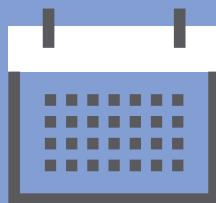
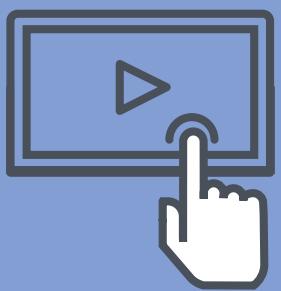


# EXCELJET



# 101 EXCEL FUNCTIONS

You Should Know



PDF GUIDE



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Published: 2021-04-14 09:59:45

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# 101 Excel Functions

Excel has over 480 built-in functions, and more are still being added. That is a huge number of functions to think about, even for advanced users. Thankfully, you don't need to learn all of these functions to be productive in Excel. If you have a basic understanding of about a hundred key functions, you'll be far ahead of the average user.

This document contains a brief overview of about 100 important Excel functions you should know, with links to detailed examples. It is based on a more complete list of Excel functions [here](#).

## Excel Function List

Excel functions by category. Optional arguments in white. Click any function for a detailed description with formula examples. Also see [500 Formulas](#) and [101 Functions](#).

Logical	
<a href="#">AND</a>	Test multiple conditions with AND logical logical2 ...
<a href="#">FALSE</a>	Generate the logical value FALSE
<a href="#">IF</a>	Test for a specific condition logical_test value_if_true value_if_false
<a href="#">IFERROR</a>	Trap and handle errors value value_if_error
<a href="#">IFNA</a>	Trap and handle #N/A errors value value_if_na
<a href="#">IFS</a>	Test multiple conditions, return first true test1 value1 test2,value2 ...
<a href="#">NOT</a>	Reverse arguments or results logical
<a href="#">OR</a>	Test multiple conditions with OR logical1 logical2 ...
<a href="#">SWITCH</a>	Match multiple values, return first match expression val1/result1 val2/result2 ... default
<a href="#">TRUE</a>	Generate the logical value TRUE
<a href="#">XOR</a>	Perform exclusive OR logical1 logical2 ...

## Excel Function List

We also have a [large list of example formulas](#) and [video training](#). If you are new to Excel formulas and how functions are used, [see this introduction](#).

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## Date and Time Functions

Excel provides many functions to work with [dates](#) and [times](#).

### NOW and TODAY

You can get the current date with the [TODAY function](#) and the current date and time with the [NOW Function](#). Technically, the NOW function returns the current date and time, but you can format as time only, as seen below:

The screenshot shows an Excel spreadsheet with the following data:

C4	A	B	C	D	E	F	G
1							
2							
3							
4							
5							
6							
7							

*Current time and date*

TODAY      15-Nov-2018

NOW      1:37 PM

**EXCELJET**

**Code Snippet:**

```
TODAY() // returns current date
NOW() // returns current time
```

Note: these are [volatile functions](#) and will recalculate with every worksheet change. If you want a static value, use [date](#) and [time](#) shortcuts.

**DATE SHORTCUT:** This shortcut will insert the current date as a fixed value; it will not change.

Windows shortcut	Mac shortcut
Ctrl ;	^ ;

**TIME SHORCUT:** This shortcut will insert the current time as a fixed value; it will not change. [Note: In Mac 2016, Control Shift : stopped working to insert a time. Command ; now seems to work.]

Windows shortcut	Mac shortcut
Ctrl Shift :	⌘ ;

[More excel shortcuts.](#)



**Easily add Date and Time to your Excel files using these functions**

## DAY, MONTH, YEAR, and DATE

You can use the [DAY](#), [MONTH](#), and [YEAR](#) functions to disassemble any date into its raw components, and the [DATE function](#) to put things back together again.

A screenshot of Microsoft Excel demonstrating the breakdown and reconstruction of dates. The formula `=DATE(D5,E5,F5)` is entered in cell H5. The data in columns A, B, C, D, E, F, and G shows various dates and their corresponding year, month, and day components.

Date	YEAR	MONTH	DAY	DATE
14-Nov-18	2018	11	14	14-Nov-18
23-Apr-12	2012	4	23	23-Apr-12
20-Feb-00	2000	2	20	20-Feb-00
4-Oct-95	1995	10	4	4-Oct-95

```

=DAY("14-Nov-2018") // returns 14
=MONTH("14-Nov-2018") // returns 11
=YEAR("14-Nov-2018") // returns 2018
=DATE(2018,11,14) // returns 14-Nov-2018
  
```

## HOUR, MINUTE, SECOND, and TIME

Excel provides a set of parallel functions for times. You can use the [HOUR](#), [MINUTE](#), and [SECOND](#) functions to extract pieces of a time, and you can assemble a [TIME](#) from individual components with the [TIME function](#).

A screenshot of Microsoft Excel demonstrating the breakdown and reconstruction of times. The formula `=TIME(D5,E5,F5)` is entered in cell H5. The data in columns A, B, C, D, E, F, and G shows various times and their corresponding hour, minute, and second components.

Date	HOUR	MINUTE	SECOND	TIME
10:00 AM	10	0	0	10:00 AM
11:30 AM	11	30	0	11:30 AM
3:05:02	3	5	2	3:05:02
5:15 PM	17	15	0	5:15 PM

```

=HOUR("10:30") // returns 10
=MINUTE("10:30") // returns 30
=SECOND("10:30") // returns 0
=TIME(10,30,0) // returns 10:30
  
```

## Did you know?

Excel dates are serial numbers that start in the year 1900.

Excel times are fractions of the number 1.

Both [dates](#) and [times](#) are numbers that can be used in math operations.



## DATEDIF and YEARFRAC

You can use the [DATEDIF function](#) to get time between dates in years, months, or days. DATEDIF can also be configured to get total time in “normalized” denominations, i.e. “2 years and 5 months and 27 days”.

The screenshot shows a table comparing three methods for calculating time between dates:

Time between dates		total by unit			normalized		
Date 1	Date 2	Years	Months	Days	Years	Months	Days
14-Nov-18	10-Jun-21	2	30	939	2	6	27
23-Apr-12	17-Oct-13	1	17	542	1	5	24
20-Feb-00	11-May-08	8	98	3003	8	2	21
4-Oct-95	1-Mar-12	16	196	5993	16	4	26

The DATEDIF function is a good way to calculate age from a birthday. See [this example formula](#).

Use [YEARFRAC](#) to get fractional years:

The screenshot shows a table using the YEARFRAC function to calculate the fraction of a year between dates:

Fractional years between dates		YEARFRAC
Date 1	Date 2	
14-Nov-18	10-Jun-21	2.6
23-Apr-12	17-Oct-13	1.5
20-Feb-00	11-May-08	8.2
4-Oct-95	1-Mar-12	16.4

`= YEARFRAC("14-Nov-2018","10-Jun-2021") // returns 2.57`

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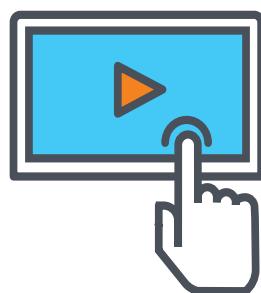


## EDATE and EOMONTH

A common task with dates is to shift a date forward (or backward) by a given number of months. You can use the [EDATE](#) and [EOMONTH](#) functions for this. EDATE moves by month and retains the day. EOMONTH works the same way, but always returns the last day of the month.

Start	Months	EDATE	EOMONTH
20-Mar-2010	6	20-Sep-2010	30-Sep-2010
11-Aug-2013	-6	11-Feb-2013	28-Feb-2013
30-Nov-2015	12	30-Nov-2016	30-Nov-2016
10-Jan-2017	0	10-Jan-2017	31-Jan-2017
7-May-2018	9	7-Feb-2019	28-Feb-2019
19-Jul-2020	24	19-Jul-2022	31-Jul-2022

**EDATE(date,6) // 6 months forward**  
**EOMONTH(date,6) // 6 months forward (end of month)**



**VIDEO**

[How to highlight expiration dates](#)



**Shift dates Forward (or Backward) using EDATE**

## WORKDAY and NETWORKDAYS

To figure out a date  $n$  working days in the future, you can use the WORKDAY function. To calculate the number of [workdays](#) between two dates, you can use [NETWORKDAYS](#).

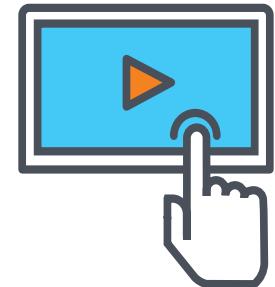
	A	B	C
1	Start	Days	
2	Mon, 6-May-2019	5	--> Mon, 13-May-2019
3	Mon, 6-May-2019	10	--> Mon, 20-May-2019
4	Sat, 1-Jun-2019	30	--> Mon, 15-Jul-2019
5	Fri, 10-May-2019	15	--> Mon, 3-Jun-2019
6	Fri, 10-May-2019	-5	--> Fri, 3-May-2019

Holidays  
27-May-2019  
4-Jul-2019

holidays = G5:G6

EXCELJET

**WORKDAY(start,n,holidays) // date n workdays in future**



### VIDEO

[How to calculate due dates with WORKDAY](#)

	A	B	C	D	E	F	G
1	Start	Finish			Workdays		Holidays
2	Mon, 6-May-2019	Mon, 13-May-2019	-->	-->	6		27-May-2019
3	Mon, 6-May-2019	Mon, 20-May-2019	-->	-->	11		4-Jul-2019
4	Sat, 1-Jun-2019	Mon, 15-Jul-2019	-->	-->	30		
5	Fri, 10-May-2019	Mon, 3-Jun-2019	-->	-->	16		
6	Fri, 10-May-2019	Fri, 3-May-2019	-->	-->	-6		

holidays = E5:E6

EXCELJET

**NETWORKDAYS(start,end,holidays) // number of workdays between dates**

[Practice worksheets included with online Video Training](#)

Note: Both functions automatically skip weekends (Saturday and Sunday) and will also skip holidays, if provided. If you need more flexibility on what days are considered weekends, see the [WORKDAY.INTL](#) function and [NETWORKDAYS.INTL](#) function.



## WEEKDAY and WEEKNUM

To figure out the day of week from a date, Excel provides the [WEEKDAY function](#). WEEKDAY returns a number between 1-7 that indicates Sunday, Monday, Tuesday, etc. Use the [WEEKNUM function](#) to get the week number in a given year.

	Date	WEEKDAY	WEEKNUM
1	Sun, 11-Nov-2018	1	46
2	Mon, 12-Nov-2018	2	46
3	Tue, 1-Jan-2019	3	1
4	Fri, 1-Feb-2019	6	5

```
=WEEKDAY(date) // returns a number 1-7
=WEEKNUM(date) // returns week number in year
```

See [this formula](#) to calculate sales per weekday.



MONDAY



TUESDAY



WEDNESDAY



THURSDAY



FRIDAY



SATURDAY

## FORMULA

[Get the monday of the week](#)

# Engineering

## CONVERT

Most Engineering functions are pretty technical... you'll find a lot of functions for complex numbers in this section. However, the [CONVERT](#) function is quite useful for everyday unit conversions. You can use CONVERT to change units for distance, weight, temperature, and much more.

Input	From	To	Output
72	F	C	22.2
10	km	mi	6.2
175	lbm	kg	79.4
75	in	m	1.9
1	gal	l	3.8

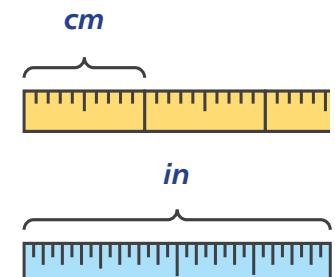
```
= CONVERT(72, "F", "C") // returns 22.2
```

See [this formula](#) to calculate the BMI of an individual where the CONVERT function is used to convert between the metric and imperial unit systems.

## Using the Versatile Convert Function



1 Gallon = 3.8 Litres

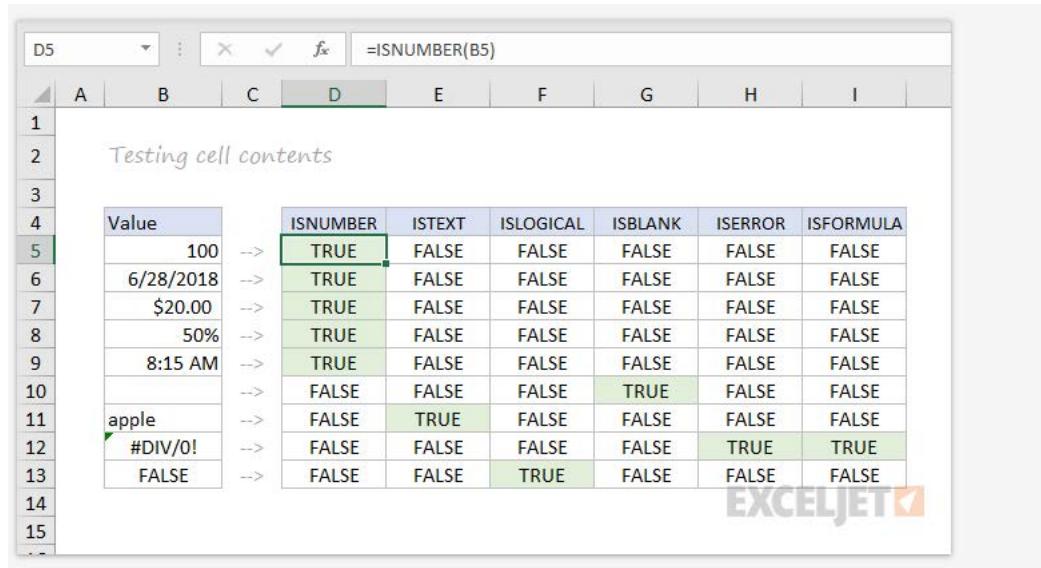


1 in = 2.54 cm

## Information Functions

### ISBLANK, ISERROR, ISNUMBER, and ISFORMULA

Excel provides many functions for checking the value in a cell, including [ISNUMBER](#), [ISTEXT](#), [ISLOGICAL](#), [ISBLANK](#), [ISERROR](#), and [ISFORMULA](#). These functions are sometimes called the “IS” functions, and they all return TRUE or FALSE based on a cell’s contents.



The screenshot shows an Excel spreadsheet titled "Testing cell contents". The table has columns for "Value" and several "Information Functions". The "Value" column contains various data types: 100, 6/28/2018, \$20.00, 50%, 8:15 AM, apple, #DIV/0!, and FALSE. The "ISNUMBER" column shows TRUE for all numerical values and FALSE for text and error values. The "ISTEXT" column shows FALSE for numbers and TRUE for text and error values. The "ISLOGICAL" column shows FALSE for all values. The "ISBLANK" column shows FALSE for all values. The "ISERROR" column shows FALSE for all values except #DIV/0! which is TRUE. The "ISFORMULA" column shows FALSE for all values.

		D5						
1			X	✓	f(x)	=ISNUMBER(B5)		
2								
3								
4								
5	Value		ISNUMBER	ISTEXT	ISLOGICAL	ISBLANK	ISERROR	ISFORMULA
6	100	-->	TRUE	FALSE	FALSE	FALSE	FALSE	FALSE
7	6/28/2018	-->	TRUE	FALSE	FALSE	FALSE	FALSE	FALSE
8	\$20.00	-->	TRUE	FALSE	FALSE	FALSE	FALSE	FALSE
9	50%	-->	TRUE	FALSE	FALSE	FALSE	FALSE	FALSE
10	8:15 AM	-->	TRUE	FALSE	FALSE	FALSE	FALSE	FALSE
11	apple	-->	FALSE	FALSE	FALSE	TRUE	FALSE	FALSE
12	#DIV/0!	-->	FALSE	TRUE	FALSE	FALSE	FALSE	FALSE
13	FALSE	-->	FALSE	FALSE	TRUE	FALSE	TRUE	FALSE
14								
15								

Excel also has [ISODD](#) and [ISEVEN](#) functions will test a number to see if it's even or odd.

By the way, the green fill in the screenshot above is applied automatically with a [conditional formatting](#) formula.



**True or False  
results using  
Information  
Functions**

## Logical Functions

Excel's logical functions are a key building block of many advanced formulas. Logical functions return the boolean values TRUE or FALSE. If you need a primer on logical formulas, [this video goes through many examples](#).

### AND, OR and NOT

The core of Excel's logical functions are the [AND function](#), the [OR function](#), and the [NOT function](#). In the screen below, each of these function is used to run a simple test on the values in column B:

Value	AND	OR	NOT
2	FALSE	FALSE	TRUE
4	TRUE	FALSE	FALSE
3	FALSE	TRUE	FALSE
2	FALSE	FALSE	TRUE
7	TRUE	TRUE	FALSE
9	FALSE	TRUE	TRUE

**D5**    **=AND(B5>3,B5<9)**

**E5**    **=OR(B5=3,B5=9)**

**F5**    **=NOT(B5=2)**

### IF and IFS functions

The [IF function](#) is one of the most used functions in Excel. In the screen below, IF checks test scores and assigns "pass" or "fail":

Name	Score	Result
Anderson	92	Pass
Bautista	85	Pass
Block	65	Fail
Burrows	79	Pass
Chandler	69	Fail
Colby	95	Pass

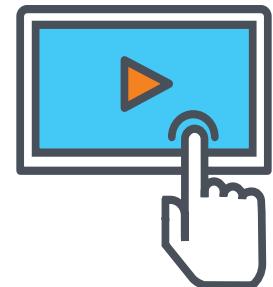
**D5**    **=IF(C5>=70,"Pass","Fail")**

**Passing score: 70**

The logical functions above can be combined with the IF function to create more complex logical tests. Alternatively, multiple IF functions [can be nested together](#) to return more than two values as a result.

### Is it Green?

	TRUE	FALSE



### VIDEO

[How to build logical formulas](#)

### GUIDE

[50 examples of formula criteria](#)



New in Excel 2019 and Office 365, the [IFS function](#) can run multiple logical tests without [nesting IFs](#).

A screenshot of an Excel spreadsheet demonstrating the use of the IFS function. The formula in cell D5 is =IFS(C5<60,"F",C5<70,"D",C5<80,"C",C5<90,"B",C5>=90,"A"). The table shows student names, their scores, and the corresponding grades assigned by the formula.

Name	Score	Grade
Hannah	81.8	B
Edward	82.8	B
Miranda	91.3	A
William	76	C
Joanna	71.2	C
Collin	80.6	B
Mallory	85	B
Oscar	79.2	C

The formula bar shows the formula =IFS(C5 < 60, "F", C5 < 70, "D", C5 < 80, "C", C5 < 90, "B", C5 >= 90, "A")

## IFERROR and IFNA

The [IFERROR function](#) and [IFNA function](#) can be used as a simple way to trap and handle errors. In the screen below, [VLOOKUP](#) is used to retrieve cost from a menu item. Column F contains just a [VLOOKUP function](#), with no error handling. Column G shows how to use IFNA with VLOOKUP to display a custom message when an unrecognized item is entered.

A screenshot of an Excel spreadsheet demonstrating the use of the IFNA function to trap VLOOKUP errors. The formula in cell G5 is =IFNA(VLOOKUP(E5,menu,2,0),"Not found"). The table shows menu items and their costs, with an additional column F showing the raw VLOOKUP results which include an #N/A error for 'Ice cream'.

Item	Cost
Pizza	\$3.25
Hot Dog	\$1.75
Chicken	\$3.50
Sushi	\$5.00
Hamburger	\$3.25

Item	Cost	IFNA
Pizza	\$3.25	\$3.25
Sushi	\$5.00	\$5.00
Ice cream	#N/A	Not found

The formula bar shows the formulas =VLOOKUP(E5,menu,2,0) // no error trapping and =IFNA(VLOOKUP(E5,menu,2,0),"Not found") // catch errors

Whereas IFNA only catches an #N/A error, the [IFERROR function](#) will catch any formula error.

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# Lookup and Reference Functions

## VLOOKUP and HLOOKUP

Excel offers a number of functions to lookup and retrieve data. Most famous of all is [VLOOKUP](#):

A screenshot of Microsoft Excel demonstrating a vertical lookup. The formula `=VLOOKUP(C5,$F$5:$G$7,2,TRUE)` is entered in cell D5. The data range is \$F\$5:\$G\$7, which contains two columns: Sales and Commission. The lookup value is C5, which contains 'Ferris'. The result is 3%, which is the value in the Commission column for Ferris.

Name	Sales	Commission
Ferris	\$71,900	3%
Bueller	\$93,500	4%
Chung	\$151,200	5%
Tanaka	\$124,600	5%
Irwin	\$82,500	4%
McNulty	\$60,400	3%

The formula bar shows the formula: `=VLOOKUP(C5,$F$5:$G$7,2,TRUE)`

More: [23 things to know about VLOOKUP](#).

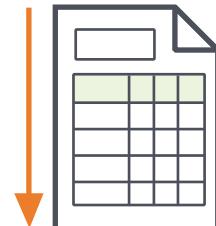
[HLOOKUP](#) works like [VLOOKUP](#), but expects data arranged horizontally:

A screenshot of Microsoft Excel demonstrating a horizontal lookup. The formula `=HLOOKUP(C5,$G$4:$I$5,2,TRUE)` is entered in cell D5. The data range is \$G\$4:\$I\$5, which contains three columns: Sales, \$50,000, \$75,000, \$100,000; Commission, 3%, 4%, 5%. The lookup value is C5, which contains 'Ferris'. The result is 3%, which is the value in the Commission column for Ferris.

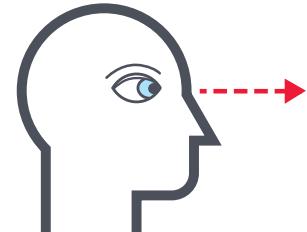
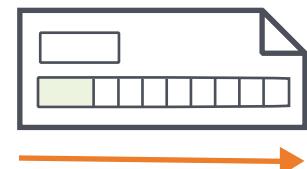
Sales	\$50,000	\$75,000	\$100,000
Commission	3%	4%	5%

The formula bar shows the formula: `=HLOOKUP(C5,$G$4:$I$5,2,TRUE)`

**VLOOKUP is for vertical data**



**HLOOKUP is for horizontal data**



**VLOOKUP only looks to the Right**



## INDEX and MATCH

For more complicated lookups, [INDEX](#) and [MATCH](#) offers more flexibility and power:

```
= INDEX(C5:E12, MATCH(H4, B5:B12, 0), MATCH(H5, C4:E4, 0))
```

Both the [INDEX function](#) and the [MATCH function](#) are powerhouse functions that turn up in all kinds of formulas.

## LOOKUP

The [LOOKUP function](#) has default behaviors that make it useful when solving certain problems. LOOKUP assumes values are sorted in ascending order and always performs an approximate match. When LOOKUP can't find a match, it will match the next smallest value. In the example below we are using LOOKUP to find the last entry in a column:

[This page](#) explains this LOOKUP example in more depth.

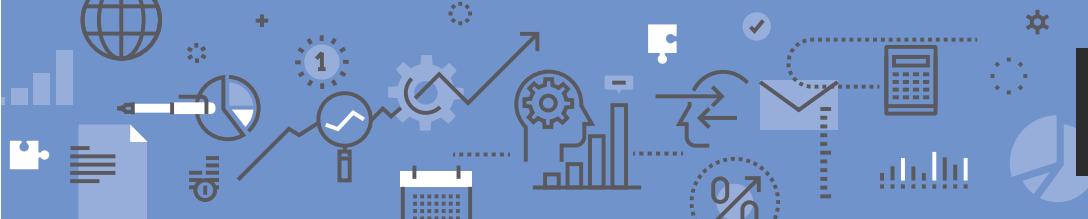


***The MATCH function is designed to find the position of an item in a range.***



## ARTICLE

**[How to use INDEX and MATCH](#)**



## ROW and COLUMN

You can use the [ROW function](#) and [COLUMN function](#) to find row and column numbers on a worksheet. Notice both ROW and COLUMN return values for the current cell if no reference is supplied:

ROW	Formula
5	=ROW()
100	=ROW(Z100)
11	=ROW(D11:D16)
2	=ROW(Q2)

COLUMN	Formula
6	=COLUMN()
26	=COLUMN(Z100)
4	=COLUMN(D11:D16)
17	=COLUMN(Q2)

The row function also shows up often in advanced formulas that process data with [relative row numbers](#).

## ROWS and COLUMNS

The [ROWS function](#) and [COLUMNS function](#) provide a count of rows in a reference. In the screen below, we are counting rows and columns in an [Excel Table](#) named “Table1”.

Planet	Diameter (km)	Satellites
Mercury	4,879	0
Venus	12,104	0
Earth	12,756	1
Mars	6,792	2
Jupiter	142,984	67
Saturn	120,536	200
Uranus	51,118	27
Neptune	49,528	13
Pluto	2,306	5

Note ROWS returns a count of data rows in a table, excluding the header row. By the way, here are [23 things to know about Excel Tables](#).

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## HYPERLINK

You can use the [HYPERLINK function](#) to construct a link with a formula. Note HYPERLINK lets you build both external links and internal links:

Name	Target	Hyperlink
Exceljet	https://exceljet.net	<a href="https://exceljet.net">Exceljet</a>
Google	https://www.google.com	<a href="https://www.google.com">Google</a>
Sheet2	#Sheet2!A1	<a href="#">Sheet2</a>
worksheet	worksheet.xlsx	<a href="#">worksheet</a>

= HYPERLINK(C5,B5)

## Build External and Internal Hyperlinks



## GETPIVOTDATA

The [GETPIVOTDATA function](#) is useful for retrieving information from existing pivot tables.

Sales	Region			
Product	East	Midwest	West	Total
Extra Dark	\$12,798	\$6,615	\$9,495	\$28,908
Hazelnut	\$35,735	\$9,829	\$16,893	\$62,456
Almond	\$12,864	\$1,546	\$8,099	\$22,509
Chilli Fire	\$8,220	\$3,790	\$3,890	\$15,900
Pistachio	\$2,513	\$768	\$2,604	\$5,885
Bacon	\$2,114	\$292	\$538	\$2,944
<b>Total</b>	<b>\$74,244</b>	<b>\$22,840</b>	<b>\$41,519</b>	<b>\$138,603</b>

= GETPIVOTDATA("Sales",\$B\$4,"Region",I6,"Product",I7)

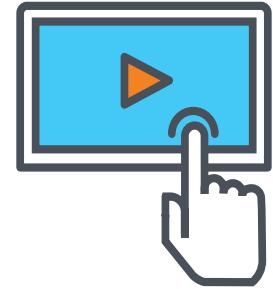
## CHOOSE

The [CHOOSE function](#) is handy any time you need to make a choice based on a number:

Simple lookups with the *CHOOSE* function

Input	Output
1	red
2	blue
3	green

```
=CHOOSE(2,"red","blue","green") // returns "blue"
```



### VIDEO

[How to use the \*CHOOSE\* function](#)

## TRANSPOSE

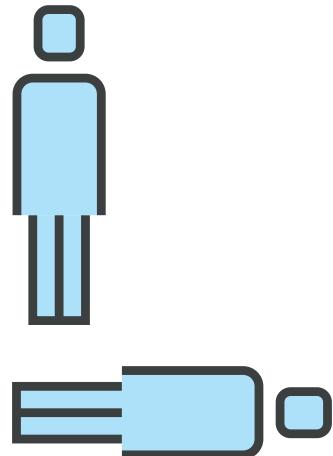
The [TRANSPOSE function](#) gives you an easy way to transpose vertical data to horizontal, and vice versa.

Vertical to horizontal with the *TRANSPOSE* function

Item	Cost
Pizza	\$3.25
Hot Dog	\$1.75
Chicken	\$3.50
Sushi	\$5.00
Falafel	\$3.25

Item	Pizza	Hot Dog	Chicken	Sushi	Falafel
Cost	\$3.25	\$1.75	\$3.50	\$5.00	\$3.25

```
{=TRANSPOSE(B4:C9)}
```



Note: TRANSPOSE is a formula and is therefore dynamic. If you just need to do a one-time transpose operation, use [Paste Special](#) instead.

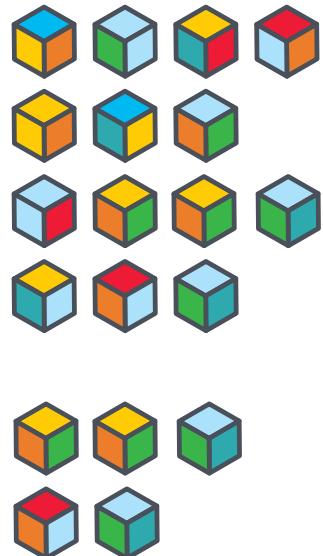
**Transpose Vertical Data to Horizontal**



## OFFSET

The [OFFSET function](#) is useful for all kinds of dynamic ranges. From a starting location, it lets you specify row and column offsets, and also the final row and column size. The result is a range that can respond dynamically to changing conditions and inputs. You can feed this range to other functions, as in the screen below, where OFFSET builds a range that is fed to the SUM function:

```
=SUM(OFFSET(B4,1,I4,4,1)) // sum of Q3
```



## INDIRECT

The [INDIRECT function](#) allows you to build references as text. This concept is a bit tricky to understand at first, but it can be useful in many situations. Below, we are using INDIRECT to get values from cell A1 in 5 different worksheets. Each reference is dynamic. If a sheet name changes, the reference will update.

```
=INDIRECT(B5 & "!A1") // =Sheet1!A1
```

*The main purpose of OFFSET is to allow formulas to dynamically adjust to available data or to user input.*

**Caution:** Both [OFFSET](#) and [INDIRECT](#) are [volatile functions](#) and can slow down large or complicated spreadsheets.

The INDIRECT function is also used to “lock” references so they won’t change, when rows or columns are added or deleted. For more details, see linked examples at the bottom of the [INDIRECT function page](#).

## STATISTICAL Functions

### COUNT and COUNTA

You can count numbers with the [COUNT function](#) and non-empty cells with [COUNTA](#). You can count blank cells with [COUNTBLANK](#), but in the screen below we are counting blank cells with [COUNTIF](#), which is more generally useful.

	COUNT	COUNTA	Empty
-->	5	5	0
-->	0	5	0
-->	5	5	0
-->	2	4	1
-->	3	3	2

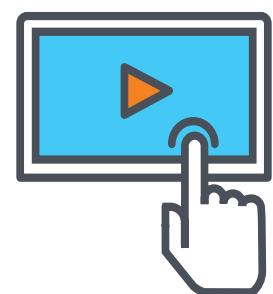


**How Many?**

### COUNTIF and COUNTIFS

For conditional counts, the [COUNTIF function](#) can apply one criteria. The [COUNTIFS function](#) can apply multiple criteria at the same time:

	Red	
> 50		2
Red and TX		2
Blue > 50		1



**VIDEO**

[How to use the COUNTIF Function](#)

```
=COUNTIF(C5:C12, "red") // count red
=COUNTIF(F5:F12, ">50") // count total > 50
=COUNTIFS(C5:C12, "red", D5:D12, "TX") // red and tx
=COUNTIFS(C5:C12, "blue", F5:F12, ">50") // blue > 50
```

## SUM, SUMIF, SUMIFS

To sum everything, use the [SUM function](#). To sum conditionally, use SUMIF or SUMIFS. Following the same pattern as the counting functions, the [SUMIF function](#) can apply only one criteria while the [SUMIFS function](#) can apply multiple criteria.

The screenshot shows an Excel spreadsheet with a table of purchases in rows 5 to 12. The columns are Date, Color, State, Qty, and Total. A second table in columns I and J shows sums for Red, >50, Red and TX, and Blue > 50. The formula in cell I5 is =SUMIF(C5:C12,"red",F5:F12).

Date	Color	State	Qty	Total
9-Jan	Red	TX	1	\$18.00
23-Jan	Blue	CO	2	\$34.00
3-Feb	Red	NM	2	\$36.00
18-Feb	Blue	TX	1	\$17.00
2-Mar	Blue	AZ	3	\$51.00
15-Mar	Red	AZ	1	\$17.00
25-Mar	Red	TX	2	\$36.00
2-Apr	Red	CO	4	\$72.00

	Total
Total	\$281.00
Red	\$179.00
> 50	\$123.00
Red and TX	\$54.00
Blue > 50	\$51.00

```
=SUM(F5:F12) // everything
=SUMIF(C5:C12,"red",F5:F12) // red only
=SUMIF(F5:F12,">50") // over 50
=SUMIFS(F5:F12,C5:C12,"red",D5:D12,"tx") // red & tx
=SUMIFS(F5:F12,C5:C12,"blue",F5:F12,">50") // blue & >50
```

## AVERAGE, AVERAGEIF, and AVERAGEIFS

Following the same pattern, you can calculate an average with [AVERAGE](#), [AVERAGEIF](#), and [AVERAGEIFS](#).

The screenshot shows an Excel spreadsheet with the same purchase data as before. A second table in columns I and J shows averages for All, Red, and Red and TX. The formula in cell I5 is =AVERAGEIF(C5:C12,"red",F5:F12).

Date	Color	State	Qty	Total
9-Jan	Red	TX	1	\$18.00
23-Jan	Blue	CO	2	\$34.00
3-Feb	Red	NM	2	\$36.00
18-Feb	Blue	TX	1	\$17.00
2-Mar	Blue	AZ	3	\$51.00
15-Mar	Red	AZ	1	\$17.00
25-Mar	Red	TX	2	\$36.00
2-Apr	Red	CO	4	\$72.00

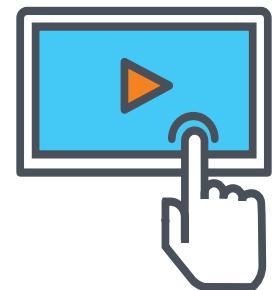
	All
All	\$35.13
Red	\$35.80
Red and TX	\$27.00

```
=AVERAGE(F5:F12) // all
=AVERAGEIF(C5:C12,"red",F5:F12) // red only
=AVERAGEIFS(F5:F12,C5:C12,"red",D5:D12,"tx") // red and tx
```

5  
9  
7  

---

23



## VIDEO

[How to use the SUMIF function](#)

## MIN, MAX, LARGE, SMALL

You can find largest and smallest values with [MAX](#) and [MIN](#), and nth largest and smallest values with [LARGE](#) and [SMALL](#). In the screen below, “data” is the named range C5:C13, used in all formulas.

First	Score
Sue	66
Sarah	84
Justin	69
Manfred	77
Ted	67
Aubrey	88
Gen	86
Renee	74
Otto	84

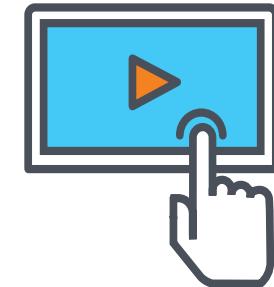
	MAX	MIN
	88	66

Nth	LARGE	SMALL
1	88	66
2	86	67
3	84	69

```
= MAX(data) // largest
= MIN(data) // smallest
= LARGE(data,1) // 1st largest
= LARGE(data,2) // 2nd largest
= LARGE(data,3) // 3rd largest
= SMALL(data,1) // 1st smallest
= SMALL(data,2) // 2nd smallest
= SMALL(data,3) // 3rd smallest
```



**Find LARGEST and SMALLEST values**



**VIDEO**

[How to find the nth smallest or largest value](#)

## MINIFS, MAXIFS

The [MINIFS](#) and [MAXIFS](#). These functions let you find minimum and maximum values with conditions:

Name	Gender	Score
Hannah	Female	93
Edward	Male	79
Miranda	Female	85
William	Male	64
Joanna	Female	81
Collin	Male	83
Oscar	Male	64
Arturo	Male	76
Annie	Female	72
Weston	Male	64
Cassidy	Female	83

Gender	MAXIF	MINIF
Female	93	72
Male	83	64

```
=MAXIFS(D5:D15,C5:C15,"female") // highest female
=MAXIFS(D5:D15,C5:C15,"male") // highest male
=MINIFS(D5:D15,C5:C15,"female") // lowest female
=MINIFS(D5:D15,C5:C15,"male") // lowest male
```

Note: MINIFS and MAXIFS are new in Excel via Office 365 and Excel 2019.

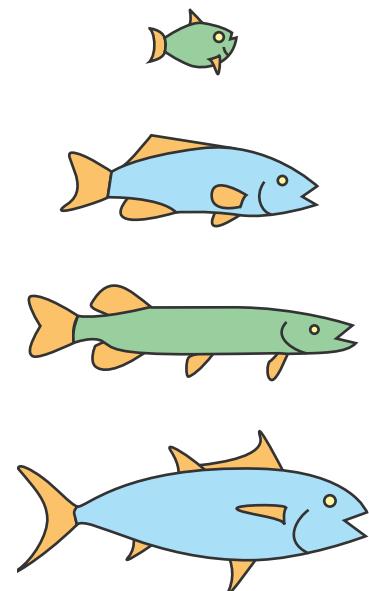
## MODE

The [MODE function](#) returns the most commonly occurring number in a range:

	1	2	3	4	5	6
1	2	2	1	1	2	
5	10	15	15	10	5	
69	70	70	71	71	70	
95	115	125	115	95	115	

```
=MODE(B5:G5) // returns 1
```

*Find the smallest blue fish*

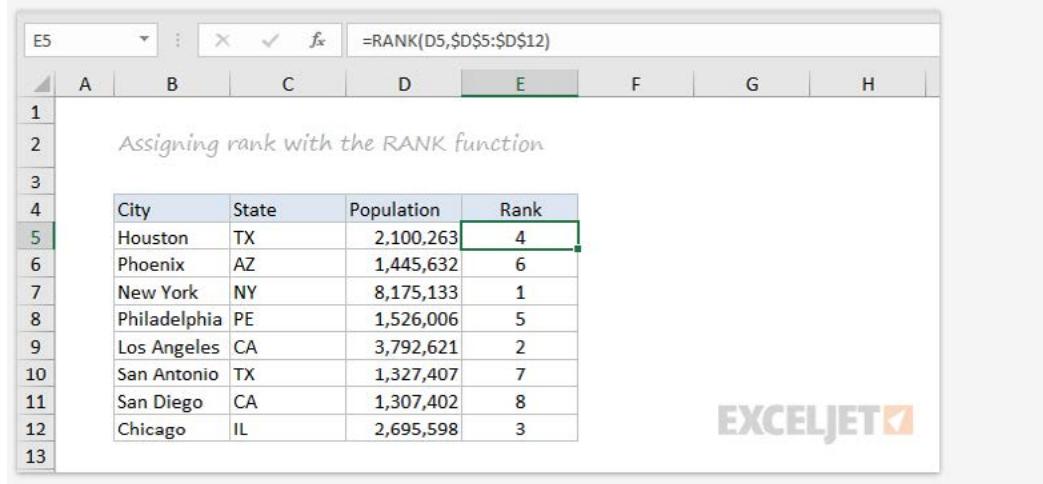


*Most commonly occurring dog color*



## RANK

To rank values largest to smallest, or smallest to largest, use the [RANK function](#):



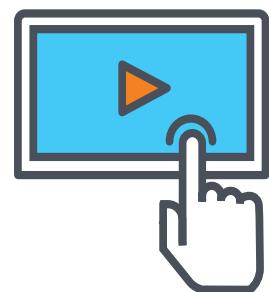
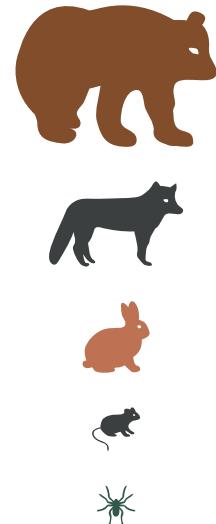
The screenshot shows an Excel spreadsheet with the following data:

City	State	Population	Rank
Houston	TX	2,100,263	4
Phoenix	AZ	1,445,632	6
New York	NY	8,175,133	1
Philadelphia	PA	1,526,006	5
Los Angeles	CA	3,792,621	2
San Antonio	TX	1,327,407	7
San Diego	CA	1,307,402	8
Chicago	IL	2,695,598	3

The formula `=RANK(D5,$D$5:$D$12)` is entered in cell E5. The cell containing the value "4" in the Rank column is highlighted with a green border.

See [this formula](#) which demonstrates how to use the RANK function to calculate race results.

### Rank Largest to Smallest



### Video

[How to rank values with the RANK function](#)

## MATH Functions

### ABS

To change negative values to positive use the [ABS function](#).

Input	Output
-134.50	\$134.50
500.00	500
5.13	5.125
-0.13	\$0.13
-43.00	\$43.00

```
= ABS( -134.50 ) // returns 134.50
```

**ABS — Negative to Positive**

-100.00  
↓  
\$100.00

### RAND and RANDBETWEEN

Both the [RAND function](#) and [RANDBETWEEN function](#) can generate random numbers on the fly. RAND creates long decimal numbers between zero and 1. RANDBETWEEN generates random integers between two given numbers.

RAND	RANDBETWEEN
0.351613613	58
0.301564961	22
0.683756914	4
0.673618677	66
0.749792539	27
0.770318131	58

```
= RAND() // between zero and 1
= RANDBETWEEN(1,100) // between 1 and 100
```



**To generate a random dice roll**

**RANDBETWEEN(1,6)**

## ROUND, ROUNDUP, ROUNDDOWN, INT

To round values up or down, use the [ROUND function](#). To force rounding up to a given number of digits, use [ROUNDUP](#). To force rounding down, use [ROUNDDOWN](#). To discard the decimal part of a number altogether, use the [INT function](#).

Number	Digits	ROUND	ROUNDUP	ROUNDDOWN	INT
11.777	1	11.8	11.8	11.7	11
15.11	1	15.1	15.2	15.1	15
13.85	1	13.9	13.9	13.8	13
9.91	1	9.9	10	9.9	9

```
=ROUND(11.777,1) // returns 11.8
=ROUNDUP(11.777) // returns 11.8
=ROUNDDOWN(11.777,1) // returns 11.7
=INT(11.777) // returns 11
```

## MROUND, CEILING, FLOOR

To round values to a the nearest multiple use the [MROUND function](#). The [FLOOR function](#) and [CEILING function](#) also round to a given multiple. FLOOR forces rounding down, and CEILING forces rounding up.

Number	Multiple	MROUND	CEILING	FLOOR
11.777	0.25	11.75	12	11.75
15.49	0.25	15.5	15.5	15.25
13.85	0.25	13.75	14	13.75
10.05	0.25	10	10.25	10

```
=MROUND(13.85,.25) // returns 13.75
=CEILING(13.85,.25) // returns 14
=FLOOR(13.85,.25) // returns 13.75
```

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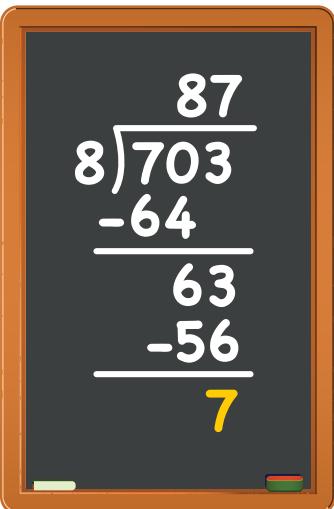
101 EXCEL FUNCTIONS

25

## MOD

The [MOD function](#) returns the remainder after division. This sounds boring and geeky, but MOD turns up in all kinds of formulas, especially formulas that need to do something “every nth time”. In the screen below, you can see how MOD returns zero every third number when the divisor is 3:

Number	Divisor	MOD
1	3	1
2	3	2
3	3	0
4	3	1
5	3	2
6	3	0
7	3	1
8	3	2
9	3	0



*The [MOD function](#) returns the remainder*

## SUMPRODUCT

The [SUMPRODUCT](#) function is powerful and versatile tool when dealing with all kinds data. You can use SUMPRODUCT to easily count and sum based on criteria, and you can use it in elegant ways that just don't work with COUNTIFS and SUMIFS. In the screen below, we are using SUMPRODUCT to count and sum orders in March. See the [SUMPRODUCT page](#) for details and links to many examples.

Date	Sales
10-Jan	75
25-Jan	100
3-Feb	125
17-Feb	125
25-Feb	150
5-Mar	125
12-Mar	200
19-Mar	175

```
= SUMPRODUCT( --(MONTH(B5:B12) = 3)) // count March
= SUMPRODUCT( --(MONTH(B5:B12) = 3), C5:C12) // sum March
```



Sunglasses sold in July

*Sumproduct is a powerful and versatile tool that is easy to use.*

## SUBTOTAL

The [SUBTOTAL function](#) is an “aggregate function” that can perform a number of operations on a set of data. The key feature of SUBTOTAL is that it will ignore rows that have been “filtered out” of an [Excel Table](#), and, optionally, rows that have been manually hidden. In the screen below, SUBTOTAL is used to count and sum only the 7 visible rows in the table:

Item	Category	Qty	Price	Total
apples	Fruit	12	\$0.15	\$1.80
pears	Fruit	6	\$0.35	\$2.10
oranges	Fruit	10	\$0.22	\$2.20
plums	Fruit	4	\$0.26	\$1.04
banannas	Fruit	6	\$0.12	\$0.72
lemons	Fruit	3	\$0.16	\$0.48
limes	Fruit	6	\$0.20	\$1.20

= SUBTOTAL(3,B5:B14) // returns 7  
= SUBTOTAL(9,F5:F14) // returns 9.54

## AGGREGATE

Like SUBTOTAL, the [AGGREGATE function](#) can run a number of aggregate operations on a set of data and can optionally ignore hidden rows. The key differences are that AGGREGATE can run more operations and can also ignore errors.

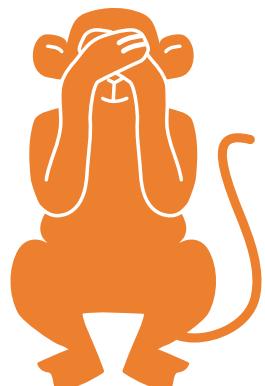
Values
98
95
87
95
#N/A
75
90
100
80

= AGGREGATE(4,6,values) // MAX ignore errors, returns 100  
= AGGREGATE(5,6,values) // MIN ignore errors, returns 75

Above, AGGREGATE is used to perform MIN, MAX, LARGE and SMALL operations while ignoring errors. Normally, the error in cell B9 would prevent these functions from returning a result.

**SUBTOTAL** can perform 11 operations, including SUM, AVERAGE, COUNT, MAX, MIN, etc. (see [This Page](#) for the full list)

**AGGREGATE** can perform 19 operations and can also ignore errors. See [this page](#) for a full list of operations.



## TEXT Functions

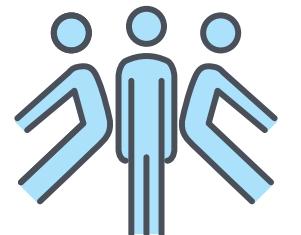
### LEFT, RIGHT, MID

To extract characters from the left, right, or middle of text, use [LEFT](#), [RIGHT](#), and [MID](#) functions:

The screenshot shows a Microsoft Excel spreadsheet with data in columns A, B, C, and D. Column A contains text strings: "ABC-1234-RED", "BEF-6549-GRN", "SIU-9264-BLK", and "ZRT-6278-BLU". Column B contains the formula =LEFT(B5,3) for row 5, resulting in "ABC". Column C contains the formula =MID(B5,5,4) for row 5, resulting in "1234". Column D contains the formula =RIGHT(B5,3) for row 5, resulting in "RED". The title bar shows the formula =LEFT(B5,3).

	A	B	C	D
1				
2	Extracting text with LEFT, RIGHT, and MID			
3				
4	Text	LEFT	MID	RIGHT
5	ABC-1234-RED	ABC	1234	RED
6	BEF-6549-GRN	BEF	6549	GRN
7	SIU-9264-BLK	SIU	9264	BLK
8	ZRT-6278-BLU	ZRT	6278	BLU

```
=LEFT("ABC-1234-RED",3) // returns "ABC"
=MID("ABC-1234-RED",5,4) // returns "1234"
=RIGHT("ABC-1234-RED",3) // returns "RED"
```



[Separate text into columns](#)

### FORMULA

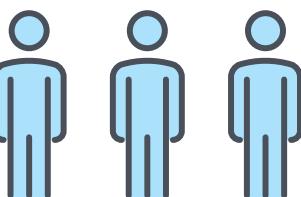
[Get first name from full name](#)

### LEN

The [LEN function](#) will return the length of a text string. LEN shows up in a lot of formulas that count words or [characters](#).

The screenshot shows a Microsoft Excel spreadsheet with data in columns A, B, and C. Column A contains text strings: "We drove that car as far as we could", "Better the devil you know", "Perfect is the enemy of the good", "This is not my beautiful wife", and "Holly came from Miami, F.L.A.". Column B contains the formula =LEN(B5) for row 5, resulting in 36. Column C contains the formula =LEN(B6) for row 6, resulting in 25. Column D contains the formula =LEN(B7) for row 7, resulting in 32. Column E contains the formula =LEN(B8) for row 8, resulting in 29. Column F contains the formula =LEN(B9) for row 9, resulting in 29. The title bar shows the formula =LEN(B5).

	A	B	C	D	E	F	G
1							
2	Counting characters with LEN						
3							
4	Text	LEN					
5	We drove that car as far as we could	-->	36				
6	Better the devil you know	-->	25				
7	Perfect is the enemy of the good	-->	32				
8	This is not my beautiful wife	-->	29				
9	Holly came from Miami, F.L.A.	-->	29				



## FIND, SEARCH

To look for specific text in a cell, use the [FIND function](#) or [SEARCH function](#). These functions return the numeric position of matching text, but SEARCH allows wildcards and FIND is case-sensitive. Both functions will throw an error when text is not found, so wrap in the [ISNUMBER function](#) to return TRUE or FALSE ([example here](#)).

Text	Look for	SEARCH	FIND
We drove that car as far as we could	car	15	15
Better the devil you know	devil	12	12
Perfect is the enemy of the good	GOOD	29	#VALUE!
This is not my beautiful wife	bea*	16	#VALUE!
Holly came from Miami, F.L.A.	Holly	1	1

### Text Functions — Find, Replace and Substitute

```
=FIND("Better the devil you know","devil") // returns 12
=SEARCH("This is not my beautiful wife","bea*") // returns 12
```

## REPLACE, SUBSTITUTE

To replace text by position, use the [REPLACE function](#). To replace text by matching, use the [SUBSTITUTE function](#). In the first example, REPLACE removes the two asterisks (\*\*) by replacing the first two characters with an empty string (""). In the second example, SUBSTITUTE removes all hash characters (#) by replacing "#" with "".

Input	REPLACE	Input	SUBSTITUTE
**Red	Red	##Red##	Red
**Blue	Blue	##Blue##	Blue
**Green	Green	##Green##	Green
**Silver	Silver	##Silver##	Silver
**Black	Black	##Black##	Black

```
=REPLACE("**Red",1,2,"") // returns "Red"
=SUBSTITUTE("##Red##","#","") // returns "Red"
```

### FORMULA

### Cell contains one of many things

101 EXCEL FUNCTIONS

29

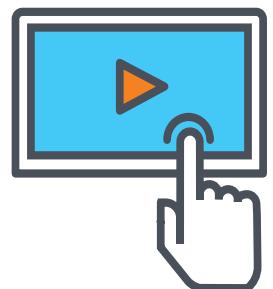


## CODE, CHAR

To figure out the numeric code for a character, use the [CODE function](#). To translate the numeric code back to a character, use the [CHAR function](#). In the example below, CODE translates each character in column B to its corresponding code. In column F, CHAR translates the code back to a character.

	A	B	C	D	E	F	G	H	I
1									
2									
3									
4									
5	<b>Input</b>	a	<b>CODE</b>	97	-->	<b>CHAR</b>	a		
6		b	-->	98	-->		b		
7		c	-->	99	-->		c		
8		X	-->	88	-->		X		
9		Y	-->	89	-->		Y		
10		Z	-->	90	-->		Z		
11									

```
= CODE("a") // returns 97
= CHAR(97) // returns "a"
```



## VIDEO

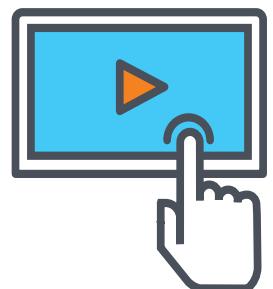
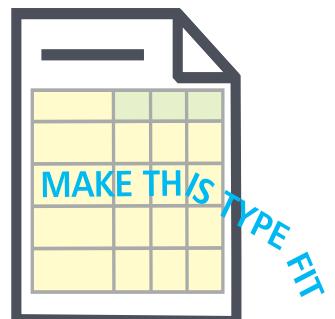
[How to use the CODE and CHAR functions](#)

## TRIM, CLEAN

To get rid of extra space in text, use the [TRIM function](#). To remove line breaks and other non-printing characters, use [CLEAN](#).

	A	B	C	D	E	F	G
1							
2							
3							
4							
5	<b>Input</b>	Toy Story	<b>TRIM</b>	Toy Story	-->	<b>CLEAN</b>	Toy Story
6		The Lord of the Rings	-->	The Lord of the Rings	-->		The Lord of the Rings
7		The Sixth Sense	-->	The Sixth Sense	-->		The Sixth Sense
8							
9							
10							

```
= TRIM(A1) // remove extra space
= CLEAN(A1) // remove line breaks
```



## VIDEO

[How to clean text with TRIM and CLEAN](#)

## CONCAT, TEXTJOIN, CONCATENATE

New in Excel via Office 365 are CONCAT and TEXTJOIN. The [CONCAT function](#) lets you concatenate (join) multiple values, including a range of values without a delimiter. The [TEXTJOIN function](#) does the same thing, but allows you to specify a delimiter and can also ignore empty values.

The screenshot shows an Excel spreadsheet with the following data:

	A	B	C	D	E	F	G	H	I	J	K
1											
2	Joining values with <i>CONCAT</i> and <i>TEXTJOIN</i>										
3											
4	red	blue	green	pink		black	→	red, blue, green, pink, black			
5											
6											
7	8	6	7	5	3	0	9	→	8675309		
8											
9											
10											

Below the table, the formula bar shows =TEXTJOIN(", ",TRUE,B4:H4) and =CONCAT(B7:H7). A callout box contains the following code:

```
=TEXTJOIN(", ",TRUE,B4:H4) // returns "red,blue,green,pink,black"
=CONCAT(B7:H7) // returns "8675309"
```

Excel also provides the [CONCATENATE function](#), but it doesn't offer special features. I would't bother with it and would instead [concatenate](#) directly with the ampersand (&) character in a formula.

## EXACT

The [EXACT](#) function allows you to compare two text strings in a case-sensitive manner.

The screenshot shows an Excel spreadsheet with the following data:

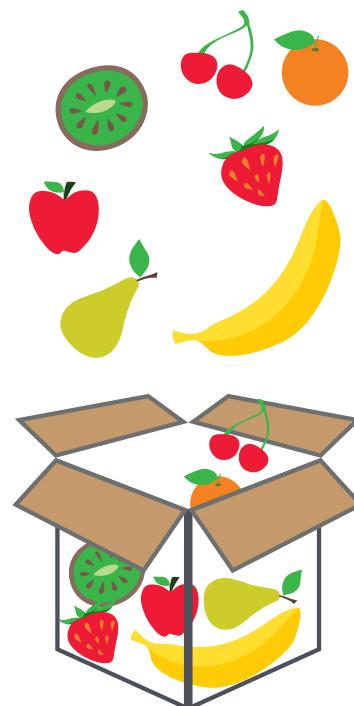
	A	B	C	D	E	F	G	H	I	J	
1											
2	Compare text, case-sensitive, with EXACT										
3											
4	<b>Text 1</b>	<b>Text 2</b>									
5	Apple	Apple									
6	Orange	Orange									
7	Pear	PEAR									
8	Kiwi	Kiwi									
9	Peach	peach									
10											

Next to the table, a dropdown menu for the EXACT function shows the following options:

- TRUE
- TRUE
- FALSE
- TRUE
- FALSE

Below the table, the formula bar shows =EXACT(B5,C5).

*Join cells together*



## UPPER, LOWER, PROPER

To change the case of text, use the [UPPER](#), [LOWER](#), and [PROPER](#) function

The screenshot shows a Microsoft Excel spreadsheet with data in columns A through F. Column A contains names. Column D contains the formula =UPPER(B5) for the first row. Column E contains the formula =LOWER(B5) for the first row. Column F contains the formula =PROPER(B5) for the first row. The results are shown in columns D, E, and F respectively.

Name	UPPER	LOWER	PROPER
Sue BROWN	SUE BROWN	sue brown	Sue Brown
Sarah DUNCAN	SARAH DUNCAN	sarah duncan	Sarah Duncan
Justin GATT	JUSTIN GATT	justin gatt	Justin Gatt
Manfred HOLLIS	MANFRED HOLLIS	manfred hollis	Manfred Hollis
Troy JOHNSON	TROY JOHNSON	troy johnson	Troy Johnson
Aubrey SINCLAIR	AUBREY SINCLAIR	aubrey sinclair	Aubrey Sinclair
Gen TANAKA	GEN TANAKA	gen tanaka	Gen Tanaka
Renee ZWICK	RENEE ZWICK	renee zwick	Renee Zwick

```
=UPPER("Sue BROWN") // returns "SUE BROWN"
=LOWER("Sue BROWN") // returns "sue brown"
=PROPER("Sue BROWN") // returns "Sue Brown"
```

## TEXT

Last but definitely not least is the [TEXT function](#). The text function lets you apply number formatting to numbers (including dates, times, etc.) as text. This is especially useful when you need to embed a formatted number in a message, like “Sale ends on [date]”.

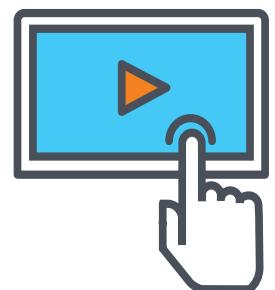
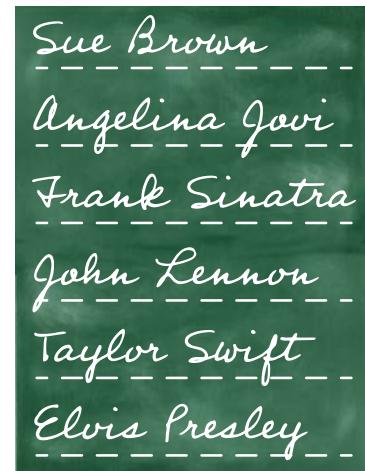
The screenshot shows a Microsoft Excel spreadsheet with data in columns A through I. Column D contains the formula =TEXT(B5,"\$#,##0.00") for the first row. The results are shown in column D.

Number	TEXT
1000	\$1,000.00
123	000123
15%	Save 15%
1-Dec-2018	Sale ends Dec. 1

```
=TEXT(B5,"$#,##0.00")
=TEXT(B6,"000000")
="Save " & TEXT(B7,"0%")
="Sale ends " & TEXT(B8,"mmm d")
```

More: [Detailed examples of custom number formatting](#)

## Standardize a List of Names



## VIDEO

### [How to change case with formulas](#)



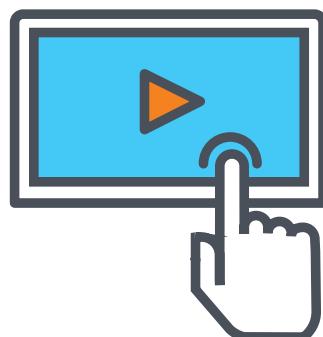
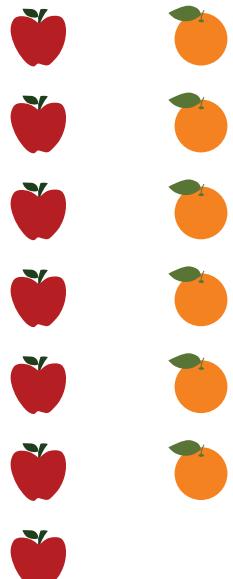
## Dynamic Array Functions

[Dynamic arrays](#) are new in [Excel 365](#), and are a *major* upgrade to Excel's formula engine. As part of the dynamic array update, Excel includes new functions which directly leverage dynamic arrays to solve problems that are traditionally hard to solve with conventional formulas. If you are using Excel 365, make sure you are aware of these new functions:

### FUNCTION      PURPOSE

<a href="#">FILTER</a>	..... Filter data and return matching records
<a href="#">RANDARRAY</a>	.... Generate array of random numbers
<a href="#">SEQUENCE</a>	.... Generate array of sequential numbers
<a href="#">SORT</a>	..... Sort range by column
<a href="#">SORTBY</a>	..... Sort range by another range or array
<a href="#">UNIQUE</a>	..... Extract unique values from a list or range
<a href="#">XLOOKUP</a>	..... Modern replacement for VLOOKUP
<a href="#">XMATCH</a>	..... Modern replacement for the MATCH function

**FILTER and SORT  
can be used in  
many ways**



### VIDEO

[New dynamic array functions in Excel  
\(about 3 minutes\).](#)

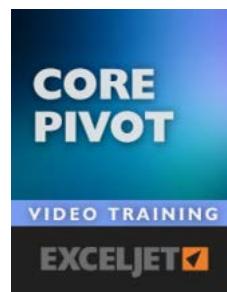


## More Resources

See also the [full list of Excel functions](#) and collection of [Excel Formulas](#) on our website for reference.

## Excel Training

In addition to the free resources on the site, we also provide [high quality video training](#). Our videos are quick, clean, and to the point, so you can learn Excel in less time, and easily review key topics when needed. Each video comes with its own practice worksheet. [Read more...](#)



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