- If the date resulting from the calculation is not a valid Excel Date, EDATE returns the #NUM! error value.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	D
1			1		
2	Start Date	Months	2	Start Date	Months
3	42370	3	3	1-Jan-16	3
4	42371	3	4	2-Jan-16	3
5	42371	-3	5	2-Jan-16	-3
-			-		

# 71. EOMONTH Function

## Description

The EOMONTH function returns the serial number for the last day of the month that is the indicated number of months before or after start\_date.

## Syntax

```
EOMONTH (start_date, months)
```

## Arguments

Argument	Description	Required /Optional
Start_date	A date that represents the starting date. Dates should be entered by using the DATE function, or as results of other formulas or functions. Problems can occur if dates are entered as text.	Required
Months	The number of months before or after start_date. A positive value for months yields a future date. A negative value yields a past date.	Required

## Notes

- Microsoft Excel stores dates as sequential serial numbers so they can be used in calculations. By default, January 1, 1900 is serial number 1, and January 1, 2008 is serial number 39448 because it is 39,448 days after January 1, 1900
- If months is not an integer, it is truncated.
- The result will normally be expressed as a number that can be formatted to represent a Date with Format Cells.
- If start\_date is not a valid date, EOMONTH returns the #NUM! error value.
- If start\_date plus months yields an invalid date, EOMONTH returns the #NUM! error value.
- If any of the supplied arguments are non-numeric values, EOMONTH returns the #VALUE! error value.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage				Results			
A	B	C	D	A	B	C	D
1				1			
2	<b>Start Date</b>	<b>Months</b>	<b>End Of Month</b>	2	<b>Start Date</b>	<b>Months</b>	<b>End Of Month</b>
3	42370	2	=EOMONTH(B3,C3)	3	1-Jan-16	2	42460
4	42370	2	=EOMONTH(B4,C4)	4	1-Jan-16	2	31-Mar-16
5	42370	-2	=EOMONTH(B5,C5)	5	1-Jan-16	-2	30-Nov-15

# 72. HOUR Function

## Description

The HOUR function returns the hour of a time value. The hour is given as an integer, ranging from 0 (12:00 A.M.) to 23 (11:00 P.M.).

## Syntax

```
HOUR (serial_number)
```

## Arguments

Argument	Description	Required /Optional
Serial_number	<p>The time that contains the hour, you want to find. Times can be entered</p> <ul style="list-style-type: none"><li>as text strings within quotation marks (E.g. "6:45 PM")</li><li>as decimal numbers (E.g. 0.78125, which represents 6:45 PM)</li><li>as results of other formulas or functions (E.g. TIMEVALUE("6:45 PM"))</li></ul>	Required

## Notes

- Time values are a portion of a date value and represented by a decimal number (E.g., 12:00 PM is represented as 0.5 because it is half of a day).
- If the supplied serial\_number is not a valid Excel time, HOUR returns the #VALUE! Error value.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage		Results																
A	B	C																
1																		
2	<table border="1"><thead><tr><th>Number</th><th>Hour</th></tr></thead><tbody><tr><td>0.88541666666667</td><td>=HOUR(B3)</td></tr><tr><td>0.25</td><td>=HOUR(B4)</td></tr><tr><td>0.5</td><td>=HOUR(B5)</td></tr></tbody></table>	Number	Hour	0.88541666666667	=HOUR(B3)	0.25	=HOUR(B4)	0.5	=HOUR(B5)	<table border="1"><thead><tr><th>Number</th><th>Hour</th></tr></thead><tbody><tr><td>21:15</td><td>21</td></tr><tr><td>0.25</td><td>6</td></tr><tr><td>0.5</td><td>12</td></tr></tbody></table>	Number	Hour	21:15	21	0.25	6	0.5	12
Number	Hour																	
0.88541666666667	=HOUR(B3)																	
0.25	=HOUR(B4)																	
0.5	=HOUR(B5)																	
Number	Hour																	
21:15	21																	
0.25	6																	
0.5	12																	
3																		
4																		
5																		

# 73. ISOWEEKNUM Function

## Description

The ISOWEEKNUM function returns number of the ISO week number of the year for a given date.

## Syntax

```
ISOWEEKNUM (date)
```

## Arguments

Argument	Description	Required /Optional
Date	Date is the date-time code used by Excel for date and time calculation.	Required

## Notes

- Microsoft Excel stores dates as sequential numbers so they can be used in calculations. By default, January 1, 1900 is serial number 1, and January 1, 2008 is serial number 39448 because it is 39,448 days after January 1, 1900.
- If the date argument is not a valid number, ISOWEEKNUM returns the #NUM! error value.
- If the date argument is not a valid date type, ISOWEEKNUM returns the #VALUE! error value.

## Applicability

Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Date	ISOWEEKNUM	2	Date	ISOWEEKNUM
3	42005	=ISOWEEKNUM(B3)	3	1/1/2015	1
4	42370	=ISOWEEKNUM(B4)	4	1/1/2016	53
5	42431	=ISOWEEKNUM(B5)	5	3/2/2016	9
6	42463	=ISOWEEKNUM(B6)	6	4/3/2016	13
7					

# 74. MINUTE Function

## Description

The MINUTE function returns the minutes of a time value. The minute is given as an integer, ranging from 0 to 59.

## Syntax

```
MINUTE (serial_number)
```

## Arguments

Argument	Description	Required /Optional
Serial_number	<p>The time that contains the minute, you want to find. Times can be entered</p> <ul style="list-style-type: none"><li>as text strings within quotation marks (E.g. "6:45 PM")</li><li>as decimal numbers (E.g. 0.78125, which represents 6:45 PM)</li><li>as results of other formulas or functions (E.g. TIMEVALUE("6:45 PM"))</li></ul>	Required

## Notes

- Time values are a portion of a date value and represented by a decimal number (For example, 12:00 PM is represented as 0.5, since it is half of a day).
- If the supplied serial\_number is not a valid Excel time, MINUTE returns the #VALUE! error value.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Number	Minute	2	Number	Minute
3	0.885416666666667	=MINUTE(B3)	3	21:15	15
4	0.78125	=MINUTE(B4)	4	0.78125	45
5	0.525	=MINUTE(B5)	5	0.525	36
6	0.67708333333333	=MINUTE(B6)	6	4:15:00 PM	15
7	4:75:00 PM	=MINUTE(B7)	7	4:75:00 PM	#VALUE!

# 75. MONTH Function

## Description

The MONTH function returns the month of a date represented by a serial number. The month is given as an integer, ranging from 1 (January) to 12 (December).

## Syntax

```
MONTH (serial_number)
```

## Arguments

Argument	Description	Required /Optional
Serial_number	The date of the month you are trying to find. Dates should be entered by using the DATE Function, or as results of other formulas or functions. Problems can occur if dates are entered as text.	Required

## Notes

- Microsoft Excel stores dates as sequential serial numbers so they can be used in calculations. By default, January 1, 1900 is serial number 1, and January 1, 2008 is serial number 39448 because it is 39,448 days after January 1, 1900.
- Values returned by the YEAR, MONTH and DAY functions would be Gregorian values regardless of the display format for the supplied date value.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Date	=MONTH(B3)	2	Date	Month
3	42370		3	1-Jan-16	1
4	42370	=MONTH(B4)	4	1-Jan-16	January

# 76. NETWORKDAYS Function

## Description

The NETWORKDAYS function returns the number of whole working days between start\_date and end\_date. Working days exclude weekends and any dates identified in holidays.

## Syntax

```
NETWORKDAYS (start_date, end_date, [holidays])
```

## Arguments

Argument	Description	Required /Optional
Start_date	A date that represents the start date.	Required
End_date	A date that represents the end date.	Required
Holidays	An optional range of one or more dates to exclude from the working calendar, such as state and federal holidays and floating holidays. The list can be either a range of cells that contains the dates or an array constant of the serial numbers that represent the dates.	Optional

## Notes

- Microsoft Excel stores dates as sequential serial numbers so they can be used in calculations. By default, January 1, 1900 is serial number 1, and January 1, 2012 is serial number 40909 because it is 40,909 days after January 1, 1900
- If any argument is not a valid date, NETWORKDAYS returns the #VALUE! error value

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Start Date	End Date	2	Start Date	End Date
3	42430	42436	3	1-Mar-16	7-Mar-16
4	42119	42216	4	25-Apr-15	31-Jul-15
5	42353	42370	5	15-Dec-15	1-Jan-16
6	14/15/2015	42370	6	14/15/2015	1-Jan-16
		=NETWORKDAYS(B3,C3)			#VALUE!
		=NETWORKDAYS(B4,C4)			
		=NETWORKDAYS(B5,C5)			
		=NETWORKDAYS(B6,C6)			

# 77. NETWORKDAYS.INTL Function

## Description

The NETWORKDAY.INTL function returns the number of whole workdays between two dates using parameters to indicate which and how many days are weekend days. Weekend days and any days that are specified as holidays are not considered as workdays.

## Syntax

```
NETWORKDAYS.INTL (start_date, end_date, [weekend], [holidays])
```

## Arguments

Argument	Description	Required /Optional
Start_date	The dates for which the difference is to be computed.	Required
end_date	The start_date can be earlier than, the same as, or later than the end_date.	Required
Weekend	Indicates the days of the week that are weekend days and are not included in the number of whole working days between start_date and end_date. Weekend is a weekend number or string that specifies when weekends occur. Look at Weekend Number - Weekend Days Table given below.	Optional
Holidays	An optional set of one or more dates that are to be excluded from the working day calendar. Holidays shall be <ul style="list-style-type: none"><li>• a range of cells that contain the dates</li><li>• an array constant of the serial values that represent those dates</li></ul> The ordering of dates or serial values in holidays can be arbitrary.	Optional

### **Weekend Number - Weekend Days Table**

<b>Weekend Number</b>	<b>Weekend Days</b>
1 or omitted	Saturday, Sunday
2	Sunday, Monday
3	Monday, Tuesday
4	Tuesday, Wednesday
5	Wednesday, Thursday
6	Thursday, Friday
7	Friday, Saturday
11	Sunday only
12	Monday only
13	Tuesday only
14	Wednesday only
15	Thursday only
16	Friday only
17	Saturday only

Weekend string values are seven characters long and each character in the string represents a day of the week, starting with Monday. 1 represents a non-workday and 0 represents a workday. Only the characters 1 and 0 are permitted in the string. Using 1111111 will always return 0.

### **Notes**

- If start\_date is later than end\_date, the return value will be negative, and the magnitude will be the number of whole workdays.
- If start\_date is out of range for the current date base value, NETWORKDAYS.INTL returns the #NUM! error value.
- If end\_date is out of range for the current date base value, NETWORKDAYS.INTL returns the #NUM! error value.
- If the specified weekend is an invalid numeric value, NETWORKDAYS.INTL returns the NUM! error value.
- If a weekend string is of invalid length or contains invalid characters, NETWORKDAYS.INTL returns the #VALUE! error value.
- If the supplied start\_date, end\_date, or any of the values in the supplied [holidays] array are not valid dates, NETWORKDAYS.INTL returns the #VALUE! error value.

### **Applicability**

Excel 2010, Excel 2013, Excel 2016

## Example

	A	B	C	D	E	F	G
1							
2	Start Date	End Date	Weekend	Holidays		No. of Work Days	Function Usage
3	42370	42460	1			=NETWORKDAYS.INTL(B3,C3,D3)	
4	42460	42370	1			=NETWORKDAYS.INTL(B4,C4,D4)	
5	42370	42460	11			=NETWORKDAYS.INTL(B5,C5,D5)	
6	42370	42460	11	42384	42385	=NETWORKDAYS.INTL(B6,C6,D6,E6:F6)	

	A	B	C	D	E	F	G
1							
2	Start Date	End Date	Weekend	Holidays		No. of Work Days	Results
3	1/1/2016	3/31/2016	1			65	
4	3/31/2016	1/1/2016	1			-65	
5	1/1/2016	3/31/2016	11			78	
6	1/1/2016	3/31/2016	11	1/15/2016	1/16/2016	76	

# 78. NOW Function

## Description

The NOW function returns the serial number of the current date and time.

## Syntax

```
NOW ()
```

## Arguments

The NOW function syntax has no arguments.

## Notes

- If the cell format was General before the function was entered, Excel changes the cell format so that it matches the date and time format of your regional settings. You can change the date and time format for the cell by using the commands in the Number group of the Home tab on the Ribbon.
- The NOW Function is useful when you need to display the current date and time on a Worksheet or calculate a value based on the current date and time, and have that value updated each time you open the Worksheet.
- If the NOW Function does not update cell values when you expect it to, you might need to change settings that control when the Workbook or Worksheet recalculates. These settings can be changed in Control Panel of Excel.
- Excel stores dates as sequential serial numbers so that they can be used in calculations. By default, January 1, 1900 is serial number 1, and January 1, 2008 is serial number 39448 because it is 39,447 days after January 1, 1900.
- Numbers to the right of the decimal point in the serial number represent the time; numbers to the left represent the date. For example, the serial number 0.5 represents the time 12:00 noon.
- The results of the NOW Function change only when the worksheet is calculated or when a macro that contains the function is run. It is not updated continuously.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

**Example**

Function Usage		Results	
A	B	A	B
1		1	
2	<b>Current Date and Time</b>	2	<b>Current Date and Time</b>
3	=NOW()	3	42472.60524
4	=NOW()	4	4/12/2016 14:31
5	=NOW()	5	4/12/16 2:31 PM

# 79. SECOND Function

## Description

The SECOND function returns the seconds of a time value. The second is given as an integer in the range 0 (zero) to 59.

## Syntax

```
SECOND (serial_number)
```

## Arguments

Argument	Description	Required /Optional
Serial_number	<p>The time that contains the seconds, you want to find. Times can be entered as-</p> <ul style="list-style-type: none"><li>Text strings within quotation marks (E.g. "6:45 PM")</li><li>Decimal numbers (E.g. 0.78125, which represents 6:45 PM)</li><li>Results of other formulas or functions (E.g. TIMEVALUE("6:45 PM"))</li></ul>	Required

## Notes

- Time values are a portion of a date value and represented by a decimal number (for example, 12:00 PM is represented as 0.5 because it is half of a day).
- If the specified serial\_number is not a valid Excel time, SECOND returns the #VALUE! Error value.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	<b>Number</b>	<b>Second</b>	2	<b>Number</b>	<b>Second</b>
3	=NOW()	=SECOND(B3)	3	13/Apr/16 05:24:08	8
4	0.5	=SECOND(B4)	4	12:00:00 PM	0
5	0.5	=SECOND(B5)	5	0.50	0
6	0.51	=SECOND(B6)	6	0.51	24
7	2.51	=SECOND(B7)	7	2.51	24

# 80. TIME Function

## Description

The TIME function returns the decimal number for a particular time. If the cell format was General before the Function was entered, the result is formatted as a date.

The decimal number returned by TIME is a value ranging from 0 (zero) to 0.99988426, representing the times from 0:00:00 (12:00:00 AM) to 23:59:59 (11:59:59 P.M.)

## Syntax

```
TIME (hour, minute, second)
```

## Arguments

Argument	Description	Required /Optional
Hour	A number from 0 (zero) to 32767 representing the hour. Any value greater than 23 will be divided by 24 and the remainder will be treated as the hour value.	Required
Minute	A number from 0 to 32767 representing the minute. Any value greater than 59 will be converted to hours and minutes.	Required
Second	A number from 0 to 32767 representing the second. Any value greater than 59 will be converted to hours, minutes, and seconds.	Required

## Notes

- Time values are a portion of a date value and represented by a decimal number (for example, 12:00 PM is represented as 0.5 because it is half of a day)
- If the arguments evaluate to a negative time, TIME returns the #NUM! error value
- If any of the supplied arguments are non-numeric values, TIME returns the #VALUE! error value

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage				Results			
	A	B	C		D	E	F
1							
2		Hour	Minute	Second	Time		
3	14	30	59		=TIME(B3,C3,D3)		
4	14	30	59		=TIME(B4,C4,D4)		
5	14	30	59		=TIME(B5,C5,D5)		
6	25	5	0		=TIME(B6,C6,D6)		
7	25	5			=TIME(B7,C7,D7)		
8	25	-5			=TIME(B8,C8,D8)		
9	-25	-5			=TIME(B9,C9,D9)		
10	-25	Five			=TIME(B10,C10,D10)		

	A	B	C	D	E	F	G
1							
2		Hour	Minute	Second	Time		
3	14	30	59		14:30:59		
4	14	30	59		2:30:59 PM		
5	14	30	59		0.60485		
6	25	5	0		1:05:00 AM		
7	25	5			1:05:00 AM		
8	25	-5			12:55:00 AM		
9	-25	-5			#NUM!		
10	-25	Five			#VALUE!		

# 81. TIMEVALUE Function

## Description

The TIMEVALUE function returns the decimal number of the time represented by a text string.

The decimal number is a value ranging from 0 (zero) to 0.99988426, representing the times from 0:00:00 (12:00:00 AM) to 23:59:59 (11:59:59 P.M.).

## Syntax

```
TIMEVALUE (time_text)
```

## Arguments

Argument	Description	Required /Optional
Time_text	A text string that represents a time in any one of the Microsoft Excel time formats.	Required

## Notes

- Date information in time\_text is ignored.
- Time values are a portion of a date value and represented by a decimal number (for example, 12:00 PM is represented as 0.5 because it is half of a day)
- If the supplied time\_text cannot be recognized as a valid Excel time, TIMEVALUE returns the #VALUE! Error.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Time	Time Value	2	Time	Time Value
3	14:30:59	=TIMEVALUE(B3)	3	14:30:59	0.604849537
4	14:30:59	=TIMEVALUE(B4)	4	14:30:59	14:30:59
5	14:30:59	=TIMEVALUE(B5)	5	14:30:59	2:30:59 PM

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## 82. TODAY Function

### Description

The TODAY function returns the serial number of the current date. The serial number is the date-time code used by Excel for date and time calculations. If the cell format was General before the function was entered, Excel changes the cell format to Date. If you want to view the serial number, you must change the cell format to General or Number.

### Syntax

```
TODAY ()
```

### Arguments

The TODAY Function syntax has no arguments.

### Notes

- Excel stores dates as sequential serial numbers so they can be used in calculations. By default, January 1, 1900 is serial number 1, and January 1, 2008 is serial number 39448 because it is 39,447 days after January 1, 1900
- If the TODAY function does not update the date when you expect it to, you might need to change the settings that control when the workbook or worksheet recalculates

### Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

### Example

Function Usage		Results	
A	B	A	B
1		1	
2	Today	2	Today
3	=TODAY()	3	4/13/2016
A		A	

# 83. WEEKDAY Function

## Description

The WEEKDAY function returns the day of the week corresponding to a date. The day is given as an integer, ranging from 1 (Sunday) to 7 (Saturday), by default

## Syntax

```
WEEKDAY (serial_number, [return_type])
```

## Arguments

Argument	Description	Required /Optional
Serial_number	A sequential number that represents the date of the day you are trying to find. Dates should be entered by using the DATE function, or as results of other formulas or functions.	Required
Return_type	A number that determines the type of return value. Look at the Return Type Table given below.	Optional

## Return Type Table

Return_type	Number Returned
1 or omitted	Numbers 1 (Sunday) through 7 (Saturday). Behaves like previous versions of Microsoft Excel.
2	Numbers 1 (Monday) through 7 (Sunday).
3	Numbers 0 (Monday) through 6 (Sunday).
11	Numbers 1 (Monday) through 7 (Sunday).
12	Numbers 1 (Tuesday) through 7 (Monday).
13	Numbers 1 (Wednesday) through 7 (Tuesday).
14	Numbers 1 (Thursday) through 7 (Wednesday).
15	Numbers 1 (Friday) through 7 (Thursday).
16	Numbers 1 (Saturday) through 7 (Friday).
17	Numbers 1 (Sunday) through 7 (Saturday).

## Notes

- Microsoft Excel stores dates as sequential serial numbers so they can be used in calculations. By default, January 1, 1900 is serial number 1, and January 1, 2008 is serial number 39448 because it is 39,448 days after January 1, 1900
- If serial\_number is out of range for the current date base value, WEEKDAY returns the #NUM! error value.
- If return\_type is out of the range specified in the table above, WEEKDAY returns the #NUM! error value.
- If the specified serial\_number cannot be recognized as a numeric value, WEEKDAY returns the #VALUE! error value.

- If the specified return\_type cannot be recognized as a numeric value, WEEKDAY returns the #VALUE! error value.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Date	Weekday	2		
3	42370	=WEEKDAY(B3)	3	Fri 01-Jan-16	6
4	42370	=WEEKDAY(B4)	4	Fri 01-Jan-16	6
5	42370	=WEEKDAY(B5,1)	5	Fri 01-Jan-16	6
6	42370	=WEEKDAY(B6,2)	6	Fri 01-Jan-16	5
7	42370	=WEEKDAY(B7,3)	7	Fri 01-Jan-16	4

# 84. WEEKNUM Function

## Description

The WEEKNUM function returns the week number of a specific date. The number represents where the week falls numerically within a year.

There are two systems used for this Function-

- **System 1:** The week containing January 1 is the first week of the year, and is numbered week 1.
- **System 2:** The week containing the first Thursday of the year is the first week of the year, and is numbered as week 1. This system is the methodology specified in ISO 8601, which is commonly known as the European week numbering system.

## Syntax

```
WEEKNUM (serial_number, [return_type])
```

## Arguments

Argument	Description	Required /Optional
Serial_number	A date within the week. Dates should be entered by using the DATE function, or as results of other formulas or functions. Problems can occur if dates are entered as text.	Required
Return_type	A number that determines on which day the week begins. The default is 1. Look at the Week_beginning Day Table given below.	Optional

## Week\_beginning Day Table

Return_type	Week begins on	System
1 or omitted	Sunday	1
2	Monday	1
11	Monday	1
12	Tuesday	1
13	Wednesday	1
14	Thursday	1
15	Friday	1
16	Saturday	1
17	Sunday	1
21	Monday	2

## Notes

- Excel stores dates as sequential serial numbers so they can be used in calculations. By default, January 1, 1900 is serial number 1. January 1, 2008 is serial number 39448 because it is 39,448 days after January 1, 1900
- If Serial\_number is out of range for the current date base value, WEEKNUM returns #NUM! error value.
- If Return\_type is out of the range specified in the table above, WEEKNUM returns #NUM! error value.
- If Serial\_number cannot be recognized as a numeric value or a date, WEEKNUM returns #NUM! error value.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Date	Return Type	2	Date	Return Type
3	42370	1	3	1/1/2016	1
4	42375	1	4	1/6/2016	1
5	42375	21	5	1/6/2016	21
6	42380	21	6	1/11/2016	21
7			7		

# 85. WORKDAY Function

## Description

The WORKDAY function returns a number that represents a date that is the indicated number of working days before or after a date (the starting date). Working days exclude weekends and any dates identified as holidays.

Use WORKDAY to exclude weekends or holidays when you calculate invoice due dates, expected delivery times, or the number of days of work performed.

## Syntax

```
WORKDAY (start_date, days, [holidays])
```

## Arguments

Argument	Description	Required /Optional
Start_date	A date that represents the start date.	Required
Days	The number of nonweekend and nonholiday days before or after start_date. A positive value for days yields a future date. A negative value yields a past date.	Required
Holidays	An optional list of one or more dates to exclude from the working calendar, such as state and federal holidays and floating holidays. The list can be either a range of cells that contain the dates or an array constant of the serial numbers that represent the dates.	Optional

## Notes

- Microsoft Excel stores dates as sequential serial numbers so they can be used in calculations. By default, January 1, 1900 is serial number 1, and January 1, 2008 is serial number 39448 because it is 39,448 days after January 1, 1900
- If days is not an integer, it is truncated.
- If any argument is not a valid date, WORKDAY returns the #VALUE! error value.
- If days is non-numeric, WORKDAY returns the #VALUE! error value.
- If start\_date plus days yields an invalid date, WORKDAY returns the #NUM! error value.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage				Results			
A	B	C	D	A	B	C	D
1				1			
2	Start Date	Days	Result	2	Start Date	Days	Result
3	42370	55	=WORKDAY(B3,C3)	3	1-Jan-16	55	42447
4	42370	55	=WORKDAY(B4,C4)	4	1-Jan-16	55	18-Mar-16

# 86. WORKDAY.INTL Function

## Description

The WORKDAY.INTL function returns the serial number of the date before or after a specified number of workdays with custom weekend parameters. Weekend parameters indicate which and how many days are weekend days. Weekend days and any days that are specified as holidays are not considered as workdays.

## Syntax

```
WORKDAY.INTL (start_date, days, [weekend], [holidays])
```

## Arguments

Argument	Description	Required /Optional
Start_date	The start date, truncated to integer.	Required
Days	The number of workdays before or after the start_date. <ul style="list-style-type: none"><li>• A positive value yields a future date</li><li>• A negative value yields a past date</li><li>• A zero value yields the start_date</li></ul> Day-offset is truncated to an integer.	Required
Weekend	Indicates the days of the week that are weekend days and are not considered working days. Weekend is a weekend number or string that specifies when weekends occur. Look at Weekend-Number-Days Table given below. Weekend string values are seven characters long and each character in the string represents a day of the week, starting with Monday. 1 represents a non-workday and 0 represents a workday. Only the characters 1 and 0 are permitted in the string.	Optional
Holidays	An optional set of one or more dates that are to be excluded from the working day calendar. Holidays shall be a range of cells that contain the dates, or an array constant of the serial values that represent those dates. The ordering of dates or serial values in holidays can be arbitrary.	Optional

## Notes

- If start\_date is out of range for the current date base value, WORKDAY.INTL returns the #NUM! error value.
- If any date in holidays is out of range for the current date base value, WORKDAY.INTL returns the #NUM! error value.
- If start\_date plus day-offset yields an invalid date, WORKDAY.INTL returns the #NUM! error value.

- If weekend is an invalid numeric value, WORKDAY.INTL returns the #NUM! error value.
- If a weekend string is of invalid length or contains invalid characters, WORKDAY.INTL returns the #VALUE! error value.
- If start\_date or any of the values in the holiday's array are not valid dates, WORKDAY.INTL returns the #VALUE! error value.
- If days is non-numeric, WORKDAY.INTL returns the #VALUE! error value.

## Applicability

Excel 2010, Excel 2013, Excel 2016

## Example

	A	B	C	D	E	F	G	
1								
2	Start Date	No. of Work Days	Weekend	Holidays		Date		Function Usage
3	42370	65	1			=WORKDAY.INTL(B3,C3,D3)		
4	42461	-65	1			=WORKDAY.INTL(B4,C4,D4)		
5	42370	78	11			=WORKDAY.INTL(B5,C5,D5)		
6	42370	76	11	42384	42385	=WORKDAY.INTL(B6,C6,D6)		

	A	B	C	D	E	F	G	
1								
2	Start Date	No. of Work Days	Weekend	Holidays		Date		Results
3	1/1/2016	65	1			4/1/2016		
4	4/1/2016	-65	1			1/1/2016		
5	1/1/2016	78	11			4/1/2016		
6	1/1/2016	76	11	1/15/2016	1/16/2016	3/30/2016		

# 87. YEAR Function

## Description

The YEAR function returns the year corresponding to a date. The year is returned as an integer in the range 1900-9999.

## Syntax

```
YEAR (serial_number)
```

## Arguments

Argument	Description	Required /Optional
Serial_number	The date of the year you want to find. Dates should be entered by using the DATE function, or as results of other formulas or functions. Problems can occur if dates are entered as text.	Required

## Notes

- Microsoft Excel stores dates as sequential serial numbers so they can be used in calculations. By default, January 1, 1900 is serial number 1, and January 1, 2008 is serial number 39448 because it is 39,448 days after January 1, 1900
- Values returned by the YEAR, MONTH and DAY functions would be Gregorian values regardless of the display format for the supplied date value.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Date	Year	2	Date	Year
3	42370	=YEAR(B3)	3	1-Jan-16	2016

# 88. YEARFRAC Function

## Description

The YEARFRAC function calculates the fraction of the year represented by the number of whole days between two dates (the start\_date and the end\_date).

Use the YEARFRAC worksheet function to identify the proportion of a whole year's benefits or obligations to assign to a specific term.

## Syntax

```
YEARFRAC (start_date, end_date, [basis])
```

## Arguments

Argument	Description	Required /Optional
Start_date	A date that represents the start date.	Required
End_date	A date that represents the end date.	Required
Basis	The type of day count basis to use. Look at the Day Count Basis Table given below.	Optional

## Day Count Basis Table

Basis	Day Count Basis
0 or omitted	US (NASD) 30/360
1	Actual/actual
2	Actual/360
3	Actual/365
4	European 30/360

## Notes

- Microsoft Excel stores dates as sequential serial numbers so they can be used in calculations. By default, January 1, 1900 is serial number 1, and January 1, 2008 is serial number 39448 because it is 39,448 days after January 1, 1900
- All arguments are truncated to integers.
- If start\_date or end\_date are not valid dates, YEARFRAC returns the #VALUE! error value.
- If basis is non-numeric, YEARFRAC returns the #VALUE! error value.
- If basis < 0 or if basis > 4, YEARFRAC returns the #NUM! error value.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Start Date	End Date	2	Start Date	End Date
3	42370	42461	3	1-Jan-16	1-Apr-16
4	42005	42369	4	1-Jan-15	31-Dec-15
5	42370	42460	5	1-Jan-16	31-Mar-16
6			6		

# Engineering Functions

# 89. Engineering Functions – Overview

The Excel Engineering functions perform the most commonly used Engineering calculations, many of which relate to Bessel functions, complex numbers, or converting between different bases.

## Engineering Functions

The following table lists all the Engineering functions-

S. No.	Function and Description
1	BESSELI Returns the modified Bessel function $I_n(x)$
2	BESSELJ Returns the Bessel function $J_n(x)$
3	BESSELK Returns the modified Bessel function $K_n(x)$
4	BESSELY Returns the Bessel function $Y_n(x)$
5	BIN2DEC Converts a binary number to decimal
6	BIN2HEX Converts a binary number to hexadecimal
7	BIN2OCT Converts a binary number to octal
8	BITAND Returns a 'Bitwise And' of two numbers
9	BITLSHIFT Returns a value number shifted left by shift_amount bits
10	BITOR Returns a bitwise OR of 2 numbers
11	BITRSHIFT Returns a value number shifted right by shift_amount bits
12	BITXOR Returns a bitwise 'Exclusive Or' of two numbers
13	COMPLEX Converts real and imaginary coefficients into a complex number

S. No.	Function and Description
14	CONVERT Converts a number from one measurement system to another
15	DEC2BIN Converts a decimal number to binary
16	DEC2HEX Converts a decimal number to hexadecimal
17	DEC2OCT Converts a decimal number to octal
18	DELTA Tests whether two values are equal
19	ERF Returns the error function
20	ERF.PRECISE Returns the error function
21	ERFC Returns the complementary error function
22	ERFC.PRECISE Returns the complementary error function
23	GESTEP Tests whether a number is greater than a threshold value
24	HEX2BIN Converts a hexadecimal number to binary
25	HEX2DEC Converts a hexadecimal number to decimal
26	HEX2OCT Converts a hexadecimal number to octal
27	IMABS Returns the absolute value (modulus) of a complex number
28	IMAGINARY Returns the imaginary coefficient of a complex number
29	IMARGUMENT Returns the argument theta, an angle expressed in radians
30	IMCONJUGATE Returns the complex conjugate of a complex number
31	IMCOS Returns the cosine of a complex number
32	IMCOSH Returns the hyperbolic cosine of a complex number

S. No.	Function and Description
33	<b>IMCOT</b> Returns the cotangent of a complex number
34	<b>IMCSC</b> Returns the cosecant of a complex number
35	<b>IMCSCH</b> Returns the hyperbolic cosecant of a complex number
36	<b>IMDIV</b> Returns the quotient of two complex numbers
37	<b>IMEXP</b> Returns the exponential of a complex number
38	<b>IMLN</b> Returns the natural logarithm of a complex number
39	<b>IMLOG10</b> Returns the base-10 logarithm of a complex number
40	<b>IMLOG2</b> Returns the base-2 logarithm of a complex number
41	<b>IMPOWER</b> Returns a complex number raised to an integer power
42	<b>IMPRODUCT</b> Returns the product of complex numbers
43	<b>IMREAL</b> Returns the real coefficient of a complex number
44	<b>IMSEC</b> Returns the secant of a complex number
45	<b>IMSECH</b> Returns the hyperbolic secant of a complex number
46	<b>IMSIN</b> Returns the sine of a complex number
47	<b>IMSINH</b> Returns the hyperbolic sine of a complex number
48	<b>IMSQRT</b> Returns the square root of a complex number
49	<b>IMSUB</b> Returns the difference of two complex numbers
50	<b>IMSUM</b> Returns the sum of complex numbers
51	<b>IMTAN</b> Returns the tangent of a complex number

S. No.	Function and Description
52	OCT2BIN Converts an octal number to binary
53	OCT2DEC Converts an octal number to decimal
54	OCT2HEX Converts an octal number to hexadecimal

# 90. BESSELI Function

## Description

The BESSELI function returns the modified Bessel function  $I_n(x)$ , which is equivalent to the Bessel function evaluated for purely imaginary arguments.

## Syntax

```
BESSELI(X, N)
```

## Arguments

Argument	Description	Required /Optional
X	The value at which to evaluate the function.	Required
N	The order of the Bessel function. If n is not an integer, it is truncated.	Required

## Notes

- If x is nonnumeric, BESSELI returns the #VALUE! Error value.
- If n is nonnumeric, BESSELI returns the #VALUE! Error value.
- If n < 0, BESSELI returns the #NUM! Error value.
- The n-th order modified Bessel function of the variable x is:

$$I_n(x) = (i)^{-n} J_n(ix)$$

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage				Results			
A	B	C	D	A	B	C	D
1				1			
2	X	N	Result	2	X	N	Result
3	2.5	1	=BESSELI(B3,C3)	3	2.5	1	2.516716242

# 91. BESSELJ Function

## Description

The BESSELJ function returns the Bessel function J<sub>n</sub>(x).

## Syntax

```
BESSELJ(X, N)
```

## Arguments

Argument	Description	Required /Optional
X	The value at which to evaluate the function.	Required
N	The order of the Bessel function. If n is not an integer, it is truncated.	Required

## Notes

- If x is nonnumeric, BESSELJ returns the #VALUE! Error value.
- If n is nonnumeric, BESSELJ returns the #VALUE! Error value.
- If n < 0, BESSELJ returns the #NUM! Error value.
- The n-th order Bessel function of the variable x is-

$$J_n(x) = \sum_{k=0}^{\infty} \frac{(-1)^k}{k! \Gamma(n+k+1)} \left(\frac{x}{2}\right)^{n+2k}$$

Where-

$$\Gamma(n+k+1) = \int_0^{\infty} e^{-x} x^{n+k} dx$$

is the Gamma function.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage				Results			
A	B	C	D	A	B	C	D
1				1			
2	X	N	Result	2	X	N	Result
3	2.8	2	=BESSELJ(B3,C3)	3	2.8	2	0.477685497
.				*			

## 92. BESSELK Function

### Description

The BESSELK function returns the modified Bessel function  $K_n(x)$ , which is equivalent to the Bessel functions evaluated for purely imaginary arguments.

These are also known as the hyperbolic Bessel Functions.

### Syntax

```
BESSELK(X, N)
```

### Arguments

Argument	Description	Required /Optional
X	The value at which to evaluate the function.	Required
N	The order of the function. If n is not an integer, it is truncated.	Required

### Notes

- If x is nonnumeric, BESSELK returns the #VALUE! Error value.
- If n is nonnumeric, BESSELK returns the #VALUE! Error value.
- If n < 0, BESSELK returns the #NUM! Error value.
- The n-th order modified Bessel function of the variable x is:

$$K_n(x) = \frac{\pi}{2} i^{n+1} [J_n(ix) + iY_n(ix)]$$

Where Jn and Yn are the J and Y Bessel functions, respectively.

### Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

### Example

Function Usage			Results		
A	B	C	A	B	D
1			1		
2	X	N	2	X	N
3	2.5	1	3	=BESSELK(B3,C3)	0.073890816

# 93. BESSELY Function

## Description

The BESSELY function returns the Bessel function,  $Y_n(x)$ , (also known as the Weber function or the Neumann function), for a specified order and value of  $x$ .

## Syntax

```
BESSELY(X, N)
```

## Arguments

Argument	Description	Required /Optional
X	The value at which to evaluate the function.	Required
N	The order of the function. If n is not an integer, it is truncated.	Required

## Notes

- If  $x$  is nonnumeric, BESSELY returns the #VALUE! Error value.
- If  $n$  is nonnumeric, BESSELY returns the #VALUE! Error value.
- If  $n < 0$ , BESSELY returns the #NUM! Error value.
- The  $n$ -th order Bessel function of the variable  $x$  is-

$$Y_n(x) = \lim_{v \rightarrow \infty} \frac{J_v(x) \cos(v\pi) - J_{-v}(x)}{\sin(v\pi)}$$

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage				Results			
A	B	C	D	A	B	C	D
1				1			
2	X	N	Result	2	X	N	Result
	2.5	1	=BESSELY(B3,C3)		2.5	1	0.145918138

# 94. BIN2DEC Function

## Description

The BIN2DEC function converts a binary number to decimal.

## Syntax

```
BIN2DEC (number)
```

## Arguments

Argument	Description	Required /Optional
number	<p>The binary number you want to convert. Number cannot contain more than 10 characters (10 bits).</p> <p>The most significant bit of number is the sign bit. The remaining 9 bits are magnitude bits. Negative numbers are represented using two's-complement notation.</p>	Required

## Notes

If number is not a valid binary number, or if a number contains more than 10 characters (10 bits), BIN2DEC returns the #NUM! Error value.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Binary Number	Decimal Equivalent	2	Binary Number	Decimal Equivalent
3	0	=BIN2DEC(B3)	3	0	0
4	1	=BIN2DEC(B4)	4	1	1
5	10	=BIN2DEC(B5)	5	10	2
6	11	=BIN2DEC(B6)	6	11	3
7	1111111111	=BIN2DEC(B7)	7	1111111111	511
8	11111111111	=BIN2DEC(B8)	8	11111111111	-1
9	11111111110	=BIN2DEC(B9)	9	11111111110	-2
10	11111111101	=BIN2DEC(B10)	10	11111111101	-3
11	1000000000	=BIN2DEC(B11)	11	1000000000	-512
12	111111111111	=BIN2DEC(B12)	12	111111111111	#NUM!

# 95. BIN2HEX Function

## Description

The BIN2HEX function converts a binary number to hexadecimal.

## Syntax

```
BIN2HEX (number, [places])
```

## Arguments

Argument	Description	Required / Optional
number	The binary number you want to convert. Number cannot contain more than 10 characters (10 bits). The most significant bit of number is the sign bit. The remaining 9 bits are magnitude bits. Negative numbers are represented using two's-complement notation.	Required
places	The number of characters to use. If places is omitted, BIN2HEX uses the minimum number of characters necessary. Places is useful for padding the return value with leading 0s (zeros).	Optional

## Notes

- If number is not a valid binary number, or if number contains more than 10 characters (10 bits), BIN2HEX returns the #NUM! Error value.
- If number is negative, BIN2HEX ignores places and returns a 10-character hexadecimal number.
- If BIN2HEX requires more than places characters, it returns the #NUM! Error value.
- If places is not an integer, it is truncated.
- If places is nonnumeric, BIN2HEX returns the #VALUE! Error value.
- If places is negative, BIN2HEX returns the #NUM! Error value.
- If places is > 10, BIN2HEX returns the #NUM! Error value.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Number	Places	2	Number	Places
3	101111011	5	3	101111011	5
4	1110011	3	4	1110011	3
5	1111111111		5	1111111111	
		=BIN2HEX(B3,C3)			0017B
		=BIN2HEX(B4,C4)			073
		=BIN2HEX(B5)			FFFFFFFFF

# 96. BIN2OCT Function

## Description

The BIN2OCT function converts a decimal number to octal.

## Syntax

```
DEC2OCT (number, [places])
```

## Arguments

Argument	Description	Required /Optional
number	The decimal integer you want to convert. If number is negative, places is ignored and DEC2OCT returns a 10-character (30-bit) octal number in which the most significant bit is the sign bit. The remaining 29 bits are magnitude bits. Negative numbers are represented using two's-complement notation.	Required
places	The number of characters to use. If places is omitted, DEC2OCT uses the minimum number of characters necessary. Places is useful for padding the return value with leading 0s (zeros).	Optional

## Notes

- If number < -536,870,912 or if number > 536,870,911, DEC2OCT returns the #NUM! Error value.
- If number is nonnumeric, DEC2OCT returns the #VALUE! Error value.
- If DEC2OCT requires more than places characters, it returns the #NUM! Error value.
- If places is not an integer, it is truncated.
- If places is nonnumeric, DEC2OCT returns the #VALUE! Error value.
- If places is negative, DEC2OCT returns the #NUM! Error value.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Number	Places	2	Number	Places
3	101111011	5	3	101111011	5
4	1110011	3	4	1110011	3
5	1111111111		5	1111111111	7777777777
				=BIN2OCT(B3,C3)	=BIN2OCT(B4,C4)
				=BIN2OCT(B5)	

# 97. BITAND Function

## Description

The BITAND function returns a bitwise 'AND' of two numbers.

## Syntax

```
BITAND (number1, number2)
```

## Arguments

Argument	Description	Required /Optional
number1	Must be in decimal form and greater than or equal to 0.	Required
number2	Must be in decimal form and greater than or equal to 0.	Required

## Notes

- BITAND returns a decimal number.
- The result is a bitwise 'AND' of its parameters.
- The value of each bit position is counted only if both parameter's bits at that position are 1.
- The values returned from the bit positions progress from right to left as powers of 2. The rightmost bit returns 1 ( $2^0$ ), the bit to its left returns 2 ( $2^1$ ), and so on.
- If either argument is less than 0, BITAND returns the #NUM! Error value.
- If either argument is a non-integer or is greater than  $(2^{48})-1$ , BITAND returns the #NUM! Error value.
- If either argument is a non-numeric value, BITAND returns the #VALUE! Error value.

## Applicability

Excel 2013, Excel 2016

## Example

Function Usage						Results									
	A	B	C	D	E	F	G		A	B	C	D	E	F	G
1								1							
2	Number1		Number2		Result			2	Number1		Number2		Result		
3	Decimal	Binary	Decimal	Binary	Binary	Decimal		3	Decimal	Binary	Decimal	Binary	Binary	Decimal	
4	1	=DEC2BIN(B4)	7	=DEC2BIN(D4)	1	=BITAND(B4,D4)	4	1	1	7	111	1	1		7
5	15	=DEC2BIN(B5)	35	=DEC2BIN(D5)	11	=BITAND(B5,D5)	5	15	1111	35	100011	11	3		6
6	50	=DEC2BIN(B6)	30	=DEC2BIN(D6)	10010	=BITAND(B6,D6)	6	50	110010	30	11110	10010	18		

# 98. BITLSHIFT Function

## Description

The BITLSHIFT function returns a number shifted left by the specified number of bits.

## Syntax

```
BITLSHIFT (number, shift_amount)
```

## Arguments

Argument	Description	Required /Optional
number	Number must be an integer greater than or equal to 0.	Required
shift_amount	Shift_amount must be an integer.	Required

## Notes

- Shifting a number left is equivalent to adding zeros (0) to the right of the binary representation of the number. For example, a 2-bit shift to the left on the decimal value 4 converts its binary value (100) to 10000, or 16 in decimal.
- If either argument is outside their constraints, BITLSHIFT returns the #NUM! Error value.
- If Number is greater than  $(2^{48})-1$ , BITLSHIFT returns the #NUM! Error value.
- If the absolute value of Shift\_amount is greater than 53, BITLSHIFT returns the #NUM! Error value.
- If either argument is a non-numeric value, BITLSHIFT returns the #VALUE! Error value.
- A negative number used as the Shift\_amount argument shifts the number of bits to the right.
- A negative number used as the Shift\_amount argument returns the same result as a positive shift\_amount argument for the BITRSHIFT function.

## Applicability

Excel 2013, Excel 2016

## Example

Function Usage					Results							
	A	B	C	D	E	F	A	B	C	D	E	F
1						1						
2	Number		Shift	Result		2	Number		Shift	Result		
3	Decimal	Binary	Amount	Binary	Decimal	3	Decimal	Binary	Amount	Binary	Decimal	
4	7	=DEC2BIN(B4)	2	11100	=BITLSHIFT(B4,D4)	4	7	111	2	11100	28	
5	15	=DEC2BIN(B5)	2	111100	=BITLSHIFT(B5,D5)	5	15	1111	2	111100	60	
6	25	=DEC2BIN(B6)	3	11001000	=BITLSHIFT(B6,D6)	6	25	11001	3	11001000	200	
7	15	=DEC2BIN(B7)	-2	11	=BITLSHIFT(B7,D7)	7	15	1111	-2	11	3	

# 99. BITOR Function

## Description

The BITOR function returns a bitwise 'OR' of two numbers.

## Syntax

```
BITOR (number1, number2)
```

## Arguments

Argument	Description	Required /Optional
Number1	Must be in decimal form and greater than or equal to 0.	Required
Number2	Must be in decimal form and greater than or equal to 0.	Required

## Notes

- The result is a bitwise 'OR' of its parameters.
- In the result, each bit position is 1 if any of the parameter's bits at that position are 1
- The values returned from the bit positions progress from right to left as powers of 2. The rightmost bit returns 1 ( $2^0$ ), the bit to the left returns 2 ( $2^1$ ), and so on
- If either argument is outside their constraints, BITOR returns the #NUM! error value
- If either argument is greater than  $(2^{48})-1$ , BITOR returns the #NUM! error value
- If either argument is a non-numeric value, BITOR returns the #VALUE! error value

## Applicability

Excel 2013, Excel 2016

## Example

Function Usage						Results									
	A	B	C	D	E	F	G		A	B	C	D	E	F	G
1								1							
2	Number1		Number2		Result			2	Number1		Number2		Result		
3	Decimal	Binary	Decimal	Binary	Binary	Decimal		3	Decimal	Binary	Decimal	Binary	Binary	Decimal	
4	1	=DEC2BIN(B4)	7	=DEC2BIN(D4)	111	=BITOR(B4,D4)	4	1	1	7	111	111	7		5
5	15	=DEC2BIN(B5)	35	=DEC2BIN(D5)	101111	=BITOR(B5,D5)	6	15	1111	35	100011	101111	47		6
6	50	=DEC2BIN(B6)	30	=DEC2BIN(D6)	111110	=BITOR(B6,D6)		50	110010	30	11110	111110	62		

# 100. BITRSHIFT Function

## Description

The BITRSHIFT function returns a number shifted right by the specified number of bits.

## Syntax

```
BITRSHIFT (number, shift_amount)
```

## Arguments

Argument	Description	Required /Optional
number	Must be an integer greater than or equal to 0.	Required
shift_amount	Must be an integer.	Required

## Notes

- Shifting a number right is equivalent to removing digits from the rightmost side of the binary representation of the number. For example, a 2-bit shift to the right on the decimal value 13 converts its binary value (1101) to 11, or 3 in decimal.
- If either argument is outside its constraints, BITRSHIFT returns the #NUM! Error value.
- If Number is greater than  $(2^{48})-1$ , BITRSHIFT returns the #NUM! Error value.
- If the absolute value of Shift\_amount is greater than 53, BITRSHIFT returns the #NUM! Error value.
- If either argument is a non-numeric value, BITRSHIFT returns the #VALUE! Error value.
- A negative number used as the Shift\_amount argument shifts the number of bits to the left.
- A negative number used as the Shift\_amount argument returns the same result as a positive Shift\_amount argument for the BITLSHIFT function.

## Applicability

Excel 2013, Excel 2016

## Example

Function Usage					Results						
A	B	C	D	E	A	B	C	D	E	F	
1					1						
2	Number		Shift	Result		2	Number		Shift	Result	
	Decimal	Binary	Amount	Binary	Decimal		Decimal	Binary	Amount	Binary	Decimal
7	=DEC2BIN(B4)	2	1		=BITRSHIFT(B4,D4)	7	111		2	1	1
15	=DEC2BIN(B5)	2	11		=BITRSHIFT(B5,D5)	15	1111		2	11	3
58	=DEC2BIN(B6)	3	111		=BITRSHIFT(B6,D6)	58	111010		3	111	7
15	=DEC2BIN(B7)	-2	111100		=BITRSHIFT(B7,D7)	15	1111		-2	111100	60

# 101. BITXOR Function

## Description

The BITXOR function returns a bitwise 'XOR' of two numbers.

## Syntax

```
BITXOR (number1, number2)
```

## Arguments

Argument	Description	Required /Optional
number1	Must be greater than or equal to 0.	Required
number2	Must be greater than or equal to 0.	Required

## Notes

- BITXOR returns a decimal number that is the result of the sum of a bitwise 'XOR' (exclusive XOR) of its parameters.
- If either argument is outside its constraint, BITXOR returns the #NUM! Error value.
- If either argument is greater than  $(2^{48})-1$ , BITXOR returns the #NUM! Error value.
- If either argument is a non-numeric value, BITXOR returns the #VALUE! Error value.
- In the result, each bit position is 1 if the values of the parameters at that bit position are not equal; in other words, one value is 0 and the other is 1.
- For example, using BITXOR (5, 3), 5 is expressed as 101 in binary and 3 as 11 in binary. To help with comparison, you can consider 3 as 011. From right to left, the bit values at the three positions in this example are the same (1) only at the rightmost position. A 'not equal' result returns a 1 for the second and third positions from the right, and an 'equal' result returns 0 for the rightmost position.
- Values of 1 returned from the bit positions progress from right to left as powers of 2. The rightmost bit returns 1 ( $2^0$ ), the bit to the left returns 2 ( $2^1$ ), and so on.
- Using the same example, 0 is returned for the rightmost bit position because it is a 0, 2 ( $2^1$ ) is returned for the second bit position from the right (a 1 value), and 4 ( $2^2$ ) is returned for the leftmost bit (also a 1 value). The total is 6, in decimal representation.

## Applicability

Excel 2013, Excel 2016

### Example

Function Usage						Results							
	B	C	D	E	F	G	A	B	C	D	E	F	G
2	Number1		Number2		Result		2	Number1		Number2		Result	
	Decimal	Binary	Decimal	Binary	Binary	Decimal		Decimal	Binary	Decimal	Binary	Binary	Decimal
3							3						
4	1	=DEC2BIN(B4)	7	=DEC2BIN(D4)	110	=BITXOR(B4,D4)	4	1	1	7	111	110	6
5	15	=DEC2BIN(B5)	35	=DEC2BIN(D5)	101100	=BITXOR(B5,D5)	5	15	1111	35	100011	101100	44
6	50	=DEC2BIN(B6)	30	=DEC2BIN(D6)	101100	=BITXOR(B6,D6)	6	50	110010	30	11110	101100	44

# 102. COMPLEX FUNCTION

## Description

The COMPLEX function converts real and imaginary coefficients into a complex number of the form  $x+yi$  or  $x+yj$ .

## Syntax

```
COMPLEX (real_num, i_num, [suffix])
```

## Arguments

Argument	Description	Required /Optional
real_num	The real coefficient of the complex number.	Required
i_num	The imaginary coefficient of the complex number.	Required
suffix	The suffix for the imaginary component of the complex number. If omitted, suffix is assumed to be "i".	Optional

## Notes

- All complex number functions accept "i" and "j" for suffix, but neither "I" nor "J". Using uppercase results in the #VALUE! Error value.
- All functions that accept two or more complex numbers require that all suffixes match.
- If real\_num is nonnumeric, COMPLEX returns the #VALUE! error value.
- If i\_num is nonnumeric, COMPLEX returns the #VALUE! error value.
- If suffix is neither "i" nor "j", COMPLEX returns the #VALUE! error value.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage				Results							
	A	B	C	D	E	A	B	C	D	E	
2		Real Coefficient	Imaginary Coefficient	Suffix	Result	2		Real Coefficient	Imaginary Coefficient	Suffix	Result
3		5	4	i	=COMPLEX(B3,C3,D3)	3		5	4	i	5+4i
4		5	4	j	=COMPLEX(B4,C4,D4)	4		5	4	j	5+4j
5		5	4		=COMPLEX(B5,C5,D5)	5		5	4		5+4i
6		5	4	I	=COMPLEX(B6,C6,D6)	6		5	4	I	#VALUE!
7		5	4	J	=COMPLEX(B7,C7,D7)	7		5	4	J	#VALUE!
8		5			=COMPLEX(B8,C8,D8)	8		5			5
9			4		=COMPLEX(B9,C9,D9)	9			4		4i

# 103. CONVERT Function

## Description

The CONVERT function converts a number from one measurement system to another.

For example, CONVERT can translate a table of distances in miles to a table of distances in kilometers.

## Syntax

```
CONVERT (number,from_unit,to_unit)
```

## Arguments

Argument	Description	Required /Optional
Number	The value in from_units to convert.	Required
From_unit	The units for number.	Required
To_unit	The units for the result.	Required

## Notes

- The from\_unit and to\_unit arguments should be Compatible i.e. they may not be from different measurement types (e.g. temperature and distance). If you attempt to convert between two incompatible measurement types, Excel will return the #N/A error.
- CONVERT accepts the following text values (in quotation marks) for from\_unit and to\_unit
  - The text abbreviations for the unit types are case sensitive.
  - The unit types that are colored in orange were introduced in Excel 2013 and were not available in earlier versions of Excel.

Weight & Mass Units	
Weight and mass	From_unit or to_unit
Gram	"g"
Slug	"sg"
Pound Mass	"lbm"
U (Atomic Mass Unit)	"u"
Ounce Mass	"ozm"
Grain	"grain"
U.S. hundredweight	"cwt" (or "shweight")
Imperial hundredweight	"uk_cwt" (or "lcwt" or "hweight")
Stone	"stone"

<b>Weight &amp; Mass Units</b>	
<b>Weight and mass</b>	<b>From_unit or to_unit</b>
Ton	"ton"
Imperial ton	"uk_ton" (or "LTON" or "brton")

<b>Distance Units</b>	
<b>Distance</b>	<b>From_unit or to_unit</b>
Meter	"m"
Statute Mile	"mi"
Nautical Mile	"Nmi"
Inch	"in"
Foot	"ft"
Yard	"yd"
Angstrom	"ang"
Pica (1/6 inch)	"pica"
Pica (1/72 inch)	"Pica" (or "Picapt")
Ell	"ell"
Light-year	"ly"
Parsec	"parsec" (or "pc")
U.S. survey mile	"survey_mi"

<b>Time Units</b>	
<b>Time</b>	<b>From_unit or to_unit</b>
Year	"yr"
Day	"day"
Hour	"hr"
Minute	"mn"
Second	"sec"

<b>Pressure Units</b>	
<b>Pressure</b>	<b>From_unit or to_unit</b>
Pascal	"Pa" (or "p")
Atmosphere	"atm" (or "at")
mm of Mercury	"mmHg"
PSI	"psi"
Torr	"Torr"

<b>Force Units</b>	
<b>Force</b>	<b>From_unit or to_unit</b>
Newton	"N"
Dyne	"dyn" (or "dy")
Pound Force	"lbf"
Pond	"pond"

<b>Energy Units</b>	
<b>Energy</b>	<b>From_unit or to_unit</b>
Joule	"J"
Erg	"e"
Thermodynamic Calorie	"c"
IT Calorie	"cal"
Electron Volt	"eV" (or "ev")
Horsepower-Hour	"HPh"
Watt-Hour	"Wh"
Foot-Pound	"flb"
BTU	"BTU" (or "btu")

<b>Power Units</b>	
<b>Power</b>	<b>From_unit or to_unit</b>
Horsepower	"HP" (or "h")
Watt	"W" (or "w")
Pferdestärke	"PS"

<b>Magnetism Units</b>	
<b>Magnetism</b>	<b>From_unit or to_unit</b>
Tesla	"T"
Gauss	"ga"

<b>Temperature Units</b>	
<b>Temperature</b>	<b>From_unit or to_unit</b>
Degree Celsius	"C" (or "cel")
Degree Fahrenheit	"F" (or "fah")
Kelvin	"K" (or "kel")
Degrees Rankine	"Rank"
Degrees Réaumur	"Reau"

<b>Liquid (Volume) Units</b>	
<b>Liquid (Volume)</b>	<b>From_unit or to_unit</b>
Teaspoon	"tsp"
Tablespoon	"tbs"
Fluid Ounce	"oz"
Cup	"cup"
U.S. Pint	"pt" (or "us_pt")
U.K. Pint	"uk_pt"
Quart	"qt"
Imperial quart	"uk_qt"
Gallon	"gal"
Imperial gallon	"uk_gal"
Liter	"l" (or "lt")
Cubic angstrom	"ang3" (or "ang^3")
U.S. oil barrel	"barrel"
U.S. bushel	"bushel"
Cubic feet	"ft3" (or "ft^3")
Cubic inch	"in3" (or "in^3")
Cubic light-year	"ly3" (or "ly^3")
Cubic meter	"m3" (or "m^3")
Cubic mile	"mi3" (or "mi^3")
Cubic yard	"yd3" (or "yd^3")
Cubic nautical mile	"Nmi3" (or "Nmi^3")
Cubic Pica	"Picapt3" (or "Picapt^3" or "Pica3" or "Pica^3")
Gross Registered Ton	"GRT" (or "regon")
Measurement ton	"MTON"

<b>Area Units</b>	
<b>Area</b>	<b>From_unit or to_unit</b>
International acre	"uk_acre"
U.S. survey acre	"us_acre"
Square angstrom	"ang2" (or "ang^2")
Are	"ar"
Square feet	"ft2" (or "ft^2")
Hectare	"ha"
Square inches	"in2" (or "in^2")
Square light-year	"ly2" (or "ly^2")
Square meters	"m2" (or "m^2")
Morgen	"Morgen"
Square miles	"mi2" (or "mi^2")
Square nautical miles	"Nmi2" (or "Nmi^2")

<b>Area Units</b>	
<b>Area</b>	<b>From_unit or to_unit</b>
Square Pica	"Picapt2" (or "Pica2" or "Pica^2" or "Picapt^2")
Square yards	"yd2" (or "yd^2")

<b>Information Units</b>	
<b>Information</b>	<b>From_unit or to_unit</b>
Bit	"bit"
Byte	"byte"

<b>Speed Units</b>	
<b>Speed</b>	<b>From_unit or to_unit</b>
Admiralty knot	"admkn"
Knot	"kn"
Meters per hour	"m/h" (or "m/hr")
Meters per second	"m/s" (or "m/sec")
Miles per hour	"mph"

In addition, the following text can be prepended any metric to\_unit or from\_unit. For example, the "c" prepended to the meter unit, "m" becomes "cm" to denote centimeters.

<b>Prefix</b>	<b>Prefix Value</b>	<b>Abbreviation</b>
yotta	1.00E+24	"Y"
zetta	1.00E+21	"Z"
exa	1.00E+18	"E"
peta	1.00E+15	"P"
tera	1.00E+12	"T"
giga	1.00E+09	"G"
mega	1.00E+06	"M"
kilo	1.00E+03	"k"
hecto	1.00E+02	"h"
deka	1.00E+01	"e" (or "da")
deci	1.00E-01	"d"
centi	1.00E-02	"c"
milli	1.00E-03	"m"
micro	1.00E-06	"u"
nano	1.00E-09	"n"
pico	1.00E-12	"p"
femto	1.00E-15	"f"
atto	1.00E-18	"a"
zepto	1.00E-21	"z"
yocto	1.00E-24	"y"

Binary Prefix	Prefix Value	Abbreviation	Derived from
yobi	$2^{80}$	"Yi"	yotta
zebi	$2^{70}$	"Zi"	zetta
exbi	$2^{60}$	"Ei"	exa
pebi	$2^{50}$	"Pi"	peta
tebi	$2^{40}$	"Ti"	tera
gibi	$2^{30}$	"Gi"	giga
mebi	$2^{20}$	"Mi"	mega
kibi	$2^{10}$	"ki"	kilo

## Notes

- If the input data types are incorrect, CONVERT returns the #VALUE! error value.
- If the unit does not exist, CONVERT returns the #N/A error value.
- If the unit does not support a binary prefix, CONVERT returns the #N/A error value.
- If the units are in different groups, CONVERT returns the #N/A error value.
- Unit names and prefixes are case-sensitive.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage				Results					
A	B	C	E	A	B	C	E		
1	Amount To Convert	Converting From	Converting To	Converted Amount	1	Amount To Convert	Converting From	Converting To	Converted Amount
2	1	in	cm	=CONVERT(B3,C3,D3)	3	1	in	cm	2.54
3	1	ft	m	=CONVERT(B4,C4,D4)	4	1	ft	m	0.3048
4	1	yd	m	=CONVERT(B5,C5,D5)	5	1	yd	m	0.9144
5	1	yr	day	=CONVERT(B6,C6,D6)	6	1	yr	day	365.25
6	1	day	hr	=CONVERT(B7,C7,D7)	7	1	day	hr	24
7	3	hr	mn	=CONVERT(B8,C8,D8)	8	3	hr	mn	180
8	0.5	mn	sec	=CONVERT(B9,C9,D9)	9	0.5	mn	sec	30

# 104. DEC2BIN Function

## Description

The DEC2BIN function converts a decimal number to binary.

## Syntax

```
DEC2BIN (number, [places])
```

## Arguments

Argument	Description	Required /Optional
number	The decimal integer you want to convert. If number is negative, valid place values are ignored and DEC2BIN returns a 10-character (10-bit) binary number in which the most significant bit is the sign bit. The remaining 9 bits are magnitude bits. Negative numbers are represented using two's-complement notation.	Required
places	The number of characters to use. If places is omitted, DEC2BIN uses the minimum number of characters necessary. Places is useful for padding the return value with leading 0s (zeros).	Optional

## Notes

- If number < -512 or if number > 511, DEC2BIN returns the #NUM! error value
- If number is nonnumeric, DEC2BIN returns the #VALUE! error value
- If DEC2BIN requires more than places characters, it returns the #NUM! error value
- If places is not an integer, it is truncated
- If places is nonnumeric, DEC2BIN returns the #VALUE! error value
- If places is zero or negative, DEC2BIN returns the #NUM! error value

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

**Function Usage:**

Decimal Number	Binary Equivalent
0	=DEC2BIN(B3)
1	=DEC2BIN(B4)
2	=DEC2BIN(B5)
511	=DEC2BIN(B6)
512	=DEC2BIN(B7)
-1	=DEC2BIN(B8)
-2	=DEC2BIN(B9)
-511	=DEC2BIN(B10)
-512	=DEC2BIN(B11)
-513	=DEC2BIN(B12)

**Results:**

Decimal Number	No. of Characters	Binary Equivalent
1	1	=DEC2BIN(E3,F3)
1	2	=DEC2BIN(E4,F4)
1	3	=DEC2BIN(E5,F5)
4	3	=DEC2BIN(E6,F6)
4	2	=DEC2BIN(E7,F7)
1	9	=DEC2BIN(E8,F8)
1	9.3	=DEC2BIN(E9,F9)
1	0	=DEC2BIN(E10,F10)
1	-2	=DEC2BIN(E11,F11)
1	Two	=DEC2BIN(E12,F12)

Decimal Number	Binary Equivalent
0	0
1	1
2	10
511	111111111
512	#NUM!
-1	1111111111
-2	1111111110
-511	1000000001
-512	1000000000
-513	#NUM!

Decimal Number	No. of Characters	Binary Equivalent
1	1	1
1	2	01
1	3	001
4	3	100
4	2	#NUM!
1	9	000000001
1	9.3	000000001
1	0	#NUM!
1	-2	#NUM!
1	Two	#VALUE!

# 105. DEC2HEX Function

## Description

The DEC2HEX function converts a decimal number to hexadecimal.

## Syntax

```
DEC2HEX (number, [places])
```

## Arguments

Argument	Description	Required /Optional
number	The decimal integer you want to convert. If number is negative, places is ignored and DEC2HEX returns a 10-character (40-bit) hexadecimal number in which the most significant bit is the sign bit. The remaining 39 bits are magnitude bits. Negative numbers are represented using two's-complement notation.	Required
places	The number of characters to use. If places is omitted, DEC2HEX uses the minimum number of characters necessary. Places is useful for padding the return value with leading 0s (zeros).	Optional

## Notes

- If Number is < -549,755,813,888 or if Number is > 549,755,813,887, DEC2HEX returns the #NUM! error value.
- If Number is non-numeric, DEC2HEX returns the #VALUE! error value.
- If the result of DEC2HEX requires more than the number of specified Places characters, it returns the #NUM! Error value. For example, DEC2HEX(64,1) returns the error value because the result (40) requires two characters.
- If Places is not an integer, the value of Places is truncated.
- If Places is non-numeric, DEC2HEX returns the #VALUE! error value.
- If Places is negative, DEC2HEX returns the #NUM! error value.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

**Function Usage**

Decimal Number	Hexadecimal	Decimal Number	No. of Characters	Hexadecimal
0	=DEC2HEX(B3)	1	1	=DEC2HEX(E3,F3)
25	=DEC2HEX(B4)	1	2	=DEC2HEX(E4,F4)
26	=DEC2HEX(B5)	46	3	=DEC2HEX(E5,F5)
27	=DEC2HEX(B6)	46	8	=DEC2HEX(E6,F6)
46	=DEC2HEX(B7)	46	1	=DEC2HEX(E7,F7)
-1	=DEC2HEX(B8)	46	-8	=DEC2HEX(E8,F8)
-2	=DEC2HEX(B9)	46	8.4	=DEC2HEX(E9,F9)
549755813887	=DEC2HEX(B10)	46	Two	=DEC2HEX(E10,F10)
549755813888	=DEC2HEX(B11)	46	0	=DEC2HEX(E11,F11)
-549755813888	=DEC2HEX(B12)	-1	2	=DEC2HEX(E12,F12)
-549755813889	=DEC2HEX(B13)	-1	-2	=DEC2HEX(E13,F13)

**Results**

Decimal Number	Hexadecimal	Decimal Number	No. of Characters	Hexadecimal
0	0	1	1	1
25	19	1	2	01
26	1A	46	3	02E
27	1B	46	8	0000002E
46	2E	46	1	#NUM!
-1	FFFFFFFF	46	-8	#NUM!
-2	FFFFFFFE	46	8.4	0000002E
549,755,813,887	7FFFFFFF	46	Two	#VALUE!
549,755,813,888	#NUM!	46	0	#NUM!
-549,755,813,888	8000000000	-1	2	FFFFFFFFF
-549,755,813,889	#NUM!	-1	-2	#NUM!

# 106. DEC2OCT Function

## Description

The DEC2OCT function converts a decimal number to octal.

## Syntax

```
DEC2OCT (number, [places])
```

## Arguments

Argument	Description	Required /Optional
number	The decimal integer you want to convert. If number is negative, places is ignored and DEC2OCT returns a 10-character (30-bit) octal number in which the most significant bit is the sign bit. The remaining 29 bits are magnitude bits. Negative numbers are represented using two's-complement notation.	Required
places	The number of characters to use. If places is omitted, DEC2OCT uses the minimum number of characters necessary. Places is useful for padding the return value with leading 0s (zeros).	Optional

## Notes

- If number < -536,870,912 or if number > 536,870,911, DEC2OCT returns the #NUM! error value.
- If number is nonnumeric, DEC2OCT returns the #VALUE! error value.
- If DEC2OCT requires more than places characters, it returns the #NUM! error value.
- If places is not an integer, it is truncated.
- If places is nonnumeric, DEC2OCT returns the #VALUE! error value.
- If places is negative, DEC2OCT returns the #NUM! error value.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Number	Places	2	Number	Places
3	379	5	3	379	5
4	115	3	4	115	3
5	-1		5	-1	7777777777

# 107. DELTA Function

## Description

The DELTA function tests whether two values are equal. It returns 1 if number1 = number2; returns 0 otherwise.

You can use this function to filter a set of values. For example, by summing several DELTA functions you calculate the count of equal pairs. This function is also known as the Kronecker Delta function.

## Syntax

```
DELTA (number1, [number2])
```

## Arguments

Argument	Description	Required /Optional
number1	The first number.	Required
number2	The second number. If omitted, number2 is assumed to be zero.	Optional

## Notes

- If number1 is nonnumeric, DELTA returns the #VALUE! error value.
- If number2 is nonnumeric, DELTA returns the #VALUE! error value.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Number1	Number2	2	Number1	Number2
3	10	20	=DELTA(B3,C3)	10	20
4	50	50	=DELTA(B4,C4)	50	50
5	17.5	17.5	=DELTA(B5,C5)	17.5	17.5
6	17.5	17.5	=DELTA(B6,C6)	17.5	18
7	0.175	0.175	=DELTA(B7,C7)	17.50%	0.175
8	Text	1	=DELTA(B8,C8)	Text	1
9	1	Text	=DELTA(B9,C9)	1	Text
10		55	=DELTA(B10,C10)		55
11	1		=DELTA(B11)	1	0
12			=DELTA(B12)		1

# 108. ERF Function

## Description

The ERF function returns the error function integrated between lower\_limit and upper\_limit.

The Error function is given by the equation-

$$Erf(x) = \frac{2}{\sqrt{\pi}} \int e^{-t^2} dt$$

## Syntax

```
ERF (lower_limit, [upper_limit])
```

## Arguments

Argument	Description	Required / Optional
lower_limit	The lower bound for integrating ERF.	Required
upper_limit	The upper bound for integrating ERF. If omitted, ERF integrates between zero and lower_limit.	Optional

## Notes

- If lower\_limit is nonnumeric, ERF returns the #VALUE! error value.
- If upper\_limit is nonnumeric, ERF returns the #VALUE! error value

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

- In Excel 2007, if you input a negative value for the upper or lower limit, the function would return #NUM! error value.
- In Excel 2010, the function algorithm has been improved, so that it can now calculate the function for both positive and negative ranges.

**Example**

Function Usage				Results			
A	B	C	D	A	B	C	D
1				1			
2	Lower Limit	Upper Limit	Result	2	Lower Limit	Upper Limit	Result
3	0.8		=ERF(B3)	3	0.8		0.742100965
4	1.2		=ERF(B4)	4	1.2		0.910313978
5	1.6	5	=ERF(B5,C5)	5	1.6	5	0.023651617
6	2	6	=ERF(B6,C6)	6	2	6	0.004677735

# 109. ERF.PRECISE Function

## Description

The ERF.PRECISE function returns the error function. The Error function is given by the formula-

$$Erf(x) = \frac{2}{\sqrt{\pi}} \int e^{-t^2} dt$$

The ERF.PRECISE function calculates this function with the upper or lower limit of the integral set to 0 (depending on whether the user-supplied limit is positive or negative).

If you want to choose both the upper and lower limits yourself, you should consider using the ERF Function.

## Syntax

```
ERF.PRECISE(x)
```

## Arguments

Argument	Description	Required /Optional
x	The lower bound for integrating ERF.PRECISE.	Required

## Notes

If lower\_limit is nonnumeric, ERF.PRECISE returns the #VALUE! Error value.

## Applicability

Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Lower Limit	=ERF.PRECISE(B3)	2	Lower Limit	Result
3	0.8	=ERF.PRECISE(B4)	3	0.8	0.742100965
4	1.2	=ERF.PRECISE(B5)	4	1.2	0.910313978
5	1.6	=ERF.PRECISE(B6)	5	1.6	0.976348383
6	2		6	2	0.995322265

# 110. ERFC Function

## Description

The ERFC function returns the complementary ERF function integrated between x and infinity.

The Complementary Error Function is equal to 1 - ERF (i.e. 1 - Error Function), and is given by the equation:

$$Erfc(x) = \frac{2}{\sqrt{\pi}} \int_x^{\infty} e^{-t^2} dt$$

## Syntax

```
ERFC(x)
```

## Arguments

Argument	Description	Required /Optional
x	The lower bound for integrating ERFC.	Required

## Notes

If x is nonnumeric, ERFC returns the #VALUE! error value.

## Applicability

- Excel 2007, Excel 2010, Excel 2013, Excel 2016
- In Excel 2007, if you input a negative value for the argument - x, the function would return a #NUM! Error value.
- In Excel 2010, the function algorithm has been improved, so that it can now calculate the function for both positive and negative x values.

**Example**

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Lower Limit	Result	2		
3	0.8	=ERFC(B3)	3	0.8	0.257899035
4	1.2	=ERFC(B4)	4	1.2	0.089686022
5	1.6	=ERFC(B5)	5	1.6	0.023651617
6	2	=ERFC(B6)	6	2	0.004677735
7			-		

# 111. ERFC.PRECISE Function

## Description

The ERFC.PRECISE function returns the complementary ERF function integrated between x and infinity.

The Complementary Error Function is equal to 1 - ERF (i.e. 1 - Error Function), and is given by the equation-

$$Erfc(x) = \frac{2}{\sqrt{\pi}} \int_x^{\infty} e^{-t^2} dt$$

## Syntax

```
ERFC.PRECISE(x)
```

## Arguments

Argument	Description	Required /Optional
x	The lower bound for integrating ERFC.PRECISE.	Required

## Notes

If x is nonnumeric, ERFC.PRECISE returns the #VALUE! Error value.

## Applicability

Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	<b>Lower Limit</b>	<b>Result</b>	2	<b>Lower Limit</b>	<b>Result</b>
3	0.8	=ERFC.PRECISE(B3)	3	0.8	0.257899035
4	1.2	=ERFC.PRECISE(B4)	4	1.2	0.089686022
5	1.6	=ERFC.PRECISE(B5)	5	1.6	0.023651617
6	2	=ERFC.PRECISE(B6)	6	2	0.004677735

# 112. GESTEP Function

## Description

The GESTEP function returns-

- 1 if number  $\geq$  step
- 0 (zero) if number  $<$  step

You can use this function to filter a set of values. For example, by summing several GESTEP functions, you calculate the count of values that exceed a threshold.

## Syntax

```
GESTEP (number, [step])
```

## Arguments

Argument	Description	Required /Optional
number	The value to test against step.	Required
step	The threshold value. If you omit a value for step, GESTEP uses zero.	Optional

## Notes

- If number is nonnumeric, GESTEP returns the #VALUE! error value.
- If step is nonnumeric, GESTEP returns the #VALUE! error value.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
2	Number1	Number2	2	Number1	Number2
3	10	20	3	10	0
4	50	20	4	50	1
5	99	100	5	99	0
6	100	100	6	100	1
7	101	100	7	101	1
8	2		8	2	1
9		2	9	2	0
10	Two	2	10	Two	#VALUE!
11	2	Two	11	2	#VALUE!

# 113. HEX2BIN Function

## Description

The HEX2BIN function converts a hexadecimal number to binary.

## Syntax

```
HEX2BIN (number, [places])
```

## Arguments

Argument	Description	Required /Optional
number	The hexadecimal number you want to convert. Number cannot contain more than 10 characters (40 bits). The most significant bit of number is the sign bit (40th bit from the right). The remaining 39 bits are magnitude bits. Negative numbers are represented using two's-complement notation.	Required
places	The number of characters to use. If places is omitted, HEX2BIN uses the minimum number of characters necessary. Places is useful for padding the return value with leading 0s (zeros).	Optional

## Notes

- The Hexadecimal (Base 16) Numeral System uses the digits 0-9 and the characters A-F
- The following table shows the first 32 hexadecimal values, along with the equivalent decimal values:

Hexadecimal	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	10	11	12	13	14	15	16	17	18	19	1A	1B	1C	1D	1E	1F	20
Decimal	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32

- As hexadecimals use the numbers 0-9 and the characters A-F, they should be enclosed in quotation marks when they are supplied to an Excel function. For example, the hexadecimal 11A should be input as "11A"
- The Binary (Base 2) Numeral System uses the digits 0 & 1.

- The following table shows the first 8 binary values, along with the equivalent decimal values-

Binary	1	10	11	100	101	110	111	1000
Decimal	1	2	3	4	5	6	7	8

- If number is negative, HEX2BIN ignores places and returns a 10-character binary number.
- If number is negative, it cannot be less than FFFFFFFE00
- If number is positive, it cannot be greater than 1FF.
- If number is not a valid hexadecimal number, HEX2BIN returns the #NUM! error value.
- If HEX2BIN requires more than places characters, it returns the #NUM! error value.
- If places is not an integer, it is truncated.
- If places is nonnumeric, HEX2BIN returns the #VALUE! error value.
- If places is negative, HEX2BIN returns the #NUM! error value.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	<b>Hexadecimal</b>	<b>Binary Number</b>	2	<b>Hexadecimal</b>	<b>Binary Number</b>
3	0	=HEX2BIN(B3)	3	0	0
4	1	=HEX2BIN(B4)	4	1	1
5	2	=HEX2BIN(B5)	5	2	10
6	3	=HEX2BIN(B6)	6	3	11
7	1A	=HEX2BIN(B7)	7	1A	11010
8	1B	=HEX2BIN(B8)	8	1B	11011
9	1B	=HEX2BIN(B9,-1)	9	1B	#NUM!
10	7FFFFFFF	=HEX2BIN(B10)	10	7FFFFFFF	#NUM!
11	8000000000	=HEX2BIN(B11)	11	8000000000	#NUM!
12	FFFFFFFF	=HEX2BIN(B12)	12	FFFFFFFF	1111111111
13	FFFFFFFE	=HEX2BIN(B13)	13	FFFFFFFE	1111111110
14	FFFFFFFD	=HEX2BIN(B14)	14	FFFFFFFD	1111111101

# 114. HEX2DEC Function

## Description

The HEX2DEC function converts a hexadecimal number to decimal.

## Syntax

```
HEX2DEC (number)
```

## Arguments

Argument	Description	Required /Optional
number	The hexadecimal number you want to convert. Number cannot contain more than 10 characters (40 bits). The most significant bit of number is the sign bit. The remaining 39 bits are magnitude bits. Negative numbers are represented using two's-complement notation.	Required

## Notes

- The Hexadecimal (Base 16) Numeral System uses the digits 0-9 and the characters A-F
- The following table shows the first 32 hexadecimal values, along with the equivalent decimal values-

Hexadecimal	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	10	11	12	13	14	15	16	17	18	19	1A	1B	1C	1D	1E	1F	20
Decimal	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32

- As hexadecimals use the numbers 0-9 and the characters A-F, they should be enclosed in quotation marks when they are supplied to an Excel function. For example, the hexadecimal 11A should be input as "11A"
- If number is not a valid hexadecimal number, HEX2DEC returns the #NUM! error value.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
	A	B		A	B
1				1	
2	Hexadecimal	Decimal Number		2	Hexadecimal
3	0	=HEX2DEC(B3)		3	0
4	1	=HEX2DEC(B4)		4	1
5	2	=HEX2DEC(B5)		5	2
6	3	=HEX2DEC(B6)		6	3
7	1A	=HEX2DEC(B7)		7	1A
8	1B	=HEX2DEC(B8)		8	1B
9	7FFFFFFF	=HEX2DEC(B9)		9	7FFFFFFF
10	8000000000	=HEX2DEC(B10)		10	8000000000
11	FFFFFFFF	=HEX2DEC(B11)		11	FFFFFFFF
12	FFFFFFFE	=HEX2DEC(B12)		12	FFFFFFFE
13	FFFFFFFD	=HEX2DEC(B13)		13	FFFFFFFD

# 115. HEX2OCT Function

## Description

The HEX2OCT function converts a hexadecimal number to octal.

## Syntax

```
HEX2OCT (number, [places])
```

## Arguments

Argument	Description	Required /Optional
number	The hexadecimal number you want to convert. Number cannot contain more than 10 characters (40 bits). The most significant bit of number is the sign bit. The remaining 39 bits are magnitude bits. Negative numbers are represented using two's-complement notation.	Required
places	The number of characters to use. If places is omitted, HEX2OCT uses the minimum number of characters necessary. Places is useful for padding the return value with leading 0s (zeros).	Optional

## Notes

- The Hexadecimal (Base 16) Numeral System uses the digits 0-9 and the characters A-F
- The following table shows the first 32 hexadecimal values, along with the equivalent decimal values:

Hexadecimal	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	10	11	12	13	14	15	16	17	18	19	1A	1B	1C	1D	1E	1F	20
Decimal	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32

- As hexadecimals use the numbers 0-9 and the characters A-F, they should be enclosed in quotation marks when they are supplied to an Excel function. For example, the hexadecimal 11A should be input as "11A"
- The Octal (Base 8) Numeral System uses the digits 0-7.
- The following table shows the first 16 octal values, along with the equivalent decimal values-

Octal	1	2	3	4	5	6	7	10	11	12	13	14	15	16	17	20
Decimal	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

- If number is negative, HEX2OCT ignores places and returns a 10-character octal number.
- If number is negative, it cannot be less than FFE0000000
- If number is positive, it cannot be greater than 1FFFFFFF
- If number is not a valid hexadecimal number, HEX2OCT returns the #NUM! error value.
- If HEX2OCT requires more than places characters, it returns the #NUM! error value.
- If places is not an integer, it is truncated.
- If places is nonnumeric, HEX2OCT returns the #VALUE! error value.
- If places is negative, HEX2OCT returns the #NUM! error value.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
	A	B		A	B
1			1		
2	Hexadecimal	Octal Number	2	Hexadecimal	Octal Number
3	0	=HEX2OCT(B3)	3	0	0
4	1	=HEX2OCT(B4)	4	1	1
5	2	=HEX2OCT(B5)	5	2	2
6	3	=HEX2OCT(B6)	6	3	3
7	1A	=HEX2OCT(B7)	7	1A	32
8	1B	=HEX2OCT(B8)	8	1B	33
9	1B	=HEX2OCT(B9,-1)	9	1B	#NUM!
10	FFFFFFFF	=HEX2OCT(B10)	10	FFFFFFFF	#NUM!
11	8000000000	=HEX2OCT(B11)	11	8000000000	#NUM!
12	FFFFFF	=HEX2OCT(B12)	12	FFFFFF	7777777777
13	FFFFFFFE	=HEX2OCT(B13)	13	FFFFFFFE	7777777776
14	FFFFFFFD	=HEX2OCT(B14)	14	FFFFFFFD	7777777775

# 116. IMABS Function

## Description

The IMABS function returns the absolute value (modulus) of a complex number in  $x + yi$  or  $x + yj$  text format.

## Complex Numbers in Excel

- Complex numbers are simply stored as text in Excel.
- When a text string in the format "a+bi" or "a+bj" is supplied to one of Excel's built-in complex number functions, this is interpreted as a complex number.
- The complex number functions can accept simple numeric values, as this is equivalent to a complex number whose imaginary coefficient is equal to 0.

## Modulus of a Complex Number

- The absolute value (the modulus) of a complex number is calculated as the square root of the sum of the squares of the real and imaginary coefficients, i.e. the modulus of the complex number,  $z = a + bi$  is:

$$|z| = \sqrt{a^2 + b^2}$$

## Syntax

```
IMABS (inumber)
```

## Arguments

Argument	Description	Required / Optional
Inumber	A complex number for which you want the absolute value.	Required

## Notes

- Use COMPLEX to convert real and imaginary coefficients into a complex number.
- If Inumber is not recognized as a complex number, the function IMABS returns a #NUM! error.
- If Inumber is a logical value, the function IMABS returns a #VALUE! Error.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Complex Number	Result	2	Complex Number	Result
3	5+4i	=IMABS(B3)	3	5+4i	6.4
4	5+8i	=IMABS(B4)	4	5+8i	9.4
5	2+4i	=IMABS(B5)	5	2+4i	4.5

# 117. IMAGINARY Function

## Description

The IMAGINARY function returns the imaginary coefficient of a complex number in  $x + yi$  or  $x + yj$  text format.

## Syntax

```
IMAGINARY (inumber)
```

## Arguments

Argument	Description	Required /Optional
inumber	A complex number for which you want the imaginary coefficient.	Required

## Notes

- Use COMPLEX to convert real and imaginary coefficients into a complex number.
- inumber can be supplied to the function Imaginary as any of the following
  - A simple number;
  - A complex number encased in quotation marks - e.g. "5+3i";
  - A reference to a cell containing a complex number or a numeric value;
  - A value returned from another Excel function or formula.
- If Inumber is not recognized as a complex number, the function IMABS returns a #NUM! error.
- If Inumber is a logical value, the function IMABS returns a #VALUE! Error.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Complex Number	Result	2	Complex Number	Result
3	5+4i	=IMAGINARY(B3)	3	5+4i	4
4	5+i	=IMAGINARY(B4)	4	5+i	1
5	5-i	=IMAGINARY(B5)	5	5-i	-1
6	5	=IMAGINARY(B6)	6	5	0
7	i	=IMAGINARY(B7)	7	i	1
8	2i	=IMAGINARY(B8)	8	2i	2
n			-		

# 118. IMARGUMENT Function

## Description

The IMARGUMENT function returns the argument  $\theta$  (theta), an angle expressed in radians, such that-

$$x + yi = |x + yi|e^{i\theta} = |x + yi| (\cos \theta + i \sin \theta)$$

## Syntax

```
IMARGUMENT (inumber)
```

## Arguments

Argument	Description	Required /Optional
Inumber	A complex number for which you want the argument $\theta$ .	Required

## Notes

- Use COMPLEX to convert real and imaginary coefficients into a complex number
- IMARGUMENT is calculated as follows-

$$\text{IMARGUMENT}(z) = \tan^{-1}\left(\frac{y}{x}\right) = \theta$$

Where

$$\theta \in (-\pi; \pi], \text{ and } z = x + yi$$

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage		Results	
A	B	A	B
1		1	
2	Complex Number	2	Complex Number
3	=IMARGUMENT(B3)	3	5+4i
4	=IMARGUMENT(B4)	4	5+i
5	=IMARGUMENT(B5)	5	5-i
6	=IMARGUMENT(B6)	6	5
7	=IMARGUMENT(B7)	7	2i

# 119. IMCONJUGATE Function

## Description

The IMCONJUGATE function returns the complex conjugate of a complex number in  $x + yi$  or  $x + yj$  text format.

## Syntax

```
IMCONJUGATE (inumber)
```

## Arguments

Argument	Description	Required /Optional
Inumber	A complex number for which you want the conjugate.	Required

## Notes

- Use COMPLEX to convert real and imaginary coefficients into a complex number.
- The conjugate of a complex number is-

$$\text{IMCONJUGATE}(x + yi) = \bar{z} = (x - yi)$$

- If inumber is not recognized as a complex number, IMCONJUGATE Function returns #NUM! error.
- If inumber is a logical value, IMCONJUGATE Function returns #VALUE! Error.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage		Results	
A	B	A	B
1		1	
2	<b>Complex Number</b>	<b>Result</b>	<b>Complex Number</b>
3	5+4i	=IMCONJUGATE(B3)	5+4i
4	5+i	=IMCONJUGATE(B4)	5-i
5	5-i	=IMCONJUGATE(B5)	5+i
6	5	=IMCONJUGATE(B6)	5
7	2i	=IMCONJUGATE(B7)	-2i

# 120. IMCOS Function

## Description

The IMCOS function returns the cosine of a Complex Number in  $x + yi$  or  $x + yj$  text format.

## Syntax

```
IMCOS (inumber)
```

## Arguments

Argument	Description	Required /Optional
Inumber	A Complex Number for which you want the cosine.	Required

## Notes

- Complex Numbers in Excel are simply stored as text.
- When a text string in the format " $a+bi$ " or " $a+bj$ " is supplied to one of Excel's built-in Complex Number Functions, this is interpreted as a complex number.
- Complex Number Functions can accept a simple numeric value, as this is equivalent to a Complex Number whose imaginary Coefficient is equal to 0.
- Use COMPLEX to convert real and imaginary coefficients into a Complex Number.
- The cosine of a complex number is-  
$$\cos(x + yi) = \cos(x)\cosh(y) - \sin(x)\sinh(y)i$$
- If inumber is not recognized as a complex number, IMCOS returns the #NUM! error.
- If inumber is a logical value, IMCOS returns the #VALUE! Error.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
	A	B		A	B
1				1	
2	Complex Number	Result	2	Complex Number	Result
3	5+4i	=IMCOS(B3)	3	5+4i	7.74631300740307+26.1689640538728i
4	5+i	=IMCOS(B4)	4	5+i	0.437713625217675+1.12692895219814i
5	5-i	=IMCOS(B5)	5	5-i	0.437713625217675-1.12692895219814i
6	5	=IMCOS(B6)	6	5	0.283662185463226
7	2i	=IMCOS(B7)	7	2i	3.76219569108363
~			-		

# 121. IMCOSH Function

## Description

The IMCOSH function returns the hyperbolic cosine of a Complex Number in  $x+yi$  or  $x+yz$  text format.

## Syntax

```
IMCOSH (inumber)
```

## Arguments

Argument	Description	Required /Optional
Inumber	A complex number for which you want the hyperbolic cosine.	Required

## Notes

- Complex Numbers in Excel are simply stored as text in Excel.
- When a text string in the format " $a+bi$ " or " $a+bz$ " is supplied to one of Excel's built-in Complex Number Functions, this is interpreted as a complex number.
- The Complex Number functions can accept a simple numeric value, as this is equivalent to a complex number whose imaginary coefficient is equal to 0.
- Use COMPLEX to convert real and imaginary coefficients into a complex number.
- The hyperbolic cosine of a complex number is calculated by the following equation-  
$$\cosh(x + yi) = \cosh(x) \cos(y) - \sinh(x) \sin(y)i$$
- If inumber is not recognized as a complex number, IMCOS returns the #NUM! error.
- If inumber is a logical value, IMCOS returns the #VALUE! Error.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Complex Number	Result	2	Complex Number	Result
3	5+4i	=IMCOSH(B3)	3	5+4i	-48.5068594578446-56.1571749251302i
4	5+i	=IMCOSH(B4)	4	5+i	40.0958063062988+62.4398486807996i
5	5-i	=IMCOSH(B5)	5	5-i	40.0958063062988-62.4398486807996i
6	5	=IMCOSH(B6)	6	5	74.2099485247878
7	2i	=IMCOSH(B7)	7	2i	-0.416146836547142

# 122. IMCOT Function

## Description

The IMCOT function returns the cotangent of a complex number in  $x+yi$  or  $x+yj$  text format.

The cotangent of a complex number is defined as the inverse of the tangent.

$$\begin{aligned} \text{i.e. } \cot(z) &= 1 / \tan(z) \\ \text{or, } \cot(z) &= \cos(z) / \sin(z) \end{aligned}$$

## Syntax

```
IMCOT (inumber)
```

## Arguments

Argument	Description	Required /Optional
Inumber	A complex number for which you want the cotangent.	Required

## Notes

- Complex Numbers in Excel are simply stored as text.
- When a text string in the format " $a+bi$ " or " $a+bj$ " is supplied to one of Excel's built-in Complex Number Functions, this is interpreted as a complex number.
- The Complex Number functions can accept a simple numeric value, as this is equivalent to a complex number whose imaginary coefficient is equal to 0.
- Use COMPLEX to convert real and imaginary coefficients into a Complex Number.
- If inumber is not recognized as a complex number, IMCOT returns the #NUM! error.
- If inumber is a logical value, IMCOT returns the #VALUE! Error.

## Applicability

Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Complex Number	Result	2	Complex Number	Result
3	5+4i	=IMCOT(B3)	3	5+4i	-0.00036479210066036-0.999437137578517i
4	5+i	=IMCOT(B4)	4	5+i	-0.118232887780519-0.788230770852912i
5	5-i	=IMCOT(B5)	5	5-i	-0.118232887780519+0.788230770852912i
6	5	=IMCOT(B6)	6	5	-0.295812915532746
7	2i	=IMCOT(B7)	7	2i	-1.03731472072755i
0					

# 123. IMCSC Function

## Description

The IMCSC function returns the cosecant of a complex number in  $x+yi$  or  $x+yj$  text format.

The cosecant of a complex number is defined as the inverse of the sine. i.e.

$$\text{cosecant}(z) = 1 / \sin(z)$$

## Syntax

IMCSC (inumber)
-----------------

## Arguments

Argument	Description	Required /Optional
Inumber	A complex number for which you want the cosecant.	Required

## Notes

- Complex Numbers in Excel are simply stored as text in Excel.
- When a text string in the format " $a+bi$ " or " $a+bj$ " is supplied to one of Excel's built-in Complex Number Functions, this is interpreted as a complex number.
- The Complex Number functions can accept a simple numeric value, as this is equivalent to a complex number whose imaginary coefficient is equal to 0.
- Use COMPLEX to convert real and imaginary coefficients into a Complex Number.
- If inumber is not recognized as a complex number, IMCSC returns the #NUM! error.
- If inumber is a logical value, IMCSC returns the #VALUE! Error.

## Applicability

Excel 2013, Excel 2016

## Example

Function Usage		Results		
A	B	A	B	
1		1		
2	Complex Number	2	Complex Number	
3	5+4i	=IMCSC(B3)	5+4i	-0.0351186310057677-0.0103815770277425i
4	5+i	=IMCSC(B4)	5+i	-0.643169547729707-0.144899273612018i
5	5-i	=IMCSC(B5)	5-i	-0.643169547729707+0.144899273612018i
6	5	=IMCSC(B6)	5	-1.04283521277141
7	2i	=IMCSC(B7)	2i	-0.275720564771783i
^		-		

# 124. IMCSCH Function

## Description

The IMCSCH function returns the hyperbolic cosecant of a complex number in  $x+yi$  or  $x+yz$  text format.

The hyperbolic cosecant of a complex number is defined as the inverse of the hyperbolic sine i.e.

$$\operatorname{csch}(z) = 1 / \sinh(z)$$

## Syntax

```
IMCSCH (inumber)
```

## Arguments

Argument	Description	Required /Optional
Inumber	A complex number for which you want the hyperbolic cosecant.	Required

## Notes

- Complex Numbers in Excel are simply stored as text.
- When a text string in the format " $a+bi$ " or " $a+bj$ " is supplied to one of Excel's built-in Complex Number Functions, this is interpreted as a complex number.
- The Complex Number functions can accept a simple numeric value, as this is equivalent to a complex number whose imaginary coefficient is equal to 0.
- Use COMPLEX to convert real and imaginary coefficients into a Complex Number.
- If inumber is not recognized as a complex number, IMCSCH returns the #NUM! error.
- If inumber is a logical value, IMCSCH returns the #VALUE! Error.

## Applicability

Excel 2013, Excel 2016

## Example

Function Usage		Results
A	B	C
1		
2	Complex Number	Result
3	5+4i	=IMCSCH(B3)
4	5+i	=IMCSCH(B4)
5	5-i	=IMCSCH(B5)
6	5	=IMCSCH(B6)
7	2i	=IMCSCH(B7)

A	B	C
1		
2	Complex Number	Result
3	5+4i	-0.00880791586223676+0.0101989184567642i
4	5+i	0.00728045092672232-0.0113396601050494i
5	5-i	0.00728045092672232+0.0113396601050494i
6	5	0.0134765058305891
7	2i	-1.09975017029462i

# 125. IMDIV Function

## Description

The IMDIV function returns the quotient of two complex numbers in  $x + yi$  or  $x + yj$  text format.

$$\text{IMDIV}(z_1, z_2) = \frac{(a+bi)}{(c+di)} = \frac{(ac+bd)+(bc-ad)i}{c^2+d^2}$$

## Syntax

```
IMDIV (inumber1, inumber2)
```

## Arguments

Argument	Description	Required /Optional
Inumber1	The complex numerator or dividend.	Required
Inumber2	The complex denominator or divisor.	Required

## Notes

- Complex Numbers in Excel are simply stored as text.
- When a text string in the format "a+bi" or "a+bj" is supplied to one of Excel's built-in Complex Number Functions, this is interpreted as a complex number.
- The Complex Number functions can accept a simple numeric value, as this is equivalent to a complex number whose imaginary coefficient is equal to 0.
- Use COMPLEX to convert real and imaginary coefficients into a Complex Number.
- If inumber2 is equal to 0, or if either of inumber1, inumber2 is not recognized as a complex number, IMDIV returns the #NUM! error.
- If either of inumber1, inumber2 is a logical value, IMDIV returns the #VALUE! Error.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
	A	B	C	D	
1					
2		Complex Numerator	Complex Denominator	Result	
3	150+25i	15+2i	=IMDIV(B3,C3)		
4	150+25i	15-3i	=IMDIV(B4,C4)		
5					

	A	B	C	D
1				
2		Complex Numerator	Complex Denominator	Result
3	150+25i	15+2i	10.0436681222707+0.327510917030568i	
4	150+25i	15-3i	9.2948717948718+3.52564102564103i	
5				

# 126. IMEXP Function

## Description

The IMEXP function returns the exponential of a complex number in  $x + yi$  or  $x + yj$  text format. The exponential of a complex number is-

$$e^{(x+yi)} = e^x e^{yi} = e^x (\cos y + i \sin y)$$

## Syntax

```
IMEXP (inumber)
```

## Arguments

Argument	Description	Required /Optional
Inumber	A complex number for which you want the exponential.	Required

## Notes

- Complex Numbers in Excel are simply stored as text.
- When a text string in the format "a+bi" or "a+bj" is supplied to one of Excel's built-in Complex Number Functions, this is interpreted as a complex number.
- The Complex Number functions can accept a simple numeric value, as this is equivalent to a complex number whose imaginary coefficient is equal to 0.
- Use COMPLEX to convert real and imaginary coefficients into a Complex Number.
- If inumber is not recognized as a complex number, IMEXP returns the #NUM! error.
- If inumber is a logical value, IMEXP returns the #VALUE! Error.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Complex Number	Result	2	Complex Number	Result
3	5+4i	=IMEXP(B3)	3	5+4i	-97.0093146996155-112.319449145363i
4	5+i	=IMEXP(B4)	4	5+i	80.1879720842972+124.885367148496i
5	5-i	=IMEXP(B5)	5	5-i	80.1879720842972-124.885367148496i
6	5	=IMEXP(B6)	6	5	148.413159102577
7	2i	=IMEXP(B7)	7	2i	-0.416146836547142+0.909297426825682i
~			~		

# 127. IMLN Function

## Description

The IMLN function returns the natural logarithm of a complex number in  $x + yi$  or  $x + yj$  text format.

The natural logarithm of a complex number is-

$$\ln(x + yi) = \ln\sqrt{x^2 + y^2} + i\tan^{-1}\left(\frac{y}{x}\right)$$

## Syntax

```
IMLN (inumber)
```

## Arguments

Argument	Description	Required / Optional
Inumber	A complex number for which you want the natural logarithm.	Required

## Notes

- Complex Numbers in Excel are simply stored as text.
- When a text string in the format "a+bi" or "a+bj" is supplied to one of Excel's built-in Complex Number Functions, this is interpreted as a complex number
- The complex number functions can accept a simple numeric value, as this is equivalent to a complex number whose imaginary coefficient is equal to 0.
- Use COMPLEX to convert real and imaginary coefficients into a Complex Number.
- If inumber is not recognized as a complex number, IMLN returns the #NUM! error.
- If inumber is a logical value, IMLN returns the #VALUE! Error.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage		Results			
	A	A	C		
1		1			
2	Complex Number	Result	2	Complex Number	Result
3	5+4i	=IMLN(B3)	3	5+4i	1.85678603335215+0.674740942223553i
4	5+i	=IMLN(B4)	4	5+i	1.62904826901074+0.197395559849881i
5	5-i	=IMLN(B5)	5	5-i	1.62904826901074-0.197395559849881i
6	5	=IMLN(B6)	6	5	1.6094379124341
7	2i	=IMLN(B7)	7	2i	0.693147180559945+1.5707963267949i

# 128. IMLOG2 Function

## Description

The IMLOG2 function returns the base-2 logarithm of a complex number in  $x + yi$  or  $x + yj$  text format. The base-2 logarithm of a complex number can be calculated from the natural logarithm as follows:

$$\log_2(x + yi) = (\log_2 e) \ln(x + yi)$$

## Syntax

IMLOG2 (inumber)
------------------

## Arguments

Argument	Description	Required /Optional
Inumber	A complex number for which you want the base-2 logarithm.	Required

## Notes

- Complex Numbers in Excel are simply stored as text.
- When a text string in the format "a+bi" or "a+bj" is supplied to one of Excel's built-in Complex Number Functions, this is interpreted as a complex number.
- The complex number functions can accept a simple numeric value, as this is equivalent to a complex number whose imaginary coefficient is equal to 0.
- Use COMPLEX to convert real and imaginary coefficients into a complex number.
- If inumber is not recognized as a complex number, IMLOG2 returns the #NUM! error.
- If inumber is a logical value, IMLOG2 returns the #VALUE! Error.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage		Results
A	B	C
1		
2	<b>Complex Number</b>	<b>Result</b>
3	5+4i	2.67877600230904+0.973445411230666i
4	5+i	2.35021985907055+0.284781595288924i
5	5-i	2.35021985907055-0.284781595288924i
6	5	2.32192809488736
7	2i	1+2.2661800709136i

A	B	C
1		
2	<b>Complex Number</b>	<b>Result</b>
3	5+4i	=IMLOG2(B3)
4	5+i	=IMLOG2(B4)
5	5-i	=IMLOG2(B5)
6	5	=IMLOG2(B6)
7	2i	=IMLOG2(B7)

# 129. IMLOG10 Function

## Description

The IMLOG10 function returns the common logarithm (base 10) of a complex number in  $x + yi$  or  $x + yj$  text format. The common logarithm of a complex number can be calculated from the natural logarithm as follows-

$$\log_{10}(x + yi) = (\log_{10} e) \ln(x + yi)$$

## Syntax

```
IMLOG10 (inumber)
```

## Arguments

Argument	Description	Required /Optional
Inumber	A complex number for which you want the common logarithm.	Required

## Notes

- Complex Numbers in Excel are simply stored as text.
- When a text string in the format "a+bi" or "a+bj" is supplied to one of Excel's built-in Complex Number Functions, this is interpreted as a complex number.
- The complex number functions can accept a simple numeric value, as this is equivalent to a complex number whose imaginary coefficient is equal to 0.
- Use COMPLEX to convert real and imaginary coefficients into a complex number.
- If inumber is not recognized as a complex number, IMLOG10 returns the #NUM! error.
- If inumber is a logical value, IMLOG10 returns the #VALUE! error.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage		Results
A	B	C
1		
2	<b>Complex Number</b>	<b>Result</b>
3	5+4i	0.806391928359868+0.29303626792189i
4	5+i	0.707486673985409+0.0857278023950063i
5	5-i	0.707486673985409-0.0857278023950063i
6	5	0.698970004336019
7	2i	0.301029995663981+0.682188176920921i
-		

A	B	C
1		
2	<b>Complex Number</b>	<b>Result</b>
3	5+4i	=IMLOG10(B3)
4	5+i	=IMLOG10(B4)
5	5-i	=IMLOG10(B5)
6	5	=IMLOG10(B6)
7	2i	=IMLOG10(B7)
-		

# 130. IMPOWER Function

## Description

The IMPOWER function returns a complex number in  $x + yi$  or  $x + yj$  text format raised to a power. A complex number raised to a power is calculated as follows-

$$(x + yi)^n = r^n e^{in\theta} = r^n \cos n\theta + ir^n \sin n\theta$$

Where-

$$r = \sqrt{x^2 + y^2} \quad \text{and} \quad \theta = \tan^{-1}\left(\frac{y}{x}\right) \quad \text{and} \quad \theta \in (-\pi, \pi]$$

## Syntax

```
IMPOWER (inumber, number)
```

## Arguments

Argument	Description	Required /Optional
Inumber	A complex number you want to raise to a power.	Required
Number	The power to which you want to raise the complex number. Number can be an integer, fractional, or negative.	Required

## Notes

- Complex Numbers in Excel are simply stored as text.
- When a text string in the format "a+bi" or "a+bj" is supplied to one of Excel's built-in Complex Number Functions, this is interpreted as a complex number.
- The complex number functions can accept a simple numeric value, as this is equivalent to a complex number whose imaginary coefficient is equal to 0.
- Use COMPLEX to convert real and imaginary coefficients into a complex number.
- If inumber is not recognized as a complex number, IMPOWER returns the #NUM! Error.
- If number is nonnumeric, IMPOWER returns the #VALUE! Error.
- If inumber is a logical value, IMPOWER returns the #VALUE! Error.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
	A	B		A	B
1				1	
2	Complex Number	Number	Result	2	Complex Number
3	5+4i	4	=IMPOWER(B3,C3)	3	5+4i
4	5+i	2	=IMPOWER(B4,C4)	4	5+i
5	5-i	2	=IMPOWER(B5,C5)	5	5-i
6	5	5	=IMPOWER(B6,C6)	6	5
7	2i	4	=IMPOWER(B7,C7)	7	2i

# 131. IMPRODUCT Function

## Description

The IMPRODUCT function returns the product of 1 to 255 complex numbers in  $x + yi$  or  $x + yj$  text format. The product of two complex numbers is-

$$(a + bi)(c + di) = (ac - bd) + (ad + bc)i$$

## Syntax

```
IMPRODUCT (inumber1, [inumber2] ...)
```

## Arguments

Argument	Description	Required /Optional
Inumber1	1 to 255 complex numbers to multiply.	Required
[inumber2], ...	1 to 255 complex numbers to multiply.	Optional

## Notes

- Complex Numbers in Excel are simply stored as text.
- When a text string in the format "a+bi" or "a+bj" is supplied to one of Excel's built-in Complex Number Functions, this is interpreted as a complex number.
- The complex number functions can accept a simple numeric value, as this is equivalent to a complex number whose imaginary coefficient is equal to 0.
- Use COMPLEX to convert real and imaginary coefficients into a complex number.
- If any of the inumber arguments is not recognized as a Complex Number, IMPRODUCT returns the #NUM! error.
- If any of the inumber arguments is a logical value, IMPRODUCT returns the #VALUE! error.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results				
	A	B		A	B		
1			1				
2	Complex Number	Complex Number	Result	2	Complex Number	Complex Number	Result
3	5+4i	4+2i	=IMPRODUCT(B3,C3)	3	5+4i	4+2i	12+26i
4	5+i	2+i	=IMPRODUCT(B4,C4)	4	5+i	2+i	9+7i
5	5-i	5+i	=IMPRODUCT(B5,C5)	5	5-i	5+i	26
6	5	5i	=IMPRODUCT(B6,C6)	6	5	5i	25i
7	2i	4i	=IMPRODUCT(B7,C7)	7	2i	4i	-8

# 132. IMREAL Function

## Description

The IMREAL function returns the real coefficient of a complex number in  $x + yi$  or  $x + yj$  text format.

## Syntax

```
IMREAL (inumber)
```

## Arguments

Argument	Description	Required /Optional
Inumber	A complex number for which you want the real coefficient.	Required

## Notes

- Complex Numbers in Excel are simply stored as text.
- When a text string in the format "a+bi" or "a+bj" is supplied to one of Excel's built-in Complex Number Functions, this is interpreted as a complex number.
- The complex number functions can accept a simple numeric value, as this is equivalent to a complex number whose imaginary coefficient is equal to 0.
- Use COMPLEX to convert real and imaginary coefficients into a complex number.
- If inumber is not recognized as a complex number, IMREAL returns the #NUM! error.
- If inumber is a logical value, IMREAL returns the #VALUE! error.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Complex Number	=IMREAL(B3)	2	Complex Number	Result
3	2+4i	=IMREAL(B4)	3	2+4i	2
4	5+i	=IMREAL(B5)	4	5+i	5
5	5-2i	=IMREAL(B6)	5	5-2i	5
6	-2i	=IMREAL(B7)	6	-2i	0
7	25		7	25	25
-					

# 133. IMSEC Function

## Description

The IMSEC function returns the secant of a complex number in  $x+yi$  or  $x+yj$  text format. The secant of a complex number is defined as the inverse of the cosine. i.e.

$$\text{secant}(z) = 1 / \cosine(z)$$

## Syntax

```
IMSEC (inumber)
```

## Arguments

Argument	Description	Required /Optional
Inumber	A complex number for which you want the secant.	Required

## Notes

- Complex Numbers in Excel are simply stored as text.
- When a text string in the format " $a+bi$ " or " $a+bj$ " is supplied to one of Excel's built-in Complex Number Functions, this is interpreted as a complex number.
- The complex number functions can accept a simple numeric value, as this is equivalent to a complex number whose imaginary coefficient is equal to 0.
- Use COMPLEX to convert real and imaginary coefficients into a complex number.
- If inumber is not recognized as a complex number, IMSEC returns the #NUM! error.
- If inumber is a logical value, IMSEC returns the #VALUE! error.

## Applicability

Excel 2013, Excel 2016

## Example

Function Usage			Results		
	A	B		A	B
1			1		
2	Complex Number	Result	2	Complex Number	Result
3	2+4i	=IMSEC(B3)	3	2+4i	-0.0152557928051456+0.0333121579567078i
4	5+i	=IMSEC(B4)	4	5+i	0.299483430027903-0.771044190900413i
5	5-2i	=IMSEC(B5)	5	5-2i	0.0806366805126768+0.262787660369675i
6	-2i	=IMSEC(B6)	6	-2i	0.26580222883408
7	25	=IMSEC(B7)	7	25	1.00887526551704

# 134. IMSECH Function

## Description

The IMSECH function returns the hyperbolic secant of a complex number in  $x+yi$  or  $x+yj$  text format. The hyperbolic secant of a complex number is defined as the inverse of the hyperbolic cosine i.e.

$$\operatorname{sech}(z) = 1 / \cosh(z)$$

## Syntax

```
IMSECH (inumber)
```

## Arguments

Argument	Description	Required /Optional
Inumber	A complex number for which you want the hyperbolic secant.	Required

## Notes

- Complex Numbers in Excel are simply stored as text.
- When a text string in the format " $a+bi$ " or " $a+bj$ " is supplied to one of Excel's built-in Complex Number Functions, this is interpreted as a complex number.
- The complex number functions can accept a simple numeric value, as this is equivalent to a complex number whose imaginary coefficient is equal to 0.
- Use COMPLEX to convert real and imaginary coefficients into a complex number.
- If inumber is not recognized as a complex number, IMSECH returns the #NUM! error.
- If inumber is a logical value, IMSECH returns the #VALUE! error.

## Applicability

Excel 2013, Excel 2016

## Example

Function Usage		Results	
A	B	A	B
1	C	1	C
2	Complex Number	2	Complex Number
3	2+4i	=IMSECH(B3)	-0.181066848599085+0.20210168297713i
4	5+i	=IMSECH(B4)	0.00728166229072838-0.011339487429296i
5	5-2i	=IMSECH(B5)	-0.00560853811692711+0.0122537666692991i
6	-2i	=IMSECH(B6)	-2.40299796172238
7	25	=IMSECH(B7)	2.7775887729928E-11

# 135. IMSIN Function

## Description

The IMSIN function returns the sine of a complex number in  $x + yi$  or  $x + yj$  text format.  
The sine of a complex number is-

$$\sin(x + yi) = \sin(x)\cosh(y) + \cos(x)\sinh(y)i$$

## Syntax

```
IMSIN (inumber)
```

## Arguments

Argument	Description	Required /Optional
Inumber	A Complex Number for which you want the sine.	Required

## Notes

- Complex Numbers in Excel are simply stored as text.
- When a text string in the format "a+bi" or "a+bj" is supplied to one of Excel's built-in Complex Number Functions, this is interpreted as a complex number.
- The complex number functions can accept a simple numeric value, as this is equivalent to a complex number whose imaginary coefficient is equal to 0.
- Use COMPLEX to convert real and imaginary coefficients into a complex number.
- If inumber is not recognized as a complex number, IMSIN returns the #NUM! error.
- If inumber is a logical value, IMSIN returns the #VALUE! error.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Complex Number	Result	2	Complex Number	Result
3	2+4i	=IMSIN(B3)	3	2+4i	24.8313058489464-11.3566127112182i
4	5+i	=IMSIN(B4)	4	5+i	-1.47969747848694+0.333360138947993i
5	5-2i	=IMSIN(B5)	5	5-2i	-3.60766077421316-1.02880314965993i
6	-2i	=IMSIN(B6)	6	-2i	-3.62686040784702i
7	25	=IMSIN(B7)	7	25	-0.132351750097773

# 136. MSINH Function

## Description

The MSINH function returns the hyperbolic sine of a complex number in  $x+yi$  or  $x+yj$  text format. The hyperbolic sine of a complex number is calculated by the following equation-

$$\sinh(x + yi) = \sinh(x) \cos(y) - \cosh(x) \sin(y)i$$

## Syntax

```
IMSINH (inumber)
```

## Arguments

Argument	Description	Required /Optional
Inumber	A complex number for which you want the hyperbolic sine.	Required

## Notes

- Complex Numbers in Excel are simply stored as text.
- When a text string in the format " $a+bi$ " or " $a+bj$ " is supplied to one of Excel's built-in Complex Number Functions, this is interpreted as a complex number.
- The complex number functions can accept a simple numeric value, as this is equivalent to a complex number whose imaginary coefficient is equal to 0.
- Use COMPLEX to convert real and imaginary coefficients into a complex number.
- If inumber is not recognized as a complex number, IMSINH returns the #NUM! error.
- If inumber is a logical value, IMSINH returns the #VALUE! error.

## Applicability

Excel 2013, Excel 2016

## Example

Function Usage			Results		
	A	B		A	B
1				1	
2		Complex Number	Result	2	Complex Number
3	2+4i	=IMSINH(B3)		3	2+4i
4	5+i	=IMSINH(B4)		4	5+i
5	5-2i	=IMSINH(B5)		5	5-2i
6	-2i	=IMSINH(B6)		6	-2i
7	25	=IMSINH(B7)		7	25
8					

# 137. IMSQRT Function

## Description

The IMSQRT function returns the square root of a complex number in  $x + yi$  or  $x + yj$  text format. The square root of a complex number is-

$$\sqrt{x+yi} = \sqrt{r} \cos\left(\frac{\theta}{2}\right) + i\sqrt{r} \sin\left(\frac{\theta}{2}\right)$$

Where-

$$r = \sqrt{x^2 + y^2} \text{ and } \theta = \tan^{-1}\left(\frac{y}{x}\right) \text{ and } \theta \in (-\pi; \pi]$$

## Syntax

```
IMSQRT (inumber)
```

## Arguments

Argument	Description	Required /Optional
Inumber	A complex number for which you want the square root.	Required

## Notes

- Complex Numbers in Excel are simply stored as text.
- When a text string in the format "a+bi" or "a+bj" is supplied to one of Excel's built-in Complex Number Functions, this is interpreted as a complex number.
- The complex number functions can accept a simple numeric value, as this is equivalent to a complex number whose imaginary coefficient is equal to 0.
- Use COMPLEX to convert real and imaginary coefficients into a complex number.
- If inumber is not recognized as a complex number, IMSQRT returns the #NUM! error.
- If inumber is a logical value, IMSQRT returns the #VALUE! error.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Complex Number	Result	2	Complex Number	Result
3	2+4i	=IMSQRT(B3)	3	2+4i	1.79890743994787+1.11178594050284i
4	5+i	=IMSQRT(B4)	4	5+i	2.24711142509587+0.222507880301783i
5	5-2i	=IMSQRT(B5)	5	5-2i	2.27872385417085-0.438842116902255i
6	-2i	=IMSQRT(B6)	6	-2i	1-i
7	25	=IMSQRT(B7)	7	25	5

# 138. IMSUB Function

## Description

The IMSUB function returns the difference of two complex numbers in  $x + yi$  or  $x + yj$  text format. When subtracting complex numbers, the real and imaginary coefficients are subtracted separately i.e., the equation to subtract complex number  $c+di$  from complex number  $a+bi$  is-

$$(a+bi) - (c+di) = (a-c) + (b-d)i$$

## Syntax

```
IMSUB (inumber1, inumber2)
```

## Arguments

Argument	Description	Required /Optional
Inumber1	The complex number from which to subtract inumber2.	Required
Inumber2	The complex number to subtract from inumber1.	Required

## Notes

- Complex Numbers in Excel are simply stored as text.
- When a text string in the format " $a+bi$ " or " $a+bj$ " is supplied to one of Excel's built-in Complex Number Functions, this is interpreted as a complex number.
- The complex number functions can accept a simple numeric value, as this is equivalent to a complex number whose imaginary coefficient is equal to 0.
- Use COMPLEX to convert real and imaginary coefficients into a complex number.
- If one or both of the inumber arguments is not recognized as a Complex Number, IMSUB returns the #NUM! error.
- If one or both of the inumber arguments is a logical value, IMSUB returns the #VALUE! error.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results				
	A	B		A	B		
1			1				
2	Complex Number	Complex Number	Result	2	Complex Number	Complex Number	Result
3	5+4i	4+2i	=IMSUB(B3,C3)	3	5+4i	4+2i	1+2i
4	5+i	2+i	=IMSUB(B4,C4)	4	5+i	2+i	3
5	5-i	5+i	=IMSUB(B5,C5)	5	5-i	5+i	-2i
6	5	5i	=IMSUB(B6,C6)	6	5	5i	5-5i
7	2i	4i	=IMSUB(B7,C7)	7	2i	4i	-2i

# 139. IMSUM Function

## Description

The IMSUM function returns the sum of two or more complex numbers in  $x + yi$  or  $x + yj$  text format. When adding complex numbers, the real and imaginary coefficients are added separately i.e., the equation to find the sum of two complex numbers  $a+bi$  and  $c+di$  is-

$$(a+bi) + (c+di) = (a+c) + (b+d)i$$

## Syntax

```
IMSUM (inumber1, [inumber2] ...)
```

## Arguments

Argument	Description	Required /Optional
Inumber1	1 to 255 complex numbers to add.	Required
inumber2...	1 to 255 complex numbers to add.	Optional

## Notes

- Complex Numbers in Excel are simply stored as text.
- When a text string in the format "a+bi" or "a+bj" is supplied to one of Excel's built-in Complex Number Functions, this is interpreted as a complex number.
- The complex number functions can accept a simple numeric value, as this is equivalent to a complex number whose imaginary coefficient is equal to 0.
- Use COMPLEX to convert real and imaginary coefficients into a Complex Number.
- If any of the inumber arguments is not recognized as a complex number, IMSUM returns the #NUM! error.
- If any of the inumber arguments is a logical value, IMSUM returns the #VALUE! Error.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Complex Number	Complex Number	2	Complex Number	Complex Number
3	5+4i	4+2i	3	5+4i	4+2i
4	5+i	2+i	4	5+i	2+i
5	5-i	5+i	5	5-i	5+i
6	5	5i	6	5	5i
7	2i	4i	7	2i	4i
n			-		

# 140. IMTAN Function

## Description

The IMTAN function returns the tangent of a complex number in  $x+yi$  or  $x+yj$  text format. The tangent of a complex number is calculated by the following formula-

$$\tan(z) = \sin(z) / \cos(z)$$

## Syntax

```
IMTAN (inumber)
```

## Arguments

Argument	Description	Required /Optional
Inumber	A complex number for which you want the tangent.	Required

## Notes

- Complex Numbers in Excel are simply stored as text.
- When a text string in the format " $a+bi$ " or " $a+bj$ " is supplied to one of Excel's built-in Complex Number Functions, this is interpreted as a complex number.
- The complex number functions can accept a simple numeric value, as this is equivalent to a complex number whose imaginary coefficient is equal to 0.
- Use COMPLEX to convert real and imaginary coefficients into a Complex Number.
- If Inumber is not recognized as a complex number, IMTAN returns the #NUM! error.
- If Inumber is a logical value, IMTAN returns the #VALUE! Error.

## Applicability

Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1					
2	Complex Number	Result		Complex Number	Result
3	2+4i	=IMTAN(B3)		2+4i	-0.000507980623470039+1.00043851320205i
4	5+i	=IMTAN(B4)		5+i	-0.186109477647304+1.24074798292407i
5	5-2i	=IMTAN(B5)		5-2i	-0.0205530165682556-1.03100800515249i
6	-2i	=IMTAN(B6)		-2i	-0.964027580075817i
7	25	=IMTAN(B7)		25	-0.133526407021536

# 141. OCT2BIN Function

## Description

The OCT2BIN function converts an octal number to binary.

## Syntax

```
OCT2BIN (number, [places])
```

## Arguments

Argument	Description	Required /Optional
Number	The octal number you want to convert. Number may not contain more than 10 characters. The most significant bit of number is the sign bit. The remaining 29 bits are magnitude bits. Negative numbers are represented using two's-complement notation.	Required
Places	The number of characters to use. If places is omitted, OCT2BIN uses the minimum number of characters necessary. Places is useful for padding the return value with leading 0s (zeros).	Optional

## Notes

- If number is negative, OCT2BIN ignores places and returns a 10-character binary number.
- If number is negative, it cannot be less than 7777777000.
- If number is positive, it cannot be greater than 777.
- If places is not an integer, it is truncated.
- If number is not a valid octal number, OCT2BIN returns the #NUM! error value.
- If OCT2BIN requires more than places characters, it returns the #NUM! error value.
- If places is nonnumeric, OCT2BIN returns the #VALUE! error value.
- If places is negative, OCT2BIN returns the #NUM! error value.
- If places is >10, OCT2BIN returns the #NUM! error value.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

**Example**

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Octal Number	Binary	2	Octal Number	Binary
3	0	=OCT2BIN(B3)	3	0	0
4	1	=OCT2BIN(B4)	4	1	1
5	2	=OCT2BIN(B5)	5	2	10
6	3	=OCT2BIN(B6)	6	3	11
7	32	=OCT2BIN(B7)	7	32	11010
8	33	=OCT2BIN(B8)	8	33	11011
9	777777777	=OCT2BIN(B9)	9	777777777	1111111111
10	777777776	=OCT2BIN(B10)	10	777777776	1111111110
11	777777775	=OCT2BIN(B11)	11	777777775	1111111101
12			...		

# 142. OCT2DEC Function

## Description

The OCT2DEC function converts an octal number to decimal.

## Syntax

```
OCT2DEC (number)
```

## Arguments

Argument	Description	Required /Optional
Number	The octal number you want to convert. Number may not contain more than 10 octal characters (30 bits). The most significant bit of number is the sign bit. The remaining 29 bits are magnitude bits. Negative numbers are represented using two's-complement notation.	Required

## Notes

If number is not recognized as an octal number, or contains more than 10 characters, OCT2DEC returns the #NUM! Error value.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Octal Number	Binary	2	Octal Number	Decimal
3	0	=OCT2DEC(B3)	3	0	0
4	1	=OCT2DEC(B4)	4	1	1
5	2	=OCT2DEC(B5)	5	2	2
6	3	=OCT2DEC(B6)	6	3	3
7	32	=OCT2DEC(B7)	7	32	26
8	33	=OCT2DEC(B8)	8	33	27
9	777777777	=OCT2DEC(B9)	9	777777777	-1
10	777777776	=OCT2DEC(B10)	10	777777776	-2
11	777777775	=OCT2DEC(B11)	11	777777775	-3

# 143. OCT2HEX Function

## Description

The OCT2HEX function converts an octal number to hexadecimal.

## Syntax

```
OCT2HEX (number, [places])
```

## Arguments

Argument	Description	Required /Optional
Number	The octal number you want to convert. Number may not contain more than 10 octal characters (30 bits). The most significant bit of number is the sign bit. The remaining 29 bits are magnitude bits. Negative numbers are represented using two's-complement notation.	Required
Places	The number of characters to use. If places is omitted, OCT2HEX uses the minimum number of characters necessary. Places is useful for padding the return value with leading 0s (zeros).	Optional

## Notes

- If number is negative, OCT2HEX ignores places and returns a 10-character hexadecimal number.
- If places is not an integer, it is truncated.
- If number is not a valid octal number, OCT2HEX returns the #NUM! error value.
- If OCT2HEX requires more than places characters, it returns the #NUM! error value.
- If places is nonnumeric, OCT2HEX returns the #VALUE! error value.
- If places is negative, OCT2HEX returns the #NUM! error value.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Octal Number	Hexadecimal	2	Octal Number	Hexadecimal
3	0	=OCT2HEX(B3)	3	0	0
4	1	=OCT2HEX(B4)	4	1	1
5	2	=OCT2HEX(B5)	5	2	2
6	3	=OCT2HEX(B6)	6	3	3
7	32	=OCT2HEX(B7)	7	32	1A
8	33	=OCT2HEX(B8)	8	33	1B
9	777777777	=OCT2HEX(B9)	9	777777777	FFFFFFFFF
10	777777776	=OCT2HEX(B10)	10	777777776	FFFFFFFFE
11	777777775	=OCT2HEX(B11)	11	777777775	FFFFFFFFD
12			12		

# Financial Functions

# 144. Financial Functions – Overview

Excel Financial functions perform many of the common financial calculations, such as the calculation of yield, interest rates, duration, valuation and asset depreciation.

## Financial Functions

The following table lists all the Financial functions-

S. No.	Function and Description
1	ACCRINT Returns the accrued interest for a security that pays periodic interest
2	ACCRINTM Returns the accrued interest for a security that pays interest at maturity
3	AMORDEGRC Returns the depreciation for each accounting period
4	AMORLINC Returns the depreciation for each accounting period (the depreciation coefficient depends on the life of the assets)
5	COUPDAYBS Returns the number of days from the beginning of the coupon period to the settlement date
6	COUPDAYS Returns the number of days in the coupon period that contains the settlement date
7	COUPDAYSNC Returns the number of days from the settlement date to the next coupon date
8	COUPNCD Returns the next coupon date after the settlement date
9	COUPNUM Returns the number of coupons payable between the settlement date and maturity date
10	COUPPCD Returns the previous coupon date before the settlement date
11	CUMIPMT Returns the cumulative interest paid between two periods
12	CUMPRINC Returns the cumulative principal paid on a loan between two periods
13	DB Returns the depreciation of an asset for a specified period, using the fixed-declining-balance method

S. No.	Function and Description
14	DDB Returns the depreciation of an asset for a specified period, using the double-declining-balance method or some other method that you specify
15	DISC Returns the discount rate for a security
16	DOLLARDE Converts a dollar price, expressed as a fraction, into a dollar price, expressed as a decimal number
17	DOLLARFR Converts a dollar price, expressed as a decimal number, into a dollar price, expressed as a fraction
18	DURATION Returns the annual duration of a security with periodic interest payments
19	EFFECT Returns the effective annual interest rate
20	FV Returns the future value of an investment
21	FVSCHEDULE Returns the future value of an initial principal after applying a series of compound interest rates
22	INTRATE Returns the interest rate for a fully invested security
23	IPMT Returns the interest payment for an investment for a given period
24	IRR Returns the internal rate of return for a series of cash flows
25	ISPMT Calculates the interest paid during a specific period of an investment
26	MDURATION Returns the Macauley modified duration for a security with an assumed par value of \$100
27	MIRR Returns the internal rate of return where positive and negative cash flows are financed at different rates
28	NOMINAL Returns the annual nominal interest rate
29	NPER Returns the number of periods for an investment
30	NPV Returns the net present value of an investment based on a series of periodic cash flows and a discount rate
31	ODDFPRICE Returns the price per \$100 face value of a security with an odd first period

S. No.	Function and Description
32	ODDFYIELD Returns the yield of a security with an odd first period
33	ODDLPRICE Returns the price per \$100 face value of a security with an odd last period
34	ODDLYIELD Returns the yield of a security with an odd last period
35	PDURATION Returns the number of periods required by an investment to reach a specified value
36	PMT Returns the periodic payment for an annuity
37	PPMT Returns the payment on the principal for an investment for a given period
38	PRICE Returns the price per \$100 face value of a security that pays periodic interest
39	PRICEDISC Returns the price per \$100 face value of a discounted security
40	PRICEMAT Returns the price per \$100 face value of a security that pays interest at maturity
41	PV Returns the present value of an investment
42	RATE Returns the interest rate per period of an annuity
43	RECEIVED Returns the amount received at maturity for a fully invested security
44	RRI Returns an equivalent interest rate for the growth of an investment
45	SLN Returns the straight-line depreciation of an asset for one period
46	SYD Returns the sum-of-years' digits depreciation of an asset for a specified period
47	TBILLEQ Returns the bond-equivalent yield for a Treasury bill
48	TBILLPRICE Returns the price per \$100 face value for a Treasury bill
49	TBILLYIELD Returns the yield for a Treasury bill
50	VDB Returns the depreciation of an asset for a specified or partial period using a declining-balance method

S. No.	Function and Description
51	XIRR Returns the internal rate of return for a schedule of cash flows that is not necessarily periodic
52	XNPV Returns the net present value for a schedule of cash flows that is not necessarily periodic
53	YIELD Returns the yield on a security that pays periodic interest
54	YIELDDISC Returns the annual yield for a discounted security, for example, a Treasury bill
55	YIELDMAT Returns the annual yield of a security that pays interest at maturity

# 145. ACCRINT Function

## Description

The ACCRINT function returns the accrued interest for a security that pays periodic interest.

## Syntax

```
ACCRINT (issue, first_interest, settlement, rate, par, frequency, [basis],  
[calc_method])
```

## Arguments

Argument	Description	Required /Optional
Issue	The security's issue date.	Required
First_interest	The security's first interest date.	Required
Settlement	The security's settlement date. The security settlement date is the date after the issue date when the security is traded to the buyer.	Required
Rate	The security's annual coupon rate.	Required
Par	The security's par value. If you omit par, ACCRINT uses \$1,000.	Required
Frequency	The number of coupon payments per year: <ul style="list-style-type: none"><li>• for annual payments, frequency = 1</li><li>• for semiannual, frequency = 2</li><li>• for quarterly, frequency = 4</li></ul>	Required
Basis	The type of day count basis to use. Look at the Day Count Basis Table given below.	Optional
Calc_method	A logical value that specifies the way to calculate the total accrued interest when the date of settlement is later than the date of first_interest. A value of TRUE (1) returns the total accrued interest from issue to settlement. A value of FALSE (0) returns the accrued interest from first_interest to settlement. If you do not enter the argument, it defaults to TRUE.	Optional

## Day Count Basis Table

Basis	Day count basis
0 or omitted	US (NASD) 30/360
1	Actual/actual
2	Actual/360
3	Actual/365
4	European 30/360

## Notes

- ACCRINT is calculated as follows-

$$\text{ACCRINT} = \text{par} \times \frac{\text{rate}}{\text{frequency}} \times \sum_{i=1}^{\text{Nc}} \frac{A_i}{\text{NL}_i}$$

Where-

$A_i$  = number of accrued days for the  $i$ th quasi-coupon period within odd period.

$Nc$  = number of quasi-coupon periods that fit in odd period. If this number contains a fraction, raise it to the next whole number

$\text{NL}_i$  = normal length in days of the quasi-coupon period within odd period

- Dates should be entered by using the DATE function, or as results of other formulas or functions. For example, use DATE (2008,5,23) for the 23rd day of May, 2008. Problems can occur if dates are entered as text.
- Microsoft Excel stores dates as sequential serial numbers so they can be used in calculations. By default, January 1, 1900 is serial number 1, and January 1, 2008 is serial number 39448 because it is 39,448 days after January 1, 1900.
- Issue, first\_interest, settlement, frequency, and basis are truncated to integers.
- If issue, first\_interest, or settlement is not a valid date, ACCRINT returns the #VALUE! error value.
- If any of the specified values is non-numeric, ACCRINT returns the #VALUE! error value.
- If rate  $\leq 0$  or if par  $\leq 0$ , ACCRINT returns the #NUM! error value.
- If frequency is any number other than 1, 2, or 4, ACCRINT returns the #NUM! error value.
- If basis  $< 0$  or if basis  $> 4$ , ACCRINT returns the #NUM! error value.
- If issue  $\geq$  settlement, ACCRINT returns the #NUM! error value.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	<b>Issue Date</b>	42066	2	<b>Issue Date</b>	3/3/2015
3	<b>First interest Date</b>	42241	3	<b>First interest Date</b>	8/25/2015
4	<b>Settlement Date</b>	42095	4	<b>Settlement Date</b>	4/1/2015
5	<b>Rate</b>	0.1	5	<b>Rate</b>	0.1
6	<b>Par</b>	1000	6	<b>Par</b>	1000
7	<b>Frequency</b>	2	7	<b>Frequency</b>	2
8	<b>Basis</b>	0	8	<b>Basis</b>	0
9	<b>Accrued Interest</b>	=ACCRINT(C2,C3,C4,C5,C6,C7,C8)	9	<b>Accrued Interest</b>	7.78

# 146. ACCRINTM Function

## Description

The ACCRINTM function returns the accrued interest for a security that pays interest at maturity.

## Syntax

```
ACCRINTM (issue, settlement, rate, par, [basis])
```

## Arguments

Argument	Description	Required /Optional
Issue	The security's issue date.	Required
Settlement	The security's maturity date.	Required
Rate	The security's annual coupon rate.	Required
Par	The security's par value. If you omit par, ACCRINTM uses \$1,000.	Required
Basis	The type of day count basis to use. Look at the Day Count Basis table below.	Optional

## Day Count Basis Table

Basis	Day Count Basis
0 or omitted	US (NASD) 30/360
1	Actual/actual
2	Actual/360
3	Actual/365
4	European 30/360

## Notes

- ACCRINTM is calculated as follows-  
$$\text{ACCRINTM} = \text{par} \times \text{rate} \times A/D$$
Where-  
A = Number of accrued days counted according to a monthly basis. For interest at maturity items, the number of days from the issue date to the maturity date is used.  
D = Annual Year Basis.
- Dates should be entered by using the DATE function, or as results of other formulas or functions. For example, use DATE (2008,5,23) for the 23rd day of May, 2008. Problems can occur if dates are entered as text.
- Microsoft Excel stores dates as sequential serial numbers so they can be used in calculations. By default, January 1, 1900 is serial number 1, and January 1, 2008 is serial number 39448 because it is 39,448 days after January 1, 1900.

- Issue, settlement, and basis are truncated to integers.
- If issue or settlement is not a valid date, ACCRINTM returns the #VALUE! error value.
- If any of the specified values is non-numeric, ACCRINT returns the #VALUE! error value.
- If rate  $\leq 0$  or if par  $\leq 0$ , ACCRINTM returns the #NUM! error value.
- If basis  $< 0$  or if basis  $> 4$ , ACCRINTM returns the #NUM! error value.
- If issue  $\geq$  settlement, ACCRINTM returns the #NUM! error value.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage		Results	
A	B	A	C
1		1	
2	Issue Date	42066	3/3/2015
3	Settlement Date	42217	8/1/2015
4	Rate	0.1	0.1
5	Par	1000	1000
6	Basis	3	3
7	Accrued Interest	=ACCRINTM(C2,C3,C4,C5,C6)	41.37

# 147. AMORDEGRC Function

## Description

The AMORDEGRC function returns the depreciation for each accounting period. This function is provided for the French accounting system. If an asset is purchased in the middle of the accounting period, the prorated depreciation is taken into account.

The function is similar to AMORLINC, except that a depreciation coefficient is applied in the calculation depending on the life of the assets.

## Syntax

```
AMORDEGRC (cost, date_purchased, first_period, salvage, period, rate, [basis])
```

## Arguments

Argument	Description	Required /Optional
Cost	The cost of the asset.	Required
Date_purchased	The date of the purchase of the asset.	Required
First_period	The date of the end of the first period.	Required
Salvage	The salvage value at the end of the life of the asset.	Required
Period	The period.	Required
Rate	The rate of depreciation.	Required
Basis	The year basis to be used. Look at the Basis Table given below.	Optional

## Basis Table

Basis	Date system
0 or omitted	360 days (NASD method)
1	Actual
3	365 days in a year
4	360 days in a year (European method)

## Notes

- Dates should be entered by using the DATE function, or as results of other formulas or functions. For example, use DATE(2008,5,23) for the 23rd day of May, 2008. Problems can occur if dates are entered as text.
- Microsoft Excel stores dates as sequential serial numbers so they can be used in calculations. By default, January 1, 1900 is serial number 1, and January 1, 2008 is serial number 39448 because it is 39,448 days after January 1, 1900.
- This function will return the depreciation until the last period of the life of the assets or until the cumulated value of depreciation is greater than the cost of the assets minus the salvage value.

- The depreciation coefficients are given in the Depreciation Coefficients Table below.
- The depreciation rate will grow to 50 percent for the period preceding the last period and will grow to 100 percent for the last period.
- If the life of assets is between 0 (zero) and 1, 1 and 2, 2 and 3, or 4 and 5, AMORDEGRC returns #NUM! error value.

## Depreciation Coefficients Table

Life of assets (1/rate)	Depreciation Coefficient
Between 3 and 4 years	1.5
Between 5 and 6 years	2
More than 6 years	2.5

- If the date\_purchased is > first\_period, AMORDEGRC returns #NUM! error value.
- If salvage > cost, AMORDEGRC returns #NUM! error value.
- If Invalid numbers are supplied for the salvage, period, rate or [basis] arguments (i.e. if either: salvage < 0, period < 0, rate  $\leq$  0, or [basis] is any number other than 0, 1, 2, 3 or 4), AMORDEGRC returns #NUM! error value.
- If date\_purchased or first\_period are not valid Excel dates, AMORDEGRC returns #VALUE! error value.
- If any of the specified arguments is non-numeric, AMORDEGRC returns #VALUE! error value.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Cost	3500	2	Cost	3500
3	Date_purchased	42109	3	Date_purchased	4/15/2015
4	First_period	42243	4	First_period	8/27/2015
5	Salvage	400	5	Salvage	400
6	Period	2	6	Period	2
7	Rate	0.15	7	Rate	0.15
8	Basis	1	8	Basis	1
9	Depreciation	=AMORDEGRC(C2,C3,C4,C5,C6,C7,C8)	9	Depreciation	707

# 148. AMORLINC Function

## Description

The AMORLINC function returns the depreciation for each accounting period. This function is provided for the French accounting system. If an asset is purchased in the middle of the accounting period, the prorated depreciation is taken into account.

## Syntax

```
AMORLINC (cost, date_purchased, first_period, salvage, period, rate, [basis])
```

## Arguments

Argument	Description	Required /Optional
Cost	The cost of the asset.	Required
Date_purchased	The date of the purchase of the asset.	Required
First_period	The date of the end of the first period.	Required
Salvage	The salvage value at the end of the life of the asset.	Required
Period	The period.	Required
Rate	The rate of depreciation.	Required
Basis	The year basis to be used. Look at the Year Basis Table below.	Optional

## Year Basis Table

Basis	Date System
0 or omitted	360 days (NASD method)
1	Actual
3	365 days in a year
4	360 days in a year (European method)

## Notes

- Dates should be entered by using the DATE function, or as results of other formulas or functions. For example, use DATE (2008,5,23) for the 23rd day of May, 2008. Problems can occur if dates are entered as text.
- Microsoft Excel stores dates as sequential serial numbers so they can be used in calculations. By default, January 1, 1900 is serial number 1, and January 1, 2008 is serial number 39448 because it is 39,448 days after January 1, 1900.
- If the date\_purchased is > first\_period, AMORLINC returns #NUM! error value.
- If salvage > cost, AMORLINC returns #NUM! error value.
- If Invalid numbers are supplied for the salvage, period, rate or [basis] arguments (i.e. if either: salvage < 0, period < 0, rate ≤ 0, or [basis] is any number other than 0, 1, 2, 3 or 4), AMORLINC returns #NUM! error value.
- If date\_purchased or first\_period are not valid Excel dates, AMORLINC returns #VALUE! error value.
- If any of the specified arguments is non-numeric, AMORLINC returns #VALUE! error value.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage		Results	
	B		C
1		1	
2	<b>Cost</b>	3500	2
3	<b>Date_purchased</b>	42109	3
4	<b>First_period</b>	42243	4
5	<b>Salvage</b>	400	5
6	<b>Period</b>	2	6
7	<b>Rate</b>	0.15	7
8	<b>Basis</b>	1	8
9	<b>Depreciation</b>	=AMORLINC(C2,C3,C4,C5,C6,C7,C8)	9

# 149. COUPDAYBS Function

## Description

The COUPDAYBS function returns the number of days from the beginning of a coupon period until its settlement date.

## Syntax

```
COUPDAYBS (settlement, maturity, frequency, [basis])
```

## Arguments

Argument	Description	Required /Optional
Settlement	The security's settlement date. The security settlement date is the date after the issue date when the security is traded to the buyer.	Required
Maturity	The security's maturity date. The maturity date is the date when the security expires.	Required
Frequency	The number of coupon payments per year. <ul style="list-style-type: none"><li>• for annual payments, frequency = 1</li><li>• for semiannual, frequency = 2</li><li>• for quarterly, frequency = 4</li></ul>	Required
Basis	The type of day count basis to use. Look at the given below.	Optional

## Day Count Basis Table

Basis	Day Count Basis
0 or omitted	US (NASD) 30/360
1	Actual/actual
2	Actual/360
3	Actual/365
4	European 30/360

## Notes

- Dates should be entered by using the DATE function, or as results of other formulas or functions. For example, use DATE (2008,5,23) for the 23rd day of May, 2008. Problems can occur if dates are entered as text.
- Microsoft Excel stores dates as sequential serial numbers so they can be used in calculations. By default, January 1, 1900 is serial number 1, and January 1, 2008 is serial number 39448 because it is 39,448 days after January 1, 1900.
- The settlement date is the date a buyer purchases a coupon, such as a bond.

- The maturity date is the date when a coupon expires.
- For example, suppose a 30-year bond is issued on January 1, 2008, and is purchased by a buyer six months later, then-
  - the issue date would be January 1, 2008
  - the settlement date would be July 1, 2008
  - the maturity date would be January 1, 2038, 30 years after the January 1, 2008, issue date.
- All arguments are truncated to integers.
- If settlement or maturity is not a valid Excel date, COUPDAYBS returns the #VALUE! error value.
- If any of the specified arguments is non-numeric, COUPDAYBS returns the #VALUE! error value.
- If frequency is any number other than 1, 2, or 4, COUPDAYBS returns the #NUM! error value.
- If basis < 0 or if basis > 4, COUPDAYBS returns the #NUM! error value.
- If settlement ≥ maturity, COUPDAYBS returns the #NUM! error value.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Settlement	42109	2	Settlement	4/15/2015
3	Maturity	42335	3	Maturity	11/27/2015
4	Frequency	2	4	Frequency	2
5	Basis	1	5	Basis	1
6	Number of Days	=COUPDAYBS(C2,C3,C4,C5)	6	Number of Days	139

# 150. COUPDAYS Function

## Description

The COUPDAYS function returns the number of days in the coupon period that contains the settlement date.

## Syntax

```
COUPDAYS (settlement, maturity, frequency, [basis])
```

## Arguments

Argument	Description	Required /Optional
Settlement	The security's settlement date. The security settlement date is the date after the issue date when the security is traded to the buyer.	Required
Maturity	The security's maturity date. The maturity date is the date when the security expires.	Required
Frequency	The number of coupon payments per year. <ul style="list-style-type: none"><li>• for annual payments, frequency = 1</li><li>• for semiannual, frequency = 2</li><li>• for quarterly, frequency = 4</li></ul>	Required
Basis	The type of day count basis to use. Look at the Day Count Basis Table given below.	Optional

## Day Count Basis Table

Basis	Day Count Basis
0 or omitted	US (NASD) 30/360
1	Actual/actual
2	Actual/360
3	Actual/365
4	European 30/360

## Notes

- Dates should be entered by using the DATE function, or as results of other formulas or functions. For example, use DATE (2008,5,23) for the 23rd day of May, 2008. Problems can occur if dates are entered as text.
- Microsoft Excel stores dates as sequential serial numbers so they can be used in calculations. By default, January 1, 1900 is serial number 1, and January 1, 2008 is serial number 39448 because it is 39,448 days after January 1, 1900.
- The settlement date is the date a buyer purchases a coupon, such as a bond.
- The maturity date is the date when a coupon expires.

- For example, suppose a 30-year bond is issued on January 1, 2008, and is purchased by a buyer six months later, then-
  - the issue date would be January 1, 2008
  - the settlement date would be July 1, 2008
  - the maturity date would be January 1, 2038, 30 years after the January 1, 2008, issue date.
- All arguments are truncated to integers
- If settlement or maturity is not a valid Excel date, COUPDAYS returns the #VALUE! error value
- If any of the specified arguments is non-numeric, COUPDAYS returns the #VALUE! error value
- If frequency is any number other than 1, 2, or 4, COUPDAYS returns the #NUM! error value
- If basis < 0 or if basis > 4, COUPDAYS returns the #NUM! error value
- If settlement ≥ maturity, COUPDAYS returns the #NUM! error value

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Settlement	42109	2	Settlement	4/15/2015
3	Maturity	42335	3	Maturity	11/27/2015
4	Frequency	2	4	Frequency	2
5	Basis	1	5	Basis	1
6	Number of Days	=COUPDAYS(C2,C3,C4,C5)	6	Number of Days	181

# 151. COUPDAYSNC Function

## Description

The COUPDAYSNC function returns the number of days from the settlement date to the next coupon date.

## Syntax

```
COUPDAYSNC (settlement, maturity, frequency, [basis])
```

## Arguments

Argument	Description	Required /Optional
Settlement	The security's settlement date. The security settlement date is the date after the issue date when the security is traded to the buyer.	Required
Maturity	The security's maturity date. The maturity date is the date when the security expires.	Required
Frequency	The number of coupon payments per year. <ul style="list-style-type: none"><li>• for annual payments, frequency = 1</li><li>• for semiannual, frequency = 2</li><li>• for quarterly, frequency = 4</li></ul>	Required
Basis	The type of day count basis to use. Look at the Day Count Basis Table given below.	Optional

## Day Count Basis Table

Basis	Day Count Basis
0 or omitted	US (NASD) 30/360
1	Actual/actual
2	Actual/360
3	Actual/365
4	European 30/360

## Notes

- Dates should be entered by using the DATE function, or as results of other formulas or functions. For example, use DATE (2008,5,23) for the 23rd day of May, 2008. Problems can occur if dates are entered as text.
- Microsoft Excel stores dates as sequential serial numbers so they can be used in calculations. By default, January 1, 1900 is serial number 1, and January 1, 2008 is serial number 39448 because it is 39,448 days after January 1, 1900.
- The settlement date is the date a buyer purchases a coupon, such as a bond.

- The maturity date is the date when a coupon expires.
- For example, suppose a 30-year bond is issued on January 1, 2008, and is purchased by a buyer six months later, then-
  - the issue date would be January 1, 2008
  - the settlement date would be July 1, 2008
  - the maturity date would be January 1, 2038, 30 years after the January 1, 2008, issue date.
- All arguments are truncated to integers.
- If settlement or maturity is not a valid Excel date, COUPDAYSNC returns the #VALUE! error value.
- If any of the specified arguments is non-numeric, COUPDAYSNC returns the #VALUE! error value.
- If frequency is any number other than 1, 2, or 4, COUPDAYSNC returns the #NUM! error value.
- If basis < 0 or if basis > 4, COUPDAYSNC returns the #NUM! error value.
- If settlement ≥ maturity, COUPDAYSNC returns the #NUM! error value.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Settlement	42078	2	Settlement	3/15/2015
3	Maturity	42335	3	Maturity	11/27/2015
4	Frequency	2	4	Frequency	2
5	Basis	1	5	Basis	1
6	Number of Days	=COUPDAYSNC(C2,C3,C4,C5)	6	Number of Days	73
7			7		

# 152. COUPNCD Function

## Description

The COUPNCD function returns a number that represents the next coupon date after the settlement date.

## Syntax

```
COUPNCD (settlement, maturity, frequency, [basis])
```

## Arguments

Argument	Description	Required /Optional
Settlement	The security's settlement date. The security settlement date is the date after the issue date when the security is traded to the buyer.	Required
Maturity	The security's maturity date. The maturity date is the date when the security expires.	Required
Frequency	The number of coupon payments per year. <ul style="list-style-type: none"><li>• for annual payments, frequency = 1</li><li>• for semiannual, frequency = 2</li><li>• for quarterly, frequency = 4</li></ul>	Required
Basis	The type of day count basis to use. Look at the Day Count Basis Table given below.	Optional

## Day Count Basis Table

Basis	Day Count Basis
0 or omitted	US (NASD) 30/360
1	Actual/actual
2	Actual/360
3	Actual/365
4	European 30/360

## Notes

- Dates should be entered by using the DATE function, or as results of other formulas or functions. For example, use DATE (2008,5,23) for the 23rd day of May, 2008. Problems can occur if dates are entered as text.
- Microsoft Excel stores dates as sequential serial numbers so they can be used in calculations. By default, January 1, 1900 is serial number 1, and January 1, 2008 is serial number 39448 because it is 39,448 days after January 1, 1900.
- The settlement date is the date a buyer purchases a coupon, such as a bond.

- The maturity date is the date when a coupon expires.
- For example, suppose a 30-year bond is issued on January 1, 2008, and is purchased by a buyer six months later, then-
  - the issue date would be January 1, 2008
  - the settlement date would be July 1, 2008
  - the maturity date would be January 1, 2038, 30 years after the January 1, 2008, issue date.
- All arguments are truncated to integers.
- If settlement or maturity is not a valid Excel date, COUPNCD returns the #VALUE! error value.
- If any of the specified arguments is non-numeric, COUPNCD returns the #VALUE! error value.
- If frequency is any number other than 1, 2, or 4, COUPNCD returns the #NUM! error value.
- If basis < 0 or if basis > 4, COUPNCD returns the #NUM! error value.
- If settlement ≥ maturity, COUPNCD returns the #NUM! error value.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage		Results	
A	B	A	B
1		1	
2	Settlement	2	Settlement
3	Maturity	3	11/27/2015
4	Frequency	4	2
5	Basis	5	1
6	Next Coupon Date	6	42151
7	=COUPNCD(C2,C3,C4,C5)	7	i.e., 5/27/2015
	42151		

# 153. COUPNUM Function

## Description

The COUPNUM function returns the number of coupons payable between the settlement date and maturity date, rounded up to the nearest whole coupon.

## Syntax

```
COUPNUM (settlement, maturity, frequency, [basis])
```

## Arguments

Argument	Description	Required /Optional
Settlement	The security's settlement date. The security settlement date is the date after the issue date when the security is traded to the buyer.	Required
Maturity	The security's maturity date. The maturity date is the date when the security expires.	Required
Frequency	The number of coupon payments per year. <ul style="list-style-type: none"><li>• for annual payments, frequency = 1</li><li>• for semiannual, frequency = 2</li><li>• for quarterly, frequency = 4</li></ul>	Required
Basis	The type of day count basis to use. Look at the Day Count Basis Table given below.	Optional

## Day Count Basis Table

Basis	Day Count Basis
0 or omitted	US (NASD) 30/360
1	Actual/actual
2	Actual/360
3	Actual/365
4	European 30/360

## Notes

- Dates should be entered by using the DATE function, or as results of other formulas or functions. For example, use DATE (2008,5,23) for the 23rd day of May, 2008. Problems can occur if dates are entered as text.
- Microsoft Excel stores dates as sequential serial numbers so they can be used in calculations. By default, January 1, 1900 is serial number 1, and January 1, 2008 is serial number 39448 because it is 39,448 days after January 1, 1900.
- The settlement date is the date a buyer purchases a coupon, such as a bond.
- The maturity date is the date when a coupon expires.

- For example, suppose a 30-year bond is issued on January 1, 2008, and is purchased by a buyer six months later, then-
  - the issue date would be January 1, 2008
  - the settlement date would be July 1, 2008
  - the maturity date would be January 1, 2038, 30 years after the January 1, 2008, issue date.
- All arguments are truncated to integers.
- If settlement or maturity is not a valid Excel date, COUPNUM returns the #VALUE! error value.
- If any of the specified arguments is non-numeric, COUPNUM returns the #VALUE! error value.
- If frequency is any number other than 1, 2, or 4, COUPNUM returns the #NUM! error value.
- If basis < 0 or if basis > 4, COUPNUM returns the #NUM! error value.
- If settlement ≥ maturity, COUPNUM returns the #NUM! error value.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
	A	B		A	B
1			1		
2	Settlement	42078	2	Settlement	3/15/2015
3	Maturity	42335	3	Maturity	11/27/2015
4	Frequency	2	4	Frequency	2
5	Basis	1	5	Basis	1
6	No. of Coupons	=COUPNUM(C2,C3,C4,C5)	6	No. of Coupons	2

# 154. COUPPCD Function

## Description

The COUPPCD function returns a number that represents the previous coupon date before the settlement date.

## Syntax

```
COUPPCD (settlement, maturity, frequency, [basis])
```

## Arguments

Argument	Description	Required /Optional
Settlement	The security's settlement date. The security settlement date is the date after the issue date when the security is traded to the buyer.	Required
Maturity	The security's maturity date. The maturity date is the date when the security expires.	Required
Frequency	The number of coupon payments per year. <ul style="list-style-type: none"><li>• for annual payments, frequency = 1</li><li>• for semiannual, frequency = 2</li><li>• for quarterly, frequency = 4</li></ul>	Required
Basis	The type of day count basis to use. Look at the Day Count Basis Table given below.	Optional

## Day Count Basis Table

Basis	Day Count Basis
0 or omitted	US (NASD) 30/360
1	Actual/actual
2	Actual/360
3	Actual/365
4	European 30/360

## Notes

- Dates should be entered by using the DATE function, or as results of other formulas or functions. For example, use DATE (2008,5,23) for the 23rd day of May, 2008. Problems can occur if dates are entered as text.
- Microsoft Excel stores dates as sequential serial numbers so they can be used in calculations. By default, January 1, 1900 is serial number 1, and January 1, 2008 is serial number 39448 because it is 39,448 days after January 1, 1900.
- The settlement date is the date a buyer purchases a coupon, such as a bond.

- The maturity date is the date when a coupon expires.
- For example, suppose a 30-year bond is issued on January 1, 2008, and is purchased by a buyer six months later, then-
  - the issue date would be January 1, 2008
  - the settlement date would be July 1, 2008
  - the maturity date would be January 1, 2038, 30 years after the January 1, 2008, issue date.
- All arguments are truncated to integers.
- If settlement or maturity is not a valid Excel date, COUPPCD returns the #VALUE! error value.
- If any of the specified arguments are non-numeric, COUPPCD returns the #VALUE! error value.
- If frequency is any number other than 1, 2, or 4, COUPPCD returns the #NUM! error value.
- If basis < 0 or if basis > 4, COUPPCD returns the #NUM! error value.
- If settlement ≥ maturity, COUPPCD returns the #NUM! error value.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
	A	B		A	B
1				1	
2	Settlement	42078	2	Settlement	3/15/2015
3	Maturity	42335	3	Maturity	11/27/2015
4	Frequency	2	4	Frequency	2
5	Basis	1	5	Basis	1
6	Previous Coupon Date	=COUPPCD(C2,C3,C4,C5)	6	Previous Coupon Date	41970
7			7		i.e., 11/27/2014

# 155. CUMIPMT Function

## Description

The CUMIPMT function returns the cumulative interest paid on a loan between start\_period and end\_period.

## Syntax

```
CUMIPMT (rate, nper, pv, start_period, end_period, type)
```

## Arguments

Argument	Description	Required /Optional
Rate	The interest rate.	Required
Nper	The total number of payment periods.	Required
Pv	The present value.	Required
Start_period	The first period in the calculation. Payment periods are numbered beginning with 1.	Required
End_period	The last period in the calculation.	Required
Type	The timing of the payment. Look at the Type-Timing Table given below.	Required

## Type-Timing Table

Type	Timing
0 (zero)	Payment at the end of the period
1	Payment at the beginning of the period

## Notes

- Make sure that you are consistent about the units you use for specifying rate and nper
  - If you make monthly payments on a four-year loan at an annual interest rate of 10 percent, use 10%/12 for rate and 4\*12 for nper
  - If you make annual payments on the same loan, use 10% for rate and 4 for nper
- If rate ≤ 0, nper ≤ 0, or pv ≤ 0, CUMIPMT returns the #NUM! error value.
- If start\_period < 1, end\_period < 1, or start\_period > end\_period, CUMIPMT returns the #NUM! error value.
- If start\_period or end\_period > nper, CUMIPMT returns the #NUM! error value.
- If type is any number other than 0 or 1, CUMIPMT returns the #NUM! error value.

- If any of the specified arguments is not recognized as numeric value, CUMIPMT returns the #VALUE! error value.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
	A	B		A	B
1				1	
2	Annual interest Rate	0.09	2	Annual interest Rate	9%
3	Term of Loan (in Years)	4	3	Term of Loan (in Years)	4
4	Present Value	125000	4	Present Value	125,000
5	No. of Monthly Payments	=C3*12	5	No. of Monthly Payments	48
6	Interest Rate	=C2/12	6	Interest Rate	0.75%
7	Total Interest paid in the second year of payments (i.e. Months 13 - 24)	=CUMIPMT(C6,C5,C4,13,24,0)	7	Total Interest paid in the second year of payments (i.e. Months 13 - 24)	-7597.22
8	Total Interest paid in the third year of payments (i.e. Months 25 - 36)	=CUMIPMT(C6,C5,C4,25,36,0)	8	Total Interest paid in the third year of payments (i.e. Months 25 - 36)	-4808.31

# 156. CUMPRINC Function

## Description

The CUMPRINC function returns the cumulative principal paid on a loan between start\_period and end\_period.

## Syntax

```
CUMPRINC (rate, nper, pv, start_period, end_period, type)
```

## Arguments

Argument	Description	Required /Optional
Rate	The interest rate.	Required
Nper	The total number of payment periods.	Required
Pv	The present value	Required
Start_period	The first period in the calculation. Payment periods are numbered beginning with 1.	Required
End_period	The last period in the calculation.	Required
Type	The timing of the payment. Look at the Type-Timing Table given below.	Required

## Type-Timing Table

Type	Timing
0 (zero)	Payment at the end of the period
1	Payment at the beginning of the period

## Notes

- Make sure that you are consistent about the units you use for specifying rate and nper
  - If you make monthly payments on a four-year loan at an annual interest rate of 12 percent, use 12%/12 for rate and 4\*12 for nper.
  - If you make annual payments on the same loan, use 12% for rate and 4 for nper.
- If rate  $\leq 0$ , nper  $\leq 0$ , or pv  $\leq 0$ , CUMPRINC returns the #NUM! error value.
- If start\_period  $< 1$ , end\_period  $< 1$ , or start\_period  $>$  end\_period, CUMPRINC returns the #NUM! error value.
- If type is any number other than 0 or 1, CUMPRINC returns the #NUM! error value.
- If any of the specified arguments is not recognized as numeric value, CUMPRINC returns the #VALUE! error value.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
	A	B		A	B
1			1		
2	Present Value	20000	2	Present Value	\$20,000
3	Interest Rate	0.08	3	Interest Rate	8%
4	Period (in Years)	3	4	Period (in Years)	3
5	Monthly Payments		5	Monthly Payments	
6	No. of Payments	36	6	No. of Payments	36
7	Interest Rate per Month	=C3/12	7	Interest Rate per Month	0.67%
8	Start Period	13	8	Start Period	13
9	End Period	24	9	End Period	24
10	CUMPRINC	=CUMPRINC(C7,C6,C2,C8,C9,0)	10	CUMPRINC	(\$6,652.56)

# 157. DB Function

## Description

The DB function returns the depreciation of an asset for a specified period using the fixed-declining balance method.

## Syntax

```
DB (cost, salvage, life, period, [month])
```

## Arguments

Argument	Description	Required / Optional
Cost	The initial cost of the asset.	Required
Salvage	The value at the end of the depreciation (sometimes called the salvage value of the asset).	Required
Life	The number of periods over which the asset is being depreciated (sometimes called the useful life of the asset).	Required
Period	The period for which you want to calculate the depreciation. Period must use the same units as life.	Required
Month	The number of months in the first year. If month is omitted, it is assumed to be 12.	Optional

## Notes

- The fixed-declining balance method computes depreciation at a fixed rate. DB uses the following formulas to calculate depreciation for a period-

$$(\text{cost} - \text{total depreciation from prior periods}) * \text{rate}$$

Where-

rate =  $1 - ((\text{salvage} / \text{cost}) ^ (1 / \text{life}))$ , rounded to three decimal places

- Depreciation for the first and last periods is a special case.
- For the first period, DB uses this formula-  
$$\text{cost} * \text{rate} * \text{month} / 12$$
- For the last period, DB uses this formula-  
$$((\text{cost} - \text{total depreciation from prior periods}) * \text{rate} * (12 - \text{month})) / 12$$
- If the specified cost or the specified salvage argument is  $< 0$ , DB returns #NUM! error value.
- If the specified life or the specified period argument is  $\leq 0$ , DB returns #NUM! error value.

- If the specified month argument is  $\leq 0$  or is  $> 12$ , DB returns #NUM! error value.
- If the specified period  $>$  life and the month argument is omitted, DB returns #NUM! error value.
- If the specified period  $>$  life+1, DB returns #NUM! error value.
- If any of the specified arguments is not a numeric value, DB returns #VALUE! error value.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	<b>Cost</b>	3500	2	<b>Cost</b>	\$3,500
3	<b>Salvage</b>	100	3	<b>Salvage</b>	\$100
4	<b>Life</b>	5	4	<b>Life</b>	5
5	<b>Period</b>	2	5	<b>Period</b>	2
6	<b>Month</b>	5	6	<b>Month</b>	5
7	<b>Depreciation</b>	=DB(C2,C3,C4,C5,C6)	7	<b>Depreciation</b>	\$1,403.67

# 158. DDB Function

## Description

The DDB function returns the depreciation of an asset for a specified period using the double-declining balance method or some other method you specify.

## Syntax

```
DDB (cost, salvage, life, period, [factor])
```

## Arguments

Argument	Description	Required /Optional
Cost	The initial cost of the asset.	Required
Salvage	The value at the end of the depreciation (sometimes called the salvage value of the asset). This value can be 0.	Required
Life	The number of periods over which the asset is being depreciated (sometimes called the useful life of the asset).	Required
Period	The period for which you want to calculate the depreciation. Period must use the same units as life.	Required
Factor	The rate at which the balance declines. If factor is omitted, it is assumed to be 2 (the double-declining balance method).	Optional

## Notes

- All five arguments must be positive numbers.
- The double-declining balance method computes depreciation at an accelerated rate. Depreciation is highest in the first period and decreases in successive periods. DDB uses the following formula to calculate depreciation for a period-

$$\text{Min} ((\text{cost} - \text{total depreciation from prior periods}) * (\text{factor}/\text{life}), (\text{cost} - \text{salvage} - \text{total depreciation from prior periods}))$$

- Change factor if you do not want to use the double-declining balance method.
- Use the VDB Function if you want to switch to the straight-line depreciation method when depreciation is greater than the declining balance calculation.
- If either the specified cost or the specified salvage argument is < 0, DDB returns #NUM! error value.

- If any of the specified life, period or factor arguments is  $\leq 0$ , DDB returns #NUM! error value.
- If the specified period  $>$  life, DDB returns #NUM! error value.
- If any of the specified arguments is not a numeric value, #VALUE! error value.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Cost	10000	2	Cost	\$10,000
3	Life (years)	10	3	Life (years)	10
4	Salvage Value	1000	4	Salvage Value	\$1,000
5	Period	10	5	Period	10
6	DDB	=DDB(C2,C4,C3,C5)	6	DDB	\$268.44
7			7		

# 159. DISC Function

## Description

The DISC function returns the discount rate for a security.

## Syntax

```
DISC (settlement, maturity, pr, redemption, [basis])
```

## Arguments

Argument	Description	Required /Optional
Settlement	The security's settlement date. The security settlement date is the date after the issue date when the security is traded to the buyer.	Required
Maturity	The security's maturity date. The maturity date is the date when the security expires.	Required
Pr	The security's price per \$100 face value.	Required
Redemption	The security's redemption value per \$100 face value.	Required
Basis	The type of day count basis to use. Look at the Day Count Basis Table given below.	Optional

## Day Count Basis Table

Basis	Day Count Basis
0 or omitted	US (NASD) 30/360
1	Actual/actual
2	Actual/360
3	Actual/365
4	European 30/360

## Notes

- DISC is calculated as follows-

$$DISC = \frac{\text{redemption} - \text{par}}{\text{redemption}} \times \frac{B}{DSM}$$

Where

B = number of days in a year, depending on the year basis

DSM = number of days between settlement and maturity

- Dates should be entered by using the DATE Function, or as results of other formulas or functions. For example, use DATE (2008,5,23) for the 23rd day of May, 2008. Problems can occur if dates are entered as text.

- Microsoft Excel stores dates as sequential serial numbers so they can be used in calculations. By default, January 1, 1900 is serial number 1, and January 1, 2008 is serial number 39448 because it is 39,448 days after January 1, 1900.
- The settlement date is the date a buyer purchases a coupon, such as a bond.
- The maturity date is the date when a coupon expires.
- For example, suppose a 30-year bond is issued on January 1, 2008, and is purchased by a buyer six months later, then-
  - the issue date would be January 1, 2008
  - the settlement date would be July 1, 2008
  - the maturity date would be January 1, 2038, 30 years after the January 1, 2008, issue date
- Settlement, maturity, and basis are truncated to integers.
- If settlement or maturity is not a valid Excel date, DISC returns the #VALUE! error value.
- If  $pr \leq 0$  or if  $redemption \leq 0$ , DISC returns the #NUM! error value.
- If  $basis < 0$  or if  $basis > 4$ , DISC returns the #NUM! error value.
- If  $settlement \geq maturity$ , DISC returns the #NUM! error value.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Settlement Date	42050	2	Settlement Date	2/15/2015
3	Maturity Date	42231	3	Maturity Date	8/15/2015
4	Pr	98.5	4	Pr	98.5
5	Redemption	100	5	Redemption	100
6	Basis	2	6	Basis	2
7	Discount Rate	=DISC(C2,C3,C4,C5,C6)	7	Discount Rate	2.98%
~					

# 160. DOLLARDE Function

## Description

The DOLLARDE function converts a dollar price expressed as an integer part and a fraction part, such as 1.02, into a dollar price expressed as a decimal number. Fractional dollar numbers are sometimes used for security prices. The fraction part of the value is divided by an integer that you specify.

## Syntax

```
DOLLARDE (fractional_dollar, fraction)
```

## Arguments

Argument	Description	Required /Optional
Fractional_dollar	A number expressed as an integer part and a fraction part, separated by a decimal symbol.	Required
Fraction	The integer to use in the denominator of the fraction.	Required

## Notes

- If fraction is not an integer, it is truncated.
- If fraction is less than 0, DOLLARDE returns the #NUM! error value.
- If fraction is greater than or equal to 0 and less than 1, DOLLARDE returns the #DIV/0! error value.
- If either of the specified arguments is non-numeric, DOLLARDE returns the #VALUE! error value.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

**Example**

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Fractional Dollar	1.52	2	Fractional Dollar	1.52
3	Fraction	8	3	Fraction	8
4	Dollar Price	=DOLLARDE(C2,C3)	4	Dollar Price	1.65
c					

# 161. DOLLARFR Function

## Description

The DOLLARFR function converts a dollar price, expressed as a decimal number, into a dollar price, expressed as a fraction.

## Syntax

```
DOLLARFR (decimal_dollar, fraction)
```

## Arguments

Argument	Description	Required /Optional
Decimal_dollar	A decimal number.	Required
Fraction	The integer to use in the denominator of a fraction.	Required

## Notes

- If fraction is not an integer, it is truncated.
- If fraction is less than 0, DOLLARFR returns the #NUM! error value.
- If fraction is 0, DOLLARFR returns the #DIV/0! error value.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Decimal Dollar	1.65	2	Decimal Dollar	1.65
3	Fraction	8	3	Fraction	8
4	Fractional Dollar	=DOLLARFR(C2,C3)	4	Fractional Dollar	1.52
-			-		

# 162. DURATION Function

## Description

The DURATION function returns the Macauley duration for an assumed par value of \$100. Duration is defined as the weighted average of the present value of the cash flows and is used as a measure of a bond price's response to changes in yield.

## Syntax

```
DURATION (settlement, maturity, coupon, yld, frequency, [basis])
```

## Arguments

Argument	Description	Required /Optional
Settlement	The security's settlement date. The security settlement date is the date after the issue date when the security is traded to the buyer.	Required
Maturity	The security's maturity date. The maturity date is the date when the security expires.	Required
Coupon	The security's annual coupon rate.	Required
Yld	The security's annual yield.	Required
Frequency	The number of coupon payments per year. <ul style="list-style-type: none"><li>• for annual payments, frequency = 1</li><li>• for semiannual, frequency = 2</li><li>• for quarterly, frequency = 4</li></ul>	Required
Basis	The type of day count basis to use. Look at the Day Count Basis Table given below.	Optional

## Day Count Basis Table

Basis	Day Count Basis
0 or omitted	US (NASD) 30/360
1	Actual/actual
2	Actual/360
3	Actual/365
4	European 30/360

## Notes

- Dates should be entered by using the DATE function, or as results of other formulas or functions. For example, use DATE (2008,5,23) for the 23rd day of May, 2008. Problems can occur if dates are entered as text.
- Microsoft Excel stores dates as sequential serial numbers so they can be used in calculations. By default, January 1, 1900 is serial number 1, and January 1, 2008 is serial number 39448 because it is 39,448 days after January 1, 1900.

- The settlement date is the date a buyer purchases a coupon, such as a bond.
- The maturity date is the date when a coupon expires.
- For example, suppose a 30-year bond is issued on January 1, 2008, and is purchased by a buyer six months later, then-
  - the issue date would be January 1, 2008
  - the settlement date would be July 1, 2008
  - the maturity date would be January 1, 2038, which is 30 years after the January 1, 2008, issue date
- Settlement, maturity, frequency, and basis are truncated to integers.
- If settlement or maturity is not a valid Excel date, DURATION returns the #VALUE! error value.
- If any of the specified arguments is non-numeric, DURATION returns the #VALUE! error value.
- If coupon < 0 or if yld < 0, DURATION returns the #NUM! error value.
- If frequency is any number other than 1, 2, or 4, DURATION returns the #NUM! error value.
- If basis < 0 or if basis > 4, DURATION returns the #NUM! error value.
- If settlement ≥ maturity, DURATION returns the #NUM! error value.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	<b>Settlement</b>	42109	2	<b>Settlement</b>	4/15/2015
3	<b>Maturity</b>	42335	3	<b>Maturity</b>	11/27/2015
4	<b>Coupon</b>	0.08	4	<b>Coupon</b>	0.08
5	<b>Yield</b>	1	5	<b>Yield</b>	1
6	<b>Frequency</b>	2	6	<b>Frequency</b>	2
7	<b>Basis</b>	1	7	<b>Basis</b>	1
8	<b>Macauley Duration</b>	=DURATION(C2,C3,C4,C5,C6,C7)	8	<b>Macauley Duration</b>	0.588749372
⋮			⋮		

# 163. EFFECT Function

## Description

The EFFECT function returns the effective annual interest rate, given the nominal annual interest rate and the number of compounding periods per year.

## Syntax

```
EFFECT (nominal_rate, npery)
```

## Arguments

Argument	Description	Required /Optional
Nominal_rate	The nominal interest rate.	Required
Npery	The number of compounding periods per year.	Required

## Notes

- EFFECT is calculated as follows:

$$EFFECT = \left(1 + \frac{\text{Nominal\_rate}}{Npery}\right)^{Npery} - 1$$

- Npery is truncated to an integer.
- If either of the arguments is nonnumeric, EFFECT returns the #VALUE! error value.
- If nominal\_rate  $\leq 0$  or if npery < 1, EFFECT returns the #NUM! error value.
- EFFECT (nominal\_rate,npery) is related to NOMINAL(effect\_rate,npery) through

$$\text{effective\_rate} = (1 + (\text{nominal\_rate}/\text{npery}))^{npery} - 1$$

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Nominal Annual Interest Rate	0.08	2	Nominal Annual Interest Rate	8.0%
3	Number Of Compounding Periods Per Year (Compounded Quarterly)	4	3	Number Of Compounding Periods Per Year	4
4	Effective Annual Interest Rate	=EFFECT(C2,C3)	4	Effective Annual Interest Rate	8.2%

# 164. FV Function

## Description

The FV function calculates the future value of an investment based on a constant interest rate. You can use FV with either periodic, constant payments, or a single lump sum payment.

## Syntax

```
FV (rate,nper,pmt,[pv],[type])
```

## Arguments

Argument	Description	Required /Optional
Rate	The interest rate per period.	Required
Nper	The total number of payment periods in an annuity.	Required
Pmt	The payment made each period. It cannot change over the life of the annuity. Typically, pmt contains principal and interest but no other fees or taxes. If pmt is omitted, you must include the pv argument.	Required
Pv	The present value, or the lump-sum amount that a series of future payments is worth right now. If pv is omitted, it is assumed to be 0 (zero), and you must include the pmt argument.	Optional
Type	The number 0 or 1 and indicates when payments are due. See Table given below. If type is omitted, it is assumed to be 0.	Optional

Set type equal to	If payments are due
0	At the end of the period
1	At the beginning of the period

For more description of the arguments in FV and for more information on annuity functions, see PV.

## Notes

- Make sure that you are consistent about the units you use for specifying rate and nper
  - If you make monthly payments for four years at 12 percent annual interest, use 12%/12 for rate and 4\*12 for nper
  - If you make annual payments for four years at 12 percent annual interest, use 12% for rate and 4 for nper
- For all the arguments,

- cash you pay out, such as deposits to savings, is represented by negative numbers
- cash you receive, such as dividend checks, is represented by positive numbers
- If any of the specified arguments is non-numeric, FV returns #VALUE! error

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage		Results	
	B		C
2	Annual interest Rate	0.08	2
3	Duration of investment (in Years)	15	3
4	Present value (initial investment of 500, then followed by monthly payments of 200)	-500	4
5	Amount of Monthly Payment	-200	5
6	Number of Monthly Payments	=C3*12	6
7	Payment is due at the beginning of the Month	1	7
8	Future Value of the investment	=FV(C2/12, C6, C5, C4, 1)	8
9	Future Value of the investment without the initial investment of 500	=FV(C2/12,C6,C5,,1)	9

# 165. FVSCHEDULE Function

## Description

The FVSCHEDULE function returns the future value of an initial principal after applying a series of compound interest rates. Use FVSCHEDULE to calculate the future value of an investment with a variable or adjustable rate.

## Syntax

```
FVSCHEDULE (principal, schedule)
```

## Arguments

Argument	Description	Required /Optional
Principal	The present value.	Required
Schedule	An array of interest rates to apply.	Required

## Notes

- The values in schedule can be numbers or blank cells. Any other value produces the #VALUE! error value.
- Blank cells are taken as zeros (no interest).

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Principal	5000	2	Principal	5000
3		0.08	3		0.08
4	Schedule	0.12	4	Schedule	0.12
5		0.14	5		0.14
6	Future Value	=FVSCHEDULE(C2,C3:C5)	6	Future Value	6894.72
7			-		

# 166. INTRATE Function

## Description

The INTRATE function returns the interest rate for a fully invested security.

## Syntax

```
INTRATE (settlement, maturity, investment, redemption, [basis])
```

## Arguments

Argument	Description	Required /Optional
Settlement	The security's settlement date. The security settlement date is the date after the issue date when the security is traded to the buyer.	Required
Maturity	The security's maturity date. The maturity date is the date when the security expires.	Required
Investment	The amount invested in the security.	Required
Redemption	The amount to be received at maturity.	Required
Basis	The type of day count basis to use. Look at the Day Count Basis Table given below.	Optional

## Day Count Basis Table

Basis	Day Count Basis
0 or omitted	US (NASD) 30/360
1	Actual/actual
2	Actual/360
3	Actual/365
4	European 30/360

## Notes

- INTRATE is calculated as follows-

$$\text{INTRATE} = \frac{\text{redemption} - \text{investment}}{\text{investment}} \times \frac{B}{\text{DIM}}$$

Where:

B = number of days in a year, depending on the year basis.

DIM = number of days from settlement to maturity.

- Dates should be entered by using the DATE function, or as results of other formulas or functions. For example, use DATE (2008,5,23) for the 23rd day of May, 2008. Problems can occur if dates are entered as text.
- Microsoft Excel stores dates as sequential serial numbers so they can be used in calculations. By default, January 1, 1900 is serial number 1, and January 1, 2008 is serial number 39448 because it is 39,448 days after January 1, 1900

- The settlement date is the date a buyer purchases a coupon, such as a bond
- The maturity date is the date when a coupon expires
- For example, suppose a 30-year bond is issued on January 1, 2008, and is purchased by a buyer six months later, then-
  - the issue date would be January 1, 2008
  - the settlement date would be July 1, 2008
  - the maturity date would be January 1, 2038, which is 30 years after the January 1, 2008, issue date
- Settlement, maturity, and basis are truncated to integers
- If settlement or maturity is not a valid Excel date, INTRATE returns the #VALUE! error value
- If any of the specified arguments is non-numeric, INTRATE returns the #VALUE! error value
- If investment  $\leq 0$  or if redemption  $\leq 0$ , INTRATE returns the #NUM! error value
- If basis  $< 0$  or if basis  $> 4$ , INTRATE returns the #NUM! error value
- If settlement  $\geq$  maturity, INTRATE returns the #NUM! error value

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
	A	B		A	B
1			1		
2	Settlement	42078	2	Settlement	3/15/2015
3	Maturity	42335	3	Maturity	11/27/2015
4	Investment	5000	4	Investment	5000
5	Redemption	5225	5	Redemption	5225
6	Basis	2	6	Basis	2
7	Interest Rate	=INTRATE(C2,C3,C4,C5,C6)	7	Interest Rate	6.3%

# 167. IPMT Function

## Description

The IPMT function returns the interest payment for a given period for an investment based on periodic, constant payments and a constant interest rate.

## Syntax

```
IPMT (rate, per, nper, pv, [fv], [type])
```

## Arguments

Argument	Description	Required /Optional
Rate	The interest rate per period.	Required
Per	The period for which you want to find the interest and must be in the range 1 to nper.	Required
Nper	The total number of payment periods in an annuity.	Required
Pv	The present value, or the lump-sum amount that a series of future payments is worth right now.	Required
Fv	The future value, or a cash balance you want to attain after the last payment is made. If fv is omitted, it is assumed to be 0 (the future value of a loan, for example, is 0).	Optional
Type	The number 0 or 1 and indicates when payments are due. Look at the Type Table given below. If type is omitted, it is assumed to be 0.	Optional

## Type Table

Set type equal to	If payments are due
0	At the end of the period
1	At the beginning of the period

## Notes

- Make sure that you are consistent about the units you use for specifying rate and nper-
  - If you make monthly payments on a four-year loan at 12 percent annual interest, use 12%/12 for rate and 4\*12 for nper
  - If you make annual payments on the same loan, use 12% for rate and 4 for nper
- For all the arguments-
  - cash you pay out, such as deposits to savings, is represented by negative numbers

- cash you receive, such as dividend checks, is represented by positive numbers
- If the specified per argument is < 0 or is > the specified value of nper, IPMT returns #NUM! error value.
- If any of the specified arguments is not recognized as numeric value, IPMT returns #VALUE! error value.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
	B	C		B	C
1			1		
2	Present Value	20000	2	Present Value	\$20,000
3	Interest Rate	0.08	3	Interest Rate	8%
4	Period (in Years)	3	4	Period (in Years)	3
5	Monthly Payments		5	Monthly Payments	
6	No. of Payments	36	6	No. of Payments	36
7	Interest Rate per Month	=C3/12	7	Interest Rate per Month	0.67%
8	IPMT	=IPMT(C7,C6,C6,C2)	8	IPMT	(\$4.15)
-					

# 168. IRR Function

## Description

The IRR function returns the internal rate of return for a series of cash flows represented by the numbers in values. These cash flows do not have to be even, as they would be for an annuity. However, the cash flows must occur at regular intervals, such as monthly or annually.

The internal rate of return is the interest rate received for an investment consisting of payments (negative values) and income (positive values) that occur at regular periods.

## Syntax

```
IRR (values, [guess])
```

## Arguments

Argument	Description	Required /Optional
Values	An array or a reference to cells that contain numbers for which you want to calculate the internal rate of return. Values must contain at least one positive value and one negative value to calculate the internal rate of return. IRR uses the order of values to interpret the order of cash flows. Be sure to enter your payment and income values in the sequence you want. If an array or reference argument contains text, logical values, or empty cells, those values are ignored.	Required
Guess	A number that you guess is close to the result of IRR. Microsoft Excel uses an iterative technique for calculating IRR. Starting with guess, IRR cycles through the calculation until the result is accurate within 0.00001 percent. If IRR can't find a result that works after 20 tries, the #NUM! error value is returned. In most cases you do not need to provide guess for the IRR calculation. If guess is omitted, it is assumed to be 0.1 (10 percent). If IRR gives the #NUM! error value, or if the result is not close to what you expected, try again with a different value for guess.	Optional

## Notes

- IRR is closely related to NPV, the net present value (NPV) Function. The rate of return calculated by IRR is the interest rate corresponding to a 0 (zero) net present value. The following formula demonstrates how NPV and IRR are related-

**NPV (IRR (A2:A7),A2:A7) equals 1.79E-09**

[Within the accuracy of the IRR calculation, the value is effectively 0 (zero).]

- If the specified values array does not contain at least one negative and at least one positive value, IRR returns #NUM! error value.
- If the calculation failed to converge after 20 iterations, IRR returns #NUM! error value.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Year	Cash flow	2	Year	Cash flow
3	1	-3220400	3	1	-\$3,220,400
4	2	-752335	4	2	-\$752,335
5	3	787227	5	3	\$787,227
6	4	2008193	6	4	\$2,008,193
7	5	3112483	7	5	\$3,112,483
8			8		
9	IRR	=IRR(C3:C8)	9	IRR	13.3%
10					

# 169. ISPMT Function

## Description

The ISPMT function calculates the interest paid during a specific period of an investment. This Function is provided for compatibility with Lotus 1-2-3.

## Syntax

```
ISPMT (rate, per, nper, pv)
```

## Arguments

Argument	Description	Required /Optional
Rate	The interest rate for the investment.	Required
Per	The period for which you want to find the interest, and must be between 1 and nper.	Required
Nper	The total number of payment periods for the investment.	Required
Pv	The present value of the investment. For a loan, pv is the loan amount.	Required

## Notes

- Make sure that you are consistent about the units you use for specifying rate and nper
  - If you make monthly payments on a four-year loan at an annual interest rate of 12 percent, use 12%/12 for rate and 4\*12 for nper
  - If you make annual payments on the same loan, use 12% for rate and 4 for nper
- For all the arguments-
  - Cash you pay out, such as deposits to savings or other withdrawals, is represented by negative numbers
  - Cash you receive, such as dividend checks and other deposits, is represented by positive numbers

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	<b>Rate</b>	0.08	2	<b>Rate</b>	0.08
3	<b>Period</b>	1	3	<b>Period</b>	1
4	<b>No. of Payments</b>	5	4	<b>No. of Payments</b>	5
5	<b>Present Value</b>	6000000	5	<b>Present Value</b>	6000000
6	<b>Interest</b>	=ISPMT(C2,C3,C4,C5)	6	<b>Interest</b>	-384000
7			7		

# 170. MDURATION Function

## Description

The MDURATION function returns the modified Macauley duration for a security with an assumed par value of \$100.

## Syntax

```
MDURATION (settlement, maturity, coupon, yld, frequency, [basis])
```

## Arguments

Argument	Description	Required /Optional
Settlement	The security's settlement date. The security settlement date is the date after the issue date when the security is traded to the buyer.	Required
Maturity	The security's maturity date. The maturity date is the date when the security expires.	Required
Coupon	The security's annual coupon rate.	Required
Yld	The security's annual yield.	Required
Frequency	The number of coupon payments per year. <ul style="list-style-type: none"><li>• for annual payments, frequency = 1</li><li>• for semiannual, frequency = 2</li><li>• for quarterly, frequency = 4</li></ul>	Required
Basis	The type of day count basis to use. Look at Day Count Basis Table given below.	Optional

## Day Count Basis Table

Basis	Day Count Basis
0 or omitted	US (NASD) 30/360
1	Actual/actual
2	Actual/360
3	Actual/365
4	European 30/360

## Notes

- Modified duration is defined as follows-

$$\text{MDURATION} = \frac{\text{DURATION}}{1 + \left( \frac{\text{Market yield}}{\text{Coupon payments per year}} \right)}$$

- Dates should be entered by using the DATE Function, or as results of other formulas or functions. For example, use DATE (2008,5,23) for the 23rd day of May, 2008. Problems can occur if dates are entered as text.

- Microsoft Excel stores dates as sequential serial numbers so they can be used in calculations. By default, January 1, 1900 is serial number 1, and January 1, 2008 is serial number 39448 because it is 39,448 days after January 1, 1900.
- The settlement date is the date a buyer purchases a coupon, such as a bond.
- The maturity date is the date when a coupon expires.
- For example, suppose a 30-year bond is issued on January 1, 2008, and is purchased by a buyer six months later, then-
  - the issue date would be January 1, 2008
  - the settlement date would be July 1, 2008
  - the maturity date is January 1, 2038, which is 30 years after the January 1, 2008, issue date
- Settlement, maturity, frequency, and basis are truncated to integers.
- If settlement or maturity is not a valid Excel date, MDURATION returns the #VALUE! error value.
- If any of the specified arguments is non-numeric, MDURATION returns the #VALUE! error value.
- If  $yld < 0$  or if  $coupon < 0$ , MDURATION returns the #NUM! error value.
- If frequency is any number other than 1, 2, or 4, MDURATION returns the #NUM! error value.
- If  $basis < 0$  or if  $basis > 4$ , MDURATION returns the #NUM! error value.
- If  $settlement \geq maturity$ , MDURATION returns the #NUM! error value.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
	B	C		B	C
Settlement	42109		Settlement	4/15/2015	
Maturity	42335		Maturity	11/27/2015	
Coupon	0.08		Coupon	0.08	
Yield	1		Yield	1	
Frequency	2		Frequency	2	
Basis	1		Basis	1	
Modified Macauley Duration	=MDURATION(C2,C3,C4,C5,C6,C7)		Modified Macauley Duration	0.392499581	

# 171. MIRR Function

## Description

The MIRR function returns the modified internal rate of return for a series of periodic cash flows. MIRR considers both the cost of the investment and the interest received on reinvestment of cash.

## Syntax

```
MIRR (values, finance_rate, reinvest_rate)
```

## Arguments

Argument	Description	Required / Optional
Values	An array or a reference to cells that contain numbers. These numbers represent a series of payments (negative values) and income (positive values) occurring at regular periods. Values must contain at least one positive value and one negative value to calculate the modified internal rate of return. Otherwise, MIRR returns the #DIV/0! error value. If an array or reference argument contains text, logical values, or empty cells, those values are ignored. However, cells with the value zero are included.	Required
Finance_rate	The interest rate you pay on the money used in the cash flows.	Required
Reinvest_rate	The interest rate you receive on the cash flows as you reinvest them.	Required

## Notes

- If n is the number of cash flows in values, frate is the finance\_rate, and rrate is the reinvest\_rate, then the formula for MIRR is:  
$$\left( \frac{-NPV(rrate, values[positive]) * (1 + rrate)^n}{NPV(frate, values[negative]) * (1 + frate)} \right)^{\frac{1}{n-1}} - 1$$
- MIRR uses the order of values to interpret the order of cash flows. Be sure to enter your payment and income values in the sequence you want and with the correct signs (positive values for cash received, negative values for cash paid)
- If the specified values array does not contain at least one negative and at least one positive value, MIRR returns #DIV/0! Error.

- If any of the specified arguments is a non-numeric value, MIRR returns #VALUE! Error.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

A	B	C	D	E	B	C	D	E	
1					1				
2	Year	Amount	Borrow	Invest	2	Year	Amount	Borrow	Invest
3	0	-120000	0.1	0.12	3	0	-120000	0.1	0.12
4	1	39000			4	1	39000		
5	2	30000	<b>MIRR</b>	=MIRR(C3:C8,D3,E3)	5	2	30000	<b>MIRR</b>	12.6%
6	3	21000	<b>IRR</b>	=IRR(C3:C8)	6	3	21000	<b>IRR</b>	13.1%
7	4	37000			7	4	37000		
8	5	46000			8	5	46000		

# 172. NOMINAL Function

## Description

Returns the nominal annual interest rate, given the effective rate and the number of compounding periods per year.

## Syntax

```
NOMINAL (effect_rate, npery)
```

## Arguments

Argument	Description	Required /Optional
Effect_rate	The effective interest rate.	Required
Npery	The number of compounding periods per year.	Required

## Notes

- Npery is truncated to an integer.
- If either of the arguments is nonnumeric, NOMINAL returns the #VALUE! error value.
- If effect\_rate ≤ 0 or if npery < 1, NOMINAL returns the #NUM! error value.
- NOMINAL (effect\_rate,nperry) is related to EFFECT(nominal\_rate,nperry) through  
$$\text{effective\_rate} = \left(1 + \frac{\text{Nominal\_rate}}{\text{Nperry}}\right)^{\frac{1}{\text{Nperry}}} - 1$$
- The relationship between NOMINAL and EFFECT is shown in the following equation:

$$\text{EFFECT} = \left(1 + \frac{\text{Nominal\_rate}}{\text{Nperry}}\right)^{\frac{1}{\text{Nperry}}} - 1$$

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Effective Annual Interest Rate	0.082	2	Effective Annual Interest Rate	8.2%
3	Number Of Compounding Periods Per Year (Compounded Quarterly)	4	3	Number Of Compounding Periods Per Year (Compounded Quarterly)	4
4	Nominal Annual Interest Rate	=NOMINAL(C2,C3)	4	Nominal Annual Interest Rate	8.0%

# 173. NPER Function

## Description

The NPER function returns the number of periods for an investment based on periodic, constant payments and a constant interest rate.

## Syntax

```
NPER (rate,pmt,pv,[fv],[type])
```

## Arguments

Argument	Description	Required /Optional
Rate	The interest rate per period.	Required
Pmt	The payment made each period. It cannot change over the life of the annuity. Typically, pmt contains principal and interest but no other fees or taxes.	Required
Pv	The present value, or the lump-sum amount that a series of future payments is worth right now.	Optional
Fv	The future value, or a cash balance you want to attain after the last payment is made. If fv is omitted, it is assumed to be 0 (the future value of a loan, for example, is 0).	Optional
Type	The number 0 or 1 and indicates when payments are due. See Table given below. If type is omitted, it is assumed to be 0.	Optional

Set type equal to	If payments are due
0	At the end of the period
1	At the beginning of the period

For complete description of the arguments in NPER and for more information about annuity functions, see PV.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Annual interest rate	0.08	2	Annual interest	8%
3	Payment made each period	-200	3	Payment made	-200
4	Present value	-500	4	Present value	-500
5	Future value	45000	5	Future value	45000
6	No. of Periods for the Investment	=NPER(C2/12, C3, C4, C5, 1)	6	No. of Periods for	135

# 174. NPV Function

## Description

The NPV function calculates the net present value of an investment by using a discount rate and a series of future payments (negative values) and income (positive values).

## Syntax

```
NPV (rate,value1,[value2],...)
```

## Arguments

Argument	Description	Required / Optional
Rate	The rate of discount over the length of one period.	Required
Value1	1 to 254 arguments representing the payments and income.	Required
value2, ...		Optional

## Notes

- If n is the number of cash flows in the list of values, the formula for NPV is-  
$$NPV = \sum_{i=1}^n \frac{values_i}{(1+rate)^i}$$
- Value1, value2 ... must be equally spaced in time and occur at the end of each period.
- NPV uses the order of value1, value2 ... to interpret the order of cash flows.
- Be sure to enter your payment and income values in the correct sequence.
- The NPV investment begins one period before the date of the value1 cash flow and ends with the last cash flow in the list. The NPV calculation is based on future cash flows. If your first cash flow occurs at the beginning of the first period, the first value must be added to the NPV result, not included in the values arguments.
- Arguments that are empty cells, logical values, or text representations of numbers, error values, or text that cannot be translated into numbers are ignored.
- If an argument is an array or reference, only numbers in that array or reference are counted. Empty cells, logical values, text, or error values in the array or reference are ignored.
- NPV is similar to the PV function (present value). The primary difference between PV and NPV is that PV allows cash flows to begin either at the end or at the beginning of the period. Unlike the variable NPV cash flow values, PV cash flows must be constant throughout the investment.

- NPV is also related to the IRR function (internal rate of return). IRR is the rate for which NPV equals zero-

$$\text{NPV}(\text{IRR}(\dots) \dots) = 0.$$

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Interest Rate	0.1	2	Interest Rate	10%
3			3		
4	Year	Cash flow	4	Year	Cash flow
5	0	=-600	5	0	(600)
6	1	200	6	1	200
7	2	200	7	2	200
8	3	500	8	3	500
9			9		
10	NPV	=NPV(C2,C6:C8)	10	NPV	723

# 175. ODDFPRICE Function

## Description

The ODDFPRICE function returns the price per \$100 face value of a security having an odd (short or long) first period.

## Syntax

```
ODDFPRICE (settlement, maturity, issue, first_coupon, rate, yld, redemption, frequency, [basis])
```

## Arguments

Argument	Description	Required /Optional
Settlement	The security's settlement date. The security settlement date is the date after the issue date when the security is traded to the buyer.	Required
Maturity	The security's maturity date. The maturity date is the date when the security expires.	Required
Issue	The security's issue date.	Required
First_coupon	The security's first coupon date.	Required
Rate	The security's interest rate.	Required
Yld	The security's annual yield.	Required
Redemption	The security's redemption value per \$100 face value.	Required
Frequency	The number of coupon payments per year. <ul style="list-style-type: none"><li>• for annual payments, frequency = 1</li><li>• for semiannual, frequency = 2</li><li>• for quarterly, frequency = 4</li></ul>	Required
Basis	The type of day count basis to use. Look at the Day Count Basis Table given below.	Optional

## Day Count Basis Table

Basis	Day Count Basis
0 or omitted	US (NASD) 30/360
1	Actual/actual
2	Actual/360
3	Actual/365
4	European 30/360

## Notes

- ODDFPRICE is calculated as follows-
  - **Odd short first coupon-**

$$\text{ODDFPRICE} = \left[ \frac{\text{redemption}}{\left( 1 + \frac{\text{yld}}{\text{frequency}} \right)^{\left( \frac{N+1+\frac{\text{DSC}}{\text{E}}}{\text{E}} \right)}} \right] + \left[ \frac{100 \times \frac{\text{rate}}{\text{frequency}} \times \frac{\text{DFC}}{\text{E}}}{\left( 1 + \frac{\text{yld}}{\text{frequency}} \right)^{\frac{\text{DSC}}{\text{E}}}} \right]$$

$$+ \left[ \sum_{k=2}^N \frac{100 \times \frac{\text{rate}}{\text{frequency}}}{\left( 1 + \frac{\text{yld}}{\text{frequency}} \right)^{\left( \frac{k+1+\frac{\text{DSC}}{\text{E}}}{\text{E}} \right)}} \right]$$

$$- \left[ 100 \times \frac{\text{rate}}{\text{frequency}} \times \frac{A}{\text{E}} \right]$$

Where

A = number of days from the beginning of the coupon period to the settlement date (accrued days).

DSC = number of days from the settlement to the next coupon date.

DFC = number of days from the beginning of the odd first coupon to the first coupon date.

E = number of days in the coupon period.

N = number of coupons payable between the settlement date and the redemption date.  
(If this number contains a fraction, it is raised to the next whole number.)

- **Odd long first coupon**

$$\begin{aligned}
 ODDFPRICE = & \left[ \frac{\text{redemption}}{\left(1 + \frac{\text{yld}}{\text{frequency}}\right)^{\left(\frac{N+N_f - DSC}{E}\right)}} \right] \\
 & + \left[ \frac{100 \times \frac{\text{rate}}{\text{frequency}} \times \left[ \sum_{j=1}^{NC} \frac{DC_j}{NL_j} \right]}{\left(1 + \frac{\text{yld}}{\text{frequency}}\right)^{\left(\frac{N_f - DSC}{E}\right)}} \right] \\
 & + \left[ \sum_{k=1}^N \frac{100 \times \frac{\text{rate}}{\text{frequency}}}{\left(1 + \frac{\text{yld}}{\text{frequency}}\right)^{\left(k - N_f + \frac{DSC}{E}\right)}} \right] \\
 & - \left[ 100 \times \frac{\text{rate}}{\text{frequency}} \times \sum_{i=1}^{NC} \frac{A_i}{NL_i} \right]
 \end{aligned}$$

Where

$A_i$  = number of days from the beginning of the  $i$ th, or last, quasi-coupon period within odd period.

$DC_i$  = number of days from dated date (or issue date) to first quasi-coupon ( $i = 1$ ) or number of days in quasi-coupon ( $i = 2, \dots, i = NC$ ).

$DSC$  = number of days from settlement to next coupon date.

$E$  = number of days in coupon period.

$N$  = number of coupons payable between the first real coupon date and redemption date. (If this number contains a fraction, it is raised to the next whole number.)

$NC$  = number of quasi-coupon periods that fit in odd period. (If this number contains a fraction, it is raised to the next whole number.)

$NL_i$  = normal length in days of the full  $i$ th, or last, quasi-coupon period within odd period.

$N_q$  = number of whole quasi-coupon periods between settlement date and first coupon.

- Dates should be entered by using the DATE Function, or as results of other formulas or functions. E.g. use DATE (2008,5,23) for the 23rd day of May, 2008. Problems can occur if dates are entered as text
- Microsoft Excel stores dates as sequential serial numbers so they can be used in calculations. By default, January 1, 1900 is serial number 1, and January 1, 2008 is serial number 39448 because it is 39,448 days after January 1, 1900
- The settlement date is the date a buyer purchases a coupon, such as a bond.

- The maturity date is the date when a coupon expires.
- For example, suppose a 30-year bond is issued on January 1, 2008, and is purchased by a buyer six months later, then-
  - the issue date would be January 1, 2008
  - the settlement date would be July 1, 2008
  - the maturity date would be January 1, 2038, which is 30 years after the January 1, 2008, issue date
- Settlement, maturity, issue, first\_coupon, and basis are truncated to integers.
- If settlement, maturity, issue, or first\_coupon is not a valid Excel date, ODDFPRICE returns the #VALUE! error value.
- If any of the specified arguments is non-numeric, ODDFPRICE returns the #VALUE! error value.
- The following date condition must be satisfied. Otherwise, ODDFPRICE returns the #NUM! error value-
 
$$\text{maturity} \geq \text{first\_coupon} \geq \text{settlement} \geq \text{issue}$$
- If rate < 0 or if yld < 0, ODDFPRICE returns the #NUM! error value.
- If frequency is any number other than 1, 2, or 4, ODDFPRICE returns the #NUM! error value.
- If basis < 0 or if basis > 4, ODDFPRICE returns the #NUM! error value.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage		Results	
1			
2	Settlement	42319	2
3	Maturity	44256	3/1/2021
4	Issue	42292	10/15/2015
5	First Coupon	42430	3/1/2016
6	Rate	0.0825	8.25%
7	Yield	0.0725	7.25%
8	Redemption	200	\$200.00
9	Frequency	2	2
10	Basis	1	1
11	Price	=ODDFPRICE(C2,C3,C4,C5,C6,C7,C8,C9,C10)	\$172.88

# 176. ODDFYIELD Function

## Description

The ODDFYIELD function returns the yield of a security that has an odd (short or long) first period.

## Syntax

```
ODDFYIELD (settlement, maturity, issue, first_coupon, rate, pr, redemption, frequency, [basis])
```

## Arguments

Argument	Description	Required /Optional
Settlement	The security's settlement date. The security settlement date is the date after the issue date when the security is traded to the buyer.	Required
Maturity	The security's maturity date. The maturity date is the date when the security expires.	Required
Issue	The security's issue date.	Required
First_coupon	The security's first coupon date.	Required
Rate	The security's interest rate.	Required
Pr	The security's price.	Required
Redemption	The security's redemption value per \$100 face value.	Required
Frequency	The number of coupon payments per year. <ul style="list-style-type: none"><li>• for annual payments, frequency = 1</li><li>• for semiannual, frequency = 2</li><li>• for quarterly, frequency = 4</li></ul>	Required
Basis	The type of day count basis to use. Look at the Day Count Basis Table given below.	Optional

## Day Count Basis Table

Basis	Day Count Basis
0 or omitted	US (NASD) 30/360
1	Actual/actual
2	Actual/360
3	Actual/365
4	European 30/360

## Notes

- Dates should be entered by using the DATE Function, or as results of other formulas or functions. For example, use DATE (2008,5,23) for the 23rd day of May, 2008. Problems can occur if dates are entered as text.
- Microsoft Excel stores dates as sequential serial numbers so they can be used in calculations. By default, January 1, 1900 is serial number 1, and January 1, 2008 is serial number 39448 because it is 39,448 days after January 1, 1900

- The settlement date is the date a buyer purchases a coupon, such as a bond.
- The maturity date is the date when a coupon expires.
- For example, suppose a 30-year bond is issued on January 1, 2008, and is purchased by a buyer six months later, then-
  - the issue date would be January 1, 2008
  - the settlement date would be July 1, 2008
  - the maturity date would be January 1, 2038, which is 30 years after the January 1, 2008, issue date.
- Settlement, maturity, issue, first\_coupon, and basis are truncated to integers.
- If settlement, maturity, issue, or first\_coupon is not a valid Excel date, ODDFYIELD returns the #VALUE! error value.
- If any of the specified arguments is non-numeric, ODDFYIELD returns the #VALUE! error value.
- If rate < 0 or if pr ≤ 0, ODDFYIELD returns the #NUM! error value.
- If frequency is any number other than 1, 2, or 4, ODDFYIELD returns the #NUM! error value. If basis < 0 or if basis > 4, ODDFYIELD returns the #NUM! error value.
- The following date condition must be satisfied; otherwise, ODDFYIELD returns the #NUM! error value-

$$\text{maturity} \geq \text{first\_coupon} \geq \text{settlement} \geq \text{issue}$$

- Excel uses an iterative technique to calculate ODDFYIELD. This Function uses the Newton method based on the formula used for the Function ODDFPRICE. The yield is changed through 100 iterations until the estimated price with the given yield is close to the price. Refer ODDFPRICE Function for the formula that ODDFYIELD uses.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage		Results		
	B		C	
1		1		
2	<b>Settlement</b>	42319	<b>Settlement</b>	11/11/2015
3	<b>Maturity</b>	44256	<b>Maturity</b>	3/1/2021
4	<b>Issue</b>	42292	<b>Issue</b>	10/15/2015
5	<b>First Coupon</b>	42430	<b>First Coupon</b>	3/1/2016
6	<b>Rate</b>	0.0825	<b>Rate</b>	8.25%
7	<b>Price</b>	172.9	<b>Price</b>	\$172.90
8	<b>Redemption</b>	200	<b>Redemption</b>	\$200.00
9	<b>Frequency</b>	2	<b>Frequency</b>	2
10	<b>Basis</b>	1	<b>Basis</b>	1
11	<b>Yield</b>	=ODDFYIELD(C2,C3,C4,C5,C6,C7,C8,C9,C10)	<b>Yield</b>	7.25%

# 177. ODDLPRICE Function

## Description

The ODDLPRICE function returns the price per \$100 face value of a security having an odd (short or long) last coupon period.

## Syntax

```
ODDLPRICE (settlement, maturity, last_interest, rate, yld, redemption, frequency,  
[basis])
```

## Arguments

Argument	Description	Required /Optional
Settlement	The security's settlement date. The security settlement date is the date after the issue date when the security is traded to the buyer.	Required
Maturity	The security's maturity date. The maturity date is the date when the security expires.	Required
Last_interest	The security's last coupon date.	Required
Rate	The security's interest rate.	Required
Yld	The security's annual yield.	Required
Redemption	The security's redemption value per \$100 face value.	Required
Frequency	The number of coupon payments per year. <ul style="list-style-type: none"><li>• for annual payments, frequency = 1</li><li>• for semiannual, frequency = 2</li><li>• for quarterly, frequency = 4</li></ul>	Required
Basis	The type of day count basis to use. Look at the Day Count Basis Table given below.	Optional

## Day Count Basis Table

Basis	Day Count Basis
0 or omitted	US (NASD) 30/360
1	Actual/actual
2	Actual/360
3	Actual/365
4	European 30/360

## Notes

- Dates should be entered by using the DATE Function, or as results of other formulas or functions. For example, use DATE (2008,5,23) for the 23rd day of May, 2008. Problems can occur if dates are entered as text.

- Microsoft Excel stores dates as sequential serial numbers so they can be used in calculations. By default, January 1, 1900 is serial number 1, and January 1, 2008 is serial number 39448 because it is 39,448 days after January 1, 1900
- The settlement date is the date a buyer purchases a coupon, such as a bond.
- The maturity date is the date when a coupon expires.
- For example, suppose a 30-year bond is issued on January 1, 2008, and is purchased by a buyer six months later, then-
  - the issue date would be January 1, 2008
  - the settlement date would be July 1, 2008
  - the maturity date would be January 1, 2038, which is 30 years after the January 1, 2008, issue date
- Settlement, maturity, issue, first\_coupon, and basis are truncated to integers.
- If settlement, maturity, or last\_interest is not a valid Excel date, ODDLPRICE returns the #VALUE! error value.
- If any of the specified arguments is non-numeric, ODDLPRICE returns the #VALUE! error value.
- If rate < 0 or if yld < 0, ODDLPRICE returns the #NUM! error value.
- If basis < 0 or if basis > 4, ODDLPRICE returns the #NUM! error value.
- The following date condition must be satisfied; otherwise, ODDLPRICE returns the #NUM! error value-

maturity > settlement > last\_coupon

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage		Results	
A	B	A	B
1		1	
2	Settlement	42319	11/11/2015
3	Maturity	44256	3/1/2021
4	Last Coupon	42217	8/1/2015
5	Rate	0.0825	8.25%
6	Yield	0.0725	7.25%
7	Redemption	200	\$200.00
8	Frequency	2	
9	Basis	1	1
10	Price	=ODDLPRICE(C2,C3,C4,C5,C6,C7,C8,C9)	\$175.43

# 178. ODDLYIELD Function

## Description

The ODDLYIELD function returns the yield of a security that has an odd (short or long) last period.

## Syntax

```
ODDLYIELD (settlement, maturity, last_interest, rate, pr, redemption, frequency, [basis])
```

## Arguments

Argument	Description	Required /Optional
Settlement	The security's settlement date. The security settlement date is the date after the issue date when the security is traded to the buyer.	Required
Maturity	The security's maturity date. The maturity date is the date when the security expires.	Required
Last_interest	The security's last coupon date.	Required
Rate	The security's interest rate.	Required
Pr	The security's price.	Required
Redemption	The security's redemption value per \$100 face value.	Required
Frequency	The number of coupon payments per year. <ul style="list-style-type: none"><li>• for annual payments, frequency = 1</li><li>• for semiannual, frequency = 2</li><li>• for quarterly, frequency = 4</li></ul>	Required
Basis	The type of day count basis to use. Look at the Day Count Basis Table given below.	Optional

## Day Count Basis Table

Basis	Day Count Basis
0 or omitted	US (NASD) 30/360
1	Actual/actual
2	Actual/360
3	Actual/365
4	European 30/360

## Notes

- ODDLYIELD is calculated as follows-

$$\text{ODDLYIELD} = \frac{\left[ \text{redemption} + \left( \left( \sum_{j=1}^{\text{NC}} \frac{\text{DC}_j}{\text{NL}_j} \right) \times \frac{100 \times \text{rate}}{\text{frequency}} \right) - \left( \text{par} + \left( \left( \sum_{j=1}^{\text{NC}} \frac{\text{A}_j}{\text{NL}_j} \right) \times \frac{100 \times \text{rate}}{\text{frequency}} \right) \right) \right]}{\text{par} + \left( \left( \sum_{j=1}^{\text{NC}} \frac{\text{A}_j}{\text{NL}_j} \right) \times \frac{100 \times \text{rate}}{\text{frequency}} \right)} \\ \times \left[ \frac{\text{frequency}}{\left( \sum_{j=1}^{\text{NC}} \frac{\text{DSC}_j}{\text{NL}_j} \right)} \right]$$

Where-

$\text{A}_i$  = number of accrued days for the ith, or last, quasi-coupon period within odd period counting forward from last interest date before redemption.

$\text{DC}_i$  = number of days counted in the ith, or last, quasi-coupon period as delimited by the length of the actual coupon period.

$\text{NC}$  = number of quasi-coupon periods that fit in odd period; if this number contains a fraction it will be raised to the next whole number.

$\text{NL}_i$  = normal length in days of the ith, or last, quasi-coupon period within odd coupon period.

- Dates should be entered by using the DATE Function, or as results of other formulas or functions. For example, use DATE (2008,5,23) for the 23rd day of May, 2008. Problems can occur if dates are entered as text
- Microsoft Excel stores dates as sequential serial numbers so they can be used in calculations. By default, January 1, 1900 is serial number 1, and January 1, 2008 is serial number 39448 because it is 39,448 days after January 1, 1900
- The settlement date is the date a buyer purchases a coupon, such as a bond
- The maturity date is the date when a coupon expires
- For example, suppose a 30-year bond is issued on January 1, 2008, and is purchased by a buyer six months later, then-
  - the issue date would be January 1, 2008
  - the settlement date would be July 1, 2008
  - the maturity date would be January 1, 2038, which is 30 years after the January 1, 2008, issue date
- Settlement, maturity, last\_interest, and basis are truncated to integers.
- If settlement, maturity, or last\_interest is not a valid date, ODDLYIELD returns the #VALUE! error value.

- If any of the specified arguments is non-numeric, ODDLYIELD returns the #VALUE! error value.
- If rate < 0 or if pr ≤ 0, ODDLYIELD returns the #NUM! error value.
- If basis < 0 or if basis > 4, ODDLYIELD returns the #NUM! error value.
- The following date condition must be satisfied; otherwise, ODDLYIELD returns the #NUM! error value-

maturity ≥ settlement ≥ last\_interest

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage		Results	
A	B	A	B
1		1	
2 Settlement	42319	2 Settlement	11/11/2015
3 Maturity	44256	3 Maturity	3/1/2021
4 Last Coupon	42217	4 Last Coupon	8/1/2015
5 Rate	0.0825	5 Rate	8.25%
6 Price	175.45	6 Price	\$175.45
7 Redemption	200	7 Redemption	\$200.00
8 Frequency	2	8 Frequency	2
9 Basis	1	9 Basis	1
10 Yield	=ODDLYIELD(C2,C3,C4,C5,C6,C7,C8,C9)	10 Yield	7.25%
		--	

# 179. PDURATION Function

## Description

The PDURATION function returns the number of periods required by an investment to reach a specified value.

PDURATION uses the following equation-

$$PDURATION = \frac{\log(specifiedValue) - \log(currentValue)}{\log(1 + rate)}$$

Where

- specifiedValue is equal to fv
- currentValue is equal to pv

## Syntax

```
PDURATION (rate, pv, fv)
```

## Arguments

Argument	Description	Required /Optional
Rate	Rate is the interest rate per period.	Required
Pv	Pv is the present value of the investment.	Required
Fv	Fv is the desired future value of the investment.	Required

## Notes

- PDURATION requires that all arguments are positive values.
- If any of the argument values are zero or negative, PDURATION returns the #NUM! error value.
- If any of the arguments is not recognized as numeric value, PDURATION returns the #VALUE! error value.

## Applicability

Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Rate	0.08	2	Rate	8.0%
3	Present Value	25000	3	Present Value	25000
4	Future Value	55000	4	Future Value	55000
5	No. of Periods	=PDURATION(C2,C3,C4)	5	No. of Periods	10.24
c					

# 180. PMT Function

## Description

The PMT function calculates the payment for a loan based on constant payments and a constant interest rate.

## Syntax

```
PMT (rate, nper, pv, [fv], [type])
```

## Arguments

Argument	Description	Required /Optional
Rate	The interest rate for the loan.	Required
Nper	The total number of payments for the loan.	Required
Pv	The present value, or the total amount that a series of future payments is worth now. Also known as the principal.	Required
Fv	The future value, or a cash balance you want to attain after the last payment is made. If fv is omitted, it is assumed to be 0 (zero), that is, the future value of a loan is 0.	Optional
Type	The number 0 (zero) or 1 and indicates when payments are due. Look at the Type-Payment Table below.	Optional

## Type-Payment Table

Set type equal to	If payments are due
0 or omitted	At the end of the period
1	At the beginning of the period

## Notes

- The payment returned by PMT includes principal and interest but no taxes, reserve payments, or fees sometimes associated with loans.
- Make sure that you are consistent about the units you use for specifying rate and nper
  - If you make monthly payments on a four-year loan at an annual interest rate of 12 percent, use 12%/12 for rate and 4\*12 for nper
  - If you make annual payments on the same loan, use 12 percent for rate and 4 for nper
- To find the total amount paid over the duration of the loan, multiply the returned PMT value by nper

- If the specified value of rate is less than or equal to -1, PMT returns #NUM! error value.
- If the specified value of nper is equal to 0, PMT returns #NUM! error value.
- If any of the specified arguments is non-numeric, PMT returns #VALUE! error value.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Loan Amount	10000	2	Loan Amount	\$10,000.00
3	Annual interest Rate	0.08	3	Annual interest Rate	8%
4	Term of Loan (in Years)	4	4	Term of Loan (in Years)	4
5	<b>Payment done Monthly</b>		5	<b>Payment done Monthly</b>	
6	Interest Rate	=C3/12	6	Interest Rate	1%
7	Number of Payments	=C4*12	7	Number of Payments	48
8	Monthly Payment (if paid at the end of the Month)	=PMT(C6,C7,C2)	8	Monthly Payment (if paid at the end of the Month)	(\$244.13)
9	Monthly Payment (if paid at the beginning of the Month)	=PMT(C6,C7,C2,,1)	9	Monthly Payment (if paid at the beginning of the Month)	(\$242.51)
10	<b>Payment done Yearly</b>		10	<b>Payment done Yearly</b>	
11	Interest Rate	0.08	11	Interest Rate	8%
12	Number of Payments	4	12	Number of Payments	4
13	Yearly Payment (if paid at the end of the Year)	=PMT(C11,C12,C2)	13	Yearly Payment (if paid at the end of the Year)	(\$3,019.21)
14	Monthly Payment (if paid at the beginning of the Year)	=PMT(C11,C12,C2,,1)	14	Monthly Payment (if paid at the beginning of the Year)	(\$2,795.56)

# 181. PPMT Function

## Description

The PPMT function returns the payment on the principal for a given period for an investment based on periodic, constant payments and a constant interest rate.

## Syntax

```
PPMT (rate, per, nper, pv, [fv], [type])
```

## Arguments

Argument	Description	Required /Optional
Rate	The interest rate per period.	Required
Per	Specifies the period and must be in the range 1 to nper.	Required
Nper	The total number of payment periods in an annuity.	Required
Pv	The present value — the total amount that a series of future payments is worth now.	Required
Fv	The future value, or a cash balance you want to attain after the last payment is made. If fv is omitted, it is assumed to be 0 (zero), that is, the future value of a loan is 0.	Optional
Type	The number 0 or 1 and indicates when payments are due. Look at the Type-Payment Table given below.	Optional

## Type-Payment Table

Set type equal to	If payments are due
0 or omitted	At the end of the period
1	At the beginning of the period

## Notes

- Make sure that you are consistent about the units you use for specifying rate and nper
  - If you make monthly payments on a four-year loan at 12 percent annual interest, use 12%/12 for rate and 4\*12 for nper
  - If you make annual payments on the same loan, use 12% for rate and 4 for nper
- If the specified per argument is < 0 or is > the specified value of nper, PPMT returns #NUM! error value.
- If any of the specified arguments is not recognized as numeric value, PPMT returns #VALUE!error value.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
	A	B		A	B
1				1	
2	Present Value	20000	2	Present Value	\$20,000
3	Interest Rate	0.08	3	Interest Rate	8%
4	Period (in Years)	3	4	Period (in Years)	3
5	Monthly Payments		5	Monthly Payments	
6	No. of Payments	36	6	No. of Payments	36
7	Interest Rate per Month	=C3/12	7	Interest Rate per Month	0.67%
8	PPMT	=PPMT(C7,C6,C6,C2)	8	PPMT	(\$622.58)

# 182. PRICE Function

## Description

The PRICE function returns the price per \$100 face value of a security that pays periodic interest.

## Syntax

```
PRICE (settlement, maturity, rate, yld, redemption, frequency, [basis])
```

## Arguments

Argument	Description	Required /Optional
Settlement	The security's settlement date. The security settlement date is the date after the issue date when the security is traded to the buyer.	Required
Maturity	The security's maturity date. The maturity date is the date when the security expires.	Required
Rate	The security's annual coupon rate.	Required
Yld	The security's annual yield.	Required
Redemption	The security's redemption value per \$100 face value.	Required
Frequency	The number of coupon payments per year. <ul style="list-style-type: none"><li>• for annual payments, frequency = 1</li><li>• for semiannual, frequency = 2</li><li>• for quarterly, frequency = 4</li></ul>	Required
Basis	The type of day count basis to use. Look at the Day Count Basis Table given below.	Optional

## Day Count Basis Table

Basis	Day Count Basis
0 or omitted	US (NASD) 30/360
1	Actual/actual
2	Actual/360
3	Actual/365
4	European 30/360

## Notes

- When  $N > 1$  ( $N$  is the number of coupons payable between the settlement date and redemption date), PRICE is calculated as follows:

$$PRICE = \left[ \frac{redemption}{\left( 1 + \frac{yld}{frequency} \right)^{\left( N-1 + \frac{DSC}{E} \right)}} \right] + \left[ \sum_{k=1}^N \frac{100 \times \frac{rate}{frequency}}{\left( 1 + \frac{yld}{frequency} \right)^{\left( k-1 + \frac{DSC}{E} \right)}} \right] - \left( 100 \times \frac{rate}{frequency} \times \frac{A}{E} \right)$$

Where:

DSC = number of days from settlement to next coupon date.

E = number of days in coupon period in which the settlement date falls.

A = number of days from beginning of coupon period to settlement date.

- When  $N = 1$  ( $N$  is the number of coupons payable between the settlement date and redemption date), PRICE is calculated as follows-

$$DSR = E - A$$

$$T1 = 100 * \frac{rate}{frequency} + redemption$$

$$T2 = \frac{yld}{frequency} * \frac{DSR}{E} + 1$$

$$T3 = 100 * \frac{rate}{frequency} * \frac{A}{E}$$

$$Price = \frac{T1}{T2} - T3$$

- Dates should be entered by using the DATE Function, or as results of other formulas or functions. For example, use DATE (2008,5,23) for the 23rd day of May, 2008. Problems can occur if dates are entered as text
- Microsoft Excel stores dates as sequential serial numbers so they can be used in calculations. By default, January 1, 1900 is serial number 1, and January 1, 2008 is serial number 39448 because it is 39,448 days after January 1, 1900.
- The settlement date is the date a buyer purchases a coupon, such as a bond.

- The maturity date is the date when a coupon expires.
- For example, suppose a 30-year bond is issued on January 1, 2008, and is purchased by a buyer six months later, then-
  - the issue date would be January 1, 2008
  - the settlement date would be July 1, 2008
  - the maturity date would be January 1, 2038, which is 30 years after the January 1, 2008, issue date
- Settlement, maturity, frequency, and basis are truncated to integers.
- If settlement or maturity is not a valid Excel date, PRICE returns the #VALUE! error value.
- If any of the specified arguments is non-numeric, PRICE returns the #VALUE! error value.
- If yld < 0 or if rate < 0, PRICE returns the #NUM! error value.
- If redemption ≤ 0, PRICE returns the #NUM! error value.
- If frequency is any number other than 1, 2, or 4, PRICE returns the #NUM! error value.
- If basis < 0 or if basis > 4, PRICE returns the #NUM! error value.
- If settlement ≥ maturity, PRICE returns the #NUM! error value.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage		Results	
A	B	A	B
1		1	
2	Settlement Date	2	Settlement Date
3	42415	3	2/15/2016
4	Maturity Date	4	2/10/2026
5	46063	5	8%
6	Rate	6	9%
7	0.08	7	100
8	Yield	8	2
9	0.09	9	0
10	Redemption	10	\$934.99
11	Frequency		
12	2		
13	Basis		
14	0		
15	Value		
16	=PRICE(C2,C3,C4,C5,C6,C7,C8)*10		

# 183. PRICEDISC Function

## Description

The PRICEDISC function returns the price per \$100 face value of a discounted security.

## Syntax

```
PRICEDISC (settlement, maturity, discount, redemption, [basis])
```

## Arguments

Argument	Description	Required /Optional
Settlement	The security's settlement date. The security settlement date is the date after the issue date when the security is traded to the buyer.	Required
Maturity	The security's maturity date. The maturity date is the date when the security expires.	Required
Discount	The security's discount rate.	Required
Redemption	The security's redemption value per \$100 face value.	Required
Basis	The type of day count basis to use. Look at the Day Count Basis Table given below.	Optional

## Day Count Basis Table

Basis	Day Count Basis
0 or omitted	US (NASD) 30/360
1	Actual/actual
2	Actual/360
3	Actual/365
4	European 30/360

## Notes

- PRICEDISC is calculated as follows-

$$PRICEDISC = \text{redemption} - \text{discount} \times \text{redemption} \times \frac{DSM}{B}$$

Where

B = number of days in year, depending on year basis.

DSM = number of days from settlement to maturity.

- Dates should be entered by using the DATE Function, or as results of other formulas or functions. For example, use DATE (2008,5,23) for the 23rd day of May, 2008. Problems can occur if dates are entered as text

- Microsoft Excel stores dates as sequential serial numbers so they can be used in calculations. By default, January 1, 1900 is serial number 1, and January 1, 2008 is serial number 39448 because it is 39,448 days after January 1, 1900
- The settlement date is the date a buyer purchases a coupon, such as a bond
- The maturity date is the date when a coupon expires
- For example, suppose a 30-year bond is issued on January 1, 2008, and is purchased by a buyer six months later, then-
  - the issue date would be January 1, 2008
  - the settlement date would be July 1, 2008
  - the maturity date would be January 1, 2038, which is 30 years after the January 1, 2008, issue date
- Settlement, maturity, and basis are truncated to integers.
- If settlement or maturity is not a valid Excel date, PRICEDISC returns the #VALUE! error value.
- If any of the specified arguments is non-numeric, PRICEDISC returns the #VALUE! error value.
- If discount  $\leq 0$  or if redemption  $\leq 0$ , PRICEDISC returns the #NUM! error value.
- If basis < 0 or if basis > 4, PRICEDISC returns the #NUM! error value.
- If settlement  $\geq$  maturity, PRICEDISC returns the #NUM! error value.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage		Results	
	B		C
1		1	
2	Settlement	42078	2
3	Maturity	42335	3
4	Discount	0.04	4
5	Redemption	200	5
6	Basis	2	6
7	Price	=PRICEDISC(C2,C3,C4,C5,C6)	7

# 184. PRICEMAT Function

## Description

The PRICEMAT function returns the price per \$100 face value of a security that pays interest at maturity.

## Syntax

```
PRICEMAT (settlement, maturity, issue, rate, yld, [basis])
```

## Arguments

Argument	Description	Required /Optional
Settlement	The security's settlement date. The security settlement date is the date after the issue date when the security is traded to the buyer.	Required
Maturity	The security's maturity date. The maturity date is the date when the security expires.	Required
Issue	The security's issue date, expressed as a serial date number.	Required
Rate	The security's interest rate at date of issue.	Required
Yld	The security's annual yield.	Required
Basis	The type of day count basis to use. Look at the Day Count Basis Table given below.	Optional

## Day Count Basis Table

Basis	Day Count Basis
0 (zero) or omitted	US (NASD) 30/360
1	Actual/actual
2	Actual/360
3	Actual/365
4	European 30/360

## Notes

- PRICEMAT is calculated as follows-

$$PRICEMAT = \frac{100 + \left( \frac{DIM}{B} \times rate \times 100 \right)}{1 + \left( \frac{DSM}{B} \times yld \right)} - \left( \frac{A}{B} \times rate \times 100 \right)$$

Where

B = number of days in year, depending on year basis.

DSM = number of days from settlement to maturity.

DIM = number of days from issue to maturity.

A = number of days from issue to settlement.

- Dates should be entered by using the DATE Function, or as results of other formulas or functions. E.g. use DATE (2008,5,23) for the 23rd day of May, 2008. Problems can occur if dates are entered as text
- Microsoft Excel stores dates as sequential serial numbers so they can be used in calculations. By default, January 1, 1900 is serial number 1, and January 1, 2008 is serial number 39448 because it is 39,448 days after January 1, 1900
- The settlement date is the date a buyer purchases a coupon, such as a bond
- The maturity date is the date when a coupon expires
- For example, suppose a 30-year bond is issued on January 1, 2008, and is purchased by a buyer six months later, then-
  - the issue date would be January 1, 2008
  - the settlement date would be July 1, 2008
  - the maturity date would be January 1, 2038, which is 30 years after the January 1, 2008, issue date
- Settlement, maturity, issue, and basis are truncated to integers.
- If settlement, maturity, or issue is not a valid Excel date, PRICEMAT returns the #VALUE! error value.
- If any of the specified arguments is non-numeric, PRICEMAT returns the #VALUE! error value.
- If rate < 0 or if yld < 0, PRICEMAT returns the #NUM! error value.
- If basis < 0 or if basis > 4, PRICEMAT returns the #NUM! error value.
- If settlement ≥ maturity, PRICEMAT returns the #NUM! error value.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage		Results	
Settlement	42078	Settlement	3/15/2015
Maturity	45988	Maturity	11/27/2025
Issue	42005	Issue	1/1/2015
Rate	0.08	Rate	8.00%
Yield	0.0825	Yield	8.25%
Basis	2	Basis	2
Price	=PRICEMAT(C2,C3,C4,C5,C6,C7)	Price	97.80

# 185. PV Function

## Description

The PV function calculates the present value of a loan or an investment, based on a constant interest rate. You can use PV with either periodic, constant payments (such as a mortgage or other loan), or a future value, which is your investment goal.

## Syntax

```
PV (rate, nper, pmt, [fv], [type])
```

## Arguments

Argument	Description	Required /Optional
Rate	The interest rate per period.	Required
Nper	The total number of payment periods in an annuity.	Required
Pmt	The payment made each period and cannot change over the life of the annuity. Typically, pmt includes principal and interest but no other fees or taxes.	Required
Fv	The future value, or a cash balance you want to attain after the last payment is made. If fv is omitted, it is assumed to be 0 (the future value of a loan, for example, is 0).	Optional
Type	The number 0 or 1 and indicates when payments are due. Look at the Type-Payment Table given below.	Optional

## Type-Payment Table

Set type equal to	If payments are due
0 or omitted	At the end of the period
1	At the beginning of the period

## Notes

- Make sure that you are consistent about the units you use for specifying rate and nper
  - If you make monthly payments on a four-year loan at 12 percent annual interest, use 12%/12 for rate and 4\*12 for nper
  - If you make annual payments on the same loan, use 12% for rate and 4 for nper
- The following functions apply to annuities:
  - CUMIPMT
  - CUMPRINC
  - FV

- FVSCHEDULE
- IPMT
- PMT
- PPMT
- PV
- RATE
- XIRR
- XNPV
- An annuity is a series of constant cash payments made over a continuous period.
- For example, a car loan or a mortgage is an annuity. In annuity functions,
  - cash you pay out, such as a deposit to savings, is represented by a negative number
  - cash you receive, such as a dividend check, is represented by a positive number
- Microsoft Excel solves for one financial argument in terms of the others. If rate is not 0, then-

$$pv * (1 + rate)^{nper} + pmt(1 + rate * type) * \left( \frac{(1 + rate)^{nper} - 1}{rate} \right) + fv = 0$$

If rate is 0, then-

$$(pmt * nper) + pv + fv = 0$$

- If any of the specified arguments is non-numeric, PV returns #VALUE! Error.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Rate	0.08	2	Rate	8.00%
3	No. of Periods (Years)	20	3	No. of Periods	20
4	Payment	500	4	Payment	\$500.00
5	Type	0	5	Type	0
6	Present Value	=PV(C2,C3,C4,,C5)	6	Present Value	(\$4,909.07)

# 186. RATE Function

## Description

The RATE function returns the interest rate per period of an annuity. RATE is calculated by iteration and can have zero or more solutions. If the successive results of RATE do not converge to within 0.0000001 after 20 iterations, RATE returns the #NUM! Error value.

## Syntax

```
RATE (nper, pmt, pv, [fv], [type], [guess])
```

For a complete description of the arguments nper, pmt, pv, fv, and type, refer PV Function.

## Arguments

Argument	Description	Required /Optional
Nper	The total number of payment periods in an annuity.	Required
Pmt	The payment made each period and cannot change over the life of the annuity. Typically, pmt includes principal and interest but no other fees or taxes. If pmt is omitted, you must include the fv argument.	Required
Pv	The present value — the total amount that a series of future payments is worth now.	Required
Fv	The future value, or a cash balance you want to attain after the last payment is made. If fv is omitted, it is assumed to be 0 (the future value of a loan, for example, is 0). If fv is omitted, you must include the pmt argument.	Optional
Type	The number 0 or 1 and indicates when payments are due. Look at the Type-Payment Table given below.	Optional
Guess	Your guess for what the rate will be. If you omit guess, it is assumed to be 10 percent. If RATE does not converge, try different values for guess. RATE usually converges if guess is between 0 and 1.	Optional

## Type-Payment Table

Set type equal to	If payments are due
0 or omitted	At the end of the period
1	At the beginning of the period

## Notes

- Make sure that you are consistent about the units you use for specifying guess and nper
  - If you make monthly payments on a four-year loan at 12 percent annual interest, use 12%/12 for guess and 4\*12 for nper
  - If you make annual payments on the same loan, use 12% for guess and 4 for nper
- If the Function fails to converge to a solution, RATE returns #NUM! error.
- If any of the specified arguments is non-numeric, RATE returns #VALUE! Error.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Loan Amount	8000	2	Loan Amount	\$8,000
3	Loan Term (in Years)	4	3	Loan Term (in Years)	4
4	Monthly Payment	-200	4	Monthly Payment	-\$200
5	No. of Monthly Payments	=C3*12	5	No. of Monthly Payments	48
6	Rate	=RATE(C5,C4,C2)	6	Rate	0.77%
7	Annual Rate	=C6*12	7	Annual Rate	9.24%
8			-		

# 187. RECEIVED Function

## Description

The RECEIVED function returns the amount received at maturity for a fully invested security.

## Syntax

```
RECEIVED (settlement, maturity, investment, discount, [basis])
```

## Arguments

Argument	Description	Required /Optional
Settlement	The security's settlement date. The security settlement date is the date after the issue date when the security is traded to the buyer.	Required
Maturity	The security's maturity date. The maturity date is the date when the security expires.	Required
Investment	The amount invested in the security.	Required
Discount	The security's discount rate.	Required
Basis	The type of day count basis to use. Look at the Day Count Basis Table given below.	Optional

## Day Count Basis Table

Basis	Day Count Basis
0 or omitted	US (NASD) 30/360
1	Actual/actual
2	Actual/360
3	Actual/365
4	European 30/360

## Notes

- RECEIVED is calculated as follows-

$$RECEIVED = \frac{investment}{1 - (discount \times \frac{DIM}{B})}$$

Where

B = number of days in a year, depending on the year basis.

DIM = number of days from issue to maturity.

- Dates should be entered by using the DATE Function, or as results of other formulas or functions. For example, use DATE (2008,5,23) for the 23rd day of May, 2008. Problems can occur if dates are entered as text.
- Microsoft Excel stores dates as sequential serial numbers so they can be used in calculations. By default, January 1, 1900 is serial number 1, and January 1, 2008 is serial number 39448 because it is 39,448 days after January 1, 1900
- The settlement date is the date a buyer purchases a coupon, such as a bond.
- The maturity date is the date when a coupon expires.
- For example, suppose a 30-year bond is issued on January 1, 2008, and is purchased by a buyer six months later, then-
  - the issue date would be January 1, 2008
  - the settlement date would be July 1, 2008
  - the maturity date would be January 1, 2038, which is 30 years after the January 1, 2008, issue date
- Settlement, maturity, and basis are truncated to integers.
- If settlement or maturity is not a valid Excel date, RECEIVED returns the #VALUE! error value.
- If any of the specified arguments is non-numeric, RECEIVED returns the #VALUE! error value.
- If investment  $\leq 0$  or if discount  $\leq 0$ , RECEIVED returns the #NUM! error value.
- If basis  $< 0$  or if basis  $> 4$ , RECEIVED returns the #NUM! error value.
- If settlement  $\geq$  maturity, RECEIVED returns the #NUM! error value.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
	A	B		A	B
1			1		
2	Settlement	42078	2	Settlement	3/15/2015
3	Maturity	42335	3	Maturity	11/27/2015
4	Investment	1500000	4	Investment	\$1,500,000.00
5	Discount	0.04	5	Discount	4.00%
6	Basis	2	6	Basis	2
7	Amount Received	=RECEIVED(C2,C3,C4,C5,C6)	7	Amount Received	\$1,544,092.42
~			~		

# 188. RRI Function

## Description

The RRI function returns an equivalent interest rate for the growth of an investment.

## Syntax

```
RRI (nper, pv, fv)
```

RRI returns the interest rate given nper (the number of periods), pv (present value), and fv (future value), calculated by using the following equation:

$$\frac{Fv^{(1/Nper)} - 1}{Pv}$$

## Arguments

Argument	Description	Required /Optional
Nper	Nper is the number of periods for the investment.	Required
Pv	Pv is the present value of the investment.	Required
Fv	Fv is the future value of the investment.	Required

## Notes

- If nper or pv is zero, RRI returns #NUM! error.
- If any of the specified arguments is negative, RRI returns #NUM! error.
- If any of the specified arguments is not recognized as a numeric value, RRI returns #VALUE! Error.

## Applicability

Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	No. of Periods (in Years)	15	2	No. of Periods (in Years)	15
3	Present Value	10000	3	Present Value	10000
4	Future Value	15000	4	Future Value	15000
5	Equivalent Interest Rate	=RRI(C2,C3,C4)	5	Equivalent Interest Rate	2.74%

# 189. SLN Function

## Description

The SLN function returns the straight-line depreciation of an asset for one period.

## Syntax

```
SLN (cost, salvage, life)
```

## Arguments

Argument	Description	Required /Optional
Cost	The initial cost of the asset.	Required
Salvage	The value at the end of the depreciation (sometimes called the salvage value of the asset).	Required
Life	The number of periods over which the asset is depreciated (sometimes called the useful life of the asset).	Required

## Notes

- If the specified life argument is 0, SLN returns #DIV/0! Error.
- If any of the specified life arguments is a non-numeric value, SLN returns non-numeric value Error.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2		Machine 1      Machine 2	2		Machine 1      Machine 2
3	Price	40000      75000	3	Price	40,000      75,000
4	Shipping and Installation	0      6000	4	Shipping and Installation	0      6,000
5	Salvage Value	0      15000	5	Salvage Value	0      15,000
6	Life	10      5	6	Life	10      5
7	Depreciation	=SLN(C3+C4, C5,C6)      =SLN(D3+D4, D5,D6)	7	Depreciation	4,000      13,200

# 190. SYD Function

## Description

The SYD function returns the sum-of-years' digits depreciation of an asset for a specified period.

## Syntax

```
SYD (cost, salvage, life, per)
```

## Arguments

Argument	Description	Required /Optional
Cost	The initial cost of the asset.	Required
Salvage	The value at the end of the depreciation (sometimes called the salvage value of the asset).	Required
Life	The number of periods over which the asset is depreciated (sometimes called the useful life of the asset).	Required
Per	The period and must use the same units as life.	Required

## Notes

- SYD is calculated as follows-

$$SYD = \frac{(cost - salvage) * (life - per + 1) * 2}{(life)(life + 1)}$$

- If the specified salvage argument is < 0, SYD returns #NUM! error.
- If the specified life or the specified per argument is  $\leq 0$ , SYD returns #NUM! error.
- If the specified per is greater than the specified life argument, SYD returns #NUM! error.
- If any of the specified values is non-numeric, SYD returns #VALUE! Error.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

**Example**

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	<b>Cost</b>	10000	2	<b>Cost</b>	\$10,000
3	<b>Life (years)</b>	10	3	<b>Life (years)</b>	10
4	<b>Salvage Value</b>	1000	4	<b>Salvage Value</b>	\$1,000
5	<b>Period</b>	10	5	<b>Period</b>	10
6	<b>SYD</b>	=SYD(C2,C4,C3,C5)	6	<b>SYD</b>	\$163.64
~			~		

# 191. TBILLEQ Function

## Description

The TBILLEQ function returns the bond-equivalent yield for a Treasury bill.

## Syntax

```
TBILLEQ (settlement, maturity, discount)
```

## Arguments

Argument	Description	Required /Optional
Settlement	The Treasury bill's settlement date. The security settlement date is the date after the issue date when the Treasury bill is traded to the buyer.	Required
Maturity	The Treasury bill's maturity date. The maturity date is the date when the Treasury bill expires.	Required
Discount	The Treasury bill's discount rate.	Required

## Notes

- TBILLEQ is calculated as

$$\text{TBILLEQ} = (365 \times \text{rate})/(360 - (\text{rate} \times \text{DSM}))$$

Where DSM is the number of days between settlement and maturity computed according to the 360 days per year basis.

- Dates should be entered by using the DATE Function, or as results of other formulas or functions. For example, use DATE (2008,5,23) for the 23rd day of May, 2008. Problems can occur if dates are entered as text.
- Microsoft Excel stores dates as sequential serial numbers so they can be used in calculations. By default, January 1, 1900 is serial number 1, and January 1, 2008 is serial number 39448 because it is 39,448 days after January 1, 1900.
- Settlement and maturity are truncated to integers.
- If settlement or maturity is not a valid Excel date, TBILLEQ returns the #VALUE! error value.
- If any of the specified arguments is non-numeric, TBILLEQ returns the #VALUE! error value.
- If discount  $\leq 0$ , TBILLEQ returns the #NUM! error value.

- If settlement > maturity, or if maturity is more than one year after settlement, TBILLEQ returns the #NUM! error value.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Settlement	42078	2	Settlement	3/15/2015
3	Maturity	42335	3	Maturity	11/27/2015
4	Discount	0.04	4	Discount	4.00%
5	Bond Equivalent Yield	=TBILLEQ(C2,C3,C4)	5	Bond Equivalent Yield	4.15%
6					

# 192. TBILLPRICE Function

## Description

The TBILLPRICE function returns the price per \$100 face value for a Treasury bill.

## Syntax

```
TBILLPRICE (settlement, maturity, discount)
```

## Arguments

Argument	Description	Required /Optional
Settlement	The Treasury bill's settlement date. The security settlement date is the date after the issue date when the Treasury bill is traded to the buyer.	Required
Maturity	The Treasury bill's maturity date. The maturity date is the date when the Treasury bill expires.	Required
Discount	The Treasury bill's discount rate.	Required

## Notes

- TBILLPRICE is calculated as follows-

$$TBILLPRICE = 100 \times \left(1 - \frac{discount \times DSM}{360}\right)$$

Where DSM = number of days from settlement to maturity, excluding any maturity date that is more than one calendar year after the settlement date.

- Dates should be entered by using the DATE Function, or as results of other formulas or functions. For example, use DATE (2008,5,23) for the 23rd day of May, 2008. Problems can occur if dates are entered as text.
- Microsoft Excel stores dates as sequential serial numbers so they can be used in calculations. By default, January 1, 1900 is serial number 1, and January 1, 2008 is serial number 39448 because it is 39,448 days after January 1, 1900.
- Settlement and maturity are truncated to integers.
- If settlement or maturity is not a valid Excel date, TBILLPRICE returns the #VALUE! error value.
- If any of the specified arguments is non-numeric, TBILLPRICE returns the #VALUE! error value.
- If discount  $\leq 0$ , TBILLPRICE returns the #NUM! error value.

- If settlement > maturity, or if maturity is more than one year after settlement, TBILLPRICE returns the #NUM! error value.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Settlement	42078	2	Settlement	3/15/2015
3	Maturity	42335	3	Maturity	11/27/2015
4	Discount	0.04	4	Discount	4.00%
5	Price	=TBILLPRICE(C2,C3,C4)	5	Price	\$97.14
c			6		

# 193. TBILLYIELD Function

## Description

The TBILLYIELD function returns the yield for a Treasury bill.

## Syntax

```
TBILLYIELD (settlement, maturity, pr)
```

## Arguments

Argument	Description	Required /Optional
Settlement	The Treasury bill's settlement date. The security settlement date is the date after the issue date when the Treasury bill is traded to the buyer.	Required
Maturity	The Treasury bill's maturity date. The maturity date is the date when the Treasury bill expires.	Required
Pr	The Treasury bill's price per \$100 face value.	Required

## Notes

- TBILLYIELD is calculated as follows-

$$TBILLYIELD = \frac{100 - pr}{pr} \times \frac{360}{DSM}$$

Where DSM = number of days from settlement to maturity, excluding any maturity date that is more than one calendar year after the settlement date.

- Dates should be entered by using the DATE Function, or as results of other formulas or functions. For example, use DATE (2008,5,23) for the 23rd day of May, 2008. Problems can occur if dates are entered as text
- Microsoft Excel stores dates as sequential serial numbers so they can be used in calculations. By default, January 1, 1900 is serial number 1, and January 1, 2008 is serial number 39448 because it is 39,448 days after January 1, 1900
- Settlement and maturity are truncated to integers
- If settlement or maturity is not a valid Excel date, TBILLYIELD returns the #VALUE! error value
- If any of the specified arguments is non-numeric, TBILLYIELD returns the #VALUE! error value
- If pr  $\leq$  0, TBILLYIELD returns the #NUM! error value

- If settlement  $\geq$  maturity, or if maturity is more than one year after settlement, TBILLYIELD returns the #NUM! error value

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Settlement	42078	2	Settlement	3/15/2015
3	Maturity	42335	3	Maturity	11/27/2015
4	Price	97.14	4	Price	\$97.14
5	Yield	=TBILLYIELD(C2,C3,C4)	5	Yield	4.12%

# 194. VDB Function

## Description

The VDB function returns the depreciation of an asset for any period you specify, including partial periods, using the double-declining balance method or some other method you specify. VDB stands for variable declining balance.

## Syntax

```
VDB (cost, salvage, life, start_period, end_period, [factor], [no_switch])
```

## Arguments

Argument	Description	Required /Optional
Cost	The initial cost of the asset.	Required
Salvage	The value at the end of the depreciation (sometimes called the salvage value of the asset). This value can be 0.	Required
Life	The number of periods over which the asset is depreciated (sometimes called the useful life of the asset).	Required
Start_period	The starting period for which you want to calculate the depreciation. <i>Start_period must use the same units as life.</i>	Required
End_period	The ending period for which you want to calculate the depreciation. <i>End_period must use the same units as life.</i>	Required
Factor	The rate at which the balance declines. If factor is omitted, it is assumed to be 2 (the double-declining balance method). Change factor if you do not want to use the double-declining balance method. For a description of the double-declining balance method, refer DDB Function.	Optional
No_switch	A logical value specifying whether to switch to straight-line depreciation when depreciation is greater than the declining balance calculation. If no_switch is TRUE, Excel does not switch to straight-line depreciation even when the depreciation is greater than the declining balance calculation. If no_switch is FALSE or omitted, Excel switches to straight-line depreciation when depreciation is greater than the declining balance calculation.	Optional

## Notes

- All arguments except no\_switch must be positive numbers.
- If any of the specified cost, salvage, start\_period, end\_period or [factor] arguments is < 0, VDB returns #NUM! error.
- If the specified life argument is ≤ 0, VDB returns #NUM! error.
- If the specified start\_period is > the supplied end\_period, VDB returns #NUM! error.
- If start\_period > life or end\_period > life, VDB returns #NUM! error.
- If any of the specified arguments is non-numeric, VDB returns #VALUE! Error.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage		Results	
A	B	A	B
1		1	
2	Cost	2	\$10,000
3	Life (years)	3	10
4	Salvage Value	4	\$1,000
5	Starting Period	5	0
6	Ending Period	6	3
7	Factor	7	2
8	No-Switch	8	TRUE
9	VDB	9	4880

# 195. XIRR Function

## Description

The XIRR function returns the internal rate of return for a schedule of cash flows that is not necessarily periodic. To calculate the internal rate of return for a series of periodic cash flows, use the IRR function.

## Syntax

```
XIRR (values, dates, [guess])
```

## Arguments

Argument	Description	Required /Optional
Values	A series of cash flows that corresponds to a schedule of payments in dates. See Notes below.	Required
Dates	A schedule of payment dates that corresponds to the cash flow payments. Dates may occur in any order. See Notes below.	Required
Guess	A number that you guess is close to the result of XIRR.	Optional

## Notes

- The first payment is optional and corresponds to a cost or payment that occurs at the beginning of the investment
  - If the first value is a cost or payment, it must be a negative value
  - All succeeding payments are discounted based on a 365-day year
- The series of values must contain at least one positive and one negative value. Dates should be entered by using the DATE Function, or as results of other formulas or functions. Problems can occur if dates are entered as text.
- Microsoft Excel stores dates as sequential serial numbers so they can be used in calculations. By default, January 1, 1900 is serial number 1, and January 1, 2008 is serial number 39448 because it is 39,448 days after January 1, 1900.
- Numbers in dates are truncated to integers.
- XIRR expects at least one positive cash flow and one negative cash flow. Otherwise, XIRR returns the #NUM! error value.
- If any number in dates is not a valid Excel date, XIRR returns the #VALUE! error value.

- If any number in dates precedes the starting date, XIRR returns the #NUM! error value.
- If values and dates contain a different number of values, XIRR returns the #NUM! error value.
- In most cases you do not need to provide guess for the XIRR calculation. If omitted, guess is assumed to be 0.1 (10 percent)
- XIRR is closely related to XNPV, the net present value function. The rate of return calculated by XIRR is the interest rate corresponding to XNPV = 0.
- Excel uses an iterative technique for calculating XIRR. Using a changing rate (starting with guess), XIRR cycles through the calculation until the result is accurate within 0.000001 percent. If XIRR can't find a result that works after 100 tries, the #NUM! error value is returned. The rate is changed until-

$$0 = \sum_{i=1}^N \frac{P_i}{(1+rate)^{\frac{(d_i - d_1)}{365}}}$$

Where

$d_i$  = the ith, or last, payment date.

$d_1$  = the 0th payment date.

$P_i$  = the ith, or last, payment.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Date	Value	2		
3	42005	-10000	3	1/1/15	(10,000.00)
4	42064	2750	4	3/1/15	2,750.00
5	42307	4250	5	10/30/15	4,250.00
6	42415	3250	6	2/15/16	3,250.00
7	42461	2750	7	4/1/16	2,750.00
8			8		
9	XIRR	=XIRR(C3:C7,B3:B7,0.1)	9	XIRR	37.46%
..			..		

# 196. XNPV Function

## Description

The XNPV function returns the net present value for a schedule of cash flows that is not necessarily periodic. To calculate the net present value for a series of cash flows that is periodic, use the NPV function.

## Syntax

```
XNPV (rate, values, dates)
```

## Arguments

Argument	Description	Required /Optional
Rate	The discount rate to apply to the cash flows.	Required
Values	A series of cash flows that corresponds to a schedule of payments in dates. See Notes below.	Required
Dates	A schedule of payment dates that corresponds to the cash flow payments. See Notes below.	Required

## Notes

- The first payment is optional and corresponds to a cost or payment that occurs at the beginning of the investment.
- If the first value is a cost or payment, it must be a negative value.
- All succeeding payments are discounted based on a 365-day year.
- The first payment date indicates the beginning of the schedule of payments.
- All other dates must be later than this date, but they may occur in any order.
- The series of values must contain at least one positive value and one negative value.
- Microsoft Excel stores dates as sequential serial numbers so they can be used in calculations. By default, January 1, 1900 is serial number 1, and January 1, 2008 is serial number 39448 because it is 39,448 days after January 1, 1900.
- Numbers in dates are truncated to integers.
- If any argument is nonnumeric, XNPV returns the #VALUE! error value.

- If any number in dates is not a valid Excel date, XNPV returns the #VALUE! error value.
- If any number in dates precedes the starting date, XNPV returns the #NUM! error value.
- If values and dates contain a different number of values, XNPV returns the #NUM! error value.
- XNPV is calculated as follows-

$$XNPV = \sum_{i=1}^N \frac{P_i}{(1 + rate)^{\frac{(d_i - d_1)}{365}}}$$

Where

$d_i$  = the ith, or last, payment date.

$d_1$  = the 0th payment date.

$P_i$  = the ith, or last, payment.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Discount Rate	0.08	2	Discount Rate	8%
3			3		
4	Date	Value	4	Date	Value
5	42005	-10000	5	1/1/15	(10,000.00)
6	42064	2750	6	3/1/15	2,750.00
7	42307	4250	7	10/30/15	4,250.00
8	42415	3250	8	2/15/16	3,250.00
9	42461	2750	9	4/1/16	2,750.00
10			10		
11	XNPV	=XNPV(\$C\$2,C5:C9,B5:B9)	11	XNPV	2182.56
...					

# 197. YIELD Function

## Description

The YIELD function returns the yield on a security that pays periodic interest. Use YIELD to calculate bond yield.

## Syntax

```
YIELD (settlement, maturity, rate, pr, redemption, frequency, [basis])
```

## Arguments

Argument	Description	Required /Optional
Settlement	The security's settlement date. The security settlement date is the date after the issue date when the security is traded to the buyer.	Required
Maturity	The security's maturity date. The maturity date is the date when the security expires.	Required
Rate	The security's annual coupon rate.	Required
Pr	The security's price per \$100 face value.	Required
Redemption	The security's redemption value per \$100 face value.	Required
Frequency	The number of coupon payments per year. <ul style="list-style-type: none"><li>• for annual payments, frequency = 1</li><li>• for semiannual, frequency = 2</li><li>• for quarterly, frequency = 4</li></ul>	Required
Basis	The type of day count basis to use. Look at the Day Count Basis Table given below.	Optional

## Day Count Basis Table

Basis	Day Count Basis
0 or omitted	US (NASD) 30/360
1	Actual/actual
2	Actual/360
3	Actual/365
4	European 30/360

## Notes

- Dates should be entered by using the DATE Function, or as results of other formulas or functions. For example, use DATE (2008,5,23) for the 23rd day of May, 2008. Problems can occur if dates are entered as text.
- Microsoft Excel stores dates as sequential serial numbers so they can be used in calculations. By default, January 1, 1900 is serial number 1, and January 1, 2008 is serial number 39448 because it is 39,448 days after January 1, 1900.
- The settlement date is the date a buyer purchases a coupon, such as a bond.
- The maturity date is the date when a coupon expires.
- For example, suppose a 30-year bond is issued on January 1, 2008, and is purchased by a buyer six months later, then-
  - the issue date would be January 1, 2008
  - the settlement date would be July 1, 2008
  - the maturity date would be January 1, 2038, which is 30 years after the January 1, 2008, issue date
- Settlement, maturity, frequency, and basis are truncated to integers.
- If settlement or maturity is not a valid Excel date, YIELD returns the #VALUE! error value.
- If any of the specified arguments is non-numeric, YIELD returns the #VALUE! error value.
- If rate < 0, YIELD returns the #NUM! error value.
- If pr ≤ 0 or if redemption ≤ 0, YIELD returns the #NUM! error value.
- If frequency is any number other than 1, 2, or 4, YIELD returns the #NUM! error value.
- If basis < 0 or if basis > 4, YIELD returns the #NUM! error value.
- If settlement ≥ maturity, YIELD returns the #NUM! error value.
- If there is one coupon period or less until redemption, YIELD is calculated as follows-

$$YIELD = \frac{\left(\frac{redemption}{100} + \frac{rate}{frequency}\right) - \left(\frac{par}{100} + \left(\frac{A}{E} \times \frac{rate}{frequency}\right)\right)}{\frac{par}{100} + \left(\frac{A}{E} \times \frac{rate}{frequency}\right)} \times \frac{frequency \times E}{DSR}$$

Where

A = number of days from the beginning of the coupon period to the settlement date (accrued days).

DSR = number of days from the settlement date to the redemption date.

E = number of days in the coupon period.

- If there is more than one coupon period until redemption, YIELD is calculated through a hundred iterations. The resolution uses the Newton method, based on the formula used for the PRICE Function. The yield is changed until the estimated price given the yield is close to price.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage		Results	
A	B	A	B
1		1	
2	Settlement Date	2	Settlement Date
3	42415	3	2/15/2016
4	Maturity Date	4	Maturity Date
5	46063	5	2/10/2026
6	Rate	6	Rate
7	0.08	7	8%
8	Pr	8	Pr
9	93.4993073597614	9	\$93.50
10	Redemption	10	Redemption
11	100	11	100
12	Frequency	12	Frequency
13	2	13	2
14	Basis	14	Basis
15	0	15	0
16	Yield	16	Yield
	=YIELD(C2,C3,C4,C5,C6,C7,C8)		9%

# 198. YIELDDISC Function

## Description

The YIELDDISC function returns the annual yield for a discounted security.

## Syntax

```
YIELDDISC (settlement, maturity, pr, redemption, [basis])
```

## Arguments

Argument	Description	Required /Optional
Settlement	The security's settlement date. The security settlement date is the date after the issue date when the security is traded to the buyer.	Required
Maturity	The security's maturity date. The maturity date is the date when the security expires.	Required
Pr	The security's price per \$100 face value.	Required
Redemption	The security's redemption value per \$100 face value.	Required
Basis	The type of day count basis to use. Look at the Day Count Basis Table below.	Optional

## Day Count Basis Table

Basis	Day Count Basis
0 or omitted	US (NASD) 30/360
1	Actual/actual
2	Actual/360
3	Actual/365
4	European 30/360

## Notes

- Dates should be entered by using the DATE Function, or as results of other formulas or functions. For example, use DATE (2008,5,23) for the 23rd day of May, 2008. Problems can occur if dates are entered as text.
- Microsoft Excel stores dates as sequential serial numbers so they can be used in calculations. By default, January 1, 1900 is serial number 1, and January 1, 2008 is serial number 39448 because it is 39,448 days after January 1, 1900.

- The settlement date is the date a buyer purchases a coupon, such as a bond.
- The maturity date is the date when a coupon expires.
- For example, suppose a 30-year bond is issued on January 1, 2008, and is purchased by a buyer six months later, then-
  - the issue date would be January 1, 2008
  - the settlement date would be July 1, 2008
  - the maturity date would be January 1, 2038, which is 30 years after the January 1, 2008, issue date.
- Settlement, maturity, and basis are truncated to integers.
- If settlement or maturity is not a valid Excel date, YIELDDISC returns the #VALUE! error value.
- If any of the specified arguments is non-numeric, YIELDDISC returns the #VALUE! error value.
- If  $pr \leq 0$  or if  $redemption \leq 0$ , YIELDDISC returns the #NUM! error value.
- If  $basis < 0$  or if  $basis > 4$ , YIELDDISC returns the #NUM! error value.
- If  $settlement \geq maturity$ , YIELDDISC returns the #NUM! error value.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
	A	B		A	B
1					
2	Settlement Date	42050		Settlement Date	2/15/2015
3	Maturity Date	42231		Maturity Date	8/15/2015
4	Pr	98.5		Pr	98.5
5	Redemption	100		Redemption	100
6	Basis	3		Basis	3
7	Annual Yield for a Discounted Security	=YIELDDISC(C2,C3,C4,C5,C6)		Annual Yield for a Discounted Security	3.07%

# 199. YIELDMAT Function

## Description

The YIELDMAT function returns the annual yield of a security that pays interest at maturity.

## Syntax

```
YIELDMAT (settlement, maturity, issue, rate, pr, [basis])
```

## Arguments

Argument	Description	Required /Optional
Settlement	The security's settlement date. The security settlement date is the date after the issue date when the security is traded to the buyer.	Required
Maturity	The security's maturity date. The maturity date is the date when the security expires.	Required
Issue	The security's issue date, expressed as a serial date number.	Required
Rate	The security's interest rate at date of issue.	Required
Pr	The security's price per \$100 face value.	Required
Basis	The type of day count basis to use. Look at the Day Count Basis Table given below.	Optional

## Day Count Basis Table

Basis	Day Count Basis
0 or omitted	US (NASD) 30/360
1	Actual/actual
2	Actual/360
3	Actual/365
4	European 30/360

## Notes

- Dates should be entered by using the DATE Function, or as results of other formulas or functions. For example, use DATE (2008,5,23) for the 23rd day of May, 2008. Problems can occur if dates are entered as text.

- Microsoft Excel stores dates as sequential serial numbers so they can be used in calculations. By default, January 1, 1900 is serial number 1, and January 1, 2008 is serial number 39448 because it is 39,448 days after January 1, 1900.
- The settlement date is the date a buyer purchases a coupon, such as a bond.
- The maturity date is the date when a coupon expires.
- For example, suppose a 30-year bond is issued on January 1, 2008, and is purchased by a buyer six months later, then-
  - the issue date would be January 1, 2008
  - the settlement date would be July 1, 2008
  - the maturity date would be January 1, 2038, which is 30 years after the January 1, 2008, issue date.
- Settlement, maturity, and basis are truncated to integers.
- If settlement, maturity, or issue is not a valid Excel date, YIELDMAT returns the #VALUE! error value.
- If any of the specified arguments is non-numeric, YIELDMAT returns the #VALUE! error value.
- If rate < 0 or if pr ≤ 0, YIELDMAT returns the #NUM! error value.
- If basis < 0 or if basis > 4, YIELDMAT returns the #NUM! error value.
- If settlement ≥ maturity, YIELDMAT returns the #NUM! error value.
- If issue ≥ settlement, YIELDMAT returns the #NUM! error value.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Settlement	42078	2	Settlement	3/15/2015
3	Maturity	45988	3	Maturity	11/27/2025
4	Issue	42005	4	Issue	1/1/2015
5	Rate	0.08	5	Rate	8.00%
6	Price	97.8	6	Price	\$97.80
7	Basis	2	7	Basis	2
8	Yield	=YIELDMAT(C2,C3,C4,C5,C6,C7)	8	Yield	8.25%
~			0		

# Information Functions

# 200. Information Functions – Overview

Information functions provide information about the content, formatting and location of cells in an Excel Worksheet.

## Information Functions

The following table lists all the Information functions-

S. No.	Function and Description
1	CELL Returns information about the formatting, location, or contents of a cell
2	ERROR.TYPE Returns a number corresponding to an error type
3	INFO Returns information about the current operating environment
4	ISBLANK Returns TRUE if the value is blank
5	ISERR Returns TRUE if the value is any error value except #N/A
6	ISERROR Returns TRUE if the value is any error value
7	ISEVEN Returns TRUE if the number is even
8	ISFORMULA Returns TRUE if there is a reference to a cell that contains a formula
9	ISLOGICAL Returns TRUE if the value is a logical value
10	ISNA Returns TRUE if the value is the #N/A error value
11	ISNOTEXT Returns TRUE if the value is not text
12	ISNUMBER Returns TRUE if the value is a number
13	ISODD Returns TRUE if the number is odd
14	ISREF Returns TRUE if the value is a reference

S. No.	Function and Description
15	ISTEXT Returns TRUE if the value is text
16	N Returns a value converted to a number
17	NA Returns the error value #N/A
18	SHEET Returns the sheet number of the referenced sheet
19	SHEETS Returns the number of sheets in a reference
20	TYPE Returns a number indicating the data type of a value

# 201. CELL Function

## Description

The CELL function returns information about the formatting, location, or contents of a cell.

## Syntax

```
CELL (info_type, [reference])
```

## Arguments

Argument	Description	Required /Optional
Info_type	A text value that specifies what type of cell information you want to return. The possible values of the Info_type, are shown in the Table Info_type Values below.	Required
Reference	The cell that you want information about. If omitted, the information specified in the Info_type argument is returned for the last cell that was changed. If the reference argument is a range of cells, the CELL function returns the information for only the upper left cell of the range.	Optional

## Info\_type Values

Info_type	Type of cell information to return
"address"	Reference of the first cell in reference, as text.
"col"	Column number of the cell in reference.
"color"	The value 1 if the cell is formatted in color for negative values. Otherwise returns 0 (zero).
"contents"	Value of the upper-left cell in reference. Not a formula.
"filename"	Filename (including full path) of the file that contains reference, as text. Returns empty text ("") if the Worksheet that contains reference has not yet been saved.
"format"	Text value corresponding to the number format of the cell. The text values for the various formats are shown in the table CELL Format Codes below. Returns "-" at the end of the text value if the cell is formatted in color for negative values. Returns "(" at the end of the text value if the cell is formatted with parentheses for positive or all values. If you later apply a different format to the referenced cell, you must recalculate the Worksheet to update the results of the CELL function.
"parentheses"	The value 1 if the cell is formatted with parentheses for positive or all values. Otherwise returns 0.
"prefix"	Text value corresponding to the "label prefix" of the cell. Returns

Info_type	Type of cell information to return
	<ul style="list-style-type: none"> <li>single quotation mark (' ) if the cell contains left-aligned text</li> <li>double quotation mark (" ) if the cell contains right-aligned text</li> <li>caret (^ ) if the cell contains centered text</li> <li>backslash (\ ) if the cell contains fill-aligned text</li> <li>empty text ("") if the cell contains anything else</li> </ul>
"protect"	The value 0 if the cell is not locked. Otherwise, returns 1 (if the cell is locked).
"row"	Row number of the cell in reference.
"type"	Text value corresponding to the type of data in the cell. Returns <ul style="list-style-type: none"> <li>"b" for blank if the cell is empty</li> <li>"l" for label if the cell contains a text constant</li> <li>"v" for value if the cell contains anything else</li> </ul>
"width"	Column width of the cell, rounded off to an integer. Each unit of column width is equal to the width of one character in the default font size.

## CELL Format Codes

The following table describes the text values that the CELL function returns when the Info\_type argument is "format" and the reference argument is a cell that is formatted with a built-in number format.

Excel Format of the Cell	What CELL Function returns
General	"G"
0	"F0"
#,##0	",0"
0.00	"F2"
#,##0.00	",2"
\$#,##0_);(\$#,##0)	"C0"
\$#,##0_);[Red](\$#,##0)	"C0-"
\$#,##0.00_);(\$#,##0.00)	"C2"
\$#,##0.00_);[Red](\$#,##0.00)	"C2-"
0%	"P0"
0.00%	"P2"
0.00E+00	"S2"
# ?/? or # ??/??	"G"
m/d/yy or m/d/yy h:mm or mm/dd/yy	"D4"
d-mmm-yy or dd-mmm-yy	"D1"
d-mmm or dd-mmm	"D2"
mmm-yy	"D3"
mm/dd	"D5"
h:mm AM/PM	"D7"
h:mm:ss AM/PM	"D6"
h:mm	"D9"
h:mm:ss	"D8"

## Notes

If info\_type is not one of the recognized types as given above, CELL Function returns #VALUE! Error.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	<b>info_type</b>	<b>Function</b>	2	<b>info_type</b>	<b>Result</b>
3	"address"	=CELL("address",D4)	3	"address"	\$D\$4
4	"col"	=CELL("col", D4)	4		4
5	"color"	=CELL("color", D4)	5	"color"	0
6	"contents"	=CELL("contents", D4)	6	"contents"	80.1
7	"contents"	=CELL("contents", D3)	7	"contents"	"Text"
8	"filename"	=CELL("filename", D4)	8	"filename"	
9	"format"	=CELL("format", D4)	9	"format"	F1
10	"format"	=CELL("format", D3)	10	"format"	G
11	"parentheses"	=CELL("parentheses", D4)	11	"parentheses"	0
12	"prefix"	=CELL("prefix", D4)	12	"prefix"	
13	"prefix"	=CELL("prefix", D3:D4)	13	"prefix"	"
14	"protect"	=CELL("protect", D4)	14	"protect"	1
15	"row"	=CELL("row", D4)	15	"row"	4
16	"type"	=CELL("type", D4)	16	"type"	v
17	"type"	=CELL("type", D3)	17	"type"	i
18	"width"	=CELL("width", D4)	18	"width"	14
19			19		

# 202. ERROR.TYPE Function

## Description

The `ERROR.TYPE` function returns a number corresponding to one of the error values in Microsoft Excel or returns the `#N/A` error if no error exists. You can use `ERROR.TYPE` in an IF function to test for an error value and return a text string, such as a message, instead of the error value.

## Syntax

```
ERROR.TYPE (error_val)
```

## Arguments

Argument	Description	Required /Optional
Error_val	The error value whose identifying number you want to find. Although <code>error_val</code> can be the actual error value, it will usually be a reference to a cell containing a formula that you want to test. The Error Values Table given below shows you what numbers this Function returns for the different error values.	Required

## Error Values

Error_val	What <code>ERROR.TYPE</code> returns
<code>#NULL!</code>	1
<code>#DIV/0!</code>	2
<code>#VALUE!</code>	3
<code>#REF!</code>	4
<code>#NAME?</code>	5
<code>#NUM!</code>	6
<code>#N/A</code>	7
<code>#GETTING_DATA</code>	8
Anything else	<code>#N/A</code>

## Notes

The following table shows what each of these different error messages mean-

Error Value	Meaning of the Error Value
<code>#NULL!</code>	Arises when you refer to an intersection of two ranges that do not intersect.

#DIV/0!	Occurs when a formula attempts to divide by zero.
#VALUE!	Occurs if one of the variables in your formula is of the wrong type (e.g. text value when a numeric value is expected).
#REF!	Arises when a formula contains an invalid cell reference.
#NAME?	Occurs if Excel does not recognize a formula name or does not recognize text within a formula.
#NUM!	Occurs when Excel encounters an invalid number.
#N/A	Indicates that a value is not available to a formula.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage				Results				
	B	C	D		B	C	D	
2		Data	Error	Error Type	2	Data	Error	Error Type
3	80	0	=B3/C3	=ERROR.TYPE(D3)	3	80	0	#DIV/0!
4	80	3	=B4+ALAN	=ERROR.TYPE(D4)	4	80	3	#NAME?
5	80	3	=B5+C5+#REF!	=ERROR.TYPE(D5)	5	80	3	#REF!
6	0.458333333333333	0.541666666666667	=B6-C6	=ERROR.TYPE(D6)	6	11:00	13:00	#####

# 203. INFO Function

## Description

The INFO function returns information about the current operating environment.

## Syntax

```
INFO (type_text)
```

## Arguments

Argument	Description	Required /Optional
Type_text	Text that specifies the type of Information that is to be returned. The values for Type_text and the corresponding return Information is given in the table below.	Required

## Type\_text Values

Type_text	Information Returned
"directory"	Path of the current directory or folder.
"numfile"	Number of active worksheets in the open Workbooks.
"origin"	Returns the absolute cell reference of the top and leftmost cell visible in the window, based on the current scrolling position, as text prepended with "\$A:". This value is intended for Lotus 1-2-3 release 3.x compatibility. The actual value returned depends on the current Reference Style setting. For example, with D9, the return value will be- With A1 Reference Style:     "\$A:\$D\$9". With R1C1 Reference Style:     "\$A:R9C4"
"osversion"	Current operating system version, as text.
"recalc"	Current recalculation mode; returns "Automatic" or "Manual".
"release"	Version of Microsoft Excel, as text.
"system"	Name of the operating environment: E.g. Windows = "pcdos"

## Notes

- If the type\_text value is "memavail", "memused", or "totmem", INFO returns a #N/A error value.
- These type\_text values returned memory information in earlier versions of Excel and are no longer supported.
- If the type\_text value is any other invalid value, INFO returns a #VALUE! Error value.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage		Results
	Function Usage	Result
System Information		
Directory	=INFO("directory")	C:\Users\Your Name\Documents\
Number of active Worksheets	=INFO("numfile")	196
Top Left-most Cell	=INFO("origin")	\$A:\$A\$1
Operating System	=INFO("osversion")	Windows (32-bit) NT ::00
Recalculation Mode	=INFO("recalc")	Automatic
Excel Version	=INFO("release")	15.0
Operating Environment	=INFO("system")	pcdos
Some Text	=INFO("Some Text")	#VALUE!
Following returned memory information in earlier versions of Excel and are no longer supported		r versions of Excel and are no longer supported
Available bytes of memory	=INFO("memavail")	#N/A
Memory in use	=INFO("memused")	#N/A
Total bytes of memory	=INFO("totmem")	#N/A

# 204. ISBLANK Function

## Description

The ISBLANK function returns the logical value TRUE if the specified cell is blank (empty). Otherwise returns FALSE.

## Syntax

```
ISBLANK (value)
```

## Arguments

Argument	Description	Required /Optional
value	A reference to a cell.	Required

## Notes

You can use this function to test the contents of a cell before performing a calculation.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage		Results	
A	B	A	B
1		1	
2	Cell Value	Cell Value	Cell Blank
3	5	=ISBLANK(B3)	FALSE
4	Text	=ISBLANK(B4)	FALSE
5	42370	=ISBLANK(B5)	FALSE
6		=ISBLANK(B6)	TRUE
7	"Text"	=ISBLANK(B7)	FALSE

# 205. ISERR Function

## Description

The ISERR function returns the logical value TRUE if the value refers to an Excel Error, except the #N/A error. Otherwise returns FALSE.

## Syntax

```
ISERR (value)
```

## Arguments

Argument	Description	Required /Optional
value	An error	Required

## Notes

- This function is useful in formulas for testing the outcome of a calculation. When combined with the IF function, this function provides a method for locating errors in formulas
- Both ISERR and ISERROR Functions test a value and return True or False depending on whether the value is an error or not. The only difference is
  - The ISERROR function returns True if value is any error
  - The ISERR function returns True if value is any error except the #N/A error

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Cell Value	Function Usage	2	Cell Value	Function Usage
3	4	=ISERR(B3)	3	4	FALSE
4	=10/0	=ISERR(B4)	4	#DIV/0!	TRUE
5	=SUM(BLAN)	=ISERR(B5)	5	#NAME?	TRUE
6	=SUM("BLAN")	=ISERR(B6)	6	#VALUE!	TRUE
7	#REF!	=ISERR(B7)	7	#REF!	TRUE
8	#N/A	=ISERR(B8)	8	#N/A	FALSE
n			~		

# 206. ISERROR Function

## Description

The ISERROR function returns the logical value TRUE if the value refers to an Excel Error. Otherwise returns FALSE.

## Syntax

```
ISERROR (value)
```

## Arguments

Argument	Description	Required /Optional
value	An error	Required

## Notes

- This function is useful in formulas for testing the outcome of a calculation. When combined with the IF Function, this Function provides a method for locating errors in formulas
- Both ISERR and ISERROR functions test a value and return True or False depending on whether the value is an error or not. The only difference is-
  - The ISERROR function returns True if value is any error.
  - The ISERR function returns True if value is any error except the #N/A error.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Cell Value	Function Usage	2	Cell Value	Function Usage
3	4	=ISERROR(B3)	3	4	FALSE
4	=10/0	=ISERROR(B4)	4	#DIV/0!	TRUE
5	=SUM(BLAN)	=ISERROR(B5)	5	#NAME?	TRUE
6	=SUM("BLAN")	=ISERROR(B6)	6	#VALUE!	TRUE
7	#REF!	=ISERROR(B7)	7	#REF!	TRUE
8	#N/A	=ISERROR(B8)	8	#N/A	TRUE
9			9		

# 207. ISEVEN Function

## Description

The ISEVEN function returns TRUE if number is even, or FALSE if number is odd.

## Syntax

```
ISEVEN (number)
```

## Arguments

Argument	Description	Required /Optional
Number	The value to test. If number is not an integer, it is truncated.	Required

## Notes

- If number is nonnumeric, ISEVEN returns the #VALUE! error value.
- You can use this function to test the contents of a cell before performing a calculation.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage		Results	
A	B	A	B
1		1	
2	Number	2	Number
3	1	3	1
4	=ISEVEN(B3)	4	FALSE
5	2	5	TRUE
6	=ISEVEN(B5)	6	TRUE
7	2.6	7	TRUE
8	=ISEVEN(B6)	8	FALSE
9	3	9	FALSE
10	=ISEVEN(B7)	10	FALSE
11	3.5	11	FALSE
12	=ISEVEN(B8)	12	FALSE
13	3.6	13	#VALUE!
Text	=ISEVEN(B9)	1-Jan-15	FALSE
42005	=ISEVEN(B10)	1-Jan-16	TRUE
42370	=ISEVEN(B11)		

# 208. ISFORMULA Function

## Description

The ISFORMULA function returns the logical value TRUE if the reference is to a cell that contains a formula. Otherwise returns FALSE.

## Syntax

```
ISFORMULA (reference)
```

## Arguments

Argument	Description	Required /Optional
reference	Reference can be a cell reference, a formula, or a name that refers to a cell.	Required

## Notes

- If reference is not a valid data type, such as a defined name that is not a reference, ISFORMULA returns the #VALUE! error value.
- You can use this Function to test the contents of a cell before performing a calculation..

## Applicability

Excel 2013, Excel 2016

## Example

Function Usage			Results		
	A	B		A	B
1			C		
2		Reference	Result		Reference
3		=TODAY()	=ISFORMULA(B3)	3	4/14/2016
4		42474	=ISFORMULA(B4)	4	4/14/2016
5		=CONCATENATE("Is this ","Text","?")	=ISFORMULA(B5)	5	Is this Text?
6		Is this Text?	=ISFORMULA(B6)	6	Is this Text?
7		=SUM(5,40)	=ISFORMULA(B7)	7	45
8		45	=ISFORMULA(B8)	8	45
9		=5+40	=ISFORMULA(B9)	9	45
10					

# 209. ISLOGICAL Function

## Description

The ISLOGICAL function returns the logical value TRUE if the specified value or expression evaluates to a logical value, i.e. True or False. Otherwise returns FALSE.

## Syntax

```
ISLOGICAL (value)
```

## Arguments

Argument	Description	Required /Optional
value	Value or expression.	Required

## Notes

You can use this function to test the contents of a cell before performing a calculation.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	<b>Cell Value</b>	<b>Result</b>	2	<b>Cell Value</b>	<b>Result</b>
3	=40>80	=ISLOGICAL(B3)	3	FALSE	TRUE
4	=40<80	=ISLOGICAL(B4)	4	TRUE	TRUE
5	=40=80	=ISLOGICAL(B5)	5	FALSE	TRUE
6		=ISLOGICAL(B6)	6		FALSE
7	20	=ISLOGICAL(B7)	7	20	FALSE
8	42005	=ISLOGICAL(B8)	8	1-Jan-15	FALSE
9	Text	=ISLOGICAL(B9)	9	Text	FALSE
10	"Text"	=ISLOGICAL(B10)	10	"Text"	FALSE
11	#REF!	=ISLOGICAL(B11)	11	#REF!	FALSE
12	=4/0	=ISLOGICAL(B12)	12	#DIV/0!	FALSE
			--		

# 210. ISNA Function

## Description

The ISNA function returns the logical value TRUE if the specified value is Excel #N/A error value or the expression returns the Excel #N/A error. Otherwise returns FALSE. Excel #N/A error occurs when a value is not available to your formula.

## Syntax

```
ISNA (value)
```

## Arguments

Argument	Description	Required /Optional
value	Value or expression.	Required

## Notes

You can use this function to test the contents of a cell before performing a calculation.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Cell Value	Result	2	Cell Value	Result
3	1	=ISNA(B3)	3	1	FALSE
4	Text	=ISNA(B4)	4	Text	FALSE
5	"Text"	=ISNA(B5)	5	"Text"	FALSE
6		=ISNA(B6)	6		FALSE
7	42005	=ISNA(B7)	7	1-Jan-15	FALSE
8	#REF!	=ISNA(B8)	8	#REF!	FALSE
9	#N/A	=ISNA(B9)	9	#N/A	TRUE
10	=ISBLANK(5)	=ISNA(B10)	10	FALSE	FALSE
11	=ISBLANK(B6)	=ISNA(B11)	11	TRUE	FALSE

# 211. ISNONTEXT Function

## Description

The ISNONTEXT function returns the logical value TRUE if the specified value refers to any item that is not text. Otherwise returns FALSE. The function returns TRUE if the value refers to a blank cell.

## Syntax

```
ISNONTEXT (value)
```

## Arguments

Argument	Description	Required /Optional
value	Value or expression or a reference to a cell.	Required

## Notes

You can use this function to test the contents of a cell before performing a calculation.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2			2		
	<b>Cell Value</b>	<b>Result</b>		<b>Cell Value</b>	<b>Result</b>
3	5	=ISNONTEXT(B3)	3	5	TRUE
4	Text	=ISNONTEXT(B4)	4	Text	FALSE
5	"Text"	=ISNONTEXT(B5)	5	"Text"	FALSE
6		=ISNONTEXT(B6)	6		TRUE
7	42370	=ISNONTEXT(B7)	7	1-Jan-16	TRUE
8	100	=ISNONTEXT(B8)	8	100	FALSE
9	100	=ISNONTEXT(B9)	9	100	TRUE

# 212. ISNUMBER Function

## Description

The ISNUMBER function returns the logical value TRUE if the specified value is a number. Otherwise returns FALSE.

## Syntax

```
ISNUMBER (value)
```

## Arguments

Argument	Description	Required /Optional
value	Refers to a number.	Required

## Notes

- You can use this function to test the contents of a cell before performing a calculation.
- In ISNUMBER, any numeric values that are enclosed in double quotation marks are treated as text and are not converted. For example, ISNUMBER ("19") returns FALSE as "19" is not converted from a text value to a number value.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	<b>Cell Value</b>	<b>Result</b>	2	<b>Cell Value</b>	<b>Result</b>
3	5	=ISNUMBER(B3)	3	5	TRUE
4	"5"	=ISNUMBER(B4)	4	"5"	FALSE
5	Text	=ISNUMBER(B5)	5	Text	FALSE
6	"Text"	=ISNUMBER(B6)	6	"Text"	FALSE
7		=ISNUMBER(B7)	7		FALSE
8	42370	=ISNUMBER(B8)	8	1-Jan-16	TRUE
9	100	=ISNUMBER(B9)	9	100	FALSE
10	100	=ISNUMBER(B10)	10	100	TRUE

# 213. ISODD Function

## Description

The ISODD function returns TRUE if number is odd, or FALSE if number is even.

## Syntax

```
ISODD (number)
```

## Arguments

Argument	Description	Required / Optional
Number	Value or expression to test. If number is not an integer, it is truncated.	Required

## Notes

- You can use this function to test the contents of a cell before performing a calculation.
- If the specified number argument is not a numeric value, ISODD function returns #VALUE! Error.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Number	Is Number Odd?	2	Number	Is Number Odd?
3	1	=ISODD(B3)	3	1	TRUE
4	2	=ISODD(B4)	4	2	FALSE
5	2.5	=ISODD(B5)	5	2.5	FALSE
6	2.6	=ISODD(B6)	6	2.6	FALSE
7	3	=ISODD(B7)	7	3	TRUE
8	3.5	=ISODD(B8)	8	3.5	TRUE
9	3.6	=ISODD(B9)	9	3.6	TRUE
10	Text	=ISODD(B10)	10	Text	#VALUE!
11	42005	=ISODD(B11)	11	1-Jan-15	TRUE
12	42370	=ISODD(B12)	12	1-Jan-16	FALSE

# 214. ISREF Function

## Description

The ISREF function returns the logical value TRUE if the specified value is a reference. Otherwise returns FALSE.

## Syntax

```
ISREF (value)
```

## Arguments

Argument	Description	Required /Optional
value	A reference to a cell.	Required

## Notes

You can use this function to test the contents of a cell before performing any action.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage		Results	
A	B	A	B
1		1	
2	<b>Cell Value</b>	2	<b>Cell Value</b>
3	=ISREF(A1)	3	TRUE
4	=ISREF("A1")	4	FALSE
5	=ISREF(#REF!)	5	FALSE
6	=ISREF(Text)	6	FALSE
7	=ISREF(10)	7	FALSE
8	=ISREF(NOW())	8	FALSE
9	=ISREF(_XX99)	9	FALSE

# 215. ISTEXT Function

## Description

The ISTEXT function returns the logical value TRUE if the specified value is text. Otherwise returns FALSE.

## Syntax

```
ISTEXT (value)
```

## Arguments

Argument	Description	Required /Optional
value	Refers to Text.	Required

## Notes

You can use this function to test the contents of a cell before performing a calculation.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	<b>Cell Value</b>	<b>Result</b>	2	<b>Cell Value</b>	<b>Result</b>
3	5	=ISTEXT(B3)	3	5	FALSE
4	"5"	=ISTEXT(B4)	4	"5"	TRUE
5	Text	=ISTEXT(B5)	5	Text	TRUE
6	"Text"	=ISTEXT(B6)	6	"Text"	TRUE
7		=ISTEXT(B7)	7		FALSE
8	42370	=ISTEXT(B8)	8	1-Jan-16	FALSE
9	100	=ISTEXT(B9)	9	100	TRUE
10	100	=ISTEXT(B10)	10	100	FALSE
..			..		

# 216. N Function

## Description

The N function returns a value converted to a number.

## Syntax

N (value)
-----------

## Arguments

Argument	Description	Required /Optional
Value	The value or reference to a value that you want converted. N converts values listed in the table below.	Required

Value	Return Value of N
A number	That number
A date, in one of the built-in date formats available in Microsoft Excel	The serial number of that date
TRUE	1
FALSE	0
An error value, such as #DIV/0!	The error value
Anything else	0

## Notes

- You need not use the N function in a formula to convert values to numbers since Excel automatically converts values as necessary. This function is provided for compatibility with other spreadsheet programs.
- Excel stores dates as sequential serial numbers so they can be used in calculations. By default, January 1, 1900 is serial number 1, and January 1, 2008 is serial number 39448 because it is 39,448 days after January 1, 1900.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
	A	B		A	B
1			1		
2		<b>Value</b>	<b>Result</b>	2	
3	1	=N(B3)		3	1
4	40	=N(B4)		4	40
5	5.5	=N(B5)		5	5 1/2
6	5.5	=N(B6)		6	5.5
7	0.035	=N(B7)		7	3.50%
8	42370	=N(B8)		8	1-Jan-16
9	TRUE	=N(B9)		9	42370
10	FALSE	=N(B10)		10	TRUE
11	Text	=N(B11)		11	1
12	"Text"	=N(B12)		12	FALSE
13		=N(B13)		13	0
14	=15/0	=N(B14)		14	"Text"
					0
					0
					#DIV/0!
					#DIV/0!

# 217. NA Function

## Description

The NA function returns the error value #N/A. #N/A is the error value that means "no value is available." Use NA to mark empty cells. You can also get the same result by simply typing #N/A directly into a Worksheet cell.

By entering NA () or #N/A in cells where you are missing information, you can avoid the problem of unintentionally including empty cells in your calculations. (When a formula refers to a cell containing #N/A, the formula returns the #N/A error value.)

## Syntax

```
NA ( )
```

## Arguments

The NA function syntax has no arguments.

## Notes

- You must include the empty parentheses with the function name. Otherwise, Microsoft Excel will not recognize it as a function.
- You can also type the value #N/A directly into a cell. The NA function is provided for compatibility with other spreadsheet programs.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	<b>Value</b>	<b>Result</b>	2	<b>Value</b>	<b>Result</b>
3	=NA()		3		#N/A
4	8	=IF(ISBLANK(B4),NA(),B4+1)	4	8	9
5		=IF(ISBLANK(B5),NA(),B5+1)	5		#N/A
6	30	=IF(ISBLANK(B6),NA(),B6+1)	6	30	31
7			7		
8	<b>Sales</b>		8	<b>Sales</b>	
9	North	100	9	North	100
10	South	=NA()	10	South	#N/A
11	East	#N/A	11	East	#N/A
12	West	200	12	West	200
13	<b>Sum</b>	=SUM(C9:C12)	13	<b>Sum</b>	#N/A
14					

# 218. SHEET Function

## Description

The SHEET function returns the sheet number of the reference sheet.

## Syntax

```
SHEET (value)
```

## Arguments

Argument	Description	Required /Optional
Value	Value is the name of a sheet or a reference for which you want the sheet number. If value is omitted, SHEET returns the number of the sheet that contains the function.	Optional

## Notes

- SHEET includes all worksheets (visible, hidden or very hidden), in addition to all other sheet types (macro, chart, or dialog sheets).
- If the value argument is a non-valid reference, SHEET returns the #REF! error value.
- For example, if the value argument had previously referenced cell Sheet2!A1, and Sheet2 was deleted later or the cell A1 within Sheet2 was deleted later, this would no longer be a valid reference.
- If the value argument is a sheet name that is not valid, SHEET returns the #NA error value.

## Applicability

Excel 2013, Excel 2016

**Example**

Function Usage		Results	
A	B	A	B
1		1	
2	<b>Sheet Number</b>	2	<b>Sheet Number</b>
3	=SHEET()	3	4
4	=SHEET(Sheet2!B2)	4	2
5	=SHEET(Sheet6!B3)	5	#N/A
c		-	

# 219. SHEETS Function

## Description

The SHEETS function returns the number of sheets in a reference.

## Syntax

```
SHEETS (reference)
```

## Arguments

Argument	Description	Required /Optional
Reference	Reference is a reference for which you want to know the number of sheets it contains. If Reference is omitted, SHEETS returns the number of sheets in the workbook that contains the function.	Optional

## Notes

- SHEETS includes all worksheets (visible, hidden, or very hidden) in addition to all other sheet types (macro, chart, or dialog sheets).
- If reference is not a valid value, SHEETS returns the #REF! error value.

## Applicability

Excel 2013, Excel 2016

## Example

Function Usage		Results
A	B	
1		
2	<b>No. of Sheets</b>	
3	=SHEETS()	

The screenshot shows two parts of a Microsoft Excel spreadsheet. The left part, titled 'Function Usage', shows a formula in cell B2: '=SHEETS()'. The right part, titled 'Results', shows the output of the formula: '3'. Both parts have columns A and B, and rows 1 through 4. Row 2 is highlighted in green in both sections.

# 220. TYPE Function

## Description

The TYPE function receives a value and returns an integer that represents the specified value's data type. Use TYPE when the behavior of another Function depends on the type of value in a particular cell.

## Syntax

TYPE (value)
--------------

## Arguments

Argument	Description	Required /Optional
Value	Value or a reference to a cell containing the value that you want to know the type of. Data type can be a number, text, logical value, etc. Look at the Table below for the Integers that TYPE Function returns and the corresponding Data types.	Required

Integer returned by TYPE Function	Corresponding Data Type
1	Number
2	Text
4	Logical value
16	Error value
64	Array

## Notes

- TYPE evaluates an empty cell as the value 0, and hence returns the integer 1, to denote a Number.
- TYPE is most useful when you are using Functions that can accept different types of data. Use TYPE to find out what type of data is returned by a Function or Formula.
- You cannot use TYPE to determine whether a cell contains a Formula. TYPE only determines the type of the resulting, or displayed, value. If value is a cell reference to a cell that contains a Formula, TYPE returns the type of the Formula's resulting value.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

**Example**

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	<b>Value</b>	<b>Type</b>	2	<b>Value</b>	<b>Type</b>
3	5	=TYPE(B3)	3	5	1
4	Text	=TYPE(B4)	4	Text	2
5	=5/0	=TYPE(B5)	5	#DIV/0!	16
6	TRUE	=TYPE(B6)	6	TRUE	4
-			-		

# Logical Functions

# 221. Logical Functions – Overview

Logical functions include the boolean operators and conditional tests, which will be an essential part of many working spreadsheets.

## Logical Functions

The following table lists all the Logical functions-

S. No.	Function and Description
1	AND Returns TRUE if all its arguments are TRUE.
2	FALSE Returns the logical value FALSE.
3	IF Specifies a logical test to perform.
4	IFERROR Returns a different result if the first argument evaluates to an error.
5	IFNA Returns the value you specify if the expression resolves to #N/A, otherwise returns the result of the expression.
6	IFS Checks whether one or more conditions are met and returns a value that corresponds to the first TRUE condition.
7	NOT Reverses the logic of its argument.
8	OR Returns TRUE if any argument is TRUE.
9	SWITCH Evaluates an expression against a list of values and returns the result corresponding to the first matching value. If there is no match, an optional default value may be returned.
10	TRUE Returns the logical value TRUE.
11	XOR Returns a logical exclusive OR of all arguments.

# 222. AND Function

## Description

The AND function returns TRUE if all its arguments evaluate to TRUE and returns FALSE if one or more arguments evaluate to FALSE.

One common use of the AND Function is to expand the usefulness of other functions that perform logical tests. For example, the IF Function performs a logical test and then returns one value if the test evaluates to TRUE and another value if the test evaluates to FALSE. By using the AND Function as the *logical\_test* argument of the IF Function, you can test many different conditions instead of just one.

## Syntax

```
AND (logical1, [logical2] ...)
```

## Arguments

Argument	Description	Required /Optional
logical1	The first condition that you want to test that can evaluate to either TRUE or FALSE.	Required
logical2, ...	Additional conditions that you want to test that can evaluate to either TRUE or FALSE, up to a maximum of 255 conditions.	Optional

## Notes

- The arguments must evaluate to logical values, such as TRUE or FALSE, or the arguments must be arrays or references that contain logical values.
- If an array or reference argument contains text or empty cells, those values are ignored.
- If the specified range contains no logical values, the AND Function returns the #VALUE! error value.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
	A	B		A	B
1				1	
2	Value1	Value2	Formula	2	Value1
3	TRUE	TRUE	=AND(B3,C3)	3	TRUE
4	TRUE	FALSE	=AND(B4,C4)	4	FALSE
5	=2<10	=2<7	=AND(B5,C5)	5	TRUE
6	2	0	=IF(AND(B6>C6,B7<C7),"OK","Not OK")	6	OK
7	2	7	=IF(AND(B7<=B6,C7<=C6),"OK","Not OK")	7	Not OK

# 223. FALSE Function

## Description

The FALSE function returns the logical value FALSE.

## Syntax

```
FALSE ()
```

## Arguments

The FALSE function has no arguments.

## Notes

- You can also type the word FALSE directly onto the worksheet or into the formula, and Microsoft Excel interprets it as the logical value FALSE
- The FALSE function is provided primarily for compatibility with other spreadsheet programs

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage		Results	
A	B	A	B
1		1	
2	=FALSE()	2	FALSE

# 224. IF Function

## Description

The IF function returns one value if a condition is TRUE and another value if it is FALSE.

## Syntax

```
IF (logical_test, value_if_true, [value_if_false])
```

## Arguments

Argument	Description	Required /Optional
logical_test	The condition you want to test.	Required
value_if_true	The value that you want returned if the result of logical_test is TRUE.	Required
value_if_false	The value that you want returned if the result of logical_test is FALSE.	Optional

## Notes

- IF Function returns an error 0 (zero) in cell, if neither value\_if\_true nor value\_if\_false are provided.
- To see the right value returned, add argument text to the two arguments, or add TRUE or FALSE to the argument.
- IF Function returns an error #NAME? in cell if the formula is misspelled.
- IF Function is more useful when nested. Up to 64 IF Functions can be nested with each other for value\_if\_true and value\_if\_false arguments to construct more elaborate tests.
- If any of the arguments to the IF Function are arrays, every element of the array is evaluated when the IF statement is carried out.
- You can use IF in conjunction with other Excel functions-
  - To count the number of occurrences of a string of text or a number within a range of cells, use the COUNTIF or the COUNTIFS functions
  - To calculate a sum based on a string of text or a number within a range, use the SUMIF or the SUMIFS functions

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage				Results						
	A	B	C	D	E	A	B	C	D	E
1						1				
2	Name	Sales	Target		Result	2	Name	Sales	Target	Result
3	Alan	1000	5000	=IF(C3>=D3,"Achieved","Not Achieved")		3	Alan	1000	5000	Not Achieved
4	Bob	6000	5000	=IF(C4>=D4,"Achieved","Not Achieved")		4	Bob	6000	5000	Achieved
5	Carol	2000	4000	=IF(C5>=D5,"Achieved","Not Achieved")		5	Carol	2000	4000	Not Achieved
6	Carol	2000	4000	=IF(C6>=D6,"Achieved","Not Achieved")		6	Carol	2000	4000	Achieved
7	Carol	2000	4000	=IF(C7>=D7,,)		7	Carol	2000	4000	0
8	Carol	5000	4000	=IF(C8>=D8,,)		8	Carol	5000	4000	0
~						~				

# 225. IFERROR Function

## Description

The IFERROR function returns a value you specify if a formula evaluates to an error. Otherwise, returns the result of the formula. Use the IFERROR function to trap and handle errors in a formula.

## Syntax

```
IFERROR (value, value_if_error)
```

## Arguments

Argument	Description	Required /Optional
value	The argument that is checked for an error.	Required
value_if_error	The value to return if the formula evaluates to an error. The following error types are evaluated: #N/A, #VALUE!, #REF!, #DIV/0!, #NUM!, #NAME?, or #NULL!.	Required

## Notes

- If Value or Value\_if\_error is an empty cell, IFERROR treats it as an empty string value ("")
- If Value is an array formula, IFERROR returns an array of results for each cell in the range specified in value.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	D
1			1		
2	Value	Value If Error	2	Value	Result
3	=5/5	Error	=IFERROR(B3,C3)	3	1
4	=5/0	Error	=IFERROR(B4,C4)	4	#DIV/0!
5		Error	=IFERROR(B5,C5)	5	0
6			=IFERROR(B6,C6)	6	0
7	=DATEVALUE(341)	Error	=IFERROR(B7,C7)	7	#VALUE!
8	=WEEKDAY(1/1/2016)	Error	=IFERROR(B8,C8)	8	7
9	=WEEKDAY(4326728)	Error	=IFERROR(B9,C9)	9	#NUM!

# 226. IFNA Function

## Description

The IFNA function returns the value you specify if the formula returns the #N/A error value. Otherwise, returns the result of the formula.

## Syntax

```
IFNA (value, value_if_na)
```

## Arguments

Argument	Description	Required /Optional
value	The argument that is checked for the #N/A error value.	Required
value_if_na	The value to return if the formula evaluates to the #N/A error value.	Required

## Notes

- If Value or Value\_if\_na is an empty cell, IFNA treats it as an empty string value ("")
- If Value is an array formula, IFNA returns an array of results for each cell in the range specified in value.

## Applicability

Excel 2013, Excel 2016

## Example

	A	B	C	D
1				
2	ID	Student Name	Marks	
3	2001	John	50	
4	2002	Peter	70	
5	2003	Anne	55	
6	2004	Mary	85	
7	2005	Thomas	80	
8	2006	Jane	75	
9	2007	Sally	65	
10	2008	Kate	80	
11				
12				
13	Find Student Marks			
14	ID	Student Name	Marks	
15	2010	=VLOOKUP(B15,B1:D9,2,FALSE)	=VLOOKUP(C15,B1:D9,3,FALSE)	
16	2010	=IFNA(VLOOKUP(B16,B2:D10,2,FALSE),"Student ID doesn't match.")	=IFNA(VLOOKUP(B16,B2:D10,D2,FALSE),"Marks for ID not Found")	
17	2005	=IFNA(VLOOKUP(B17,B2:D10,2,FALSE),"Student ID doesn't match.")	=VLOOKUP(B17,B2:D10,3,FALSE)	
13	Find Student Marks			
14	ID	Student Name	Marks	
15	2010	#N/A	#N/A	
16	2010	Student ID doesn't match.	Marks for ID not Found	
17	2005	Thomas	80	

## Function Usage

### Results

# 227. IFS Function

## Description

The IFS function checks whether one or more conditions are met and returns a value that corresponds to the first TRUE condition. This Function was added in Excel 2016.

## Syntax

```
IFS    (logical_test1,    value_if_true1,    [logical_test2,    value_if_true2],  
[logical_test3, value_if_true3]...)
```

## Arguments

Argument	Description	Required /Optional
logical_test1	Condition that evaluates to TRUE or FALSE.	Required
value_if_true1	Result to be returned if logical_test1 evaluates to TRUE. Can be empty.	Required
logical_test2...logical_test127	Condition that evaluates to TRUE or FALSE.	Optional
value_if_true2...value_if_true127	Result to be returned if logical_testN evaluates to TRUE. Each value_if_trueN corresponds with a condition logical_testN. Can be empty.	Optional

## Notes

- As functions are limited to 254 parameters, you can use up to 127 pairs of condition and result arguments.
- To specify a default result, enter a condition that will always be true for your final logical\_test argument, such as TRUE or 1=1. The corresponding value will return, if none of the other conditions are met.
- If a logical\_test argument is supplied without a corresponding value\_if\_true, IFS shows the typical "You've entered too few arguments for this function" error message.
- If a logical\_test argument is evaluated and resolves to a value other than TRUE or FALSE, IFS returns a #VALUE! Error.
- If no TRUE conditions are found, IFS returns #N/A! error.

## Applicability

Excel 2016

## Example

				Function Usage	Results	
	A	B	C	D	E	
1						
2		10	15	2	=IFS(C2>B2,D2,C2>B3,D3,C2>B4,D4,C2>B5,D5,C2>B6,D6,C2>B7,D7,C2>B8,D8,C2>B9,D9,C2>B10,D10,C2>B11,D11)	2
3		20	5	3	=IFS(C3>B3,D3,C3>B4,D4,C3>B5,D5,C3>B6,D6,C3>B7,D7,C3>B8,D8,C3>B9,D9,C3>B10,D10,C3>B11,D11)	#N/A
4		30	25	4	=IFS(C4>B4,D4,C4>B5,D5,C4>B6,D6,C4>B7,D7,C4>B8,D8,C4>B9,D9,C4>B10,D10,C4>B11,D11)	11
5		40	35	5	=IFS(C5>B5,D5,C5>B6,D6,C5>B7,D7,C5>B8,D8,C5>B9,D9,C5>B10,D10,C5>B11,D11)	10
6		50	75	6	=IFS(C6>B6,D6,C6>B7,D7,C6>B8,D8,C6>B9,D9,C6>B10,D10,C6>B11,D11)	6
7		60	55	7	=IFS(C7>B7,D7,C7>B8,D8,C7>B9,D9,C7>B10,D10,C7>B11,D11)	8
8		50	45	8	=IFS(C8>B8,D8,C8>B9,D9,C8>B10,D10,C8>B11,D11)	9
9		40	15	9	=IFS(C9>B9,D9,C9>B10,D10,C9>B11,D11)	#N/A
10		30	95	10	=IFS(C10>B10,D10,C10>B11,D11)	10
11		20	85	11	=IFS(C11>B11,D11)	11
12						

# 228. NOT Function

## Description

The NOT function reverses the value of its argument. Use NOT when you want to make sure a value is not equal to one particular value.

## Syntax

```
NOT (logical)
```

## Arguments

Argument	Description	Required /Optional
logical	A value or expression that can be evaluated to TRUE or FALSE.	Required

## Notes

- If logical is FALSE, NOT returns TRUE.
- If logical is TRUE, NOT returns FALSE.
- If the argument is not a logical or a numeric value, NOT function returns error.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results			
	B	C		B	C	
1			1			
2			2			
3	TRUE	=NOT(C3)	3	TRUE	FALSE	
4	FALSE	=NOT(C4)	4	FALSE	TRUE	
5		=NOT(C5)	5		TRUE	
6	100	200	=NOT(B6>C6)	6	200	TRUE
7	100	200	=NOT(B7=C7)	7	200	TRUE
8	100	200	=NOT(B8<C8)	8	200	FALSE
9	42370	42401	=NOT(B9>C9)	9	1-Jan-16	1-Feb-16
10	Text	Text	=NOT(B10=C10)	10	Text	Text
11	"Text"	Text	=NOT(B11=C11)	11	"Text"	Text
12	"Text"	"Text"	=NOT(B12=C12)	12	"Text"	"Text"
13	Text	Tex	=NOT(B13=C13)	13	Tex	TRUE
14	=NA()	=NA()	=NOT(B14=C14)	14	#N/A	#N/A
15	=5/0	=10/0	=NOT(B15>C15)	15	#DIV/0!	#DIV/0!
16						

# 229. OR Function

## Description

The OR function returns a TRUE if any argument is TRUE and returns FALSE if all arguments are FALSE.

## Syntax

```
OR (logical1, [logical2], ...)
```

## Arguments

Argument	Description	Required /Optional
logical1	1 to 255 conditions you want to test that can be either TRUE or FALSE.	Required
logical2, ...	logical1 is required and subsequent logical values (up to 254) are optional.	Optional

## Notes

- The arguments must evaluate to logical values such as TRUE or FALSE, or in arrays or references that contain logical values.
- If any of the supplied logical\_test arguments are text values, OR returns the #VALUE! error value.
- If an array or reference argument contains text or empty cells, those values are ignored.
- If the specified range contains no logical values, OR returns the #VALUE! error value.
- If the logical\_tests return numbers, instead of logical values, zero is treated as the logical value FALSE and all non-zero numbers are treated as the logical value TRUE.
- You can use an OR array formula to see if a value occurs in an array. To enter an array formula, press CTRL+SHIFT+ENTER
- Common functions used with the OR function include the IF function, AND function, and NOT function.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage		Results	
A	B	A	B
1		1	
2	<b>Payment Type</b>	<b>Result</b>	<b>Payment Type</b>
3	Cash	=OR(B3="Visa",B3="Master")	Cash
4	Visa	=OR(B4="Visa",B4="Master")	Visa
5	Cheque	=OR(B5="Visa",B5="Master")	Cheque
6	Delta	=OR(B6="Visa",B6="Master")	Delta
7	Master	=OR(B7="Visa",B7="Master")	Master
8		=OR(B8="Visa",B8="Master")	
9		=OR(5<2,5<4)	
10		=OR(5,0)	
11		=OR(5,5)	
12		=OR(0,0)	
13		=OR("Visa","Master")	
14	Visa	=OR(B14,"Master")	Visa
15	Visa	=OR(B15="Visa","Master")	Visa

# 230. SWITCH Function

## Description

The SWITCH function evaluates an expression against a list of values and returns the result corresponding to the first matching value. If there is no match, an optional default value may be returned. This function was added in Excel 2016.

## Syntax

```
SWITCH (expression, value1, result1, [default or value2, result2],...[default or value3, result3])
```

## Arguments

Argument	Description	Required /Optional
expression	Expression is the value that will be compared against value1...value126.	Required
value1...value126	ValueN is a value that will be compared against expression.	Required
result1...result126	ResultN is the value to be returned when the corresponding valueN argument matches expression. ResultN must be supplied for each corresponding valueN argument.	Required
Default	Default is the value to return in case no matches are found in the valueN expressions. The Default argument is identified by having no corresponding result expression (see examples). Default must be the final argument in the function.	Optional

## Notes

- As functions are limited to 254 arguments, you can use up to 126 pairs of value and result arguments.
- If none of the value arguments match expression and no default argument is supplied, the SWITCH function returns the #N/A! error.

## Applicability

Excel 2016

## Example

A	B	C	D	E
1				
2	Value	Result	Expression	Return Value
3	2	Monday	1	=SWITCH(D3,\$B\$3,\$C\$3,\$B\$4,\$C\$4,\$B\$5,\$C\$5,\$B\$6,\$C\$6,\$B\$7,\$C\$7,\$B\$8,\$C\$8,\$B\$9,\$C\$9)
4	6	Friday	2	=SWITCH(D4,\$B\$3,\$C\$3,\$B\$4,\$C\$4,\$B\$5,\$C\$5,\$B\$6,\$C\$6,\$B\$7,\$C\$7,\$B\$8,\$C\$8,\$B\$9,\$C\$9)
5	3	Tuesday	3	=SWITCH(D5,\$B\$3,\$C\$3,\$B\$4,\$C\$4,\$B\$5,\$C\$5,\$B\$6,\$C\$6,\$B\$7,\$C\$7,\$B\$8,\$C\$8,\$B\$9,\$C\$9)
6	4	Wednesday	4	=SWITCH(D6,\$B\$3,\$C\$3,\$B\$4,\$C\$4,\$B\$5,\$C\$5,\$B\$6,\$C\$6,\$B\$7,\$C\$7,\$B\$8,\$C\$8,\$B\$9,\$C\$9)
7	1	Sunday	5	=SWITCH(D7,\$B\$3,\$C\$3,\$B\$4,\$C\$4,\$B\$5,\$C\$5,\$B\$6,\$C\$6,\$B\$7,\$C\$7,\$B\$8,\$C\$8,\$B\$9,\$C\$9)
8	5	Thursday	6	=SWITCH(D8,\$B\$3,\$C\$3,\$B\$4,\$C\$4,\$B\$5,\$C\$5,\$B\$6,\$C\$6,\$B\$7,\$C\$7,\$B\$8,\$C\$8,\$B\$9,\$C\$9)
9	7	Saturday	7	=SWITCH(D9,\$B\$3,\$C\$3,\$B\$4,\$C\$4,\$B\$5,\$C\$5,\$B\$6,\$C\$6,\$B\$7,\$C\$7,\$B\$8,\$C\$8,\$B\$9,\$C\$9)

A	B	C	D	E
1				
2	Value	Result	Expression	Return Value
3	2	Monday	1	Sunday
4	6	Friday	2	Monday
5	3	Tuesday	3	Tuesday
6	4	Wednesday	4	Wednesday
7	1	Sunday	5	Thursday
8	5	Thursday	6	Friday
9	7	Saturday	7	Saturday

**Function Usage**

**Results**

# 231. TRUE Function

## Description

The TRUE function returns the logical value TRUE.

You can use this function when you want to return the value TRUE based on a condition. Example =IF (A1=1, TRUE ()).

You can also enter the value TRUE directly into cells and formulas without using this function. Example =IF(A1=1,TRUE)

If the condition is met, Excel returns TRUE in both examples. If the condition is not met, Excel returns FALSE in both examples.

## Syntax

```
TRUE ()
```

## Arguments

The TRUE function syntax has no arguments.

## Notes

The TRUE function is provided primarily for compatibility with other spreadsheet programs.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage		Results
A	B	A
1	=TRUE()	1
2		2
3		3

# 232. XOR Function

## Description

The XOR function returns a logical Exclusive OR of all arguments. The XOR Function returns TRUE if an odd number of the supplied conditions evaluate to TRUE, and FALSE otherwise.

## Syntax

```
XOR (logical1, [logical2],...)
```

## Arguments

Argument	Description	Required /Optional
logical1	logical1 is required and subsequent logical values are optional.1 to 254 conditions you want to test that can be either TRUE or FALSE, and can be logical values, arrays, or references.	Required
logical2, ...		Optional

## Notes

- Exclusive OR
  - The Exclusive OR logical operation returns True if one (and only one) of two supplied conditions evaluate to True. It can be thought of as "either A or B, but not both A and B".
  - When there is just one condition or when there are more than two conditions, the Exclusive OR operation evaluates to True if an odd number of conditions evaluate to True.
- The arguments must evaluate to logical values such as TRUE or FALSE, or in arrays or references that contain logical values.
- If an array or reference argument contains text or empty cells, those values are ignored.
- If the specified range contains no logical values, XOR returns the #VALUE! error value.
- You can use an XOR array formula to see if a value occurs in an array. To enter an array formula, press Ctrl+Shift+Enter.
- The result of XOR is TRUE when the number of TRUE inputs is odd and FALSE when the number of TRUE inputs is even.

- #NAME? Error occurs if Excel does not recognize the function name. This is probably because you have an earlier version of Excel, which does not support the Xor function.

## Applicability

Excel 2013, Excel 2016

## Example

	A	B	C	D	E	F	G	H	I
1									
2	Exp1	Exp2	Exp3	Exp4	Exp5	Exp6	No. of TRUEs	XOR	
3	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	6	=XOR(B3:G3)	
4	TRUE	FALSE	TRUE	FALSE	TRUE	TRUE	4	=XOR(B4:G4)	
5	TRUE	TRUE	FALSE	FALSE	TRUE	FALSE	3	=XOR(B5:G5)	
6	TRUE	FALSE	TRUE	TRUE	FALSE	FALSE	3	=XOR(B6:G6)	
7	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	0	=XOR(B7:G7)	
8	FALSE	FALSE	FALSE	FALSE	FALSE	TRUE	1	=XOR(B8:G8)	
9	FALSE	TRUE	TRUE	TRUE	TRUE	FALSE	4	=XOR(B9:G9)	
10	FALSE	TRUE	TRUE	TRUE	TRUE	TRUE	5	=XOR(B10:G10)	

**Function Usage**

	A	B	C	D	E	F	G	H	I
1									
2	Exp1	Exp2	Exp3	Exp4	Exp5	Exp6	No. of TRUEs	XOR	
3	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	6	FALSE	
4	TRUE	FALSE	TRUE	FALSE	TRUE	TRUE	4	FALSE	
5	TRUE	TRUE	FALSE	FALSE	TRUE	FALSE	3	TRUE	
6	TRUE	FALSE	TRUE	TRUE	FALSE	FALSE	3	TRUE	
7	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	0	FALSE	
8	FALSE	FALSE	FALSE	FALSE	FALSE	TRUE	1	TRUE	
9	FALSE	TRUE	TRUE	TRUE	TRUE	FALSE	4	FALSE	
10	FALSE	TRUE	TRUE	TRUE	TRUE	TRUE	5	TRUE	

**Results**

# Lookup & Reference Functions

# 233. Lookup & Reference Functions – Overview

Lookup & Reference functions help you to work with arrays of data, and are particularly useful when you need to cross reference between different data sets. They perform tasks such as providing information about a range, returning the location of a given address or value, or looking up specific values.

## Lookup & Reference Functions

The following table lists all the Lookup & Reference functions-

S. No.	Function and Description
1	ADDRESS Returns a reference as text to a single cell in a worksheet
2	AREAS Returns the number of areas in a reference
3	CHOOSE Chooses a value from a list of values
4	COLUMN Returns the column number of a reference
5	COLUMNS Returns the number of columns in a reference
6	FORMULATEXT Returns the formula at the given reference as text
7	GETPIVOTDATA Returns data stored in a PivotTable
8	HLOOKUP Searches for a value in the top row of a table and then returns a value in the same column from a row you specify in the table
9	HYPERLINK Creates a shortcut that opens a document on your hard drive, a server, or the Internet
10	INDEX Uses an index to choose a value from a reference or array
11	INDIRECT Returns a reference indicated by a text value
12	LOOKUP Returns a value either from a one-row or one-column range or from an array
13	MATCH Returns the relative position of an item in an array
14	OFFSET Returns a reference offset from a given reference

S. No.	Function and Description
15	ROW Returns the row number of a reference
16	ROWS Returns the number of rows in a reference
17	RTD Returns real-time data from a program that supports COM automation
18	TRANSPOSE Returns the transpose of an array
19	VLOOKUP Searches for a value in the leftmost column of a table and then returns a value in the same row from a column you specify in the table

# 234. ADDRESS Function

## Description

You can use the ADDRESS function to obtain the address of a cell in a worksheet, given specified row and column numbers.

For example, ADDRESS (2,3) returns \$C\$2. As another example, ADDRESS (77,300) returns \$KN\$77. You can use other functions, such as the ROW and COLUMN functions, to provide the row and column number arguments for the ADDRESS function.

## Syntax

```
ADDRESS (row_num, column_num, [abs_num], [a1], [sheet_text])
```

## Arguments

Argument	Description	Required /Optional
row_num	A numeric value that specifies the row number to use in the cell reference.	Required
column_num	A numeric value that specifies the column number to use in the cell reference.	Required
abs_num	A numeric value that specifies the type of reference to return. See the Table given below.	Optional
a1	A logical value that specifies the A1 or R1C1 reference style. In A1 style, columns are labeled alphabetically, and rows are labeled numerically. In R1C1 reference style, both columns and rows are labeled numerically. If the A1 argument is TRUE or omitted, the ADDRESS function returns an A1-style reference If the A1 argument is FALSE, the ADDRESS function returns an R1C1-style reference.	Optional
sheet_text	A text value that specifies the name of the worksheet to be used as the external reference. For example, the formula =ADDRESS(1,1,,,"Sheet2") returns Sheet2!\$A\$1. If the sheet_text argument is omitted, no sheet name is used, and the address returned by the function refers to a cell on the current sheet.	Optional

**abs\_num** argument returns the following values-

abs_num	Returns this type of reference
1 or omitted	Absolute
2	Absolute row; relative column
3	Relative row; absolute column
4	Relative

## Notes

- If the row\_num is less than 1 or greater than the number of rows in the spreadsheet, ADDRESS Functions returns #VALUE error.
- If the column\_num is less than 1 or greater than the number of columns in the spreadsheet, ADDRESS Functions returns #VALUE error
- If any of the supplied row\_num, column\_num or [abs\_num] arguments are non-numeric, ADDRESS Functions returns #VALUE error.
- If the supplied [a1] argument is not recognized as a logical value, ADDRESS Functions returns #VALUE error.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage		Results	
A	B	A	B
1 Column Number:	2	1 Column Number:	2
2 Row Number:	3	2 Row Number:	3
3 Sheet Name:	AddressExample	3 Sheet Name:	AddressExample
4		4	
5 Reference Type	A1 Reference Style	5 Reference Type	A1 Reference Style
6 Absolute	=ADDRESS(B2,B1,1,TRUE)	6 Absolute	\$B\$3
7 Absolute row; relative column	=ADDRESS(B2,B1,2,TRUE)	7 Absolute row; relative column	B\$3
8 Relative row; absolute column	=ADDRESS(B2,B1,3,TRUE)	8 Relative row; absolute column	\$B3
9 Relative	=ADDRESS(B2,B1,4,TRUE)	9 Relative	B3
10		10	
11 Reference Type	R1C1 Reference Style	11 Reference Type	R1C1 Reference Style
12 Absolute	=ADDRESS(B2,B1,1,FALSE)	12 Absolute	R3C2
13 Absolute row; relative column	=ADDRESS(B2,B1,2,FALSE)	13 Absolute row; relative column	R3C[2]
14 Relative row; absolute column	=ADDRESS(B2,B1,3,FALSE)	14 Relative row; absolute column	R[3]C2
15 Relative	=ADDRESS(B2,B1,4,FALSE)	15 Relative	R[3]C[2]
16		16	
17 Reference Type	A1 Reference Style	17 Reference Type	A1 Reference Style
18 Absolute	=ADDRESS(B2,B1,1,TRUE,B3)	18 Absolute	AddressExample!\$B\$3
19 Absolute row; relative column	=ADDRESS(B2,B1,2,TRUE,B3)	19 Absolute row; relative column	AddressExample!B\$3
20 Relative row; absolute column	=ADDRESS(B2,B1,3,TRUE,B3)	20 Relative row; absolute column	AddressExample!\$B3
21 Relative	=ADDRESS(B2,B1,4,TRUE,B3)	21 Relative	AddressExample!B3

# 235. AREAS Function

## Description

The AREAS function returns the number of areas in a reference. An area is a range of contiguous cells or a single cell.

## Syntax

AREAS (reference)
-------------------

## Arguments

Argument	Description	Required /Optional
reference	A standard Excel reference to a cell or range of cells OR A named range OR A list of references, separated by commas and surrounded by parentheses. Then, the list is taken as a single argument, and Microsoft Excel will not interpret the comma as a field separator.	Required

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

In the example given below, two teams are selected (i.e. the Ranges are selected) and given the Name Team1 and Team 2. The Areas function returns 2 as there are two ranges in the selection.

Function Usage			Results		
Team1	Player	Rank	Team1	Player	Rank
Player11	3		Player11	3	
Player12	2		Player12	2	
Player13	5		Player13	5	
Player14	1		Player14	1	
Player15	4		Player15	4	
Team2	Player	Rank	Team2	Player	Rank
Player21	1		Player21	1	
Player22	3		Player22	3	
Player23	4		Player23	4	
Player24	5		Player24	5	
Player25	2		Player25	2	

Areas    =AREAS(Teams)

Areas                  2

# 236. CHOOSE Function

## Description

The CHOOSE function returns a value from an array that corresponds to a supplied index number (position). You can consider CHOOSE Function as a function that returns the *n*th entry in a given list. CHOOSE function uses index\_num to return a value from the list of value arguments. You can use it to select one of up to 254 values based on the index number.

For example, if value1 through value7 are the days of the week, the CHOOSE function returns one of the days when a number between 1 and 7 is used as index\_num.

## Syntax

```
CHOOSE (index_num, value1, [value2], ...)
```

## Arguments

Argument	Description	Required /Optional
Index_num	Specifies which value argument is selected. Index_num must be a number between 1 and 254, or a formula or reference to a cell containing a number between 1 and 254. If index_num is 1, CHOOSE Function returns value1; if it is 2, CHOOSE returns value2; and so on. If index_num is less than 1 or greater than the number of the last value in the list, CHOOSE returns the #VALUE! error value. If index_num is a fraction, it is truncated to the lowest integer before being used.	Required
Value1	1 to 254 value arguments from which CHOOSE Function selects a value or an action to perform based on index_num.	Required
Value2, ...	Value1, Value2 ... can be numbers, cell references, defined names, formulas, or text.	Optional

## Notes

- If index\_num is an array, every value is evaluated when CHOOSE Function is evaluated.
- The value arguments to CHOOSE Function can be range references as well as single values.
- If index\_num is less than 1 or is greater than the supplied number of Value arguments, CHOOSE Function returns #VALUE error.

- If any of the Value arguments are text values that are not enclosed in quotes, CHOOSE Function returns #NAME? error.
- If any of the Value arguments are not valid cell references, the CHOOSE Function returns #NAME? error.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage		Results	
A	B	A	C
1	<code>=CHOOSE(B3,"Apple","Orange","Plum")</code>	2	Index Value
3	<code>=CHOOSE(B4,"Apple","Orange","Plum")</code>	3	1 Apple
2	<code>=CHOOSE(B5,"Apple","Orange","Plum")</code>	4	3 Plum
3	<code>=CHOOSE(B6,50,100,150,200,250,300,350,400,500)</code>	5	2 Orange
8	<code>=CHOOSE(B7,50,100,150,200,250,300,350,400,500)</code>	6	3 150
2	<code>=CHOOSE(B8,50,100,150,200,250,300,350,400,500)</code>	7	8 400
		8	2 100

# 237. COLUMN Function

## Description

The COLUMN function returns the first Column number within a supplied reference. If no reference is supplied, the Column Function returns the number of the current Column in the current Excel Worksheet.

## Syntax

```
COLUMN ([reference])
```

## Arguments

Argument	Description	Required /Optional
reference	The cell or range of cells for which you want to return the first Column number. If reference is omitted, the Column Function returns the number of the current Column in the current Excel Worksheet, in which the Function appears. See Notes Below.	Optional

## Notes

- If the reference argument is omitted or refers to a range of cells, and if the COLUMN function is entered as a horizontal array formula, the COLUMN function returns the column numbers of reference as a horizontal array.
- To enter a formula as an array formula- Starting with the formula cell, select the range that you want to contain the array formula. Press F2, and then press CTRL+SHIFT+ENTER.
- If the reference argument is a range of cells, and if the COLUMN function is not entered as a horizontal array formula, the COLUMN function returns the number of the leftmost Column (the first Column in the Range).
- The reference argument cannot refer to multiple areas.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage		Results	
A	B	A	B
1		1	
2	<b>Result</b>	2	<b>Result</b>
3	=COLUMN(B8)	3	2
4	=COLUMN(E5)	4	5
5	=COLUMN()	5	2

# 238. COLUMNS Function

## Description

The COLUMNS function returns the number of Columns in an array or reference.

## Syntax

```
COLUMNS (array)
```

## Arguments

Argument	Description	Required /Optional
array	An array or array formula, or a reference to a range of cells for which you want the number of Columns.	Required

## Notes

=COLUMNS (1:1) returns the number of Columns in Excel, i.e. 16384.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage		Results	
A	B	A	B
1		1	
2	Result =COLUMNS(1:1)	2	Result 16384
3	=COLUMNS(D2:E15)	3	2
4	=COLUMNS(D2:T5)	4	17
5		5	
c		c	

# 239. FORMULATEXT Function

## Description

The FORMULATEXT function returns a formula as a string.

## Syntax

FORMULATEXT (reference)
-------------------------

## Arguments

Argument	Description	Required /Optional
reference	A reference to a cell or range of cells.	Required

## Notes

- The FORMULATEXT function returns what is displayed in the formula bar if you select the referenced cell.
- The Reference argument can be to another Worksheet or Workbook.
- If the Reference argument is to another workbook that is not open, FORMULATEXT returns the #N/A error value.
- If the Reference argument is to an entire row or column, or to a range or defined name containing more than one cell, FORMULATEXT returns the value in the upper leftmost cell of the row, column, or range.
- In the following cases, FORMULATEXT returns the #N/A error value-
  - The cell used as the Reference argument does not contain a formula.
  - The formula in the cell is longer than 8192 characters.
  - The formula cannot be displayed in the Worksheet, for example, due to Worksheet protection.
  - If the Reference argument is to another Workbook that is not open.
  - If the Reference argument is to a cell whose formula cannot be viewed, for example, if it is protected.
- Invalid data types used as inputs will produce a #VALUE! error value.
- If the Reference argument is not a valid cell reference, FORMULATEXT returns the #VALUE! error value.

- Entering a reference to the cell in which you are entering the function as the argument will not result in a circular reference warning. FORMULATEXT will successfully return the formula as text in the cell.

## Applicability

Excel 2013, Excel 2016

## Example

Function Usage			Results				
	A	B		A	B		
1				1			
2		Formula	Result	2		Formula	Result
3		=NOW()	=FORMULATEXT(B3)	3		4/23/2016 13:01	=NOW()
4		=TRUE()	=FORMULATEXT(B4)	4		TRUE	=TRUE()
5		=5/0	=FORMULATEXT(B5)	5		#DIV/0!	=5/0
6		=TODAY()+5	=FORMULATEXT(B6)	6		4/28/2016	=TODAY()+5
7			=FORMULATEXT(B4:B6)	7			=TRUE()
8			=FORMULATEXT(B:B)	8			#N/A
9			=FORMULATEXT(B2:B9)	9			#N/A
10			=FORMULATEXT(B3:B10)	10			=NOW()

## 240. GETPIVOTDATA Function

### Description

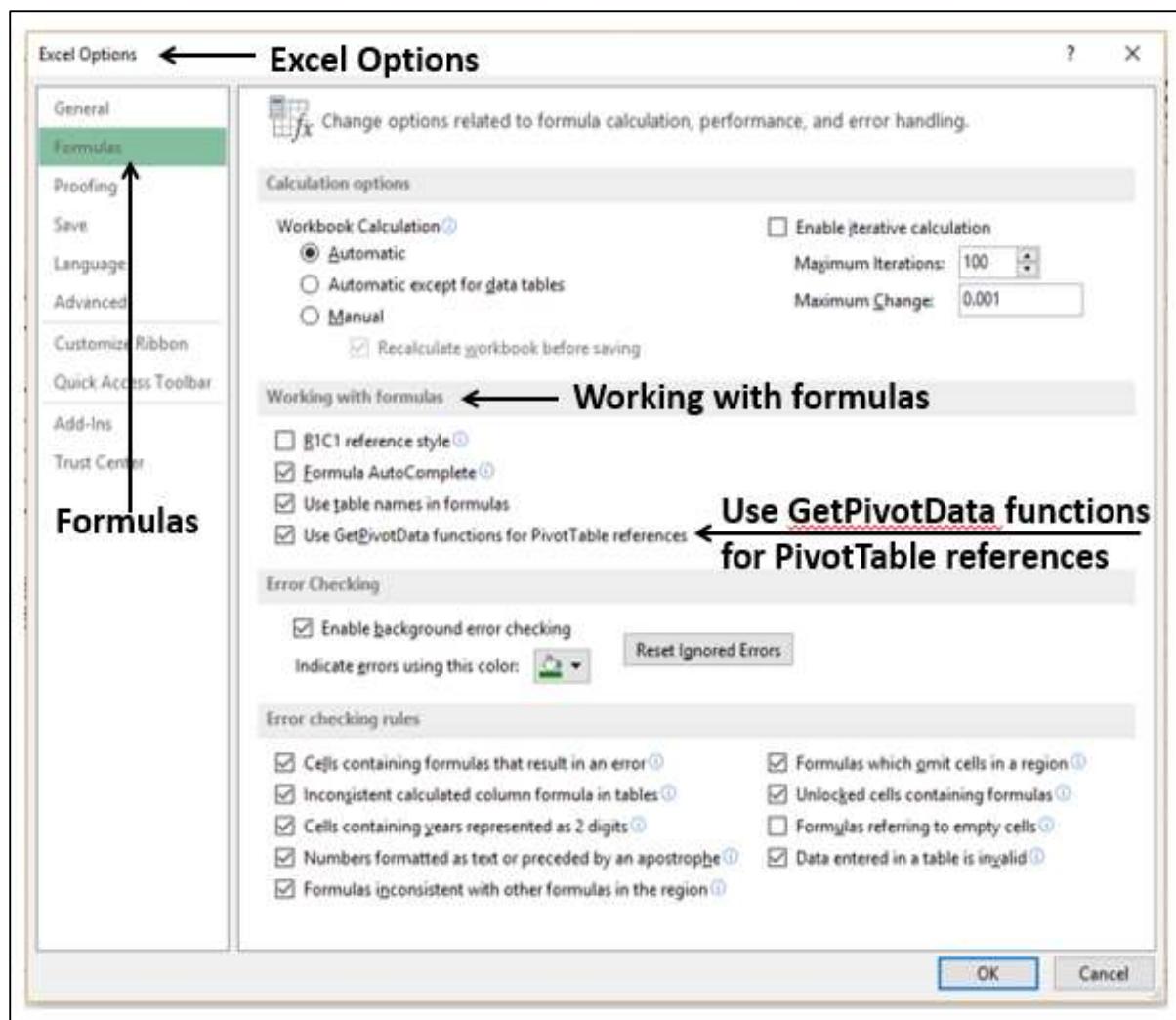
The GETPIVOTDATA function returns data stored in a PivotTable report. You can use it to retrieve summary data from a PivotTable report, provided the summary data is visible in the report.

You can quickly enter a simple GETPIVOTDATA formula by typing = (the equal sign) in the cell you want to return the value to and then clicking the cell in the PivotTable report that contains the data you want to return. Excel then automatically inserts the GETPIVOTDATA function into the active cell.

In order to have this quick entry of GETPIVOTDATA function, 'Use GetPivotData functions for PivotTable references' Excel option should be enabled.

Use the following steps-

- Step 1: Click File > Options. The Excel Options Window appears.
- Step 2: Click Formulas in the left pane.
- Step 3: Select 'Use GetPivotData functions for PivotTable references' in the "Working with formulas" section.
- Step 4: Click OK.



## Syntax

```
GETPIVOTDATA (data_field, pivot_table, [field1, item1, field2, item2] ...)
```

## Arguments

Argument	Description	Required / Optional
data_field	The name, enclosed in quotation marks, for the data field that contains the data that you want to retrieve.	Required
pivot_table	A reference to any cell, range of cells, or named range of cells in a PivotTable report. This information is used to determine which PivotTable report contains the data that you want to retrieve.	Required
field1, item1, field2, item2	1 to 126 pairs of field names and item names that describe the data that you want to retrieve. The pairs can be in any order. Field names and names for items other than dates and numbers are enclosed in quotation marks.	Optional

Argument	Description	Required /Optional
	For OLAP PivotTable reports, items can contain the source name of the dimension and also the source name of the item. A field and item pair for an OLAP PivotTable might look like this: "[Product]", "[Product].[All Products].[Foods].[Baked Goods]"	

## Notes

- Calculated fields or items and custom calculations are included in GETPIVOTDATA calculations.
- If pivot\_table is a range that includes two or more PivotTable reports, data will be retrieved from whichever report was created most recently in the range.
- If the field and item arguments describe a single cell, the value of that cell is returned regardless of whether it is a string, number, error, etc.
- If an item contains a date, the value must be expressed as a serial number or populated by using the DATE function so that the value will be retained if the Worksheet is opened in a different location.
- For example, an item referring to the date March 5, 1999 could be entered as 36224 or DATE(1999,3,5).
- Times can be entered as decimal values or by using the TIME function.
- If pivot\_table is not a range in which a PivotTable report is found, GETPIVOTDATA returns #REF! error value.
- If the arguments do not describe a visible field, or if they include a report filter in which the filtered data is not displayed, GETPIVOTDATA returns the #REF! error value.
- Any of the fields specified by the data\_field, [field] or [item] arguments are not valid fields within the specified pivot table, GETPIVOTDATA returns the #REF! error value.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

**PivotTable**

A	B	C	D	E	
1					
2					
3	<b>Sum of Order Amount</b>	Column Labels			
4	Row Labels	January	February	March	Grand Total
5	East	1690	1950	700	4340
6	Albertson, Kathy	925	1375	350	2650
7	Post, Melissa	765	575	350	1690
8	North	1140	1720	300	3160
9	Thompson, Shannon	1140	1720	300	3160
10	South	3110	3975	3790	10875
11	Davis, William	1100	235	600	1935
12	Flores, Tia	1655	985	1925	4565
13	Walters, Chris	355	2755	1265	4375
14	West	3150	1515	525	5190
15	Brennan, Michael	2750	550	400	3700
16	Dumlao, Richard	400	965	125	1490
17	<b>Grand Total</b>	<b>9090</b>	<b>9160</b>	<b>5315</b>	<b>23565</b>
18					

**PivotTable Fields**

Choose fields to add to report:

- Salesperson
- Region
- Account
- Order Amount
- Month

MORE TABLES...

Drag fields between areas below

FILTERS

ROWS

**Function Usage**

A	B	C
1		
2	Total Sales	=GETPIVOTDATA("Order Amount",PivotTable!\$A\$4)
3	January Sales	=GETPIVOTDATA("Order Amount",PivotTable!\$A\$4,"Month","March")
4	East Region Sales	=GETPIVOTDATA("Order Amount",PivotTable!A4,"Region","East")
5	Sales by Thompson	=GETPIVOTDATA("Order Amount",PivotTable!A4,"Salesperson","Thompson, Shannon")

A	B	C
1		
2	Total Sales	23565
3	January Sales	5315
4	East Region Sales	4340
5	Sales by Thompson	3160

**Results**

# 241. HLOOKUP Function

## Description

The HLOOKUP function searches for a value in the top row of a table or an array of values, and then returns a value in the same column from a row you specify in the table or array.

You can use HLOOKUP when your comparison values are located in a row across the top of a table of data, and you want to look down a specified number of rows.

The H in HLOOKUP stands for "Horizontal". You can use VLOOKUP when your comparison values are located in a column to the left of the data you want to find.

## Syntax

```
HLOOKUP (lookup_value, table_array, row_index_num, [range_lookup])
```

## Arguments

Argument	Description	Required /Optional
lookup_value	The value to be found in the first row of the table. Lookup_value can be a value, a reference, or a text string.	Required
table_array	A table of information in which data is looked up. Use a reference to a range or a range name. The values in the first row of table_array can be text, numbers, or logical values.  See Notes Below.	Required
row_index_num	The row number in table_array from which the matching value will be returned. A row_index_num of 1 returns the first row value in table_array, a row_index_num of 2 returns the second row value in table_array, and so on. $1 \leq \text{row\_index\_num} \leq \text{the number of rows in the table\_array}$ . HLOOKUP returns the #VALUE! error value; if row_index_num is greater than,	Required
range_lookup	A logical value that specifies whether you want HLOOKUP to find an exact match or an approximate match. If TRUE or if omitted, an approximate match is returned. In other words, if an exact match is not	Optional

Argument	Description	Required /Optional
	found, the next largest value that is less than lookup_value is returned.  If FALSE, HLOOKUP will find an exact match. If one is not found, the error value #N/A is returned.	

## Notes

- **table\_array**
  - If range\_lookup is TRUE, the values in the first row of table\_array must be placed in ascending order: ...-2, -1, 0, 1, 2..., A-Z, FALSE, TRUE. Otherwise, HLOOKUP may not give the correct value
  - Uppercase and lowercase text are equivalent
  - Sort the values in ascending order, left to right
  - If range\_lookup is FALSE, table\_array does not need to be sorted
- If row\_index\_num is less than 1, HLOOKUP function returns the #VALUE! error value.
- If row\_index\_num is not recognized as a numeric value, HLOOKUP function returns the #VALUE! error value.
- If row\_index\_num is greater than the number of rows in the table\_array, HLOOKUP function returns the #REF! error value.
- If HLOOKUP function cannot find lookup\_value, and range\_lookup is TRUE, it uses the largest value that is less than lookup\_value.
- If lookup\_value is smaller than the smallest value in the first row of table\_array, HLOOKUP function returns the #N/A error value.
- If range\_lookup is FALSE and lookup\_value is text, you can use the wildcard characters, question mark (?) and asterisk (\*), in lookup\_value. A question mark matches any single character; an asterisk matches any sequence of characters. If you want to find an actual question mark or asterisk, type a tilde (~) before the character.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Jan	Feb	2	Jan	Feb
3	10	80	3	10	80
4	20	90	4	20	90
5	30	100	5	30	100
6	40	110	6	40	110
7	50	120	7	50	120
8			8		
9	Month	Feb	9	Month	Feb
10	Row	4	10	Row	4
11	Result	=HLOOKUP(C9,B2:D7,C10,FALSE)	11	Result	100
12			12		
13	Month	Feb	13	Month	Feb
14	Row	11	14	Row	11
15	Result	=HLOOKUP(C13,B2:D7,C14,FALSE)	15	Result	#REF!

# 242. HYPERLINK Function

## Description

The HYPERLINK function creates a shortcut or jump that opens a document stored on a network server, an intranet, or the Internet.

When you click the cell that contains the HYPERLINK function, Microsoft Excel opens the file that is stored at link\_location.

## Syntax

```
HYPERLINK (link_location, [friendly_name])
```

## Arguments

Argument	Description	Required /Optional
Link_location	<p>The path and file name to the document to be opened. Link_location can refer to a place in a document — such as a specific cell or named range in an Excel worksheet or workbook, or to a bookmark in a Microsoft Word document.</p> <p>The path can be to a file that is stored on a hard disk drive.</p> <p>The path can also be a universal naming convention (UNC) path on a server (in Microsoft Excel for Windows) or a Uniform Resource Locator (URL) path on the Internet or an intranet.</p>	Required
Friendly_name	<p>The jump text or numeric value that is displayed in the cell.</p> <p>Friendly_name is displayed in blue and is underlined. If friendly_name is omitted, the cell displays the link_location as the jump text.</p>	Optional

## Notes

- Friendly\_name can be a value, a text string, a name, or a cell that contains the jump text or value.
- If friendly\_name returns an error value (for example, #VALUE!), the cell displays the error instead of the jump text.
- To select a cell that contains a hyperlink without jumping to the hyperlink destination, click the cell and hold the mouse button until the pointer becomes a cross , then release the mouse button.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

		B	Function Usage
A	B		Results
1			
2	=HYPERLINK(Sheet35!C6)		
3	=HYPERLINK("http://www.tutorialspoint.com/microsoft_technologies_tutorials.htm", "Excel Tutorials")		
4			
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# 243. INDEX Function

## Description

The INDEX function returns a value or the reference to a value from within a table or range. You can use INDEX function in two ways-

- To return the value of a specified cell or array of cells.
- To return a reference to specified cells.

## Using INDEX function to return the value of a specified cell or array of cells

Use this if the first argument to INDEX is an array constant.

## Description

The function returns the value of an element in a table or an array, selected by the row and column number indexes.

## Syntax

```
INDEX (array, row_num, [column_num])
```

## Arguments

Argument	Description	Required /Optional
Array	A range of cells or an array constant. If array contains only one row or column, the corresponding Row_num or Column_num argument is optional. If array has more than one row and more than one column, and only Row_num or Column_num is used, INDEX returns an array of the entire row or column in array.	Required
Row_num	Selects the row in array from which to return a value. If Row_num is omitted, Column_num is required.	Required
Column_num	Selects the column in array from which to return a value. If Column_num is omitted, Row_num is required.	Optional

## Notes

- If both the Row\_num and Column\_num arguments are used, INDEX returns the value in the cell at the intersection of Row\_num and Column\_num.
- If you set Row\_num or Column\_num to 0 (zero), INDEX returns the array of values for the entire column or row, respectively. To use values returned as an array,

enter the INDEX function as an array formula in a horizontal range of cells for a row, and in a vertical range of cells for a column. To enter an array formula, press CTRL+SHIFT+ENTER

- Row\_num and Column\_num must point to a cell within array. Otherwise, INDEX returns the #REF! error value.

## Using INDEX function to return a reference to specified cells

### Description

The function returns the reference of the cell at the intersection of a particular row and column. If the reference is made up of nonadjacent selections, you can pick the selection to look in.

### Syntax

`INDEX (reference, row_num, [column_num], [area_num])`

### Arguments

Argument	Description	Required /Optional
Reference	A reference to one or more cell ranges. If you are entering a nonadjacent range for the reference, enclose reference in parentheses. If each area in reference contains only one row or column, the Row_num or Column_num argument, respectively, is optional. E.g. for a single row reference, use: <code>INDEX(reference,,column_num)</code>	Required
Row_num	The number of the row in reference from which to return a reference.	Required
Column_num	The number of the column in reference from which to return a reference.	Optional
Area_num	Selects a range in reference from which to return the intersection of Row_num and Column_num. The first area selected or entered is numbered 1, the second is 2, and so on. If Area_num is omitted, INDEX uses area 1.	Optional

### Notes

- After Reference and Area\_num have selected a particular range, Row\_num and Column\_num select a particular cell: Row\_num 1 is the first row in the range, Column\_num 1 is the first column, and so on. The reference returned by INDEX is the intersection of Row\_num and Column\_num.
- If you set Row\_num or Column\_num to 0 (zero), INDEX returns the reference for the entire column or row, respectively.

- Row\_num, Column\_num, and Area\_num must point to a cell within reference. Otherwise, INDEX returns the #REF! Error value. If Row\_num and Column\_num are omitted, INDEX returns the area in reference specified by Area\_num.
- The result of the INDEX function is a reference and is interpreted as such by other formulas. Depending on the formula, the return value of INDEX may be used as a reference or as a value. For example, the formula CELL("width",INDEX(A1:B2,1,2)) is equivalent to CELL("width",B1). The CELL function uses the return value of INDEX as a cell reference. On the other hand, a formula such as 2\*INDEX(A1:B2,1,2) translates the return value of INDEX into the number in cell B1.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage					Results						
A	B	C	D	E	A	B	C	D	E	F	
1					1						
2	<b>NORTH</b>	Qtr1	Qtr2	Qtr3	Qtr4	2	<b>NORTH</b>	Qtr1	Qtr2	Qtr3	Qtr4
3	Bricks	1000	2000	3000	4000	3	Bricks	\$1,000	\$2,000	\$3,000	\$4,000
4	Wood	5000	6000	7000	8000	4	Wood	\$5,000	\$6,000	\$7,000	\$8,000
5	Glass	9000	10000	11000	12000	5	Glass	\$9,000	\$10,000	\$11,000	\$12,000
6											
7	<b>SOUTH</b>	Qtr1	Qtr2	Qtr3	Qtr4	7	<b>SOUTH</b>	Qtr1	Qtr2	Qtr3	Qtr4
8	Bricks	1500	2500	3500	4500	8	Bricks	\$1,500	\$2,500	\$3,500	\$4,500
9	Wood	5500	6500	7500	8500	9	Wood	\$5,500	\$6,500	\$7,500	\$8,500
10	Glass	9500	10500	11500	12500	10	Glass	\$9,500	\$10,500	\$11,500	\$12,500
11											
12		Product (1/2/3)			2	12		Product (1/2/3)		2	
13		Quarter(1/2/3/4)			3	13		Quarter(1/2/3/4)		3	
14		Region (1-North, 2-South)			2	14		Region (1-North, 2-South)		2	
15						15					
16		<b>Result</b>	=INDEX([NorthAndSouth,F12,F13,F14]			16	<b>Result</b>	7500			

# 244. INDIRECT Function

## Description

The INDIRECT function returns the reference specified by a text string.

If you type the reference B1 in an Excel Formula, Excel understands that this refers to cell B1. However, Excel does not understand the text string "B1" to be a reference. Hence, if your cell reference takes the form of a text string, you will need to use the INDIRECT function to convert this into an actual cell reference.

References are immediately evaluated to display their contents. Use INDIRECT when you want to change the reference to a cell within a formula without changing the formula itself.

## Syntax

```
INDIRECT (ref_text, [a1])
```

## Arguments

Argument	Description	Required /Optional
Ref_text	A reference to a cell that contains an A1-style reference, an R1C1-style reference, a name defined as a reference, or a reference to a cell as a text string. See Notes below.	Required
A1	A logical value that specifies what type of reference is contained in the cell ref_text. If a1 is TRUE or omitted, ref_text is interpreted as an A1-style reference. If a1 is FALSE, ref_text is interpreted as an R1C1-style reference.	Optional

## Notes

- If ref\_text is not a valid cell reference, INDIRECT returns the #REF! error value
- If ref\_text refers to another workbook (an external reference), the other workbook must be open. If the source workbook is not open, INDIRECT returns the #REF! error value
- If ref\_text refers to a cell range outside the row limit of 1,048,576 or the column limit of 16,384 (XFD), INDIRECT returns a #REF! error

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

**Example**

Function Usage					Results				
A	B	C	D	E	A	B	C	D	E
1					1				
2		Jan	Feb	Mar	2		Jan	Feb	Mar
3	North	10	20	30	3	North	10	20	30
4	South	40	50	60	4	South	40	50	60
5	East	70	80	90	5	East	70	80	90
6	West	100	110	120	6	West	100	110	120
7					7				
8		Address of the Cell	D5		8		Address of the Cell	D5	
9		Value in the Cell	=INDIRECT(E8)		9		Value in the Cell	80	
...					...				

# 245. LOOKUP Function

## Description

Use LOOKUP function when you need to look in a single row or column and find a value from the same position in a second row or column. Use the LOOKUP Function to search one row or one column.

Use VLOOKUP Function to search one row or column, or to search multiple rows and columns (like a table). It is a much improved version of LOOKUP.

There are two ways to use LOOKUP-

**Vector form:** Use this form of LOOKUP to search one row or one column for a value. Use the vector form when you want to specify the range that contains the values that you want to match.

**Array form:** Microsoft strongly recommends using VLOOKUP or HLOOKUP instead of the array form. The array form is provided for compatibility with other spreadsheet programs, but its functionality is limited.

An array is a collection of values in rows and columns (like a table) that you want to search.

To use the array form, your data must be sorted.

## Vector form

The vector form of LOOKUP looks in a one-row or one-column range (known as a vector) for a value and returns a value from the same position in a second one-row or one-column range.

## Syntax

```
LOOKUP (lookup_value, lookup_vector, [result_vector])
```

## Arguments

Argument	Description	Required /Optional
lookup_value	A value that LOOKUP searches for in the lookup_vector. Lookup_value can be a number, text, a logical value, or a name or reference that refers to a value.	Required
lookup_vector	A range that contains only one row or one column. The values in lookup_vector can be text, numbers, or logical values. The values in lookup_vector must be placed in ascending order: ..., -2, -1, 0, 1, 2... A-Z, FALSE, TRUE. Otherwise, LOOKUP might not return the correct value. Uppercase and lowercase text are equivalent.	Required

result_vector	A range that contains only one row or column. The result_vector argument must be the same size as lookup_vector.	Optional
---------------	---	----------

## Notes

- If the LOOKUP Function cannot find the lookup\_value, the Function matches the largest value in lookup\_vector that is less than or equal to lookup\_value.
- If lookup\_value is smaller than the smallest value in lookup\_vector, LOOKUP returns the #N/A error value.
- If the lookup\_vector is not in ascending order, LOOKUP returns the #N/A error value.
- If the LOOKUP Function is attempting to reference cells that do not exist, LOOKUP returns the #REF! Error value. i.e. when
  - Cells being deleted after the Lookup function has been entered.
  - Relative references in the Lookup function, which become invalid when the function is copied to other cells.
- If the contents of the cells that are being compared have different data types, LOOKUP might not return the correct value.
- If there are unseen spaces at the start or end of either the lookup\_value, or in the cells of lookup\_vector, LOOKUP might not return the correct value.

## Array form

You can consider using VLOOKUP or HLOOKUP instead of the array form. The array form of LOOKUP is provided for compatibility with other spreadsheet programs, but its functionality is limited. The array form of LOOKUP looks in the first row or column of an array for the specified value and returns a value from the same position in the last row or column of the array.

Use this form of LOOKUP when the values that you want to match are in the first row or column of the array.

## Syntax

LOOKUP (lookup_value, array)
------------------------------

### Arguments

Argument	Description	Required / Optional
lookup_value	A value that LOOKUP searches for in an array. Lookup_value can be a number, text, a logical value, or a name or reference that refers to a value.	Required
array	A range of cells that contains text, numbers, or logical values that you want to compare with lookup_value. The values in array must be placed in ascending order: ..., -2, -1, 0, 1, 2... A-Z, FALSE, TRUE.	Required

	Otherwise, LOOKUP might not return the correct value. Uppercase and lowercase text are equivalent.	
--	---	--

## Notes

- If the LOOKUP Function cannot find the lookup\_value, the Function matches the largest value in the array that is less than or equal to lookup\_value.
- If lookup\_value is smaller than the smallest value in the first row or column (depending on the array dimensions), LOOKUP returns the #N/A error value.
- If the LOOKUP Function is attempting to reference cells that do not exist, LOOKUP returns the #REF! Error value. i.e. when
  - Cells being deleted after the Lookup function has been entered.
  - Relative references in the Lookup function, which become invalid when the function is copied to other cells.
- If the contents of the cells that are being compared have different data types, LOOKUP might not return the correct value.
- If there are unseen spaces at the start or end of either the lookup\_value, or in the cells of array, LOOKUP might not return the correct value.
- The array form of LOOKUP is very similar to the HLOOKUP and VLOOKUP functions. The difference is that HLOOKUP searches for the value of lookup\_value in the first row, VLOOKUP searches in the first column, and LOOKUP searches according to the dimensions of array.
  - If array covers an area that is wider than it is tall (more columns than rows), LOOKUP searches for the value of lookup\_value in the first row.
  - If an array is square or is taller than it is wide (more rows than columns), LOOKUP searches in the first column.
  - With the HLOOKUP and VLOOKUP functions, you can index down or across, but LOOKUP always selects the last value in the row or column.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

### Vector Form

Function Usage					Results				
A	B	C	D	E	A	B	C	D	E
<b>Product Sales</b>									
3	Region	Jan	Feb	Mar	3	Region	Jan	Feb	Mar
4	North	1200	1000	2000	4	North	1200	1000	2000
5	East	1000	1080	1500	5	East	1000	1080	1500
6	South	1000	1100	1800	6	South	1000	1100	1800
7	West	1500	1900	1200	7	West	1500	1900	1200
9	Region	South							
10	Sales in Feb	=LOOKUP(D9,B4:B7,D4:D7)							

### Array Form

Function Usage					Results				
A	B	C	D	E	A	B	C	D	E
<b>Product Sales</b>									
3	Region	Jan	Feb	Mar	3	Region	Jan	Feb	Mar
4	East	1000	1080	1500	4	East	1000	1080	1500
5	North	1200	1000	2000	5	North	1200	1000	2000
6	South	1000	1100	1800	6	South	1000	1100	1800
7	West	1500	1900	1200	7	West	1500	1900	1200
9	Region	South							
10	Sales in March	=LOOKUP(D9,B4:E7)							

# 246. MATCH Function

## Description

The MATCH Function searches for a specified item in a range of cells, and then returns the relative position of that item in the range.

Use MATCH instead of one of the LOOKUP Functions when you need the position of an item in a range instead of the item itself. E.g. you can use the MATCH Function to provide a value for the row\_num argument of the INDEX Function.

## Syntax

```
MATCH (lookup_value, lookup_array, [match_type])
```

## Arguments

Argument	Description	Required /Optional
lookup_value	The value that you want to match in lookup_array. E.g. when you look up someone's number in a telephone book, you are using the person's name as the lookup value, but the telephone number is the value you want. The lookup_value argument can be a value (number, text, or logical value) or a cell reference to a number, text, or logical value.	Required
lookup_array	The range of cells being searched.	Required
match_type	The number -1, 0, or 1. The match_type argument specifies how Excel matches lookup_value with values in lookup_array. The default value for this argument is 1. See below to know how the function finds values based on the match_type argument.	Optional

match_type	What MATCH Function Finds
1 or omitted	MATCH finds the largest value that is less than or equal to lookup_value. The values in the lookup_array argument must be placed in ascending order, for example: ...-2, -1, 0, 1, 2... A-Z, FALSE, TRUE.
0	MATCH finds the first value that is exactly equal to lookup_value. The values in the lookup_array argument can be in any order.
-1	MATCH finds the smallest value that is greater than or equal to lookup_value. The values in the lookup_array argument must be placed in descending order, for example: TRUE, FALSE, Z-A ...2, 1, 0, -1, -2..., and so on.

## Notes

- MATCH returns the position of the matched value within lookup\_array, not the value itself. E.g. MATCH ("b", {"a", "b", "c"}, 0) returns 2, which is the relative position of "b" within the array {"a", "b", "c"}.
- MATCH does not distinguish between uppercase and lowercase letters when matching text values.
- If MATCH is unsuccessful in finding a match, it returns the #N/A error value.
- If match\_type is 0 and lookup\_value is a text string, you can use the wildcard characters - the question mark (?) and asterisk (\*) - in the lookup\_value argument
  - A question mark matches any single character
  - An asterisk matches any sequence of characters
  - If you want to find an actual question mark or asterisk, type a tilde (~) before the character
- If the lookup\_array is not being ordered correctly, Match Function returns the wrong result
- Match Function returns a #N/A error value when the Function fails to find a match for the lookup\_value. This can happen
  - If match\_type = 0 and an exact match for the lookup\_value is not found within the lookup\_array.
  - If match\_type = 1 or is omitted and the first value in the lookup\_array is larger than the if match\_type = 1 lookup\_value (i.e., the array is in ascending order and there is no closest match below or equal to the lookup\_value).
  - If match\_type = -1 and the first value in the lookup\_array is smaller than the lookup\_value (and therefore, if the array is in descending order, there is no closest match above or equal to the lookup\_value).
  - If there are unseen characters in either the lookup\_value or the values in the lookup\_array.
  - If lookup\_value and the data in the lookup\_array have different data types.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage					Results				
A	B	C	D	E	A	B	C	D	E
<b>Product Sales</b>					<b>Product Sales</b>				
3	Region	Jan	Feb	Mar	3	Region	Jan	Feb	Mar
4	North	1200	1000	2000	4	North	1200	1000	2000
5	East	1000	1080	1500	5	East	1000	1080	1500
6	South	1000	1100	1800	6	South	1000	1100	1800
7	West	1500	1900	1200	7	West	1500	1900	1200
9	Region	South			9	Region	South		
10	Sales in Feb	=MATCH(D9,B4:B7)			10	Sales in Feb	3		
12	Sale Value	1100			12	Sale Value	1100		
13	Sales in Feb	=MATCH(D12,D3:D7)			13	Sales in Feb	4		
14									

# 247. OFFSET Function

## Description

The OFFSET function returns a reference to a range that is a specified number of rows and columns from a cell or range of cells.

The reference that is returned can be a single cell or a range of cells. You can specify the number of rows and the number of columns to be returned.

## Syntax

```
OFFSET (reference, rows, cols, [height], [width])
```

## Arguments

Argument	Description	Required /Optional
Reference	The reference from which you want to base the offset. Reference must refer to a cell or range of adjacent cells. Otherwise, OFFSET returns the #VALUE! Error value.	Required
Rows	The number of rows, up or down, that you want the upper-left cell to refer to. E.g. Using 5 as the rows argument specifies that the upper-left cell in the reference is five rows below reference. Rows can be positive (which means below the starting reference) or negative (which means above the starting reference).	Required
Cols	The number of columns, to the left or right that you want the upper-left cell of the result to refer to. E.g. Using 5 as the cols argument specifies that the upper-left cell in the reference is five columns to the right of reference. Cols can be positive (which means to the right of the starting reference) or negative (which means to the left of the starting reference).	Required
Height	The height, in number of rows that you want the returned reference to be. Height must be a positive number.	Optional
Width	The width, in number of columns that you want the returned reference to be. Width must be a positive number.	Optional

## Notes

- If height or width is omitted, it is assumed to be the same height or width as reference
- OFFSET does not actually move any cells or change the selection. It just returns a reference.

- OFFSET can be used with any function expecting a reference argument. E.g. the formula `SUM(OFFSET(C2,1,2,3,1))` calculates the total value of a 3-row by 1-column range that is 1 row below and 2 columns to the right of cell C2.
- If rows and cols offset reference over the edge of the worksheet, OFFSET returns the #REF! error value.
- If any the arguments, rows, cols, height or width is non-numeric, OFFSET returns the # VALUE! error value.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage						Results						
D2			X	✓	fx	B2			X	✓	fx	5
A	B	C	D	E	F	A	B	C	D	E	F	
1						1						
2	5	2	=OFFSET(F2,2,-4,3,2)	=OFFSET(F2,2,-4,3,2)		2	5	2	25	23		
3	15	13	=OFFSET(F2,2,-4,3,2)	=OFFSET(F2,2,-4,3,2)		3	15	13	30	32		
4	25	23	=OFFSET(F2,2,-4,3,2)	=OFFSET(F2,2,-4,3,2)		4	25	23	55	40		
5	30	32				5	30	32				
6	55	40				6	55	40				

# 248. ROW Function

## Description

The ROW function returns the row number of a reference.

## Syntax

```
ROW ([reference])
```

## Arguments

Argument	Description	Required /Optional
<b>Reference</b>	The cell or range of cells for which you want the row number. If reference is omitted, it is assumed to be the reference of the cell in which the ROW function appears. See Notes below.	Optional

## Notes

- If reference is a range of cells, and if ROW is entered as a vertical array, ROW returns the row numbers of reference as a vertical array.
- Reference cannot refer to multiple areas.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage		Results	
A	B	1	1
2	<b>Result</b>	2	<b>Result</b>
	=ROW(B8)	3	8
	=ROW(E5)	4	5
	=ROW()	5	5
		6	

# 249. ROWS Function

## Description

The ROWS function returns the number of rows in a reference or array.

## Syntax

```
ROWS (array)
```

## Arguments

Argument	Description	Required /Optional
<b>Array</b>	An array, an array formula, or a reference to a range of cells for which you want the number of rows.	Required

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage		Results	
A	B	A	B
1		1	
2	Result =ROWS(B:B)	2	Result 1048576
3	=ROWS(D2:E15)	3	14
4	=ROWS(D2:T6)	4	5
5		5	
...		...	

# 250. RTD Function

## Description

The RTD function retrieves real-time data from a program that supports COM automation.

## Syntax

```
RTD (ProgID, server, topic1, [topic2] ...)
```

## Arguments

Argument	Description	Required / Optional
ProgID	The name of the ProgID of a registered COM automation add-in that has been installed on the local computer. Enclose the name in quotation marks.	Required
server	Name of the server where the add-in should be run. If there is no server, and the program is run locally, leave the argument blank. Otherwise, enter quotation marks ("") around the server name. When using RTD within Visual Basic for Applications (VBA), double quotation marks or the VBA NullString property are required for the server, even if the server is running locally.	Required
Topic1, topic2, ...	Topic1 is required, subsequent topics are optional. 1 to 253 parameters that together represent a unique piece of real-time data.	Topic1 Required Other Topics Optional

## Notes

- The RTD COM automation add-in must be created and registered on a local computer. If you have not installed a real-time data server, the RTD function returns the #NAME? error message in a cell when you try to use the RTD function.
- When the server has been programmed to continually update results, unlike other functions, RTD formulas will change when Microsoft Excel is in automatic calculation mode.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

		Function Usage	
A	B		
1			
2	=RTD("mycomaddin.progid","","Server_name","Report")		
3			
A	B		Results
1			
2	#N/A		
3			

Error showing that a value is not available to the Function

# 251. TRANSPOSE Function

## Description

The TRANSPOSE function returns a vertical range of cells as a horizontal range, or vice versa. The TRANSPOSE Function must be entered as an array formula in a range that has the same number of rows and columns, respectively, as the source range has columns and rows.

You can use TRANSPOSE to shift the vertical and horizontal orientation of an array or range on a worksheet.

## Syntax

```
TRANSPOSE (array)
```

Press CTRL+SHIFT+ENTER after you type the function, as this function returns an array of values, it must be entered as an Array Formula.

## Arguments

Argument	Description	Required /Optional
array	An array or range of cells on a worksheet that you want to transpose. The transpose of an array is created by using the first row of the array as the first column of the new array, the second row of the array as the second column of the new array, and so on.	Required

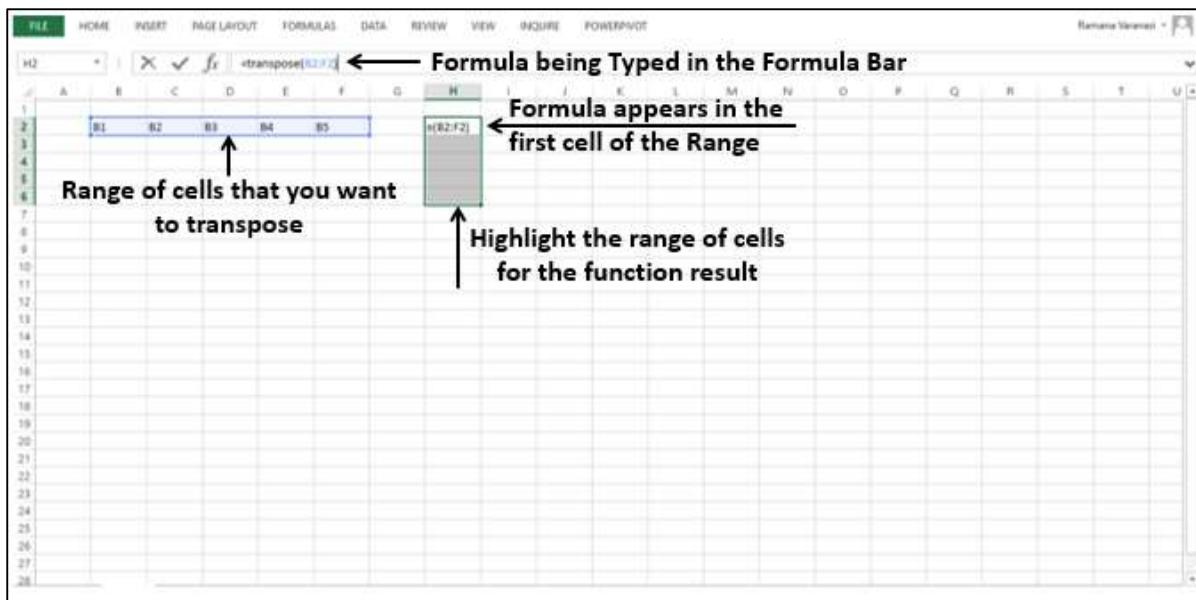
## Notes

As the result is an Array, you need to input this function as an Array formula-

Step 1: Select the range of cells to be transposed.

Step 2: Highlight the range of cells for the function result.

Step 3: Type the function in the formula bar.



Step 4: Press CTRL-SHIFT-Enter

Excel surrounds the formula with braces ({}). You can observe this in the formula bar. It does that automatically, and you cannot enter them yourself. If you do, the formula will not work because Excel treats the braces as text, and it cannot calculate text. Hence, make sure you press Ctrl+Shift+Enter.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

A	B	C	D	E
1				
2	Item	Cost	Units Sold	
3	Notebooks	50	100	
4	Pens	150	75	
5	Stickers	15	200	
6				
7	=TRANSPOSE(B2:D5)	=TRANSPOSE(B2:D5)	=TRANSPOSE(B2:D5)	=TRANSPOSE(B2:D5)
8	=TRANSPOSE(B2:D5)	=TRANSPOSE(B2:D5)	=TRANSPOSE(B2:D5)	=TRANSPOSE(B2:D5)
9	=TRANSPOSE(B2:D5)	=TRANSPOSE(B2:D5)	=TRANSPOSE(B2:D5)	=TRANSPOSE(B2:D5)
7	Item	Notebooks	Pens	Stickers
8	Cost		50	150
9	Units Sold		100	75
				200

**Function Usage**

**Results**

# 252. VLOOKUP Function

## Description

Use VLOOKUP when you need to find things in a table or a range by row. Organize your data so that the value you look up is to the left of the return value you want to find.

## Syntax

```
VLOOKUP (lookup_value, table_array, col_index_num, [range_lookup])
```

## Arguments

Argument	Description	Required /Optional
lookup_value	The value you want to look up. The value you want to look up must be in the first column of the range of cells you specify in table_array. Lookup_value can be a value or a reference to a cell.	Required
table_array	The range of cells in which the VLOOKUP will search for the lookup_value and the return value. The first column in the cell range must contain the lookup_value. The cell range also needs to include the return value you want to find.	Required
col_index_num	The column number (starting with 1 for the left-most column of table-array) that contains the return value.	Required
range_lookup	A logical value that specifies whether you want VLOOKUP to find an exact match or an approximate match: <ul style="list-style-type: none"><li>TRUE assumes the first column in the table is sorted either numerically or alphabetically, and will then search for the closest value. This is the default method if you do not specify one.</li><li>FALSE searches for the exact value in the first column.</li></ul>	Optional

## Notes

- Use absolute references for range\_lookup as it allows you to fill-down a formula so that it always looks at the same exact lookup range.
- When searching number or date values, ensure that the data in the first column of table\_array is not stored as text values. Otherwise, VLOOKUP might return an incorrect or unexpected value.
- If range\_lookup is FALSE and lookup\_value is text, you can use the wildcard characters—the question mark (?) and the asterisk (\*)—in lookup\_value. A question mark matches any single character. An asterisk matches any sequence of

characters. If you want to find an actual question mark or asterisk, type a tilde (~) in front of the character.

- If range\_lookup is TRUE or left out, the first column of the table\_array needs to be sorted alphabetically or numerically. If the first column is not sorted, the return value can be wrong.
- Either sort the first column of the table\_array, or use FALSE for an exact match.
- When searching text values in the first column, make sure the data in the first column does not have leading spaces, trailing spaces, inconsistent use of straight ( ' or " ) and curly ( ` or " ) quotation marks, or nonprinting characters. In these cases, VLOOKUP might return an unexpected value
- If range\_lookup is TRUE, then if the value in the lookup\_value is smaller than the smallest value in the first column of the table\_array, you will get the #N/A error value
- If range\_lookup is FALSE and the exact number isn't found, you will get the #N/A error value
- If col\_index\_num is greater than the number of columns in table\_array, you will get the #REF! error value
- If the table\_array is less than 1, you will get the #VALUE! error value
- If the formula is missing quotes, you will get the #NAME? error value

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

	A	B	C	D	E	F	G
1							
2		Jan	10	20	30	40	50
3		Feb	80	90	100	110	120
4		Mar	97	69	45	51	77
5							
6		Month	Feb		Month	Feb	
7		Column	4		Column	4	
8		Result	=VLOOKUP(C6,B2:G4,C7,FALSE)		Result	100	
9							
10		Month	Feb		Month	Feb	
11		Column	11		Column	11	
12		Result	=VLOOKUP(C10,B2:G4,C11,FALSE)		Result	#REF!	
..							
		<b>Function Usage</b>			<b>Results</b>		

# Math & Trigonometric Functions

# 253. Math & Trigonometric Functions – Overview

The Excel Math & Trig functions perform many of the common mathematical calculations, including basic arithmetic, conditional sums & products, exponents & logarithms, and the trigonometric ratios.

Some more math-related functions are also discussed in the Statistical functions and Engineering functions categories.

## Math & Trigonometric Functions

The following table lists all the Math & Trigonometric functions-

S. No.	Function and Description
1	ABS Returns the absolute value of a number
2	ACOS Returns the arccosine of a number
3	ACOSH Returns the inverse hyperbolic cosine of a number
4	ACOT Returns the arccotangent of a number
5	ACOTH Returns the hyperbolic arccotangent of a number
6	AGGREGATE Returns an aggregate in a list or database
7	ARABIC Converts a Roman number to Arabic, as a number
8	ASIN Returns the arcsine of a number
9	ASINH Returns the inverse hyperbolic sine of a number
10	ATAN Returns the arctangent of a number
11	ATAN2 Returns the arctangent from x and y coordinates
12	ATANH Returns the inverse hyperbolic tangent of a number
13	BASE Converts a number into a text representation with the given radix (base)

S. No.	Function and Description
14	CEILING.MATH Rounds a number up, to the nearest integer or to the nearest multiple of significance
15	COMBIN Returns the number of combinations for a given number of objects
16	COMBINA Returns the number of combinations with repetitions for a given number of items
17	COS Returns the cosine of a number
18	COSH Returns the hyperbolic cosine of a number
19	COT Returns the cotangent of an angle
20	COTH Returns the hyperbolic cotangent of a number
21	CSC Returns the cosecant of an angle
22	CSCH Returns the hyperbolic cosecant of an angle
23	DECIMAL Converts a text representation of a number in a given base into a decimal number
24	DEGREES Converts radians to degrees
25	EVEN Rounds a number up to the nearest even integer
26	EXP Returns e raised to the power of a given number
27	FACT Returns the factorial of a number
28	FACTDOUBLE Returns the double factorial of a number
29	FLOOR.MATH Rounds a number down, to the nearest integer or to the nearest multiple of significance
30	GCD Returns the greatest common divisor
31	INT Rounds a number down to the nearest integer

S. No.	Function and Description
32	LCM Returns the least common multiple
33	LN Returns the natural logarithm of a number
34	LOG Returns the logarithm of a number to a specified base
35	LOG10 Returns the base-10 logarithm of a number
36	MDETERM Returns the matrix determinant of an array
37	MINVERSE Returns the matrix inverse of an array
38	MMULT Returns the matrix product of two arrays
39	MOD Returns the remainder from division
40	MROUND Returns a number rounded to the desired multiple
41	MULTINOMIAL Returns the multinomial of a set of numbers
42	MUNIT Returns the unit matrix or the specified dimension
43	ODD Rounds a number up to the nearest odd integer
44	PI Returns the value of pi
45	POWER Returns the result of a number raised to a power
46	PRODUCT Multiplies its arguments
47	QUOTIENT Returns the integer portion of a division
48	RADIANS Converts degrees to radians
49	RAND Returns a random number between 0 and 1
50	RANDBETWEEN Returns a random number between the numbers that you specify
51	ROMAN Converts an Arabic numeral to Roman, as text

S. No.	Function and Description
52	ROUND Rounds a number to a specified number of digits
53	ROUNDDOWN Rounds a number down, toward 0
54	ROUNDUP Rounds a number up, away from 0
55	SEC Returns the secant of an angle
56	SECH Returns the hyperbolic secant of an angle
57	SERIESSUM Returns the sum of a power series based on the formula
58	SIGN Returns the sign of a number
59	SIN Returns the sine of the given angle
60	SINH Returns the hyperbolic sine of a number
61	SQRT Returns a positive square root
62	SQRTPI Returns the square root of pi
63	SUBTOTAL Returns a subtotal in a list or database
64	SUM Adds its arguments
65	SUMIF Adds the cells specified by a given criteria
66	SUMIFS Adds the cells specified by a multiple criteria
67	SUMPRODUCT Returns the sum of the products of corresponding array components
68	SUMSQ Returns the sum of the squares of the arguments
69	SUMX2MY2 Returns the sum of the difference of squares of corresponding values in two arrays
70	SUMX2PY2 Returns the sum of the sum of squares of corresponding values in two arrays
71	SUMXMY2 Returns the sum of squares of differences of corresponding values in two arrays

S. No.	Function and Description
72	TAN Returns the tangent of a number
73	TANH Returns the hyperbolic tangent of a number
74	TRUNC Truncates a number (you specify the precision of the truncation)

# 254. ABS Function

## Description

The ABS function returns the remainder after number is divided by divisor. The result has the same sign as divisor.

## Syntax

```
MOD (number, divisor)
```

## Arguments

Argument	Description	Required /Optional
Number	The number for which you want to find the remainder.	Required
Divisor	The number by which you want to divide number.	Required

## Notes

- If divisor is 0, MOD returns the #DIV/0! error value.
- The MOD function can be expressed in terms of the INT function-

$$\text{MOD (n, d)} = n - d * \text{INT (n/d)}$$

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage		Results	
A	B	A	B
1 Number	=ABS(A2)	1 Number	Absolute Value
2 125		2 125	125
3 -15	=ABS(A3)	3 -15	15
	=ABS(A2-A3)	4	140
	=ABS(A3-A2)	5	140

# 255. ACOS Function

## Description

The ACOS function returns the arccosine, or inverse cosine, of a number. The arccosine is the angle whose cosine is number. The returned angle is given in radians between 0 and  $\pi$ .

## Syntax

```
ACOS (number)
```

## Arguments

Argument	Description	Required /Optional
Number	The cosine of the angle you want and must be from -1 to 1.	Required

## Notes

- If you want the angle returned by the ACOS Function to be expressed in degrees, you can convert it,
  - using the Excel Degrees Function =DEGREES (radians)
  - or, by multiplying it by  $180/\text{PI}()$
- If the specified number is outside the range -1 to +1, ACOS returns #NUM! error.
- If the specified number is not recognized as a numeric value, ACOS returns #VALUE! Error.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Number	=ACOS(B3)	2	Number	Result
3	0.5		3	0.5	1.047197551
4					

# 256. ACOSH Function

## Description

The ACOSH function returns the inverse hyperbolic cosine of a number. The inverse hyperbolic cosine is the value whose hyperbolic cosine is number. i.e.

$$\text{ACOSH}(\text{COSH}(\text{number})) = \text{number}$$

## Syntax

ACOSH (number)
----------------

## Arguments

Argument	Description	Required /Optional
Number	Any real number equal to or greater than 1.	Required

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Number	Result	2	Number	Result
3	5	=ACOSH(B3)	3	5	2.29243167
*			*		

# 257. ACOT FUNCTION

## Description

The ACOT function returns the principal value of the arccotangent, or inverse cotangent, of a number as an angle, in radians, between 0 and  $\pi$ .

## Syntax

```
ACOT (number)
```

## Arguments

Argument	Description	Required /Optional
Number	Number is the cotangent of the angle you want. This must be a real number.	Required

## Notes

- To convert the result from radians to degrees,
  - use the DEGREES function (=DEGREES (radians))
  - or, multiply it by  $180/\text{PI}()$
- If Number is a non-numeric value, ACOT returns the #VALUE! Error.

## Applicability

Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Number	Result	2	Number	Result
	5	=ACOT(B3)		5	0.19739556

# 258. ACOTH Function

## Description

The ACOTH function returns the inverse hyperbolic cotangent of a number.

## Syntax

```
ACOTH (number)
```

## Arguments

Argument	Description	Required /Optional
Number	The absolute value of Number must be greater than 1. i.e., Number must be less than -1 or greater than +1.	Required

## Notes

- The equation used to calculate the hyperbolic arccotangent is-
$$\operatorname{acoth}(x) = \frac{1}{2} \ln \left( \frac{x+1}{x-1} \right)$$
- The hyperbolic arccotangent is an analog of the ordinary (circular) arccotangent.
- If Number is less than 1, ACOTH returns the #NUM! error value.
- If the absolute value of Number is less than 1, ACOT returns the #VALUE! error value.

## Applicability

Excel 2013, Excel 2016

## Example

Function Usage		Results	
A	B	A	B
1		1	
2	Number	2	Number
3	=ACOTH(B3)	3	Result
*		.	0.202732554

# 259. AGGREGATE Function

## Description

Returns an aggregate in a list or database. The AGGREGATE Function can apply different aggregate functions to a list or database with the option to ignore hidden rows and error values.

The AGGREGATE Function has two different formats-

- Reference Format
- Array Format

## Reference Format

### Syntax

```
AGGREGATE (function_num, options, ref1, [ref2] ...)
```

## Arguments

Argument	Description	Required /Optional
Function_num	A number 1 to 19 that specifies which function to use. Look at the Function_num Table given below to know the Functions.	Required
options	A number, between 0 and 7, that determines which values to be ignored in the calculation of the Function. Look at the options Table given below to know the values.	Required
ref1	The first numeric argument for functions that take multiple numeric arguments for which you want the aggregate value.	Required
ref2 ...	Numeric arguments 2 to 253 for which you want the aggregate value.	Optional

## Array Format

### Syntax

```
AGGREGATE (function_num, options, array, [k])
```

## Arguments

Argument	Description	Required /Optional
Function_num	A number 1 to 19 that specifies which function to use. Look at the Function_num Table given below to know the Functions.	Required
options	A number, between 0 and 7, that determines which values to be ignored in the calculation of the Function. Look at the options Table given below to know the values.	Required
array	An array, an array formula, or a reference to a range of cells for which you want the aggregate value.	Required
k	An integer that denotes the position in the array for Functions that require this additional argument. Required for the 'Large', 'Small', 'Percentile' and 'Quartile' Functions Look at the argument k Table given below.	Optional

## Function\_num Table

Function_num	Function
1	AVERAGE
2	COUNT
3	COUNTA
4	MAX
5	MIN
6	PRODUCT
7	STDEV.S
8	STDEV.P
9	SUM
10	VAR.S
11	VAR.P
12	MEDIAN
13	MODE.SNGL
14	LARGE
15	SMALL
16	PERCENTILE.INC
17	QUARTILE.INC
18	PERCENTILE.EXC
19	QUARTILE.EXC

## Options Table

Option	Behavior
0 or omitted	Ignore nested SUBTOTAL and AGGREGATE Functions
1	Ignore hidden rows, nested SUBTOTAL and AGGREGATE Functions
2	Ignore error values, nested SUBTOTAL and AGGREGATE Functions
3	Ignore hidden rows, error values, nested SUBTOTAL and AGGREGATE Functions

4	Ignore nothing
5	Ignore hidden rows
6	Ignore error values
7	Ignore hidden rows and error values

## Argument k Table

Function	Meaning of k
Large	Return the kth largest value
Small	Return the kth smallest value
Percentile.Inc Percentile.Exc	Return the kth percentile
Quartile.Inc Quartile.Exc	Return the kth quartile

## Notes

- When you enter the AGGREGATE function into a cell on the worksheet, as soon as you type the function\_num argument, you will see a list of all Functions that you can use as arguments.
- The AGGREGATE function is designed for columns of data, or vertical ranges. It is not designed for rows of data, or horizontal ranges. E.g. when you subtotal a horizontal range using option 1, such as AGGREGATE (1, 1, ref1), hiding a column does not affect the aggregate sum value, but, hiding a row in vertical range does affect the aggregate.
- If function\_num argument is any number less than 1 or greater than 19, AGGREGATE returns a #VALUE! Error.
- If options argument is any number less than 0 or greater than 7, AGGREGATE returns a #VALUE! Error.
- If argument k is required but not provided, i.e. when the function\_num argument is between 14 and 19 (denoting the 'Large', 'Small', 'Percentile' or 'Quartile' functions), AGGREGATE returns a #VALUE! Error.
- If any of the specified arguments is non-numeric, AGGREGATE returns a #VALUE! Error.
- If one or more of the references are 3-D references, AGGREGATE returns the #VALUE! error value.

## Applicability

Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
	A	B	A	B	C
1			1		
2		Array	2	Array	
3	#DIV/0!	82	3	#DIV/0!	82
4	72	65	4	72	65
5	30	95	5	30	95
6	61	#NUM!	6	61	#NUM!
7	31	53	7	31	53
8	96	71	8	96	71
9	32	55	9	32	55
10	81	83	10	81	83
11	33	100	11	33	100
12	53	91	12	53	91
13	34	89	13	34	89
14	<b>Maximum ignoring Error Values</b>		14	<b>Maximum ignoring Error Values</b>	
15	<code>=AGGREGATE(4,6,B3:C13)</code>		15	100	
16	<b>Count ignoring Error Values</b>		16	<b>Count ignoring Error Values</b>	
17	<code>=AGGREGATE(3,6,B3:C13)</code>		17	20	
			...		

# 260. ARABIC Function

## Description

The ARABIC function converts a Roman numeral to an Arabic numeral.

## Syntax

```
ARABIC (text)
```

## Arguments

Argument	Description	Required /Optional
Text	A string enclosed in quotation marks, an empty string (""), or a reference to a cell containing text.	Required

## Notes

- If an empty string ("") is used as an input value, 0 is returned..
- The maximum length of the argument is 255 characters. Therefore, the largest number that can be returned is 255,000.
- The case of the text argument is ignored. For example, "mxmlvii" evaluates to the same result (1997) as "MXMVII."
- Although a negative Roman number is non-standard, evaluation of a negative Roman numeral is supported. Insert the negative sign before the Roman text, such as "-MMXI."
- Leading and trailing spaces are ignored.
- If Text is not a valid value, ARABIC returns the #VALUE! error value.
- Values that return a #VALUE! Error value include numbers, dates, and text that is not a valid Roman numeral.
- If Text is not encased in quotation marks, ARABIC returns the #NAME? error value.
- If ARABIC Function is not recognized (in case of versions previous to Excel 2013), the #NAME? error value is returned.

## Applicability

Excel 2013, Excel 2016

**Example**

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Roman	Arabic	2	Roman	Arabic
3	MMXVI	=ARABIC(B3)	3	MMXVI	2016
4	XL	=ARABIC(B4)	4	XL	40
5	CCXL	=ARABIC(B5)	5	CCXL	240
6	-CCXL	=ARABIC(B6)	6	-CCXL	-240
7	LV	=ARABIC(B7)	7	LV	55
8	BC	=ARABIC(B8)	8	BC	#VALUE!

# 261. ASIN Function

## Description

The ASIN function returns the arcsine, or inverse sine of a given number, and returns an angle in radians, between  $-\pi/2$  and  $\pi/2$ .

## Syntax

```
ASIN (number)
```

## Arguments

Argument	Description	Required /Optional
Number	The sine of the angle you want and must be from -1 to 1.	Required

## Notes

- If you want the angle returned by the ASIN Function to be expressed in degrees, you can convert it,
  - using the Excel Degrees Function(=DEGREES (radians))
  - or, by multiplying it by  $180/\text{PI}()$
- If the specified number is outside the range -1 to +1, ASIN returns #NUM! error.
- If the specified number is not recognized as a numeric value, ASIN returns #VALUE! Error.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Number	=ASIN(B3)	2	Number	Result
3	0.5		3	0.5	0.523598776
.			.		

# 262. ASINH Function

## Description

The ASINH function returns the inverse hyperbolic sine of a number. The inverse hyperbolic sine is the value whose hyperbolic sine is number, i.e. ASINH (SINH (number)) equals number.

## Syntax

```
ASINH (number)
```

## Arguments

Argument	Description	Required /Optional
Number	Any real number.	Required

## Notes

If the specified number is not recognized as a numeric value, ASIN returns #VALUE! error

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Number	Result	2	Number	Result
3	0.523599	=ASINH(B3)	3	0.523599	0.5
.			4		

# 263. ATAN Function

## Description

The ATAN function returns the arctangent, or inverse tangent, of a number. The returned angle is given in radians between  $-\pi/2$  and  $+\pi/2$ . The arctangent is the angle whose tangent is number.

## Syntax

```
ATAN (number)
```

## Arguments

Argument	Description	Required /Optional
Number	The tangent of the angle you want.	Required

## Notes

- If you want the angle returned by the ATAN Function to be expressed in degrees, you can convert it,
  - using the Excel Degrees Function (=DEGREES (radians))
  - or, by multiplying it by  $180/\text{PI}()$
- If the specified number is not recognized as a numeric value, ATAN returns #VALUE! error

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Number	=ATAN(B3)	2	Number	Result
3	0.523599		3	0.523599	0.5
4					

# 264. ATAN2 Function

## Description

The ATAN2 function returns the arctangent, or inverse tangent, of the specified x- and y-coordinates, in radians, between  $-\pi/2$  and  $+\pi/2$ .

## Syntax

```
ATAN2 (x_num, y_num)
```

## Arguments

Argument	Description	Required /Optional
X_num	The x-coordinate of the point.	Required
Y_num	The y-coordinate of the point.	Required

## Notes

- A positive result represents a counterclockwise angle from the x-axis. A negative result represents a clockwise angle
- If you want the angle returned by the ATAN2 Function to be expressed in degrees, you can convert it,
  - using the Excel Degrees Function(=DEGREES (radians))
  - or, by multiplying it by  $180/\text{PI}()$
- ATAN2 (a, b) equals ATAN (b/a), except that a can equal 0 in ATAN2.
- If both x\_num and y\_num are 0, ATAN2 returns the #DIV/0! error value.
- If either x\_num or y\_num is non-numeric, ATAN2 returns the #VALUE! error value.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage				Results			
A	B	C	D	A	B	C	D
1				1			
2	X	Y	Result	2	X	Y	Result
3	5	5	=ATAN2(B3,C3)	3	5	5	0.785398163
*				*			

# 265. ATANH Function

## Description

The ATANH function returns the inverse hyperbolic tangent of a number. The inverse hyperbolic tangent is the value whose hyperbolic tangent is number, so ATANH (TANH (number)) equals number.

## Syntax

```
ATANH (number)
```

## Arguments

Argument	Description	Required /Optional
Number	Any real number between (but not equal to) 1 and -1.	Required

## Notes

- If the specified number is  $\leq -1$  or  $\geq 1$ , ATANH returns #NUM! error.
- If the specified number is non-numeric, ATANH returns #VALUE! Error.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Number	Result	2	Number	Result
3	0.999909204	=ATANH(B3)	3	0.999909204	5
A			*		

# 266. BASE Function

## Description

The BASE function converts a number into a text representation with the given radix (base).

## Syntax

```
BASE (Number, Radix [Min_length])
```

## Arguments

Argument	Description	Required /Optional
Number	The number that you want to convert. Must be an integer greater than or equal to 0 and less than $2^{53}$ .	Required
Radix	The base radix that you want to convert the number into. Must be an integer greater than or equal to 2 and less than or equal to 36.	Required
Min_length	The minimum length of the returned string. Must be an integer greater than or equal to 0.	Optional

## Notes

- Any non-integer number entered as an argument is truncated to an integer.
- The maximum value of the Min\_length argument is 255.
- If the Min\_length argument is included, leading zeros are added to the result if the result would otherwise be shorter than the minimum length specified.
- For example, BASE (16,2) returns 10000, but BASE(16,2,8) returns 00010000.
- If Number, Radix, or Min\_length are outside the minimum or maximum constraints, BASE returns the #NUM! error value.
- If any of Number, Radix, or Min\_length is a non-numeric value, BASE returns the #VALUE! error value.

## Applicability

Excel 2013, Excel 2016

## Example

Function Usage			Results		
	A	B		A	B
1			1		
2	Number	55	2	Number	55
3	Radix	8	3	Radix	8
4	Result	=BASE(C2,C3)	4	Result	67
-			e		

# 267. CEILING.MATH Function

## Description

The CEILING.MATH function rounds a number up to the nearest integer or to the nearest multiple of significance. The Excel CEILING.MATH Function is one of the fifteen rounding Functions in Excel.

## Syntax

```
CEILING.MATH (number, [significance], [mode])
```

## Arguments

Argument	Description	Required /Optional
Number	Number must be less than 9.99E+307 and greater than -2.229E-308.	Required
Significance	The multiple to which Number is to be rounded. If omitted, the significance argument takes on the default value 1 (i.e. round up to the nearest integer). The arithmetic sign of the significance argument is ignored. See Notes below.	Optional
Mode	For negative numbers, controls whether Number is rounded toward or away from zero. If mode = 0 (or is omitted), negative numbers are rounded towards zero. If mode = any other numeric value, negative numbers are rounded away from zero. See Notes below.	Optional

## Notes

- By default, significance is +1 for positive numbers and -1 for negative numbers
- By default, positive numbers with decimal portions are rounded up to the nearest integer. For example, 6.3 is rounded up to 7.
- By default, negative numbers with decimal portions are rounded up (toward 0) to the nearest integer. For example, -6.7 is rounded up to -6.
- By specifying the Significance and Mode arguments, you can change the direction of the rounding for negative numbers. For example, rounding -6.3 to a significance of 1 with a mode of 1 rounds away from 0, to -7.
- There are many combinations of Significance and Mode values that affect rounding of negative numbers in different ways.

- The Mode argument does not affect positive numbers.
- The significance argument rounds the number up to the nearest integer that is a multiple of the significance specified. The exception is where the number to be rounded is an integer. For example, significance of 3 means the number is rounded up to the next integer that is a multiple of 3.
- If Number divided by a Significance of 2 or greater results in a remainder, the result is rounded up.
- If any of the specified arguments are non-numeric, #VALUE! Error.

## Applicability

Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Number	Rounded To	2	Number	Rounded To
3	2.1	=CEILING.MATH(B3,1)	3	2.1	3
4	1.5	=CEILING.MATH(B4,1)	4	1.5	2
5	1.9	=CEILING.MATH(B5,1)	5	1.9	2
6	20	=CEILING.MATH(B6,30)	6	20	30
7	25	=CEILING.MATH(B7,30)	7	25	30
8	40	=CEILING.MATH(B8,30)	8	40	60
9	-25	=CEILING.MATH(B9,30, 0)	9	-25	0
10	-25	=CEILING.MATH(B10,30, 1)	10	-25	-30
11	-25	=CEILING.MATH(B11,, 0)	11	-25	-25
12	-25	=CEILING.MATH(B12,, 1)	12	-25	-25

# 268. COMBIN Function

## Description

The COMBIN function returns the number of combinations for a given number of items. Use COMBIN to determine the total possible number of groups for a given number of items.

## Syntax

```
COMBIN (number, number_chosen)
```

## Arguments

Argument	Description	Required /Optional
Number	The number of items.	Required
Number_chosen	The number of items in each combination.	Required

## Notes

- A combination is any set or subset of items, regardless of their internal order. Combinations are distinct from permutations, for which the internal order is significant
- The number of combinations is as follows, where number = n and number\_chosen = k:

$$\binom{n}{k} = \frac{P_{k,n}}{k!} = \frac{n!}{k!(n-k)!}$$

Where:

$$P_{k,n} = \frac{n!}{(n-k)!}$$

- Numeric arguments are truncated to integers.
- If either of the arguments is nonnumeric, COMBIN returns the #VALUE! error value.
- If number < 0, number\_chosen < 0, or number < number\_chosen, COMBIN returns the #NUM! error value.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Total No. of Items	Items In A Group	2	Total No. of Items	Items In A Group
3	5	2	3	5	10
4	4	=COMBIN(B3,C3)	4	4	1
5	25	=COMBIN(B4,C4)	5	25	53130

# 269. COMBINA Function

## Description

The COMBINA function returns the number of combinations (with repetitions) for a given number of items.

## Syntax

```
COMBINA (number, number_chosen)
```

## Arguments

Argument	Description	Required /Optional
Number	Must be greater than or equal to 0, and greater than or equal to Number_chosen. Non-integer values are truncated.	Required
Number_chosen	Must be greater than or equal to 0. Non-integer values are truncated.	Required

## Notes

- The following equation is used-

$$\binom{N+M-1}{N-1}$$

Where, N is Number and M is Number\_chosen.

- If the value of either argument is outside of its constraints, COMBINA returns the #NUM! error value.
- If either argument is a non-numeric value, COMBINA returns the #VALUE! error value.

## Applicability

Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Number	Number Chosen	2	Number	Number Chosen
3	4	2	3	4	10
4	15	3	4	15	680
c			-		

# 270. COS Function

## Description

The COS function returns the cosine of the given angle.

## Syntax

```
COS (number)
```

## Arguments

Argument	Description	Required /Optional
Number	The angle in radians for which you want the cosine.	Required

## Notes

If the angle is in degrees, either multiply the angle by PI()/180 or use the RADIANS function to convert the angle to radians

```
=RADIANS (degrees)
```

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
	A	B		A	B
1				1	
2		Number	Result	2	Number
3	5	=COS(B3)		3	0.283662185
*				*	

# 271. COSH Function

## Description

The COSH function returns the hyperbolic cosine of a number.

## Syntax

```
COSH (number)
```

## Arguments

Argument	Description	Required /Optional
Number	Any real number for which you want to find the hyperbolic cosine.	Required

## Notes

The formula for the hyperbolic cosine is:

$$\text{COSH}(z) = \frac{e^z + e^{-z}}{2}$$

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Number	Result	2	Number	Result
3	5	=COSH(B3)	3	5	74.20994852

# 272. COT Function

## Description

The COT function return the cotangent of an angle specified in radians.

## Syntax

```
COT (number)
```

## Arguments

Argument	Description	Required / Optional
Number	The angle in radians for which you want the cotangent.	Required

## Notes

- If the angle is in degrees, convert it to radians by multiplying with by PI()/180 or use the RADIANS Function  
 $=RADIANS(\text{degrees})$
- The absolute value of Number must be less than  $2^{27}$ .
- If Number is outside its constraints, COT returns the #NUM! error value.
- If Number is a non-numeric value, COT returns the #VALUE! error value.
- COT (0) returns the #DIV/0! error value.

## Applicability

Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Number	Result	2	Number	Result
3	5	=COT(B3)	3	5	-0.295812916

# 273. COTH Function

## Description

The COTH function returns the hyperbolic cotangent of a hyperbolic angle.

## Syntax

```
COTH (number)
```

## Arguments

Argument	Description	Required /Optional
Number	The angle in radians for which you want the hyperbolic cotangent.	Required

## Notes

- The following equation is used:

$$\coth(N) = \frac{1}{\tanh(N)} = \frac{\cosh(N)}{\sinh(N)} = \frac{e^N + e^{-N}}{e^N - e^{-N}}$$

- If the angle is in degrees, convert it to radians by multiplying with by PI()/180 or use the RADIANS Function  
 $=\text{RADIANS}(\text{degrees})$
- The absolute value of Number must be less than  $2^{27}$ .
- If Number is outside its constraints, COTH returns the #NUM! error value.
- If Number is a non-numeric value, COTH returns the #VALUE! error value.
- COTH (0) returns the #DIV/0! error value.

## Applicability

Excel 2013, Excel 2016

## Example

Function Usage		Results	
A	B	A	B
1		1	
2	Number	2	Number
3	=COTH(B3)	3	Result
			5
			1.000090804

# 274. CSC Function

## Description

The CSC function returns the cosecant of an angle specified in radians.

## Syntax

```
CSC (number)
```

## Arguments

Argument	Description	Required /Optional
Number	The angle (in radians) that you want to calculate the cosecant of.	Required

## Notes

- CSC (n) equals 1/SIN (n)
- If the angle is in degrees, convert it to radians by multiplying with by PI()/180 or use the RADIANS Function  
 $=RADIANS(\text{degrees})$
- The absolute value of Number must be less than  $2^{27}$ .
- If Number is outside its constraints, CSC returns the #NUM! error value.
- If Number is a non-numeric value, CSC returns the #VALUE! error value.
- CSC (0) returns the #DIV/0! error value.

## Applicability

Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Number	Result	2	Number	Result
3	5	=CSC(B3)	3	5	-1.042835213
*					

# 275. CSCH Function

## Description

The CSCH function returns the hyperbolic cosecant of an angle specified in radians.

## Syntax

```
CSCH (number)
```

## Arguments

Argument	Description	Required /Optional
Number	The angle (in radians) that you want to calculate the hyperbolic cosecant of.	Required

## Notes

- The value of the hyperbolic cosecant is given by the equation-

$$\text{csch}(x) = \frac{1}{\sinh(x)} = \frac{2}{(e^x - e^{-x})}$$

- If the angle is in degrees, convert it to radians by multiplying with by PI()/180 or use the RADIANS Function

=RADIANS (degrees)

- The absolute value of Number must be less than 2^27.
- If Number is outside its constraints, CSCH returns the #NUM! error value.
- If Number is a non-numeric value, CSCH returns the #VALUE! error value.
- CSCH (0) returns the #DIV/0! error value.

## Applicability

Excel 2013, Excel 2016

## Example

Function Usage			Results		
	A	B		B	C
1					
2		Number	Result		
3	5	=CSCH(B3)		3	0.013476506
4					

# 276. DECIMAL Function

## Description

The DECIMAL function converts a text representation of a number in a given base into a decimal number.

## Syntax

```
DECIMAL (text, radix)
```

## Arguments

Argument	Description	Required /Optional
Text	The text representation of the number that you want to convert The string length of Text must be less than or equal to 255 characters.	Required
Radix	The base (radix) of the supplied number Radix must be an integer	Required

## Notes

- The Text argument can be any combination of alpha-numeric characters that are valid for the radix, and is not case sensitive.
- Excel supports a Text argument greater than or equal to 0 and less than  $2^{53}$ . A text argument that resolves to a number greater than  $2^{53}$  may result in a loss of precision.
- Radix must be greater than or equal to 2 (binary, or base 2) and less than or equal to 36 (base 36)
  - A radix greater than 10 use the numeric values 0-9 and the letters A-Z as needed. For example, base 16 (hexadecimal) uses 0-9 and A-F, and base 36 uses 0-9 and A-Z.
- If the specified radix is < 2 or > 36, DECIMAL returns the #NUM! error value
- If the specified text argument is not recognized as a number in the specified base (radix), DECIMAL returns the #NUM! error value
- If the specified text argument is greater than 255 characters long, DECIMAL returns the #VALUE! error value
- If the specified text argument is non-numeric, DECIMAL returns the #VALUE! error value

## Applicability

Excel 2013, Excel 2016

## Example

Function Usage			Results		
	A	B		C	D
1					
2	Text	Radix	Result		
3	1101	2	=DECIMAL(B3,C3)		
4	FFF	16	=DECIMAL(B4,C4)		
5					

# 277. DEGREES Function

## Description

The DEGREES function converts radians into degrees.

## Syntax

```
DEGREES (angle)
```

## Arguments

Argument	Description	Required /Optional
Angle	The angle in radians that you want to convert.	Required

## Notes

The conversion between Radians and Degrees is calculated by the relationship

$$180 \text{ degrees} = \pi \text{ radians}$$

Where  $\pi$  is the mathematical constant,  $\text{PI} = 3.14159265358979\dots$

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	<b>Angle</b>	<b>Result</b>	2	<b>Angle</b>	<b>Result</b>
3	3.14159265358979	=DEGREES(B3)	3	3.141592654	180
4	1.5707963267949	=DEGREES(B4)	4	1.570796327	90
5	0.785398163397448	=DEGREES(B5)	5	0.785398163	45

# 278. EVEN Function

## Description

The EVEN function returns number rounded up to the nearest even integer. You can use this function for processing items that come in twos.

## Syntax

```
EVEN (number)
```

## Arguments

Argument	Description	Required /Optional
Number	The value to round.	Required

## Notes

- If number is nonnumeric, EVEN returns the #VALUE! error value.
- Regardless of the sign of number, a value is rounded up when adjusted away from zero. If number is an even integer, no rounding occurs.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage		Results	
A	B	A	B
1		1	
2	Number	Number	Evenly Rounded
3	1	=EVEN(B3)	2
4	1.2	=EVEN(B4)	2
5	2.3	=EVEN(B5)	4
6	25	=EVEN(B6)	26
		7	

# 279. EXP Function

## Description

The EXP function returns e raised to the power of number. The constant e equals 2.71828182845904, the base of the natural logarithm.

## Syntax

```
EXP (number)
```

## Arguments

Argument	Description	Required /Optional
Number	The exponent applied to the base e.	Required

## Notes

- To calculate powers of other bases, use the exponentiation operator (^)
- EXP is the inverse of LN, the natural logarithm of number.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Number	Exponentiation	2	Number	Exponentiation
3	2.3	=EXP(B3)	3	2.3	10
4	3.9	=EXP(B4)	4	3.9	49
5	4.61	=EXP(B5)	5	4.6	100
6	6.116	=EXP(B6)	6	6.1	453
7	6.908	=EXP(B7)	7	6.9	1000
n			n		

# 280. FACT Function

## Description

The FACT function returns the factorial of a number. The factorial of a number is equal to  $1*2*3*...* \text{number}$ .

## Syntax

```
FACT (number)
```

## Arguments

Argument	Description	Required /Optional
Number	The nonnegative number for which you want the factorial. If number is not an integer, it is truncated.	Required

## Notes

- If the specified number is  $< 0$ , FACT returns #NUM! error.
- If the specified number is non-numeric, FACT returns #VALUE! Error.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Number	Factorial	2	Number	Factorial
3	3	=FACT(B3)	3	3	6
4	3.8	=FACT(B4)	4	3.8	6
5	5	=FACT(B5)	5	5	120
6	-5	=FACT(B6)	6	-5	#NUM!
7	10	=FACT(B7)	7	10	3,628,800
8	25	=FACT(B8)	8	25	15,511,210,043,331,000,000,000,000
n			n		

# 281. FACTDOUBLE Function

## Description

The FACTDOUBLE function returns the double factorial of a number.

## Syntax

```
FACTDOUBLE (number)
```

## Arguments

Argument	Description	Required /Optional
Number	The value for which to return the double factorial. If number is not an integer, it is truncated.	Required

## Notes

- The Double Factorial of a number, n, is
$$n!! = n(n-2)(n-4)\dots(4)(2), \text{ if number is even}$$
$$n!! = n(n-2)(n-4)\dots(3)(1), \text{ if number is odd}$$
- If number is nonnumeric, FACTDOUBLE returns the #VALUE! error value.
- If number is negative, FACTDOUBLE returns the #NUM! error value.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	<b>Number</b>	<b>Result</b>	2	<b>Number</b>	<b>Result</b>
3	8	=FACTDOUBLE(B3)	3	8	384
4	7.5	=FACTDOUBLE(B4)	4	7.5	105
-			5		

## 282. FLOOR.MATH Function

### Description

The FLOOR.MATH function rounds a number down to the nearest integer or to the nearest multiple of significance.

### Syntax

```
FLOOR.MATH (number, significance, mode)
```

### Arguments

Argument	Description	Required /Optional
Number	The number to be rounded down.	Required
Significance	The multiple to which you want to round.	Optional
Mode	The direction (toward or away from 0) to round negative numbers.	Optional

### Notes

- By default, positive numbers with decimal portions are rounded down to the nearest integer.
- By default, negative numbers with decimal portions are rounded away from 0 to the nearest integer.
- By using 0 or a negative number as the Mode argument, you can change the direction of the rounding for negative numbers.
- The Significance argument rounds the number down to the nearest integer that is a multiple of the significance specified. The exception is where the number to be rounded is an integer.
- If Number is divided by a Significance of 2 or greater results in a remainder, the result is rounded down.
- If any of the specified arguments is non-numeric, FLOOR.MATH returns #VALUE! Error.

### Applicability

Excel 2013, Excel 2016

## Example

Function Usage				Results							
A	B	C	D	E	A	B	C	D	E		
1	2	Number	Significance	Mode	Result	1	2	Number	Significance	Mode	Result
	3	4.5	1	1	=FLOOR.MATH(B3,C3,D3)		3	4.5	1	1	4
	4	4.5	-1	0	=FLOOR.MATH(B4,C4,D4)		4	4.5	-1	0	4
	5	4.5	-1	-1	=FLOOR.MATH(B5,C5,D5)		5	4.5	-1	-1	4
	6	-4.5	1	1	=FLOOR.MATH(B6,C6,D6)		6	-4.5	1	1	-4
	7	-4.5	-1	0	=FLOOR.MATH(B7,C7,D7)		7	-4.5	-1	0	-5
	8	-4.5	-1	-1	=FLOOR.MATH(B8,C8,D8)		8	-4.5	-1	-1	-4

# 283. GCD Function

## Description

The GCD function returns the greatest common divisor of two or more integers. The greatest common divisor is the largest integer that divides both number1 and number2 without a remainder.

## Syntax

```
GCD (number1, [number2] ...)
```

## Arguments

Argument	Description	Required /Optional
Number1	1 to 255 values. If any value is not an integer, it is truncated.	Required
number2, ...		Optional

## Notes

- One divides any value evenly.
- A prime number has only itself and one as even divisors.
- If any argument is nonnumeric, GCD returns the #VALUE! error value.
- If any argument is less than zero, GCD returns the #NUM! error value.
- If a parameter to GCD is  $>=2^{53}$ , GCD returns the #NUM! error value.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage				Results					
	A	B	C	D	A	B	C	D	E
1					1				
2					2				
Numbers			GCD	Numbers			GCD		
3	18	72	96	=GCD(B3,C3,D3)	3	18	72	96	6
4	300	500	200	=GCD(B4,C4,D4)	4	300	500	200	100
5	2	4	6	=GCD(B5,C5,D5)	5	2	4	6	2
6	2.7	4	6	=GCD(B6,C6,D6)	6	2.7	4	6	2
7	1	4	6	=GCD(B7,C7,D7)	7	1	4	6	1
8	-2	4	6	=GCD(B8,C8,D8)	8	-2	4	6	#NUM!
9	Two	4	6	=GCD(B9,C9,D9)	9	Two	4	6	#VALUE!

# 284. INT Function

## Description

The INT function rounds a number down to the nearest integer.

## Syntax

```
INT (number)
```

## Arguments

Argument	Description	Required / Optional
Number	The real number you want to round down to an integer.	Required

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	<b>Number</b>	<b>Integer</b>	2	<b>Number</b>	<b>Integer</b>
3	1.47589	=INT(B3)	3	1.47589	1
4	-1.47589	=INT(B4)	4	-1.47589	-2
5	2.3	=INT(B5)	5	2.3	2
6	10.75	=INT(B6)	6	10.75	10
7	9.85	=INT(B7)	7	9.85	9

# 285. LCM Function

## Description

The LCM function returns the least common multiple of integers. The least common multiple is the smallest positive integer that is a multiple of all integer arguments number1, number2, and so on. Use LCM to add fractions with different denominators.

## Syntax

```
LCM (number1, [number2] ...)
```

## Arguments

Argument	Description	Required /Optional
Number1, number2...	1 to 255 values for which you want the least common multiple. If value is not an integer, it is truncated.	Number1 is Required. Subsequent numbers are Optional.

## Notes

- If any argument is nonnumeric, LCM returns the #VALUE! error value.
- If any argument is less than zero, LCM returns the #NUM! error value.
- If  $\text{LCM} (a, b) >= 2^{53}$ , LCM returns the #NUM! error value.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Numbers	LCM	2	Numbers	LCM
3	6	=LCM(B3,C3)	3	6	60
4	12	=LCM(B4,C4)	4	12	36
5	34	=LCM(B5,C5)	5	34	1632
6	0	=LCM(B6,C6)	6	0	0
7	-5	=LCM(B7,C7)	7	-5	#NUM!
8	5	=LCM(B8,C8)	8	5	#NUM!
9	Five	=LCM(B9,C9)	9	Five	#VALUE!

# 286. LN Function

## Description

The LN function returns the natural logarithm of a number. Natural logarithms are based on the constant e (2.71828182845904).

## Syntax

```
LN (number)
```

## Arguments

Argument	Description	Required /Optional
Number	The positive real number for which you want the natural logarithm.	Required

## Notes

- The Natural Logarithm of a number, written as  $\text{Ln}(x)$  or  $\text{Log}_e(x)$ , is the logarithm to the base e

$$\text{If } e^x = y, \text{ then } \text{Ln}(y) = x$$

- Thus, LN is the inverse of the EXP Function.
- If the specified number is negative or zero, LN returns #NUM! error.
- If the specified number is not a numeric value, LN returns #VALUE! Error.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

**Example**

Function Usage			Results		
	A	B		A	B
1			1		
2			2		
	Number	Natural Logarithm		Number	Natural Logarithm
3	10	=LN(B3)	3	10	2.303
4	50	=LN(B4)	4	50	3.912
5	100	=LN(B5)	5	100	4.605
6	453	=LN(B6)	6	453	6.116
7	1000	=LN(B7)	7	1000	6.908
8	-453	=LN(B8)	8	-453	#NUM!
9	0	=LN(B9)	9	0	#NUM!
10			10		

# 287. LOG Function

## Description

The LOG function returns the logarithm of a number to the base you specify.

## Syntax

```
LOG (number, [base])
```

## Arguments

Argument	Description	Required /Optional
Number	The positive real number for which you want the logarithm.	Required
Base	The base of the logarithm. If base is omitted, it is assumed to be 10.	Optional

## Notes

- The Logarithm of a number, to a given base, is the power to which the base must be raised to give that number  
$$\text{If } a^x = b, \text{ then } \ln_a(b) = x$$
- If either the specified number or the specified base is negative or zero, LOG returns #NUM! error.
- If the specified number or the specified base is not a numeric value, LOG returns #VALUE! Error.
- If the specified base is equal to 1, LOG returns #DIV/0! Error.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Number	Base	2	Number	Base
3	9	2	=LOG(B3,C3)	3	2
4	81	4	=LOG(B4,C4)	4	3
5	25	2	=LOG(B5,C5)	5	5
6	1	0	=LOG(B6,C6)	6	#NUM!
7	0	2	=LOG(B7,C7)	7	#NUM!
8	25	1	=LOG(B8,C8)	8	#DIV/0!

# 288. LOG10 Function

## Description

The LOG10 function returns the base-10 logarithm of a number.

## Syntax

```
LOG10 (number)
```

## Arguments

Argument	Description	Required /Optional
Number	The positive real number for which you want the base-10 logarithm.	Required

## Notes

- The base 10 Logarithm of a number, (also known as the Common Logarithm, and written as  $\text{Log}_{10}(x)$ ), is the logarithm to the base 10  
$$\text{If } 10^x = y, \text{ then } \text{Log}_{10}(y) = x$$
- If the specified number is negative or zero, LOG10 returns #NUM! error.
- If the specified number is not a numeric value, LOG10 returns #VALUE! Error.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	<b>Number</b>	<b>Log 10</b>	2		
3	10	=LOG10(B3)	3	10	1
4	100	=LOG10(B4)	4	100	2
5	1000	=LOG10(B5)	5	1000	3
6	10000	=LOG10(B6)	6	10000	4
7	452	=LOG10(B7)	7	452	3
n			o		

# 289. MDETERM Function

## Description

The MDETERM function returns the matrix determinant of an array.

## Syntax

```
MDETERM (array)
```

## Arguments

Argument	Description	Required /Optional
Array	A numeric array with an equal number of rows and columns.	Required

## Notes

- Array can be given as a cell range, for example, A1:C3; as an array constant, such as {1,2,3;4,5,6;7,8,9}; or as a name to either of these
- The matrix determinant is a number derived from the values in array. For a three-row, three-column array, A1:C3, the determinant is defined as-

$\text{MDETERM (A1:C3)} = \text{A1} * (\text{B2} * \text{C3} - \text{B3} * \text{C2}) + \text{A2} * (\text{B3} * \text{C1} - \text{B1} * \text{C3}) + \text{A3} * (\text{B1} * \text{C2} - \text{B2} * \text{C1})$

- Matrix determinants are generally used for solving systems of mathematical equations that involve several variables
- MDETERM is calculated with an accuracy of approximately 16 digits, which may lead to a small numeric error when the calculation is not complete
- MDETERM returns the #VALUE! error when
  - Any of the cells in the array is empty or contains non-numeric values
  - Array does not have an equal number of rows and columns

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage				Results
A	B	C	D	E
1				
2	Matrix		Result	
3	2	2	5	
4	4	3	15	
5	8	4	8	=MDETERM(B3:D5)
6				

# 290. MINVERSE Function

## Description

The MINVERSE function returns the inverse matrix for the matrix stored in an array.

## Syntax

```
MINVERSE (array)
```

## Arguments

Argument	Description	Required /Optional
Array	A numeric array with an equal number of rows and columns.	Required

## Notes

- Array can be given as a cell range, such as A1:C3 or as an array constant, such as {1,2,3;4,5,6;7,8,9} or as a name for either of these.
- Inverse matrices, like determinants, are generally used for solving systems of mathematical equations involving several variables. The product of a matrix and its inverse is the identity matrix. i.e. the square array in which the diagonal values equal 1, and all other values equal 0.
- If an inverse exists, the original matrix is known as invertible. Otherwise, the original matrix is described as singular.
- If a matrix is not invertible, MINVERSE returns the #NUM! Error value. The matrix is singular and the determinant is 0.
- Formulas that return arrays must be entered as array formulas.
- MINVERSE is calculated with an accuracy of approximately 16 digits, which may lead to a small numeric error when the cancellation is not complete.
- If any cells in Array are empty or contain text, MINVERSE returns the #VALUE! error value.
- If array does not have an equal number of rows and columns, MINVERSE returns the #VALUE! error value.
- If you select additional cells that are not part of the resulting matrix, MINVERSE returns the #N/A error value in these cells.

- If you do not highlight the full range of cells for the resulting matrix, Excel will just show the part of the result that fits into the highlighted range. There will be no error message to let you know that your highlighted range is not big enough.
- If you do not enter the formula as an array formula, the cell in which you enter the formula will just show you the first entry of the resulting matrix and there will be no error message.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

	A	B	C	D	E	F	G	
1								
2	Matrix			Result				Function Usage
3	2	2	5	=MINVERSE(B3:D5)	=MINVERSE(B3:D5)	=MINVERSE(B3:D5)		
4	4	3	15	=MINVERSE(B3:D5)	=MINVERSE(B3:D5)	=MINVERSE(B3:D5)		
5	8	4	8	=MINVERSE(B3:D5)	=MINVERSE(B3:D5)	=MINVERSE(B3:D5)		

	A	B	C	D	E	F	G	
1								
2	Matrix			Result				Results
3	2	2	5	-0.56	0.06	0.23		
4	4	3	15	1.38	-0.38	-0.16		
5	8	4	8	-0.13	0.13	-0.03		

# 291. MMULT Function

## Description

The MMULT function returns the matrix product of two arrays array1 and array2. The result is an array with the same number of rows as array1 and the same number of columns as array2.

## Syntax

```
MMULT (array1, array2)
```

## Arguments

Argument	Description	Required /Optional
Array1		
Array2	The arrays you want to multiply.	Required

## Notes

- The number of columns in Array1 must be the same as the number of rows in Array2, and both arrays must contain only numbers.
- Array1 and Array2 can be given as cell ranges, array constants, or references.
- The matrix product array a of two arrays b and c is:

$$a_{ij} = \sum_{k=1}^n b_{ik}c_{kj}$$

Where i is the row number, and j is the column number.

- Formulas that return arrays must be entered as array formulas
- MMULT returns the #VALUE! error when
  - Any of the cells is empty or contains a non-numeric value
  - The number of columns in Array1 is different from the number of rows in Array2
- If you select additional cells that are not part of the resulting matrix, MMULT returns the #N/A error value in these cells.
- If you do not highlight the full range of cells for the resulting matrix, Excel will just show the part of the result that fits into the highlighted range. There will be no error message to let you know that your highlighted range is not big enough.

- If you do not enter the formula as an array formula, the cell in which you enter the formula will just show you the first entry of the resulting matrix and there will be no error message.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

The diagram illustrates the usage of the MMULT function in Excel across three stages:

- Function Usage:** This stage shows the input matrices and the formula used. It includes:
  - Chocolates in a Box:** A 3x3 matrix where rows represent Box Size (Large, Medium, Small) and columns represent Milk, Dark, and White chocolates. Data: Large (70, 50, 50), Medium (55, 30, 35), Small (25, 10, 10).
  - Customers Orders:** A 3x3 matrix where rows represent Large, Medium, and Small customers, and columns represent Milk, Dark, and White chocolates. Data: Large (300, 400, 500), Medium (400, 500, 600), Small (500, 600, 700).
  - Quantity To Produce:** A 3x3 matrix where rows represent Milk, Dark, and White chocolates, and columns represent Large, Medium, and Small customers. Formulas: =MMULT(C10:E10,C4:E6) for Milk, =MMULT(C10:E10,C4:E6) for Dark, and =MMULT(C10:E10,C4:E6) for White.
- Results:** This stage shows the output of the MMULT function, which is the total quantity to produce for each chocolate type across all customer sizes. The results are:
 

	Milk	Dark	White
	55,500	32,000	34,000

# 292. MOD Function

## Description

The MOD function returns the remainder after number is divided by divisor. The result has the same sign as divisor.

## Syntax

```
MOD (number, divisor)
```

## Arguments

Argument	Description	Required /Optional
Number	The number for which you want to find the remainder.	Required
Divisor	The number by which you want to divide number.	Required

## Notes

- The MOD function can be expressed in terms of the INT function:  
$$\text{MOD}(n, d) = n - d * \text{INT}(n/d)$$
- If divisor is 0, MOD returns the #DIV/0! error value

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Number	Divisor	2	Number	Divisor
3	13	5	=MOD(B3,C3)	3	5
4	20	7	=MOD(B4,C4)	4	6
5	20	-7	=MOD(B5,C5)	5	-1
6	-20	7	=MOD(B6,C6)	6	1
7	18	3	=MOD(B7,C7)	7	0
8	24	7	=MOD(B8,C8)	8	3
9	24	1	=MOD(B9,C9)	9	0
10	24	24	=MOD(B10,C10)	10	0
11	24	0	=MOD(B11,C11)	11	#DIV/0!
--					

# 293. MROUND Function

## Description

The MROUND function returns a number rounded to the desired multiple. MROUND function is one of fifteen rounding functions in Excel.

## Syntax

```
MROUND (number, multiple)
```

## Arguments

Argument	Description	Required /Optional
Number	The value to round.	Required
Multiple	The multiple to which you want to round number.	Required

## Notes

- MROUND rounds up, away from zero, if the remainder of dividing number by multiple is greater than or equal to half the value of multiple.
- If multiple has a different arithmetic sign (positive or negative) to the number, MROUND returns #NUM! error.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	D
1			1		
2	Number	Multiple	2	Number	Multiple
3	110	50	3	110	50
4	120	50	4	120	50
5	140	50	5	140	50
6	160	50	6	160	50
7	170	50	7	170	50
8	-170	-50	8	-170	-50
9	-180	-50	9	-180	-50
10	-170	50	10	-170	50
11	170	-50	11	170	-50

# 294. MULTINOMIAL Function

## Description

The MULTINOMIAL function returns the ratio of the factorial of a sum of values to the product of factorials.

## Syntax

```
MULTINOMIAL (number1, [number2] ...)
```

## Arguments

Argument	Description	Required /Optional
Number1	1 to 255 values for which you want the multinomial.	Required
number2, ...		Optional

## Notes

- The multinomial is-

$$\text{MULTINOMIAL}(a_1, a_2, \dots, a_n) = \frac{(a_1 + a_2 + \dots + a_n)!}{a_1! a_2! \dots a_n!}$$

- If any argument is nonnumeric, MULTINOMIAL returns the #VALUE! error value.
- If any argument is less than zero, MULTINOMIAL returns the #NUM! error value.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	2		2	2	
3	Numbers	4	3	4	
4		8	4		
5	Result	=MULTINOMIAL(C2:C4)	5	Result	45045

# 295. MUNIT Function

## Description

The MUNIT function returns the unit matrix for the specified dimension.

## Syntax

```
MUNIT (dimension)
```

## Arguments

Argument	Description	Required /Optional
Dimension	Dimension is an integer specifying the dimension of the unit matrix that you want to return. The dimension has to be greater than zero.	Required

## Notes

- MUNIT returns an array. Hence, it should be entered as an array formula  
$$\begin{matrix} 1 & 0 & \dots & 0 \\ 0 & 1 & \dots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & \dots & 1 \end{matrix}$$
  
MUNIT (N) =
- If dimension is a value that is equal to or smaller than zero (0), MUNIT returns the #VALUE! error value.
- If dimension is not recognized as a numeric value, MUNIT returns the #VALUE! error value.
- If you select additional cells that are not part of the resulting matrix, MUNIT returns the #N/A error value in these cells.
- If you do not highlight the full range of cells for the resulting matrix, Excel will just show the part of the result that fits into the highlighted range. There will be no error message to let you know that your highlighted range is not big enough.
- If you do not enter the formula as an array formula, the cell in which you enter the formula will just show you the first entry of the resulting matrix and there will be no error message.

## Applicability

Excel 2013, Excel 2016

**Example**

Function Usage

Results

The screenshot shows two parts of an Excel spreadsheet. The top part, titled 'Function Usage', displays a formula bar with 'C3' selected and the formula '{=MUNIT(B3)}'. Below it is a table with a single row labeled 'Dimension' and four columns labeled 'Result'. The formula '=MUNIT(B3)' is repeated four times in the 'Result' column. The bottom part, titled 'Results', shows the output of the MUNIT function. It has a single row labeled 'Dimension' with value '4' and four columns labeled 'Result' containing the matrix:

Dimension	Result	Result	Result	Result
4	1	0	0	0
	0	1	0	0
	0	0	1	0
	0	0	0	1

# 296. ODD Function

## Description

The ODD function returns number rounded up to the nearest odd integer. ODD Function is one of fifteen rounding Functions in Excel.

## Syntax

```
ODD (number)
```

## Arguments

Argument	Description	Required /Optional
Number	The value to round.	Required

## Notes

- Regardless of the sign of number, a value is rounded away from zero to the next odd number.
- If number is an odd integer, no rounding occurs.
- If number is 0 (zero), ODD Function rounds to the positive value +1.
- If number is nonnumeric, ODD returns the #VALUE! error value.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
	A	B		A	B
1			1		
2			2		
3	2	=ODD(B3)	3		3
4	2.4	=ODD(B4)	4		3
5	2.8	=ODD(B5)	5		3
6	3	=ODD(B6)	6		3
7	3.4	=ODD(B7)	7		5
8	3.8	=ODD(B8)	8		5
9	0	=ODD(B9)	9		1
10		=ODD(B10)	10		1
11	-2	=ODD(B11)	11		-3
12	-5.4	=ODD(B12)	12		-7
13	-5	=ODD(B13)	13		-5
14	TRUE	=ODD(B14)	14		1
15	FALSE	=ODD(B15)	15		1
16	Text	=ODD(B16)	16		#VALUE!
17	"Text"	=ODD(B17)	17		#VALUE!
18	Five	=ODD(B18)	18		#VALUE!
19			19		

# 297. PI Function

## Description

The PI function returns the number 3.14159265358979, the mathematical constant pi, accurate to 15 digits.

## Syntax

```
PI ()
```

## Arguments

The PI function syntax has no arguments.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage		Results	
	A		B
1			
2		$\pi$	
3	=PI()		3.14159265358979

# 298. POWER Function

## Description

The POWER function returns the result of a number raised to a power.

## Syntax

```
POWER (number, power)
```

## Arguments

Argument	Description	Required /Optional
Number	The base number. It can be any real number.	Required
Power	The exponent to which the base number is raised.	Required

## Notes

- The " $^$ " operator can be used instead of POWER to indicate to what power the base number is to be raised, such as in  $5^2$
- The number and power arguments are numerical values that can be supplied to the Function either directly or as values returned from other functions or as references to cells containing numbers.
- If either of the specified arguments is non-numeric, POWER returns #VALUE! Error.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Number	Power	2	Number	Power
3	3	2	=POWER(B3,C3)	3	9
4	3	4	=POWER(B4,C4)	4	81
5	5	2	=POWER(B5,C5)	5	25
6	5.5	2	=POWER(B6,C6)	6	30.25
7	5	2.5	=POWER(B7,C7)	7	55.90169944
8	5	0	=POWER(B8,C8)	8	1
9	0	2	=POWER(B9,C9)	9	0
10	5	Two	=POWER(B10,C10)	10	#VALUE!
11	Five	2	=POWER(B11,C11)	11	#VALUE!

# 299. PRODUCT Function

## Description

The PRODUCT function multiplies all the numbers given as arguments and returns the product.

For example, if cells A1 and A2 contain numbers, to multiply those two numbers together, you can use the formula

=PRODUCT (A1, A2)

This is same as multiplying with the (\*) mathematical operator. i.e.

=A1 \* A2

The PRODUCT Function is useful when you need to multiply many cells together.

Example

=PRODUCT (A1:A3, C1:C3)

This is same as

=A1 \* A2 \* A3 \* C1 \* C2 \* C3.

## Syntax

PRODUCT (number1, [number2] ...)

## Arguments

Argument	Description	Required /Optional
number1	The first number or range that you want to multiply.	Required
number2, ...	Additional numbers or ranges that you want to multiply, up to a maximum of 255 arguments.	Optional

## Notes

- Numbers and Dates are always counted as numeric values by the Product Function. However, text and logical values are handled differently, depending on whether they are values stored in the cells of the Worksheet, or they are supplied directly to the function.

- The table given below shows which values are included in the Product Function calculation, and which values are ignored or produce errors-

	<b>Value Within a Range of Cells</b>	<b>Value Supplied Directly to Function</b>
Numbers	Included	Included
Dates	Included	Included
Logical Values	Ignored	Included (True=1; False=0)
Text Representations of Numbers & Dates	Ignored	Included
Other Text	Ignored	#VALUE! Error
Errors	Error	Error

If any of the arguments that is supplied directly to the Product function cannot be interpreted as numeric value, Product Function returns #VALUE! Error.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	<b>Numbers</b>		<b>Product</b>	<b>Numbers</b>	
3	2	3	=PRODUCT(B3,C3)	2	6
4	5	10	=PRODUCT(B4:C4)	5	50
5	3	7	=PRODUCT(B5:C5,10)	3	210
6			=PRODUCT(B3:B5,C3:C5)		6300
7			=PRODUCT(B3:C5)		6300
8			=PRODUCT(B3:B5,"Two")		#VALUE!
-					

# 300. QUOTIENT Function

## Description

The QUOTIENT function returns the integer portion of a division. Use this function when you want to discard the remainder of a division.

## Syntax

```
QUOTIENT (numerator, denominator)
```

## Arguments

Argument	Description	Required /Optional
Numerator	The dividend.	Required
Denominator	The divisor.	Required

## Notes

- If you want to divide numeric values and keep a remainder use the "/" operator as there is no DIVIDE Function in Excel.
- For example, to divide 5 by 2, you would type "=5/2" (without the quotes) into a cell, which returns 2.5. The QUOTIENT Function for these same numbers QUOTIENT (5, 2) returns 2.
- If either of the arguments is nonnumeric, QUOTIENT returns the #VALUE! error value.
- If the specified denominator is zero, QUOTIENT returns the #DIV/0! error value.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
	A	B		A	B
1				1	
2		Numerator	Denominator	2	Numerator
3	12	5	=QUOTIENT(B3,C3)	3	12
4	20	3	=QUOTIENT(B4,C4)	4	20
5	46	15	=QUOTIENT(B5,C5)	5	46
6	20	Three	=QUOTIENT(B6,C6)	6	20
7	Twenty	3	=QUOTIENT(B7,C7)	7	Twenty
8	20	0	=QUOTIENT(B8,C8)	8	20

# 301. RADIANS Function

## Description

The RADIANS function converts degrees to radians. The conversion between Degrees and Radians is calculated by the relationship

$$180 \text{ degrees} = \pi \text{ radians}$$

Where  $\pi$  is the mathematical constant, PI = 3.14159265358979...

## Syntax

```
RADIANS (angle)
```

## Arguments

Argument	Description	Required /Optional
Angle	An angle in degrees that you want to convert.	Required

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
	A	B		A	B
1				1	
2				2	
	A	B	C	A	B
3				3	
4				4	
5				5	
-					
Angle			Angle		
3	180	=RADIANS(B3)	3	180	3.141592654
4	90	=RADIANS(B4)	4	90	1.570796327
5	45	=RADIANS(B5)	5	45	0.785398163

# 302. RAND Function

## Description

The RAND function returns an evenly distributed random real number greater than or equal to 0 and less than 1. A new random real number is returned every time the Worksheet is calculated.

## Syntax

```
RAND ()
```

## Arguments

The RAND Function has no arguments.

## Notes

- You can generate a random real number between a and b, with  
$$=RAND()*(b-a)+a$$
- If you want to use RAND to generate a random number but do not want the numbers to change every time the cell is calculated, enter =RAND() in the formula bar, and then press F9 to change the formula to a random number

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage		Results	
A	B	A	B
1		1	
2	Random Number ≥ 0 and < 1	2	Random Number ≥ 0 and < 1
3	=RAND()	3	0.506513886
4		4	
5	Random Number ≥ 0 and < 5	5	Random Number ≥ 0 and < 5
6	=RAND()*5	6	3.701515017
7		7	
8	Random Number between 5 and 10	8	Random Number between 5 and 10
9	=RAND()*(10-5)+5	9	6.611514086

# 303. RANDBETWEEN Function

## Description

The RANDBETWEEN function returns a random integer number between the numbers you specify. A new random integer number is returned every time the Worksheet is calculated.

## Syntax

```
RANDBETWEEN (bottom, top)
```

## Arguments

Argument	Description	Required /Optional
Bottom	The smallest integer RANDBETWEEN will return.	Required
Top	The largest integer RANDBETWEEN will return.	Required

## Notes

- If the specified bottom argument is greater than the supplied top argument, RANDBETWEEN returns #NUM! error.
- If either of the supplied arguments is not recognized as a numeric value, RANDBETWEEN returns #VALUE! Error.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage				Results			
A	B	C	D	A	B	C	D
1				1			
2	Bottom	Top	=RANDBETWEEN(B3,C3)	2	Bottom	Top	Random Number
3	5	10	=RANDBETWEEN(B3,C3)	3	5	10	9
4	5	48	=RANDBETWEEN(B4,C4)	4	5	48	5
5	10	5	=RANDBETWEEN(B5,C5)	5	10	5	#NUM!
6	Ten	5	=RANDBETWEEN(B6,C6)	6	Ten	5	#VALUE!
7	10	Five	=RANDBETWEEN(B7,C7)	7	10	Five	#VALUE!

# 304. ROMAN Function

## Description

The ROMAN function converts an Arabic numeral to roman, as text.

## Syntax

```
ROMAN (number, [form])
```

## Arguments

Argument	Description	Required /Optional
Number	The Arabic numeral you want converted.	Required
Form	A number specifying the type of roman numeral you want. The roman numeral style ranges from Classic to Simplified, becoming more concise as the value of form increases. See the Roman numeral Styles Table given below. If omitted, it takes on the default value of 0 (denoting the classic form is used).	Optional

## Roman numeral Styles Table

Form	Type
0 or omitted	Classic.
1	More concise.
2	More concise.
3	More concise.
4	Simplified.
TRUE	Classic.
FALSE	Simplified.

## Notes

- If any of the arguments is specified as a decimal value, it is truncated to integer.
- If number is negative, ROMAN returns the #VALUE! Error.
- If number is greater than 3999, ROMAN returns the #VALUE! Error.
- If form is specified, but is invalid, i.e. is not one of the values 0, 1, 2, 3 4, TRUE or FALSE, ROMAN returns the #VALUE! Error

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1	2	Number	1	2	Number
		=ROMAN(B3)			I
	2	=ROMAN(B4)			II
	3	=ROMAN(B5)			III
	5	=ROMAN(B6)			V
	10	=ROMAN(B7)			X
	1984	=ROMAN(B8)	8	1984	MCMLXXXIV
	1984	=ROMAN(B9,0)	9	1984	MCMLXXXIV
	1984	=ROMAN(B10,1)	10	1984	MLMXXXIV
	1984	=ROMAN(B11,2)	11	1984	MLMXXXIV
	1984	=ROMAN(B12,3)	12	1984	MLMXXXIV
	1984	=ROMAN(B13,4)	13	1984	MLMXXXIV
	1984	=ROMAN(B14,TRUE)	14	1984	MCMLXXXIV
	1984	=ROMAN(B15,FALSE)	15	1984	MLMXXXIV

# 305. ROUND Function

## Description

The ROUND function rounds a number to a specified number of digits. ROUND is one of the Excel Rounding Functions.

## Syntax

```
ROUND (number, num_digits)
```

## Arguments

Argument	Description	Required /Optional
number	The number that you want to round.	Required
num_digits	The number of digits to which you want to round the number argument.	Required

## Notes

- If num\_digits is greater than 0 (zero), then number is rounded to the specified number of decimal places.
- If num\_digits is 0, the number is rounded to the nearest integer.
- If num\_digits is less than 0, the number is rounded to the left of the decimal point.
- To always round up (away from zero) use the ROUNDUP function.
- To always round down (toward zero) use the ROUNDDOWN function.
- To round a number to a specific multiple (for example, to round to the nearest 0.5), use the MROUND Function

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
	B	C	A	B	C
1			1		
2	Number	Number of Digits	2	Number	Number of Digits
3	1.47589	0	3	1.47589	0
4	1.84589	0	4	1.84589	0
5	1.47589	1	5	1.47589	1
6	1.84589	1	6	1.84589	1
7	1.47589	2	7	1.47589	2
8	1.84589	2	8	1.84589	2
9	13643.47589	-1	9	13643.47589	-1
10	13643.47589	-2	10	13643.47589	-2
11	13643.47589	-3	11	13643.47589	-3

# 306. ROUNDDOWN Function

## Description

The ROUNDDOWN function rounds a number down, toward zero. ROUNDDOWN is one of the Excel Rounding Functions.

## Syntax

```
ROUNDDOWN (number, num_digits)
```

## Arguments

Argument	Description	Required /Optional
Number	Any real number that you want rounded down.	Required
Num_digits	The number of digits to which you want to round number.	Required

## Notes

- ROUNDDOWN behaves like ROUND, except that it always rounds a number down.
- If num\_digits is greater than 0 (zero), then number is rounded down to the specified number of decimal places.
- If num\_digits is 0, then number is rounded down to the nearest integer.
- If num\_digits is less than 0, then number is rounded down to the left of the decimal point.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage				Results				
	A	B	C		A	B	C	
1					1			
2		Number	Number of Digits	Result	2	Number	Number of Digits	Result
3		1.47589	0	=ROUNDDOWN(B3,C3)	3	1.47589	0	1
4		1.84589	0	=ROUNDDOWN(B4,C4)	4	1.84589	0	1
5		1.47589	1	=ROUNDDOWN(B5,C5)	5	1.47589	1	1.4
6		1.84589	1	=ROUNDDOWN(B6,C6)	6	1.84589	1	1.8
7		1.47589	2	=ROUNDDOWN(B7,C7)	7	1.47589	2	1.47
8		1.84589	2	=ROUNDDOWN(B8,C8)	8	1.84589	2	1.84
9		13643.47589	-1	=ROUNDDOWN(B9,C9)	9	13643.47589	-1	13640
10		13643.47589	-2	=ROUNDDOWN(B10,C10)	10	13643.47589	-2	13600
11		13643.47589	-3	=ROUNDDOWN(B11,C11)	11	13643.47589	-3	13000

# 307. ROUNDUP Function

## Description

The ROUNDUP function rounds a number up, away from 0 (zero). ROUNDUP is one of the Excel Rounding Functions.

## Syntax

```
ROUNDUP (number, num_digits)
```

## Arguments

Argument	Description	Required /Optional
Number	Any real number that you want rounded up.	Required
Num_digits	The number of digits to which you want to round number.	Required

## Notes

- ROUNDUP behaves like ROUND, except that it always rounds a number up.
- If num\_digits is greater than 0 (zero), then number is rounded up to the specified number of decimal places.
- If num\_digits is 0, then number is rounded up to the nearest integer.
- If num\_digits is less than 0, then number is rounded up to the left of the decimal point.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results			
	A	B		A	B	
1			1			
2			2			
	Number	Number of Digits		Number	Number of Digits	
3	1.47589	0	=ROUNDUP(B3,C3)	3	1.47589	0
4	1.84589	0	=ROUNDUP(B4,C4)	4	1.84589	0
5	1.47589	1	=ROUNDUP(B5,C5)	5	1.47589	1
6	1.84589	1	=ROUNDUP(B6,C6)	6	1.84589	1
7	1.47589	2	=ROUNDUP(B7,C7)	7	1.47589	2
8	1.84589	2	=ROUNDUP(B8,C8)	8	1.84589	2
9	13643.47589	-1	=ROUNDUP(B9,C9)	9	13643.47589	-1
10	13643.47589	-2	=ROUNDUP(B10,C10)	10	13643.47589	-2
11	13643.47589	-3	=ROUNDUP(B11,C11)	11	13643.47589	-3
12						

# 308. SEC Function

## Description

The SEC function returns the secant of an angle.

## Syntax

```
SEC (number)
```

## Arguments

Argument	Description	Required /Optional
Number	Number is the angle in radians for which you want the secant.	Required

## Notes

- The absolute value of number must be less than  $2^{27}$
- If the angle is in degrees, either multiply the angle by  $\text{PI()}/180$  or use the RADIANS Function to convert the angle to radians  
 $= \text{RADIANS} (\text{degrees})$
- If number is outside of its constraints, SEC returns the #NUM! error value.
- If number is a non-numeric value, SEC returns the #VALUE! error value.

## Applicability

Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Number	Result	2	Number	Result
3	5	=SEC(B3)	3	5	3.525320086

# 309. SECH Function

## Description

The SECH function returns the hyperbolic secant of an angle. The hyperbolic secant is the reciprocal of the hyperbolic cosine. Hence, the value of the hyperbolic secant is given by the equation-

$$\operatorname{sech}(x) = \frac{1}{\cosh(x)} = \frac{2}{(e^x + e^{-x})}$$

## Syntax

```
SECH (number)
```

## Arguments

Argument	Description	Required /Optional
Number	Number is the angle in radians for which you want the hyperbolic secant.	Required

## Notes

- The absolute value of number must be less than  $2^{27}$
- If the angle is in degrees, either multiply the angle by  $\text{PI()}/180$  or use the RADIANS Function to convert the angle to radians  
 $=\text{RADIANS}(\text{degrees})$
- If number is outside of its constraints, SECH returns the #NUM! error value.
- If number is a non-numeric value, SECH returns the #VALUE! error values.

## Applicability

Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Number	Result	2	Number	Result
3	5	=SECH(B3)	3	5	0.013475282

# 310. SERIESSUM Function

## Description

The SERIESSUM function returns the sum of a power series. Many functions can be approximated by a power series expansion.

## Syntax

```
SERIESSUM (x, n, m, coefficients)
```

## Arguments

Argument	Description	Required /Optional
X	The input value to the power series.	Required
N	The initial power to which you want to raise x.	Required
M	The step by which to increase n for each term in the series.	Required
Coefficients	A set of coefficients by which each successive power of x is multiplied. The number of values in coefficients determines the number of terms in the power series.	Required

## Notes

- The sum of a power series is given by

$$\text{SERIESSUM}(x,n,m,a) = a_1x^n + a_2x^{(n+m)} + a_3x^{(n+2m)} + \dots + a_jx^{(n+(j-1)m)}$$

Where  $(a_1, a_2, a_3 \dots a_j)$  is the set of coefficients.

- If any of the specified arguments is non-numeric, SERIESSUM returns #VALUE! error

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
1	A	B	C	1	A
2	X	0.785398163	Coefficients	2	X
3	N	0		3	N
4	M	2		4	M
5		1		5	
6		-0.5		6	1
7		0.041666667		7	-0.5
8		-0.001388889		8	0.041666667
9	Result	=SERIESSUM(C2,C3,C4,C5:C8)		9	-0.001388889
					Result
					0.707103215

# 311. SIGN Function

## Description

The SIGN function determines the sign of a number. The function returns-

- 1 if the number is positive
- zero (0) if the number is 0
- -1 if the number is negative

## Syntax

```
SIGN (number)
```

## Arguments

Argument	Description	Required /Optional
Number	Any real number.	Required

## Notes

If the specified number is not recognized as a numeric value, SIGN returns #VALUE! error.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	<b>Number</b>	<b>Result</b>	2		
3	15	=SIGN(B3)	3		
4	25	=SIGN(B4)	4		
5	0	=SIGN(B5)	5		
6	-15	=SIGN(B6)	6		
7	-25	=SIGN(B7)	7		
8	Two	=SIGN(B8)	8		#VALUE!

# 312. SIN Function

## Description

The SIN function returns the sine of the given angle.

## Syntax

```
SIN (number)
```

## Arguments

Argument	Description	Required /Optional
Number	The angle in radians for which you want the sine.	Required

## Notes

If number is in degrees, multiply it by PI()/180 or use the RADIANS Function to convert it to radians

```
=RADIANS (degrees)
```

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Number	Result	2	Number	Result
3	5	=SIN(B3)	3	5	-0.958924275
*			4		

# 313. SINH Function

## Description

The SINH function returns the hyperbolic sine of a number.

## Syntax

```
SINH (number)
```

## Arguments

Argument	Description	Required /Optional
Number	Any real number.	Required

## Notes

The formula for the hyperbolic sine is-

$$\text{SINH}(z) = \frac{e^z - e^{-z}}{2}$$

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Number	=SINH(B3)	2	Number	Result
3	5		3	5	74.20321058
*					

# 314. SQRT Function

## Description

The SQRT function returns a positive square root.

## Syntax

```
SQRT (number)
```

## Arguments

Argument	Description	Required /Optional
Number	The number for which you want the square root.	Required

## Notes

- If specified number is negative, SQRT returns the #NUM! error value.
- If specified number is non-numeric, SQRT returns the #VALUE! error value.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
	A	B		A	B
1			C	1	
2		Number	Result	2	Number
3	16	=SQRT(B3)		3	16
4	55.55	=SQRT(B4)		4	55.55 7.453187238

# 315. SQRTPI Function

## Description

The SQRTPI function returns the square root of (number \* pi).

## Syntax

```
SQRTPI (number)
```

## Arguments

Argument	Description	Required /Optional
Number	The number by which pi is multiplied.	Required

## Notes

- If the specified number < 0, SQRTPI returns the #NUM! error value.
- If the specified number is non-numeric, SQRTPI returns the #VALUE! error value.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
	A	B		A	B
1			C		
2		Number	5		
3		Result	=SQRTPI(C2)		5
.					3.963327298

# 316. SUBTOTAL Function

## Description

The SUBTOTAL function returns a subtotal in a list or database. You can create a list with subtotals by using the Subtotal command in the Outline group on the Data tab in Excel. Once the subtotal list is created, you can modify it by editing the SUBTOTAL Function.

## Syntax

```
SUBTOTAL (function_num, ref1, [ref2]...)
```

## Arguments

Argument	Description	Required /Optional
Function_num	<p>The number 1-11 or 101-111 that specifies the function to use for the subtotal.</p> <ul style="list-style-type: none"><li>• 1-11 includes manually-hidden rows</li><li>• 101-111 excludes them</li></ul> <p>Filtered-out cells are always excluded. Look at the Function_num Table below to know the Functions.</p>	Required
Ref1	The first named range or reference for which you want the subtotal.	Required
Ref2...	Named ranges or references 2 to 254 for which you want the subtotal.	Optional

## Function\_num Table

Function_num (includes hidden values)	Function_num (ignores hidden values)	Function
1	101	AVERAGE
2	102	COUNT
3	103	COUNTA
4	104	MAX
5	105	MIN
6	106	PRODUCT
7	107	STDEV
8	108	STDEVP
9	109	SUM
10	110	VAR
11	111	VARP

## Notes

- If there are other subtotals within ref1, ref2... (or nested subtotals), these nested subtotals are ignored to avoid double counting.

- For the function\_num constants from 1 to 11, the SUBTOTAL function includes the values of rows hidden by the Hide Rows command under the Hide & Unhide submenu of the Format command in the Cells group on the Home tab in Excel. Use these constants when you want to subtotal hidden and nonhidden numbers in a list.
- For the function\_Num constants from 101 to 111, the SUBTOTAL function ignores values of rows hidden by the Hide Rows command. Use these constants when you want to subtotal only nonhidden numbers in a list.
- The SUBTOTAL function ignores any rows that are not included in the result of a filter, no matter which function\_num value you use.
- The SUBTOTAL function is designed for columns of data, or vertical ranges. It is not designed for rows of data, or horizontal ranges.
- If any of the references are 3-D references, SUBTOTAL returns the #VALUE! error value
- If the specified function\_num is not one of the permitted values (an integer between 1 & 11 or between 101 & 111), SUBTOTAL returns the #VALUE! error value.
- If the required calculation involves a division by zero (e.g. finding the average, standard deviation or variance for a range of cells that do not contain any numeric values), SUBTOTAL returns the #DIV/0!error value.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Range	140	2	140	
3		100	3	100	
4		150	4	150	
5		230	5	230	
6	Result	=SUBTOTAL(5,C2:C5)	6	Result	100
-			7		

# 317. SUM Function

## Description

The SUM function adds values.

## Syntax

```
SUM (number1, [number2]...)
```

## Arguments

Argument	Description	Required /Optional
number1	The first number you want to add. The number can be a value, a cell reference, or a cell range.	Required
number2, ...	You can specify up to 255 additional numbers.	Optional

## Notes

- Numbers and Dates are always counted as numeric values by the SUM function.
- However, Text representations and Logical values are handled differently, depending on whether they are values stored in the cells of the worksheet, or they are supplied directly to the function. See the table given below for the details-

	Value Within a Range of Cells	Value Supplied Directly to Function
Numbers	Included	Included
Dates	Included	Included
Logical Values	Ignored	Included (True=1; False=0)
Text Representations of Numbers & Dates	Ignored	Included
Other Text	Ignored	#VALUE! Error
Errors	Error	Error

If any of the number arguments that are supplied directly to the SUM function cannot be interpreted as numeric values, SUM returns #VALUE! Error.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
	B	C		B	C
1			1		
2	<b>Numbers</b>		2	<b>Numbers</b>	
3	100	400	3	100	400
4	200	500	4	200	500
5	300	600	5	300	600
6			6		
7	<b>Sum</b>		7	<b>Sum</b>	
8	<code>=SUM(B3,C3)</code>		8	500	
9	<code>=SUM(B3:C3)</code>		9	500	
10	<code>=SUM(B3:B5)</code>		10	600	
11	<code>=SUM(B3:B5,C3:C5)</code>		11	2100	
12	<code>=SUM(B3:C5)</code>		12	2100	
13	<code>=SUM(B3:C3,B4:C4,B5:C5)</code>		13	2100	
14	<code>=SUM(B6:C6)</code>		14	0	
15	<code>=SUM(B3,"Two")</code>		15	#VALUE!	

# 318. SUMIF Function

## Description

You can use the SUMIF Function to sum the values in a range that meet criteria that you specify.

## Syntax

```
SUMIF (range, criteria, [sum_range])
```

## Arguments

Argument	Description	Required /Optional
range	The range of cells that you want evaluated by criteria. Cells in each range must be numbers or names, arrays, or references that contain numbers. Blank and text values are ignored. The selected range may contain Dates in standard Excel format.	Required
criteria	The criteria in the form of a number, expression, a cell reference, text, or a Function that defines which cells will be added. Any text criteria or any criteria that includes logical or mathematical symbols must be enclosed in double quotation marks (""). If the criteria is numeric, double quotation marks are not required.	Required
sum_range	The actual cells to add, if you want to add cells other than those specified in the range argument. If sum_range is omitted, Excel adds the cells that are specified in the range (the same cells to which the criteria is applied).	Optional

## Notes

- You can use the wildcard characters—the question mark (?) and asterisk (\*) - as the criteria argument. A question mark matches any single character and an asterisk matches any sequence of characters. If you want to find an actual question mark or asterisk, type a tilde (~) preceding the character.
- The SUMIF function returns incorrect results when you use it to match strings longer than 255 characters or to the string #VALUE!
- The sum\_range argument does not have to be the same size and shape as the range argument. The actual cells that are added are determined by using the upper leftmost cell in the sum\_range argument as the beginning cell, and then including cells that correspond in size and shape to the range argument

- However, when the range and sum\_range arguments in the SUMIF function do not contain the same number of cells, worksheet recalculation may take longer than expected.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

			Function Usage			Results		
A	B	C	D	E	F	D	E	F
1								
2	Item	Cost		Criteria	Result		Criteria	Result
3	Notebooks	300		Notebooks	=SUMIF(B3:B10,E3,C3:C10)		Notebooks	400
4	Pens	150		Pens	=SUMIF(B3:B10,E4,C3:C10)		Pens	375
5	Notebooks	100		< 300	=SUMIF(C3:C10,E5)		< 300	680
6	Stickers	50						
7	Stickers	75						
8	Pens	100						
9	Pens	125						
10	Stickers	80						
11								

# 319. SUMIFS Function

## Description

The SUMIFS Function adds all of its arguments that meet multiple criteria.

## Syntax

```
SUMIFS (sum_range, criteria_range1, criteria1, [criteria_range2, criteria2] ...)
```

## Arguments

Argument	Description	Required /Optional
Sum_range	The range of cells to sum.	Required
Criteria_range1	The range that is tested using Criteria1. Criteria_range1 and Criteria1 set up a search pair whereby a range is searched for specific criteria. Once items in the range are found, their corresponding values in Sum_range are added.	Required
Criteria1	The criteria that defines which cells in Criteria_range1 will be added.	Required
Criteria_range2, criteria2, ...	Additional ranges and their associated criteria. You can enter up to 127 range/criteria pairs.	Optional

## Notes

- If the length of any of the supplied criteria\_range arrays is not equal to the length of the sum\_range array, SUMIFS returns #VALUE! Error.
- You can use wildcard characters like the question mark (?) and asterisk (\*) in criteria1, 2 to find matches that are similar but not exact.
- A question mark matches any single character. An asterisk matches any sequence of characters. If you want to find an actual question mark or asterisk, type a tilde (~) in front of the question mark.
- The order of arguments differ between SUMIFS and SUMIF. In particular, the sum\_range argument is the first argument in SUMIFS, but it is the third argument in SUMIF.
- The Criteria\_range argument must contain the same number of rows and columns as the Sum\_range argument.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

A	B	C	D
1			
2	Product	Month	Quantity Sold
3	Apples	January	5
4	Apples	April	4
5	Plums	February	15
6	Plums	April	3
7	Pears	February	22
8	Pears	April	12
9	Carrots	January	10
10	Carrots	December	52
11			
12	Result	=SUMIFS(D3:D10,B3:B10,"=P*",C3:C10,"=February")	
13		=SUMIFS(D3:D10,B3:B10,"=C*",C3:C10,"=December")	
14	Result	37	
15		52	

**Function Usage**

**Results**

# 320. SUMPRODUCT Function

## Description

The SUMPRODUCT function multiplies corresponding components in the given arrays, and returns the sum of those products.

## Syntax

```
SUMPRODUCT (array1, [array2], [array3] ...)
```

## Arguments

Argument	Description	Required /Optional
Array1	The first array argument whose components you want to multiply and then add.	Required
Array2, array3...	Array arguments 2 to 255 whose components you want to multiply and then add.	Optional

## Notes

- All of the supplied arrays must have the same dimensions.
- If just one array is supplied, the function returns the sum of the values in that array.
- Non-numeric values in the supplied arrays are treated as the value zero.
- Arrays that are supplied directly to the SUMPRODUCT function should be surrounded by curly braces, with values in the same row separated by a comma and each row separated by a semicolon.
- If the supplied arrays have different dimensions, SUMPRODUCT returns #VALUE! Error.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Item	Cost	2	Item	Cost
3	Notebooks	50	3	Notebooks	50
4	Pens	150	4	Pens	150
5	Stickers	15	5	Stickers	15
6			6		
7	Total Amount	=SUMPRODUCT(C3:C5,D3:D5)	7	Total Amount	19250
-			-		

# 321. SUMSQ Function

## Description

The SUMSQ function returns the sum of the squares of the arguments.

## Syntax

```
SUMSQ (number1, [number2] ...)
```

## Arguments

Argument	Description	Required /Optional
Number1	1 to 255 arguments for which you want the sum of the squares.	Required
number2, ...	You can also use a single array or a reference to an array instead of arguments separated by commas.	Optional

## Notes

- Arguments can either be numbers or names, arrays, or references that contain numbers.
- Numbers, logical values, and text representations of numbers that you type directly into the list of arguments are counted.
- If an argument is an array or reference, only numbers in that array or reference are counted. Empty cells, logical values, text, or error values in the array or reference are ignored.
- Arguments that are error values or text that cannot be translated into numbers cause errors.
- If a value that is supplied directly to the Function cannot be interpreted as a number, SUMSQ returns #VALUE! Error.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

**Example**

Function Usage			Results		
A	B	C	A	B	C
1			1		
2		19	2		19
3		17	3		17
4	Numbers	45	4		45
5		50	5		50
6		16	6		16
7	Result	=SUMSQ(C2:C6)	7		5431

# 322. SUMX2MY2 Function

## Description

The SUMX2MY2 function returns the sum of the difference of squares of corresponding values in two arrays.

## Syntax

```
SUMX2MY2 (array_x, array_y)
```

## Arguments

Argument	Description	Required /Optional
Array_x	The first array or range of values.	Required
Array_y	The second array or range of values.	Required

## Notes

- The arguments should be either numbers or names, arrays, or references that contain numbers.
- If an array or reference argument contains text, logical values, or empty cells, those values are ignored. However, cells with the value zero are included.
- If array\_x and array\_y have a different number of values, SUMX2MY2 returns the #N/A error value.
- The equation for the sum of the difference of squares is-

$$\text{SUMX2MY2} = \sum (x^2 - y^2)$$

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Array1	Array2	2	Array1	Array2
3	30	19	3	30	19
4	25	17	4	25	17
5	40	45	5	40	45
6	55	50	6	55	50
7	75	16	7	75	16
8	Result	=SUMX2MY2(B3:B7,C3:C7)	8	Result	6344

# 323. SUMX2PY2 Function

## Description

The SUMX2PY2 function returns the sum of the sum of squares of corresponding values in two arrays.

## Syntax

```
SUMX2PY2 (array_x, array_y)
```

## Arguments

Argument	Description	Required /Optional
Array_x	The first array or range of values.	Required
Array_y	The second array or range of values.	Required

## Notes

- The arguments should be either numbers or names, arrays, or references that contain numbers.
- If an array or reference argument contains text, logical values, or empty cells, those values are ignored. However, cells with the value zero are included.
- If array\_x and array\_y have a different number of values, SUMX2PY2 returns the #N/A error value.
- The equation for the sum of the sum of squares is-

$$\text{SUMX2PY2} = \sum(x^2 + y^2)$$

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Array1	Array2	2	Array1	Array2
3	30	19	3	30	19
4	25	17	4	25	17
5	40	45	5	40	45
6	55	50	6	55	50
7	75	16	7	75	16
8	Result	=SUMX2PY2(B3:B7,C3:C7)	8	Result	17206
n					

# 324. SUMXMY2 Function

## Description

The SUMXMY2 function returns the sum of squares of differences of corresponding values in two arrays.

## Syntax

```
SUMXMY2 (array_x, array_y)
```

## Arguments

Argument	Description	Required /Optional
Array_x	The first array or range of values.	Required
Array_y	The second array or range of values.	Required

## Notes

- The arguments should be either numbers or names, arrays, or references that contain numbers.
- If an array or reference argument contains text, logical values, or empty cells, those values are ignored. However, cells with the value zero are included.
- If array\_x and array\_y have a different number of values, SUMXMY2 returns the #N/A error value.
- The equation for the sum of squared differences is:

$$\text{SUMXMY2} = \sum(x - y)^2$$

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Array1	Array2	2	Array1	Array2
3	30	19	3	30	19
4	25	17	4	25	17
5	40	45	5	40	45
6	55	50	6	55	50
7	75	16	7	75	16
8	Result	=SUMXMY2(B3:B7,C3:C7)	8	Result	3716
~			~		

# 325. TAN Function

## Description

The TAN function returns the tangent of the given angle.

## Syntax

```
TAN (number)
```

## Arguments

Argument	Description	Required /Optional
Number	The angle in radians for which you want the tangent.	Required

## Notes

If Number is in degrees, multiply it by PI()/180 or use the RADIANS Function to convert it to radians

$$= \text{RADIANS}(\text{degrees})$$

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage		Results	
A	B	A	B
1		1	
2	Number	2	Number
3	5	3	-3.380515006
	=TAN(B3)		

# 326. TANH Function

## Description

The TANH function returns the hyperbolic tangent of a number.

## Syntax

```
TANH (number)
```

## Arguments

Argument	Description	Required /Optional
Number	Any real number.	Required

## Notes

The formula for the hyperbolic tangent is-

$$\text{TANH}(z) = \frac{\text{SINH}(z)}{\text{COSH}(z)} = \frac{e^z - e^{-z}}{e^z + e^{-z}}$$

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage		Results	
A	B	A	C
1		1	
2	Number	2	Number
3	5	3	0.999909204
	=TANH(B3)		

# 327. TRUNC Function

## Description

The TRUNC function truncates a number to an integer by removing the fractional part of the number.

## Syntax

```
TRUNC (number, [num_digits])
```

## Arguments

Argument	Description	Required /Optional
Number	The number you want to truncate.	Required
Num_digits	A number specifying the precision of the truncation. The default value for num_digits is 0 (zero).	Optional

## Notes

- TRUNC and INT are similar in that both return integers
  - TRUNC removes the fractional part of the number
  - INT rounds numbers down to the nearest integer based on the value of the fractional part of the number
- INT and TRUNC are different only when using negative numbers.
- For example, TRUNC (-4.3) returns -4, but INT (-4.3) returns -5 because -5 is the lower number

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Number	Num Digits	2	Number	Num Digits
3	2.47567	0	3	2.47567	0
4	2.47567	1	4	2.47567	1
5	2.47567	2	5	2.47567	2
6	-2.47567	0	6	-2.47567	0
7	-2.47567	1	7	-2.47567	1
8	-2.47567	2	8	-2.47567	2
~			~		

# Statistical Functions

# 328. Statistical Functions – Overview

Statistical functions perform calculations ranging from basic mean, median & mode to the more complex statistical distribution and probability tests.

## Statistical Functions

The following table lists all the Statistical functions-

S. No.	Function and Description
1	AVEDEV Returns the average of the absolute deviations of data points from their mean
2	AVERAGE Returns the average of its arguments
3	AVERAGEA Returns the average of its arguments and includes evaluation of text and logical values
4	AVERAGEIF Returns the average for the cells specified by a given criterion
5	AVERAGEIFS Returns the average for the cells specified by multiple criteria
6	BETA.DIST Returns the beta cumulative distribution function
7	BETA.INV Returns the inverse of the cumulative distribution function for a specified beta distribution
8	BINOM.DIST Returns the individual term binomial distribution probability
9	BINOM.DIST.RANGE Returns the probability of a trial result using a binomial distribution
10	BINOM.INV Returns the smallest value for which the cumulative binomial distribution is less than or equal to a criterion value
11	CHISQ.DIST Returns the cumulative beta probability density function
12	CHISQ.DIST.RT Returns the one-tailed probability of the chi-squared distribution
13	CHISQ.INV Returns the cumulative beta probability density function
14	CHISQ.INV.RT Returns the inverse of the one-tailed probability of the chi-squared distribution

S. No.	Function and Description
15	CHISQ.TEST Returns the test for independence
16	CONFIDENCE.NORM Returns the confidence interval for a population mean
17	CONFIDENCE.T Returns the confidence interval for a population mean, using a Student's t distribution
18	CORREL Returns the correlation coefficient between two data sets
19	COUNT Counts how many numbers are in the list of arguments
20	COUNTA Counts how many values are in the list of arguments
21	COUNTBLANK Counts the number of blank cells in the argument range
22	COUNTIF Counts the number of cells that meet the criteria you specify in the argument
23	COUNTIFS Counts the number of cells that meet multiple criteria
24	COVARIANCE.P Returns covariance, the average of the products of paired deviations
25	COVARIANCE.S Returns the sample covariance, the average of the products deviations for each data point pair in two data sets
26	DEVSQ Returns the sum of squares of deviations
27	EXPON.DIST Returns the exponential distribution
28	F.DIST Returns the F probability distribution
29	F.DIST.RT Returns the F probability distribution
30	F.INV Returns the inverse of the F probability distribution
31	F.INV.RT Returns the inverse of the F probability distribution
32	F.TEST Returns the result of an F-test
33	FISHER Returns the Fisher transformation
34	FISHERINV Returns the inverse of the Fisher transformation

S. No.	Function and Description
35	<b>FORECAST</b> Returns a value along a linear trend
36	<b>FORECAST.ETS</b> Calculates a future value based on existing values using the Exponential Triple Smoothing (ETS) algorithm
37	<b>FORECAST.ETS.CONFINT</b> Returns a confidence interval for the forecast value at the specified target date
38	<b>FORECAST.ETS.SEASONALITY</b> Returns the length of the repetitive pattern detected for the specified time series
39	<b>FORECAST.ETS.STAT</b> Returns a statistical value as a result of time series forecasting
40	<b>FORECAST.LINEAR</b> Calculates a future value by using existing values, using linear regression.
41	<b>FREQUENCY</b> Returns a frequency distribution as a vertical array
42	<b>GAMMA</b> Returns the Gamma function value
43	<b>GAMMA.DIST</b> Returns the gamma distribution
44	<b>GAMMA.INV</b> Returns the inverse of the gamma cumulative distribution
45	<b>GAMMALN</b> Returns the natural logarithm of the gamma function, G(x)
46	<b>GAMMALN.PRECISE</b> Returns the natural logarithm of the gamma function, G(x)
47	<b>GAUSS</b> Returns 0.5 less than the standard normal cumulative distribution
48	<b>GEOMEAN</b> Returns the geometric mean
49	<b>GROWTH</b> Returns values along an exponential trend
50	<b>HARMEAN</b> Returns the harmonic mean
51	<b>HYPGEOM.DIST</b> Returns the hypergeometric distribution
52	<b>INTERCEPT</b> Returns the intercept of the linear regression line
53	<b>KURT</b> Returns the kurtosis of a data set
54	<b>LARGE</b> Returns the kth largest value in a data set

S. No.	Function and Description
55	<b>LINEST</b> Returns the parameters of a linear trend
56	<b>LOGEST</b> Returns the parameters of an exponential trend
57	<b>LOGNORM.DIST</b> Returns the cumulative lognormal distribution
58	<b>LOGNORM.INV</b> Returns the inverse of the lognormal cumulative distribution
59	<b>MAX</b> Returns the maximum value in a list of arguments, ignoring logical values and text
60	<b>MAXA</b> Returns the maximum value in a list of arguments, including logical values and text
61	<b>MAXIFS</b> Returns the maximum value among cells specified by a given set of conditions or criteria.
62	<b>MEDIAN</b> Returns the median of the given numbers
63	<b>MIN</b> Returns the minimum value in a list of arguments, ignoring logical values and text
64	<b>MINA</b> Returns the minimum value in a list of arguments, including logical values and text
65	<b>MINIFS</b> Returns the minimum value among cells specified by a given set of conditions or criteria.
66	<b>MODE.MULT</b> Returns a vertical array of the most frequently occurring, or repetitive values in an array or range of data
67	<b>MODE.SNGL</b> Returns the most common value in a data set
68	<b>NEGBINOM.DIST</b> Returns the negative binomial distribution
69	<b>NORM.DIST</b> Returns the normal cumulative distribution
70	<b>NORM.INV</b> Returns the inverse of the normal cumulative distribution
71	<b>NORM.S.DIST</b> Returns the standard normal cumulative distribution
72	<b>NORM.S.INV</b> Returns the inverse of the standard normal cumulative distribution

S. No.	Function and Description
73	PEARSON Returns the Pearson product moment correlation coefficient
74	PERCENTILE.EXC Returns the k-th percentile of values in a range, where k is in the range 0..1, exclusive
75	PERCENTILE.INC Returns the k-th percentile of values in a range
76	PERCENTRANK.EXC Returns the rank of a value in a data set as a percentage (0..1, exclusive) of the data set
77	PERCENTRANK.INC Returns the percentage rank of a value in a data set
78	PERMUT Returns the number of permutations for a given number of objects
79	PERMUTATIONA Returns the number of permutations for a given number of objects (with repetitions) that can be selected from the total objects
80	PHI Returns the value of the density function for a standard normal distribution
81	POISSON.DIST Returns the Poisson distribution
82	PROB Returns the probability that values in a range are between two limits
83	QUARTILE.EXC Returns the quartile of the data set, based on percentile values from 0..1, exclusive
84	QUARTILE.INC Returns the quartile of a data set
85	RANK.AVG Returns the rank of a number in a list of numbers
86	RANK.EQ Returns the rank of a number in a list of numbers
87	RSQ Returns the square of the Pearson product moment correlation coefficient
88	SKEW Returns the skewness of a distribution
89	SKEW.P Returns the skewness of a distribution based on a population: a characterization of the degree of asymmetry of a distribution around its mean
90	SLOPE Returns the slope of the linear regression line
91	SMALL Returns the kth smallest value in a data set

S. No.	Function and Description
92	STANDARDIZE Returns a normalized value
93	STDEV.P Calculates standard deviation based on the entire population
94	STDEV.S Estimates standard deviation based on a sample
95	STDEVA Estimates standard deviation based on a sample, including text and logical values
96	STDEVPA Calculates standard deviation based on the entire population, including text and logical values
97	STEYX Returns the standard error of the predicted y-value for each x in the regression
98	T.DIST Returns the Percentage Points (probability) for the Student t-distribution
99	T.DIST.2T Returns the Percentage Points (probability) for the Student t-distribution
100	T.DIST.RT Returns the Student's t-distribution
101	T.INV Returns the t-value of the Student's t-distribution as a function of the probability and the degrees of freedom
102	T.INV.2T Returns the inverse of the Student's t-distribution
103	T.TEST Returns the probability associated with a Student's t-test
104	TREND Returns values along a linear trend
105	TRIMMEAN Returns the mean of the interior of a data set
106	VAR.P Calculates variance based on the entire population
107	VAR.S Estimates variance based on a sample
108	VARA Estimates variance based on a sample, including logical values and text
109	VARPA Calculates variance based on the entire population, including logical values and text
110	WEIBULL.DIST Returns the Weibull distribution

S. No.	Function and Description
111	Z.TEST Returns the one-tailed probability-value of a z-test
112	BAHTTEXT Converts a number to Thai text and adds a suffix of "Baht."
113	CHAR Returns the character specified by a number. Use CHAR to translate code page numbers you might get from files on other types of computers into characters.
114	CLEAN Removes all nonprintable characters from text. Use CLEAN on text imported from other applications that contains characters that may not print with your operating system.
115	CODE Returns a numeric code for the first character in a text string. The returned code corresponds to the ANSI character set for the Windows System.
116	CONCAT Combines the text from multiple ranges and/or strings, but it doesn't provide the delimiter or IgnoreEmpty arguments.
117	CONCATENATE Joins two or more text strings into one string.
118	DOLLAR Converts a number to text format and applies a currency symbol. The name of the Function and the symbol that it applies depend upon your language settings.
119	EXACT Compares two text strings and returns TRUE if they are exactly the same, FALSE otherwise.
120	FIND FIND and FINDB locate one text string within a second text string, and return the number of the starting position of the first text string from the first character of the second text string.
121	FIXED Rounds a number to the specified number of decimals, formats the number in decimal format using a period and commas, and returns the result as text.
122	LEFT Returns the first character or characters in a text string, based on the number of characters you specify.
123	LEN <b>LEN</b> returns the number of characters in a text string. <b>LENB</b> returns the number of bytes used to represent the characters in a text string.
124	LOWER Converts all uppercase letters in a text string to lowercase.

S. No.	Function and Description
125	<b>MID</b> Returns a specific number of characters from a text string, starting at the position you specify, based on the number of characters you specify.
126	<b>NUMBERVALUE</b> Converts text to a number, in a locale-independent way.
127	<b>PROPER</b> Capitalizes the first letter in a text string and any other letters in text that follow any character other than a letter. Converts all other letters to lowercase letters.
128	<b>REPLACE</b> Replaces part of a text string, based on the number of characters you specify, with a different text string.
129	<b>REPT</b> Repeats text a given number of times. Use REPT to fill a cell with a number of instances of a text string.
130	<b>RIGHT</b> Returns the last character or characters in a text string, based on the number of characters you specify.
131	<b>SEARCH</b> The SEARCH and SEARCHB functions locate one text string within a second text string, and return the number of the starting position of the first text string from the first character of the second text string.
132	<b>SUBSTITUTE</b> Substitutes new_text for old_text in a text string.
133	<b>T Function</b> The T function returns the text referred to by value.
134	<b>TEXT</b> Converts a numeric value to text and lets you specify the display formatting by using special format strings.
135	<b>TEXTJOIN</b> Combines the text from multiple ranges and/or strings, and includes a delimiter you specify between each text value that will be combined. If the delimiter is an empty text string, this function will effectively concatenate the ranges.
136	<b>TRIM</b> Removes all spaces from text except for single spaces between words. Use TRIM on text that you have received from another application that may have irregular spacing.
137	<b>UNICHAR</b> Returns the Unicode character that is referenced by the given numeric value.
138	<b>UNICODE</b> Returns the number (code point) corresponding to the first character of the text.

S. No.	Function and Description
139	UPPER Converts text to uppercase.
140	VALUE Converts a text string that represents a number to a number.
141	ENCODEURL Returns a URL-encoded string.
142	FILTERXML Returns specific data from the XML content by using the specified XPath.
143	WEBSERVICE Returns data from a web service on the Internet or Intranet.

# 329. AVEDEV Function

## Description

The AVEDEV function returns the average of the absolute deviations of data points from their mean. AVEDEV is a measure of the variability in a data set.

## Syntax

```
AVEDEV (number1, [number2] ...)
```

## Arguments

Argument	Description	Required /Optional
Number1	1 to 255 arguments for which you want the average of the absolute deviations.	Required
number2, ...	You can also use a single array or a reference to an array instead of arguments separated by commas.	Optional

## Notes

- The equation for average deviation is-  
$$\frac{1}{n} \sum |x - \bar{x}|$$
- AVEDEV is influenced by the unit of measurement in the input data.
- Arguments must either be numbers or be names, arrays, or references that contain numbers.
- Logical values and text representations of numbers that you type directly into the list of arguments are counted.
- If an array or reference argument contains text, logical values, or empty cells, those values are ignored. However, cells with the value zero are included.
- Text representations of numbers that are supplied as a part of an array are not interpreted as numeric values by the AVEDEV function.
- If none of the values supplied to the Function are numeric, AVEDEV returns #DIV/0! Error.
- If any of the number arguments that are supplied directly to the Function are non-numeric text strings, AVEDEV returns #VALUE! Error.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

**Example**

Function Usage			Results		
A	B	C	A	B	C
1			1		
2		4	2		4
3		8	3		8
4		2	4		2
5	Numbers	7	5		7
6		7	6		7
7		5	7		5
8		2	8		2
9	Result	=AVEDEV(C2:C8)	9	Result	2

# 330. AVERAGE Function

## Description

The AVERAGE function returns the average (arithmetic mean) of the arguments.

## Syntax

```
AVERAGE (number1, [number2] ...)
```

## Arguments

Argument	Description	Required /Optional
Number1	The first number, cell reference, or range for which you want the average.	Required
Number2, ...	Additional numbers, cell references or ranges for which you want the average, up to a maximum of 255.	Optional

## Notes

- Arguments can either be numbers or names, ranges, or cell references that contain numbers.
- Logical values and text representations of numbers that you type directly into the list of arguments are counted.
- If a range or cell reference argument contains text, logical values, or empty cells, those values are ignored. However, cells with the value zero are included.
- Arguments that are error values or text that cannot be translated into numbers cause errors.
- If you want to include logical values and text representations of numbers in a reference as part of the calculation, use the AVERAGEA function.
- If you want to calculate the average of only the values that meet certain criteria, use the AVERAGEIF Function or the AVERAGEIFS function.
- The AVERAGE function measures central tendency, which is the location of the center of a group of numbers in a statistical distribution. The three most common measures of central tendency are-
  - **Average**, which is the arithmetic mean, and is calculated by adding a group of numbers and then dividing by the count of those numbers. For example, the average of 2, 3, 3, 5, 7, and 10 is 30 divided by 6, which is 5

- **Median**, which is the middle number of a group of numbers; that is, half the numbers have values that are greater than the median, and half the numbers have values that are less than the median. For example, the median of 2, 3, 3, 5, 7, and 10 is 4
- **Mode**, which is the most frequently occurring number in a group of numbers. For example, the mode of 2, 3, 3, 5, 7, and 10 is 3
- For a symmetrical distribution of a group of numbers, these three measures of central tendency are all the same. For a skewed distribution of a group of numbers, they can be different.
- When you average cells, keep in mind the difference between empty cells and those containing the value zero, especially if you have cleared the Show a zero in cells that have a zero value check box in the Excel Options dialog box in Excel. When this option is selected, empty cells are not counted, but zero values are
- If the values to be averaged are all non-numeric, AVERAGE returns #DIV/0! Error
- If any of the arguments that is supplied directly to the Function cannot be interpreted as numeric value, AVERAGE returns #VALUE! Error

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

In the example given below, same range is selected for the AVERAGE Function. The result depends on the contents of the cells in the range.

A	B	C	D	E	F	G	H	I	J
1									
2		Mon	Tue	Wed	Thu	Fri	Sat	Sun	Average
3	Temp	30	0	32	29	26	28	27	=AVERAGE(C3:I3)
4									
5		Mon	Tue	Wed	Thu	Fri	Sat	Sun	Average
6	Temp	30		32	29	26	28	27	=AVERAGE(C6:I6)
7									
8		Mon	Tue	Wed	Thu	Fri	Sat	Sun	Average
9	Temp	30	Not Taken	32	29	26	28	27	=AVERAGE(C9:I9)
10									
Function Usage									
11	Temp	30		32	29	26	28	27	=AVERAGE(C11:I11)
12									

A	B	C	D	E	F	G	H	I	J
1									
2		Mon	Tue	Wed	Thu	Fri	Sat	Sun	Average
3	Temp	30	0	32	29	26	28	27	24.6
4									If the cell contains zero 0, the cell will be included in the average calculation.
5									
6		Mon	Tue	Wed	Thu	Fri	Sat	Sun	Average
7	Temp	30		32	29	26	28	27	28.7
8									If the cell is blank, the cell will not be used in the average calculation.
9									
Results									
10	Temp	30	Not Taken	32	29	26	28	27	28.7
11									If the cell contains text, the cell will not be used in the average calculation.
12									

# 331. AVERAGEA Function

## Description

The AVERAGEA function calculates the average (arithmetic mean) of the values in the list of arguments.

## Syntax

```
AVERAGEA (value1, [value2] ...)
```

## Arguments

Argument	Description	Required /Optional
Value1	1 to 255 cells, ranges of cells, or values for which you want the average.	Required
value2, ...		Optional

## Notes

- Arguments can be the following-
  - numbers
  - names, arrays, or references that contain numbers
  - text representations of numbers
  - logical values, such as TRUE and FALSE, in a reference
- Logical values and text representations of numbers that you type directly into the list of arguments are counted.
- Arguments that contain TRUE evaluate as 1. Arguments that contain FALSE evaluate as 0 (zero)
- Array or reference arguments that contain text evaluate as 0 (zero)
- Empty text ("") evaluates as 0 (zero)
- If an argument is an array or reference, only values in that array or reference are used. Empty cells and text values in the array or reference are ignored.
- If you do not want to include logical values and text representations of numbers in a reference as part of the calculation, use the AVERAGE function.
- Arguments that are error values or text that cannot be translated into numbers cause errors.
- If the arguments to the Function are all references to blank cells, AVERAGEA returns #DIV/0! Error.

- If any of the arguments that is supplied directly to the Function are text values that cannot be interpreted as numbers, AVERAGEA returns #VALUE! Error.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2		4	2		4
3		8	3		8
4		2	4		2
5	Values	7	5		7
6		0	6		0
7		5	7		5
8		2	8		2
9	Result	=AVERAGEA(C2:C8)	9	Result	4
10					

# 332. AVERAGEIF Function

## Description

The AVERAGEIF function returns the average (arithmetic mean) of all the cells in a range that meet a given criteria.

## Syntax

```
AVERAGEIF (range, criteria, [average_range])
```

## Arguments

Argument	Description	Required /Optional
Range	One or more cells to average, including numbers or names, arrays, or references that contain numbers.	Required
Criteria	The criteria in the form of a number, expression, cell reference, or text that defines which cells are averaged.	Required
Average_range	The actual set of cells to average. If omitted, range is used.	Optional

## Notes

- Cells in range that contain TRUE or FALSE are ignored.
- If a cell in average\_range is an empty cell, AVERAGEIF ignores it.
- If a cell in criteria is empty, AVERAGEIF treats it as a 0 value.
- You can use the wildcard characters, question mark (?) and asterisk (\*), in criteria. A question mark matches any single character; an asterisk matches any sequence of characters. If you want to find an actual question mark or asterisk, type a tilde (~) before the character.
- Average\_range does not have to be the same size and shape as range. The actual cells that are averaged are determined by using the top, left cell in average\_range as the beginning cell, and then including cells that correspond in size and shape to range.
- If range is a blank or text value, AVERAGEIF returns the #DIV0! error value.
- If no cells in the range meet the criteria, AVERAGEIF returns the #DIV/0! error value.
- If values to be averaged are all non-numeric, AVERAGEIF returns the #DIV0! error value.

- If the criteria argument is a text string with length greater than 255 characters, AVERAGEIF returns the #VALUE! error value.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage					Results				
A	B	C	D	E	A	B	C	D	E
1					1				
2		Sales			2		Sales		
3		Jan	Feb	Mar	3		Jan	Feb	Mar
4	North	5000	6000	4500	4	North	\$5,000	\$6,000	\$4,500
5	South	5800	7000	3000	5	South	\$5,800	\$7,000	\$3,000
6	East	3500	2000	10000	6	East	\$3,500	\$2,000	\$10,000
7	West	12000	4000	6000	7	West	\$12,000	\$4,000	\$6,000
8					8				
9	Results	=AVERAGEIF(C4:E7, ">=5000")			9		7400		
10		=AVERAGEIF(C4:E4, ">=5000")			10		5500		
11		=AVERAGEIF(C5:E5, ">=5000")			11		6400		
12		=AVERAGEIF(C6:E6, ">=5000")			12		10000		
13		=AVERAGEIF(C7:E7, ">=5000")			13		9000		
14					14				

# 333. AVERAGEIFS Function

## Description

The AVERAGEIFS function returns the average (arithmetic mean) of all cells that meet multiple criteria.

## Syntax

```
AVERAGEIFS (average_range, criteria_range1, criteria1, [criteria_range2, criteria2] ...)
```

## Arguments

Argument	Description	Required /Optional
Average_range	One or more cells to average, including numbers or names, arrays, or references that contain numbers.	Required
Criteria_range1	1 to 127 ranges in which to evaluate the associated criteria.	Required
criteria_range2, ...		Optional
Criteria1	1 to 127 criteria in the form of a number, expression, cell reference, or text that define which cells will be averaged.	Required
criteria2, ...		Optional

## Notes

- If average\_range is a blank or text value, AVERAGEIFS returns the #DIV0! error value
- If a cell in a criteria range is empty, AVERAGEIFS treats it as a 0 value.
- Cells in range that contain TRUE evaluate as 1. Cells in range that contain FALSE evaluate as 0 (zero).
- Each cell in average\_range is used in the average calculation only if all of the corresponding criteria specified are true for that cell.
- You can use the wildcard characters, question mark (?) and asterisk (\*), in criteria. A question mark matches any single character; an asterisk matches any sequence of characters. If you want to find an actual question mark or asterisk, type a tilde (~) before the character.
- Unlike the range and criteria arguments in the AVERAGEIF function, in AVERAGEIFS each criteria\_range must be the same size and shape as average\_range.
- If the length of any of the supplied criteria\_range arrays is not equal to the length of the average\_range array, AVERAGEIFS returns the #VALUE! error value.

- If cells in average\_range cannot be translated into numbers, AVERAGEIFS returns the #DIV/0! error value.
- If there are no cells that meet all the criteria, AVERAGEIFS returns the #DIV/0! error value.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
	Sales	Results		Sales	Results
North	5000	=AVERAGEIFS(C3:C10,C3:C10,">=5000",B3:B10,"=North")		North	\$5,000
South	5800	=AVERAGEIFS(C4:C10,C4:C10,">=5000",B4:B10,"=South")		South	\$5,800
East	3500	=AVERAGEIFS(C3:C10,C3:C10,">=5000",B3:B10,"=East")		East	\$3,500
West	12000	=AVERAGEIFS(C4:C10,C4:C10,">=5000",B4:B10,"=West")		West	\$12,000
South	6000			South	\$6,000
East	7000			East	\$7,000
North	2000			North	\$2,000
West	4000			West	\$4,000

# 334. BETA.DIST Function

## Description

The BETA.DIST function returns the beta distribution. The beta distribution is commonly used to study variation in the percentage of something across samples.

## Syntax

```
BETA.DIST(x,alpha,beta,cumulative,[A],[B])
```

## Arguments

Argument	Description	Required / Optional
X	The value between A and B at which to evaluate the function.	Required
Alpha	A parameter of the distribution.	Required
Beta	A parameter of the distribution.	Required
Cumulative	A logical value that determines the form of the function. BETA.DIST returns- <ul style="list-style-type: none"><li>the cumulative distribution function if cumulative is TRUE</li><li>the probability density function if cumulative is FALSE</li></ul>	Required
A	A lower bound to the interval of x.	Optional
B	An upper bound to the interval of x.	Optional

## Notes

- If you omit values for A and B, BETA.DIST uses the standard cumulative beta distribution, so that A = 0 and B = 1
- If any argument is nonnumeric, BETA.DIST returns the #VALUE! error value.
- If alpha ≤ 0 or beta ≤ 0, BETA.DIST returns the #NUM! error value.
- If x < A, x > B, or A = B, BETA.DIST returns the #NUM! error value.

## Applicability

Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	x	10	2	x	10
3	Alpha	0.08	3	Alpha	0.08
4	Beta	0.03	4	Beta	0.03
5	A	7	5	A	7
6	B	14	6	B	14
7	Beta Distribution Value	=BETA.DIST(C2,C3,C4,C5,TRUE,C6)	7	Beta Distribution Value	0.29
8					

# 335. BETA.INV Function

## Description

The BETA.INV function returns the inverse of the beta cumulative probability density function (BETA.DIST). If probability = BETA.DIST(x ...TRUE), then BETA.INV (probability...) = x.

The beta distribution can be used in project planning to model probable completion times given an expected completion time and variability.

## Syntax

```
BETA.INV (probability,alpha,beta,[A],[B])
```

## Arguments

Argument	Description	Required /Optional
Probability	A probability associated with the beta distribution.	Required
Alpha	A parameter of the distribution.	Required
Beta	A parameter of the distribution.	Required
A	A lower bound to the interval of x.	Optional
B	An upper bound to the interval of x.	Optional

## Notes

- If you omit values for A and B, BETA.INV uses the standard cumulative beta distribution, so that A = 0 and B = 1
- If any argument is nonnumeric, BETA.INV returns the #VALUE! error value.
- If alpha ≤ 0 or beta ≤ 0, BETA.INV returns the #NUM! error value.
- If probability ≤ 0 or probability > 1, BETA.INV returns the #NUM! error value.
- If A and B are equal, BETA.INV returns the #NUM! error value.
- Given a value for probability, BETA.INV seeks that value x such that  
$$\text{BETA.DIST}(x, \text{alpha}, \text{beta}, \text{TRUE}, \text{A}, \text{B}) = \text{probability}$$

Thus, precision of BETA.INV depends on precision of BETA.DIST.

## Applicability

Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Probability	0.27	2	Probability	0.27
3	Alpha	0.08	3	Alpha	0.08
4	Beta	0.03	4	Beta	0.03
5	A	7	5	A	7
6	B	14	6	B	14
7	x	=BETA.INV(C2,C3,C4,C5,C6)	7	x	10
8			9		

# 336. BINOM.DIST Function

## Description

The BINOM.DIST function returns the individual term binomial distribution probability.

Use BINOM.DIST in problems with a fixed number of tests or trials

- when the outcomes of any trial are only success or failure
- when trials are independent, and
- when the probability of success is constant throughout the experiment

## Syntax

```
BINOM.DIST (number_s,trials,probability_s,cumulative)
```

## Arguments

Argument	Description	Required /Optional
Number_s	The number of successes in trials.	Required
Trials	The number of independent trials.	Required
Probability_s	The probability of success on each trial.	Required
Cumulative	A logical value that determines the form of the function. <ul style="list-style-type: none"><li>• If cumulative is TRUE, then BINOM.DIST returns the cumulative distribution function, which is the probability that there are at most number_s successes</li><li>• If cumulative is FALSE, then BINOM.DIST returns the probability mass function, which is the probability that there are number_s successes</li></ul>	Required

## Notes

- Number\_s and trials are truncated to integers.
- If number\_s, trials, or probability\_s is nonnumeric, BINOM.DIST returns the #VALUE! error value.
- If number\_s < 0 or number\_s > trials, BINOM.DIST returns the #NUM! error value.
- If probability\_s < 0 or probability\_s > 1, BINOM.DIST returns the #NUM! error value.

- The binomial probability mass function is-

$$b(x; n, p) = \binom{n}{x} p^x (1-p)^{n-x}$$

Where  $\binom{n}{x}$  is COMBIN (n,x).

- The cumulative binomial distribution is-

$$B(x; n, p) = \sum_{y=0}^x b(y; n, p)$$

## Applicability

Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	No. of Trials	1500	2	No. of Trials	1500
3	Number of Successes	135	3	Number of Successes	135
4	Probability of Success in each Trial	0.1	4	Probability of Success in each Trial	0.1
5	Cumulative	TRUE	5	Cumulative	TRUE
6	Binomial Probability	=BINOM.DIST(C3,C2,C4,C5)	6	Binomial Probability	10.48%

# 337. BINOM.DIST.RANGE Function

## Description

The BINOM.DIST.RANGE function returns the probability of a trial result using a binomial distribution.

## Syntax

```
BINOM.DIST.RANGE (trials,probability_s,number_s,[number_s2])
```

## Arguments

Argument	Description	Required /Optional
Trials	The number of independent trials. Must be greater than or equal to 0.	Required
Probability_s	The probability of success in each trial. Must be greater than or equal to 0 and less than or equal to 1.	Required
Number_s	The number of successes in trials. Must be greater than or equal to 0 and less than or equal to Trials.	Required
Number_s2	If provided, returns the probability that the number of successful trials will fall between Number_s and number_s2. Must be greater than or equal to Number_s and less than or equal to Trials.	Optional

## Notes

- The following equation is used

$$\sum_{k=s}^{s2} \binom{N}{k} p^k (1-p)^{N-k}$$

- In the equation above, N is Trials, p is Probability\_s, s is Number\_s, s2 is Number\_s2, and k is the iteration variable.
- Numeric arguments are truncated to integers.
- If probability\_s is < 0 or > 1, BINOM.DIST.RANGE returns the #NUM! error value.
- If number\_s is < 0 or > trials, BINOM.DIST.RANGE returns the #NUM! error value.
- If number\_s2 is < 0 or > trials or < number\_s, BINOM.DIST.RANGE returns the #NUM! error value.
- If any of the arguments are non-numeric values, BINOM.DIST.RANGE returns the #VALUE! error value.

## Applicability

Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Trials	25	2	Trials	25
3	Probability of Success	0.5	3	Probability of Success	0.5
4	No. of Successes 1	10	4	No. of Successes 1	10
5	No. of Successes 2	15	5	No. of Successes 2	15
6	Result	=BINOM.DIST.RANGE(C2,C3,C4,C5)	6	Result	0.7705

# 338. BINOM.INV Function

## Description

The BINOM.INV function returns the smallest value for which the cumulative binomial distribution is greater than or equal to a criterion value.

## Syntax

```
BINOM.INV (trials,probability_s,alpha)
```

## Arguments

Argument	Description	Required /Optional
Trials	The number of Bernoulli trials.	Required
Probability_s	The probability of a success on each trial.	Required
Alpha	The criterion value.	Required

## Notes

- If trials is not an integer, it is truncated.
- If any argument is nonnumeric, BINOM.INV returns the #VALUE! error value.
- If trials < 0, BINOM.INV returns the #NUM! error value.
- If probability\_s is < 0 or probability\_s > 1, BINOM.INV returns the #NUM! error value.
- If alpha < 0 or alpha > 1, BINOM.INV returns the #NUM! error value.

## Applicability

Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
	A	B		A	B
1			C		
2	Trials	6			
3	Probability of Success	0.5			
4	Alpha	0.75			
5	Result	=BINOM.INV(C2,C3,C4)			

# 339. CHISQ.DIST Function

## Description

The CHISQ.DIST function returns the chi-squared distribution. The chi-squared distribution is commonly used to study variation in the percentage of something across samples, such as the fraction of the day people spend watching television.

## Syntax

```
CHISQ.DIST(x,deg_freedom,cumulative)
```

## Arguments

Argument	Description	Required /Optional
X	The value at which you want to evaluate the distribution.	Required
Deg_freedom	The number of degrees of freedom.	Required
Cumulative	A logical value that determines the form of the function. If cumulative is TRUE, CHISQ.DIST returns the cumulative distribution function. If cumulative is FALSE, CHISQ.DIST returns the probability density function.	Required

## Notes

- If deg\_freedom is not an integer, it is truncated.
- If any argument is nonnumeric, CHISQ.DIST returns the #VALUE! error value.
- If x is negative, CHISQ.DIST returns the #NUM! error value.
- If deg\_freedom < 1 or deg\_freedom > 10^10, CHISQ.DIST returns the #NUM! error value.

## Applicability

Excel 2010, Excel 2013, Excel 2016

## Example

A	B	C	D	
1				
2	X	Deg of Freedom	Cumulative	
3	5	4	TRUE	
4	Chi Square Distribution	<code>=CHISQ.DIST(B3,C3,D3)</code>		
A	B	C	D	
1				
2	X	Deg of Freedom	Cumulative	
3	5	4	TRUE	
4	Chi Square Distribution	0.71		

**Function Usage**

**Results**

# 340. CHISQ.DIST.RT Function

## Description

The CHISQ.DIST.RT function returns the right-tailed probability of the chi-squared distribution.

The  $\chi^2$  distribution is associated with a  $\chi^2$  test. Use the  $\chi^2$  test to compare observed and expected values. By comparing the observed results with the expected ones, you can decide whether your original hypothesis is valid.

## Syntax

```
CHISQ.DIST.RT(x,deg_freedom)
```

## Arguments

Argument	Description	Required /Optional
X	The value at which you want to evaluate the distribution.	Required
Deg_freedom	The number of degrees of freedom.	Required

## Notes

- If deg\_freedom is not an integer, it is truncated.
- If either argument is nonnumeric, CHISQ.DIST.RT function returns the #VALUE! error value.
- If any argument is nonnumeric, CHISQ.DIST.RT function returns the #VALUE! error value.
- If deg\_freedom < 1 or deg\_freedom > 10^10, CHISQ.DIST.RT returns the #NUM! error value.

## Applicability

Excel 2010, Excel 2013, Excel 2016

## Example

A	B	C	Function Usage
1			
2	X	Deg of Freedom	
3	10	4	
4	Right-tailed Probability	=CHISQ.DIST.RT(B3,C3)	

A	B	C	Results
1			
2	X	Deg of Freedom	
3	10	4	
4	Right-tailed Probability	0.04	

# 341. CHISQ.INV Function

## Description

The CHISQ.INV function returns the inverse of the left-tailed probability of the chi-squared distribution. The chi-squared distribution is commonly used to study variation in the percentage of something across samples.

## Syntax

```
CHISQ.INV (probability,deg_freedom)
```

## Arguments

Argument	Description	Required /Optional
Probability	A probability associated with the chi-squared distribution.	Required
Deg_freedom	The number of degrees of freedom.	Required

## Notes

- If deg\_freedom is not an integer, it is truncated.
- If argument is nonnumeric, CHISQ.INV returns the #VALUE! error value.
- If probability < 0 or probability > 1, CHISQ.INV returns the #NUM! error value.
- If deg\_freedom < 1 or deg\_freedom > 10^10, CHISQ.INV returns the #NUM! error value.

## Applicability

Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
	A	B		A	B
1			C	1	
2	Probability	0.3		2	Probability
3	Deg of Freedom	4		3	Deg of Freedom
4	Chi-Square Value	=CHISQ.INV(C2,C3)		4	Chi-Square Value
-				-	2.19

# 342. CHISQ.INV.RT Function

## Description

The CHISQ.INV.RT function returns the inverse of the right-tailed probability of the chi-squared distribution. If probability = CHISQ.DIST.RT(x...), then CHISQ.INV.RT(probability,...) = x.

Use this function to compare observed results with expected ones in order to decide whether your original hypothesis is valid.

## Syntax

```
CHISQ.INV.RT (probability,deg_freedom)
```

## Arguments

Argument	Description	Required /Optional
Probability	A probability associated with the chi-squared distribution.	Required
Deg_freedom	The number of degrees of freedom.	Required

## Notes

- If deg\_freedom is not an integer, it is truncated
- If either argument is nonnumeric, CHISQ.INV.RT returns the #VALUE! error value
- If probability < 0 or probability > 1, CHISQ.INV.RT returns the #NUM! error value
- If deg\_freedom < 1, CHISQ.INV.RT returns the #NUM! error value
- Given a value for probability, CHISQ.INV.RT seeks that value x such that CHISQ.DIST.RT(x, deg\_freedom) = probability. Thus, precision of CHISQ.INV.RT depends on precision of CHISQ.DIST.RT.
- CHISQ.INV.RT uses an iterative search technique. If the search has not converged after 64 iterations, the function returns the #N/A error value.

## Applicability

Excel 2010, Excel 2013, Excel 2016

**Example**

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Right-tailed Probability	Deg of Freedom	2	Right-tailed Probability	Deg of Freedom
3	0.04	4	3	0.04	4
4	x	=CHISQ.INV.RT(B3,C3)	4	x	10
e			5		

# 343. CHISQ.TEST Function

## Description

The CHISQ.TEST function returns the test for independence. CHISQ.TEST returns the value from the chi-squared ( $\chi^2$ ) distribution for the statistic and the appropriate degrees of freedom. You can use  $\chi^2$  tests to determine whether hypothesized results are verified by an experiment.

## Syntax

```
CHISQ.TEST (actual_range,expected_range)
```

## Arguments

Argument	Description	Required /Optional
Actual_range	The range of data that contains observations to test against expected values.	Required
Expected_range	The range of data that contains the ratio of the product of row totals and column totals to the grand total.	Required

## Notes

- The  $\chi^2$  test first calculates a  $\chi^2$  statistic using the formula-

$$\chi^2 = \sum_{i=1}^r \sum_{j=1}^c \frac{(A_{ij} - E_{ij})^2}{E_{ij}}$$

Where:

$A_{ij}$  = actual frequency in the i-th row, j-th column

$E_{ij}$  = expected frequency in the i-th row, j-th column

r = number of rows

c = number of columns

If actual\_range and expected\_range have a different number of data points, CHISQ.TEST returns the #N/A error value.

- A low value of  $\chi^2$  is an indicator of independence. As can be seen from the formula,  $\chi^2$  is always positive or 0, and is 0 only if  $A_{ij} = E_{ij}$  for every i,j
- CHISQ.TEST returns the probability that a value of the  $\chi^2$  statistic at least as high as the value calculated by the above formula could have happened by chance under the assumption of independence
  - In computing this probability, CHISQ.TEST uses the  $\chi^2$  distribution with an appropriate number of degrees of freedom, df
    - If  $r > 1$  and  $c > 1$ , then  $df = (r - 1)(c - 1)$
    - If  $r = 1$  and  $c > 1$ , then  $df = c - 1$

- If  $r > 1$  and  $c = 1$ , then  $df = r - 1$
- $r = c = 1$  is not allowed and #N/A is returned
- Use of CHISQ.TEST is most appropriate when  $E_{ij}$ 's are not too small. Some statisticians suggest that each  $E_{ij}$  should be greater than or equal to 5.
- If any of the values in the expected\_range is negative, CHISQ.TEST returns #NUM! error.

## Applicability

Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage					Results				
A	B	C	D	E	A	B	C	D	E
<b>Actual Range</b>		<b>Expected Range</b>			<b>Actual Range</b>		<b>Expected Range</b>		
3738	4704	3461	4981		3738	4704	3461	4981	
1494	2827	1771	2550		1494	2827	1771	2550	
5232	7531	5232	7531		5232	7531	5232	7531	
<b>Test for Independence</b>	<code>=CHISQ.TEST(B3:C5,D3:E5)</code>				<b>Test for Independence</b>	7.92589E-25			

# 344. CONFIDENCE.NORM Function

## Description

The CONFIDENCE.NORM function returns the confidence interval for a population mean, using a normal distribution.

The confidence interval is a range of values. Your sample mean,  $x$ , is at the center of this range and the range is  $x \pm \text{CONFIDENCE.NORM}$ .

## Syntax

```
CONFIDENCE.NORM (alpha,standard_dev,size)
```

## Arguments

Argument	Description	Required /Optional
Alpha	The significance level used to compute the confidence level. The confidence level equals $100*(1 - \alpha)\%$ In other words, an alpha of 0.05 indicates a 95 percent confidence level.	Required
Standard_dev	The population standard deviation for the data range and is assumed to be known.	Required
Size	The sample size.	Required

## Notes

- If we assume alpha equals 0.05, we need to calculate the area under the standard normal curve that equals  $(1 - \alpha)$ , or 95 percent. This value is  $\pm 1.96$ . The confidence interval is therefore:

$$\bar{x} \pm 1.96 \left( \frac{\sigma}{\sqrt{n}} \right)$$

- If size is not an integer, it is truncated
- If size < 1, CONFIDENCE.NORM returns the #NUM! error value
- If alpha  $\leq 0$  or alpha  $\geq 1$ , CONFIDENCE.NORM returns the #NUM! error value
- If standard\_dev  $\leq 0$ , CONFIDENCE.NORM returns the #NUM! error value
- If any argument is nonnumeric, CONFIDENCE.NORM returns the #VALUE! error value

## Applicability

Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Alpha	0.05	2	Alpha	0.05
3	Population Standard Deviation	22	3	Population Standard Deviation	22.00
4	Sample Size	16	4	Sample Size	16
5	Confidence Interval	=CONFIDENCE.NORM(C2,C3,C4)	5	Confidence Interval	10.78

# 345. CONFIDENCE.T Function

## Description

The CONFIDENCE.T function returns the confidence interval for a population mean, using a student's t distribution.

## Syntax

```
CONFIDENCE.T (alpha,standard_dev,size)
```

## Arguments

Argument	Description	Required /Optional
Alpha	The significance level used to compute the confidence level. The confidence level equals $100*(1 - \text{alpha})\%$ In other words, an alpha of 0.05 indicates a 95 percent confidence level.	Required
Standard_dev	The population standard deviation for the data range and is assumed to be known.	Required
Size	The sample size.	Required

## Notes

- If size is not an integer, it is truncated.
- If size equals 1, CONFIDENCE.T returns #DIV/0! error value.
- If size < 1, CONFIDENCE.T returns #NUM! error value.
- If alpha ≤ 0 or alpha ≥ 1, CONFIDENCE.T returns the #NUM! error value.
- If standard\_dev ≤ 0, CONFIDENCE.T returns the #NUM! error value.
- If any argument is nonnumeric, CONFIDENCE.T returns the #VALUE! error value.

## Applicability

Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Alpha	0.05	2	Alpha	0.05
3	Sample Standard Deviation	20.97	3	Sample Standard Deviation	20.97
4	Sample Size	16	4	Sample Size	16
5	Confidence Interval	=CONFIDENCE.T(C2,C3,C4)	5	Confidence Interval	11.17
a			a		

# 346. CORREL Function

## Description

The CORREL function returns the correlation coefficient of the Array1 and Array2 cell ranges. Use the correlation coefficient to determine the relationship between two properties.

## Syntax

```
CORREL (array1, array2)
```

## Arguments

Argument	Description	Required /Optional
Array1	A cell range of values.	Required
Array2	A second cell range of values.	Required

## Notes

- The equation for the correlation coefficient is-

$$\text{Correl}(X, Y) = \frac{\sum (x - \bar{x})(y - \bar{y})}{\sqrt{\sum (x - \bar{x})^2 \sum (y - \bar{y})^2}}$$

Where  $\bar{x}$  and  $\bar{y}$  are the sample means AVERAGE(array1) and AVERAGE(array2).

- If an array or reference argument contains text, logical values, or empty cells, those values are ignored. However, cells with the value zero are included.
- If Array1 and Array2 have a different number of data points, CORREL returns the #N/A error value.
- If either Array1 or Array2 is empty, or if s (the standard deviation) of their values equals zero, CORREL returns the #DIV/0! error value.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Month	Avg Temp	2	Month	Avg Temp
3	Jan	25	3	Jan	25
4	Feb	30	4	Feb	30
5	Mar	40	5	Mar	40
6	Apr	50	6	Apr	50
7	May	50	7	May	50
8	Jun	40	8	Jun	40
9	Correlation		9	Correlation	
	=CORREL(C3:C8,D3:D8)			88.54%	

# 347. COUNT Function

## Description

The COUNT Function counts the number of cells that contain numbers, and counts numbers within the list of arguments. Use the COUNT function to get the number of entries in a number field that is in a range or array of numbers.

## Syntax

```
COUNT (value1, [value2] ...)
```

## Arguments

Argument	Description	Required /Optional
value1	The first item, cell reference, or range within which you want to count numbers.	Required
value2, ...	Up to 255 additional items, cell references, or ranges within which you want to count numbers.	Optional

## Notes

- The arguments can contain or refer to a variety of different types of data, but only numbers are counted.
- Arguments that are numbers, dates, or Time are counted.
- Logical values and text representations of numbers that you type directly into the list of arguments are counted.
- Arguments that are error values or text that cannot be translated into numbers are not counted.
- If an argument is an array or reference, only numbers in that array or reference are counted. Empty cells, logical values, text, or error values in the array or reference are not counted.
- If you want to count logical values, text, or error values, use the COUNTA function.
- If you want to count only numbers that meet certain criteria, use the COUNTIF Function or the COUNTIFS function.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage				Results	
	A	B	C	D	E
2		Entries To Be Counted		Count	
3	5	20	40	=COUNT(B3:D3)	3
4	5	0	40	=COUNT(B4:D4)	3
5	5	-20	40	=COUNT(B5:D5)	3
6	5	42370	40	=COUNT(B6:D6)	3
7	5	0.895833333333333	40	=COUNT(B7:D7)	3
8	5	=RAND()	40	=COUNT(B8:D8)	3
9	5		40	=COUNT(B9:D9)	2
10	5		40	=COUNT(B10, "45",D10)	3
11	5	"45"	40	=COUNT(B11:D11)	2
12	5		40	=COUNT(B12,TRUE,D12)	3
13	5	TRUE	40	=COUNT(B13:D13)	2
14	5	Text	40	=COUNT(B14:D14)	2
15	5	"Text"	40	=COUNT(B15:D15)	2
16	5	=0/0	40	=COUNT(B16:D16)	2

# 348. COUNTA Function

## Description

The COUNTA function counts the number of cells that are not empty in a range.

## Syntax

```
COUNTA (value1, [value2] ...)
```

## Arguments

Argument	Description	Required / Optional
value1	The first argument representing the values that you want to count.	Required
value2, ...	Additional arguments representing the values that you want to count, up to a maximum of 255 arguments.	Optional

## Notes

- The COUNTA function counts cells containing any type of information, including error values and empty text ("").
- The COUNTA function does not count empty cells.
- If you do not need to count logical values, text, or error values (in other words, if you want to count only cells that contain numbers), use the COUNT function.
- If you want to count only cells that meet certain criteria, use the COUNTIF function or the COUNTIFS function.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage				Results			
	B	C	D		B	C	D
1							
2	Entries To Be Counted		Count		Entries To Be Counted		Count
3	5	20	40	=COUNTA(B3:D3)	5	20	40
4	5	0	40	=COUNTA(B4:D4)	5	0	40
5	5	-20	40	=COUNTA(B5:D5)	5	-20	40
6	5	42370	40	=COUNTA(B6:D6)	5	1-Jan-16	40
7	5	0.895833333333333	40	=COUNTA(B7:D7)	5	21:30	40
8	5	=RAND()	40	=COUNTA(B8:D8)	5	0.46	40
9	5		40	=COUNTA(B9:D9)	5		40
10	5	""	40	=COUNTA(B10:D10)	5	""	40
11	5	"45"	40	=COUNTA(B11:D11)	5	"45"	40
12	5	TRUE	40	=COUNTA(B12:D12)	5	TRUE	40
13	5	Text	40	=COUNTA(B13:D13)	5	Text	40
14	5	"Text"	40	=COUNTA(B14:D14)	5	"Text"	40
15	5	=0/0	40	=COUNTA(B15:D15)	5	#DIV/0!	40

# 349. COUNTBLANK Function

## Description

The COUNTBLANK function counts empty cells in a specified range of cells.

## Syntax

```
COUNTBLANK (range)
```

## Arguments

Argument	Description	Required / Optional
Range	The range from which you want to count the blank cells.	Required

## Notes

- Cells with formulas that return "" (empty text) are also counted. Cells with zero values are not counted.
- To use this function, ensure that the iterative calculation is turned off i.e the **Enable iterative calculation** check box is cleared in

**File → Options → Formulas → Calculation options**

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage		Results	
	B		C
1			
2	<b>Range</b>	<b>No. of Blanks</b>	
3	20	=COUNTBLANK(B3:B15)	
4	0		
5	-20		
6	42370		
7	0.895833333333333		
8	=RAND()		
9	""		
10	"45"		
11	TRUE		
12	Text		
13			
14			
15	=0/0		#DIV/0!

# 350. COUNTIF Function

## Description

The COUNTIF function counts the number of cells that meet a criterion.

## Syntax

```
COUNTIF (range, criteria)
```

## Arguments

Argument	Description	Required /Optional
range	The group of cells you want to count. Range can contain numbers, arrays, a named range, or references that contain numbers. Blank and text values are ignored.	Required
criteria	A number, expression, cell reference, or text string that determines which cells will be counted.	Required

## Notes

- Criteria are not case sensitive. E.g. the string "apples" and the string "APPLES" will match the same cells.
- Wildcard characters the question mark (?) and asterisk (\*) can be used in criteria. A question mark matches any single character. An asterisk matches any sequence of characters. If you want to find an actual question mark or asterisk, type a tilde (~) in front of the character.
- When counting text values, make sure the data doesn't contain leading spaces, trailing spaces, inconsistent use of straight and curly quotation marks, or nonprinting characters. In these cases, COUNTIF might return an unexpected value.
- COUNTIF supports named ranges. The named range can be in the current Worksheet, another Worksheet in the same Workbook, or from a different Workbook. To reference from another Workbook, that second Workbook also must be open.
- COUNTIF uses only a single criteria. Use COUNTIFS to use multiple criteria.
- If the specified criteria argument is a text string that is greater than 255 characters in length, COUNTIF returns #VALUE! Error value.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

	B	C	D	E	F	
1						
2	Item	Cost		# Chocolates	=COUNTIF(B3:B11, "Chocolates")	Function Usage
3	Chocolates	100		# Muffins	=COUNTIF(B3:B11, "Muffins")	
4	Cakes	200		# Cookies	=COUNTIF(B3:B11, "Cookies")	
5	Cookies	80		#Items with Cost 100	=COUNTIF(C3:C11, 100)	
6	Chocolates	150		#Items with Cost > 100	=COUNTIF(C3:C11, ">100")	
7	Muffins	300				
8	Chocolates	50		# Chocolates	4	Results
9	Muffins	200		# Muffins	2	
10	Candies	100		# Cookies	1	
11	Chocolates	200		#Items with Cost 100	2	
				#Items with Cost > 100	5	

# 351. COUNTIFS Function

## Description

The COUNTIFS function applies multiple criteria to cells across multiple ranges and counts the number of times all criteria are met.

## Syntax

```
COUNTIFS (criteria_range1, criteria1, [criteria_range2, criteria2]...)
```

## Arguments

Argument	Description	Required /Optional
criteria_range1	The first range in which to evaluate the associated criteria.	Required
criteria1	The criteria in the form of a number, expression, cell reference, or text that define which cells will be counted.	Required
criteria_range2, criteria2, ...	Additional ranges and their associated criteria. Up to 127 range/criteria pairs are allowed.	Optional

## Notes

- Each additional range must have the same number of rows and columns as the criteria\_range1 argument.
- The ranges do not have to be adjacent to each other.
- Each range's criteria is applied one cell at a time. If all of the first cells meet their associated criteria, the count increases by 1. If all of the second cells meet their associated criteria, the count increases by 1 again, and so on until all of the cells are evaluated.
- If the criteria argument is a reference to an empty cell, the COUNTIFS Function treats the empty cell as a 0 value.
- You can use the wildcard characters the question mark (?) and asterisk (\*) in criteria. A question mark matches any single character, and an asterisk matches any sequence of characters. If you want to find an actual question mark or asterisk, type a tilde (~) before the character.
- If all the supplied criteria\_range arrays do not have equal length, COUNTIFS returns #VALUE! Error value.
- If any of the specified criteria arguments are text strings that are greater than 255 characters long, COUNTIFS returns #VALUE! Error value.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Sales	Results	2		
3	North	=COUNTIFS(C3:C10,">=5000", B3:B10, "=North")	3	North	\$5,000
4	South	=COUNTIFS(C4:C10,">=5000",B4:B10, "=South")	4	South	\$5,800
5	East	=COUNTIFS(C3:C10,">=5000",B3:B10, "=East")	5	East	\$3,500
6	West	=COUNTIFS(C4:C10,">=5000",B4:B10, "=West")	6	West	\$12,000
7	South		7	South	\$6,000
8	East		8	East	\$7,000
9	North		9	North	\$2,000
10	West		10	West	\$4,000

# 352. COVARIANCE.P Function

## Description

The COVARIANCE.P function returns population covariance, the average of the products of deviations for each data point pair in two data sets. Use covariance to determine the relationship between two data sets.

## Syntax

```
COVARIANCE.P (array1, array2)
```

## Arguments

Argument	Description	Required /Optional
Array1	The first cell range of integers.	Required
Array2	The second cell range of integers.	Required

## Notes

- Covariance is given by-

$$Cov(X,Y) = \frac{\sum (x - \bar{x})(y - \bar{y})}{n}$$

Where n is the sample size and  $\bar{x}$  and  $\bar{y}$  are the sample means AVERAGE (array1) and AVERAGE (array2).

- The arguments must either be numbers or be names, arrays, or references that contain numbers.
- If an array or reference argument contains text, logical values, or empty cells, those values are ignored. However, cells with the value zero are included.
- If array1 and array2 have different numbers of data points, COVARIANCE.P returns the #N/A error value.
- If either array1 or array2 is empty, COVARIANCE.P returns the #DIV/0! error value.

## Applicability

Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Array1	Array2	2	Array1	Array2
3	30	19	3	30	19
4	25	17	4	25	17
5	40	45	5	40	45
6	55	50	6	55	50
7	75	16	7	75	16
8	Result	=COVARIANCE.P(B3:B7,C3:C7)	8	Result	26
n			-		

# 353. COVARIANCE.S Function

## Description

The COVARIANCE.S function returns the sample covariance, the average of the products of deviations for each data point pair in two data sets.

## Syntax

```
COVARIANCE.S (array1, array2)
```

## Arguments

Argument	Description	Required /Optional
Array1	The first cell range of integers.	Required
Array2	The second cell range of integers.	Required

## Notes

- The arguments must either be numbers or be names, arrays, or references that contain numbers.
- If an array or reference argument contains text, logical values, or empty cells, those values are ignored. However, cells with the value zero are included.
- If array1 and array2 have different numbers of data points, COVARIANCE.S returns the #N/A error value.
- If either array1 or array2 is empty or contains only 1 data point each, COVARIANCE.S returns the #DIV/0! error value.

## Applicability

Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Array1	Array2	2	Array1	Array2
3	30	19	3	30	19
4	25	17	4	25	17
5	40	45	5	40	45
6	55	50	6	55	50
7	75	16	7	75	16
8	Result	=COVARIANCE.S(B3:B7,C3:C7)	8	Result	32.5
9			9		

# 354. DEVSQ Function

## Description

The DEVSQ function returns the sum of squares of deviations of data points from their sample mean.

## Syntax

```
DEVSQ (number1, [number2] ...)
```

## Arguments

Argument	Description	Required /Optional
Number1	1 to 255 arguments for which you want to calculate the sum of squared deviations.	Required
number2, ...	You can also use a single array or a reference to an array instead of arguments separated by commas.	Optional

## Notes

- The equation for the sum of squared deviations is-

$$\text{DEVSQ} = \sum (x - \bar{x})^2$$

- Arguments can either be numbers or names, arrays, or references that contain numbers.
- Logical values and text representations of numbers that you type directly into the list of arguments are counted.
- If an array or reference argument contains text, logical values, or empty cells, those values are ignored. However, cells with the value zero are included.
- Text representations of numbers, that are supplied as a part of an array, are not interpreted as numeric values by the DEVSQ function.
- Arguments that are error values or text that cannot be translated into numbers cause errors.
- If none of the values supplied to the Function are numeric DEVSQ returns #NUM! error value.
- If any of the number arguments that are supplied directly to the Function are non-numeric text strings, DEVSQ returns #VALUE! error value.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Number 1	105	2	Number 1	105
3	Number 2	83	3	Number 2	83
4	Number 3	101	4	Number 3	101
5	Sum of Squares of Deviations	=DEVSQ(C2:C4)	5	Sum of Squares of Deviations	274.67

# 355. EXPON.DIST Function

## Description

The EXPON.DIST function returns the exponential distribution. Use EXPON.DIST to model the time between events.

## Syntax

```
EXPON.DIST(x,lambda,cumulative)
```

## Arguments

Argument	Description	Required /Optional
X	The value of the function.	Required
Lambda	The parameter value.	Required
Cumulative	A logical value that indicates which form of the exponential function to provide. If cumulative is TRUE, EXPON.DIST returns the cumulative distribution function. If cumulative is FALSE, EXPON.DIST returns the probability density function.	Required

## Notes

- The equation for the probability density function is-

$$f(x; \lambda) = \lambda e^{-\lambda x}$$

- The equation for the cumulative distribution function is-

$$F(x; \lambda) = 1 - e^{-\lambda x}$$

- If x or lambda is nonnumeric, EXPON.DIST returns the #VALUE! error value.
- If x < 0, EXPON.DIST returns the #NUM! error value.
- If lambda ≤ 0, EXPON.DIST returns the #NUM! error value.

## Applicability

Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	x	0.17	2	x	0.17
3	Lambda	20	3	Lambda	20
4	Cumulative	TRUE	4	Cumulative	TRUE
5	Exponential Distribution Value	=EXPO.DIST(C2,C3,C4)	5	Exponential Distribution Value	0.97

# 356. F.DIST Function

## Description

The F.DIST function returns the F probability distribution. You can use this function to determine whether two data sets have different degrees of diversity.

## Syntax

```
F.DIST(x,deg_freedom1,deg_freedom2,cumulative)
```

## Arguments

Argument	Description	Required /Optional
X	The value at which to evaluate the function.	Required
Deg_freedom1	The numerator degrees of freedom.	Required
Deg_freedom2	The denominator degrees of freedom.	Required
Cumulative	A logical value that determines the form of the function. If cumulative is TRUE, F.DIST returns the cumulative distribution function. If cumulative is FALSE, F.DIST returns the probability density function.	Required

## Notes

- If deg\_freedom1 or deg\_freedom2 is not an integer, it is truncated.
- If any argument is nonnumeric, F.DIST returns the #VALUE! error value.
- If x is negative, F.DIST returns the #NUM! error value.
- If deg\_freedom1 < 1, F.DIST returns the #NUM! error value.
- If deg\_freedom2 < 1, F.DIST returns the #NUM! error value.

## Applicability

Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	X	0.38	2	X	0.38
3	Degrees of Freedom1	19	3	Degrees of Freedom1	19
4	Degrees of Freedom2	19	4	Degrees of Freedom2	19
5	Cumulative	TRUE	5	Cumulative	TRUE
6	F Probability	=F.DIST(C2,C3,C4,C5)	6	F Probability	0.02

# 357. F.DIST.RT Function

## Description

The F.DIST.RT function returns the (right-tailed) F probability distribution (degree of diversity) for two data sets. You can use this function to determine whether two data sets have different degrees of diversity.

## Syntax

```
F.DIST.RT(x,deg_freedom1,deg_freedom2)
```

## Arguments

Argument	Description	Required /Optional
X	The value at which to evaluate the function.	Required
Deg_freedom1	The numerator degrees of freedom.	Required
Deg_freedom2	The denominator degrees of freedom.	Required

## Notes

- F.DIST.RT is calculated as

$$F.DIST.RT = P(F > x)$$

Where F is a random variable that has an F distribution with deg\_freedom1 and deg\_freedom2 degrees of freedom.

- If deg\_freedom1 or deg\_freedom2 is not an integer, it is truncated.
- If any argument is nonnumeric, F.DIST.RT returns the #VALUE! error value.
- If x is negative, F.DIST.RT returns the #NUM! error value.
- If deg\_freedom1 < 1 F.DIST.RT returns the #NUM! error value.
- If deg\_freedom2 < 1 F.DIST.RT returns the #NUM! error value.

## Applicability

Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	X	2.6	2	X	2.60
3	Degrees of Freedom1	19	3	Degrees of Freedom1	19
4	Degrees of Freedom2	19	4	Degrees of Freedom2	19
5	F Probability	=F.DIST.RT(C2,C3,C4)	5	F Probability	0.02

# 358. F.INV Function

## Description

The F.INV function returns the inverse of the F probability distribution.

If  $p = F.DIST(x...)$ , then  $F.INV(p...) = x$ .

The F distribution can be used in an F-test that compares the degree of variability in two data sets.

## Syntax

```
F.INV (probability,deg_freedom1,deg_freedom2)
```

## Arguments

Argument	Description	Required /Optional
Probability	A probability associated with the F cumulative distribution.	Required
Deg_freedom1	The numerator degrees of freedom.	Required
Deg_freedom2	The denominator degrees of freedom.	Required

## Notes

- If  $\text{deg\_freedom1}$  or  $\text{deg\_freedom2}$  is not an integer, it is truncated.
- If any argument is nonnumeric, F.INV returns the #VALUE! error value.
- If  $\text{probability} < 0$  or  $\text{probability} > 1$ , F.INV returns the #NUM! error value.
- If  $\text{deg\_freedom1} < 1$ , or  $\text{deg\_freedom2} < 1$ , F.INV returns the #NUM! error value.

## Applicability

Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Probability	0.95	2	Probability	0.95
3	Degrees of Freedom1	19	3	Degrees of Freedom1	19
4	Degrees of Freedom2	19	4	Degrees of Freedom2	19
5	F-Value	=F.INV(C2,C3,C4)	5	F-Value	2.17

# 359. F.INV.RT Function

## Description

The F.INV.RT function returns the inverse of the (right-tailed) F probability distribution.

If  $p = F.DIST.RT(x, \dots)$ , then  $F.INV.RT(p, \dots) = x$ .

The F distribution can be used in an F-test that compares the degree of variability in two data sets.

## Syntax

```
F.INV.RT (probability,deg_freedom1,deg_freedom2)
```

## Arguments

Argument	Description	Required /Optional
Probability	A probability associated with the F cumulative distribution.	Required
Deg_freedom1	The numerator degrees of freedom.	Required
Deg_freedom2	The denominator degrees of freedom.	Required

## Notes

- If `Deg_freedom1` or `Deg_freedom2` is not an integer, it is truncated.
- If any argument is non-numeric, `F.INV.RT` returns the `#VALUE!` error value.
- If `Probability` is  $< 0$  or `probability` is  $> 1$ , `F.INV.RT` returns the `#NUM!` error value.
- If `Deg_freedom1` is  $< 1$ , or `Deg_freedom2` is  $< 1$ , `F.INV.RT` returns the `#NUM!` error value.
- If `Deg_freedom2` is  $< 1$  or `Deg_freedom2` is  $\geq 10^{10}$ , `F.INV.RT` returns the `#NUM!` error value.
- Given a value for `probability`, `F.INV.RT` seeks that value  $x$  such that  
$$F.DIST.RT(x, deg\_freedom1, deg\_freedom2) = probability$$
  - Thus, precision of `F.INV.RT` depends on precision of `F.DIST.RT`.
  - `F.INV.RT` uses an iterative search technique. If the search has not converged after 64 iterations, the function returns the `#N/A` error value.

## Applicability

Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage		Results	
A	B	A	B
1		1	
2	Probability Degrees of Freedom1 Degrees of Freedom2 Right Tailed F-Value	0.05 19 19 =F.INV.RT(C2,C3,C4)	0.05 19 19 2.17
3			
4			
5			

# 360. F.TEST Function

## Description

The F.TEST function returns the result of an F-test, the two-tailed probability that the variances in array1 and array2 are not significantly different. Use this function to determine whether two samples have different variances.

## Syntax

```
F.TEST (array1, array2)
```

## Arguments

Argument	Description	Required /Optional
Array1	The first array or range of data.	Required
Array2	The second array or range of data.	Required

## Notes

- The arguments must be either numbers or names, arrays, or references that contain numbers.
- If an array or reference argument contains text, logical values, or empty cells, those values are ignored; however, cells with the value zero are included.
- If the number of data points in array1 or array2 is less than 2, or if the variance of array1 or array2 is zero, F.TEST returns the #DIV/0! error value.

## Applicability

Excel 2010, Excel 2013, Excel 2016

**Example**

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Array1	Array2	2		
3	6	20	3	6	20
4	7	28	4	7	28
5	9	31	5	9	31
6	15	38	6	15	38
7	21	40	7	21	40
8	F-Test Value	=F.TEST(B3:B7,C3:C7)	8	F-Test Value	0.64832
n					

# 361. FISHER Function

## Description

The FISHER function returns the Fisher transformation at x. This transformation produces a function that is normally distributed rather than skewed. Use this function to perform hypothesis testing on the correlation coefficient.

## Syntax

```
FISHER(x)
```

## Arguments

Argument	Description	Required /Optional
x	A numeric value for which you want the transformation.	Required

## Notes

- The equation for the Fisher transformation is:
$$z' = \frac{1}{2} \ln\left(\frac{1+x}{1-x}\right)$$
- If x is nonnumeric, FISHER returns the #VALUE! error value.
- If  $x \leq -1$  or if  $x \geq 1$ , FISHER returns the #NUM! error value.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
	A	B		A	B
1			C		
2	x	Fisher Transformation		2	x
3	0.85	=FISHER(B3)		3	0.85
					1.25615

# 362. FISHERINV Function

## Description

The FISHERINV function returns the inverse of the Fisher transformation. Use this transformation when analyzing correlations between ranges or arrays of data. If  $y = \text{FISHER}(x)$ , then  $\text{FISHERINV}(y) = x$ .

## Syntax

```
FISHERINV(y)
```

## Arguments

Argument	Description	Required /Optional
Y	The value for which you want to perform the inverse of the transformation.	Required

## Notes

- The equation for the inverse of the Fisher transformation is-

$$x = \frac{e^{2y} - 1}{e^{2y} + 1}$$

- If  $y$  is nonnumeric, FISHERINV returns the #VALUE! error value.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Fisher Transformation	x	2	Fisher Transformation	x
3	1.25615	=FISHERINV(B3)	3	1.25615	0.85

# 363. FORECAST Function

## Description

The FORECAST function calculates, or predicts, a future value by using existing values. The predicted value is a y-value for a given x-value. The known values are existing x-values and y-values, and the new value is predicted by using linear regression.

## Syntax

```
FORECAST(x, known_y's, known_x's)
```

## Arguments

Argument	Description	Required /Optional
X	The data point for which you want to predict a value.	Required
Known_y's	The dependent array or range of data.	Required
Known_x's	The independent array or range of data.	Required

## Notes

- The equation for FORECAST is  $a+bx$ , where-

$$a = \bar{y} - b\bar{x}$$

and

$$b = \frac{\sum (x - \bar{x})(y - \bar{y})}{\sum (x - \bar{x})^2}$$

where x and y are the sample means AVERAGE(known\_x's) and AVERAGE(known\_y's).

- If x is nonnumeric, FORECAST returns the #VALUE! error value.
- If known\_y's and known\_x's are empty or contain a different number of data points, FORECAST returns the #N/A error value.
- If the variance of known\_x's equals zero, then FORECAST returns the #DIV/0! error value.
- In Excel 2016, FORECAST Function has been replaced with FORECAST.LINEAR. However, it is still available for backward compatibility.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

		Function Usage		Results	
A	B	C	A	B	C
1			1		
2	<b>Month</b>	<b>Sales</b>	2	<b>Month</b>	<b>Sales</b>
3	1	1000	3	1	\$1,000
4	2	1500	4	2	\$1,500
5	3	2500	5	3	\$2,500
6	4	3500	6	4	\$3,500
7	5	3800	7	5	\$3,800
8	6	4000	8	6	\$4,000
9			9		
10	<b>Month</b>	<b>Prediction</b>	10	<b>Month</b>	<b>Prediction</b>
11	8	=FORECAST(B11,C3:C8,B3:B8)	11	8	\$5,661
...			...		

# 364. FORECAST.ETS.CONFINT Function

## Description

The FORECAST.ETS.CONFINT function returns a confidence interval for the forecast value at the specified target date.

A confidence interval of 95% means that 95% of future points are expected to fall within this radius from the result FORECAST.ETS forecasted (with normal distribution). Using confidence interval can help grasp the accuracy of the predicted model. A smaller interval would imply more confidence in the prediction for this specific point.

## Syntax

```
FORECAST.ETS.CONFINT (target_date, values, timeline, [confidence_level],  
[seasonality], [data_completion], [aggregation])
```

## Arguments

Argument	Description	Required /Optional
Target_date	The data point for which you want to predict a value. Target date can be date/time or numeric.	Required
Values	Values are the historical values, for which you want to forecast the next points.	Required
Timeline	The independent array or range of numeric data. The dates in the timeline must have a consistent step between them and cannot be zero. However, FORECAST.ETS.CONFINT supports up to 30% missing data, and will automatically adjust for it. The timeline is not required to be sorted, as FORECAST.ETS.CONFINT will sort it implicitly for calculations.	Required
Confidence_level	A numerical value between 0 and 1 (exclusive), indicating a confidence_level for the calculated confidence interval. For example, for a 90% confidence interval, a 90% confidence level will be computed (90% of future points are to fall within this radius from prediction). The default value is 95%.	Optional
Seasonality	A numeric value. The default value of 1 means Excel detects seasonality automatically for the forecast and uses positive, whole numbers for the length of the seasonal pattern. 0 indicates no seasonality, meaning the prediction will be linear. Positive whole numbers will indicate to the algorithm to use patterns of this length as the seasonality.	Optional

Argument	Description	Required /Optional
	Maximum supported seasonality is 8,760 (number of hours in a year).	
Data_completion	FORECAST.ETS.CONFINT supports up to 30% missing data in the timeline and will automatically adjust for it based on Data_completion. The default value of 1 will account for missing points by completing them to be the average of the neighboring points. 0 will indicate the algorithm to account for missing points as zeros.	Optional
Aggregation	Although the timeline requires a constant step between data points, FORECAST.ETS.CONFINT will aggregate multiple points which have the same time stamp. The aggregation parameter is a numeric value indicating which method will be used to aggregate several values with the same time stamp. The default value of 0 will use AVERAGE, while other options are SUM, COUNT, COUNTA, MIN, MAX, and MEDIAN.	Optional

## Notes

- FORECAST.ETS.CONFINT Function is added in Excel 2016.
- This Function uses advanced machine learning algorithms, such as Exponential Triple Smoothing (ETS).
- If the target date is chronologically before the end of the historical timeline, FORECAST.ETS.CONFINT returns the #NUM! error.
- If a constant step cannot be identified in the provided timeline, FORECAST.ETS.CONFINT returns the #NUM! error.
- If timeline contains duplicate values, FORECAST.ETS.CONFINT returns the #VALUE! Error.
- If the ranges of the timeline and values are not of same size, FORECAST.ETS.CONFINT returns the #N/A error.
- If the Confidence level is outside the range (0,1), FORECAST.ETS.CONFINT returns the #NUM! error.
- If the Seasonality is <0, or >8760, or a non-numeric value, FORECAST.ETS.CONFINT returns the #NUM! error.

## Applicability

Excel 2016

# 365. FORECAST.ETS Function

## Description

The FORECAST.ETS function calculates or predicts a future value based on existing (historical) values by using the AAA version of the Exponential Smoothing (ETS) algorithm. The predicted value is a continuation of the historical values in the specified target date, which should be a continuation of the timeline.

## Syntax

```
FORECAST.ETS (target_date, values, timeline, [seasonality], [data_completion],  
[aggregation])
```

## Arguments

Argument	Description	Required /Optional
Target_date	The data point for which you want to predict a value. Target date can be date/time or numeric.	Required
Values	Values are the historical values, for which you want to forecast the next points.	Required
Timeline	The independent array or range of numeric data. The dates in the timeline must have a consistent step between them and cannot be zero. However, FORECAST.ETS supports up to 30% missing data, and will automatically adjust for it. The timeline is not required to be sorted, as FORECAST.ETS will sort it implicitly for calculations.	Required
Seasonality	A numeric value. The default value of 1 means Excel detects seasonality automatically for the forecast and uses positive, whole numbers for the length of the seasonal pattern. 0 indicates no seasonality, meaning the prediction will be linear. Positive whole numbers will indicate to the algorithm to use patterns of this length as the seasonality. Maximum supported seasonality is 8,760 (number of hours in a year).	Optional
Data_completion	FORECAST.ETS supports up to 30% missing data in the timeline and will automatically adjust for it based on Data_completion. The default value of 1 will account for missing points by completing them to be the average of the neighboring points. 0 will indicate the algorithm to account for missing points as zeros.	Optional

Argument	Description	Required /Optional
Aggregation	Although the timeline requires a constant step between data points, FORECAST.ETS will aggregate multiple points which have the same time stamp. The aggregation parameter is a numeric value indicating which method will be used to aggregate several values with the same time stamp. The default value of 0 will use AVERAGE, while other options are SUM, COUNT, COUNTA, MIN, MAX, and MEDIAN.	Optional

### Notes

- FORECAST.ETS Function is added in Excel 2016.
- This Function uses advanced machine learning algorithms, such as Exponential Triple Smoothing (ETS).
- If the target date is chronologically before the end of the historical timeline, FORECAST.ETS returns the #NUM! error.
- If a constant step cannot be identified in the provided timeline, FORECAST.ETS returns the #NUM! error.
- If timeline contains duplicate values, FORECAST.ETS returns the #VALUE! Error.
- If the ranges of the timeline and values are not of same size, FORECAST.ETS returns the #N/A error.
- If the Seasonality is <0, or >8760, or a non-numeric value, FORECAST.ETS returns the #NUM! error.

### Applicability

Excel 2016

# 366. FORECAST.ETS.SEASONALITY Function

## Description

The FORECAST.ETS.SEASONALITY function returns the length of the repetitive pattern Excel detects for the specified time series.

FORECAST.ETS.Seasonality can be used following FORECAST.ETS to identify which automatic seasonality was detected and used in FORECAST.ETS. While it can also be used independently of FORECAST.ETS, the functions are tied since the seasonality detected in this function is identical to the one used by FORECAST.ETS, considering the same input parameters that affect data completion.

## Syntax

```
FORECAST.ETS.SEASONALITY (values, timeline, [data_completion], [aggregation])
```

## Arguments

Argument	Description	Required /Optional
Values	Values are the historical values, for which you want to forecast the next points.	Required
Timeline	The independent array or range of numeric data. The dates in the timeline must have a consistent step between them and cannot be zero. However, FORECAST.ETS.SEASONALITY supports up to 30% missing data, and will automatically adjust for it. The timeline is not required to be sorted, as FORECAST.ETS.SEASONALITY will sort it implicitly for calculations.	Required
Data_completion	FORECAST.ETS.SEASONALITY supports up to 30% missing data in the timeline and will automatically adjust for it based on Data_completion. The default value of 1 will account for missing points by completing them to be the average of the neighboring points. 0 will indicate the algorithm to account for missing points as zeros.	Optional
Aggregation	Although the timeline requires a constant step between data points, FORECAST.ETS.SEASONALITY will aggregate multiple points which have the same time stamp.	Optional

Argument	Description	Required /Optional
	<p>The aggregation parameter is a numeric value indicating which method will be used to aggregate several values with the same time stamp.</p> <p>The default value of 0 will use AVERAGE, while other options are SUM, COUNT, COUNTA, MIN, MAX, and MEDIAN.</p>	

## Notes

- FORECAST.ETS.SEASONALITY Function is added in Excel 2016.
- This Function uses advanced machine learning algorithms, such as Exponential Triple Smoothing (ETS).
- If a constant step cannot be identified in the provided timeline, FORECAST.ETS.SEASONALITY returns the #NUM! error.
- If timeline contains duplicate values, FORECAST.ETS.SEASONALITY returns the #VALUE! Error.
- If the ranges of the timeline and values are not of same size, FORECAST.ETS.SEASONALITY returns the #N/A error.

## Applicability

Excel 2016

# 367. FORECAST.ETS.STAT Function

## Description

The FORECAST.ETS.STAT function returns a statistical value as a result of time series forecasting. Statistic type indicates which statistic is requested by this function.

## Syntax

```
FORECAST.ETS.STAT    (values,      timeline,      statistic_type,      [seasonality],  
[data_completion], [aggregation])
```

## Arguments

Argument	Description	Required /Optional
Values	Values are the historical values, for which you want to forecast the next points.	Required
Timeline	The independent array or range of numeric data. The dates in the timeline must have a consistent step between them and cannot be zero. However, FORECAST.ETS.STAT supports up to 30% missing data, and will automatically adjust for it. The timeline is not required to be sorted, as FORECAST.ETS.STAT will sort it implicitly for calculations.	Required
Statistic_type	A numeric value between 1 and 8, indicating which statistic will be returned for the calculated forecast.	Required
Seasonality	A numeric value. The default value of 1 means Excel detects seasonality automatically for the forecast and uses positive, whole numbers for the length of the seasonal pattern. 0 indicates no seasonality, meaning the prediction will be linear. Positive whole numbers will indicate to the algorithm to use patterns of this length as the seasonality. Maximum supported seasonality is 8,760 (number of hours in a year).	Optional
Data_completion	FORECAST.ETS.STAT supports up to 30% missing data in the timeline and will automatically adjust for it based on Data_completion. The default value of 1 will account for missing points by completing them to be the average of the neighboring points.	Optional

Argument	Description	Required /Optional
	0 will indicate the algorithm to account for missing points as zeros.	
Aggregation	Although the timeline requires a constant step between data points, FORECAST.ETS.STAT will aggregate multiple points which have the same time stamp. The aggregation parameter is a numeric value indicating which method will be used to aggregate several values with the same time stamp. The default value of 0 will use AVERAGE, while other options are SUM, COUNT, COUNTA, MIN, MAX, and MEDIAN.	Optional

## Notes

- FORECAST.ETS.STAT function is added in Excel 2016.
- This Function uses advanced machine learning algorithms, such as Exponential Triple Smoothing (ETS).
- If a constant step cannot be identified in the provided timeline, FORECAST.ETS.STAT returns the #NUM! error.
- If timeline contains duplicate values, FORECAST.ETS.STAT returns the #VALUE! Error.
- If the ranges of the timeline and values are not of same size, FORECAST.ETS.STAT returns the #N/A error.
- If the Seasonality is <0, or >8760, or a non-numeric value, FORECAST.ETS.STAT returns the #NUM! error.

The following optional statistics can be returned-

Alpha parameter of ETS algorithm	Returns the base value parameter—a higher value gives more weight to recent data points.
Beta parameter of ETS algorithm	Returns the trend value parameter—a higher value gives more weight to the recent trend.
Gamma parameter of ETS algorithm	Returns the seasonality value parameter—a higher value gives more weight to the recent seasonal period.
MASE metric	Returns the mean absolute scaled error metric—a measure of the accuracy of forecasts.
SMAPE metric	Returns the symmetric mean absolute percentage error metric—an accuracy measure based on percentage errors.
MAE metric	Returns the symmetric mean absolute percentage error metric—an accuracy measure based on percentage errors.

RMSE metric	Returns the root mean squared error metric—a measure of the differences between predicted and observed values.
Step size detected	Returns the step size detected in the historical timeline.

## Applicability

Excel 2016

# 368. FORECAST.LINEAR Function

## Description

The FORECAST.LINEAR function calculates, or predicts, a future value by using existing values. The predicted value is a y-value for a given x-value. The known values are existing x-values and y-values, and the new value is predicted by using linear regression.

## Syntax

```
FORECAST.LINEAR(x, known_y's, known_x's)
```

## Arguments

Argument	Description	Required /Optional
X	The data point for which you want to predict a value.	Required
Known_y's	The dependent array or range of data.	Required
Known_x's	The independent array or range of data.	Required

## Notes

FORECAST.LINEAR Function is added in Excel 2016 and replaces the FORECAST Function of the earlier Excel Versions

## Applicability

Excel 2016

# 369. FREQUENCY Function

## Description

The FREQUENCY function calculates how often values occur within a range of values, and then returns a vertical array of numbers. Since FREQUENCY returns an array, it must be entered as an array formula.

## Syntax

```
FREQUENCY (data_array, bins_array)
```

## Arguments

Argument	Description	Required / Optional
Data_array	An array of or reference to a set of values for which you want to count frequencies. If data_array contains no values, FREQUENCY returns an array of zeros.	Required
Bins_array	An array of or reference to intervals into which you want to group the values in data_array. If bins_array contains no values, FREQUENCY returns the number of elements in data_array.	Required

## Notes

- FREQUENCY is entered as an array formula after you select a range of adjacent cells into which you want the returned distribution to appear.
- The number of elements in the returned array is one more than the number of elements in bins\_array. The extra element in the returned array returns the count of any values above the highest interval.
- FREQUENCY ignores blank cells and text.
- If the array formula is entered into a range of cells that is too large, #N/A error appears in all cells after the nth cell, where n is the length of the bins\_array + 1

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results				
		Sales			Sales		
		Jan	Feb	Mar	Jan	Feb	Mar
North	5000	6000	4500		\$5,000	\$6,000	\$4,500
South	5800	7000	3000		\$5,800	\$7,000	\$3,000
East	3500	2000	10000		\$3,500	\$2,000	\$10,000
West	12000	4000	6000		\$12,000	\$4,000	\$6,000
<= \$4000	4000		=FREQUENCY(C4:E7,D9:D11)		<= \$4000	\$4,000	4
\$4000 - \$6000	6000		=FREQUENCY(C4:E7,D9:D11)		\$4000 - \$6000	\$6,000	5
> \$6000	999999		=FREQUENCY(C4:E7,D9:D11)		> \$6000	\$999,999	3

# 370. GAMMA.DIST Function

## Description

The GAMMA.DIST function returns the gamma distribution. You can use this function to study variables that may have a skewed distribution. The gamma distribution is commonly used in queuing analysis.

## Syntax

```
GAMMA.DIST(x,alpha,beta,cumulative)
```

## Arguments

Argument	Description	Required /Optional
X	The value at which you want to evaluate the distribution.	Required
Alpha	A parameter to the distribution.	Required
Beta	A parameter to the distribution. If beta = 1, GAMMA.DIST returns the standard gamma distribution.	Required
Cumulative	A logical value that determines the form of the function. If cumulative is TRUE, GAMMA.DIST returns the cumulative distribution function. If cumulative is FALSE, GAMMA.DIST returns the probability density function.	Required

## Notes

- The equation for the gamma probability density function is-

$$f(x;\alpha,\beta) = \frac{1}{\beta^\alpha \Gamma(\alpha)} x^{\alpha-1} e^{-\frac{x}{\beta}}$$

- The standard gamma probability density function is-

$$f(x;\alpha) = \frac{x^{\alpha-1} e^{-x}}{\Gamma(\alpha)}$$

- When alpha = 1, GAMMA.DIST returns the exponential distribution with-

$$\lambda = \frac{1}{\beta}$$

- For a positive integer n, when alpha = n/2, beta = 2, and cumulative = TRUE, GAMMA.DIST returns (1 - CHISQ.DIST.RT(x)) with n degrees of freedom.
- When alpha is a positive integer, GAMMA.DIST is also known as the Erlang distribution.

- If  $x$ , alpha, or beta is nonnumeric, GAMMA.DIST returns the #VALUE! error value.
- If the specified value of cumulative is not recognized as a logical or a numeric value, GAMMA.DIST returns the #VALUE! error value.
- If  $x < 0$ , GAMMA.DIST returns the #NUM! error value.
- If  $\alpha \leq 0$  or if  $\beta \leq 0$ , GAMMA.DIST returns the #NUM! error value.

## Applicability

Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
	A	B		A	B
1			1		
2	x	3	2	x	3
3	Alpha	2	3	Alpha	2
4	Beta	1	4	Beta	1
5	Cumulative	TRUE	5	Cumulative	TRUE
6	Gamma Distribution Value	=GAMMA.DIST(C2,C3,C4,C5)	6	Gamma Distribution Value	0.80
7					

# 371. GAMMA Function

## Description

The GAMMA function returns the gamma function value.

## Syntax

```
GAMMA (number)
```

## Arguments

Argument	Description	Required /Optional
Number	Returns a number.	Required

## Notes

- GAMMA uses the following equation-

$$\Gamma(N) = \int_0^{\infty} t^{N-1} e^{-t} dt$$

$$\Gamma(N+1) = N * \Gamma(N)$$

- If Number is a negative integer or 0, GAMMA returns the #NUM! error value.
- If Number contains characters that are not valid, GAMMA returns the #VALUE! error value.

## Applicability

Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Number	5.3	2	Number	5.3
3	Gamma Function Value	=GAMMA(C2)	3	Gamma Function Value	38.08

# 372. GAMMA.INV Function

## Description

The GAMMA.INV function returns the inverse of the gamma cumulative distribution.

If  $p = \text{GAMMA.DIST}(x\dots)$ , then  $\text{GAMMA.INV}(p\dots) = x$ . You can use this Function to study a variable whose distribution may be skewed.

## Syntax

```
GAMMA.INV (probability, alpha, beta)
```

## Arguments

Argument	Description	Required /Optional
Probability	The probability associated with the gamma distribution.	Required
Alpha	A parameter to the distribution.	Required
Beta	A parameter to the distribution. If beta = 1, GAMMA.INV returns the standard gamma distribution.	Required

## Notes

- If any argument is text, GAMMA.INV returns the #VALUE! error value.
- If probability < 0 or probability > 1, GAMMA.INV returns the #NUM! error value.
- If alpha ≤ 0 or if beta ≤ 0, GAMMA.INV returns the #NUM! error value.
- Given a value for probability, GAMMA.INV seeks that value x such that

$$\text{GAMMA.DIST}(x, \alpha, \beta, \text{TRUE}) = \text{probability}$$

Thus, precision of GAMMA.INV depends on precision of GAMMA.DIST. GAMMA.INV uses an iterative search technique. If the search has not converged after 64 iterations, the function returns the #N/A error value.

## Applicability

Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Probability	0.8	2	Probability	0.80
3	Alpha	2	3	Alpha	2
4	Beta	1	4	Beta	1
5	x	=GAMMA.INV(C2,C3,C4)	5	x	3

# 373. GAMMALN Function

## Description

The GAMMALN function returns the natural logarithm of the gamma function,  $\Gamma(x)$ .

## Syntax

```
GAMMALN(x)
```

## Arguments

Argument	Description	Required /Optional
X	The value for which you want to calculate GAMMALN.	Required

## Notes

- GAMMALN is calculated as follows-

$$\text{GAMMALN} = \text{LN}(\Gamma(x))$$

Where

$$f(x) = \begin{cases} 0 & \text{if } x < 0 \\ x & \text{if } 0 \leq x \leq 1 \\ 1 & \text{if } x > 1 \end{cases}$$

- The number e raised to the GAMMALN(i) power, where i is an integer, returns the same result as  $(i - 1)!$ .
- If x is nonnumeric, GAMMALN returns the #VALUE! error value.
- If  $x \leq 0$ , GAMMALN returns the #NUM! error value.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Value	5.3	2	Value	5.3
	Natural Logarithm of the Gamma Function	=GAMMALN(C2)		Natural Logarithm of the Gamma Function	3.64
3			3		

# 374. GAMMALN.PRECISE Function

## Description

The GAMMALN.PRECISE function returns the natural logarithm of the gamma function,  $\Gamma(x)$ .

## Syntax

```
GAMMALN.PRECISE(x)
```

## Arguments

Argument	Description	Required /Optional
x	The value for which you want to calculate GAMMALN.PRECISE.	Required

## Notes

- GAMMALN.PRECISE is calculated as follows-

$$\text{GAMMALN.PRECISE} = \ln(\Gamma(x))$$

Where:

$$f(x) = \begin{cases} 0 & \text{if } x < 0 \\ x & \text{if } 0 \leq x \leq 1 \\ 1 & \text{if } x > 1 \end{cases}$$

- The number e raised to the GAMMALN.PRECISE(i) power, where i is an integer, returns the same result as  $(i - 1)!$
- If x is nonnumeric, GAMMALN.PRECISE returns the #VALUE! error value.
- If  $x \leq 0$ , GAMMALN.PRECISE returns the #NUM! error value.

## Applicability

Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Value	5.3	2	Value	5.3
3	Natural Logarithm of the Gamma Function	=GAMMALN.PRECISE(C2)	3	Natural Logarithm of the Gamma Function	3.64

# 375. GAUSS Function

## Description

The GAUSS function calculates the probability that a member of a standard normal population will fall between the mean and z standard deviations from the mean.

## Syntax

```
GAUSS (z)
```

## Arguments

Argument	Description	Required /Optional
Z	Returns a number.	Required

## Notes

- Because NORM.S.DIST(0,True) always returns 0.5, GAUSS (z) will always be 0.5 less than NORM.S.DIST(z,True)
- If z is not a valid number, GAUSS returns the #NUM! error value.
- If z is not a valid data type, GAUSS returns the #VALUE! error value.

## Applicability

Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	z	1.5	2	z	1.5
3	Probability	=GAUSS(C2)	3	Probability	0.43
4	Standard Normal Distribution	=NORM.S.DIST(C2,TRUE)	4	Standard Normal Distribution	0.93
				$Gauss(z) = NORM.S.DIST(z, TRUE) - 0.5$	

# 376. GEOMEAN Function

## Description

The GEOMEAN function returns the geometric mean of an array or range of positive data.

## Syntax

```
GEOMEAN (number1, [number2] ...)
```

## Arguments

Argument	Description	Required /Optional
number1	1 to 255 arguments for which you want to calculate the mean.	Required
number2, ...	You can also use a single array or a reference to an array instead of arguments separated by commas.	Optional

## Notes

- The equation for the geometric mean is-

$$GM_{\bar{y}} = \sqrt[n]{y_1 y_2 y_3 \dots y_n}$$

- Arguments can either be numbers or names, arrays, or references that contain numbers.
- Logical values and text representations of numbers that you type directly into the list of arguments are counted.
- If an array or reference argument contains text, logical values, or empty cells, those values are ignored; however, cells with the value zero are included.
- If any of the specified values cannot be interpreted as numeric values, GEOMEAN returns the #VALUE! error value.
- If any data point  $\leq 0$ , GEOMEAN returns the #NUM! error value.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

**Example**

Function Usage			Results		
A	B	C	A	B	C
1			1		
2		15	2		15
3		55	3		55
4		80	4		80
5	Numbers	17	5		17
6		16	6		16
7		50	7		50
8		30	8		30
9	Geometric Mean	=GEOMEAN(C2:C8)	9	Geometric Mean	30.9

# 377. GROWTH Function

## Description

The GROWTH function calculates predicted exponential growth by using existing data. GROWTH returns the y-values for a series of new x-values that you specify by using existing x-values and y-values. You can also use the GROWTH function to fit an exponential curve to existing x-values and y-values.

## Syntax

```
GROWTH (known_y's, [known_x's], [new_x's], [const])
```

## Arguments

Argument	Description	Required /Optional
Known_y's	<p>The set of y-values you already know in the relationship <math>y = b*m^x</math>.</p> <p>If the array known_y's is in a single column, then each column of known_x's is interpreted as a separate variable.</p> <p>If the array known_y's is in a single row, then each row of known_x's is interpreted as a separate variable.</p>	Required
Known_x's	<p>An optional set of x-values that you may already know in the relationship <math>y = b*m^x</math>.</p> <p>The array known_x's can include one or more sets of variables.</p> <p>If only one variable is used, known_y's and known_x's can be ranges of any shape, as long as they have equal dimensions.</p> <p>If more than one variable is used, known_y's must be a vector (that is, a range with a height of one row or a width of one column).</p> <p>If known_x's is omitted, it is assumed to be the array {1,2,3,...} that is the same size as known_y's.</p>	Optional
New_x's	<p>Are new x-values for which you want GROWTH to return corresponding y-values.</p> <p>New_x's must include a column (or row) for each independent variable, just as known_x's does. So, if known_y's is in a single column, known_x's and new_x's must have the same number of columns. If known_y's is in a single row, known_x's and new_x's must have the same number of rows.</p> <p>If new_x's is omitted, it is assumed to be the same as known_x's.</p> <p>If both known_x's and new_x's are omitted, they are assumed to be the array {1,2,3,...} that is the same size as known_y's.</p>	Optional

Argument	Description	Required /Optional
Const	A logical value specifying whether to force the constant b to equal 1. If const is TRUE or omitted, b is calculated normally. If const is FALSE, b is set equal to 1 and the m-values are adjusted so that $y = m^x$ .	Optional

## Notes

- Formulas that return arrays must be entered as array formulas after selecting the correct number of cells.
- When entering an array constant for an argument such as known\_x's, use commas to separate values in the same row and semicolons to separate rows.
- If any of the numbers in known\_y's is 0 or negative, GROWTH returns the #NUM! error value.
- If the known\_x's array has a different length to the known\_y's array, GROWTH returns the #REF! error value.
- If any of the values in the supplied known\_y's, known\_x's or new\_x's arrays are non-numeric, GROWTH returns the #VALUE! error value.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

When new x's are given-

Function Usage					Results
A	B	C	D	E	E
1					
2	Known_x's	Known_y's	New x's	Predicted y's	Predicted y's
3	10	6	17	=GROWTH(C3:C13,B3:B13,D3:D10,TRUE)	6.448483526
4	20	8	18	=GROWTH(C3:C13,B3:B13,D3:D10,TRUE)	6.615813982
5	15	6	55	=GROWTH(C3:C13,B3:B13,D3:D10,TRUE)	17.07001293
6	22	8	16	=GROWTH(C3:C13,B3:B13,D3:D10,TRUE)	6.285385274
7	20	6	23	=GROWTH(C3:C13,B3:B13,D3:D10,TRUE)	7.519894371
8	31	7	34	=GROWTH(C3:C13,B3:B13,D3:D10,TRUE)	9.967685817
9	12	6	14	=GROWTH(C3:C13,B3:B13,D3:D10,TRUE)	5.971459922
10	42	14	35	=GROWTH(C3:C13,B3:B13,D3:D10,TRUE)	10.22633538
11	51	16			
12	54	18			
13	33	8			

When new x's Omitted-

	Function Usage			Results
1	A	B	C	D
2	Known_x's	Known_y's	Predicted y's	Predicted y's
3	10	6	=GROWTH(C3:C13,B3:B13,,TRUE)	5.389863394
4	20	8	=GROWTH(C3:C13,B3:B13,,TRUE)	6.963613643
5	15	6	=GROWTH(C3:C13,B3:B13,,TRUE)	6.126412185
6	22	8	=GROWTH(C3:C13,B3:B13,,TRUE)	7.329697464
7	20	6	=GROWTH(C3:C13,B3:B13,,TRUE)	6.963613643
8	31	7	=GROWTH(C3:C13,B3:B13,,TRUE)	9.230330843
9	12	6	=GROWTH(C3:C13,B3:B13,,TRUE)	5.673213661
10	42	14	=GROWTH(C3:C13,B3:B13,,TRUE)	12.23488433
11	51	16	=GROWTH(C3:C13,B3:B13,,TRUE)	15.40746133
12	54	18	=GROWTH(C3:C13,B3:B13,,TRUE)	16.63826968
13	33	8	=GROWTH(C3:C13,B3:B13,,TRUE)	9.715578152

# 378. HARMEAN Function

## Description

The HARMEAN function returns the harmonic mean of a data set. The harmonic mean is the reciprocal of the arithmetic mean of reciprocals.

## Syntax

```
HARMEAN (number1, [number2] ...)
```

## Arguments

Argument	Description	Required /Optional
Number1	1 to 255 arguments for which you want to calculate the mean.	required
number2, ...	You can also use a single array or a reference to an array instead of arguments separated by commas.	optional

## Notes

- The equation for the harmonic mean is-

$$\frac{1}{H_g} = \frac{1}{n} \sum \frac{1}{Y_i}$$

- The harmonic mean is always less than the geometric mean, which is always less than the arithmetic mean.
- Arguments can either be numbers or names, arrays, or references that contain numbers.
- Logical values and text representations of numbers that you type directly into the list of arguments are counted.
- If an array or reference argument contains text, logical values, or empty cells, those values are ignored; however, cells with the value zero are included.
- If any of the specified values cannot be interpreted as numeric values, HARMEAN returns the #VALUE! error value.
- If any data point  $\leq 0$ , HARMEAN returns the #NUM! error value.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

**Example**

Function Usage			Results		
A	B	C	A	B	C
1			1		
2		15	2		15
3		55	3		55
4		80	4		80
5	Numbers	17	5		17
6		16	6		16
7		50	7		50
8		30	8		30
9	Harmonic Mean	=HARMEAN(C2:C8)	9	Harmonic Mean	25.7

# 379. HYPGEOM.DIST Function

## Description

The HYPGEOM.DIST function returns the hypergeometric distribution. HYPGEOM.DIST returns the probability of a given number of sample successes, given the sample size, population successes, and population size.

Use HYPGEOM.DIST for problems with a finite population, where each observation is either a success or a failure, and where each subset of a given size is chosen with equal likelihood.

## Syntax

```
HYPGEOM.DIST (sample_s, number_sample, population_s, number_pop, cumulative)
```

## Arguments

Argument	Description	Required /Optional
Sample_s	The number of successes in the sample.	Required
Number_sample	The size of the sample.	Required
Population_s	The number of successes in the population.	Required
Number_pop	The population size.	Required
Cumulative	A logical value that determines the form of the function. If cumulative is TRUE, then HYPGEOM.DIST returns the cumulative distribution function. If cumulative is FALSE, HYPGEOM.DIST returns the probability mass function.	Required

## Notes

- The equation for the hypergeometric distribution is-

$$P(X = x) = h(x; n, M, N) = \frac{\binom{M}{x} \binom{N-M}{n-x}}{\binom{N}{n}}$$

Where-

x = sample\_s  
n = number\_sample  
M = population\_s  
N = number\_pop

- HYPGEOM.DIST is used in sampling without replacement from a finite population.
- All arguments are truncated to integers.
- If any argument is nonnumeric, HYPGEOM.DIST returns the #VALUE! error value.

- HYPGEOM.DIST returns the #NUM! error value
  - If sample\_s < 0 or sample\_s > the lesser of number\_sample
  - If sample\_s > population\_s
  - If sample\_s > (number\_sample - number\_pop + population\_s)
  - If number\_sample ≤ 0 or > number\_pop
  - If population\_s ≤ 0 or > number\_pop
  - If number\_pop ≤ 0

## Applicability

Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	No. of Successes in Sample	2	2	No. of Successes in Sample	2
3	Sample Size	8	3	Sample Size	8
4	Number of Successes in Population	15	4	Number of Successes in Population	15
5	Population Size	100	5	Population Size	100
6	Cumulative	FALSE	6	Cumulative	FALSE
7	Result	=HYPGEOM.DIST(C2,C3,C4,C5,FALSE)	7	Result	0.2468
-			8		

# 380. INTERCEPT Function

## Description

The INTERCEPT function calculates the point at which a line will intersect the y-axis by using existing x-values and y-values. The intercept point is based on a best-fit regression line plotted through the known x-values and known y-values.

Use the INTERCEPT function when you want to determine the value of the dependent variable when the independent variable is 0 (zero).

## Syntax

```
INTERCEPT (known_y's, known_x's)
```

## Arguments

Argument	Description	Required /Optional
Known_y's	The dependent set of observations or data.	Required
Known_x's	The independent set of observations or data.	Required

## Notes

- The equation for the intercept of the regression line,  $a$ , is-

$$a = \bar{y} - b\bar{x}$$

Where the slope,  $b$ , is calculated as-

$$b = \frac{\sum (x - \bar{x})(y - \bar{y})}{\sum (x - \bar{x})^2}$$

Where  $x$  and  $y$  are the sample means AVERAGE (known\_x's) and AVERAGE (known\_y's).

- The underlying algorithm used in the INTERCEPT and SLOPE functions is different than the underlying algorithm used in the LINEST function. The difference between these algorithms can lead to different results when data is undetermined and collinear.

For example, if the data points of the known\_y's argument are 0 and the data points of the known\_x's argument are 1, then-

- INTERCEPT and SLOPE return a #DIV/0! error. The INTERCEPT and SLOPE algorithm is designed to look for one and only one answer, and in this case there can be more than one answer.

- LINEST returns a value of 0. The LINEST algorithm is designed to return reasonable results for collinear data, and in this case at least one answer can be found.
- The arguments should be either numbers or names, arrays, or references that contain numbers.
- If an array or reference argument contains text, logical values, or empty cells, those values are ignored; however, cells with the value zero are included.
- If known\_y's and known\_x's contain a different number of data points or contain no data points, INTERCEPT returns the #N/A error value.
- If the variance of the specified known\_x's evaluates to zero, INTERCEPT returns the #DIV/0! error value.
- If either of the specified known\_x's or known\_y's arrays is empty, INTERCEPT returns the #DIV/0! error value.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

		Function Usage		Results	
A	B	C	A	B	C
1			1		
2	<b>Known_x's</b>	<b>Known_y's</b>	2	<b>Known_x's</b>	<b>Known_y's</b>
3	62.880849743071	116.63560958582	3	62.9	116.6
4	64.0363421189434	126.929440274216	4	64.0	126.9
5	65.1962691915633	132.394620292621	5	65.2	132.4
6	66.3607672712156	113.546953313077	6	66.4	113.5
7	67.5299714781875	175.669141387225	7	67.5	175.7
8	67.5299714781875	173.264168461938	8	67.5	173.3
9	68.7040138064158	158.709336477748	9	68.7	158.7
10	69.8830245589655	161.616043732358	10	69.9	161.6
11	71.0671318185902	176.931251031825	11	71.1	176.9
12	76.8116585348599	164.303435443197	12	76.8	164.3
13	<b>Intercept</b>	=INTERCEPT(C3:C12,B3:B12)	13	<b>Intercept</b>	-126.25

# 381. KURT Function

## Description

The KURT function returns the kurtosis of a data set. Kurtosis characterizes the relative peakedness or flatness of a distribution compared with the normal distribution.

Two types of kurtosis exist. They are-

- Positive kurtosis indicates a relatively peaked distribution.
- Negative kurtosis indicates a relatively flat distribution.

## Syntax

```
KURT (number1, [number2] ...)
```

## Arguments

Argument	Description	Required /Optional
Number1	1 to 255 arguments for which you want to calculate kurtosis.	Required
number2, ...	You can also use a single array or a reference to an array instead of arguments separated by commas.	Optional

## Notes

- Arguments can either be numbers or names, arrays, or references that contain numbers.
- Logical values and text representations of numbers that you type directly into the list of arguments are counted.
- If an array or reference argument contains text, logical values, or empty cells, those values are ignored. However, cells with the value zero are included.
- Arguments that are error values or text that cannot be translated into numbers cause errors.
- If any of the supplied number arguments that are supplied directly to the Function are not recognized as numeric values, KURT returns the #VALUE! error value.
- If there are fewer than four data points, or if the standard deviation of the sample equals zero, KURT returns the #DIV/0! error value.

- Kurtosis is defined as-

$$\left\{ \frac{n(n+1)}{(n-1)(n-2)(n-3)} \sum \left( \frac{x_i - \bar{x}}{s} \right)^4 \right\} - \frac{3(n-1)^2}{(n-2)(n-3)}$$

Where s is the sample standard deviation.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

	A	B	C	C
1				
2	88	=KURT(B2:B17)		-0.64987
3	64			
4	50			
5	67			
6	45			
7	86			
8	71			
9	68			
10	36			
11	20			
12	57			
13	49			
14	37			
15	94			
16	39			
17	44			
18				

**Function  
Usage**

**Results**

# 382. LARGE Function

## Description

The LARGE function returns the k-th largest value in a data set. You can use this function to select a value based on its relative standing.

## Syntax

```
LARGE (array, k)
```

## Arguments

Argument	Description	Required /Optional
Array	The array or range of data for which you want to determine the k-th largest value.	Required
K	The position (from the largest) in the array or cell range of data to return.	Required

## Notes

- If n is the number of data points in a range, then-
  - LARGE (array,1) returns the largest value
  - LARGE(array,n) returns the smallest value
- If array is empty, LARGE returns the #NUM! error value.
- If k ≤ 0 or if k is greater than the number of data points, LARGE returns the #NUM! error value.
- If the specified k is non-numeric, LARGE returns the #VALUE! error value.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
	B	C		B	C
<b>Array</b>			<b>Array</b>		
1			1		
2	120	400	2	120	400
3	800	250	3	800	250
4	100	300	4	100	300
5	120	150	5	120	150
6	250	180	6	250	180
7			7		
8					
9	Largest Value	=LARGE(B3:C7,1)	9	Largest Value	800
10	2nd Largest Value	=LARGE(B3:C7,2)	10	2nd Largest Value	400
11	3rd Largest Value	=LARGE(B3:C7,3)	11	3rd Largest Value	300
12	4th Largest Value	=LARGE(B3:C7,4)	12	4th Largest Value	250
13	5th Largest Value	=LARGE(B3:C7,5)	13	5th Largest Value	250
14	K<1	=LARGE(B3:C7,0)	14	K<1	#NUM!
15	K> No. of Data Points	=LARGE(B3:C7,11)	15	K> No. of Data Points	#NUM!
16	Array is empty	=LARGE(D3:E7,5)	16	Array is empty	#NUM!
17	k is non-numeric	=LARGE(B3:C7,"One")	17	k is non-numeric	#VALUE!
18					

# 383. LINEST Function

## Description

The LINEST function calculates the statistics for a line by using the "least squares" method to calculate a straight line that best fits your data, and then returns an array that describes the line.

You can also combine LINEST with other functions to calculate the statistics for other types of models that are linear in the unknown parameters, including polynomial, logarithmic, exponential, and power series.

Since this function returns an array of values, it must be entered as an array formula.

## Syntax

```
LINEST (known_y's, [known_x's], [const], [stats])
```

## Arguments

Argument	Description	Required /Optional
known_y's	The set of y-values that you already know in the relationship $y = mx + b$ . If the range of known_y's is in a single column, each column of known_x's is interpreted as a separate variable. If the range of known_y's is contained in a single row, each row of known_x's is interpreted as a separate variable.	Required
known_x's	A set of x-values that you may already know in the relationship $y = mx + b$ . The range of known_x's can include one or more sets of variables. If only one variable is used, known_y's and known_x's can be ranges of any shape, as long as they have equal dimensions. If more than one variable is used, known_y's must be a vector (that is, a range with a height of one row or a width of one column). If known_x's is omitted, it is assumed to be the array {1,2,3,...} that is the same size as known_y's.	Optional
const	A logical value specifying whether to force the constant b to equal 0. If const is TRUE or omitted, b is calculated normally. If const is FALSE, b is set equal to 0 and the m-values are adjusted to fit $y = mx$ .	Optional
stats	A logical value specifying whether to return additional regression statistics.	Optional

Argument	Description	Required /Optional
	If stats is TRUE, LINEST returns the additional regression statistics. As a result, the returned array is {mn, mn-1 ,..., m1, b; sen ,sen-1, ..., se1, seb; r2, sey; F, df; ssreg, ssresid}. If stats is FALSE or omitted, LINEST returns only the m-coefficients and the constant b. The additional regression statistics are as given in the Table below.	

## Additional Regression Statistics

Statistic	Description
se1,se2,...,sen	The standard error values for the coefficients m1,m2,...,mn.
seb	The standard error value for the constant b (seb = #N/A when const is FALSE).
r2	The coefficient of determination. Compares estimated and actual y-values, and ranges in value from 0 to 1. If it is 1, there is a perfect correlation in the sample — there is no difference between the estimated y-value and the actual y-value. At the other extreme, if the coefficient of determination is 0, the regression equation is not helpful in predicting a y-value. For information about how r2 is calculated, see Notes below.
sey	The standard error for the y estimate.
F	The F statistic, or the F-observed value. Use the F statistic to determine whether the observed relationship between the dependent and independent variables occurs by chance.
df	The degrees of freedom. Use the degrees of freedom to help you find F-critical values in a statistical table. Compare the values you find in the table to the F statistic returned by LINEST to determine a confidence level for the model. For information about how df is calculated, see Notes below.
ssreg	The regression sum of squares.
ssresid	The residual sum of squares. For information about how ssreg and ssresid are calculated, see Notes below.

### Notes

- The equation for the line is:

$$y = mx + b$$

or

$$y = m_1x_1 + m_2x_2 + \dots + b$$

- If there are multiple ranges of x-values, where the dependent y-values are a function of the independent x-values, then-
  - The m-values are coefficients corresponding to each x-value, and b is a constant value

- Note that  $y$ ,  $x$ , and  $m$  can be vectors
- The array that the LINEST Function returns is  $\{mn, mn-1\dots m1, b\}$
- LINEST can also return additional regression statistics
- You can describe any straight line with the slope and the  $y$ -intercept:
  - **Slope ( $m$ ) :**  
To find the slope of a line, often written as  $m$ , take two points on the line,  $(x_1, y_1)$  and  $(x_2, y_2)$ . The slope is equal to  
$$(-2 - y_1)/(-2 - x_1).$$
  - **$Y$ -intercept ( $b$ ):**  
The  $y$ -intercept of a line, often written as  $b$ , is the value of  $y$  at the point where the line crosses the  $y$ -axis.
- The equation of a straight line is  $y = mx + b$ . Once you know the values of  $m$  and  $b$ , you can calculate any point on the line by plugging the  $y$ - or  $x$ -value into that equation. You can also use the TREND Function
- When you have only one independent  $x$ -variable, you can obtain the slope and  $y$ -intercept values directly by using the following formulas:
  - **Slope:**  
$$=INDEX(LINEST(known_y's, known_x's), 1)$$
  - **$Y$ -intercept:**  
$$=INDEX(LINEST(known_y's, known_x's), 2)$$
- The accuracy of the line calculated by the LINEST Function depends on the degree of scatter in your data. The more linear the data, the more accurate the LINEST model.
- LINEST uses the method of least squares for determining the best fit for the data. When you have only one independent  $x$ -variable, the calculations for  $m$  and  $b$  are based on the following formulas-

$$m = \frac{\sum (x - \bar{x})(y - \bar{y})}{\sum (x - \bar{x})^2}$$

$$b = \bar{y} - m\bar{x}$$

Where  $x$  and  $y$  are sample means. i.e.

$$x = \text{AVERAGE}(known\_x's)$$

$$y = \text{AVERAGE}(known\_y's)$$

- The line and curve-fitting Functions LINEST and LOGEST can calculate the best straight line or exponential curve that fits your data. However, you have to decide which of the two results best fits your data. You can calculate TREND (known\_y's, known\_x's) for a straight line, or GROWTH(known\_y's, known\_x's) for an exponential curve. These Functions, without the known\_x's argument omitted, return an array of  $y$ -values predicted along that line or curve at your actual data

points. You can then compare the predicted values with the actual values. You may want to chart them both for a visual comparison.

- In regression analysis, Excel calculates for each point the squared difference between the y-value estimated for that point and its actual y-value. The sum of these squared differences is called the residual sum of squares, ssresid. Excel then calculates the total sum of squares, sstotal. When the const argument = TRUE or is omitted, the total sum of squares is the sum of the squared differences between the actual y-values and the average of the y-values.
- When the const argument = FALSE, the total sum of squares is the sum of the squares of the actual y-values (without subtracting the average y-value from each individual y-value). Then regression sum of squares, ssreg, can be found from:  $ssreg = sstotal - ssresid$ . The smaller the residual sum of squares is, compared with the total sum of squares, the larger the value of the coefficient of determination, r2, which is an indicator of how well the equation resulting from the regression analysis explains the relationship among the variables. The value of r2 equals  $ssreg/sstotal$
- In some cases, one or more of the X columns (assume that Y's and X's are in columns) may have no additional predictive value in the presence of the other X columns. i.e., eliminating one or more X columns might lead to predicted Y values that are equally accurate. In that case these redundant X columns should be omitted from the regression model. This phenomenon is called "collinearity" because any redundant X column can be expressed as a sum of multiples of the non-redundant X columns.
- The LINEST Function checks for collinearity and removes any redundant X columns from the regression model when it identifies them. Removed X columns can be recognized in LINEST output as having 0 coefficients in addition to 0 se values. If one or more columns are removed as redundant, df is affected because df depends on the number of X columns actually used for predictive purposes.
- If df is changed because redundant X columns are removed, values of sey and F are also affected. Collinearity should be relatively rare in practice. However, one case where it is more likely to arise is when some X columns contain only 0 and 1 values as indicators of whether a subject in an experiment is or is not a member of a particular group. If const = TRUE or is omitted, the LINEST function effectively inserts an additional X column of all 1 values to model the intercept
- The value of df is calculated as follows, when there are k columns of known\_x's and no X columns are removed from the model due to collinearity:
  - If const = TRUE or is omitted,  $df = n - k - 1$
  - If const = FALSE,  $df = n - k$

In both cases, each X column that was removed due to collinearity increases the value of df by 1.

- When entering an array constant (such as known\_x's) as an argument, use commas to separate values that are contained in the same row and semicolons to separate rows. Separator characters may be different depending on your regional settings.

- Note that the y-values predicted by the regression equation may not be valid if they are outside the range of the y-values you used to determine the equation.
- The underlying algorithm used in the LINEST function is different than the underlying algorithm used in the SLOPE and INTERCEPT functions. The difference between these algorithms can lead to different results when data is undetermined and collinear
- In addition to using LOGEST to calculate statistics for other regression types, you can use LINEST to calculate a range of other regression types by entering functions of the x and y variables as the x and y series for LINEST. For example, the following formula:

`=LINEST (yvalues, xvalues^COLUMN($A:$C))`

Works when you have a single column of y-values and a single column of x-values to calculate the cubic (polynomial of order 3) approximation of the form:

$$y = m_1*x + m_2*x^2 + m_3*x^3 + b$$

You can adjust this formula to calculate other types of regression, but in some cases it requires the adjustment of the output values and other statistics.

- The F-test value that is returned by the LINEST Function differs from the F-test value that is returned by the FTEST Function. LINEST returns the F statistic, whereas FTEST returns the probability.
- If the array of known\_x's is not the same length as the array of known\_y's, LINEST returns the #REF! error value.
- If any of the values in the supplied known\_x's or known\_y's arrays are not numeric (this may include text representations of numbers, as the LINEST Function does not recognize these as numbers), LINEST returns the #VALUE! error value.
- If either of the const or stats arguments cannot be evaluated to TRUE or FALSE, LINEST returns the #VALUE! error value.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

**Example**

A	B	C	D	E	F	G
1						
2	Known_y's	Known_x's		LINEST()		
3	41	23	1	0	=LINEST(B3:B14,C3:E14,,TRUE)	=LINEST(B3:B14,C3:E14,,TRUE)
4	59	30	1	0	=LINEST(B3:B14,C3:E14,,TRUE)	=LINEST(B3:B14,C3:E14,,TRUE)
5	63	52	1	0	=LINEST(B3:B14,C3:E14,,TRUE)	=LINEST(B3:B14,C3:E14,,TRUE)
6	81	60	1	0	=LINEST(B3:B14,C3:E14,,TRUE)	=LINEST(B3:B14,C3:E14,,TRUE)
7	53	56	0	1	=LINEST(B3:B14,C3:E14,,TRUE)	=LINEST(B3:B14,C3:E14,,TRUE)
8	66	65	0	1		
9	75	70	0	1	LINEST()	
10	88	83	0	1	2.93	20.86
11	63	91	-1	-1	2.40	4.77
12	71	98	-1	-1	0.90	5.83
13	84	102	-1	-1	22.93	8.00
14	94	119	-1	-1	2335.99	271.68
--						

**Function Usage**

**Results**

# 384. LOGEST Function

## Description

In regression analysis, calculates an exponential curve that fits your data and returns an array of values that describes the curve. Since this function returns an array of values, it must be entered as an array formula.

## Syntax

```
LOGEST (known_y's, [known_x's], [const], [stats])
```

## Arguments

Argument	Description	Required / Optional
Known_y's	The set of y-values you already know in the relationship $y = b*m^x$ . If the array known_y's is in a single column, then each column of known_x's is interpreted as a separate variable. If the array known_y's is in a single row, then each row of known_x's is interpreted as a separate variable.	Required
Known_x's	An optional set of x-values that you may already know in the relationship $y = b*m^x$ . The array known_x's can include one or more sets of variables. If only one variable is used, known_y's and known_x's can be ranges of any shape, as long as they have equal dimensions. If more than one variable is used, known_y's must be a range of cells with a height of one row or a width of one column (which is also known as a vector). If known_x's is omitted, it is assumed to be the array {1,2,3,...} that is the same size as known_y's.	Optional
Const	A logical value specifying whether to force the constant b to equal 1. If const is TRUE or omitted, b is calculated normally. If const is FALSE, b is set equal to 1, and the m-values are fitted to $y = m^x$ .	Optional
Stats	A logical value specifying whether to return additional regression statistics. If stats is TRUE, LOGEST returns the additional regression statistics, so the returned array is {mn,mn-1,...,m1,b;sen,se1,...,seb;r2,sey;F,df;ssreg,ssresid}. If stats is FALSE or omitted, LOGEST returns only the m-coefficients and the constant b. For more information about additional regression statistics, refer the LINEST Function.	Optional

## Notes

- The equation for the curve is:

$$y = b * m^x$$

or

$$y = (b * (m1^x1) * (m2^x2) * \dots)$$

If there are multiple  $x$ -values, where the dependent  $y$ -value is a function of the independent  $x$ -values. The  $m$ -values are bases corresponding to each exponent  $x$ -value, and  $b$  is a constant value. Note that  $y$ ,  $x$ , and  $m$  can be vectors.

- The array that LOGEST returns is  $\{mn, mn-1, \dots, m1, b\}$ .
- The more a plot of your data resembles an exponential curve, the better the calculated line will fit your data. Both LINEST and LOGEST return an array of values that describes a relationship among the values, but LINEST fits a straight line to your data, whereas LOGEST fits an exponential curve.
- When you have only one independent  $x$ -variable, you can obtain  $y$ -intercept ( $b$ ) values directly by using the following formula-

Y-intercept ( $b$ ): INDEX (LOGEST (known\_y's, known\_x's), 2)

- You can use the  $y = b * m^x$  equation to predict future values of  $y$ , but the GROWTH Function does the same.
- When entering an array constant such as known\_x's as an argument, use commas to separate values in the same row and semicolons to separate rows. Separator characters may be different depending on your regional settings.
- You should note that the  $y$ -values predicted by the regression equation may not be valid if they are outside the range of  $y$ -values you used to determine the equation.
- If the array of known\_x's is not the same length as the array of known\_y's, LOGEST returns the #REF! error value.
- If any of the values in the supplied known\_x's or known\_y's arrays are not numeric (this may include text representations of numbers, as the LOGEST Function does not recognize these as numbers), LOGEST returns the #VALUE! error value.
- If either of the const or stats arguments cannot be evaluated to TRUE or FALSE, LOGEST returns the #VALUE! error value.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

**Example**

		Function Usage		
1	A	B	C	D
2	Known_x's	Known_y's	Exponential Curve Values	
3	10	6	=LOGEST(C3:C13,B3:B13,TRUE,TRUE)	=LOGEST(C3:C13,B3:B13,TRUE,TRUE)
4	20	8	=LOGEST(C3:C13,B3:B13,TRUE,TRUE)	=LOGEST(C3:C13,B3:B13,TRUE,TRUE)
5	15	6	=LOGEST(C3:C13,B3:B13,TRUE,TRUE)	=LOGEST(C3:C13,B3:B13,TRUE,TRUE)
6	22	8	=LOGEST(C3:C13,B3:B13,TRUE,TRUE)	=LOGEST(C3:C13,B3:B13,TRUE,TRUE)
7	20	6	=LOGEST(C3:C13,B3:B13,TRUE,TRUE)	=LOGEST(C3:C13,B3:B13,TRUE,TRUE)
8	31	7	Exponential Curve Values	
9	12	6	1.025948807	4.171774727
10	42	14	0.00310866	0.0986791
11	51	16	0.882981321	0.150622093
12	54	18	67.91079792	9
13	33	8	1.540693278	0.204183133
..				

**Results**

# 385. LOGNORM.DIST Function

## Description

The LOGNORM.DIST function returns the lognormal distribution of  $x$ , where  $\ln(x)$  is normally distributed with parameters Mean and Standard\_dev. Use this function to analyze data that has been logarithmically transformed.

## Syntax

```
LOGNORM.DIST(x,mean,standard_dev,cumulative)
```

## Arguments

Argument	Description	Required / Optional
X	The value at which to evaluate the function.	Required
Mean	The mean of $\ln(x)$ .	Required
Standard_dev	The standard deviation of $\ln(x)$ .	Required
Cumulative	A logical value that determines the form of the function. If cumulative is TRUE, LOGNORM.DIST returns the cumulative distribution function. If cumulative is FALSE, LOGNORM.DIST returns the probability density function.	Required

## Notes

- The equation for the lognormal cumulative distribution function is-
$$\text{LOGNORM.DIST}(x,\mu,o) = \text{NORM.S.DIST}(\ln(x)-\mu / o)$$
- If any argument is nonnumeric, LOGNORM.DIST returns the #VALUE! error value.
- If  $x \leq 0$  or if standard\_dev  $\leq 0$ , LOGNORM.DIST returns the #NUM! error value.

## Applicability

Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	x	9.21	2	x	9.21
3	Mean	10	3	Mean	10
4	Standard Deviation	2.5	4	Standard Deviation	2.5
5	Cumulative	TRUE	5	Cumulative	TRUE
6	Lognormal Distribution Value	=LOGNORM.DIST(C2,C3,C4,C5)	6	Lognormal Distribution Value	0.000929487

# 386. LOGNORM.INV Function

## Description

The LOGNORM.INV function returns the inverse of the lognormal cumulative distribution function of  $x$ , where  $\ln(x)$  is normally distributed with parameters Mean and Standard\_dev.

If  $p = \text{LOGNORM.DIST}(x\dots)$  then  $\text{LOGNORM.INV}(p\dots) = x$ . Use the lognormal distribution to analyze logarithmically transformed data.

## Syntax

```
LOGNORM.INV (probability, mean, standard_dev)
```

## Arguments

Argument	Description	Required /Optional
Probability	A probability associated with the lognormal distribution.	Required
Mean	The mean of $\ln(x)$ .	Required
Standard_dev	The standard deviation of $\ln(x)$ .	Required

## Notes

- If any argument is nonnumeric, LOGNORM.INV returns the #VALUE! error value.
- If probability <= 0 or probability >= 1, LOGNORM.INV returns the #NUM! error value.
- If standard\_dev <= 0, LOGNORM.INV returns the #NUM! error value.

## Applicability

Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Probability	0.001	2	Probability	0.001
3	Mean	10	3	Mean	10
4	Standard Deviation	2.5	4	Standard Deviation	2.5
5	x	=LOGNORM.INV(C2,C3,C4)	5	x	9.72

# 387. MAX Function

## Description

The MAX function returns the largest value in a set of values.

## Syntax

```
MAX (number1, [number2] ...)
```

## Arguments

Argument	Description	Required /Optional
Number1	1 to 255 numbers for which you want to find the maximum value.	Required
number2, ...		Optional

## Notes

- Arguments can either be numbers or names, arrays, or references that contain numbers.
- Logical values and text representations of numbers that you type directly into the list of arguments are counted.
- If an argument is an array or reference, only numbers in that array or reference are used. Empty cells, logical values, or text in the array or reference are ignored.
- If the arguments contain no numbers, MAX returns 0 (zero).
- If any values that are supplied directly to the MAX Function are non-numeric, MAX returns the #VALUE! Error.
- If you want to include logical values and text representations of numbers in a reference as part of the calculation, use the MAXA function.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage					Results					
A	B	C	D	E	F	G	B	C	D	E
1										
2	120	42005		120	Data		120	1-Jan-15		120
3	800	42335		800			800	27-Nov-15		800
4	100	42094		Hundred			100	31-Mar-15		Hundred
5	120	42335		120			120	27-Nov-15		120
6	250	42189		250			250	4-Jul-15		250
7	=MAX(B2:B6)	=MAX(C2:C6)	=MAX(D2:D6)	=MAX(E2:E6)		Result	800	27-Nov-15	0	800

# 388. MAXA Function

## Description

The MAXA function returns the largest value in a list of arguments.

## Syntax

```
MAXA (value1, [value2]...)
```

## Arguments

Argument	Description	Required /Optional
Value1	The first number argument for which you want to find the largest value.	Required
Value2...	Number arguments 2 to 255 for which you want to find the largest value.	Optional

## Notes

- Arguments can be the following-
  - Numbers
  - names, arrays, or references that contain numbers
  - text representations of numbers
  - logical values, such as TRUE and FALSE, in a reference
- Logical values and text representations of numbers that you type directly into the list of arguments are counted.
- If an argument is an array or reference, only values in that array or reference are used. Empty cells and text values in the array or reference are ignored.
- Arguments that contain TRUE evaluate as 1. Arguments that contain text or FALSE evaluate as 0 (zero).
- If the arguments contain no values, MAXA returns 0 (zero).
- If any values that are supplied directly to the MAXA Function are non-numeric, MAXA returns #VALUE! Error.
- If you do not want to include logical values and text representations of numbers in a reference as part of the calculation, use the MAX function.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

**Example**

Function Usage			Results		
A	B	C	A	B	C
1			1		
2		0.15	2		0.15
3		0.55	3		0.55
4		0.75	4		0.75
5	Values	0.16	5	0.16	
6		0.5	6		0.5
7		0.3	7		0.3
8		TRUE	8		TRUE
9	Result	=MAXA(C2:C8)	9		1
10					

# 389. MAXIFS Function

## Description

The MAXIFS function returns the maximum value among cells specified by a given set of conditions or criteria. This Function got added in Excel 2016.

## Syntax

```
MAXIFS (max_range, criteria_range1, criterial, [criteria_range2, criteria2], ...)
```

## Arguments

Argument	Description	Required /Optional
max_range	The actual range of cells in which the maximum will be determined.	Required
criteria_range1	Is the set of cells to evaluate with the criteria.	Required
criteria1	Is the criteria in the form of a number, expression, or text that defines which cells will be evaluated as maximum. The same set of criteria works for the MINIFS, SUMIFS, and AVERAGEIFS Functions.	Required
criteria_range2, criteria2, ...	Additional ranges and their associated criteria. You can enter up to 126 range/criteria pairs.	Optional

## Notes

The size and shape of the max\_range and criteria\_rangeN arguments must be the same, otherwise these functions return the #VALUE! Error.

## Applicability

Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Marks	Grade	2	Marks	Grade
3	45	C	3	45	C
4	75	A+	4	75	A+
5	55	B	5	55	B
6	52	B	6	52	B
7	52	B	7	52	B
8	65	A	8	65	A
9	70	A	9	70	A
10	85	A+	10	85	A+
11	Criteria	=MAXIFS(B3:B10,C3:C10,"B")	11	Criteria	55

# 390. MEDIAN Function

## Description

The MEDIAN function returns the median of the given numbers. The median is the number in the middle of a set of numbers.

## Syntax

```
MEDIAN (number1, [number2] ...)
```

## Arguments

Argument	Description	Required /Optional
Number1	1 to 255 numbers for which you want the median.	required
number2, ...		optional

## Notes

- The MEDIAN function measures central tendency, which is the location of the center of a group of numbers in a statistical distribution.
- If there is an even number of numbers in the set, then MEDIAN calculates the average of the two numbers in the middle.
- Arguments can either be numbers or names, arrays, or references that contain numbers.
- Logical values and text representations of numbers that you type directly into the list of arguments are counted.
- If an array or reference argument contains text, logical values, or empty cells, those values are ignored. However, cells with the value zero are included.
- Arguments that are error values or text that cannot be translated into numbers cause errors.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage						Results					
A	B	C	D	E	F	G	B	C	D	E	F
1						Numbers	20	10	20	25	2000
2	20	10	20	25	2000		50	20	40	25	1000
3	50	20	40	25	1000		10	40	30	40	10
4	10	40	30	40	10		30	40	10	25	20
5	30	40	10	25	20		40	40	5	25	8000
6	40	40	5	25	8000		30	40	25	25	1000
7	=MEDIAN(B2:B6)	=MEDIAN(C2:C6)	=MEDIAN(D2:D5)	=MEDIAN(E2:E5)	=MEDIAN(F2:F6)	Median					

# 391. MIN Function

## Description

The MIN function returns the smallest number in a set of values.

## Syntax

```
MIN (number1, [number2] ...)
```

## Arguments

Argument	Description	Required / Optional
Number1	1 to 255 numbers for which you want to find the minimum value.	Required
number2, ...		Optional

## Notes

- Arguments can either be numbers or names, arrays, or references that contain numbers.
- Logical values and text representations of numbers that you type directly into the list of arguments are counted.
- If an argument is an array or reference, only numbers in that array or reference are used. Empty cells, logical values, or text in the array or reference are ignored.
- If the arguments contain no numbers, MIN returns 0.
- If any values that are supplied directly to the Function are non-numeric, MIN returns #VALUE! Error.
- If you want to include logical values and text representations of numbers in a reference as part of the calculation, use the MINA function.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

	Function Usage					Results					
1	A	B	C	D	E	F	G	B	C	D	E
2	120	42005			120	Data	120	1-Jan-15		120	
3	800	42335			800		800	27-Nov-15		800	
4	100	42094			Hundred		100	31-Mar-15		Hundred	
5	120	42335			120		120	27-Nov-15		120	
6	250	42189			250		250	4-Jul-15		250	
7	=MIN(B2:B6)	=MIN(C2:C6)	=MIN(D2:D6)	=MIN(E2:E6)		Result	100	1-Jan-15	0	120	

# 392. MINA Function

## Description

The MINA function returns the smallest value in the list of arguments.

## Syntax

```
MINA (value1, [value2] ...)
```

## Arguments

Argument	Description	Required /Optional
Value1, value2, ...	1 to 255 values for which you want to find the smallest value.	Value1 is required, subsequent values are optional

## Notes

- Arguments can be the following-
  - Numbers
  - names, arrays, or references that contain numbers
  - text representations of numbers
  - logical values, such as TRUE and FALSE, in a reference
- If an argument is an array or reference, only values in that array or reference are used. Empty cells and text values in the array or reference are ignored.
- Arguments that contain TRUE evaluate as 1. Arguments that contain text or FALSE evaluate as 0 (zero).
- Arguments that are error values or text that cannot be translated into numbers cause errors.
- If the arguments contain no values, MINA returns 0.
- If you do not want to include logical values and text representations of numbers in a reference as part of the calculation, use the MIN function.
- If any values that are supplied directly to the MINA function are non-numeric, MINA returns #VALUE! Error.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

**Example**

Function Usage			Results		
A	B	C	A	B	C
1			1		
2		0.15	2		0.15
3		0.55	3		0.55
4		0.75	4		0.75
5	Values	0.16	5		0.16
6		0.5	6		0.5
7		0.3	7		0.3
8		FALSE	8		FALSE
9	Result	=MINA(C2:C8)	9	Result	0
10			...		

# 393. MINIFS Function

## Description

The MINIFS function returns the minimum value among cells specified by a given set of conditions or criteria. This function was added in Excel 2016.

## Syntax

```
MINIFS (min_range, criteria_range1, criterial, [criteria_range2, criteria2], ...)
```

## Arguments

Argument	Description	Required /Optional
min_range	The actual range of cells in which the minimum will be determined.	Required
criteria_range1	Is the set of cells to evaluate with the criteria.	Required
criterial	Is the criteria in the form of a number, expression, or text that defines which cells will be evaluated as minimum. The same set of criteria works for the MAXIFS, SUMIFS, and AVERAGEIFS Functions.	Required
criteria_range2, criteria2, ...	Additional ranges and their associated criteria. You can enter up to 126 range/criteria pairs.	Optional

## Notes

The size and shape of the min\_range and criteria\_rangeN arguments must be the same, otherwise these functions return the #VALUE! Error.

## Applicability

Excel 2016

**Example**

Function Usage			Results		
	A	B		A	B
1				1	
2	<b>Marks</b>	<b>Grade</b>		2	<b>Marks</b>
3	45	C		3	45
4	75	A+		4	75
5	55	B		5	55
6	52	B		6	52
7	52	B		7	52
8	65	A		8	65
9	70	A		9	70
10	85	A+		10	85
11	<b>Criteria</b>	=MINIFS(B3:B10,C3:C10,"A+")		11	<b>Criteria</b>
				12	75

# 394. MODE.MULT Function

## Description

The MODE.MULT function returns a vertical array of the most frequently occurring, or repetitive values in an array or range of data. For horizontal arrays, use TRANSPOSE (MODE.MULT (number1, number2...)). This will return more than one result if there are multiple modes. Since this function returns an array of values, it must be entered as an array formula.

## Syntax

```
MODE.MULT ((number1, [number2]...))
```

## Arguments

Argument	Description	Required /Optional
Number1	The first number argument for which you want to calculate the mode.	Required
Number2, ...	Number arguments 2 to 254 for which you want to calculate the mode. You can also use a single array or a reference to an array instead of arguments separated by commas.	Optional

## Notes

- Arguments can either be numbers or names, arrays, or references that contain numbers.
- If an array or reference argument contains text, logical values, or empty cells, those values are ignored; however, cells with the value zero are included.
- If a value that is supplied directly to the function (i.e. not part of an array of supplied values) is non-numeric, MODE.MULT returns the #VALUE! error value.
- If the data set contains no duplicate data points, and hence there is no mode, MODE.MULT returns the #N/A error value.

## Applicability

Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	<b>Numbers</b>	<b>Result</b>	2	<b>Numbers</b>	<b>Result</b>
3	15	=MODE.MULT(B3:B9)	3	15	55
4	55	=MODE.MULT(B3:B9)	4	55	35
5	35	=MODE.MULT(B3:B9)	5	35	#N/A
6	17	=MODE.MULT(B3:B9)	6	17	#N/A
7	30	=MODE.MULT(B3:B9)	7	30	#N/A
8	55	=MODE.MULT(B3:B9)	8	55	#N/A
9	35	=MODE.MULT(B3:B9)	9	35	#N/A
10			--		

# 395. MODE.SNGL Function

## Description

The MODE.SNGL function returns the most frequently occurring, or repetitive, value in an array or range of data.

## Syntax

```
MODE.SNGL (number1, [number2]...)
```

## Arguments

Argument	Description	Required /Optional
Number1	The first argument for which you want to calculate the mode.	Required
Number2, ...	Arguments 2 to 254 for which you want to calculate the mode. You can also use a single array or a reference to an array instead of arguments separated by commas.	Optional

## Notes

- The MODE.SNGL function measures central tendency, which is the location of the center of a group of numbers in a statistical distribution.
- Arguments can either be numbers or names, arrays, or references that contain numbers.
- If an array or reference argument contains text, logical values, or empty cells, those values are ignored; however, cells with the value zero are included.
- If a value that is supplied directly to the Function (i.e. not part of an array of supplied values) is non-numeric, MODE.SNGL returns the #VALUE! Value.
- If the data set contains no duplicate data points, MODE.SNGL returns the #N/A error value.

## Applicability

Excel 2010, Excel 2013, Excel 2016

**Example**

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Numbers	15	2	15	
3		55	3	55	
4		35	4	35	
5		17	5	17	
6		30	6	30	
7		55	7	55	
8		35	8	35	
9	Result	55	9	Result	=MODE.SNGL(C2:C8)

# 396. NEGBINOM.DIST Function

## Description

The NEGBINOM.DIST function returns the negative binomial distribution, the probability that there will be Number\_f failures before the Number\_s-th success, with Probability\_s probability of a success.

This function is similar to the binomial distribution, except that the number of successes is fixed, and the number of trials is variable. Like the binomial, trials are assumed to be independent.

## Syntax

```
NEGBINOM.DIST (number_f,number_s,probability_s,cumulative)
```

## Arguments

Argument	Description	Required /Optional
Number_f	The number of failures.	Required
Number_s	The threshold number of successes.	Required
Probability_s	The probability of a success.	Required
Cumulative	A logical value that determines the form of the function. If cumulative is TRUE, NEGBINOM.DIST returns the cumulative distribution function. If cumulative is FALSE, NEGBINOM.DIST returns the probability density function.	Required

## Notes

- The equation for the negative binomial distribution is-

$$nb(x;r,p) = \binom{x+r-1}{r-1} p^r (1-p)^x$$

Where:

x is number\_f, r is number\_s, and p is probability\_s.

- Number\_f and number\_s are truncated to integers.
- If the number\_f, number\_s, or probability\_s arguments are not recognized as numeric values, NEGBINOM.DIST returns the #VALUE! error value.
- If the cumulative argument is not recognized as a numeric or a logical value, NEGBINOM.DIST returns the #VALUE! error value.

- If probability\_s < 0 or if probability > 1, NEGBINOM.DIST returns the #NUM! error value.
- If number\_f < 0 or number\_s < 1, NEGBINOM.DIST returns the #NUM! error value.

## Applicability

Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	No. of Failures	7	2	No. of Failures	7
3	Threshold No. of Successes	5	3	Threshold No. of Successes	5
4	Probability of a Success	0.4	4	Probability of a Success	0.4
5	Result	=NEGBINOM.DIST(C2,C3,C4,FALSE)	5	Result	0.094595973

# 397. NORM.DIST Function

## Description

The NORM.DIST function returns the normal distribution for the specified mean and standard deviation. This function has a very wide range of applications in statistics, including hypothesis testing.

## Syntax

```
NORM.DIST(x,mean,standard_dev,cumulative)
```

## Arguments

Argument	Description	Required /Optional
X	The value for which you want the distribution.	Required
Mean	The arithmetic mean of the distribution.	Required
Standard_dev	The standard deviation of the distribution.	Required
Cumulative	A logical value that determines the form of the function. If cumulative is TRUE, NORM.DIST returns the cumulative distribution function. If cumulative is FALSE, NORM.DIST returns the probability mass function.	Required

## Notes

- The equation for the normal density function (cumulative = FALSE) is-

$$f(x; \mu, \sigma) = \frac{1}{\sqrt{2\pi}\sigma} e^{-\frac{(x-\mu)^2}{2\sigma^2}}$$

- When cumulative = TRUE, the formula is the integral from negative infinity to x of the given formula.
- If mean = 0, standard\_dev = 1 and cumulative = TRUE, NORM.DIST returns the standard normal distribution, NORM.S.DIST
- If any of the supplied arguments are non-numeric or non-logical values, NORM.DIST returns the #VALUE! error value.
- If standard\_dev ≤ 0, NORM.DIST returns the #NUM! error value.

## Applicability

Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	X	60	2	X	60
3	Mean	54.3	3	Mean	54.3
4	Standard Deviation	15	4	Standard Deviation	15
5	Cumulative	TRUE	5	Cumulative	TRUE
6	Normal Distribution	=NORM.DIST(C2,C3,C4,C5)	6	Normal Distribution	64.80%
7			-		

# 398. NORM.INV Function

## Description

The NORM.INV function returns the inverse of the normal cumulative distribution for the specified mean and standard deviation.

## Syntax

```
NORM.INV (probability,mean,standard_dev)
```

## Arguments

Argument	Description	Required /Optional
Probability	A probability corresponding to the normal distribution.	Required
Mean	The arithmetic mean of the distribution.	Required
Standard_dev	The standard deviation of the distribution.	Required

## Notes

- If any argument is nonnumeric, NORM.INV returns the #VALUE! error value.
- If probability < 0 or if probability > 1, NORM.INV returns the #NUM! error value.
- If standard\_dev ≤ 0, NORM.INV returns the #NUM! error value.
- If mean = 0 and standard\_dev = 1, NORM.INV uses the standard normal distribution. Refer NORMS.INV
- Given a value for probability, NORM.INV seeks that value x such that NORM.DIST(x, mean, standard\_dev, TRUE) = probability. Thus, precision of NORM.INV depends on precision of NORM.DIST

## Applicability

Excel 2010, Excel 2013, Excel 2016

**Example**

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Probability	0.648027292424163	2	Probability	0.648
3	Mean	54.3	3	Mean	54.3
4	Standard Deviation	15	4	Standard Deviation	15
5	X	=NORM.INV(C2,C3,C4)	5	X	60

# 399. NORM.S.DIST Function

## Description

The NORM.S.DIST function returns the standard normal distribution (has a mean of zero and a standard deviation of one). Use this function in place of a table of standard normal curve areas.

## Syntax

```
NORM.S.DIST (z,cumulative)
```

## Arguments

Argument	Description	Required /Optional
Z	The value for which you want the distribution.	Required
Cumulative	Cumulative is a logical value that determines the form of the function. If cumulative is TRUE, NORMS.DIST returns the cumulative distribution function. If cumulative is FALSE, NORMS.DIST returns the probability mass function.	Required

## Notes

- The equation for the standard normal density function is-

$$f(z) = \frac{1}{\sqrt{2\pi}} e^{-\frac{z^2}{2}}$$

- If z is nonnumeric, NORM.S.DIST returns the #VALUE! error value.

## Applicability

Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage		Results	
A	B	A	B
1		1	
2	z 1.5	2	z 1.5
3	Cumulative TRUE	3	Cumulative TRUE
4	Standard Normal Distribution =NORM.S.DIST(C2,C3)	4	Standard Normal Distribution 93.3%
e		e	

# 400. NORM.S.INV Function

## Description

The NORM.S.INV function returns the inverse of the standard normal cumulative distribution. The distribution has a mean of zero and a standard deviation of one.

## Syntax

```
NORM.S.INV (probability)
```

## Arguments

Argument	Description	Required / Optional
Probability	A probability corresponding to the normal distribution.	Required

## Notes

- If probability is nonnumeric, NORMS.INV returns the #VALUE! error value.
- If probability <= 0 or if probability >= 1, NORMS.INV returns the #NUM! error value.
- Given a value for probability, NORM.S.INV seeks that value z such that

$$\text{NORM.S.DIST}(z, \text{TRUE}) = \text{probability}$$

Thus, precision of NORM.S.INV depends on precision of NORM.S.DIST. NORM.S.INV uses an iterative search technique.

## Applicability

Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Standard Normal Distribution	0.93	2	Standard Normal Distribution	0.93
3	z	=NORM.S.INV(C2)	3	z	1.5

# 401. PEARSON Function

## Description

The PEARSON function returns the Pearson product moment correlation coefficient, r, a dimensionless index that ranges from -1.0 to 1.0 inclusive and reflects the extent of a linear relationship between two data sets.

## Syntax

```
PEARSON (array1, array2)
```

## Arguments

Argument	Description	Required /Optional
Array1	A set of independent values.	Required
Array2	A set of dependent values.	Required

## Notes

- The formula for the Pearson product moment correlation coefficient, r, is-

$$r = \frac{\sum (x - \bar{x})(y - \bar{y})}{\sqrt{\sum (x - \bar{x})^2 \sum (y - \bar{y})^2}}$$

Where x and y are the sample means AVERAGE (array1) and AVERAGE (array2).

- The arguments must be either numbers or names, array constants, or references that contain numbers.
- If an array or reference argument contains text, logical values, or empty cells, those values are ignored. However, cells with the value zero are included.
- If array1 and array2 have a different number of data points, PEARSON returns the #N/A error value.
- If array1 or array2 is empty or if the standard deviation of their values is equal to zero, PEARSON returns the #DIV/0! error value.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

**Example**

Function Usage			Results		
A	B	C	A	B	C
1					
2	Array1	Array2		Array1	Array2
3	1	2		1	2
4	2	4		2	4
5	3	6		3	6
6	4	8		4	8
7	5	10		5	10
8	Result	=PEARSON(B3:B7,C3:C7)		Result	1
A					

# 402. PERCENTILE.EXC Function

## Description

The PERCENTILE.EXC function returns the k-th percentile of values in a range, where k is in the range 0...1, exclusive.

## Syntax

```
PERCENTILE.EXC (array,k)
```

## Arguments

Argument	Description	Required /Optional
Array	The array or range of data that defines relative standing.	Required
K	The percentile value in the range 0...1, exclusive.	Required

## Notes

- If k is not a multiple of  $1/(n - 1)$ , PERCENTILE.EXC interpolates to determine the value at the k-th percentile.
- PERCENTILE.EXC will interpolate when the value for the specified percentile lies between two values in the array. If it cannot interpolate for the percentile, k specified, Excel will return #NUM! error.
- If array is empty, PERCENTILE.EXC returns the #NUM! error value.
- If k is nonnumeric, PERCENTILE.EXC returns the #VALUE! error value.
- If k is  $\leq 0$  or if k  $\geq 1$ , PERCENTILE.EXC returns the #NUM! error value.

## Applicability

Excel 2010, Excel 2013, Excel 2016

**Example**

Function Usage			Results		
A	B	C	A	B	C
1			1		
2		2	2		2
3		4	3		4
4	Array	8	4		8
5		6	5		6
6		10	6		10
7		14	7		14
8	k	0.25	8		0.25
9	Result	=PERCENTILE.EXC(C2:C7,C8)	9		3.5
..			..		

# 403. PERCENTILE.INC Function

## Description

The PERCENTILE.INC function returns the k-th percentile of values in a range, where k is in the range 0...1, inclusive. You can use this function to establish a threshold of acceptance.

## Syntax

```
PERCENTILE.INC (array,k)
```

## Arguments

Argument	Description	Required /Optional
Array	The array or range of data that defines relative standing.	Required
K	The percentile value in the range 0..1, inclusive.	Required

## Notes

- If k is not a multiple of  $1/(n - 1)$ , PERCENTILE.INC interpolates to determine the value at the k-th percentile.
- If array is empty, PERCENTILE.INC returns the #NUM! error value.
- If k is nonnumeric, PERCENTILE.INC returns the #VALUE! error value.
- If k is < 0 or if k > 1, PERCENTILE.INC returns the #NUM! error value.

## Applicability

Excel 2010, Excel 2013, Excel 2016

**Example**

Function Usage			Results		
A	B	C	A	B	C
<b>Array</b>			<b>Array</b>		
1	0.04	0.05	1		
2	0.14	-0.08	2	0.04	0.05
3	0.08	0.01	3	0.14	-0.08
4	0.03	-0.04	4	0.08	0.01
5	-0.04	0.11	5	0.03	-0.04
6	-0.07	-0.08	6	-0.04	0.11
7	0.1	0.08	7	-0.07	-0.08
8	-0.13	-0.05	8	0.10	0.08
9	0.04	-0.16	9	-0.13	-0.05
10	0.02	0.02	10	0.04	-0.16
11	0.08	0.1	11	0.02	0.02
12	0.1	-0.03	12	0.08	0.10
13	<b>Percentile</b>		13	0.10	-0.03
14	<code>=PERCENTILE.INC(B3:C14,0.95)</code>		14	<b>Percentile</b>	
15			15		
16			16	0.11	

# 404. PERCENTRANK.EXC Function

## Description

The PERCENTRANK.EXC function returns the rank of a value in a data set as a percentage (0...1, exclusive) of the data set.

## Syntax

```
PERCENTRANK.EXC (array,x,[significance])
```

## Arguments

Argument	Description	Required /Optional
Array	The array or range of data with numeric values that defines relative standing.	Required
X	The value for which you want to know the rank.	Required
Significance	A value that identifies the number of significant digits for the returned percentage value. If omitted, PERCENTRANK.EXC uses three digits (0.xxx).	Optional

## Notes

- If x does not match one of the values in array, PERCENTRANK.EXC interpolates to return the correct percentage rank.
- If array is empty, PERCENTRANK.EXC returns the #NUM! error value.
- If significance < 1, PERCENTRANK.EXC returns the #NUM! error value.
- If x is smaller than the minimum, or greater than the maximum value in the supplied array, PERCENTRANK.EXC returns the #N/A error value.

## Applicability

Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2		2	2		2
3		4	3		4
4	Array	8	4		8
5		6	5		6
6		10	6		10
7		14	7		14
8	X	8.5	8	X	8.5
9	Result	=PERCENTRANK.EXC(C2:C7,C8)	9	Result	0.607

# 405. PERCENTRANK.INC Function

## Description

The PERCENTRANK.INC function returns the rank of a value in a data set as a percentage (0..1, inclusive) of the data set. This function can be used to evaluate the relative standing of a value within a data set.

## Syntax

```
PERCENTRANK.INC (array,x,[significance])
```

## Arguments

Argument	Description	Required /Optional
Array	The array or range of data with numeric values that defines relative standing.	Required
X	The value for which you want to know the rank.	Required
Significance	A value that identifies the number of significant digits for the returned percentage value. If omitted, PERCENTRANK.INC uses three digits (0.xxx).	Optional

## Notes

- If x does not match one of the values in array, PERCENTRANK.INC interpolates to return the correct percentage rank.
- If array is empty, PERCENTRANK.INC returns the #NUM! error value.
- If significance < 1, PERCENTRANK.INC returns the #NUM! error value.
- If the supplied x is smaller than the minimum, or greater than the maximum value in the supplied array, PERCENTRANK.INC returns the #N/A error value.

## Applicability

Excel 2010, Excel 2013, Excel 2016

**Example**

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	<b>Array</b>		2	<b>Array</b>	
3	0.04	0.05	3	0.04	0.05
4	0.14	-0.08	4	0.14	-0.08
5	0.08	0.01	5	0.08	0.01
6	0.03	-0.04	6	0.03	-0.04
7	-0.04	0.11	7	-0.04	0.11
8	-0.07	-0.08	8	-0.07	-0.08
9	0.1	0.08	9	0.10	0.08
10	-0.13	-0.05	10	-0.13	-0.05
11	0.04	-0.16	11	0.04	-0.16
12	0.02	0.02	12	0.02	0.02
13	0.08	0.1	13	0.08	0.10
14	0.1	-0.03	14	0.10	-0.03
15	<b>Percentile</b>		15	<b>Percentile</b>	
16	=PERCENTRANK.INC(B3:C14,0.01)		16	0.39	

# 406. PERMUT Function

## Description

The PERMUT function returns the number of permutations for a given number of objects that can be selected from number objects. A permutation is any set or subset of objects or events where internal order is significant. Permutations are different from combinations, for which the internal order is not significant.

## Syntax

```
PERMUT (number, number_chosen)
```

## Arguments

Argument	Description	Required /Optional
Number	An integer that describes the number of objects.	Required
Number_chosen	An integer that describes the number of objects in each permutation.	Required

## Notes

- The equation for the number of permutations is-

$$P_{k,n} = \frac{n!}{(n-k)!}$$

- Both arguments are truncated to integers.
- If number or number\_chosen is nonnumeric, PERMUT returns the #VALUE! error value.
- If number  $\leq 0$  or if number\_chosen  $< 0$ , PERMUT returns the #NUM! error value.
- If number  $<$  number\_chosen, PERMUT returns the #NUM! error value.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	No. of Items	Number Chosen	2	No. of Items	Number Chosen
3	4	2	3	4	2
4	4	3	4	4	3
5	6	4	5	6	4
6	6.6	4.5	6	6.6	4.5
7	25	6	7	25	6
8	6	Four	8	6	Four
9	Ten	4	9	Ten	4
10	-6	4	10	-6	4
11	6	-4	11	6	-4
12	3	4	12	3	4

# 407. PERMUTATIONA Function

## Description

The PERMUTATIONA function returns the number of permutations for a given number of objects (with repetitions) that can be selected from the total objects.

PERMUTATIONA uses the following equation-

$$\text{PERMUTATIONA} = \text{Total}^{\text{chosen}}$$

## Syntax

```
PERMUTATIONA (number, number-chosen)
```

## Arguments

Argument	Description	Required /Optional
Number	An integer that describes the total number of objects.	Required
Number_chosen	An integer that describes the number of objects in each permutation.	Required

## Notes

- Both arguments are truncated to integers.
- If one or both of the supplied arguments are non-numeric, PERMUTATIONA returns the #VALUE! error value.
- If number < 0, PERMUTATIONA returns the #NUM! error value.
- If number\_chosen < 0, PERMUTATIONA returns the #NUM! error value.
- If number < number\_chosen, PERMUTATIONA returns the #NUM! error value.

## Applicability

Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Number	8	2	Number	8
3	Number Chosen	3	3	Number Chosen	3
4	Result	=PERMUTATIONA(C2,C3)	4	Result	512
c			-		

# 408. PHI Function

## Description

The PHI function returns the value of the density function for a standard normal distribution.

## Syntax

```
PHI(x)
```

## Arguments

Argument	Description	Required /Optional
X	X is the number for which you want the density of the standard normal distribution.	Required

## Notes

- If x is a numeric value that is not valid, PHI returns the #NUM! error value.
- If x is a nonnumeric value, PHI returns the #VALUE! error value.

## Applicability

Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	X	2	2	X	2
3	Result	=PHI(C2)	3	Result	0.053990967

# 409. POISSON.DIST Function

## Description

The POISSON.DIST function returns the Poisson distribution. A common application of the Poisson distribution is predicting the number of events over a specific time.

## Syntax

```
POISSON.DIST(x,mean,cumulative)
```

## Arguments

Argument	Description	Required /Optional
X	The number of events.	Required
Mean	The expected numeric value.	Required
Cumulative	A logical value that determines the form of the probability distribution returned. If cumulative is TRUE, POISSON.DIST returns the cumulative Poisson probability that the number of random events occurring will be between zero and x inclusive. If cumulative is FALSE, POISSON.DIST returns the Poisson probability mass function that the number of events occurring will be exactly x.	Required

## Notes

- POISSON.DIST is calculated as follows-
  - For cumulative = FALSE,

$$POISSON = \frac{e^{-\lambda} \lambda^x}{x!}$$

- For cumulative = TRUE,

$$CUMPOISSON = \sum_{k=0}^x \frac{e^{-\lambda} \lambda^k}{k!}$$

- If x is not an integer, it is truncated.
- If x or mean is nonnumeric, POISSON.DIST returns the #VALUE! error value.
- If x < 0, POISSON.DIST returns the #NUM! error value.
- If mean < 0, POISSON.DIST returns the #NUM! error value.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

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## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	x	35	2	x	35
3	Mean	40	3	Mean	40
4	Cumulative	TRUE	4	Cumulative	TRUE
5	Poisson Distribution Value	=POISSON.DIST(C2,C3,C4)	5	Poisson Distribution Value	0.24

# 410. PROB Function

## Description

The PROB function returns the probability that values in a range are between two limits. If upper\_limit is not supplied, returns the probability that values in x\_range are equal to lower\_limit.

## Syntax

```
PROB (x_range, prob_range, [lower_limit], [upper_limit])
```

## Arguments

Argument	Description	Required /Optional
X_range	The range of numeric values of x with which there are associated probabilities.	Required
Prob_range	A set of probabilities associated with values in x_range.	Required
Lower_limit	The lower bound on the value for which you want a probability.	Optional
Upper_limit	The optional upper bound on the value for which you want a probability.	Optional

## Notes

- If upper\_limit is omitted, PROB returns the probability of being equal to lower\_limit.
- If any value in prob\_range  $\leq 0$  or if any value in prob\_range  $> 1$ , PROB returns the #NUM! error value.
- If the sum of the values in prob\_range is not equal to 1, PROB returns the #NUM! error value.
- If x\_range and prob\_range contain different number of data points, PROB returns the #N/A error value.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results			
	A	B		A	B	
1				1		
2		x	f(x)	2	x	f(x)
3	0	0.1		3	0	0.1
4	1	0.2		4	1	0.2
5	2	0.2		5	2	0.2
6	3	0.3		6	3	0.3
7	4	0.2		7	4	0.2
8				8		
9	Lower Limit	1		9	Lower Limit	1
10	Upper Limit	3		10	Upper Limit	3
11	P(1≤x≤1)	=PROB(B3:B7,C3:C7,C9,C10)		11	P(1≤x≤1)	0.7
12				12		

# 411. QUARTILE.EXC Function

## Description

The QUARTILE.EXC function returns the quartile of the data set, based on percentile values from 0...1, exclusive.

## Syntax

```
QUARTILE.EXC (array, quart)
```

## Arguments

Argument	Description	Required /Optional
Array	The array or cell range of numeric values for which you want the quartile value.	Required
Quart	Indicates which value to return.	Required

## Notes

- If quart is not an integer, it is truncated.
- MIN, MEDIAN, and MAX return the same value as QUARTILE.EXC when quart is equal to 0 (zero), 2, and 4, respectively.
- If array is empty, QUARTILE.EXC returns the #NUM! error value.
- If quart  $\leq 0$  or if quart  $\geq 4$ , QUARTILE.EXC returns the #NUM! error value.
- If array has fewer than 3 values, and quart is equal to 1 or 3, QUARTILE.EXC returns the #NUM! error value.
- If the value of quart cannot be interpreted as a numeric value, QUARTILE.EXC returns the #VALUE! error value.

## Applicability

Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2		8	2		8
3		6	3		6
4		15	4		15
5		40	5		40
6		44	6		44
7	Array	45	7		45
8		55	8		55
9		32	9		32
10		30	10		30
11		56	11		56
12		22	12		22
13	Quart	1	13	Quart	1
14	Result	=QUARTILE.EXC(C2:C12,C13)	14	Result	15
15	Quart	3	15	Quart	3
16	Result	=QUARTILE.EXC(C2:C12,C15)	16	Result	45

# 412. QUARTILE.INC Function

## Description

The QUARTILE.INC function returns the quartile of a data set, based on percentile values from 0...1, inclusive.

## Syntax

```
QUARTILE.INC (array,quart)
```

## Arguments

Argument	Description	Required /Optional
Array	The array or cell range of numeric values for which you want the quartile value.	Required
Quart	Indicates which value to return	Required

## Notes

- If quart is not an integer, it is truncated.
- MIN, MEDIAN, and MAX return the same value as QUARTILE.INC when quart is equal to 0 (zero), 2, and 4, respectively.
- If array is empty, QUARTILE.INC returns the #NUM! error value.
- If quart < 0 or if quart > 4, QUARTILE.INC returns the #NUM! error value.
- If the value of quart cannot be interpreted as a numeric value, QUARTILE.INC returns the #VALUE! error value.

## Applicability

Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
	A	B		A	B
1				1	
2		8		2	8
3		6		3	6
4		15		4	15
5		40		5	40
6		44		6	44
7		45		7	45
8		55		8	55
9		32		9	32
10		30		10	30
11		56		11	56
12		22		12	22
13	Quart	1		13	1
14	Result	=QUARTILE.INC(C2:C12,C13)		14	18.5
15	Quart	3		15	3
16	Result	=QUARTILE.INC(C2:C12,C15)		16	44.5
17					

# 413. RANK.AVG Function

## Description

The RANK.AVG function returns the statistical rank of a given value, within a supplied array of values. If there are duplicate values in the list, the average rank is returned.

## Syntax

```
RANK.AVG (number,ref,[order])
```

## Arguments

Argument	Description	Required /Optional
Number	The number whose rank you want to find.	Required
Ref	An array of, or a reference to, a list of numbers. Nonnumeric values in Ref are ignored.	Required
Order	A number specifying how to rank number.	Optional

## Notes

- If Order is 0 (zero) or omitted, Excel ranks number as if ref were a list sorted in descending order.
- If Order is any nonzero value, Excel ranks number as if ref were a list sorted in ascending order.
- If the supplied number is not present within the supplied ref, RANK.AVG returns the #N/A error value.
- If the values in the supplied ref array are text values, RANK.AVG returns the #N/A error value.

## Applicability

Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	<b>Day</b>	<b>Temp (C)</b>	2	<b>Day</b>	<b>Temp (C)</b>
3	42461	36	3	4/1/2016	36
4	42462	38	4	4/2/2016	38
5	42463	39	5	4/3/2016	39
6	42464	40	6	4/4/2016	40
7	42465	40	7	4/5/2016	40
8	42466	42	8	4/6/2016	42
9	42467	45	9	4/7/2016	45
10	<b>Result</b>	=RANK.AVG(38,C3:C9)	10	<b>Result</b>	6

# 414. RANK.EQ Function

## Description

The RANK.EQ function returns the statistical rank of a given value, within a supplied array of values. If there are duplicate values in the list, these are given the same rank. If you sort the list, the rank of the number would be its position.

## Syntax

```
RANK.EQ (number,ref,[order])
```

## Arguments

Argument	Description	Required /Optional
Number	The number whose rank you want to find.	Required
Ref	An array of, or a reference to, a list of numbers. Non-numeric values in Ref are ignored.	Required
Order	A number specifying how to rank number.	Optional

## Notes

- If Order is 0 (zero) or omitted, Excel ranks Number as if Ref were a list sorted in descending order.
- If Order is any nonzero value, Excel ranks Number as if Ref were a list sorted in ascending order.
- RANK.EQ gives duplicate numbers the same rank. However, the presence of duplicate numbers affects the ranks of subsequent numbers.
- For some purposes one might want to use a definition of rank that takes ties into account. This can be done by adding the following correction factor to the value returned by RANK.EQ  
Correction factor for tied ranks =

```
[COUNT (ref) + 1 - RANK.EQ (number, ref, 0) - RANK.EQ (number, ref, 1)]/2
```

This correction factor is appropriate both for the case where rank is computed in descending order (order = 0 or omitted) or ascending order (order = nonzero value)

- If the supplied number is not present within the supplied ref, RANK.EQ returns #N/A error.
- If the values in the supplied ref array are text values, RANK.EQ returns #N/A error.

## Applicability

Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	<b>Day</b>	<b>Temp (C)</b>	2	<b>Day</b>	<b>Temp (C)</b>
3	42461	36	3	4/1/2016	36
4	42462	38	4	4/2/2016	38
5	42463	39	5	4/3/2016	39
6	42464	40	6	4/4/2016	40
7	42465	40	7	4/5/2016	40
8	42466	42	8	4/6/2016	42
9	42467	45	9	4/7/2016	45
10	<b>Result</b>	=RANK.EQ(38,C3:C9)	10	<b>Result</b>	6

# 415. RSQ Function

## Description

The RSQ function returns the square of the Pearson product moment correlation coefficient through data points in known\_y's and known\_x's.

## Syntax

```
RSQ (known_y's,known_x's)
```

## Arguments

Argument	Description	Required /Optional
Known_y's	An array or range of data points.	Required
Known_x's	An array or range of data points.	Required

## Notes

- The equation for the Pearson product moment correlation coefficient, r, is-

$$r = \frac{\sum (x - \bar{x})(y - \bar{y})}{\sqrt{\sum (x - \bar{x})^2 \sum (y - \bar{y})^2}}$$

Where x and y are the sample means AVERAGE (known\_x's) and AVERAGE (known\_y's).

- RSQ returns r2, which is the square of this correlation coefficient.
- Arguments can either be numbers or names, arrays, or references that contain numbers.
- Logical values and text representations of numbers that you type directly into the list of arguments are counted.
- If an array or reference argument contains text, logical values, or empty cells, those values are ignored; however, cells with the value zero are included.
- Arguments that are error values or text that cannot be translated into numbers cause errors.
- If known\_y's and known\_x's are empty or have a different number of data points, RSQ returns the #N/A error value.

- If one or both of the supplied arrays contain only 1 data point, RSQ returns the #DIV/0! error value.
- If the standard deviation of their values in one or both of the supplied arrays is equal to zero, RSQ returns the #DIV/0! error value.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

	A	B	C	D	E	F	Function Usage	Results
2		Known_y's	Known_x's	Square of the Pearson Product Moment Correlation Coefficient				
3		89	1	=RSQ(B3:B20,C3:C20)				
4		84	1					
5		86	1					
6		123	0					
7		99	0					
8		117	0					
9		84	-1					
10		109	-1					
11		87	-1					
12		103	1					
13		100	1					
14		112	1					
15		100	0					
16		92	0					
17		93	-1					
18		126	-1					
19		127	-1					
20		117	-1					

# 416. SKEW Function

## Description

The SKEW function returns the skewness of a distribution.

Skewness characterizes the degree of asymmetry of a distribution around its mean.

- Positive skewness indicates a distribution with an asymmetric tail extending toward more positive values.
- Negative skewness indicates a distribution with an asymmetric tail extending toward more negative values.

## Syntax

```
SKEW (number1, [number2] ...)
```

## Arguments

Argument	Description	Required /Optional
Number1	1 to 255 arguments for which you want to calculate skewness.	required
number2, ...	You can also use a single array or a reference to an array instead of arguments separated by commas.	optional

## Notes

- The equation for skewness is defined as-

$$\frac{n}{(n-1)(n-2)} \sum \left( \frac{x_i - \bar{x}}{s} \right)^3$$

- Arguments can either be numbers or names, arrays, or references that contain numbers.
- Logical values and text representations of numbers that you type directly into the list of arguments are counted.
- If an array or reference argument contains text, logical values, or empty cells, those values are ignored. However, cells with the value zero are included.
- Arguments that are error values or text that cannot be translated into numbers cause errors.
- If there are fewer than three data points, or the sample standard deviation is zero, SKEW returns the #DIV/0! error value.

- If any of the number arguments that are supplied directly to the function are not recognized as numeric values, Skew returns the #VALUE! error value.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage		Results	
A	B	A	B
1		1	
2	Values	2	Values
3	2	3	2
4	2	4	2
5	3	5	3
6	3	6	3
7	9	7	9
8	=SKEW(B3:B7)	8	2.07706

# 417. SKEW.P Function

## Description

The SKEW.P function returns the skewness of a distribution based on a population: a characterization of the degree of asymmetry of a distribution around its mean.

SKEW.P uses the following equation-

$$v = \frac{1}{N} \sum_{i=1}^N \frac{x_i - \bar{x}}{\sigma}$$

## Syntax

```
SKEW.P (number 1, [number 2]...)
```

## Arguments

Argument	Description	Required /Optional
Number 1	Number 1, number 2... are 1 to 254 numbers or names, arrays, or reference that contain numbers for which you want the population skewness.	Required
Number 2...		Optional

## Notes

- Arguments can either be numbers or names, arrays, or references that contain numbers.
- Logical values and text representations of numbers that you type directly into the list of arguments are counted.
- If an array or reference argument contains text, logical values, or empty cells, those values are ignored; however, cells with the value zero (0) are included.
- SKEW.P uses the standard deviation of an entire population, not a sample.
- If arguments are values that are not valid, SKEW.P returns the #NUM! error value.
- If arguments use data types that are not valid, SKEW.P returns the #VALUE! error value.
- If there are fewer than three data points, or the sample standard deviation is zero, SKEW.P returns the #DIV/0! Error value.

## Applicability

Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2		8	2		8
3		6	3		6
4		15	4		15
5		35	5		35
6		34	6		34
7		28	7		28
8		55	8		55
9		30	9		30
10		32	10		32
11		56	11		56
12		22	12		22
13	Numbers	=SKEW.P(C2:C12)	Result	0.276544693	

# 418. SLOPE Function

## Description

The SLOPE function returns the slope of the linear regression line through data points in known\_y's and known\_x's. The slope is the vertical distance divided by the horizontal distance between any two points on the line, which is the rate of change along the regression line.

## Syntax

```
SLOPE (known_y's, known_x's)
```

## Arguments

Argument	Description	Required /Optional
Known_y's	An array or cell range of numeric dependent data points.	Required
Known_x's	The set of independent data points.	Required

## Notes

- The equation for the slope of the regression line is-

$$b = \frac{\sum (x - \bar{x})(y - \bar{y})}{\sum (x - \bar{x})^2}$$

- Where x and y are the sample means AVERAGE (known\_x's) and AVERAGE (known\_y's).The arguments must be either numbers or names, arrays, or references that contain numbers.
- If an array or reference argument contains text, logical values, or empty cells, those values are ignored. However, cells with the value zero are included.
- If known\_y's and known\_x's have a different number of data points, SLOPE returns the #N/A error value.
- If known\_y's and known\_x's are empty, SLOPE returns the #DIV/0! error value.
- If the variance of the supplied known\_x's evaluates to zero, SLOPE returns the #DIV/0! error value.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
	A	B		A	B
1				1	
2		<b>known_x's</b>	<b>known_y's</b>	2	
3		62.9	116.6	3	62.9
4		64	126.9	4	64.0
5		65.2	132.4	5	65.2
6		66.4	113.5	6	66.4
7		67.5	175.7	7	67.5
8		67.5	173.3	8	67.5
9		68.7	158.7	9	68.7
10		69.9	161.6	10	69.9
11		71.1	176.9	11	71.1
12		76.8	164.3	12	76.8
13		<b>SLOPE</b>	=SLOPE(C3:C12,B3:B12)	13	<b>SLOPE</b>
					4.05

# 419. SMALL Function

## Description

The SMALL function returns the k-th smallest value in a data set. Use this function to return values with a particular relative standing in a data set.

## Syntax

```
SMALL (array, k)
```

## Arguments

Argument	Description	Required /Optional
Array	An array or range of numerical data for which you want to determine the k-th smallest value.	Required
K	The position (from the smallest) in the array or range of data to return.	Required

## Notes

- If n is the number of data points in array, SMALL(array,1) equals the smallest value, and SMALL(array,n) equals the largest value.
- If array is empty, SMALL returns the #NUM! error value.
- If  $k \leq 0$  or if k exceeds the number of data points, SMALL returns the #NUM! error value.
- If the supplied k is non-numeric, SMALL returns the #VALUE! error value.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
	A	B		A	B
1				1	
2		Values		2	
3		140		3	140
4		800		4	800
5		100		5	100
6		160		6	160
7		250		7	250
8				8	
9		Position	Result	9	Position
10	1	=SMALL(B3:B7,B10)		10	1
11	2	=SMALL(B3:B7,B11)		11	2
12	3	=SMALL(B3:B7,B12)		12	3
13	5	=SMALL(B3:B7,B13)		13	5
14	6	=SMALL(B3:B7,B14)		14	6
15	0	=SMALL(B3:B7,B15)		15	0
16	-1	=SMALL(B3:B7,B16)		16	-1
17	Two	=SMALL(B3:B7,B17)		17	Two
--				--	

# 420. STANDARDIZE Function

## Description

The STANDARDIZE function returns a normalized value from a distribution characterized by mean and standard\_dev.

## Syntax

```
STANDARDIZE(x, mean, standard_dev)
```

## Arguments

Argument	Description	Required /Optional
X	The value you want to normalize.	Required
Mean	The arithmetic mean of the distribution.	Required
Standard_dev	The standard deviation of the distribution.	Required

## Notes

- The equation for the normalized value is-

$$Z = \frac{X - \mu}{\sigma}$$

- If standard\_dev  $\leq 0$ , STANDARDIZE returns the #NUM! error value.
- If any of the supplied arguments are non-numeric, STANDARDIZE returns the #VALUE! error value.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	x	42000	2	x	42000
3	Mean	40000	3	Mean	40000
4	Standard Deviation	10000	4	Standard Deviation	10000
5	Normalized Value	=STANDARDIZE(C2,C3,C4)	5	Normalized Value	0.2

# 421. STDEV.P Function

## Description

The STDEV.P function calculates standard deviation based on the entire population given as arguments (ignores logical values and text).

## Syntax

```
STDEV.P (number1, [number2]...)
```

## Arguments

Argument	Description	Required /Optional
Number1	The first number argument corresponding to a population.	Required
Number2 ...	Number arguments 2 to 254 corresponding to a population. You can also use a single array or a reference to an array instead of arguments separated by commas.	Optional

## Notes

- STDEV.P uses the following formula-

$$\sqrt{\frac{\sum(x - \bar{x})^2}{n}}$$

Where  $x$  is the sample mean  $\text{AVERAGE}(\text{number1}, \text{number2}...)$  and  $n$  is the sample size.

- STDEV.P assumes that its arguments are the entire population. If your data represents a sample of the population, then compute the standard deviation using STDEV
- For large sample sizes, STDEV.S and STDEV.P return approximately equal values.
- The standard deviation is calculated using the "n" method.
- Arguments can either be numbers or names, arrays, or references that contain numbers.
- Logical values, and text representations of numbers that you type directly into the list of arguments are counted.

- If an argument is an array or reference, only numbers in that array or reference are counted. Empty cells, logical values, text, or error values in the array or reference are ignored.
- Arguments that are error values or text that cannot be translated into numbers cause errors.
- If you want to include logical values and text representations of numbers in a reference as part of the calculation, use the STDEVPA function.
- If none of the values that are supplied to the function are numeric, STDEV.P returns the #DIV/0! Error.
- If any values that are supplied directly to the Function are text values that cannot be interpreted as numeric values, STDEV.P returns the #VALUE! Error.

## Applicability

Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1	2	=STDEV.P(B2:B21)	1	2	
2	9		3	26	
3	26		4	28	
4	28		5	39	
5	39		6	42	
6	42		7	42	
7	42		8	43	
8	43		9	51	
9	51		10	56	
10	56		11	57	
11	57		12	58	
12	58		13	59	
13	59		14	62	
14	62		15	68	
15	68		16	68	
16	68		17	75	
17	75		18	76	
18	76		19	82	
19	82		20	92	
20	92		21	98	
21	98		~~	~~	

# 422. STDEV.S Function

## Description

The STDEV.S function estimates standard deviation based on a sample (ignores logical values and text in the sample).

## Syntax

```
STDEV.S (number1,[number2],...)
```

## Arguments

Argument	Description	Required /Optional
Number1	The first number argument corresponding to a sample of a population. You can also use a single array or a reference to an array instead of arguments separated by commas.	Required
Number2, ...	Number arguments 2 to 254 corresponding to a sample of a population. You can also use a single array or a reference to an array instead of arguments separated by commas.	Optional

## Notes

- STDEV.S uses the following formula-

$$\sqrt{\frac{\sum (x - \bar{x})^2}{(n-1)}}$$

Where  $x$  is the sample mean  $\text{AVERAGE}(\text{number1},\text{number2},\dots)$  and  $n$  is the sample size.

- STDEV.S assumes that its arguments are a sample of the population. If your data represents the entire population, then compute the standard deviation using STDEV.P
- The standard deviation is calculated using the "n-1" method.
- Arguments can either be numbers or names, arrays, or references that contain numbers.
- Logical values and text representations of numbers that you type directly into the list of arguments are counted.

- If an argument is an array or reference, only numbers in that array or reference are counted. Empty cells, logical values, text, or error values in the array or reference are ignored.
- Arguments that are error values or text that cannot be translated into numbers cause errors.
- If you want to include logical values and text representations of numbers in a reference as part of the calculation, use the STDEVA function.
- If fewer than two numeric values are supplied to the Function, STDEVA returns the #DIV/0! Error.
- If any values that are supplied directly to the Function are text values that cannot be interpreted as numeric values, STDEV.S returns the #DIV/0! Error.

## Applicability

Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage		Results	
A	B	A	B
1		1	
2	<b>Numbers</b>	2	<b>Numbers</b>
3	15.4	3	15.4
4	37.2	4	37.2
5	18.4	5	18.4
6	17.2	6	17.2
7	34.1	7	34.1
8	24.6	8	24.6
9	40.7	9	40.7
10	27.1	10	27.1
11	19.4	11	19.4
12	33.4	12	33.4
13	<b>Sample Standard Deviation</b>	13	<b>Sample Standard Deviation</b>
14	=STDEV.S(B3:B12)	14	9.13

# 423. STDEVA Function

## Description

The STDEVA function estimates standard deviation based on a sample. The standard deviation is a measure of how widely values are dispersed from the average value (the mean).

## Syntax

```
STDEVA (value1, [value2] ...)
```

## Arguments

Argument	Description	Required /Optional
Value1	1 to 255 values corresponding to a sample of a population.	Required
value2, ...	You can also use a single array or a reference to an array instead of arguments separated by commas.	Optional

## Notes

- STDEVA uses the following formula-

$$\sqrt{\frac{\sum (x - \bar{x})^2}{(n-1)}}$$

Where  $\bar{x}$  is the sample mean AVERAGE (value1, value2...) and n is the sample size.

- STDEVA assumes that its arguments are a sample of the population. If your data represents the entire population, you must compute the standard deviation using STDEVPA
- The standard deviation is calculated using the "n-1" method
- Arguments can be-
  - Numbers
  - names, arrays, or references that contain numbers
  - text representations of numbers
  - logical values, such as TRUE and FALSE, in a reference
- Arguments that contain TRUE evaluate as 1. Arguments that contain text or FALSE evaluate as 0 (zero)

- If an argument is an array or reference, only values in that array or reference are used. Empty cells and text values in the array or reference are ignored.
- If fewer than two numeric values are supplied to the Function, STDEVA returns the #DIV/0! Error value.
- If any values that are supplied directly to the function are text values that cannot be interpreted as numeric values, STDEVA returns the #VALUE! Error value.
- If you do not want to include logical values and text representations of numbers in a reference as part of the calculation, use the STDEV function.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage					Results							
	A	B	C	D	E	F	A	B	C	D	E	F
1							1					
2		Numbers			Result		2	Numbers			Result	
3	10	10	TRUE	10	=STDEVA(B3:E3)		3	10	10	TRUE	10	4.5
4	10	10	FALSE	10	=STDEVA(B4:E4)		4	10	10	FALSE	10	5
5	10	11	TRUE	12	=STDEVA(B5:E5)		5	10	11	TRUE	12	5.0662281

# 424. STDEVPA Function

## Description

The STDEVPA function calculates standard deviation based on the entire population given as arguments, including text and logical values.

## Syntax

```
STDEVPA (value1, [value2] ...)
```

## Arguments

Argument	Description	Required /Optional
Value1	1 to 255 values corresponding to a population.	required
value2, ...	You can also use a single array or a reference to an array instead of arguments separated by commas.	optional

## Notes

- STDEVPA uses the following formula-

$$\sqrt{\frac{\sum (x - \bar{x})^2}{n}}$$

Where  $x$  is the sample mean AVERAGE (value1, value2...) and  $n$  is the sample size.

- STDEVPA assumes that its arguments are the entire population. If your data represents a sample of the population, you must compute the standard deviation by using STDEVA
- For large sample sizes, STDEVA and STDEVPA return approximately equal values.
- The standard deviation is calculated using the "n" method.
- Arguments can be the following: numbers; names, arrays, or references that contain numbers; text representations of numbers; or logical values, such as TRUE and FALSE, in a reference.
- Text representations of numbers that you type directly into the list of arguments are counted.
- Arguments that contain TRUE evaluate as 1. Arguments that contain text or FALSE evaluate as 0 (zero).
- If an argument is an array or reference, only values in that array or reference are used. Empty cells and text values in the array or reference are ignored.

- Arguments that are error values or text that cannot be translated into numbers cause errors.
- If you do not want to include logical values and text representations of numbers in a reference as part of the calculation, use the STDEVP function.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage					Results					
A	B	C	D	E	A	B	C	D	E	F
1										
2	Numbers				Result	Numbers				Result
3	10	10	TRUE	10	=STDEVPA(B3:E3)	10	10	TRUE	10	3.897114317
4	10	10	FALSE	10	=STDEVPA(B4:E4)	10	10	FALSE	10	4.330127019
5	10	11	TRUE	12	=STDEVPA(B5:E5)	10	11	TRUE	12	4.387482194

# 425. STEYX Function

## Description

The STEYX function returns the standard error of the predicted y-value for each x in the regression. The standard error is a measure of the amount of error in the prediction of y for an individual x.

## Syntax

```
STEYX (known_y's, known_x's)
```

## Arguments

Argument	Description	Required /Optional
Known_y's	An array or range of dependent data points.	Required
Known_x's	An array or range of independent data points.	Required

## Notes

- The equation for the standard error of the predicted y is-

$$\sqrt{\frac{1}{(n-2)} \left[ \sum (y - \bar{y})^2 - \frac{\left[ \sum (x - \bar{x})(y - \bar{y}) \right]^2}{\sum (x - \bar{x})^2} \right]}$$

Where x and y are the sample means AVERAGE (known\_x's) and AVERAGE (known\_y's), and n is the sample size.

- Arguments can either be numbers or names, arrays, or references that contain numbers.
- Logical values and text representations of numbers that you type directly into the list of arguments are counted.
- If an array or reference argument contains text, logical values, or empty cells, those values are ignored; however, cells with the value zero are included.
- Arguments that are error values or text that cannot be translated into numbers cause errors.
- If known\_y's and known\_x's have a different number of data points, STEYX returns the #N/A error value.
- If known\_y's and known\_x's are empty or have less than three data points, STEYX returns the #DIV/0! error value.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Known_x's	Known_y's	2	Known_x's	Known_y's
3	1260	99850	3	1260	99,850
4	1007	58096	4	1007	58,096
5	1096	96360	5	1096	96,360
6	873	65675	6	873	65,675
7	532	51870	7	532	51,870
8	476	27462	8	476	27,462
9	482	27808	9	482	27,808
10	1173	110118	10	1173	110,118
11	692	67470	11	692	67,470
12	690	39808	12	690	39,808
13	564	32538	13	564	32,538
14	470	45825	14	470	45,825
15	Standard Error		15	Standard Error	
16	<code>=STEYX(C3:C14,B3:B14)</code>		16	12,974	

# 426. T.DIST.2T Function

## Description

The T.DIST.2T function returns the two-tailed Student's t-distribution. The Student's t-distribution is used in the hypothesis testing of small sample data sets. Use this Function in place of a table of critical values for the t-distribution.

## Syntax

```
T.DIST.2T(x,deg_freedom)
```

## Arguments

Argument	Description	Required /Optional
X	The numeric value at which to evaluate the distribution.	Required
Deg_freedom	An integer indicating the number of degrees of freedom.	Required

## Notes

- If any argument is nonnumeric, T.DIST.2T returns the #VALUE! error value.
- If deg\_freedom < 1, T.DIST.2T returns the #NUM! error value.
- If x < 0, then T.DIST.2T returns the #NUM! error value.

## Applicability

Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	x	2.18	2	x	2.18
3	Degrees of Freedom	12	3	Degrees of Freedom	12
4	Probability	=T.DIST.2T(C2,C3)	4	Probability	0.05
			-		

# 427. T.DIST Function

## Description

The T.DIST function returns the Student's left-tailed t-distribution. The t-distribution is used in the hypothesis testing of small sample data sets. Use this function in place of a table of critical values for the t-distribution.

## Syntax

```
T.DIST(x,deg_freedom, cumulative)
```

## Arguments

Argument	Description	Required /Optional
X	The numeric value at which to evaluate the distribution.	Required
Deg_freedom	An integer indicating the number of degrees of freedom.	Required
Cumulative	A logical value that determines the form of the Function. If cumulative is TRUE, T.DIST returns the cumulative distribution Function. If cumulative is FALSE, T.DIST returns the probability density function.	Required

## Notes

- If cumulative is TRUE and degrees\_freedom < 1, T.DIST returns #NUM! value.
- If cumulative is FALSE and degrees\_freedom < 0, T.DIST returns #NUM! value.
- If cumulative is FALSE and degrees\_freedom = 0, T.DIST returns #DIV/0! Value.
- If any argument is nonnumeric, T.DIST returns the #VALUE! error value.

## Applicability

Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	X	0.2	2	X	0.20
3	Degrees of Freedom	15	3	Degrees of Freedom	15
4	Cumulative	TRUE	4	Cumulative	TRUE
5	t Probability	=T.DIST(C2,C3,C4)	5	t Probability	0.58
		-			

# 428. T.DIST.RT Function

## Description

The T.DIST.RT function returns the right-tailed Student's t-distribution. The t-distribution is used in the hypothesis testing of small sample data sets. Use this function in place of a table of critical values for the t-distribution.

## Syntax

```
T.DIST.RT(x,deg_freedom)
```

## Arguments

Argument	Description	Required /Optional
X	The numeric value at which to evaluate the distribution.	Required
Deg_freedom	An integer indicating the number of degrees of freedom.	Required

## Notes

- If any argument is nonnumeric, T.DIST.RT returns the #VALUE! error value.
- If deg\_freedom < 1, T.DIST.RT returns the #NUM! error value.

## Applicability

Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	x	2.18	2	x	2.18
3	Degrees of Freedom	12	3	Degrees of Freedom	12
4	Probability	=T.DIST.RT(C2,C3)	4	Probability	0.025
e			e		

# 429. T.INV.2T Function

## Description

The T.INV.2T function returns the two-tailed inverse of the Student's t-distribution.

## Syntax

```
T.INV.2T (probability,deg_freedom)
```

## Arguments

Argument	Description	Required /Optional
Probability	The probability associated with the Student's t-distribution.	Required
Deg_freedom	An integer indicating the number of degrees of freedom.	Required

## Notes

- If either argument is nonnumeric, T.INV.2T returns the #VALUE! error value.
- If probability <= 0 or if probability > 1, T.INV.2T returns the #NUM! error value.
- If deg\_freedom is not an integer, it is truncated.
- If deg\_freedom < 1, T.INV.2T returns the #NUM! error value.
- T.INV.2T returns that value t, such that  $P(|X| > t) = \text{probability}$  where X is a random variable that follows the t-distribution and  $P(|X| > t) = P(X < -t \text{ or } X > t)$
- A one-tailed t-value can be returned by replacing probability with 2\*probability. For a probability of 0.05 and degrees of freedom of 10, the two-tailed value is calculated with T.INV.2T (0.05, 10), which returns 2.28139. The one-tailed value for the same probability and degrees of freedom can be calculated with T.INV.2T (2\*0.05, 10), which returns 1.812462
- Given a value for probability, T.INV.2T seeks that value x such that T.DIST.2T(x, deg\_freedom) = probability. Thus, precision of T.INV.2T depends on precision of T.DIST.2T

## Applicability

Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
	A	B		A	B
1				1	
2	Probability	0.05		2	Probability
3	Degrees of Freedom	12		3	Degrees of Freedom
4	Two-Tailed Inverse	=T.INV.2T(C2,C3)		4	Two-Tailed Inverse
-					

# 430. T.INV Function

## Description

The T.INV function returns the left-tailed inverse of the Student's t-distribution.

## Syntax

```
T.INV (probability,deg_freedom)
```

## Arguments

Argument	Description	Required /Optional
Probability	The probability associated with the Student's t-distribution.	Required
Deg_freedom	The number of degrees of freedom with which to characterize the distribution.	Required

## Notes

- If deg\_freedom is not an integer, it is truncated.
- If either argument is nonnumeric, T.INV returns the #VALUE! error value.
- If probability <= 0 or if probability > 1, T.INV returns the #NUM! error value.
- If deg\_freedom < 1, T.INV returns the #NUM! error value.

## Applicability

Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Alpha	0.025	2	Alpha	0.025
3	Degrees of Freedom	15	3	Degrees of Freedom	15
4	Confidence Interval	=T.INV(C2,C3)	4	Confidence Interval	-2.13
e			e		

# 431. T.TEST Function

## Description

The T.TEST function returns the probability associated with a Student's t-Test. Use T.TEST to determine whether two samples are likely to have come from the same two underlying populations that have the same mean.

## Syntax

```
T.TEST (array1,array2,tails,type)
```

## Arguments

Argument	Description	Required /Optional
Array1	The first data set.	Required
Array2	The second data set.	Required
Tails	Specifies the number of distribution tails. If tails = 1, T.TEST uses the one-tailed distribution. If tails = 2, T.TEST uses the two-tailed distribution.	Required
Type	The kind of t-Test to perform. Look at the Type-Test Table given below.	Required

## Type-Test Table

Type	Test Performed
1	Paired
2	Two-sample equal variance (homoscedastic)
3	Two-sample unequal variance (heteroscedastic)

## Notes

- T.TEST uses the data in array1 and array2 to compute a non-negative t-statistic
  - If tails=1, T.TEST returns the probability of a higher value of the t-statistic under the assumption that array1 and array2 are samples from populations with the same mean.
  - If tails=2, T.TEST returns the value that is double that returned when tails=1 and corresponds to the probability of a higher absolute value of the t-statistic under the "same population means" assumption.
- The tails and type arguments are truncated to integers.
- If array1 and array2 have a different number of data points, and type = 1 (paired), T.TEST returns the #N/A error value.
- If tails or type is nonnumeric, T.TEST returns the #VALUE! error value.

- If tails is any value other than 1 or 2, T.TEST returns the #NUM! error value.
- If type is any value other than 1, 2 or 3, T.TEST returns the #NUM! error value.

## Applicability

Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
	B	C		B	C
2	Array1	Array2	2	Array1	Array2
3	15.4	19	3	15.4	19.0
4	37.2	38.7	4	37.2	38.7
5	18.4	26.7	5	18.4	26.7
6	17.2	24.7	6	17.2	24.7
7	34.1	22.2	7	34.1	22.2
8	24.6	27.6	8	24.6	27.6
9	40.7	45.4	9	40.7	45.4
10	27.1	43.8	10	27.1	43.8
11	19.4	28.1	11	19.4	28.1
12	33.4	35.6	12	33.4	35.6
13	Tails	1	13		1
14	Type	1	14		1
15	Tails	2	15		2
16	Probability one-tail	=T.TEST(B3:B12,C3:C12,C13,C14)	16	Probability one-tail	0.043
17	Probability two-tail	=T.TEST(B3:B12,C3:C12,C15,C14)	17	Probability two-tail	0.086

# 432. TREND Function

## Description

The TREND function returns values along a linear trend. Fits a straight line (using the method of least squares) to the arrays known\_y's and known\_x's. Returns the y-values along that line for the array of new\_x's that you specify.

## Syntax

```
TREND (known_y's, [known_x's], [new_x's], [const])
```

## Arguments

Argument	Description	Required /Optional
Known_y's	<p>The set of y-values you already know in the relationship <math>y = mx + b</math>. If the array known_y's is in a single column, then each column of known_x's is interpreted as a separate variable. If the array known_y's is in a single row, then each row of known_x's is interpreted as a separate variable.</p>	Required
Known_x's	<p>An optional set of x-values that you may already know in the relationship <math>y = mx + b</math>. The array known_x's can include one or more sets of variables. If only one variable is used, known_y's and known_x's can be ranges of any shape, as long as they have equal dimensions. If more than one variable is used, known_y's must be a vector (i.e., a range with a height of one row or a width of one column). If known_x's is omitted, it is assumed to be the array {1,2,3,...} that is the same size as known_y's.</p>	Optional
New_x's	<p>New x-values for which you want TREND to return corresponding y-values. New_x's must include a column (or row) for each independent variable, just as known_x's does. So, if known_y's is in a single column, known_x's and new_x's must have the same number of columns. If known_y's is in a single row, known_x's and new_x's must have the same number of rows. If you omit new_x's, it is assumed to be the same as known_x's. If you omit both known_x's and new_x's, they are assumed to be the array {1,2,3,...} that is the same size as known_y's.</p>	Optional

Argument	Description	Required /Optional
Const	A logical value specifying whether to force the constant b to equal 0. If const is TRUE or omitted, b is calculated normally. If const is FALSE, b is set equal to 0 (zero), and the m-values are adjusted so that $y = mx$ .	Optional

## Notes

- Formulas that return arrays must be entered as array formulas.
- You can use TREND for polynomial curve fitting by regressing against the same variable raised to different powers.
- When entering an array constant for an argument such as known\_x's, use commas to separate values in the same row and semicolons to separate rows.
- If the known\_x's array and the known\_y's array are of different lengths, TREND returns #REF! error value.
- If any of the values in the supplied known\_x's, known\_y's or new\_x's arrays are non-numeric, TREND returns #VALUE! error value.
- If the supplied const argument is not recognized as a logical value, TREND returns #VALUE! error value.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
<b>Historical Data</b>					
	<b>Month</b>	<b>Sales</b>		<b>Month</b>	<b>Sales</b>
1	1000		1	1	\$1,000
2	2000		2	2	\$2,000
3	2500		3	3	\$2,500
4	3500		4	4	\$3,500
5	3800		5	5	\$3,800
6	4000		6	6	\$4,000
<b>Predicted Values</b>					
	<b>Month</b>	<b>Sales</b>		<b>Month</b>	<b>Sales</b>
7	=TREND(C4:C9,B4:B9,B13:B18)		12	7	\$4,940
8	=TREND(C4:C9,B4:B9,B13:B18)		13	8	\$5,551
9	=TREND(C4:C9,B4:B9,B13:B18)		14	9	\$6,163
10	=TREND(C4:C9,B4:B9,B13:B18)		15	10	\$6,774
11	=TREND(C4:C9,B4:B9,B13:B18)		16	11	\$7,386
12	=TREND(C4:C9,B4:B9,B13:B18)		17	12	\$7,997

# 433. TRIMMEAN Function

## Description

The TRIMMEAN function returns the mean of the interior of a data set. TRIMMEAN calculates the mean taken by excluding a percentage of data points from the top and bottom tails of a data set. You can use this function when you wish to exclude outlying data from your analysis.

## Syntax

TRIMMEAN (array, percent)
---------------------------

## Arguments

Argument	Description	Required /Optional
Array	The array or range of values to trim and average.	Required
Percent	The fractional number of data points to exclude from the calculation.	Required

## Notes

- TRIMMEAN rounds the number of excluded data points down to the nearest multiple of 2. If percent = 0.1, 10 percent of 30 data points equals 3 points. For symmetry, TRIMMEAN excludes a single value from the top and bottom of the data set.
- If percent < 0 or percent > 1, TRIMMEAN returns the #NUM! error value.
- If the supplied array is empty, TRIMMEAN returns the #NUM! error value.
- If the percent is non-numeric, TRIMMEAN returns the #VALUE! error value.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

**Example**

Function Usage		Results	
A	B	A	B
1		1	
2	Array	2	Array
3	4	3	4
4	5	4	5
5	8	5	8
6	4	6	4
7	8	7	8
8	4	8	4
9	4	9	4
10	2	10	2
11	1	11	1
12	1	12	1
13	=TRIMMEAN(B3:B12,0.2)	13	4.00
..		..	

# 434. VAR.P Function

## Description

The VAR.P function calculates variance based on the entire population (ignores logical values and text in the population).

## Syntax

```
VAR.P (number1, [number2]...)
```

## Arguments

Argument	Description	Required /Optional
Number1	The first number argument corresponding to a population.	Required
Number2, ...	Number arguments 2 to 254 corresponding to a population.	Optional

## Notes

- The equation for VAR.P is-

$$\frac{\sum (x - \bar{x})^2}{n}$$

Where  $x$  is the sample mean AVERAGE (number1, number2...) and  $n$  is the sample size.

- VAR.P assumes that its arguments are the entire population. If your data represents a sample of the population, then compute the variance by using VAR.S
- Arguments can either be numbers or names, arrays, or references that contain numbers.
- Logical values, and text representations of numbers that you type directly into the list of arguments are counted.
- If an argument is an array or reference, only numbers in that array or reference are counted. Empty cells, logical values, text, or error values in the array or reference are ignored.
- If any values that are supplied directly to the Function are text values that cannot be interpreted as numeric values, VAR.P returns the #VALUE! error value.
- If none of the values that have been supplied to the function are numeric, VAR.P returns the #DIV/0! error value.

- If you want to include logical values and text representations of numbers in a reference as part of the calculation, use the VARPA function.

## Applicability

Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage					Results							
	A	B	C	D	E	F	A	B	C	D	E	F
1							1					
2		Values			Variance		2	Values			Variance	
3		10	10	9	10	=VAR.P(B3:E3)	3	10	10	9	10	0.1875
4		10	10	11	10	=VAR.P(B4:E4)	4	10	10	11	10	0.1875
5		10	11	9	12	=VAR.P(B5:E5)	5	10	11	9	12	1.25

# 435. VAR.S Function

## Description

Estimates variance based on a sample (ignores logical values and text in the sample).

## Syntax

```
VAR.S (number1,[number2],...)
```

## Arguments

Argument	Description	Required /Optional
Number1	The first number argument corresponding to a sample of a population.	Required
Number2, ...	Number arguments 2 to 254 corresponding to a sample of a population.	Optional

## Notes

- VAR.S uses the following formula-

$$\frac{\sum (x - \bar{x})^2}{(n - 1)}$$

Where  $x$  is the sample mean AVERAGE (number1,number2,...) and  $n$  is the sample size.

- VAR.S assumes that its arguments are a sample of the population. If your data represents the entire population, then compute the variance by using VAR.P
- Arguments can either be numbers or names, arrays, or references that contain numbers.
- Logical values, and text representations of numbers that you type directly into the list of arguments are counted.
- If an argument is an array or reference, only numbers in that array or reference are counted. Empty cells, logical values, text, or error values in the array or reference are ignored.
- Arguments that are error values or text that cannot be translated into numbers cause errors.
- If you want to include logical values and text representations of numbers in a reference as part of the calculation, use the VARA function.

- If fewer than 2 numeric values have been supplied to the Function, VAR.S returns the #DIV/0! error value.
- If any values that are supplied directly to the Function are text values that cannot be interpreted as numeric values, VAR.S returns the #VALUE! error value.

## Applicability

Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage						Results							
	A	B	C	D	E	F		A	B	C	D	E	F
1							1						
2		Values			Variance		2		Values			Variance	
3	10	10	9	10	=VAR.S(B3:E3)		3	10	10	9	10	0.25	
4	10	10	11	10	=VAR.S(B4:E4)		4	10	10	11	10	0.25	
5	10	11	9	12	=VAR.S(B5:E5)		5	10	11	9	12	1.6666666667	

# 436. VARA Function

## Description

The VARA function estimates variance based on a sample. In addition to numbers, text and logical values such as TRUE and FALSE are included in the calculation.

## Syntax

```
VARA (value1, [value2] ...)
```

## Arguments

Argument	Description	Required /Optional
value1	1 to 255 value arguments corresponding to a sample of a population.	Required
value2, ...		Optional

## Notes

- VARA uses the following formula-

$$\frac{\sum (x - \bar{x})^2}{(n-1)}$$

Where x is the sample mean AVERAGE (value1,value2,...) and n is the sample size.

- VARA assumes that its arguments are a sample of the population. If your data represents the entire population, you must compute the variance by using VARPA.
- Arguments can be the following: numbers; names, arrays, or references that contain numbers; text representations of numbers; or logical values, such as TRUE and FALSE, in a reference.
- Logical values and text representations of numbers that you type directly into the list of arguments are counted.
- Arguments that contain TRUE evaluate as 1. Arguments that contain text or FALSE evaluate as 0 (zero).
- If an argument is an array or reference, only values in that array or reference are used. Empty cells and text values in the array or reference are ignored.
- Arguments that are error values or text that cannot be translated into numbers cause errors.

- If you do not want to include logical values and text representations of numbers in a reference as part of the calculation, use the VAR function.
- If fewer than 2 numeric values have been supplied to the Function, VARA returns #DIV/0! error value.
- If any values that are supplied directly to the Function are text values that cannot be interpreted as numeric values, VARA returns #VALUE! error value.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage					Results							
	A	B	C	D	E	F	A	B	C	D	E	F
1							1					
2		Values			Variance		2	Values			Variance	
3	10	10	TRUE	10	=VARA(B3:E3)		3	10	10	TRUE	10	20.25
4	10	10	FALSE	10	=VARA(B4:E4)		4	10	10	FALSE	10	25
5	10	11	TRUE	12	=VARA(B5:E5)		5	10	11	TRUE	12	25.666666667
c							c					

# 437. VARPA Function

## Description

The VARPA function calculates variance based on the entire population.

## Syntax

```
VARPA (value1, [value2] ...)
```

## Arguments

Argument	Description	Required /Optional
Value1	1 to 255 value arguments corresponding to a population.	Required
value2, ...		Optional

## Notes

- The equation for VARPA is-

$$\frac{\sum (x - \bar{x})^2}{n}$$

Where x is the sample mean AVERAGE (value1,value2,...) and n is the sample size.

- VARPA assumes that its arguments are the entire population. If your data represents a sample of the population, you must compute the variance by using VARA.
- Arguments can be numbers, names, arrays, or references that contain numbers, text representations of numbers or logical values, such as TRUE and FALSE, in a reference.
- Logical values and text representations of numbers that you type directly into the list of arguments are counted.
- Arguments that contain TRUE evaluate as 1; arguments that contain text or FALSE evaluate as 0 (zero).
- If an argument is an array or reference, only values in that array or reference are used. Empty cells and text values in the array or reference are ignored.
- If you do not want to include logical values and text representations of numbers in a reference as part of the calculation, use the VARP function.
- If none of the values that have been supplied to the function are numeric, VARPA returns the #DIV/0! Error value.

- If any values that are supplied directly to the Function are text values that cannot be interpreted as numeric values, VARPA returns the #VALUE! Error value.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage					Results						
A	B	C	D	E	F	A	B	C	D	E	F
1						1					
2	Values			Variance	=VARPA(B3:E3)	2	Values			Variance	
3	10	10	9	10	=VARPA(B4:E4)	3	10	10	9	10	0.1875
4	10	10	11	10	=VARPA(B5:E5)	4	10	10	11	10	0.1875
5	10	11	9	12		5	10	11	9	12	1.25
c						c					

# 438. WEIBULL.DIST Function

## Description

The WEIBULL.DIST function returns the Weibull distribution. Use this distribution in reliability analysis, such as calculating a device's mean time to failure.

## Syntax

```
WEIBULL.DIST(x,alpha,beta,cumulative)
```

## Arguments

Argument	Description	Required /Optional
X	The value at which to evaluate the function.	Required
Alpha	A parameter to the distribution.	Required
Beta	A parameter to the distribution.	Required
Cumulative	Determines the form of the function.	Required

## Notes

- The equation for the Weibull cumulative distribution function is-

$$F(x; \alpha, \beta) = 1 - e^{-(x/\beta)^\alpha}$$

- The equation for the Weibull probability density function is-

$$f(x; \alpha, \beta) = \frac{\alpha}{\beta^\alpha} x^{\alpha-1} e^{-(x/\beta)^\alpha}$$

- When alpha = 1, WEIBULL.DIST returns the exponential distribution with-

$$\lambda = \frac{1}{\beta}$$

- If x, alpha, or beta is nonnumeric, WEIBULL.DIST returns the #VALUE! error value.
- If x < 0, WEIBULL.DIST returns the #NUM! error value.
- If alpha ≤ 0 or if beta ≤ 0, WEIBULL.DIST returns the #NUM! error value.

## Applicability

Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	x	1320	2	x	1320
3	Alpha	14.71	3	Alpha	14.71
4	Beta	1243.44	4	Beta	1243.44
5	Cumulative	TRUE	5	Cumulative	TRUE
6	Weibull Distribution Value	=WEIBULL.DIST(C2,C3,C4,C5)	6	Weibull Distribution Value	0.91

# 439. Z.TEST Function

## Description

The Z.TEST function returns the one-tailed P-value of a z-test. For a given hypothesized population mean,  $x$ , Z.TEST returns the probability that the sample mean would be greater than the average of observations in the data set (array) i.e. the observed sample mean.

## Syntax

```
Z.TEST (array,x,[sigma])
```

## Arguments

Argument	Description	Required /Optional
Array	The array or range of data against which to test $x$ .	Required
$x$	The value to test	Required
Sigma	The population (known) standard deviation. If omitted, the sample standard deviation is used.	Optional

## Notes

- Z.TEST is calculated as follows
  - when sigma is not omitted:  
$$Z.TEST( \text{array},x,\text{sigma} ) = 1 - \text{Norm.S.Dist} ((\text{Average(array)} - x) / (\text{sigma}/\sqrt{n}), \text{TRUE})$$
  - when sigma is omitted:  
$$Z.TEST( \text{array},x ) = 1 - \text{Norm.S.Dist} ((\text{Average(array)} - x) / (\text{STDEV(array})/\sqrt{n}), \text{TRUE})$$
  
where  $x$  is the sample mean  $\text{AVERAGE(array)}$ , and  $n$  is  $\text{COUNT(array)}$ .
- If array is empty, Z.TEST returns the #N/A error value.
- Z.TEST represents the probability that the sample mean would be greater than the observed value  $\text{AVERAGE(array)}$ , when the underlying population mean is  $\mu_0$ . From the symmetry of the Normal distribution, if  $\text{AVERAGE(array)} < x$ , Z.TEST will return a value greater than 0.5
- You can calculate the two-tailed probability that the sample mean would be further from  $x$  (in either direction) than  $\text{AVERAGE(array)}$ , when the underlying population mean is  $x$ :  
$$=2 * \text{MIN}(Z.TEST(\text{array},x,\text{sigma}), 1 - Z.TEST(\text{array},x,\text{sigma})).$$
- If the supplied array is empty, Z.TEST returns the #N/A error value.

- If the sigma argument is supplied and is equal to zero, Z.TEST returns the #NUM! error value.
- If the sigma argument is not supplied and the standard deviation of the supplied array is zero, Z.TEST returns the #DIV/0! error value.
- If the supplied array contains just one value, Z.TEST returns the #DIV/0! error value.
- If either the supplied x or the supplied sigma is non-numeric, Z.TEST returns the #VALUE! error value.

## Applicability

Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage		Results
	A      B	B
1		
2	<b>Array</b>	<b>Array</b>
3	4	4
4	5	5
5	5	5
6	4	4
7	5	5
8	4	4
9	4	4
10	2	2
11	2	2
12	6	6
13	=ZTEST(B3:B12,4)	0.4029

# 440. BAHTTEXT Function

## Description

The BAHTTEXT function converts a number to Thai text and adds a suffix of "Baht."

## Syntax

```
BAHTTEXT (number)
```

## Arguments

Argument	Description	Required /Optional
Number	A number you want to convert to text, or a reference to a cell containing a number, or a formula that evaluates to a number.	Required

## Notes

- You can change the Baht format to a different style in the Excel desktop application by using Regional and Language Options in Control Panel of Windows.
- If number is not recognized as a numeric value, BAHTTEXT returns #VALUE! Error value.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
	A	B		A	B
1			1		
2		Number	2		Number
3	755	=BAHTTEXT(B3)	3	755	เจ็ดร้อยห้าสิบห้าบาทก้าว

# 441. CHAR Function

## Description

The CHAR function returns the character specified by a number. Use CHAR to translate code page numbers you might get from files on other types of computers into characters.

## Syntax

```
CHAR (number)
```

## Arguments

Argument	Description	Required /Optional
Number	A number between 1 and 255 specifying which character you want. The character is from the ANSI character set for Windows environment.	Required

## Notes

If number is not recognized as a numeric value or is a number outside of the permitted range 1 to 255, CHAR returns #VALUE! Error value

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
	A	B		A	B
1					
2		ANSI Number	Character		
3	66	=CHAR(B3)		66	B
4	80	=CHAR(B4)		80	P
5	53	=CHAR(B5)		53	5
6	63	=CHAR(B6)		63	?
7	216	=CHAR(B7)		216	Ø
n					

# 442. CLEAN Function

## Description

The CLEAN function removes all nonprintable characters from text. Use CLEAN on text imported from other applications that contains characters that may not print with your operating system.

## Syntax

```
CLEAN (text)
```

## Arguments

Argument	Description	Required /Optional
Text	Any worksheet information from which you want to remove nonprintable characters.	Required

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
	A	B		A	B
1					
2	Text	Clean Text			
3	=CLEAN(B3)				
4	Text	=CLEAN(B4)			
5	=CLEAN(B5)				

# 443. CODE Function

## Description

The CODE function returns a numeric code for the first character in a text string. The returned code corresponds to the ANSI character set for the Windows System.

## Syntax

```
CODE (text)
```

## Arguments

Argument	Description	Required /Optional
Text	The text for which you want the code of the first character.	Required

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
	A	B		A	B
1					
2		<code>=CODE(B3)</code>			
3	E				69
4	B				66
5	8				56
6	M				77
7	e				101
8	b				98
9	c				99
10	Example				69
11	example				101
12	My Example				77

# 444. CONCAT Function

## Description

Combines the text from multiple ranges and/or strings, but it doesn't provide the delimiter or IgnoreEmpty arguments. To include delimiters (such as spacing or ampersands (&)) between the texts you want to combine and to remove empty arguments you don't want to appear in the combined text result, you can use the TEXTJOIN Function.

In Excel 2016, CONCAT Function replaced the CONCATENATE Function.

## Syntax

```
CONCAT (text1, [text2] ...)
```

## Arguments

Argument	Description	Required /Optional
text1	Text item to be joined. A string, or array of strings, such as a range of cells.	Required
Text2, ...	Additional text items to join. There can be a maximum of 253 text arguments for the text items. Each can be a string, or array of strings, such as a range of cells.	Optional

## Notes

- Use commas to separate adjoining text items.
- Without designated spaces between separate text entries, the text entries will run together. You can add extra spaces as part of the CONCATENATE formula in two ways-
  - Add double quotation marks with a space between them " "
  - Add a space after the Text argument
- If the resulting string exceeds 32767 characters (cell limit), CONCAT returns the #VALUE! Error.

## Applicability

Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	B1	C1	2	B1	C1
3	B2	C2	3	B2	C2
4	B3	C3	4	B3	C3
5	B4	C4	5	B4	C4
6	B5	C5	6	B5	C5
7	=CONCAT(B2:C6)		7	B1C1B2C2B3C3B4C4B5C5	
8	=CONCAT(B2:B6,C2:C6)		8	B1B2B3B4B5C1C2C3C4C5	
9	=CONCAT(B3," ",B4)		9	B2 B3	
10	=CONCAT(B3," & ",B4)		10	B2 & B3	
11	=CONCAT("Words","and","Spaces")		11	WordsandSpaces	
12	=CONCAT("Words ","and ","Spaces")		12	Words and Spaces	
13	=CONCAT("Words","","and","","Spaces")		13	Words and Spaces	
14			14		

# 445. CONCATENATE Function

## Description

The CONCATENATE function joins two or more text strings into one string. In Excel 2016, CONCATENATE Function has been replaced with the CONCAT Function. The CONCATENATE Function is still available for backward compatibility.

## Syntax

```
CONCATENATE (text1, [text2] ...)
```

## Arguments

Argument	Description	Required /Optional
text1	The first item to join. The item can be a text value, number, or cell reference.	Required
Text2, ...	Additional text items to join. You can have up to 255 items, up to a total of 8,192 characters.	Optional

## Notes

- Use commas to separate adjoining text items.
- Numbers do not need to have quotation marks.
- Without designated spaces between separate text entries, the text entries will run together. You can add extra spaces as part of the CONCATENATE formula in two ways-
  - Add double quotation marks with a space between them " "
  - Add a space after the Text argument
- If quotation marks are missing from a Text argument, CONCATENATE returns #NAME? error value.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	D	E	F
1					
2	Text 1	Text 2	Concatenated Text		
3	Text	12	=CONCATENATE(B3,C3)		
4	Text	12	=CONCATENATE(B4,C4)		
5	Text	12	=CONCATENATE(B5," ",C5)		
6	Text	12	=CONCATENATE(B6," ",C6)		
7	Text	12	=CONCATENATE(B7," ",C7)		
8	Text	12	=CONCATENATE("Chapter",C8," ",B8)		

# 446. DOLLAR Function

## Description

The DOLLAR function converts a number to text format and applies a currency symbol. The name of the Function and the symbol that it applies depend upon your language settings.

## Syntax

```
DOLLAR (number, [decimals])
```

## Arguments

Argument	Description	Required /Optional
Number	A number, a reference to a cell containing a number, or a formula that evaluates to a number.	Required
Decimals	The number of digits to the right of the decimal point. If decimals is negative, number is rounded to the left of the decimal point. If you omit decimals, it is assumed to be 2.	Optional

## Notes

- The difference between formatting a cell with a ribbon command and using the DOLLAR Function is that DOLLAR converts its result to text.
- A number formatted with the Format Cells dialog box is still a number.
- You can continue to use the results generated by DOLLAR in other formulas, because Excel converts numbers entered as text to numbers while calculating.
- If either of the arguments is non-numeric, DOLLAR returns #VALUE! Error value.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Number	Function Usage	2	Number	Function Usage
3	80.25	=DOLLAR(B3)	3	80.25	\$80.25
4	80.25	=DOLLAR(B4,2)	4	80.25	\$80.25
5	80.25	=DOLLAR(B5,0)	5	80.25	\$80
6	80.25	=DOLLAR(B6,1)	6	80.25	\$80.3
7	80.25	=DOLLAR(B7,-1)	7	80.25	\$80
8	80.25	=DOLLAR(B8,-2)	8	80.25	\$100
9	80.25	=DOLLAR(B9,)	9	80.25	\$80
10	80.25	=DOLLAR(B10,"one")	10	80.25	#VALUE!

# 447. EXACT Function

## Description

The EXACT function compares two text strings and returns TRUE if they are exactly the same, FALSE otherwise.

## Syntax

```
EXACT (text1, text2)
```

## Arguments

Argument	Description	Required /Optional
Text1	The first text string.	Required
Text2	The second text string.	Required

## Notes

- EXACT is case-sensitive but ignores formatting differences.
- Use EXACT to test text being entered into a document.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Text1	Text2	2	Text1	Text2
3	Some Text	Some Text	=EXACT(B3,C3)	Some Text	Some Text
4	Some Text	Some text	=EXACT(B4,C4)	Some Text	Some text
5	Some Text	some Text	=EXACT(B5,C5)	Some Text	some Text
6	Some	Text	=EXACT(B6,C6)	Some	Text

# 448. FIND Function

## Description

FIND and FINDB locate one text string within a second text string, and return the number of the starting position of the first text string from the first character of the second text string.

FIND is intended for use with languages that use the single-byte character set (SBCS), whereas FINDB is intended for use with languages that use the double-byte character set (DBCS). The default language setting on your computer affects the return value as follows-

- **FIND** always counts each character, whether single-byte or double-byte, as 1, no matter what the default language setting is
- **FINDB** counts each double-byte character as 2 when you have enabled the editing of a language that supports DBCS and then set it as the default language. Otherwise, FINDB counts each character as 1

The languages that support DBCS include Japanese, Chinese (Simplified), Chinese (Traditional), and Korean.

## Syntax

```
FIND (find_text, within_text, [start_num])  
FINDB (find_text, within_text, [start_num])
```

## Arguments

Argument	Description	Required /Optional
Find_text	The text you want to find.	Required
Within_text	The text containing the text you want to find.	Required
Start_num	Specifies the character at which to start the search. The first character in within_text is character number 1. If you omit start_num, it is assumed to be 1.	Optional

## Notes

- FIND and FINDB are case sensitive and don't allow wildcard characters. If you do not want to do a case sensitive search or use wildcard characters, you can use SEARCH and SEARCHB.
- If find\_text is "" (empty text), FIND matches the first character in the search string (that is, the character numbered start\_num or 1).
- Find\_text cannot contain any wildcard characters.

- Use start\_num to skip a specified number of characters. FIND always returns the number of characters from the start of within\_text, counting the characters you skip if start\_num is greater than 1.
- If find\_text does not appear in within\_text, FIND and FINDB return the #VALUE! error value.
- If start\_num is not greater than zero, FIND and FINDB return the #VALUE! error value.
- If start\_num is greater than the length of within\_text, FIND and FINDB return the #VALUE! error value.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage				Results				
A	B	C	D	A	B	C	D	E
1				1				
2	Find Text	Within Text	Start Num	2	Find Text	Within Text	Start Num	Result
3	e	Some Text		3	e	Some Text		4
4	e	Some Text	1	4	e	Some Text	1	4
5	e	Some Text	5	5	e	Some Text	5	7
6	cc	Some Text		6	cc	Some Text		#VALUE!
7	e	Some Text	10	7	e	Some Text	10	#VALUE!
8	e	Some Text	-1	8	e	Some Text	-1	#VALUE!
9		Some Text		9		Some Text		1

# 449. FIXED Function

## Description

The FIXED function rounds a number to the specified number of decimals, formats the number in decimal format using a period and commas, and returns the result as text.

## Syntax

```
FIXED (number, [decimals], [no_commas])
```

## Arguments

Argument	Description	Required /Optional
Number	The number you want to round and convert to text.	Required
Decimals	The number of digits to the right of the decimal point.	Optional
No_commas	A logical value that, <ul style="list-style-type: none"><li>• if TRUE, prevents FIXED from including commas in the returned text</li><li>• if FALSE or omitted, then the returned text includes commas as usual</li></ul>	Optional

## Notes

- Numbers in Microsoft Excel can never have more than 15 significant digits, but decimals can be as large as 127.
- If decimals is negative, number is rounded to the left of the decimal point.
- If you omit decimals, it is assumed to be 2.
- The major difference between formatting a cell containing a number by using a command from Ribbon and formatting a number directly with the FIXED function is that FIXED converts its result to text. A number formatted with the Cells command is still a number.
- If Number or Decimals is non-numeric, FIXED returns #VALUE! Error value.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
	A	B		A	B
1			1		
2	<b>Number</b>	<b>Converted To Text</b>	2	<b>Number</b>	<b>Converted To Text</b>
3	80	=FIXED(B3)	3	80	80.00
4	80	=FIXED(B4,0)	4	80	80
5	80	=FIXED(B5,1)	5	80	80.0
6	80	=FIXED(B6,2)	6	80	80.00
7	80.25	=FIXED(B7)	7	80.25	80.25
8	80.25	=FIXED(B8,0)	8	80.25	80
9	80.25	=FIXED(B9,1)	9	80.25	80.3
10	80.25	=FIXED(B10,2)	10	80.25	80.25
11	8000	=FIXED(B11)	11	8000	8,000.00
12	8000.25	=FIXED(B12,0)	12	8000.25	8,000
13	8000.25	=FIXED(B13,0,TRUE)	13	8000.25	8000
14	8000.25	=FIXED(B14,0,FALSE)	14	8000.25	8,000

# 450. LEFT Function

## Description

**LEFT** returns the first character or characters in a text string, based on the number of characters you specify.

**LEFTB** returns the first character or characters in a text string, based on the number of bytes you specify. It counts 2 bytes per character only when a DBCS language is set as the default language. Otherwise LEFTB behaves the same as LEFT, counting 1 byte per character.

The languages that support DBCS include Japanese, Chinese (Simplified), Chinese (Traditional), and Korean.

## Syntax

```
LEFT (text, [num_chars])  
LEFTB (text, [num_bytes])
```

## Arguments

Argument	Description	Required /Optional
Text	The text string that contains the characters you want to extract.	Required
Num_chars	Specifies the number of characters you want LEFT to extract. Num_chars must be greater than or equal to zero. If num_chars is greater than the length of text, LEFT returns all of text. If num_chars is omitted, it is assumed to be 0.	Optional
Num_bytes	Specifies the number of characters you want LEFTB to extract, based on bytes.	Optional

## Notes

If num\_chars is < 0, LEFT returns #VALUE! error value.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
	A	B		A	B
1			2		
2	Text	Number of Characters	Extracted Characters	Text	Number of Characters
3	Excel Tutorial	1	=LEFT(B3,C3)	Excel Tutorial	1
4	Excel Tutorial	2	=LEFT(B4,C4)	Excel Tutorial	Ex
5	Excel Tutorial	3	=LEFT(B5,C5)	Excel Tutorial	Exc
6	Excel Tutorial	8	=LEFT(B6,C6)	Excel Tutorial	Excel Tu
7	Excel Tutorial	14	=LEFT(B7,C7)	Excel Tutorial	Excel Tutori
8	Excel Tutorial	15	=LEFT(B8,C8)	Excel Tutorial	Excel Tutorial
9	Excel Tutorial	0	=LEFT(B9,C9)	Excel Tutorial	0
10	Excel Tutorial		=LEFT(B10,C10)	Excel Tutorial	
11	Excel Tutorial	-1	=LEFT(B11,C11)	Excel Tutorial	#VALUE!

# 451. LEN Function

## Description

**LEN** returns the number of characters in a text string.

**LENB** returns the number of bytes used to represent the characters in a text string. It counts 2 bytes per character only when a DBCS language is set as the default language. Otherwise LENB behaves the same as LEN, counting 1 byte per character.

The languages that support DBCS include Japanese, Chinese (Simplified), Chinese (Traditional), and Korean.

## Syntax

LEN (text)

LENB (text)

## Arguments

Argument	Description	Required /Optional
Text	The text whose length you want to find. Spaces count as characters.	Required

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
	A	B		A	B
1			1		
2			2		
3	Excel	=LEN(B3)	3	Excel	5
4	Tutorial	=LEN(B4)	4	Tutorial	8
5	Excel Tutorial	=LEN(B5)	5	Excel Tutorial	14
6	Functions	=LEN(B6)	6	Functions	9
7	Excel Functions	=LEN(B7)	7	Excel Functions	15
8	Excel 2013	=LEN(B8)	8	Excel 2013	10
9	Excel 2016	=LEN(B9)	9	Excel 2016	10
			--		

# 452. LOWER Function

## Description

The LOWER function converts all uppercase letters in a text string to lowercase.

## Syntax

```
LOWER (text)
```

## Arguments

Argument	Description	Required /Optional
Text	The text you want to convert to lowercase. LOWER does not change characters in text that are not letters.	Required

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Text	Lower Case	2	Text	Lower Case
3	Excel	=LOWER(B3)	3	Excel	excel
4	Tutorial	=LOWER(B4)	4	Tutorial	tutorial
5	Excel Tutorial	=LOWER(B5)	5	Excel Tutorial	excel tutorial
6	Functions	=LOWER(B6)	6	Functions	functions
7	Excel Functions	=LOWER(B7)	7	Excel Functions	excel functions
8	Excel 2013	=LOWER(B8)	8	Excel 2013	excel 2013
9	Excel 2016	=LOWER(B9)	9	Excel 2016	excel 2016

# 453. MID Function

## Description

MID returns a specific number of characters from a text string, starting at the position you specify, based on the number of characters you specify.

MIDB returns a specific number of characters from a text string, starting at the position you specify, based on the number of bytes you specify.

MID is intended for use with languages that use the single-byte character set (SBCS), whereas MIDB is intended for use with languages that use the double-byte character set (DBCS). The default language setting on your computer affects the return value as follows-

- MID always counts each character, whether single-byte or double-byte, as 1, no matter what is the default language setting.
- MIDB counts each double-byte character as 2 when you have enabled the editing of a language that supports DBCS and then set it as the default language. Otherwise, MIDB counts each character as 1.

The languages that support DBCS include Japanese, Chinese (Simplified), Chinese (Traditional), and Korean.

## Syntax

```
MID (text, start_num, num_chars)  
MIDB (text, start_num, num_bytes)
```

## Arguments

Argument	Description	Required /Optional
Text	The text string containing the characters you want to extract.	Required
Start_num	The position of the first character you want to extract in text. <u>The first character in text has start_num 1, and so on.</u>	Required
Num_chars	Specifies the number of characters you want MID to return from text.	Required
Num_bytes	Specifies the number of characters you want MIDB to return from text, in bytes.	Required

## Notes

- If start\_num is greater than the length of text, MID returns "" (empty text).
- If start\_num is less than the length of text, but start\_num plus num\_chars exceeds the length of text, MID returns the characters up to the end of text.

- If start\_num is less than 1, MID returns the #VALUE! error value.
- If num\_chars is negative, MID returns the #VALUE! error value.
- If num\_bytes is negative, MIDB returns the #VALUE! error value.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage				Results					
	B	C	D	E	A	B	C	D	E
1					1				
2					2				
3	Text	Start Number	Number of Characters	Result	3	Text	Start Number	Number of Characters	Result
4	ABCDEFG	1	3	=MID(B3,C3,D3)	4	ABCDEFG	1	3	ABC
5	ABCDEFG	2	3	=MID(B4,C4,D4)	5	ABCDEFG	2	3	BCD
6	ABCDEFG	5	2	=MID(B5,C5,D5)	6	ABC-100-DEF	5	3	EF
7	ABC-100-DEF	5	3	=MID(B6,5,3)	7	ABC-200-DEF	5	3	100
8	ABC-200-DEF	5	3	=MID(B7,5,3)	9	ABC-300-DEF	5	3	200
9	ABC-300-DEF	5	3	=MID(B8,5,3)	10	Size: Large	7	99	300
11	Size: Large	7	99	=MID(B9,C9,D9)	11	Size: Medium	7	99	Large
12	Size: Medium	7	99	=MID(B10,C10,D10)	12	Size: Small	7	99	Medium
13	Size: Small	7	99	=MID(B11,C11,D11)	13	ABCDEFG	1	7	Small
14	ABCDEFG	1	7	=MID(B12,C12,D12)	14	ABCDEFG	1	8	ABCDEFG
15	ABCDEFG	1	8	=MID(B13,C13,D13)	15	ABCDEFG	1	5	ABCDE
16	ABCDEFG	1	5	=MID(B14,C14,D14)	16	ABCDEFG	1	5	ABCDE
17	ABCDEFG	4	7	=MID(B15,C15,D15)	17	ABCDEFG	4	7	DEFG
18	ABCDEFG	8	5	=MID(B16,C16,D16)	18	ABCDEFG	8	5	
19	ABCDEFG	-1	5	=MID(B17,C17,D17)	19	ABCDEFG	-1	5	#VALUE!

# 454. NUMBERVALUE Function

## Description

The NUMBERVALUE function converts text to a number, in a locale-independent way.

## Syntax

```
NUMBERVALUE (Text, [Decimal_separator], [Group_separator ])
```

## Arguments

Argument	Description	Required /Optional
Text	The text to convert to a number.	Required
Decimal_separator	The character used to separate the integer and fractional part of the result.	Optional
Group_separator	The character used to separate groupings of numbers, such as thousands from hundreds and millions from thousands.	Optional

## Notes

- If the Decimal\_separator and Group\_separator arguments are not specified, separators from the current locale are used.
- If multiple characters are used in the Decimal\_separator or Group\_separator arguments, only the first character is used.
- If an empty string ("") is specified as the Text argument, the result is 0.
- Empty spaces in the Text argument are ignored, even in the middle of the argument. For example, " 3 000 " is returned as 3000.
- If a decimal separator is used more than once in the Text argument, NUMBERVALUE returns the #VALUE! error value.
- If the group separator occurs before the decimal separator in the Text argument , the group separator is ignored.
- If the group separator occurs after the decimal separator in the Text argument, NUMBERVALUE returns the #VALUE! error value.
- If any of the arguments are not valid, NUMBERVALUE returns the #VALUE! error value.
- If the Text argument ends in one or more percent signs (%), they are used in the calculation of the result. Multiple percent signs are additive if they are used in the

Text argument just as they are if they are used in a formula. For example, =NUMBERVALUE("9%%") returns the same result (0.0009) as the formula =9%%

## Applicability

Excel 2013, Excel 2016

## Example

Function Usage		Results	
A	B	A	B
1		1	
2	Text	Text	Result
3	100000	=NUMBERVALUE(B3)	100,000.00
4	0.45	=NUMBERVALUE(B4)	45%
-		4	0.45

# 455. PROPER Function

## Description

The PROPER function capitalizes the first letter in a text string and any other letters in text that follow any character other than a letter. Converts all other letters to lowercase letters.

## Syntax

```
PROPER (text)
```

## Arguments

Argument	Description	Required /Optional
Text	Text enclosed in quotation marks, a formula that returns text, or a reference to a cell containing the text you want to partially capitalize.	Required

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	<b>Text</b>	<b>Result</b>	2	<b>Text</b>	<b>Result</b>
3	excel functions	=PROPER(B3)	3	excel functions	Excel Functions
4	EXCEL FUNCTIONS	=PROPER(B4)	4	EXCEL FUNCTIONS	Excel Functions
5	excel Functions	=PROPER(B5)	5	excel Functions	Excel Functions
6	EXcel functions	=PROPER(B6)	6	EXcel functions	Excel Functions
7	eXcel functions	=PROPER(B7)	7	eXcel functions	Excel Functions
8	EXCEL 2013	=PROPER(B8)	8	EXCEL 2013	Excel 2013
9	excel 2013	=PROPER(B9)	9	excel 2013	Excel 2013

# 456. REPLACE Function

## Description

The REPLACE function replaces part of a text string, based on the number of characters you specify, with a different text string.

REPLACEB replaces part of a text string, based on the number of bytes you specify, with a different text string.

REPLACE is intended for use with languages that use the single-byte character set (SBCS), whereas REPLACEB is intended for use with languages that use the double-byte character set (DBCS). The default language setting on your computer affects the return value as follows-

- **REPLACE** always counts each character, whether single-byte or double-byte, as 1, no matter what the default language setting is.
- **REPLACEB** counts each double-byte character as 2 when you have enabled the editing of a language that supports DBCS and then set it as the default language. Otherwise, REPLACEB counts each character as 1.

The languages that support DBCS include Japanese, Chinese (Simplified), Chinese (Traditional), and Korean.

## Syntax

```
REPLACE (old_text, start_num, num_chars, new_text)  
REPLACEB (old_text, start_num, num_bytes, new_text)
```

## Arguments

Argument	Description	Required /Optional
Old_text	Text in which you want to replace some characters.	Required
Start_num	The position of the character in old_text that you want to replace with new_text.	Required
Num_chars	The number of characters in old_text that you want REPLACE to replace with new_text.	Required
Num_bytes	The number of bytes in old_text that you want REPLACEB to replace with new_text.	Required
New_text	The text that will replace characters in old_text.	Required

## Notes

If start\_num or num\_chars is negative or is non-numeric, REPLACE returns #VALUE! error value.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

	Function Usage					Results
	A	B	C	D	E	F
1						
2	Old Text	Start Num	No. of Characters	New Characters	Modified Text	Modified Text
3	ABCDEFGH	3	1	N	=REPLACE(B3,C3,D3,E3)	ABNDEFGH
4	ABCDEFGH	3	5	N	=REPLACE(B4,C4,D4,E4)	ABNH
5	ABCDEFGH	2	1	Hello	=REPLACE(B5,C5,D5,E5)	AHelloCDEFGH
6	ABCDEFGH	3	5	Hello	=REPLACE(B6,C6,D6,E6)	ABHelloH
7	ABCDEFGH	-3	5	Hello	=REPLACE(B7,C7,D7,E7)	#VALUE!
8	ABCDEFGH	3	-5	Hello	=REPLACE(B8,C8,D8,E8)	#VALUE!
9	ABCDEFGH	Three	5	Hello	=REPLACE(B9,C9,D9,E9)	#VALUE!
10	ABCDEFGH	3	Five	Hello	=REPLACE(B10,C10,D10,E10)	#VALUE!

# 457. REPT Function

## Description

The REPT function repeats text a given number of times. Use REPT to fill a cell with a number of instances of a text string.

## Syntax

```
REPT (text, number_times)
```

## Arguments

Argument	Description	Required /Optional
Text	The text you want to repeat.	Required
Number_times	A positive number specifying the number of times to repeat text.	Required

## Notes

- If number\_times is 0 (zero), REPT returns "" (empty text).
- If number\_times is not an integer, it is truncated.
- The result of the REPT Function cannot be longer than 32,767 characters, or REPT returns #VALUE! error value.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Text	Number Times	2	Text	Number Times
3	B	3	3	B	3
4	B	3.8	4	B	3.8
5	B2	3	5	B2	3
6	-	15	6	-	15
7		15	7		15
8	B		8	B	
9	B	-1	9	B	-1
10	B	Two	10	B	Two
11	B	32800	11	B	32,800
12			12		

# 458. RIGHT Function

## Description

The **RIGHT** function returns the last character or characters in a text string, based on the number of characters you specify.

**RIGHTB** returns the last character or characters in a text string, based on the number of bytes you specify.

**RIGHT** is intended for use with languages that use the single-byte character set (SBCS), whereas **RIGHTB** is intended for use with languages that use the double-byte character set (DBCS). The default language setting on your computer affects the return value as follows:

- **RIGHT** always counts each character, whether single-byte or double-byte, as 1, no matter what the default language setting is.
- **RIGHTB** counts each double-byte character as 2 when you have enabled the editing of a language that supports DBCS and then set it as the default language. Otherwise, **RIGHTB** counts each character as 1.

The languages that support DBCS include Japanese, Chinese (Simplified), Chinese (Traditional), and Korean.

## Syntax

```
RIGHT (text, [num_chars])  
RIGHTB (text, [num_bytes])
```

## Arguments

Argument	Description	Required /Optional
Text	The text string containing the characters you want to extract.	Required
Num_chars	Specifies the number of characters you want <b>RIGHT</b> to extract.	Optional
Num_bytes	Specifies the number of characters you want <b>RIGHTB</b> to extract, based on bytes.	Optional

## Notes

- Num\_chars must be greater than or equal to zero.
- If num\_chars is greater than the length of text, **RIGHT** returns all of text.
- If num\_chars is omitted, it is assumed to be 1.
- If num\_chars is < 0, **RIGHT** returns #VALUE! Error.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
	A	B		A	B
1				1	
2				2	
3				3	Excel Functions
4			=RIGHT(B3,C3)	4	1
5			=RIGHT(B4,C4)	5	ns
6			=RIGHT(B5,C5)	6	ons
7			=RIGHT(B6,C6)	7	Functions
8		ABCD123	=RIGHT(B7,C7)	8	D123
9			=RIGHT(B8,C8)	9	
10			=RIGHT(B9)	10	s
11			=RIGHT(B10,C10)	11	
12		-2	=RIGHT(B11,C11)	12	#VALUE!
		18	=RIGHT(B12,C12)		Excel Functions

# 459. SEARCH Function

## Description

The SEARCH and SEARCHB Functions locate one text string within a second text string, and return the number of the starting position of the first text string from the first character of the second text string.

SEARCHB counts 2 bytes per character only when a DBCS language is set as the default language. Otherwise SEARCHB behaves the same as SEARCH, counting 1 byte per character.

The languages that support DBCS include Japanese, Chinese (Simplified), Chinese (Traditional), and Korean.

## Syntax

```
SEARCH (find_text,within_text,[start_num])  
SEARCHB (find_text,within_text,[start_num])
```

## Arguments

Argument	Description	Required /Optional
find_text	The text that you want to find.	Required
within_text	The text in which you want to search for the value of the find_text argument.	Required
start_num	The character number in the within_text argument at which you want to start searching.	Optional

## Notes

- The SEARCH and SEARCHB Functions are not case sensitive. If you want to do a case sensitive search, you can use FIND and FINDB.
- You can use the wildcard characters question mark (?) and asterisk (\*) in the find\_text argument. A question mark matches any single character; an asterisk matches any sequence of characters. If you want to find an actual question mark or asterisk, type a tilde (~) before the character.
- If the start\_num argument is omitted, it is assumed to be 1.
- If the value of find\_text is not found, the #VALUE! error value is returned.
- If start\_num is not greater than 0 (zero) or is greater than the length of the within\_text argument, the #VALUE! error value is returned.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

A	B	C
1		
2	Text String	Result
3	Excel Functions	=SEARCH("e",B3)
4	Excel Functions	=SEARCH("e",B4,2)
5	Excel Tutorial	=SEARCH("T",B5,8)
6	Excel Functions	=REPLACE(B6,SEARCH("Functions",B6),9,"Tutorial")

A	B	C
1		
2	Text String	Result
3	Excel Functions	1
4	Excel Functions	4
5	Excel Tutorial	9
6	Excel Functions	Excel Tutorial

**Function Usage**

**Results**

# 460. SUBSTITUTE Function

## Description

Substitutes new\_text for old\_text in a text string.

## Syntax

```
SUBSTITUTE (text, old_text, new_text, [instance_num])
```

## Arguments

Argument	Description	Required /Optional
Text	The text or the reference to a cell containing text for which you want to substitute characters.	Required
Old_text	The text you want to replace.	Required
New_text	The text you want to replace old_text with.	Required
Instance_num	Specifies which occurrence of old_text you want to replace with new_text.  If you specify instance_num, only that instance of old_text is replaced. Otherwise, every occurrence of old_text in text is changed to new_text.	Optional

## Notes

- Use SUBSTITUTE when you want to replace specific text in a text string.
- Use REPLACE when you want to replace any text that occurs in a specific location in a text string.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

		Function Usage			Results	
1	A	B	C	D	E	F
2	Text	Old Text	New Text	Instance	Result	Result
3	ABCDEFGH	CD	Hi		=SUBSTITUTE(B3,C3,D3)	ABHiEFGH
4	ABCDEFCD	CD	Hi		=SUBSTITUTE(B4,C4,D4)	ABHiEFHi
5	Excel Functions	Functions	Tutorial		=SUBSTITUTE(B5,C5,D5)	Excel Tutorial
6	ABCDEFCD	CD	Hi	1	=SUBSTITUTE(B6,C6,D6,E6)	ABHiEFCD
7	ABCDEFCD	CD	Hi	2	=SUBSTITUTE(B7,C7,D7,E7)	ABCDEFHi
8	ABCDEFCD	CD	Hi	3	=SUBSTITUTE(B8,C8,D8,E8)	ABCDEFCD
9	ABCDEFCD		Hi	2	=SUBSTITUTE(B9,C9,D9,E9)	ABCDEFCD
10		CD	Hi	2	=SUBSTITUTE(B10,C10,D10,E10)	
11	ABCDEFCD	CD	Hi	0	=SUBSTITUTE(B11,C11,D11,E11)	#VALUE!
12	ABCDEFCD	CD	Hi	-1	=SUBSTITUTE(B12,C12,D12,E12)	#VALUE!
13	ABCDEFGH	CD	Hi		=SUBSTITUTE(B13,C13,D13,E13)	#VALUE!

# 461. T Function

## Description

The T function returns the text referred to by value.

## Syntax

T (value)
-----------

## Arguments

Argument	Description	Required / Optional
Value	The value you want to test.	Required

## Notes

- If value is or refers to text, T returns value. If value does not refer to text, T returns "" (empty text).
- You do not generally need to use the T Function in a formula because Microsoft Excel automatically converts values as necessary. This Function is provided for compatibility with other spreadsheet programs.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	<b>Value</b>	<b>Result</b>	2	<b>Value</b>	<b>Result</b>
3	Text	=T(B3)	3	Text	Text
4	"Text"	=T(B4)	4	"Text"	"Text"
5	""	=T(B5)	5	""	""
6		=T(B6)	6		
7	Five	=T(B7)	7	Five	Five
8	5	=T(B8)	8	5	
9	42370	=T(B9)	9	1-Jan-16	
10	FALSE	=T(B10)	10	FALSE	
11	=5/0	=T(B11)	11	#DIV/0!	#DIV/0!

# 462. TEXT Function

## Description

The TEXT function converts a numeric value to text and lets you specify the display formatting by using special format strings.

This function is useful in situations where you want to display numbers in a more readable format, or you want to combine numbers with text or symbols.

## Syntax

```
TEXT (value, format_text)
```

## Arguments

Argument	Description	Required /Optional
value	A numeric value, a formula that evaluates to a numeric value, or a reference to a cell containing a numeric value.	Required
format_text	A numeric format as a text string enclosed in quotation marks, for example "m/d/yyyy" or "#,##0.00". The following sections provide you with specific formatting guidelines.	Required

## Guidelines for Number Formats

**Display decimal places and significant digits:** To format fractions or numbers that contain decimal points, include the following digit placeholders, decimal points, and thousand separators in the format\_text argument.

Placeholder	Description
0 (zero)	Displays insignificant zeros if a number has fewer digits than there are zeros in the format.
#	Follows the same rules as the 0 (zero). However, Excel does not display extra zeros when the number that you type has fewer digits on either side of the decimal than there are # symbols in the format.
?	Follows the same rules as the 0 (zero). However, Excel adds a space for insignificant zeros on either side of the decimal point so that decimal points are aligned in the column.
. (period)	Displays the decimal point in a number.

**Display a thousands separator:** To display a comma as a thousands separator or to scale a number by a multiple of 1,000, include the following separator in the number format.

, (comma)	Displays the thousands separator in a number. Excel separates thousands by commas if the format contains a comma that is enclosed by number signs (#) or by zeros. A comma that follows a digit placeholder scales the number by 1,000.
-----------	---

## Guidelines for Date and Time Formats

**Display days, months, and years:** To display numbers as date formats (such as days, months, and years), use the following codes in the format\_text argument.

m	Displays the month as a number without a leading zero.
mm	Displays the month as a number with a leading zero when appropriate.
mmm	Displays the month as an abbreviation (Jan to Dec).
mmmm	Displays the month as a full name (January to December).
mmmmm	Displays the month as a single letter (J to D).
d	Displays the day as a number without a leading zero.
dd	Displays the day as a number with a leading zero when appropriate.
ddd	Displays the day as an abbreviation (Sun to Sat).
ddd	Displays the day as a full name (Sunday to Saturday).
yy	Displays the year as a two-digit number.
yyyy	Displays the year as a four-digit number.

**Display hours, minutes, and seconds:** To display time formats (such as hours, minutes, and seconds), use the following codes in the format\_text argument.

h	Displays the hour as a number without a leading zero.
[h]	Displays elapsed time in hours. If you are working with a formula that returns a time in which the number of hours exceeds 24, use a number format that resembles [h]:mm:ss.
hh	Displays the hour as a number with a leading zero when appropriate. If the format contains <b>AM</b> or <b>PM</b> , the hour is shown based on the 12-hour clock. Otherwise, the hour is shown based on the 24-hour clock.

h	Displays the hour as a number without a leading zero.
m	Displays the minute as a number without a leading zero. The <b>m</b> or the <b>mm</b> code must appear immediately after the <b>h</b> or <b>hh</b> code or immediately before the <b>ss</b> code; otherwise, Excel displays the month instead of minutes.
[m]	Displays elapsed time in minutes. If you are working with a formula that returns a time in which the number of minutes exceeds 60, use a number format that resembles <b>[mm]:ss</b> .
mm	Displays the minute as a number with a leading zero when appropriate. The <b>m</b> or the <b>mm</b> code must appear immediately after the <b>h</b> or <b>hh</b> code or immediately before the <b>ss</b> code; otherwise, Excel displays the month instead of minutes.
s	Displays the second as a number without a leading zero.
[s]	Displays elapsed time in seconds. If you are working with a formula that returns a time in which the number of seconds exceeds 60, use a number format that resembles <b>[ss]</b> .
ss	Displays the second as a number with a leading zero when appropriate. If you want to display fractions of a second, use a number format that resembles <b>h:mm:ss.00</b> .
AM/PM, am/pm, A/P, a/p	Displays the hour based on a 12-hour clock. Excel displays <b>AM</b> , <b>am</b> , <b>A</b> , or <b>a</b> for times from midnight until noon and <b>PM</b> , <b>pm</b> , <b>P</b> , or <b>p</b> for times from noon until midnight.

### Guidelines for currency, percentages, and scientific notation format

**Include currency symbols:** To precede a number with a dollar sign (\$), type the dollar sign at the beginning of the format\_text argument (for example, "**\$#,##0.00**"). To enter one of the following currency symbols in a number format, press NUM LOCK and use the numeric keypad to type the ANSI code for the symbol.

You must use the numeric keypad; using the ALT key with the number keys in the top row of the keyboard will not generate ANSI codes.

To enter	Use this key combination
¢	ALT+0162
£	ALT+0163
¥	ALT+0165
€	ALT+0128

**Display percentages:** To display numbers as a percentage of 100, include the percent sign (%) in the format\_text argument.

**Display scientific notations:** To display numbers in scientific (exponential) format, use the following exponent codes in the format\_text argument.

E (E-, E+, e-, e+)	Displays a number in scientific (exponential) format. Excel displays a number to the right of the "E" or "e" that corresponds to the number of places that the decimal point was moved.
--------------------	---

## Guidelines for including Text and adding Spacing

If you include any of the following characters in the format\_text argument, they are displayed exactly as entered.

\$	Dollar sign
+	Plus sign
(	Left parenthesis
:	Colon
^	Circumflex accent (caret)
'	Apostrophe
{	Left curly bracket
<	Less-than sign
=	Equal sign
-	Minus sign
/	Slash mark
)	Right parenthesis
!	Exclamation point
&	Ampersand
~	Tilde
}	Right curly bracket
>	Greater-than sign

\$	Dollar sign
	Space character

The format\_text argument cannot contain an asterisk (\*)

Using the TEXT Function converts a numeric value to formatted text, and the result can no longer be calculated as a number

## Notes

- You can also format numbers by using the commands in the Number group on the Home tab of the Ribbon. However, these commands work only if the entire cell is numeric. If you want to format a number and combine it with other text, the TEXT Function is the best option.
- If you omit the quotation marks from around the format\_text argument, TEXT returns #NAME? error value.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
	B	C		B	C
1	A		1	A	
2	<b>Number</b>	<b>Text</b>	2	<b>Number</b>	<b>Text</b>
3	80	=TEXT(B3,"0.00")	3	80	80.00
4	80	=TEXT(B4,"\$0.00")	4	80	\$80.00
5	80	=TEXT(B5,"0")	5	80	80
6	80	=TEXT(B6,"\$0")	6	80	\$80
7	80.75	=TEXT(B7,"0.0")	7	80.75	80.8
8	80.75	=TEXT(B8,"\$0.00")	8	80.75	\$80.75
9	80750	=TEXT(B9,"0,0")	9	80750	80,750
10	42370	=TEXT(B10,"DD-MMMM-YYYY")	10	1/1/2016	01-January-2016
11	42370	=TEXT(B11,"DD-MMM-YY")	11	1/1/2016	01-Jan-16
12	42370	=TEXT(B12,"DDDD")	12	1/1/2016	Friday
--			--		

# 463. TEXTJOIN Function

## Description

The TEXTJOIN function combines the text from multiple ranges and/or strings, and includes a delimiter you specify between each text value that will be combined. If the delimiter is an empty text string, this function will effectively concatenate the ranges.

This function was added in Excel 2016.

## Syntax

```
TEXTJOIN (delimiter, ignore_empty, text1, [text2], ...)
```

## Arguments

Argument	Description	Required /Optional
delimiter	A text string, either empty, or one or more characters enclosed by double quotes, or a reference to a valid text string. If a number is supplied, it will be treated as text.	Required
ignore_empty	If TRUE, ignores empty cells.	Required
text1	Text item to be joined. A text string, or array of strings, such as a range of cells.	Required
Text2, ...	Additional text items to be joined. There can be a maximum of 252 text arguments for the text items, including text1. Each can be a text string, or array of strings, such as a range of cells.	Optional

## Notes

If the resulting string exceeds 32767 characters (cell limit), TEXTJOIN returns the #VALUE! Error.

## Applicability

Excel 2016

## Example

Function Usage			Results		
	A	B		A	B
1				1	
2	B1	C1		2	B1
3	B2	C2		3	B2
4	B3	C3		4	B3
5				5	
6	B5	C5		6	B5
7	=TEXTJOIN("",TRUE,B2:C6)			7	B1C1B2C2B3C3B5C5
8	=TEXTJOIN(", ",TRUE,B2:C6)			8	B1,C1,B2,C2,B3,C3,B5,C5
9	=TEXTJOIN(", ",FALSE,B2:C6)			9	B1,C1,B2,C2,B3,C3,,B5,C5
10	=TEXTJOIN(", ",FALSE,B2:B6,C2:C6)			10	B1,B2,B3,,B5,C1,C2,C3,,C5
11					

# 464. TRIM Function

## Description

The TRIM function removes all spaces from text except for single spaces between words. Use TRIM on text that you have received from another application that may have irregular spacing.

## Syntax

```
TRIM (text)
```

## Arguments

Argument	Description	Required /Optional
Text	The text from which you want spaces removed.	Required

## Notes

The TRIM function was designed to trim the 7-bit ASCII space character (value 32) from text. In the Unicode character set, there is an additional space character called the nonbreaking space character that has a decimal value of 160. This character is commonly used in Web pages as the HTML entity, and nbsp. By itself, the TRIM function does not remove this nonbreaking space character.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results																										
A	B	C	A	B	C																								
1			1																										
2	<table border="1"><thead><tr><th>Text</th><th>Result</th></tr></thead><tbody><tr><td>ABCDEF</td><td>=TRIM(B3)</td></tr><tr><td>A B C D E F</td><td>=TRIM(B4)</td></tr><tr><td>ABCDEF</td><td>=TRIM(B5)</td></tr><tr><td>AB CD EF</td><td>=TRIM(B6)</td></tr><tr><td>Excel Functions</td><td>=TRIM(B7)</td></tr></tbody></table>	Text	Result	ABCDEF	=TRIM(B3)	A B C D E F	=TRIM(B4)	ABCDEF	=TRIM(B5)	AB CD EF	=TRIM(B6)	Excel Functions	=TRIM(B7)		2	<table border="1"><thead><tr><th>Text</th><th>Result</th></tr></thead><tbody><tr><td>ABCDEF</td><td>ABCDEF</td></tr><tr><td>A B C D E F</td><td>A B C D E F</td></tr><tr><td>ABCDEF</td><td>ABCDEF</td></tr><tr><td>AB CD EF</td><td>AB CD EF</td></tr><tr><td>Excel Functions</td><td>Excel Functions</td></tr></tbody></table>	Text	Result	ABCDEF	ABCDEF	A B C D E F	A B C D E F	ABCDEF	ABCDEF	AB CD EF	AB CD EF	Excel Functions	Excel Functions	
Text	Result																												
ABCDEF	=TRIM(B3)																												
A B C D E F	=TRIM(B4)																												
ABCDEF	=TRIM(B5)																												
AB CD EF	=TRIM(B6)																												
Excel Functions	=TRIM(B7)																												
Text	Result																												
ABCDEF	ABCDEF																												
A B C D E F	A B C D E F																												
ABCDEF	ABCDEF																												
AB CD EF	AB CD EF																												
Excel Functions	Excel Functions																												
3			3																										
4			4																										
5			5																										
6			6																										
7			7																										
8			8																										

# 465. UNICHAR Function

## Description

The UNICHAR function returns the Unicode character that is referenced by the given numeric value.

## Syntax

```
UNICHAR (number)
```

## Arguments

Argument	Description	Required /Optional
Number	Number is the Unicode number that represents the character.	Required

## Notes

- The Unicode character that is returned can be a string of characters, for example in UTF-8 or UTF-16 codes.
- If Unicode numbers are partial surrogates and data types that are not valid, UNICHAR returns the #N/A error value.
- If numbers are numeric values that fall outside the allowable range, UNICHAR returns the #VALUE! error value.
- If number is zero (0), UNICHAR returns the #VALUE! error value.
- If number is not recognized as a numeric value, UNICHAR returns the #VALUE! error value.

## Applicability

Excel 2013, Excel 2016

## Example

Function Usage		Results	
A	B	A	C
1		1	
2	<b>Number</b>	<b>Result</b>	2
3	66	=UNICHAR(B3)	3
4	25	=UNICHAR(B4)	4
5	0	=UNICHAR(B5)	5
6	50	=UNICHAR(B6)	6
7	55	=UNICHAR(B7)	7
8	35	=UNICHAR(B8)	8
9	34	=UNICHAR(B9)	9
10	64	=UNICHAR(B10)	10

# 466. UNICODE Function

## Description

The UNICODE function returns the number (code point) corresponding to the first character of the text.

## Syntax

UNICODE (text)
----------------

## Arguments

Argument	Description	Required /Optional
Text	Text is the character for which you want the Unicode value.	Required

## Notes

If text contains partial surrogates or data types that are not valid, UNICODE returns the #VALUE! error value.

## Applicability

Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Text	Result	2	Text	Result
3	B	66	3	B	=UNICODE(B3)
4	ı	25	4	ı	=UNICODE(B4)
5	2	50	5	2	=UNICODE(B5)
6	7	55	6	7	=UNICODE(B6)
7	#	35	7	#	=UNICODE(B7)
8	"	34	8	"	=UNICODE(B8)
9	@	64	9	@	=UNICODE(B9)

# 467. UPPER Function

## Description

The UPPER function converts text to uppercase.

## Syntax

UPPER (text)
--------------

## Arguments

Argument	Description	Required /Optional
Text	The text you want converted to uppercase. Text can be a reference or text string.	Required

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	<b>Text</b>	<b>Result</b>	2	<b>Text</b>	<b>Result</b>
3	excel tutorial	=UPPER(B3)	3	excel tutorial	EXCEL TUTORIAL
4	Excel Tutorial	=UPPER(B4)	4	Excel Tutorial	EXCEL TUTORIAL
5	EXCEL Tutorial	=UPPER(B5)	5	EXCEL Tutorial	EXCEL TUTORIAL
6	abcd12345	=UPPER(B6)	6	abcd12345	ABCD12345
7	Abcd12345	=UPPER(B7)	7	Abcd12345	ABCD12345

# 468. VALUE Function

## Description

The VALUE function converts a text string that represents a number to a number.

## Syntax

```
VALUE (text)
```

## Arguments

Argument	Description	Required /Optional
Text	The text enclosed in quotation marks or a reference to a cell containing the text you want to convert.	Required

## Notes

- Text can be in any of the constant number, date, or time formats recognized by Microsoft Excel. If text is not in one of these formats, VALUE returns the #VALUE! error value.
- You do not generally need to use the VALUE function in a formula because Excel automatically converts text to numbers as necessary. This function is provided for compatibility with other spreadsheet programs.

## Applicability

Excel 2007, Excel 2010, Excel 2013, Excel 2016

## Example

Function Usage			Results		
A	B	C	A	B	C
1			1		
2	Text	Result	2	Text	Result
3	0.15	=VALUE(B3)	3	15%	0.15
4		=VALUE(B4)	4		0
5	5000	=VALUE(B5)	5	\$5,000	5000
6	0.60416666666667	=VALUE(B6)	6	14:30	0.604166667
7	0.10416666666667	=VALUE(B7)	7	2:30	0.104166667
8	December	=VALUE(B8)	8	December	#VALUE!
9	42370	=VALUE(B9)	9	1/1/2016	42370

# 469. ENCODEURL Function

## Description

The ENCODEURL function returns a URL-encoded string.

## Syntax

```
ENCODEURL (text)
```

## Arguments

Argument	Description	Required /Optional
Text	A string to be URL encoded.	Required

## Applicability

Excel 2013, Excel 2016

## Example

Function Usage		
A	B	C
1		
2	URL	http://en.wikipedia.org
3	Encoded URL	=ENCODEURL(C2)

Results		
A	B	C
1		
2	URL	http://en.wikipedia.org
3	Encoded URL	http%3A%2F%2Fen.wikipedia.org

# 470. FILTERXML Function

## Description

The FILTERXML function returns specific data from the XML content by using the specified XPath.

## Syntax

```
FILTERXML (xml, xpath)
```

## Arguments

Argument	Description	Required /Optional
Xml	A string in valid XML format.	Required
Xpath	A string in standard XPath format.	Required

## Notes

- If Xml is not valid, FILTERXML returns the #VALUE! error value.
- If Xml contains a namespace with a prefix that is not valid, FILTERXML returns the #VALUE! error value.

## Applicability

Excel 2013, Excel 2016

## Example

	A	B	C	D	
1					
2		Query URL: http://en.wikipedia.org/w/api.php?action=query&list=recentchanges &rcnamespace=0&format=xml			
3		XML Response: =WEBSERVICE(C2)			
4			=FILTERXML(C3,"//rc/@title")	=FILTERXML(C3,"//rc/@timestamp")	
5			=FILTERXML(C3,"//rc/@title")	=FILTERXML(C3,"//rc/@timestamp")	
6			=FILTERXML(C3,"//rc/@title")	=FILTERXML(C3,"//rc/@timestamp")	
					Function Usage
4		Most recently changed:	Destil Trappers	4/28/16 8:01 AM	Results
5			Jessica Jung	4/28/16 8:01 AM	
6			Edward R. Ladew	4/28/16 8:01 AM	

# 471. WEBSERVICE Function

## Description

The WEBSERVICE function returns data from a web service on the Internet or Intranet.

## Syntax

```
WEBSERVICE (url)
```

## Arguments

Argument	Description	Required /Optional
url	The URL of the web service.	Required

## Notes

- If arguments are unable to return the data, WEBSERVICE returns the #VALUE! error value.
- If arguments result in a string that is not valid or that contains more than the allowable cell limit of 32767 characters, WEBSERVICE returns the #VALUE! error value.
- If URL is a string that contains more than the 2048 characters that are allowed for a GET request, WEBSERVICE returns the #VALUE! error value.
- For protocols that aren't supported, such as **ftp://** or **file://**, WEBSERVICE returns the #VALUE! error value.

## Applicability

Excel 2013, Excel 2016

## Example

		Function Usage
Query URL:	http://en.wikipedia.org/w/api.php?action=query&list=recentchanges&rcnamespace=0&format=xml	
XML Response:	=WEBSERVICE(C2)	
Query URL:	http://en.wikipedia.org/w/api.php?action=query&list=recentchanges&rcnamespace=0&format=xml	
XML Response:	<pre>&lt;?xml version="1.0"?&gt;&lt;api batchcomplete=""&gt;&lt;continue rccontinue="20160428091041 820072544" continue="1 1" /&gt;&lt;query&gt;&lt;recentchanges&gt;&lt;rc type="edit" ns="0" title="Sukumari filmography" pageid="48892764" revid="717539216" old_revid="717396837" rcid="820072559" timestamp="2016-04-28T09:10:46Z" /&gt;&lt;rc type="edit" ns="0" title="Stjepan Kovačević" pageid="25540497" revid="717539215" old_revid="669025373" rcid="820072558" timestamp="2016-04-28T09:10:45Z" /&gt;&lt;rc type="edit" ns="0" title="Tara Institute" pageid="15036782" revid="717539214" old_revid="717539160" rcid="820072557" timestamp="2016-04-28T09:10:45Z" /&gt;&lt;rc type="edit" ns="0" title="John C. Van Hollen" pageid="25278044" revid="717539212" old_revid="631962805" rcid="820072555" timestamp="2016-04-28T09:10:44Z" /&gt;&lt;rc type="edit" ns="0" title="Jonathan Bertman" pageid="13064477" revid="717539211" old_revid="717424580" rcid="820072554" timestamp="2016-04-28T09:10:44Z" /&gt;&lt;rc type="edit" ns="0" title="Salakau" pageid="6493499" revid="717539210" old_revid="717501138" rcid="820072553" timestamp="2016-04-28T09:10:44Z" /&gt;&lt;rc type="edit" ns="0" title="Bennie Ward" pageid="28525264" revid="717539209" old_revid="643670240" rcid="820072552" timestamp="2016-04-28T09:10:44Z" /&gt;&lt;rc type="edit" ns="0" title="John Golightly" pageid="25540555" revid="717539208" old_revid="697023051" rcid="820072551" timestamp="2016-04-28T09:10:43Z" /&gt;&lt;rc type="edit" ns="0" title="The Kelly Family" pageid="13133277" revid="717539207" old_revid="713093925" rcid="820072549" timestamp="2016-04-28T09:10:41Z" /&gt;&lt;rc type="edit" ns="0" title="Tim Stratton" pageid="25540626" revid="717539206" old_revid="643412243" rcid="820072545" timestamp="2016-04-28T09:10:41Z" /&gt;&lt;/recentchanges&gt;&lt;/query&gt;&lt;/api&gt;</pre>	Results