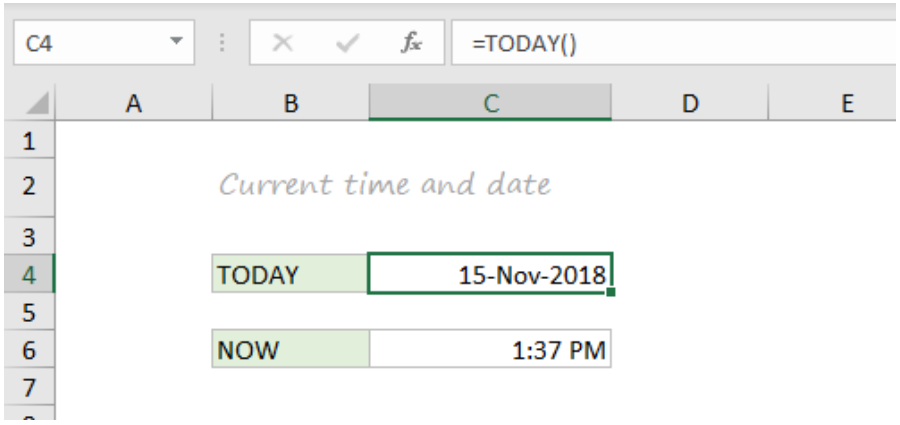
Date and Time Functions

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:



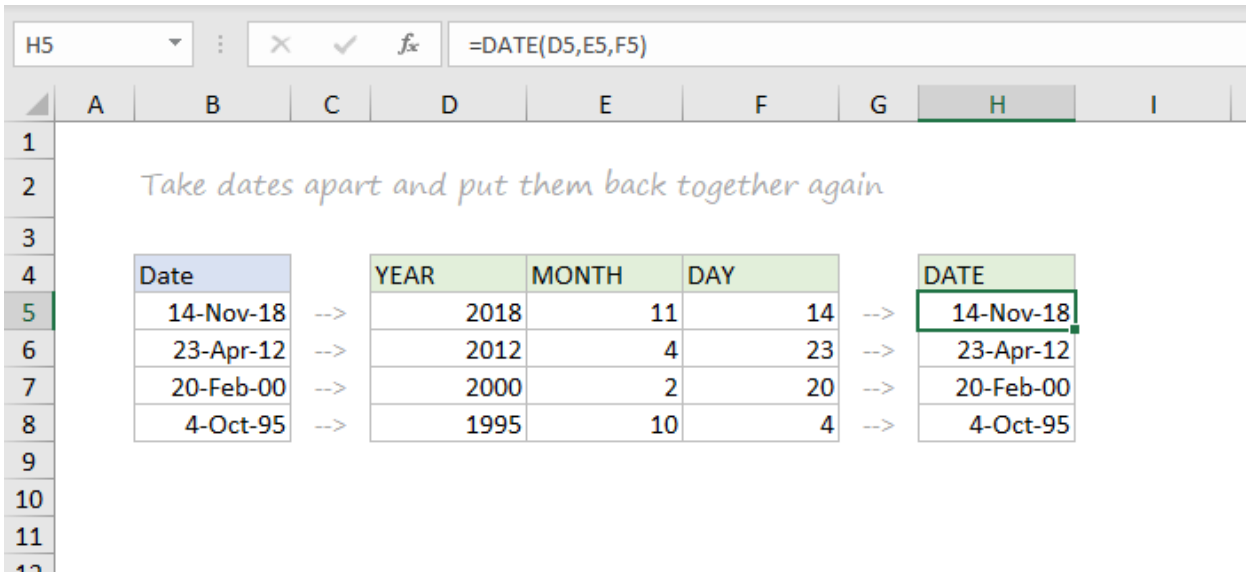
TODAY() // returns current date

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.

- **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.



=DAY("14-Nov-2018") // returns 14

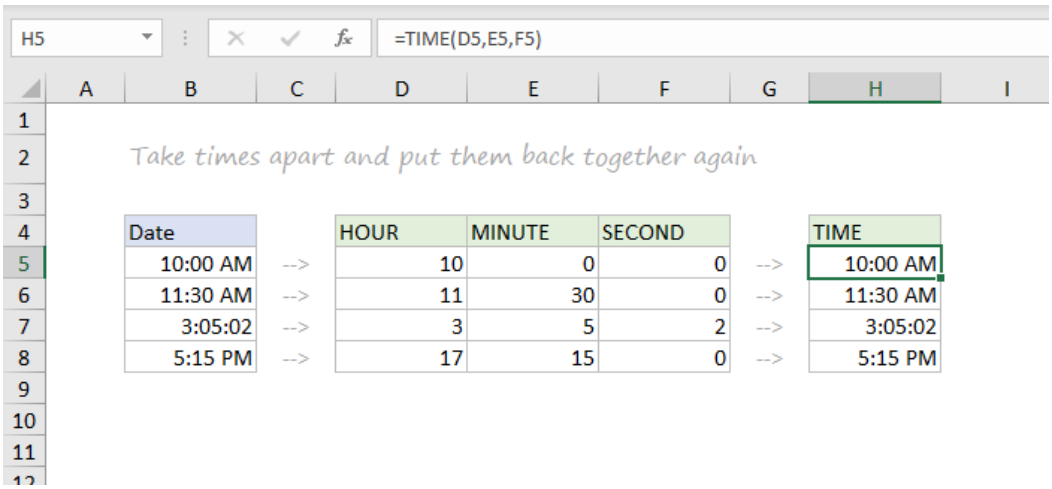
=MONTH("14-Nov-2018") // returns 11

=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.



=HOUR("10:30") // returns 10

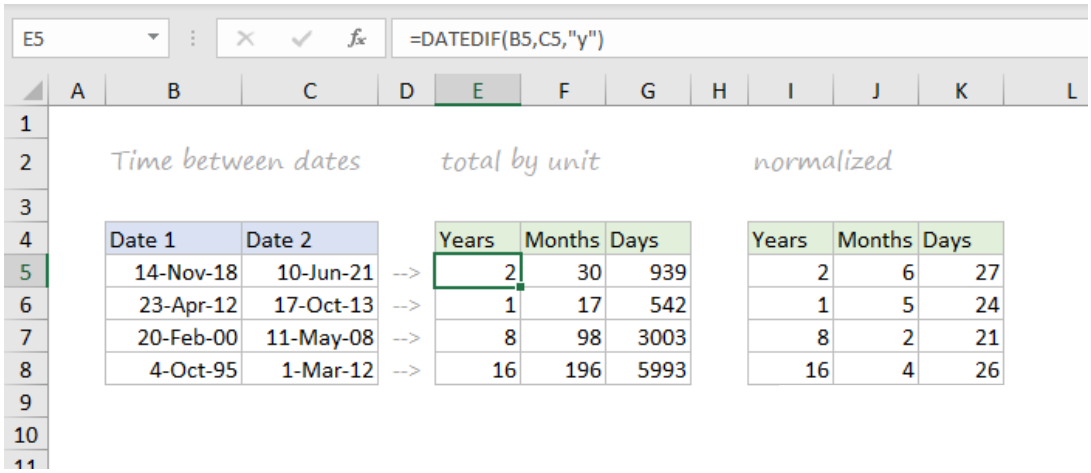
=MINUTE("10:30") // returns 30

=SECOND("10:30") // returns 0

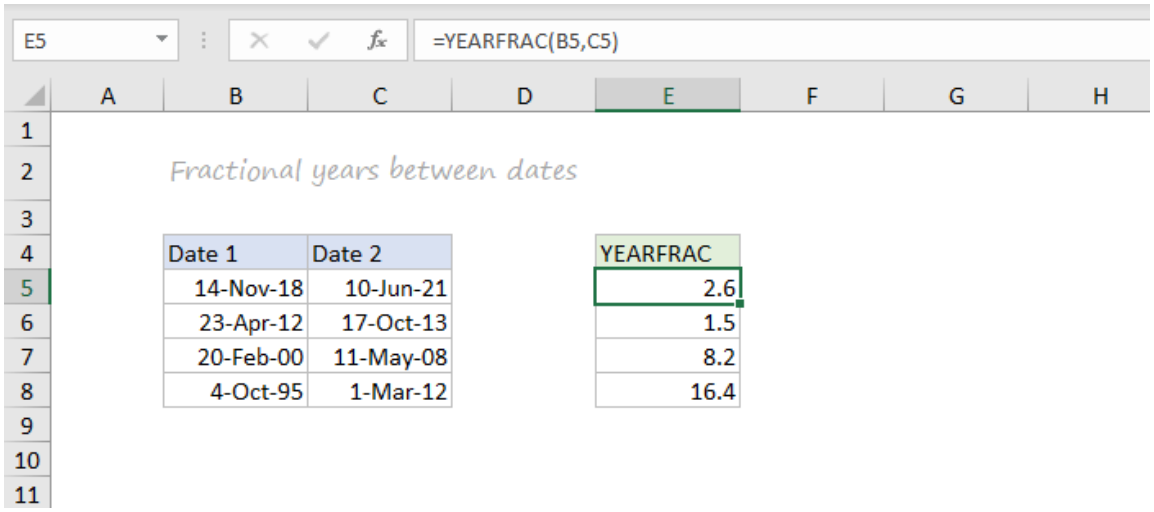
=TIME(10,30,0) // returns 10:30

- **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 6 months and 27 days".



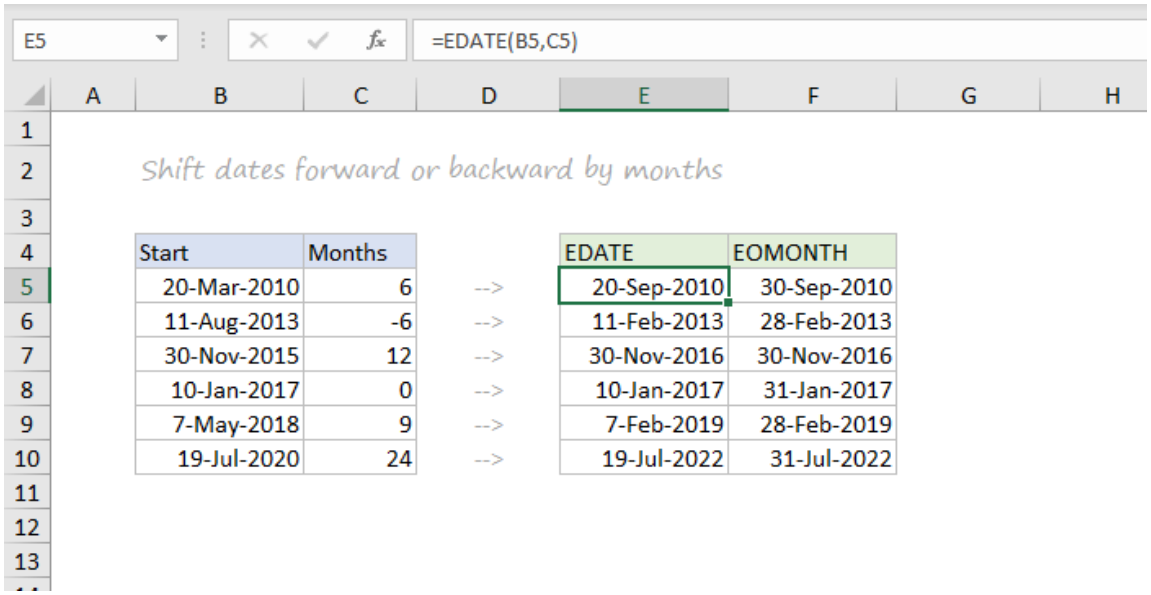
Use YEARFRAC to get fractional years:



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

- **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.

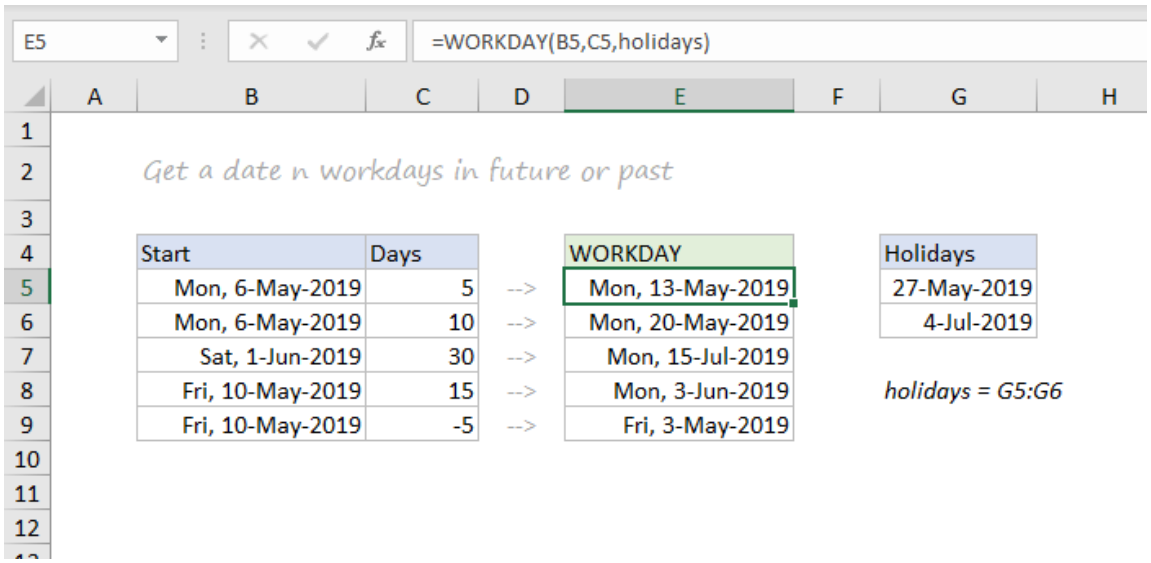


EDATE(date,6) // 6 months forward

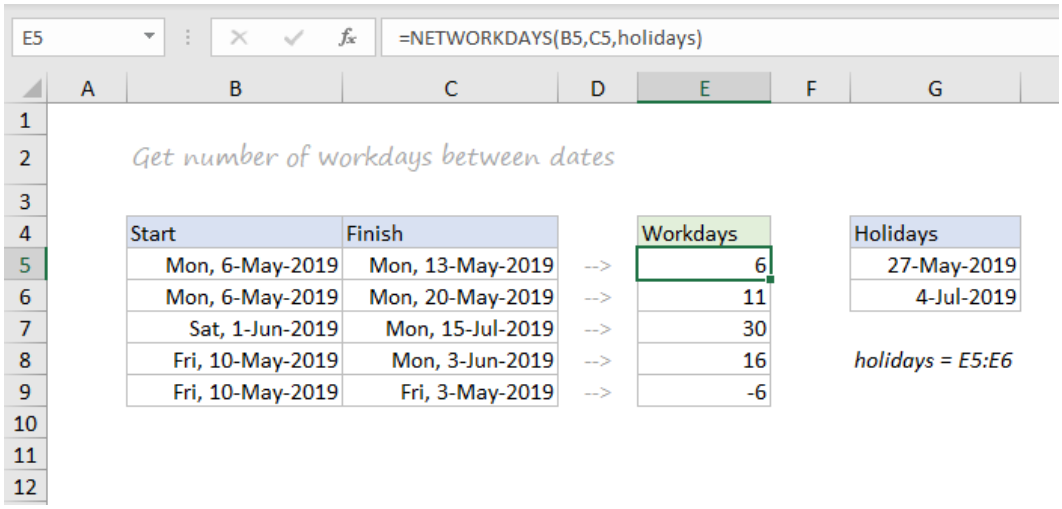
EOMONTH(date,6) // 6 months forward (end of month)

- **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.



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

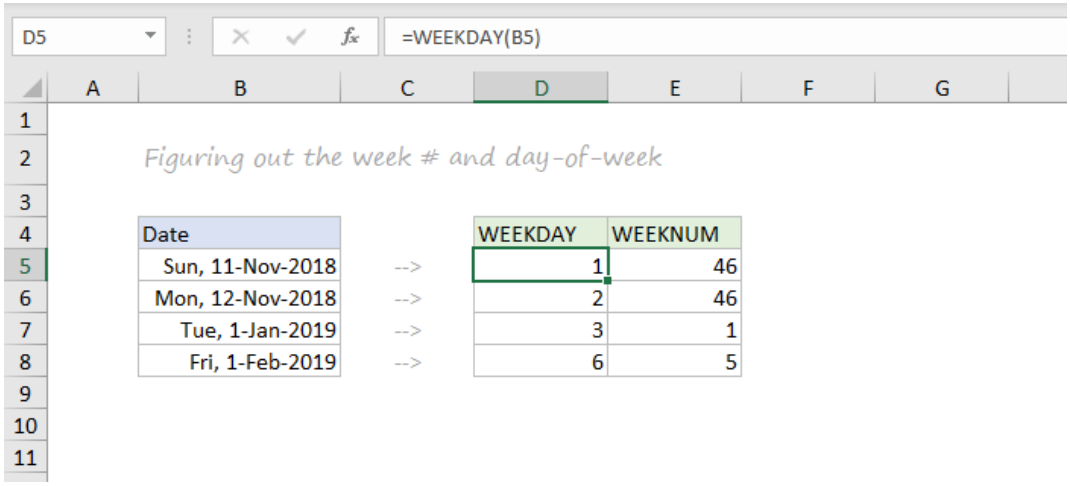


NETWORKDAYS(start,end,holidays) // number of workdays between dates

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.



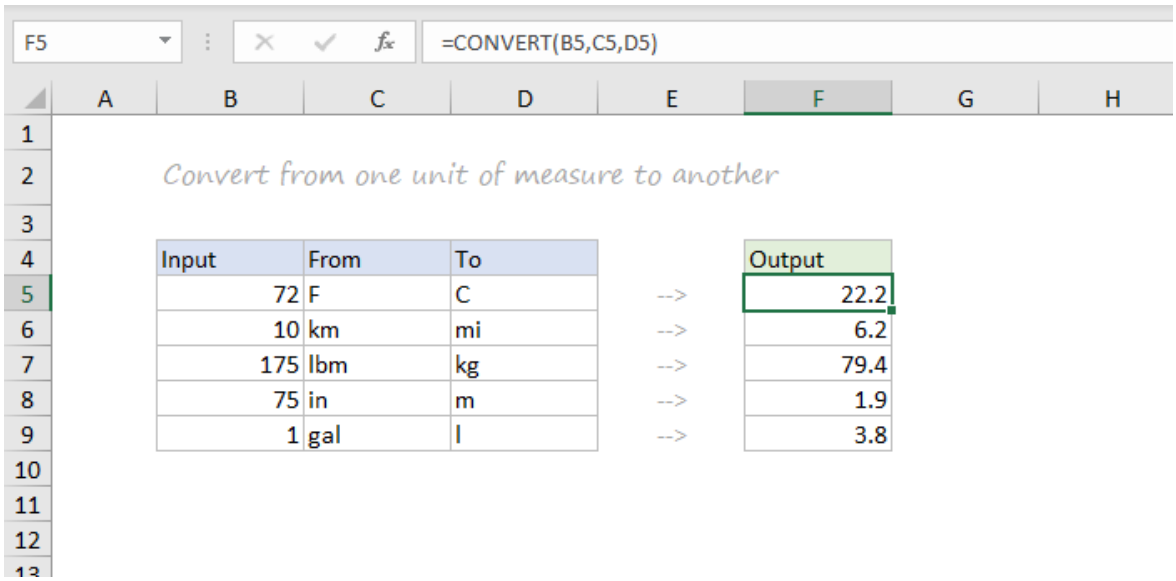
=WEEKDAY(date) // returns a number 1-7

=WEEKNUM(date) // returns week number in year

Engineering Function

- **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.



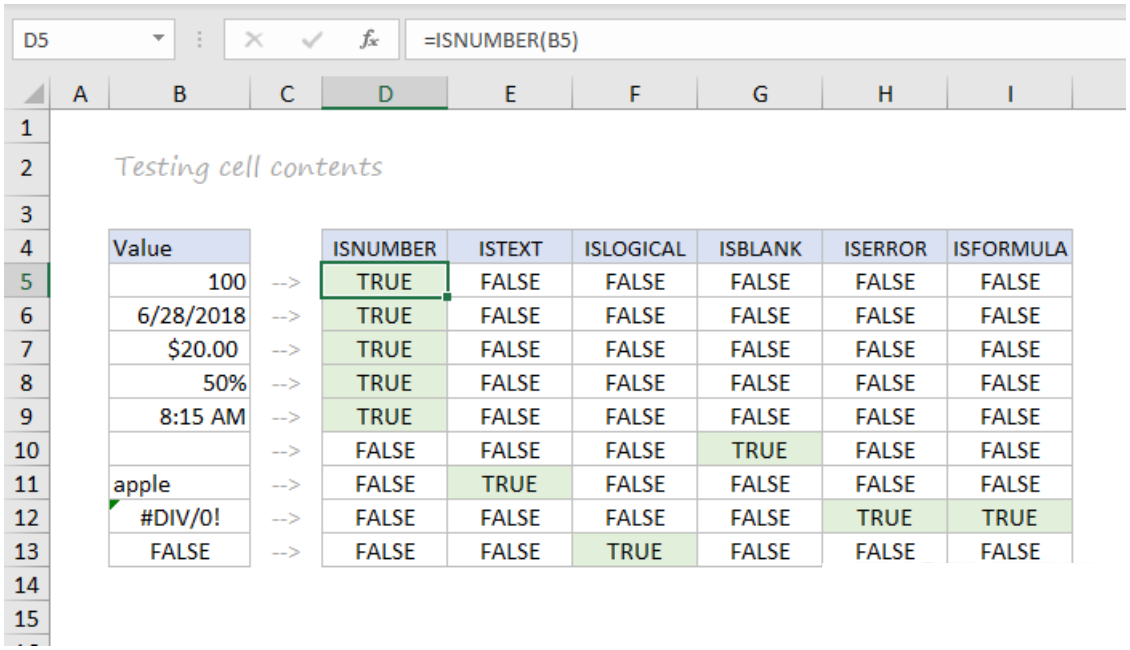
Input	From	To		Output
72	F	C	-->	22.2
10	km	mi	-->	6.2
175	lbm	kg	-->	79.4
75	in	m	-->	1.9
1	gal	l	-->	3.8

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

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.



Value		ISNUMBER	ISTEXT	ISLOGICAL	ISBLANK	ISERROR	ISFORMULA
100	-->	TRUE	FALSE	FALSE	FALSE	FALSE	FALSE
6/28/2018	-->	TRUE	FALSE	FALSE	FALSE	FALSE	FALSE
$20.00	-->	TRUE	FALSE	FALSE	FALSE	FALSE	FALSE
50%	-->	TRUE	FALSE	FALSE	FALSE	FALSE	FALSE
8:15 AM	-->	TRUE	FALSE	FALSE	FALSE	FALSE	FALSE
	-->	FALSE	FALSE	FALSE	TRUE	FALSE	FALSE
apple	-->	FALSE	TRUE	FALSE	FALSE	FALSE	FALSE
#DIV/0!	-->	FALSE	FALSE	FALSE	FALSE	TRUE	TRUE
FALSE	-->	FALSE	FALSE	TRUE	FALSE	FALSE	FALSE

Excel also has ISODD and ISEVEN functions that will test a number to see if it's even or odd.

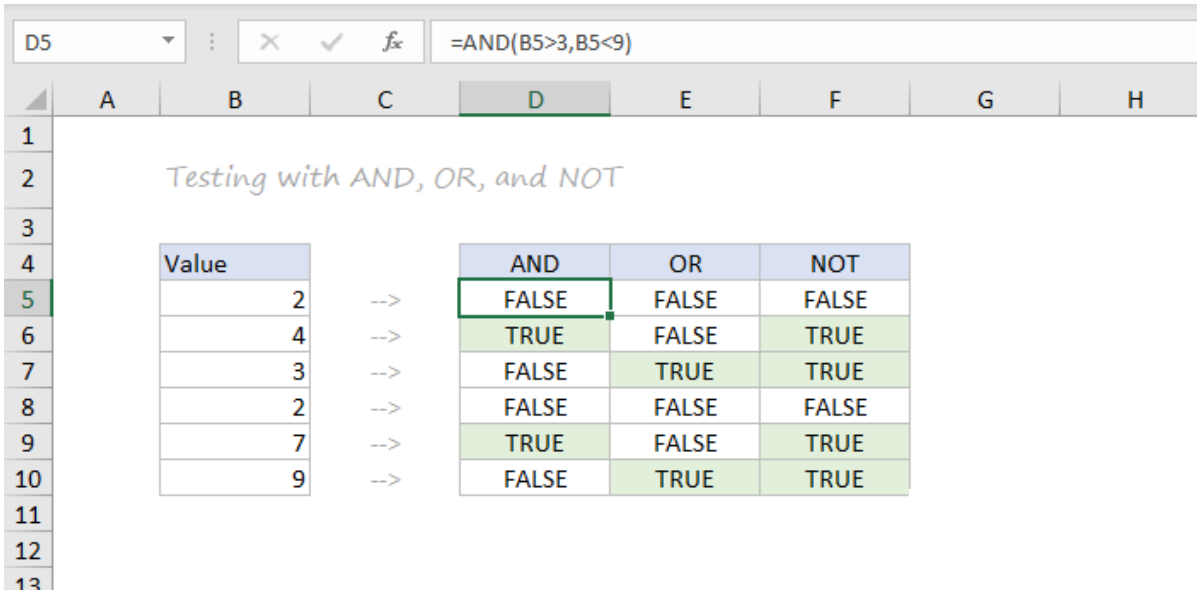
By the way, the green fill in the screenshot above is applied automatically with a conditional formatting formula.

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	FALSE
4	-->	TRUE	FALSE	TRUE
3	-->	FALSE	TRUE	TRUE
2	-->	FALSE	FALSE	FALSE
7	-->	TRUE	FALSE	TRUE
9	-->	FALSE	TRUE	TRUE

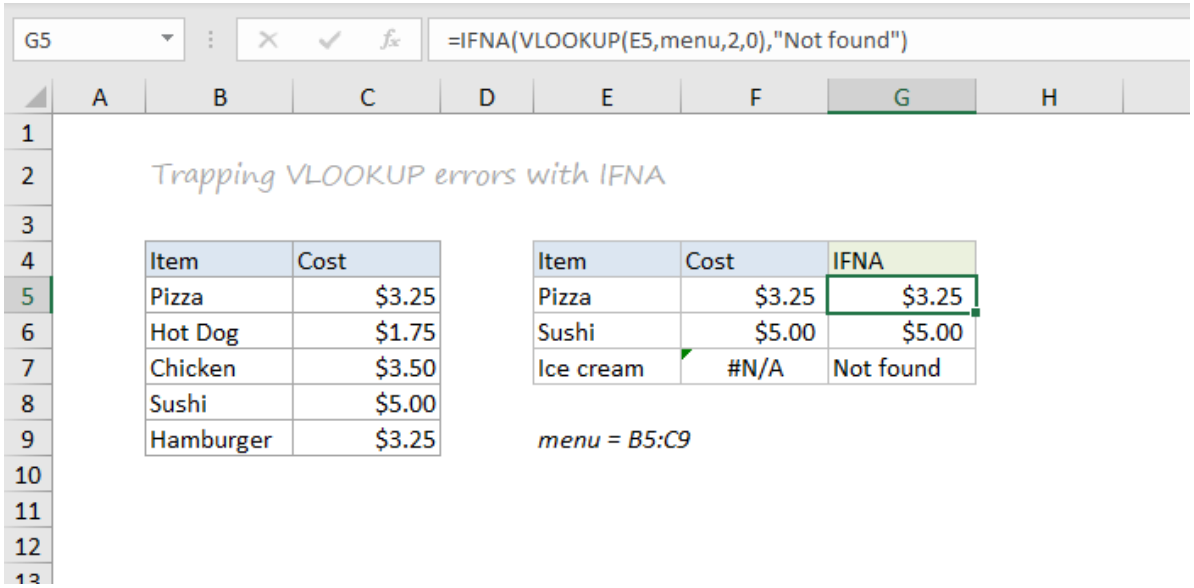
=AND(B5>3,B5<9)

=OR(B5=3,B5=9)

=NOT(B5=2)

- **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.



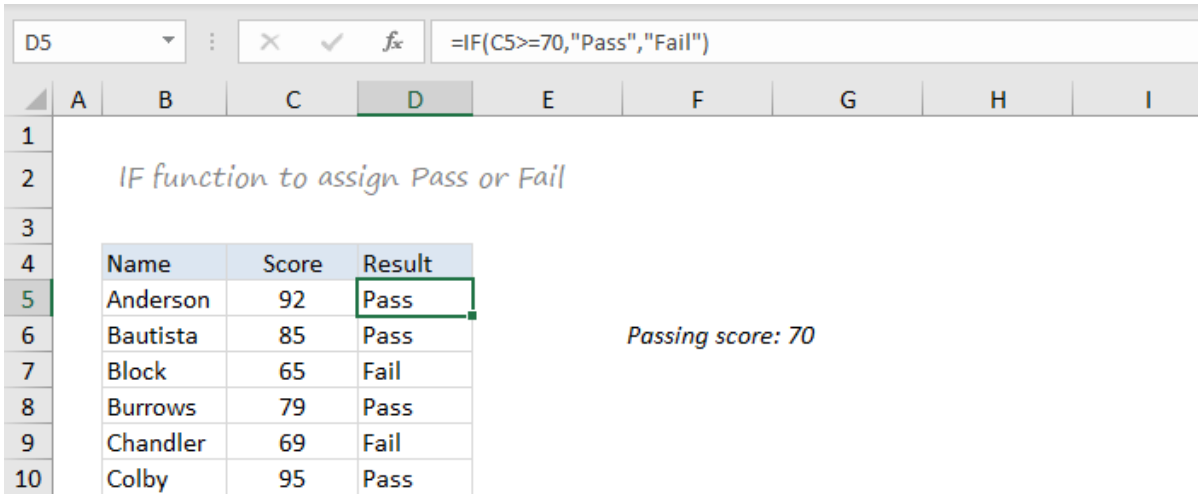
=VLOOKUP(E5,menu,2,0) // no error trapping

=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.

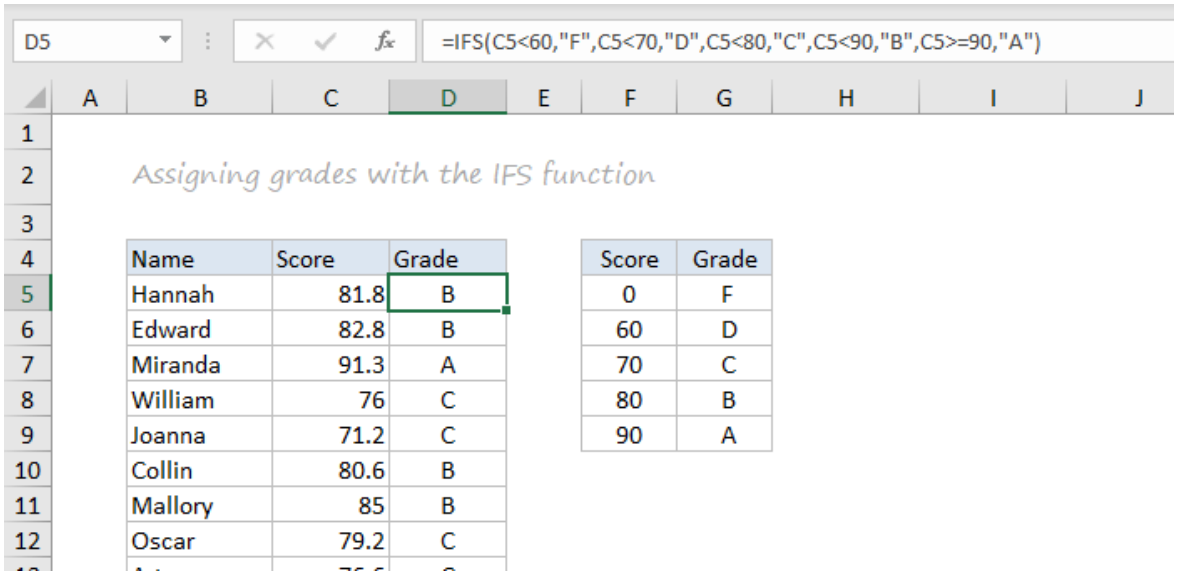
- **IF and IFS functions**

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":



Multiple IF functions can be nested together to perform more complex logical tests.

New in Excel 2019 and Excel 365, the IFS function can run multiple logical tests without nesting IFs.

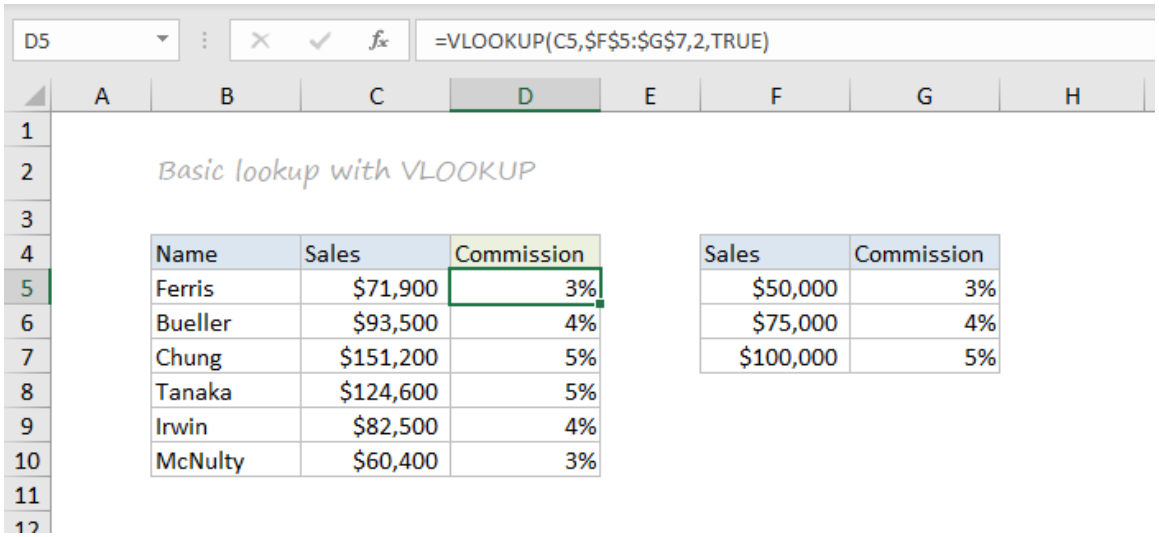


=IFS(C5<60,"F",C5<70,"D",C5<80,"C",C5<90,"B",C5>=90,"A")

Lookup and Reference Functions

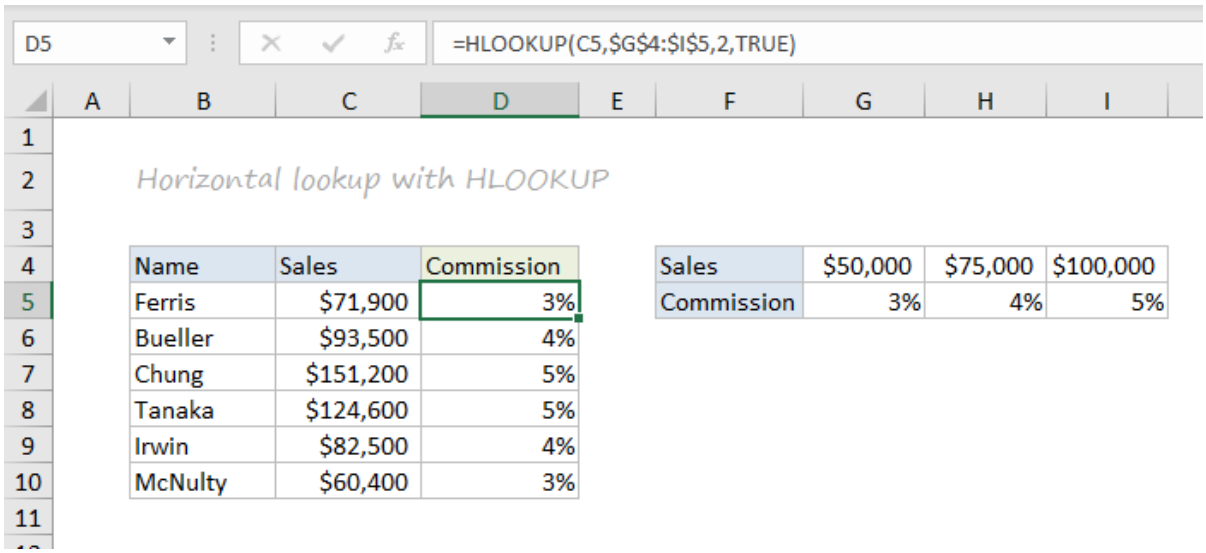
- **VLOOKUP and HLOOKUP**

Excel offers a number of functions to lookup and retrieve data. Most famous of all is VLOOKUP:



=VLOOKUP(C5,$F$5:$G$7,2,TRUE)

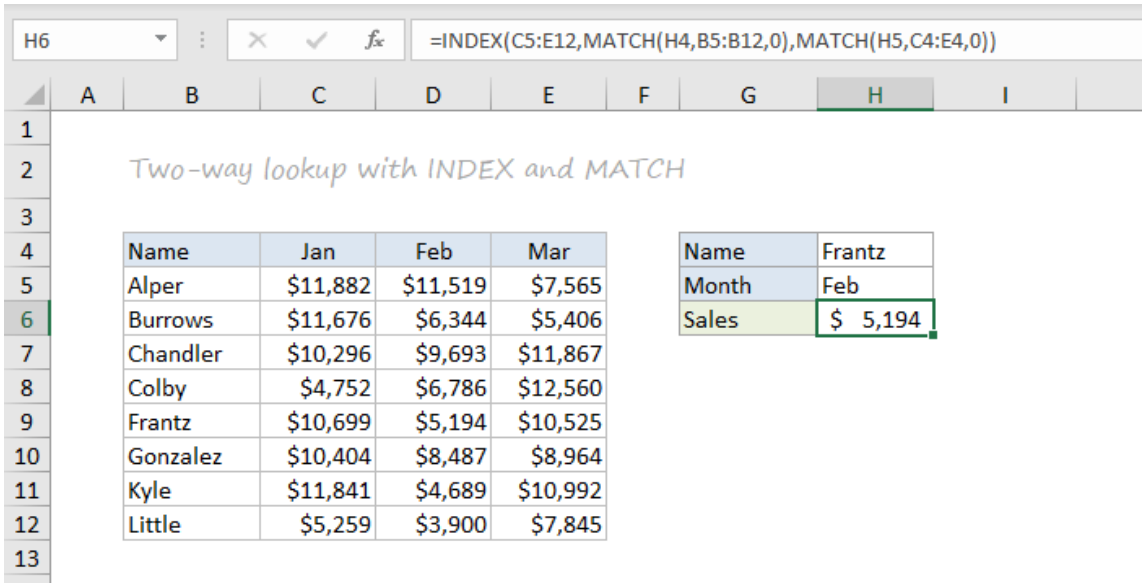
HLOOKUP works like VLOOKUP, but expects data arranged horizontally:



=HLOOKUP(C5,$G$4:$I$5,2,TRUE)

- **INDEX and MATCH**

For more complicated lookups, INDEX and MATCH offers more flexibility and power:

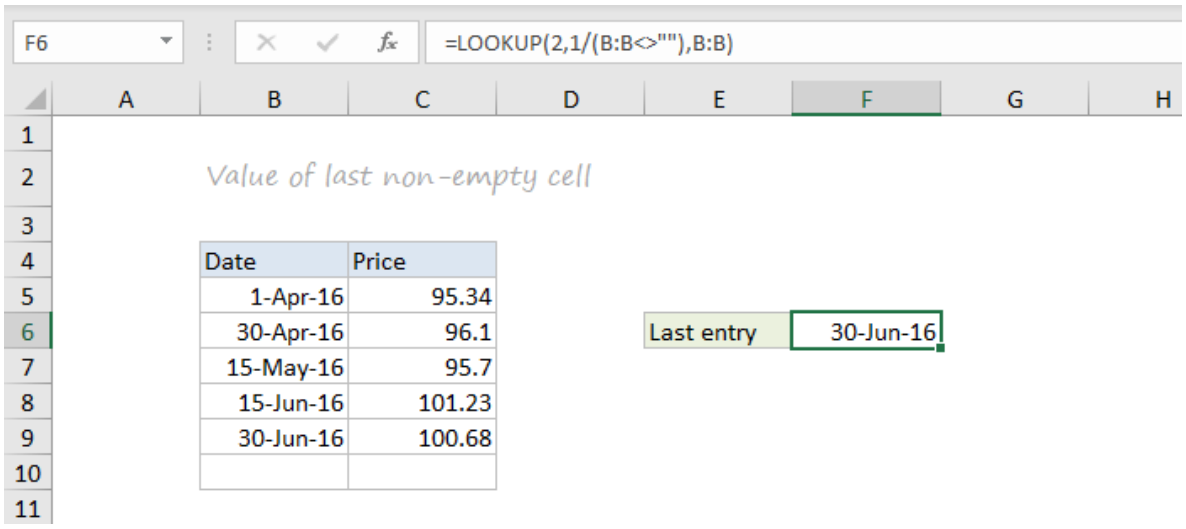


=INDEX(C5:E12,MATCH(H4,B5:B12,0),MATCH(H5,C4:E4,0))

Both the INDEX function and the MATCH function are powerhouse functions that turn up in all kinds of formulas.

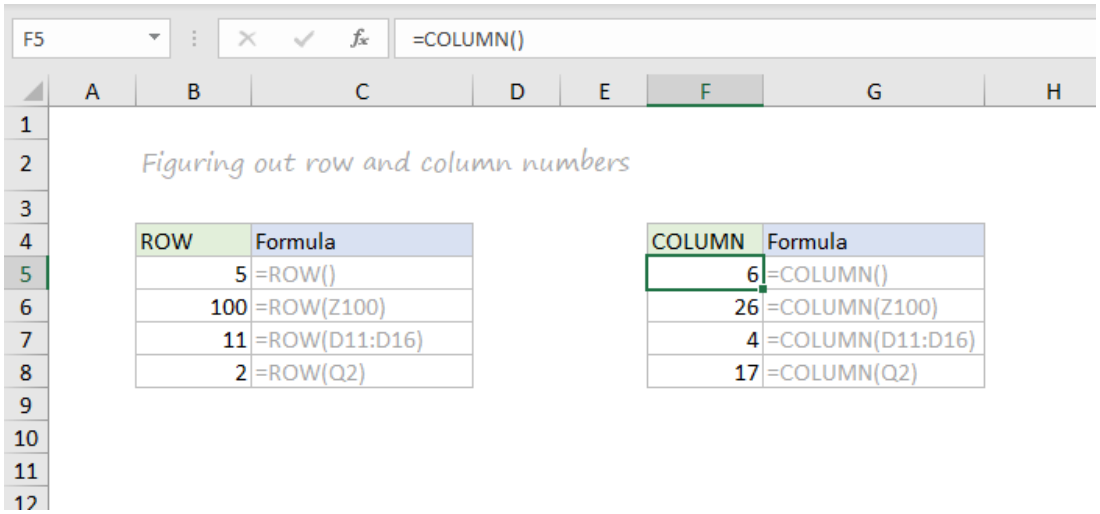
- **LOOKUP**

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:



- **ROW and COLUMN**

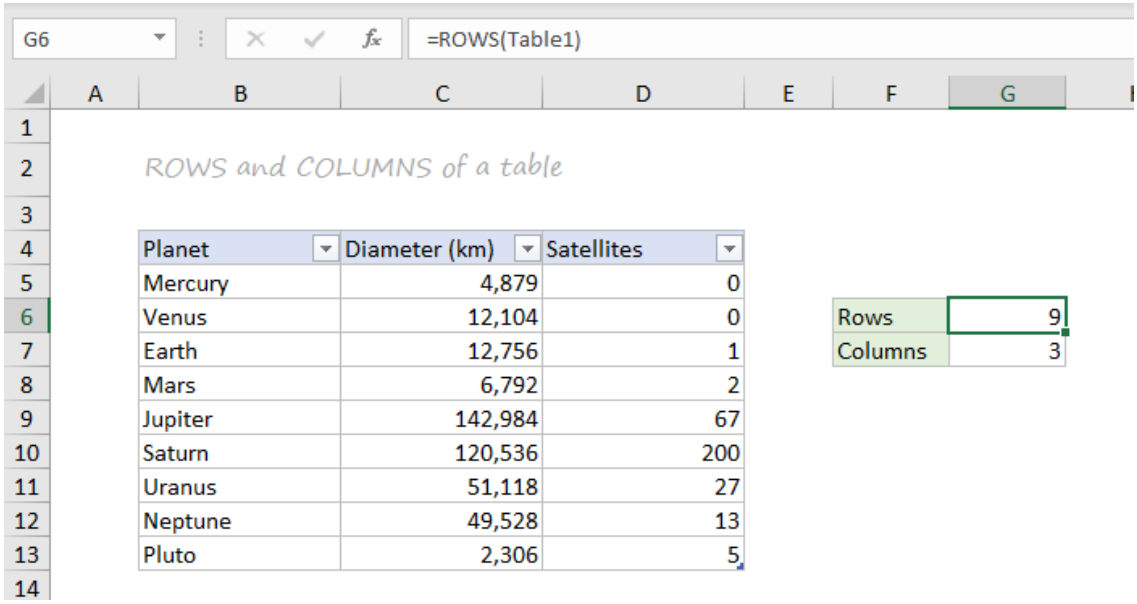
You can use the ROW function and COLUMN function to find row and column numbers on a worksheet. Notice both ROW and COLUMN return values for the current cell if no reference is supplied:



The row function also shows up often in advanced formulas that process data with relative row numbers.

- **ROWS and COLUMNS**

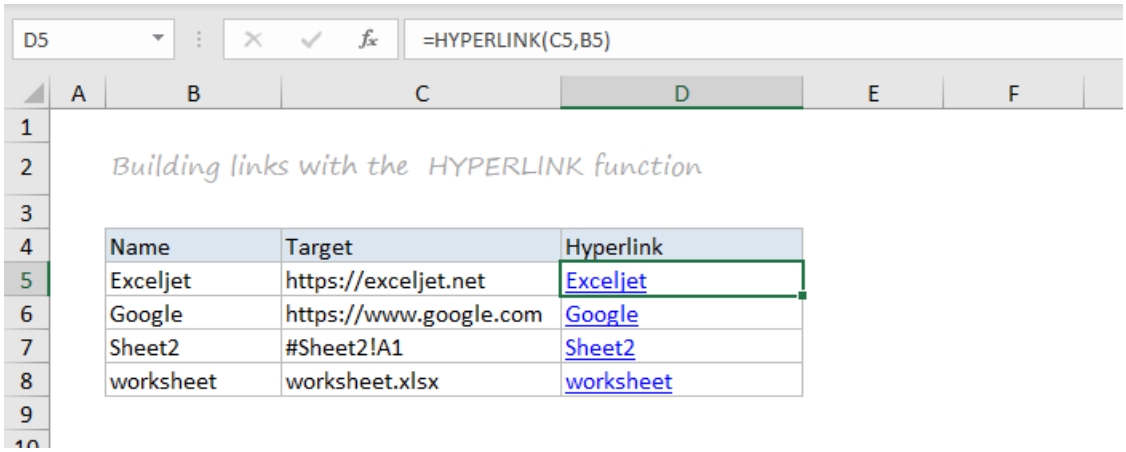
The ROWS function and COLUMNS function provide a count of rows in a reference. In the screen below, we are counting rows and columns in an Excel Table named "Table1".



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.

HYPERLINK

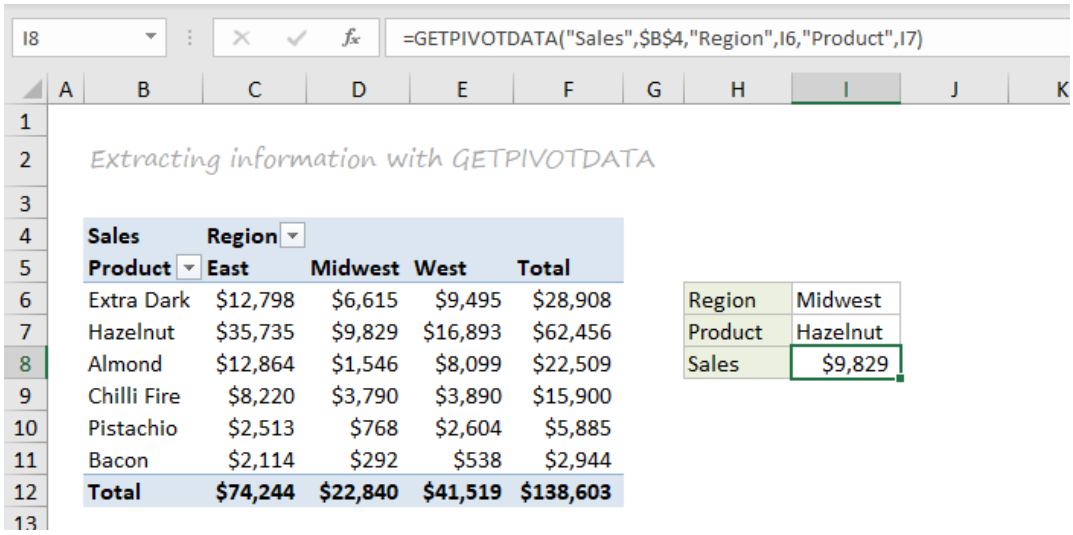
You can use the HYPERLINK function to construct a link with a formula. Note HYPERLINK lets you build both external links and internal links:



=HYPERLINK(C5,B5)

- **GETPIVOTDATA**

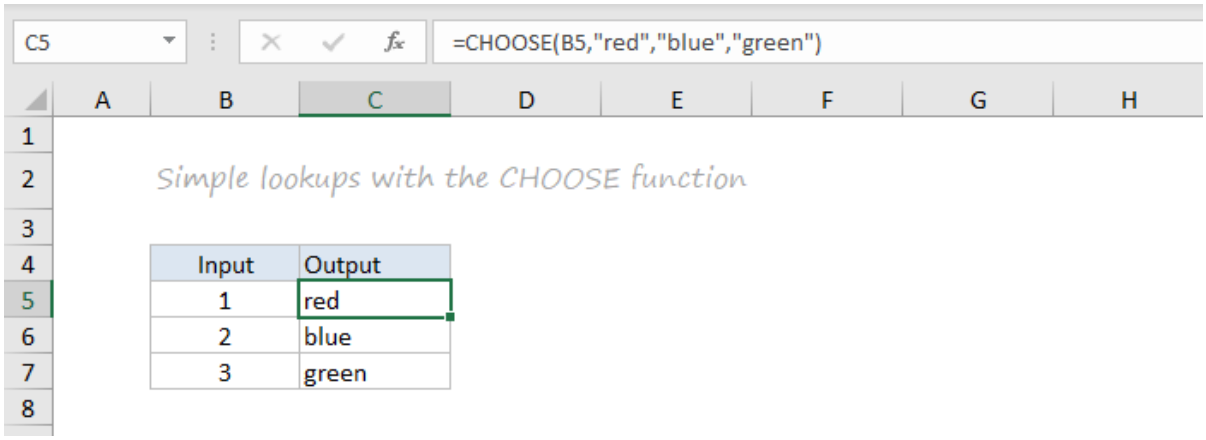
The GETPIVOTDATA function is useful for retrieving information from existing pivot tables.



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

- **CHOOSE**

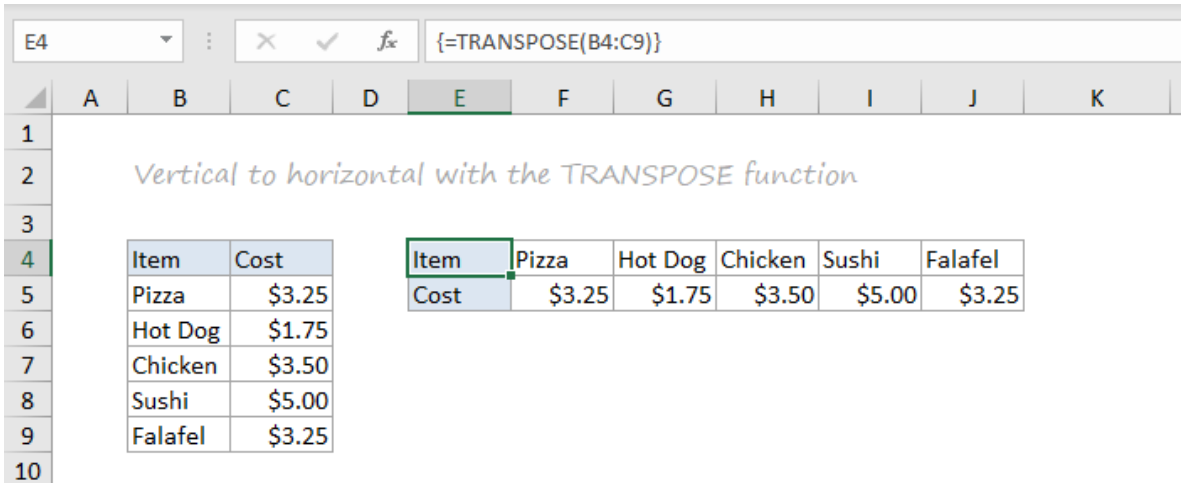
The CHOOSE function is handy any time you need to make a choice based on a number:



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

- **TRANSPOSE**

The TRANSPOSE function gives you an easy way to transpose vertical data to horizontal, and vice versa.

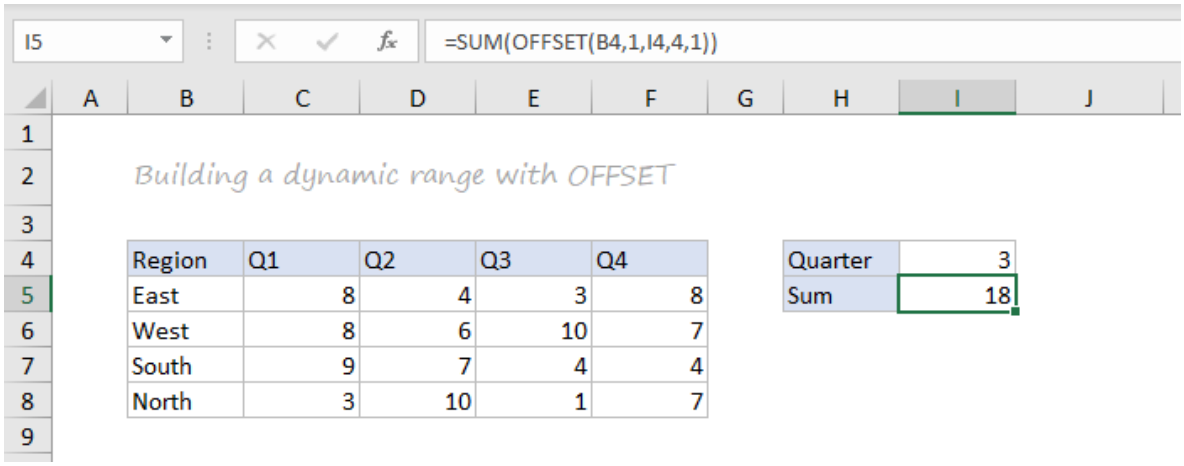


{=TRANSPOSE(B4:C9)}

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

- **OFFSET**

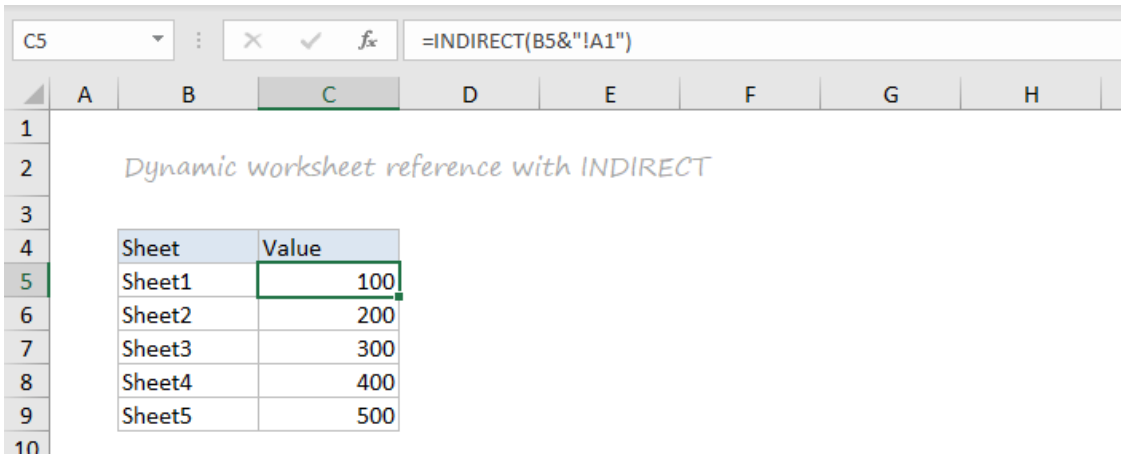
The OFFSET function is useful for all kinds of dynamic ranges. From a starting location, it lets you specify row and column offsets, and also the final row and column size. The result is a range that can respond dynamically to changing conditions and inputs. You can feed this range to other functions, 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

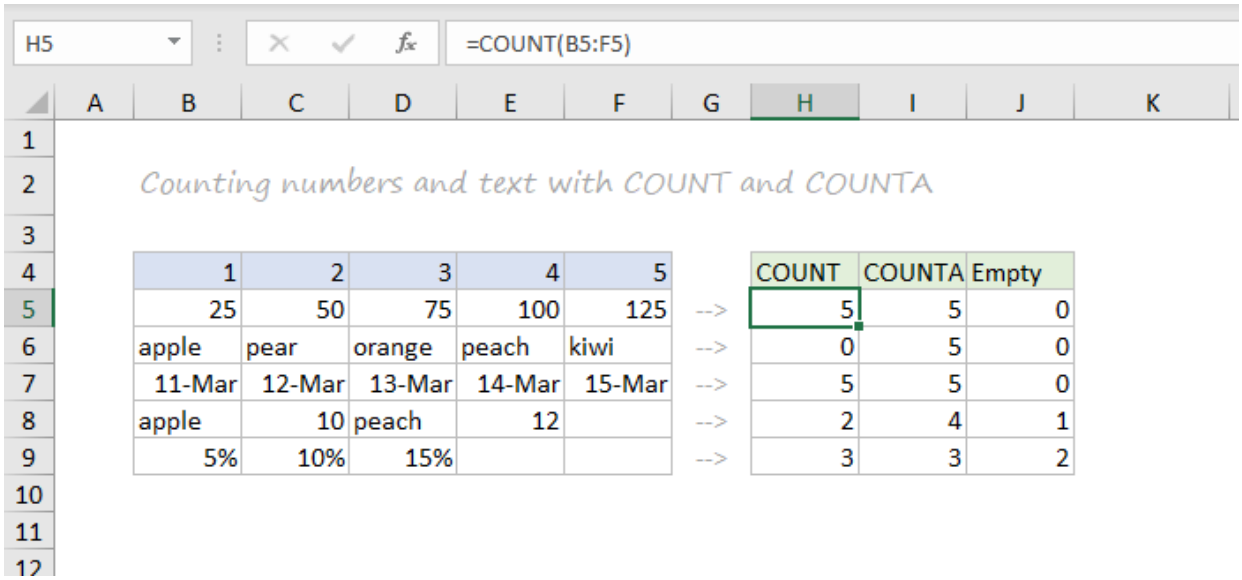
The INDIRECT function is also used to "lock" references so they won't change, when rows or columns are added or deleted.

Caution: both OFFSET and INDIRECT are volatile functions and can slow down large or complicated spreadsheets.

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.



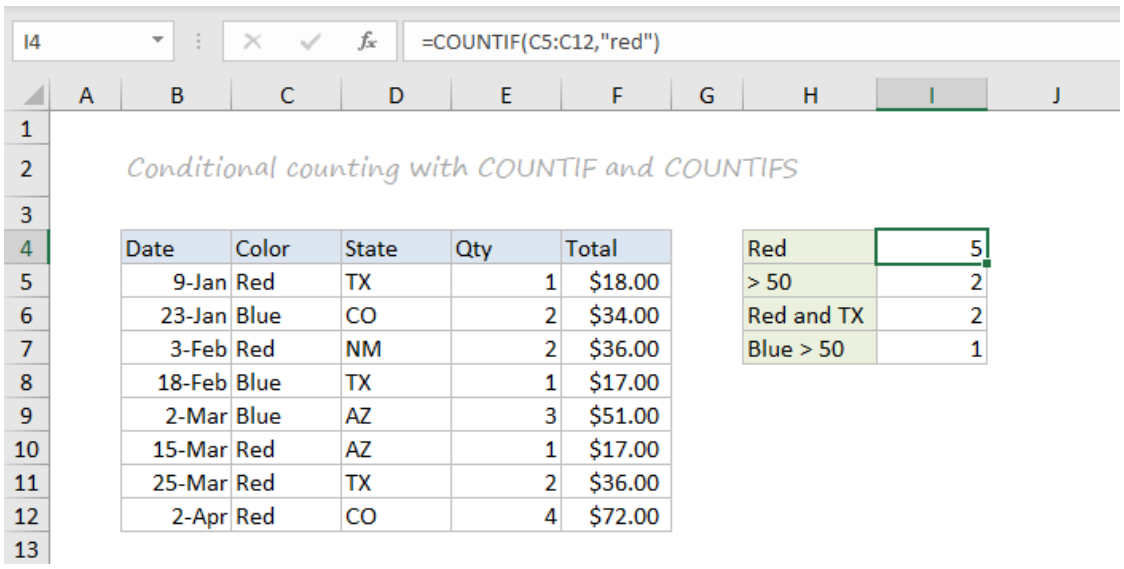
=COUNT(B5:F5) // count numbers

=COUNTA(B5:F5) // count numbers and text

=COUNTIF(B5:F5,"") // count blanks

- **COUNTIF and COUNTIFS**

For conditional counts, the COUNTIF function can apply one criteria. The COUNTIFS function can apply multiple criteria at the same time:



=COUNTIF(C5:C12,"red") // count red

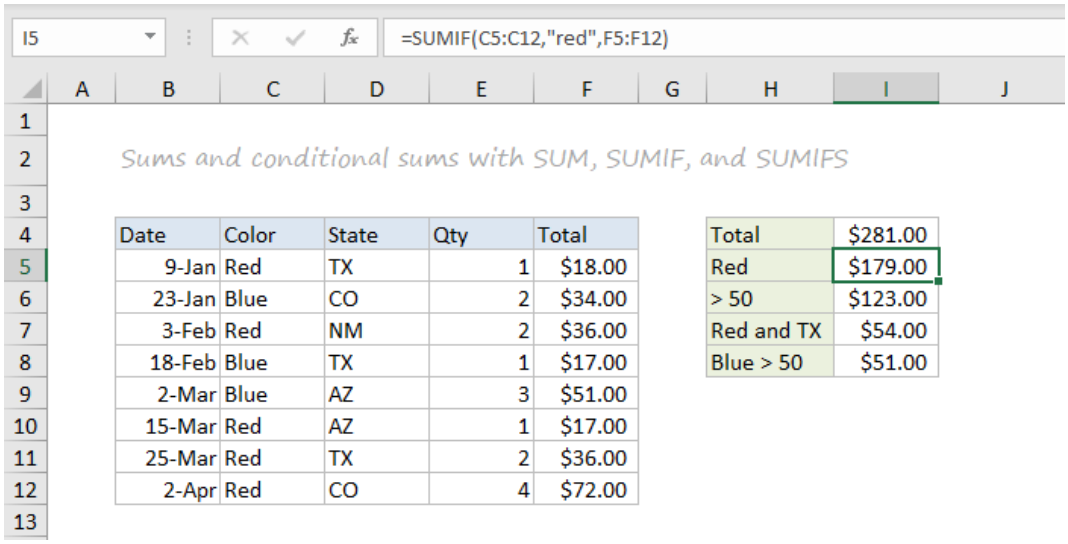
=COUNTIF(F5:F12,">50") // count total > 50

=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.



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	$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

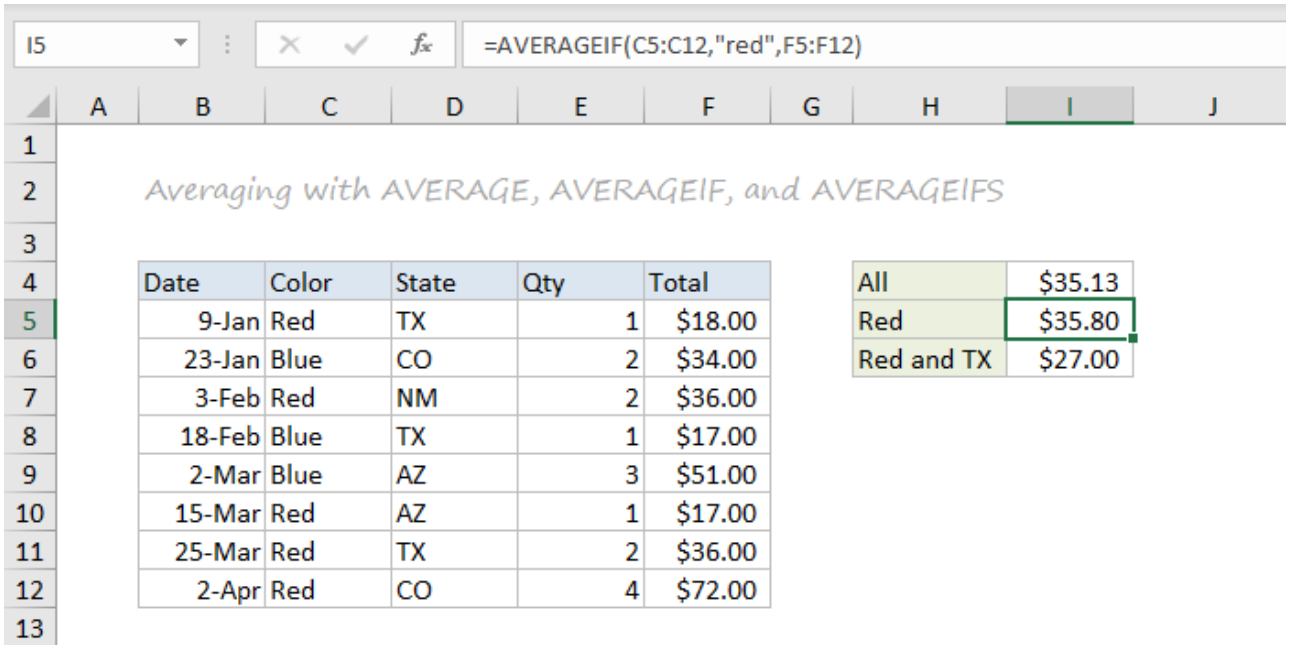
=SUMIF(F5:F12,">50") // over 50

=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.



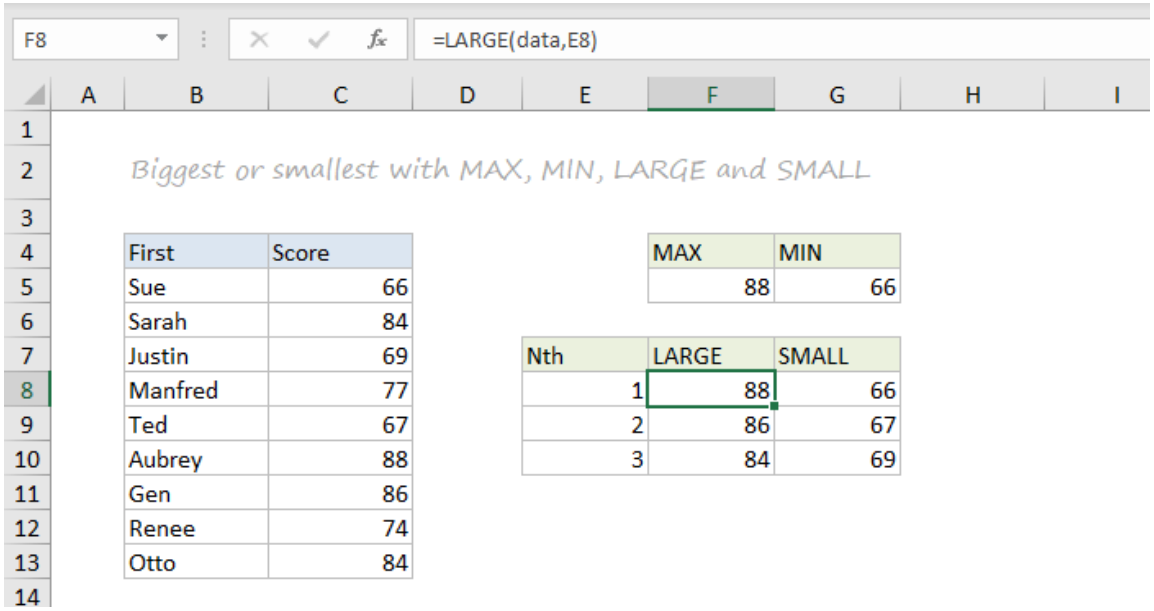
=AVERAGE(F5:F12) // all

=AVERAGEIF(C5:C12,"red",F5:F12) // red only

=AVERAGEIFS(F5:F12,C5:C12,"red",D5:D12,"tx") // red and tx

- **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.



=MAX(data) // largest

=MIN(data) // smallest

=LARGE(data,1) // 1st largest

=LARGE(data,2) // 2nd largest

=LARGE(data,3) // 3rd largest

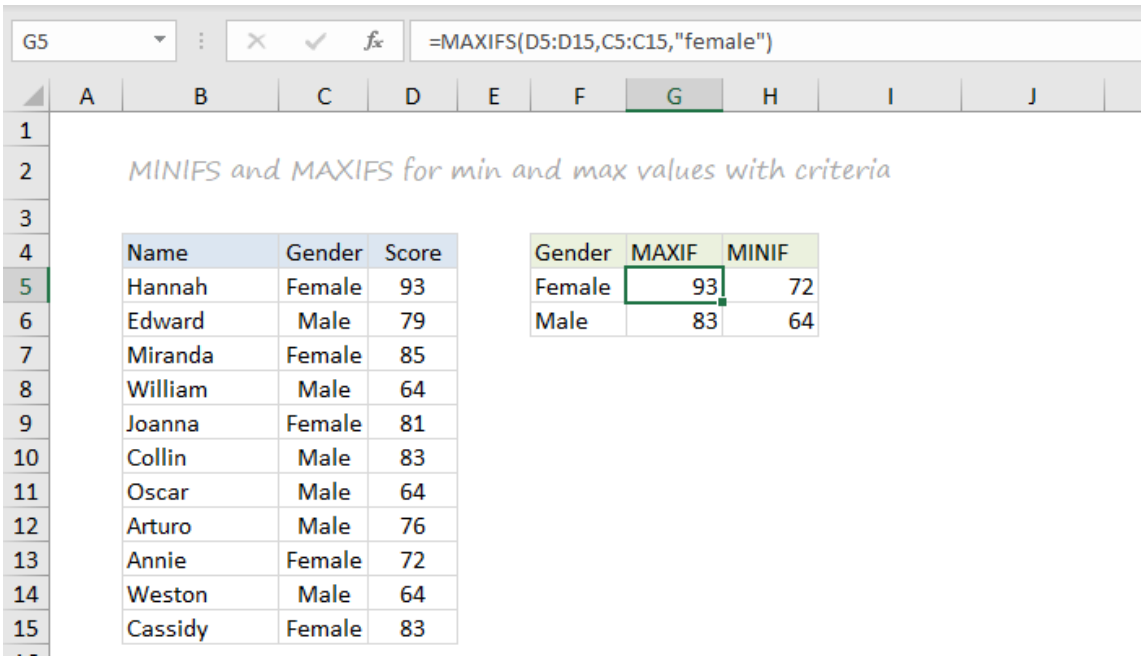
=SMALL(data,1) // 1st smallest

=SMALL(data,2) // 2nd smallest

=SMALL(data,3) // 3rd smallest

- **MINIFS, MAXIFS**

The MINIFS and MAXIFS. These functions let you find minimum and maximum values with conditions:



=MAXIFS(D5:D15,C5:C15,"female") // highest female

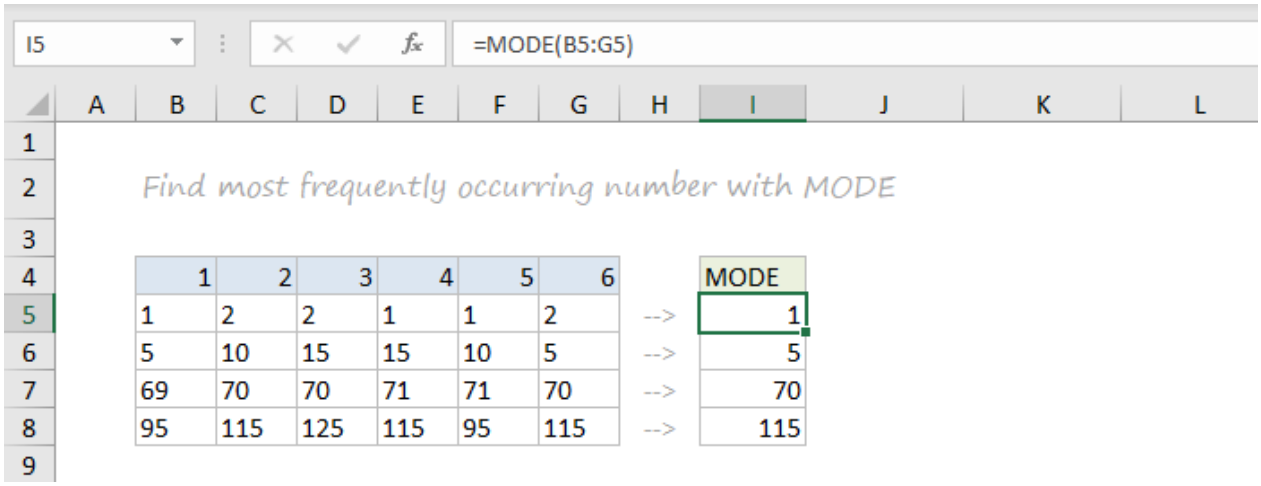
=MAXIFS(D5:D15,C5:C15,"male") // highest male

=MINIFS(D5:D15,C5:C15,"female") // lowest female

=MINIFS(D5:D15,C5:C15,"male") // lowest male

- **MODE**

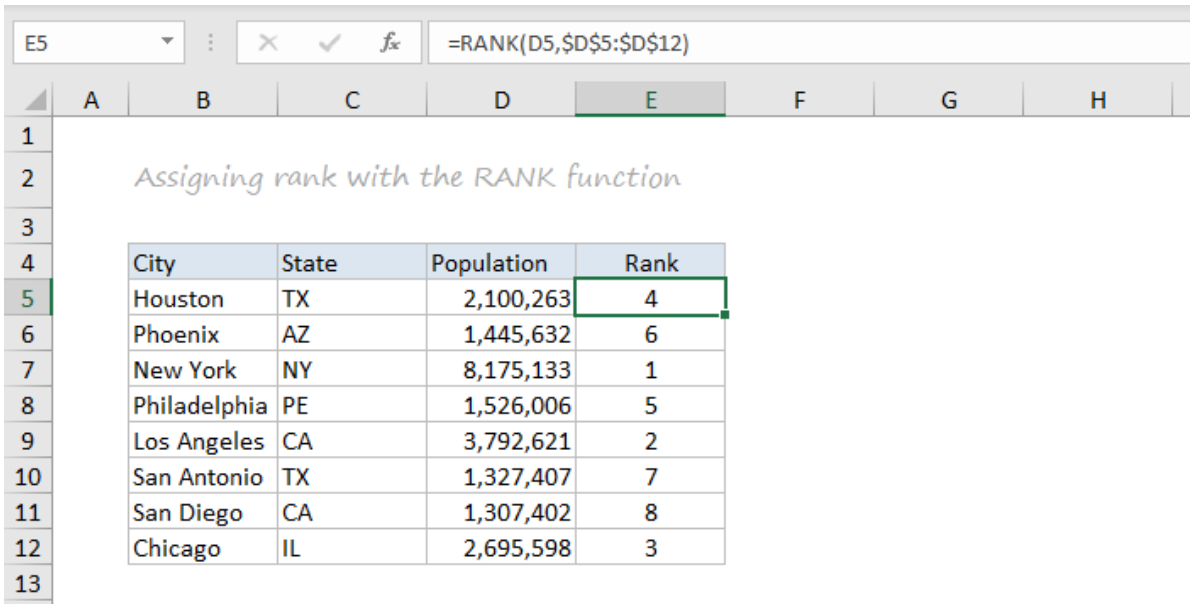
The MODE function returns the most commonly occurring number in a range:



=MODE(B5:G5) // returns 1

- **RANK**

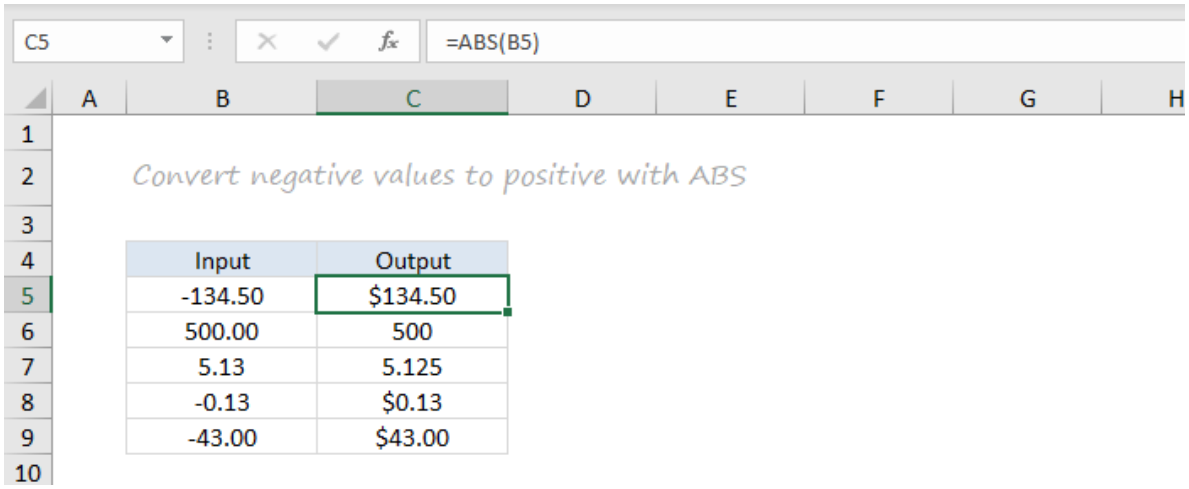
To rank values largest to smallest, or smallest to largest, use the RANK function:



MATH Functions

- **ABS**

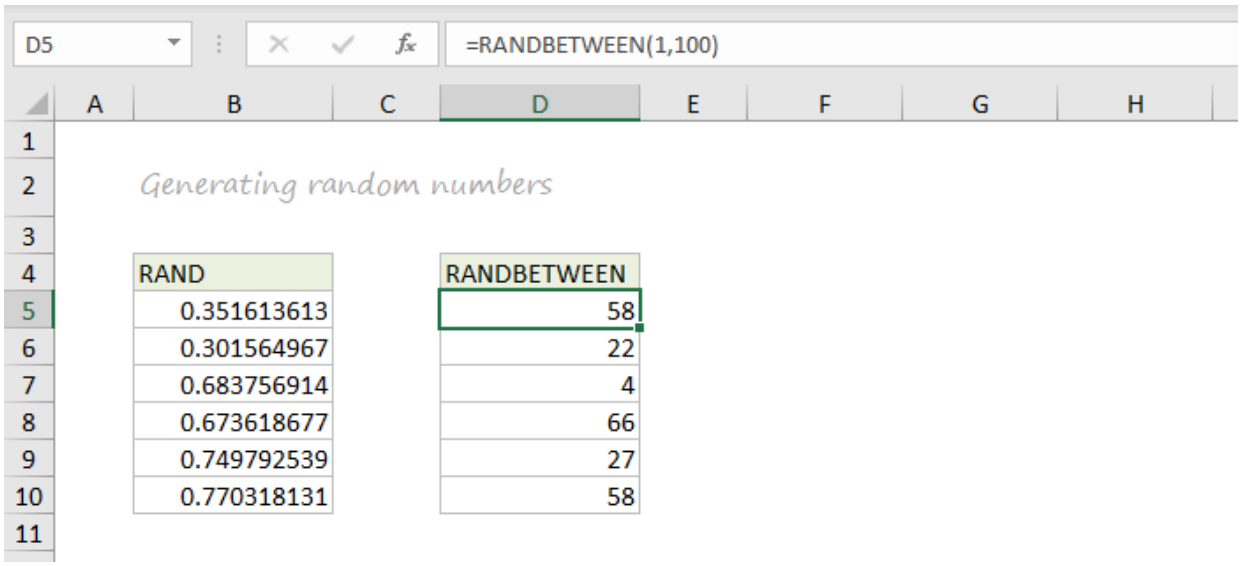
To change negative values to positive use the ABS function.



=ABS(-134.50) // returns 134.50

- **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.

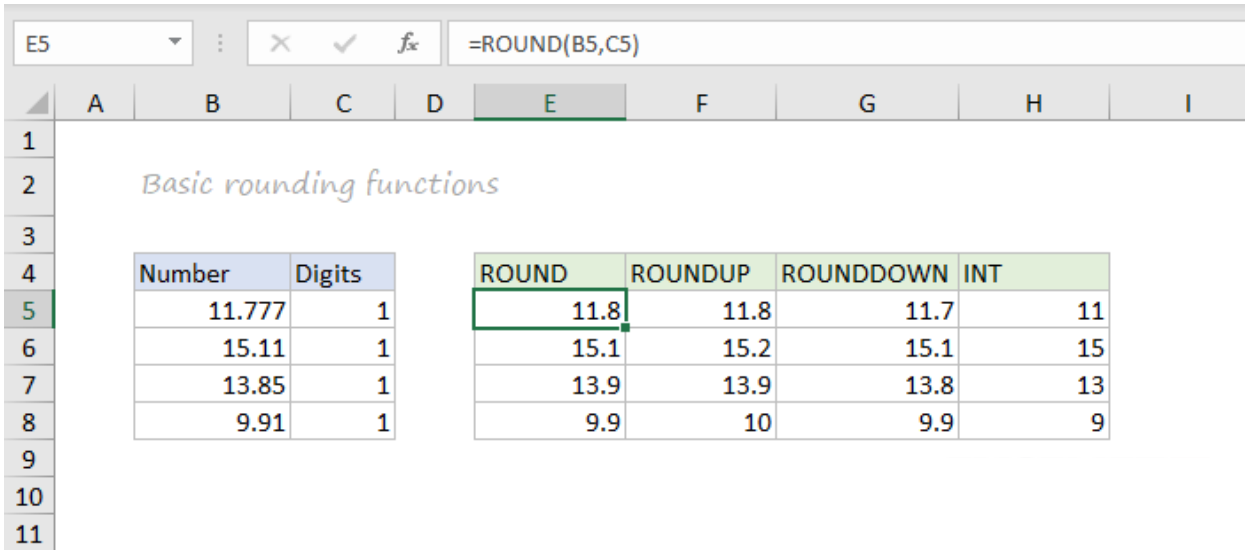


=RAND() // between zero and 1

=RANDBETWEEN(1,100) // between 1 and 100

- **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.



=ROUND(11.777,1) // returns 11.8

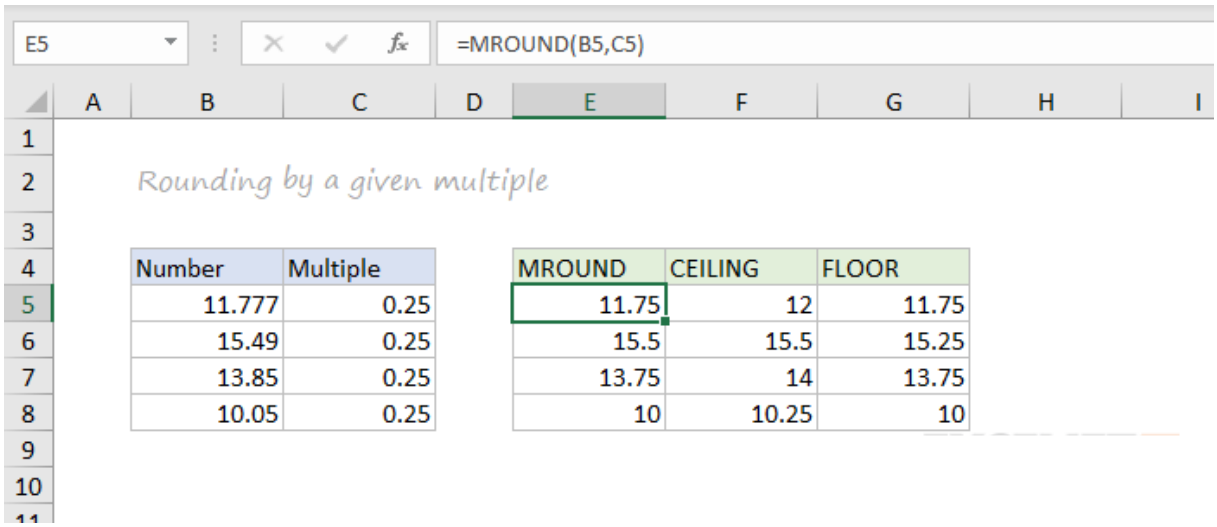
=ROUNDUP(11.777) // returns 11.8

=ROUNDDOWN(11.777,1) // returns 11.7

=INT(11.777) // returns 11

- **MROUND, CEILING, FLOOR**

To round values to 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.



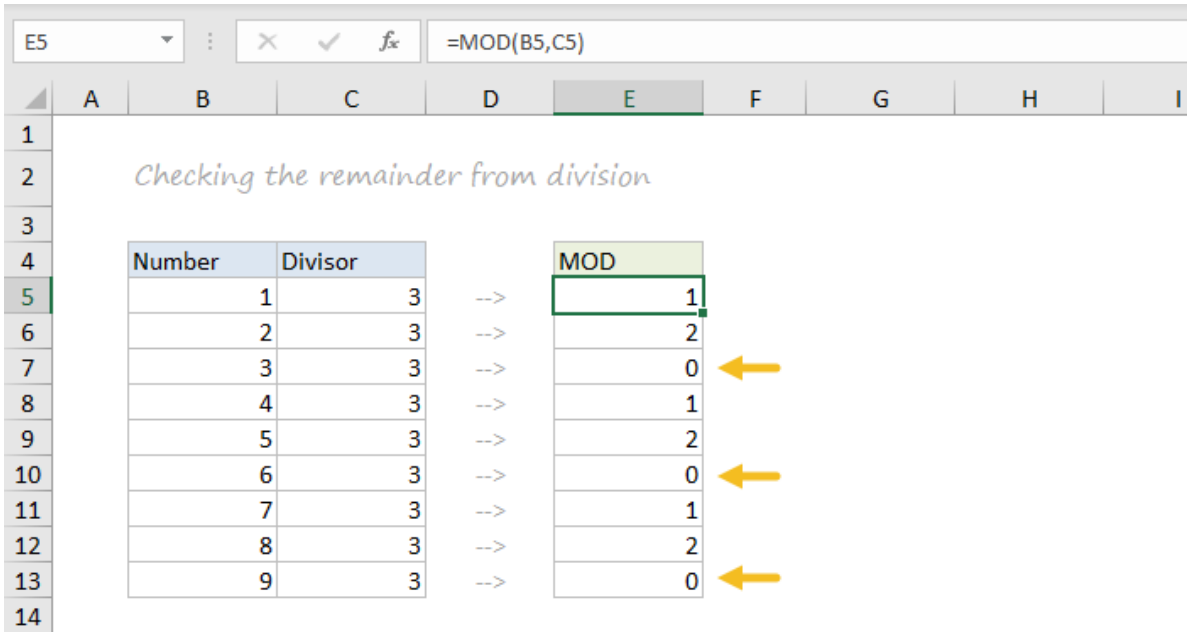
=MROUND(13.85,.25) // returns 13.75

=CEILING(13.85,.25) // returns 14

=FLOOR(13.85,.25) // returns 13.75

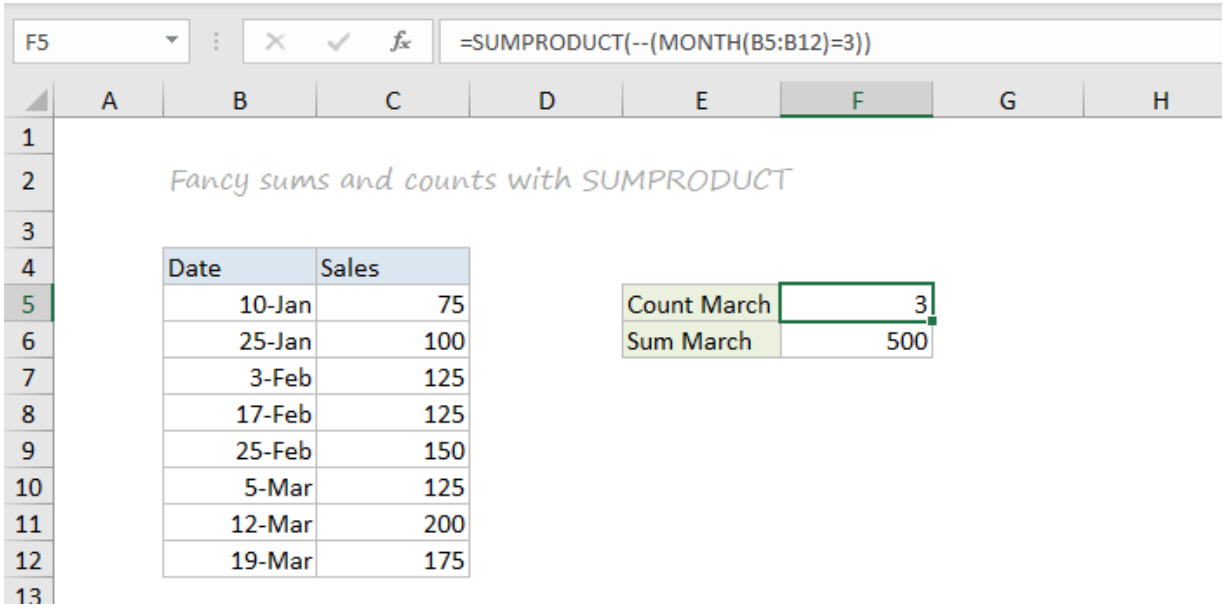
- **MOD**

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:



- **SUMPRODUCT**

The SUMPRODUCT function is a powerful and versatile tool when dealing with all kinds of 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.

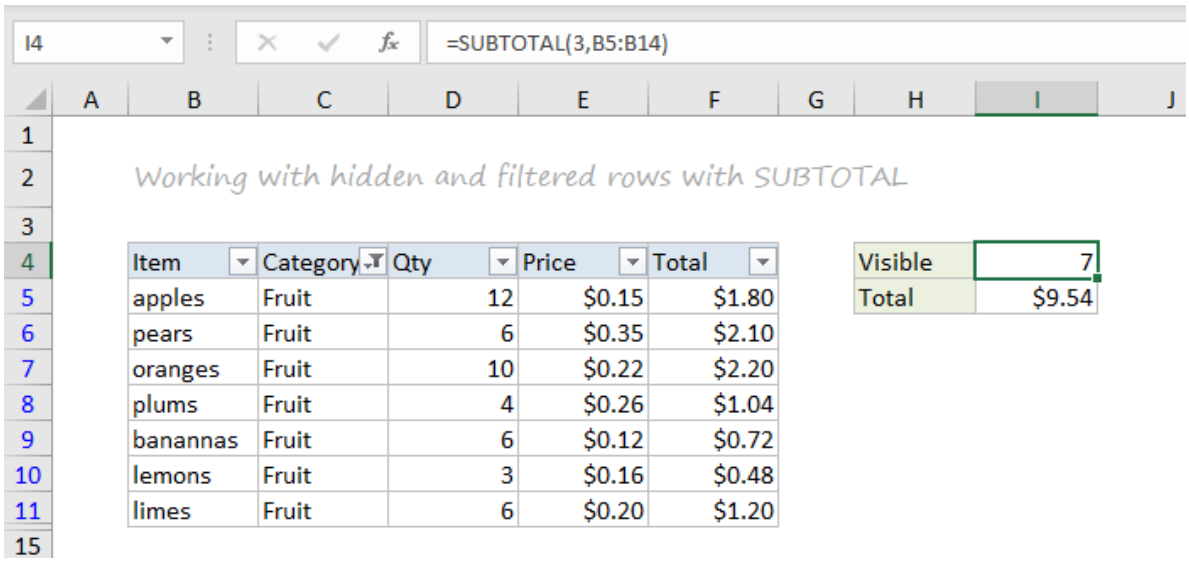


=SUMPRODUCT(--(MONTH(B5:B12)=3)) // count March

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

- **SUBTOTAL**

The SUBTOTAL function is an "aggregate function" that can perform a number of operations on a set of data. All told, SUBTOTAL can perform 11 operations, including SUM, AVERAGE, COUNT, MAX, MIN, etc. (see this page for the full list). 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

Visible	7
Total	$9.54

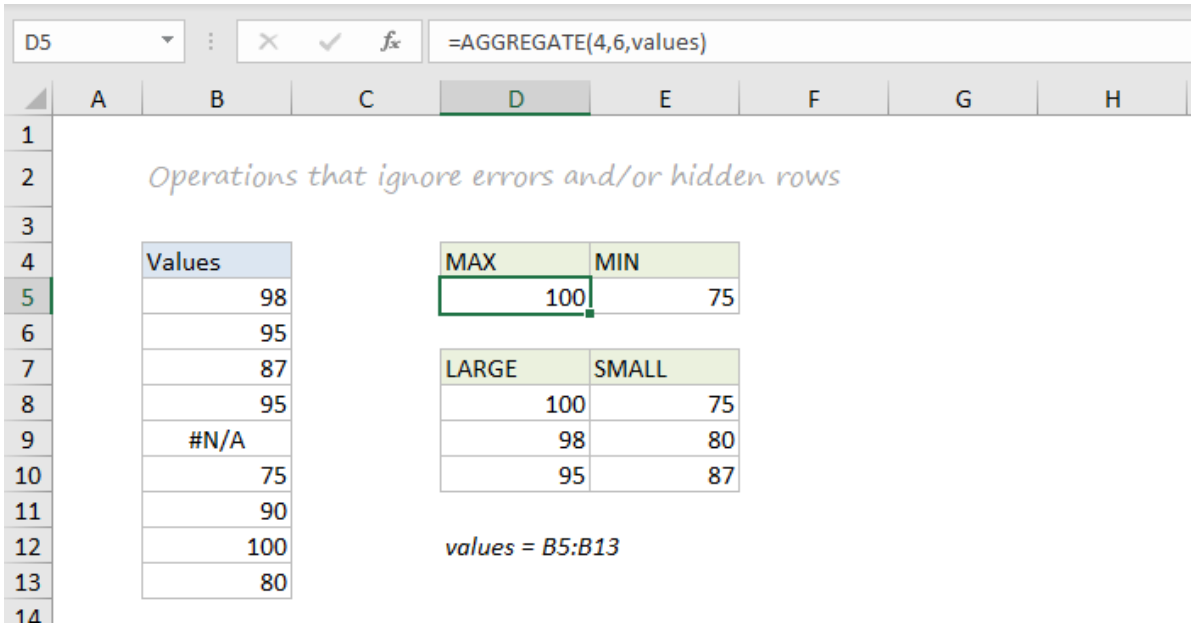
=SUBTOTAL(3,B5:B14) // returns 7

=SUBTOTAL(9,F5:F14) // returns 9.54

- **AGGREGATE**

Like SUBTOTAL, the AGGREGATE function can also 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 (19 total) and can also ignore errors.

In the screen below, 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. See this page for a full list of operations AGGREGATE can perform.



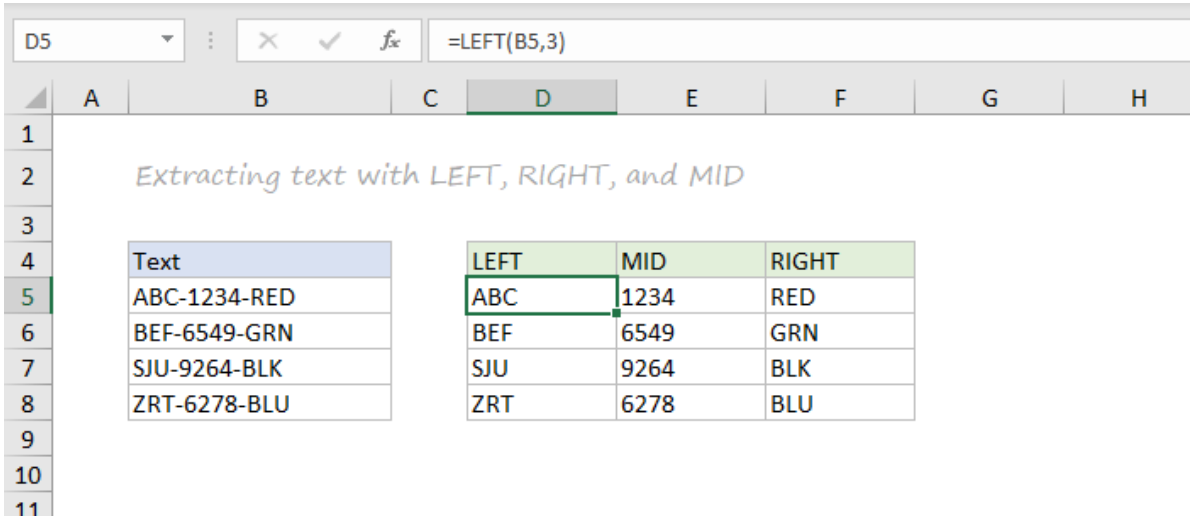
=AGGREGATE(4,6,values) // MAX ignore errors, returns 100

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

TEXT Functions

- **LEFT, RIGHT, MID**

To extract characters from the left, right, or middle of text, use LEFT, RIGHT, and MID functions:



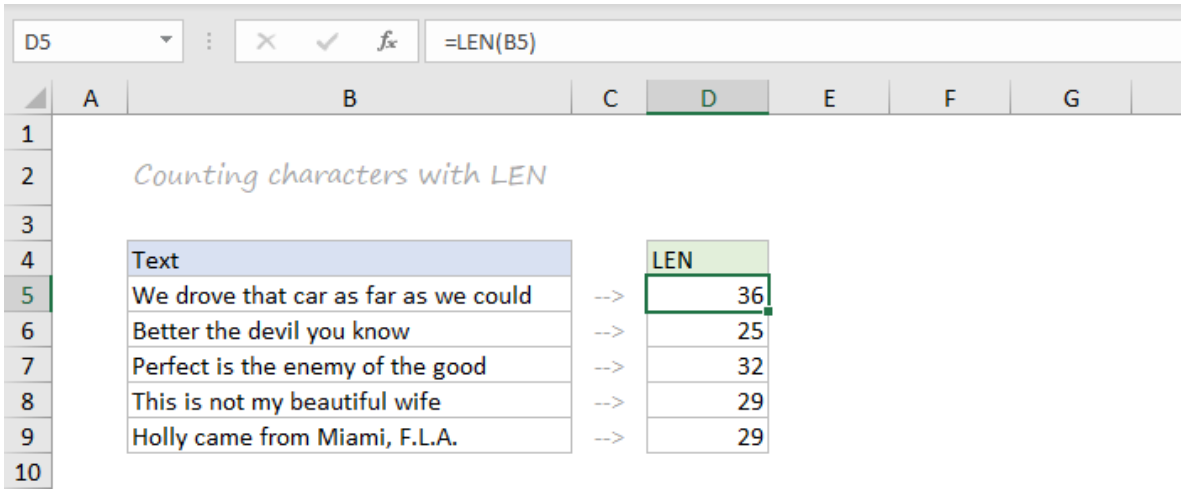
=LEFT("ABC-1234-RED",3) // returns "ABC"

=MID("ABC-1234-RED",5,4) // returns "1234"

=RIGHT("ABC-1234-RED",3) // returns "RED"

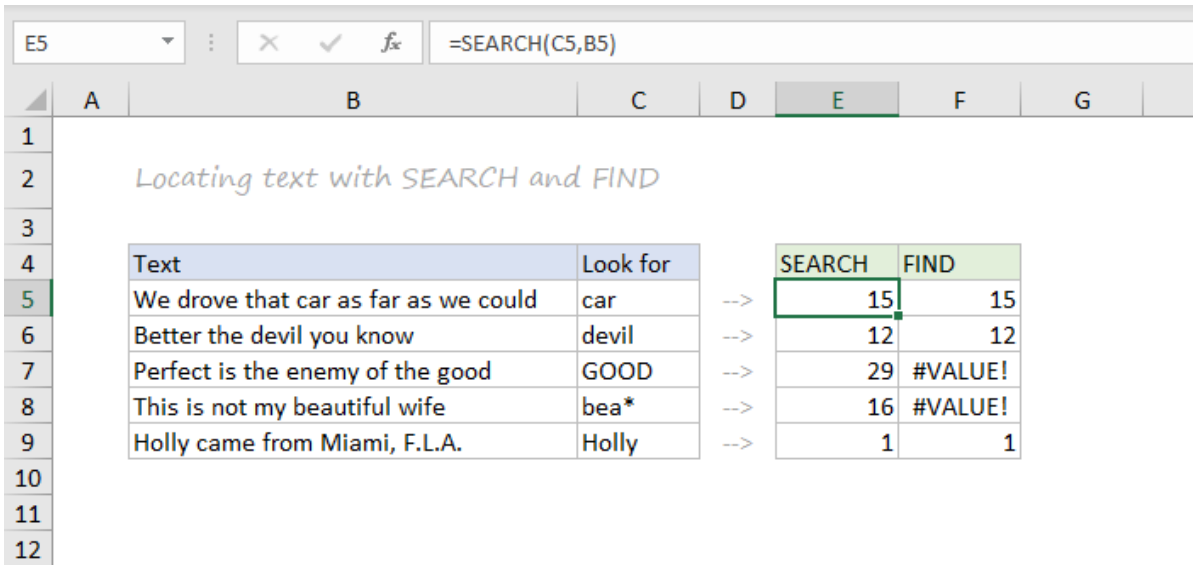
- **LEN**

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



- **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).

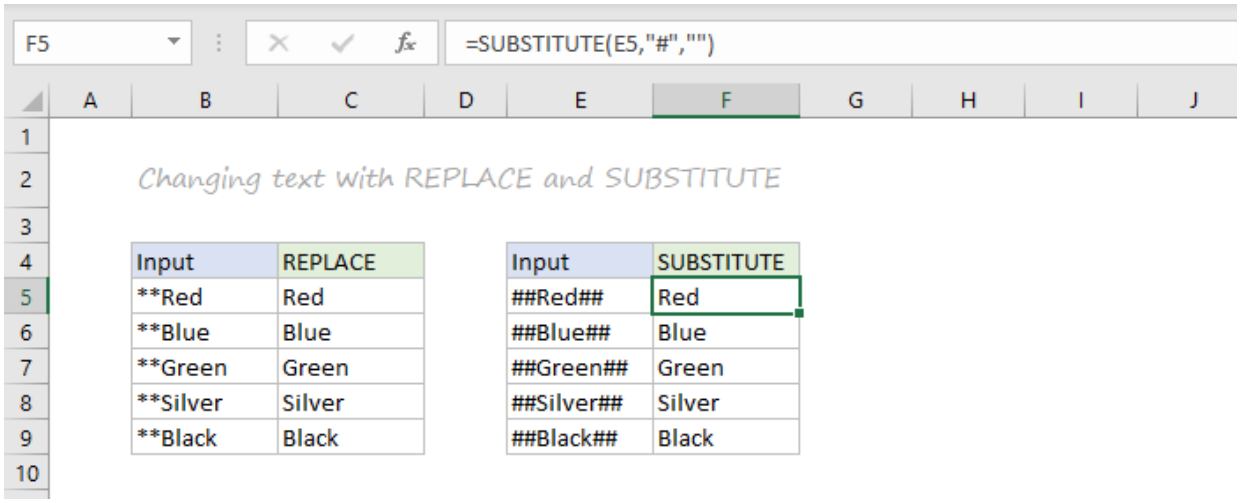


=FIND("Better the devil you know","devil") // returns 12

=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 "".

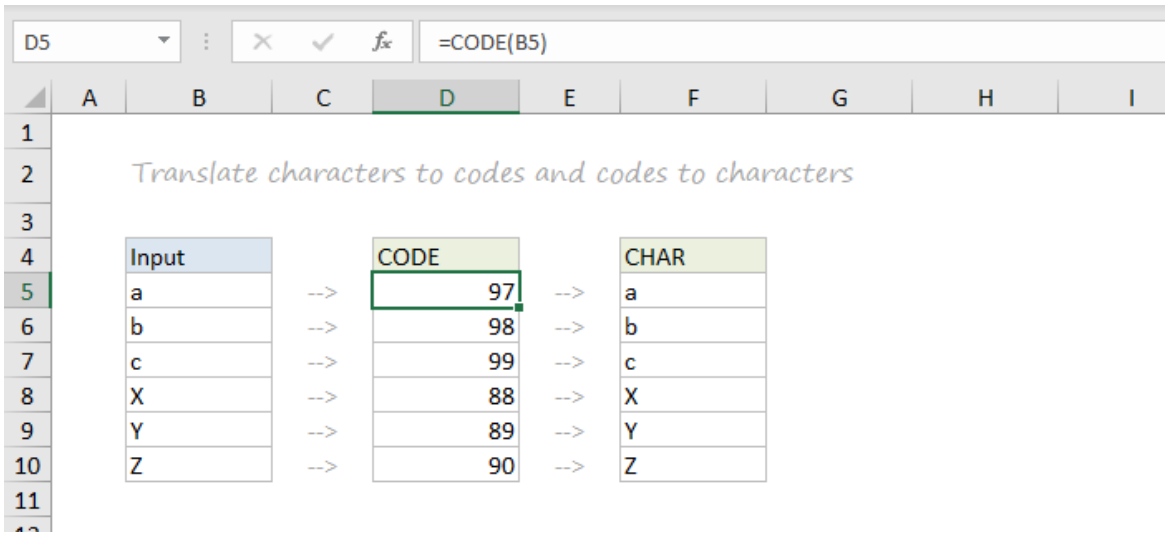


=REPLACE("**Red",1,2,"") // returns "Red"

=SUBSTITUTE("##Red##","#","") // returns "Red"

- **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.

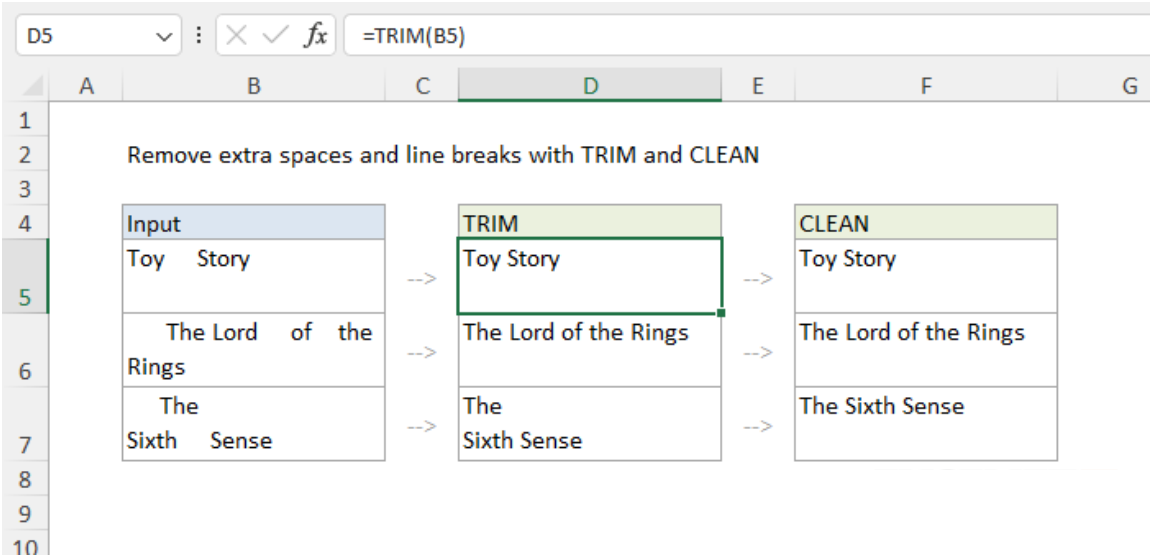


=CODE("a") // returns 97

=CHAR(97) // returns "a"

- **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.

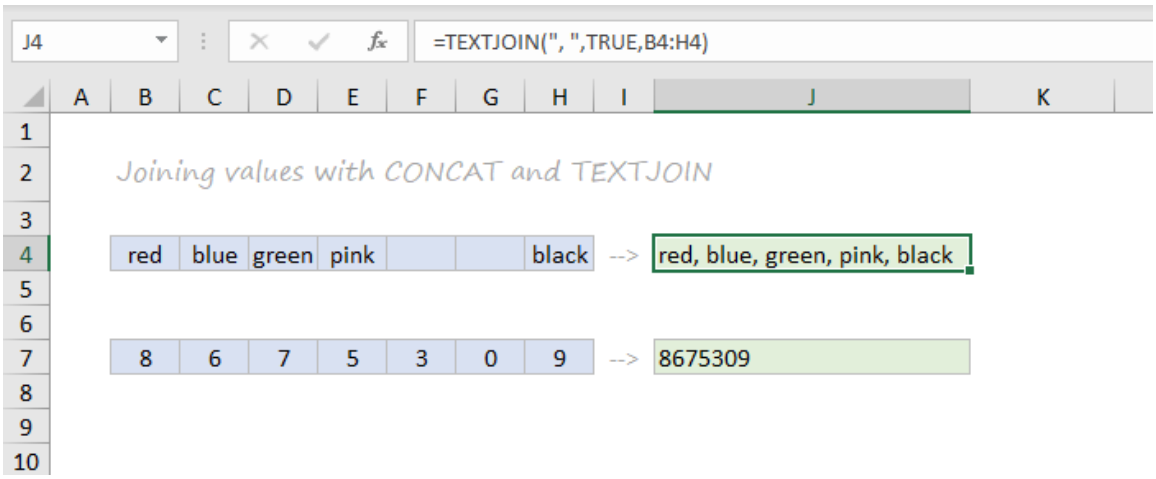


=TRIM(A1) // remove extra space

=CLEAN(A1) // remove line breaks

- **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.



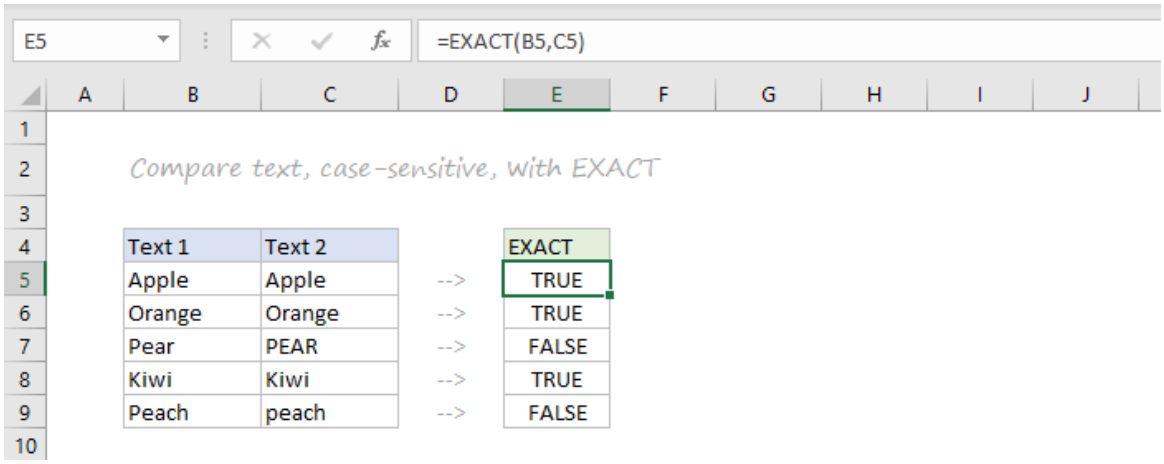
=TEXTJOIN(",",TRUE,B4:H4) // returns "red,blue,green,pink,black"

=CONCAT(B7:H7) // returns "8675309"

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

- **EXACT**

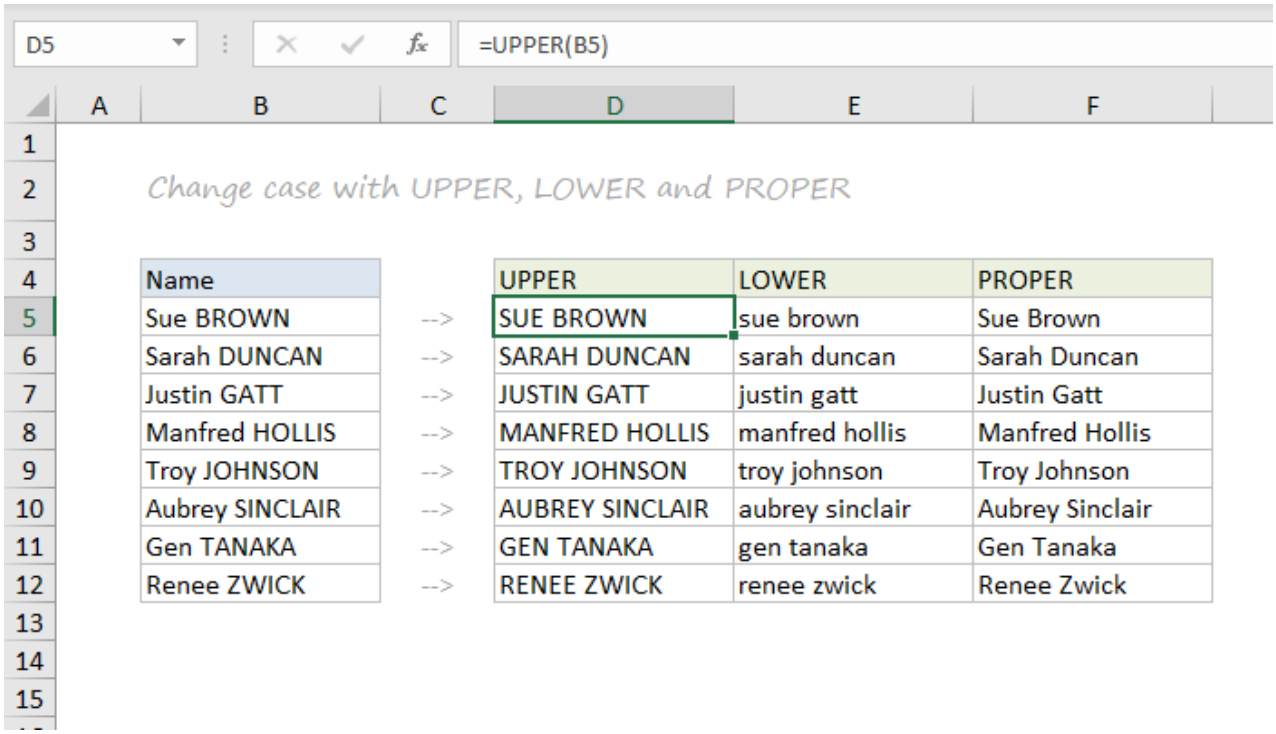
The EXACT function allows you to compare two text strings in a case-sensitive manner.



Text 1	Text 2		EXACT
Apple	Apple	-->	TRUE
Orange	Orange	-->	TRUE
Pear	PEAR	-->	FALSE
Kiwi	Kiwi	-->	TRUE
Peach	peach	-->	FALSE

- **UPPER, LOWER, PROPER**

To change the case of text, use the UPPER, LOWER, and PROPER function



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

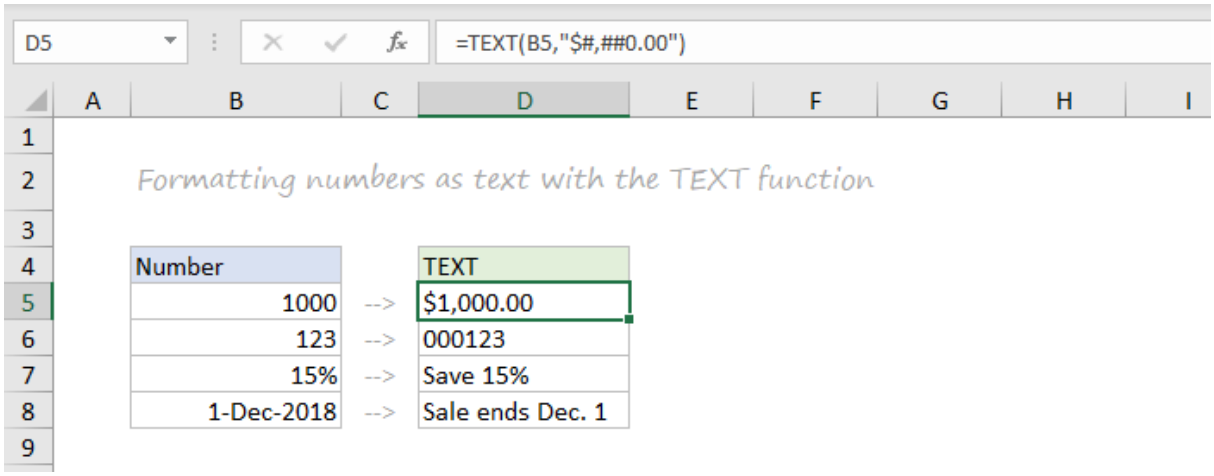
=UPPER("Sue BROWN") // returns "SUE BROWN"

=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]".



=TEXT(B5,"$#,##0.00")

=TEXT(B6,"000000")

="Save "&TEXT(B7,"0%")

="Sale ends "&TEXT(B8,"mmm d")