FORMULAE IN EXCEL

Creating Simple Formulae

Formulae allow the calculation of data or values. These calculations range from simple arithmetic (addition, multiplication etc.) to more complex statistical, logical and database functions.

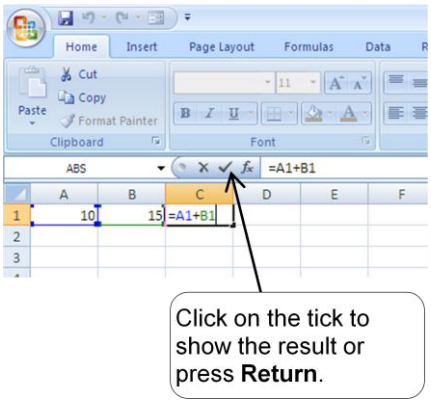
You enter a formula by typing it in the cell where you want its result to appear. When you confirm entry of a formula, Excel will display the result on the worksheet, but the underlyingcalculation appears in the formula bar.

Formulae always start with an = (equals) sign.

Place the formula in the cell where the result is to be displayed.

Formulae should refer to the **cell address** not the **contents** of the cells,
i.e. to add the two numbers shown above the correct formula is:

=A1+B1
not
=10+15



- The result is displayed in the cell when the **Tick** buttonon the formula bar is clicked, or the **Return** key is pressed.
- You can cancel a formula if necessary by clicking on the **X** button on the formula bar or pressing the **Esc** key.
- When the contents of a cell referred to in a formula change, the formula automatically calculates and displays the new result.
  I.e. if the value in cell A1 is changed to 15 in the example above, the formula automatically recalculates to display the result 30.

Some common formulae

Operator	Description	Excel Formula
+	Addition	**=A1+A2** add A1 and A2
-	Subtraction	**=A1-A2** subtract A2 from A1
*	Multiplication	**=A1*A2** multiply A1 by A2
/	Division	**=A1/A2** divide A1 by A2
^	Exponential	**=A1^A2** raise A1 to the power A2
%	Percentage	**=A1 %** express A1 as a percentage
		=A1*10% returns 10% ***of*** A1

These operations can also be combined together. For example:

=A1-A2/(A1+A2)

or

=(A1+B2–D4)*50

Use brackets to ensure that the different parts of the formula are calculated in the correctorder. For example: =(3+2)*4 is not the same as =3+2*4.

The order of precedence

Excel evaluates operators following the conventional rules – it will apply the calculations in aformula in the following order:

BODMAS: **B**rackets **O**f **D**ivision **M**ultiplication **A**ddition **S**ubtraction

( )	brackets first
^	power of
/ and *	division and multiplication
+ and -	addition and subtraction

Formula	**Result**
=3+2*4	11
=(3+2)*4	20

Take care to observe these rules when creating your ownformulae.

Incorrect syntax will result in error.

Operator Precedence	
Operator	Meaning
* and /	Multiplication and Division
+ and -	Addition and Subtraction
&	Text Concatenation
=	Equal to
<>	Not equal to
<=	Less than or equal to
>=	Greater than or equal to

Editing a formula

1. Double-click on the cell containing the formula. The cell will switch from displaying theresult of the formula to the formula itself.
2. Click the mouse over the part of the formula you wish to change to insert the cursorthere. Type any new character or use the **Backspace** or **Delete** keys to remove characters.
3. Press **Enter** to confirm your changes, or **Esc** to exit the cell without saving your changes.

or

1. Move to the cell containing the formula you wish to change.
2. The formula will be displayed in the *formula bar*.
3. Click into the *formula bar* and make the necessary changes.
4. Click on the **tick** to the left of the formula to confirm your change, or the **cross** to closethe formula without saving your changes.

or

1. Move to the cell containing the formula you wish to change and press the **F2** key.
2. Use the arrow keys to move the cursor to the edit position. Make your changes and exitthe cell as explained above.

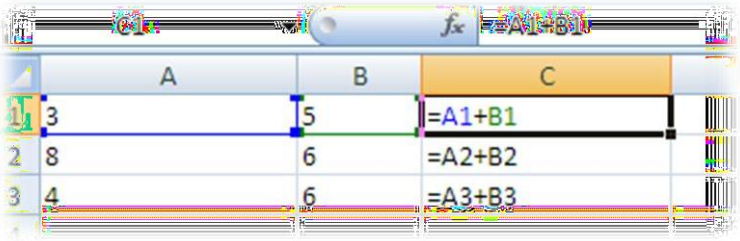
Copying formulae

Formulae can be copied using the **Copy** and **Paste** buttons in the same way as data can becopied in a worksheet.

1. Select the cell containing the formula to be copied.
2. From the **Home tab,** click on the **Copy** icon
3. Move the cursor to the new location.
4. From the **Home tab,** click on the **Paste** icon

The formula will be copied relatively, ie the cell references will change to the relative positionto where they are copied. For example, if you had a formula in C1 which contained the formula A1+B1, and then copied the formula to C2 and C3, then the formula in C2 would read A2+B2, in C3 would be A3+B3, and so on.

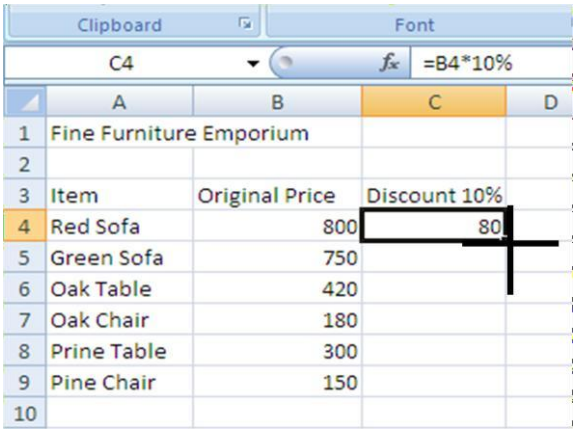
This is because the formula in C1 is adding the 2 cells to the left, and will do so whereveryou copy the formula to – it will always add the 2 cells to the left of it.



Using the fill handle

As formulae are copied to adjacent cells most of the time, it is much quicker and easier touse the “Fill Handle” to copy one formula to many cells.

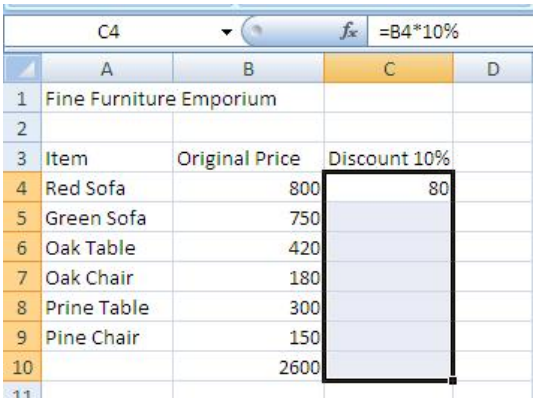
1. Move to the cell that has the formula that you want to fill.
2. Position your mouse pointer over the fill handle. It will change to a black plus. +
3. Drag the black plus down or right over the cells where you want your copied formula to generate results. You will see an outline around those cells.
4. Release the mouse when the outline includes all the cells where you want results.



Using keystrokes

You can fill a column or a row of formulae using the keyboard.

1. Select the cell containing the formula to fill and the cells where you want to copy to:



2. Press **Ctrl+D** to fill down.
   or

   Press **Ctrl+R** to fill right.

There are no keystrokes to fill up or left. Instead, repeat step one above and then click **Edit** on the menu bar, choose **Fill** and select the direction for the fill from the resulting sub-menu.The Fill Handle can also be used to fill up and left.

Formula vs. Functions

- **Formula** is an expression that calculates values in a cell or in a range of cells.

  For example, **=A2+A2+A3+A4** is a formula that adds up the values in cells A2 through A4.

- **Function** is a predefined formula already available in Excel. Functions perform specific calculations in a particular order based on the specified values, called arguments, or parameters.

For example, instead of specifying each value to be summed like in the above formula, you canuse the SUM function to add up a range of cells: **=SUM(A2:A4)**

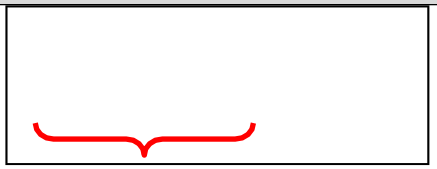
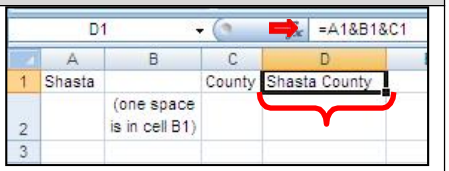
You can find all available Excel functiions here

Formulae

Arithmetic & Comparison Operators

Arithmetic & Comparison Operators			
Operator	Meaning	Example	Result
+	Addition	A1+B1	Numeric Value
-	Subtraction or Negative	A1-B1	Numeric Value
*	Multiplication	A1*B1	Numeric Value
/	Division	A1/B1	Numeric Value
=	Equal to	A1=B1	Logical Value (TRUE or FALSE)
>	Greater than	A1>B1	Logical Value (TRUE or FALSE)
<	Less than	A1<B1	Logical Value (TRUE or FALSE)
>=	Greater than or equal to	A1>=B1	Logical Value (TRUE or FALSE)
<=	Less than or equal to	A1<=B1	Logical Value (TRUE or FALSE)
<>	Not equal to	A1<>B1	Logical Value (TRUE or FALSE)

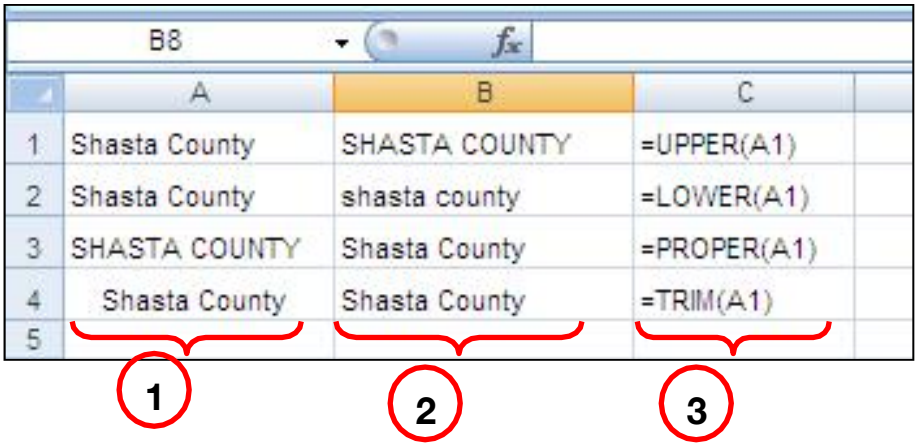
Text Concatenation Operators

Text Concatenation Operators			
Operator	Meaning	Example	Result
&	Connects, or concatenates, multiple values to produce one continuous	 Want to combine the values in columns A-C. I added a space, via the space bar, so the words wouldhave a space	 The shows what the formula in D1 looks like. You can see the value in D1 has the two words combined nicely.

	text value	between them.	

UPPER, LOWER, PROPER, and TRIM

These formulas all work with text. After using one of these functions it is good practice to *pastespecial\values* so that they will remain in their desired formatting.



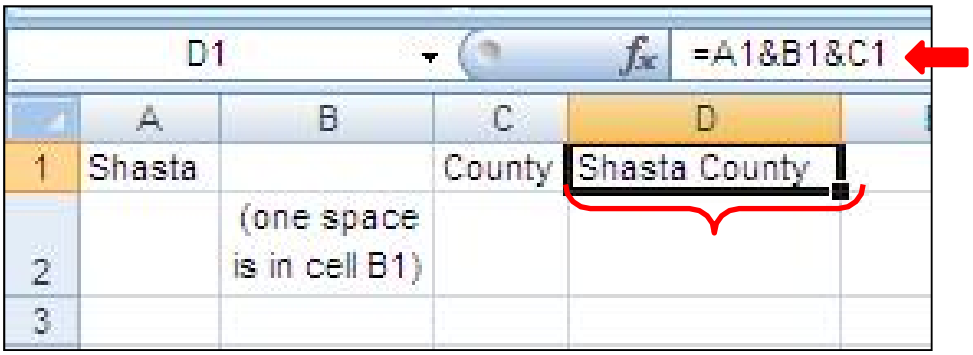
UPPER, LOWER, PROPER, and TRIM	
Formula	Description
=UPPER	Converts all text to upper case
=LOWER	Converts all text to lower case
=PROPER	Capitalizes the first letter in a text string and any other letters intext that follow any character other than a letter, i.e. a space. Converts all other letters to lowercase
=TRIM	Removes all blank, unnecessary spaces at the start and end of astring including extra spaces, tabs, and other characters that don't print.

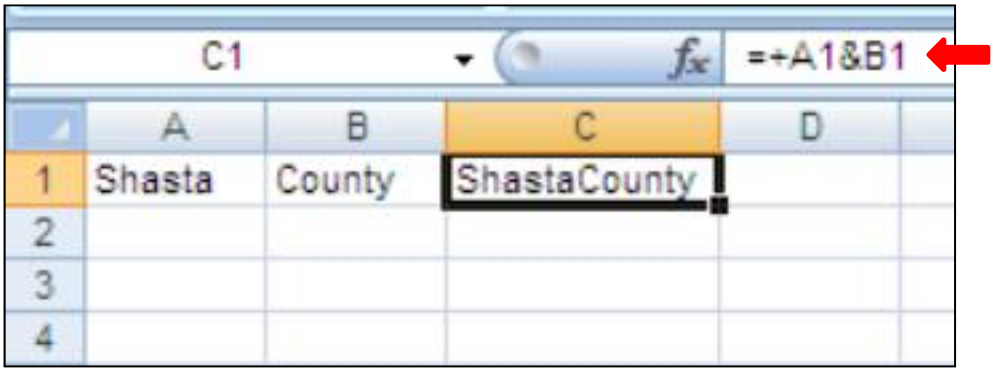
& (Ampersand)

The & connects, or concatenates, multiple values to produce one continuous text value. After using this function it is good practice to *paste special\values* so that they will remain in their desired formatting.

The finished product I want is to have Shasta County in one cell which I can accomplish with the & function. By combining the values in columns A and B I have accomplished my desired task, but quiteliterally. Note there is no space between the two words in cell C1.

By adding a column to the right of column A and pressing the space bar once, creating a single space , andmodifying my formula to now include columns A – C, I now have a more readable result.





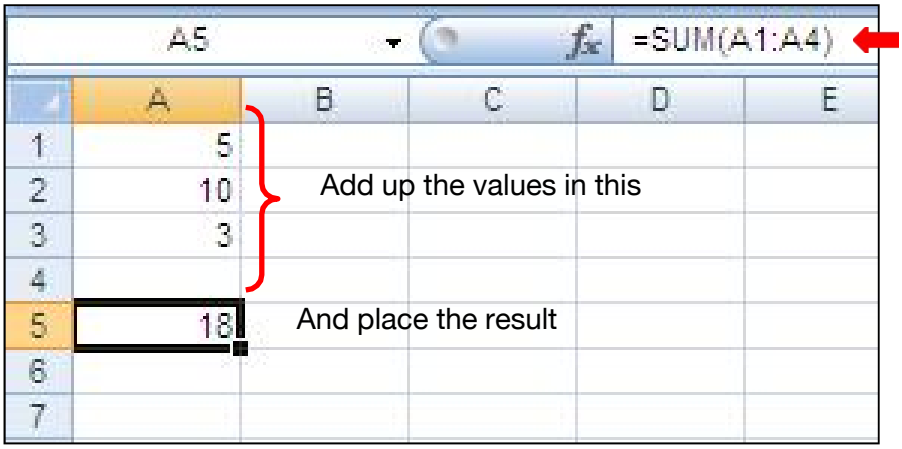
Notice there is no spacebetween the two words.

SUM

The SUM function is the singularly most used function within Excel. It is used to total values in your worksheets. These values may be continuous, noncontinuous, from different worksheets, etc, or a varietythereof.

The syntax is =SUM(*number1*,[*number2*],[...])

An example of the formula is =SUM(A1:A4). The English translation is add up all of the values found in therange of between A1 and A4, inclusive, and displays the result.



Notice that I have one extra line within my formula. I do that on all of my formulas as a best practice. If I need to add any additional rows, by doing so above the blank row, I am ensured my formula will properlybe modified automatically.

ROUND

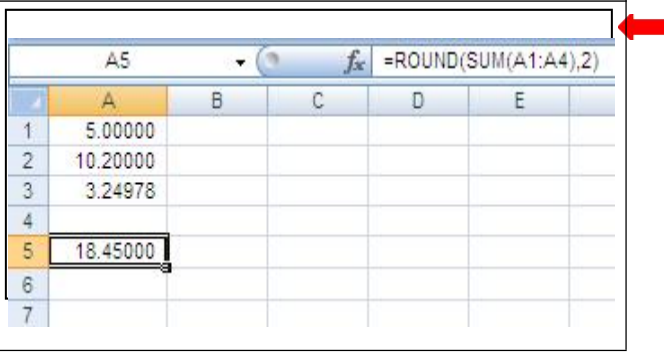
The ROUND function rounds a number to a specified number of digits. This should not be confused withformatting to a specified decimal places.

The syntax is =ROUND(*number*, *num_digits*)

Expanding our previous SUM formula from above, the formula is =ROUND(SUM(A1:A4),2). The English translation is add up all of the values found in the range of between A1 and A4, inclusive, round the resultto two decimal places, and display the result .

It is important not to confuse rounding to a specific number of decimals and formatting your cell to a specific number of decimals. For example, if cell A5 below contains 18.44978. If we were to format the cellto two decimal places, 18.45 will be displayed. However, Excel still sees it as 18.44978 (Before picture). If I

want Excel to see, and use in subsequent calculations, 18.45 I would need to have the following roundingformula in A5: =ROUND(SUM(A1:A4),2) (After picture)

Without ROUND Formula	With ROUND Formula
	

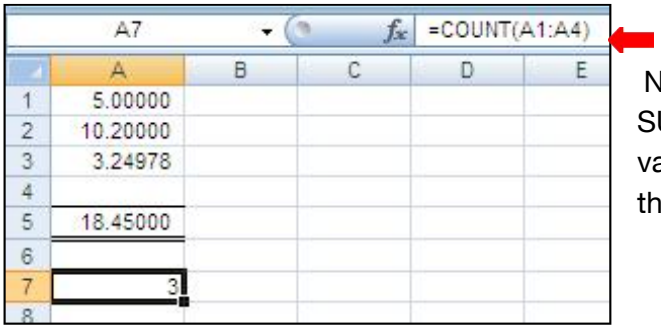
COUNT

The COUNT function counts the number of cells that contain numbers and counts numbers within the listof arguments.

The syntax is COUNT(value1, value2, …)

Continuing on with our SUM formula from above, let's not only add up the values of the range A1:A4, butlet's count how many numbers are included within the range, i.e. how many cells within the range has a value in it.

The formula is =COUNT(A1:A4). The English translation is count how many cells within the range has avalue in it and display the result.



Notice that the range is exactly the same as our SUM, A1:A4, which includes four rows. The value returned in cell A7 is three, because only three of thefour rows have values in them.

If you are trying to count text, use the COUNTA formula which counts the non-blank cells.

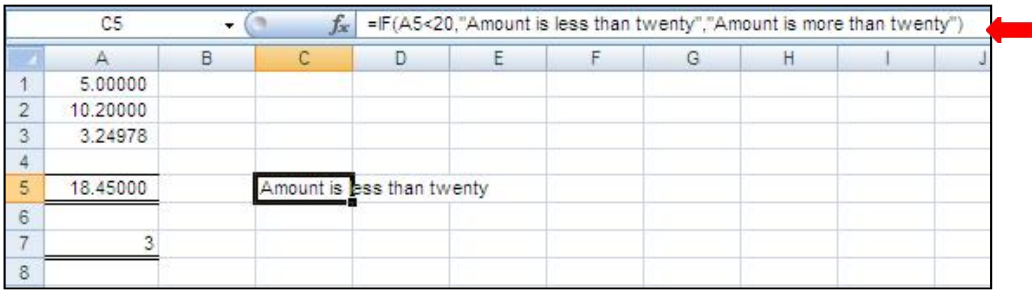
IF

The formula makes a statement/question, if the answer is true then one response is obtained. If theanswer if false, then another answer is obtained.

The syntax is =IF(logical_test,value_if_true,value_if_false)

Continuing on with our SUM formula from above, let's add some verbage to emphasize whether the resultis greater or less than twenty.

The formula is =if(A5<20,"Amount is less than twenty","Amount is more than twenty"). The English translation is if the value found in A5 is less than twenty THEN display the comment 'Amount is less thantwenty' ELSE display the comment 'Amount is more than twenty'.



Anchoring Rows and Columns With $ Sign

As formulas are copied either the column reference increases or the row number depending on the direction of the copy. If copying to the right through the spreadsheet, the column reference will increase;if copying down through the spreadsheet, the row references will increase.

In order to overrule the automatic increment, place a dollar sign in front of the reference that you don'twant to change, the column, row, or both.

Anchoring Rows and Columns With $ Sign			
Source Formula	Actio n	Destinatio n Formula	Effec t
=SUM(A1:A4)	Copy formula one cellto the right	=SUM(B1:B4)	Column references increased from A to Band A to B
=SUM($A1:A4)	Copy formula one cellto the right	=SUM($A1:B4)	Column references A stayed constant at A andincreased from A to B

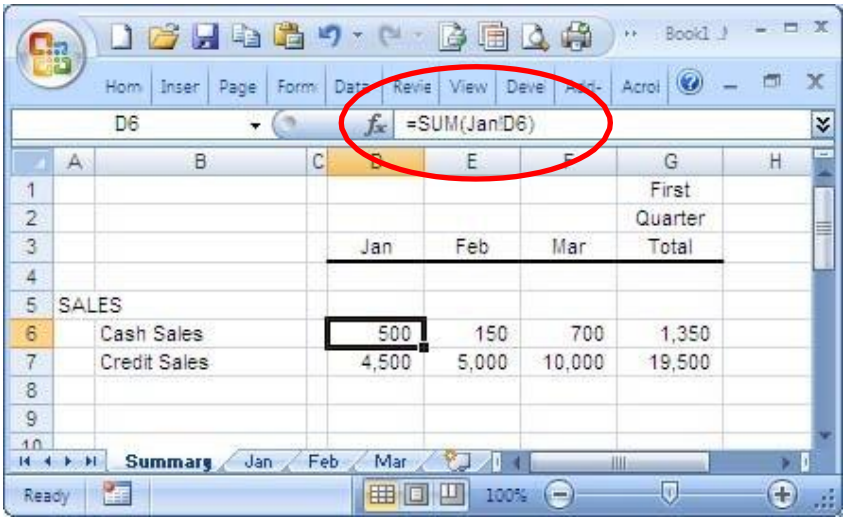
=SUM(A1:A4)	Copy formula one cell down	=SUM(A2:A5)	Row references increased from 1 to 2 and 4 to 5
=SUM(A$1:A4)	Copy formula one cell down	=SUM(A$1:A5)	Row references 1 stayed constant at 1 and increased from 2 to 5
=SUM($A$1:$A$4)	Copy formula anywhere within the spreadsheet	=SUM($A$1:$A$4)	Neither column nor row references changed

Combining Formulas Between Multiple Worksheets

Data can be pulled from other worksheets and utilized on others. This function can be used for both numerical and text data. The formulas can combine one to many worksheets are ranges.

For Example, this is extremely handy when one worksheet acts as a summary and recaps information from the detail worksheets. Our example below recaps sales on one sheet, while the monthly detail in maintained on other sheets.

Note the worksheet names of Summary, Jan, Feb, & Mar. We are working within the Summary worksheet, denoted by the tab color. The curser is in cell D6 which receives its information from the January worksheet.



Note if your data consists of several rows you would need to copy the blank space in B1 all the way to the last row.

AVERAGE

The Excel AVERAGE function does exactly what its name suggests, i.e. finds an average, orarithmetic mean, of numbers. Its syntax is similar to SUM's:

AVERAGE(number1, [number2], …)

Having a closer look at the formula from the previous section (**=SUM(B2:B6)/5**), what does it actually do? Sums values in cells B2 through B6, and then divides the result by 5. And what do you call adding up a group of numbers and then dividing the sum by the count of those numbers?Yep, an average!

The Excel AVERAGE function performs these calculations behind the scenes. So, instead ofdividing sum by count, you can simply put this formula in a cell:

=AVERAGE(B2:B6)

To average cells based on condition, use the following AVERAGEIF formula, where A2:A6 is the criteria range, D3 is he criteria, and B2:B6 are the cells to average:

=AVERAGEIF(A2:A6, D3, B2:B6)

	A	B	C	D	E	F	G	H
1	**Item**	**Qty.**		*Average*				
2	Apples	1		**All items**	2.2	=AVERAGE(B2:B6)		
3	Oranges	2		**Apples**	2	=AVERAGEIF(A2:A6, D3, B2:B6)		
4	Lemons	3						
5	Oranges	2						
6	Apples	3						

Excel AVERAGE - average cells with numbers.

- Excel AVERAGEA - find an average of cells with any data (numbers, Boolean and text values).
- Excel AVERAGEIF - average cells based on one criterion.
- Excel AVERAGEIFS - average cells based on multiple criteria.

MAX & MIN

The MAX and MIN formulas in Excel get the largest and smallest value in a set of numbers, respectively. For our sample data set, the formulas will be as simple as:

=MAX(B2:B6)

=MIN(B2:B6)

	A	B	C	D	E	F	G
1	**Item**	**Qty.**		**Max**	3	=MAX(B2:B6)	
2	Apples	1		**Min**	1	=MIN(B2:B6)	
3	Oranges	2					
4	Lemons	3					
5	Oranges	2					
6	Apples	3					

- MAX function - find the highest value.
- MAX IF formula - get the highest number with conditions.
- MAXIFS function - get the largest value based on multiple criteria.
- MIN function - return the smallest value in a data set.
- MINIFS function - find the smallest number based on one or several conditions.

COUNT & COUNTA

If you are curious to know how many cells in a given range contain **numeric values** (numbers ordates), don't waste your time counting them by hand. The Excel COUNT function will bring youthe count in a heartbeat:

COUNT(value1, [value2], ...)

While the COUNT function deals only with those cells that contain numbers, the COUNTA function counts all cells that **are not blank**, whether they contain numbers, dates, times, text,logical values of TRUE and FALSE, errors or empty text strings (""):

COUNTA (value1, [value2], ...)

For example, to find out how many cells in column B contain numbers, use this formula:

=COUNT(B:B)

To count all non-empty cells in column B, go with this one:

=COUNTA(B:B)

In both formulas, you use the so-called "whole column reference" (B:B) that refers to all the cellswithin column B.

The following screenshot shows the difference: while COUNT processes only numbers, COUNTA outputs the total number of non-blank cells in column B, including the the text valuein the column header.

	A	B	C	D	E	F	G
1	**Item**	**Qty.**		**Number count**	5	=COUNT(B:B)	
2	Apples	1		**Non-blank count**	6	=COUNTA(B:B)	
3	Oranges	2					
4	Lemons	3					
5	Oranges	2					
6	Apples	3					

- Excel COUNT function - a quick way to count cells with numbers.
- Excel COUNTA function - count cells with any values (non-empty cells).
- Excel COUNTIF function - count cells that meet one condition.
- Excel COUNTIFS function - count cells with several criteria.

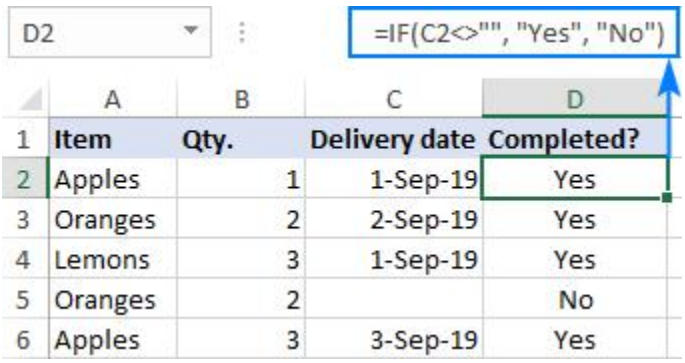
IF

Judging by the number of IF-related comments on our blog, it's the most popular function in Excel. In simple terms, you use an IF formula to ask Excel to test a certain condition and returnone value or perform one calculation if the condition is met, and another value or calculation ifthe condition is not met:

IF(logical_test, [value_if_true], [value_if_false])

For example, the following IF statement checks if the order is completed (i.e. there is a value incolumn C) or not. To test if a cell is not blank, you use the "not equal to" operator (<>) in combination with an empty string (""). As the result, if cell C2 is not empty, the formula returns "Yes", otherwise "No":

=IF(C2<>"", "Yes", "No")



	A	B	C	D
1	**Item**	**Qty.**	**Delivery date**	**Completed?**
2	Apples	1	1-Sep-19	Yes
3	Oranges	2	2-Sep-19	Yes
4	Lemons	3	1-Sep-19	Yes
5	Oranges	2		No
6	Apples	3	3-Sep-19	Yes

TRIM

If your obviously correct Excel formulas return just a bunch of errors, one of the first things to check is extra spaces in the referenced cells (You may be surprised to know how many leading,trailing and in-between spaces lurk unnoticed in your sheets just until something goes wrong!).

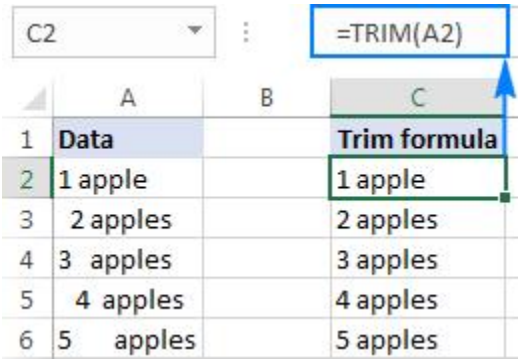
There are several ways to remove unwanted spaces in Excel, with the TRIM function being theeasiest one:

TRIM(text)

For example, to trim extra spaces in column A, enter the following formula in cell A1, and thencopy it down the column:

=TRIM(A1)

It will eliminate all extra spaces in cells but a single space character between words:



Useful resources:

- Excel TRIM function with formula examples
- How to delete line breaks and non-printing characters
- How to remove non-breaking spaces ( )
- How to delete a specific non-printing character

LEN

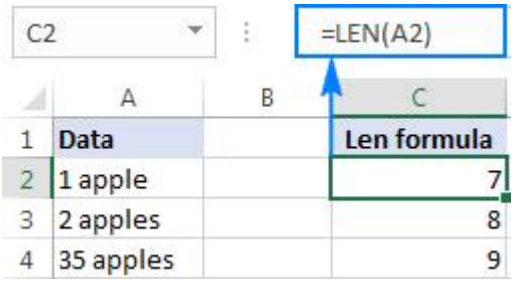
Whenever you want to know the number of characters in a certain cell, LEN is the function touse:

LEN(text)

Wish to find out how many characters are in cell A2? Just type the below formula into anothercell:

=LEN(A2)

Please keep in mind that the Excel LEN function counts absolutely all characters **includingspaces**:



Want to get the total count of characters in a range or cells or count only specific characters?Please check out the following resources.

AND & OR

These are the two most popular logical functions to check multiple criteria. The difference ishow they do this:

- AND returns TRUE if **all conditions** are met, FALSE otherwise.
- OR returns TRUE if **any** condition is met, FALSE otherwise.

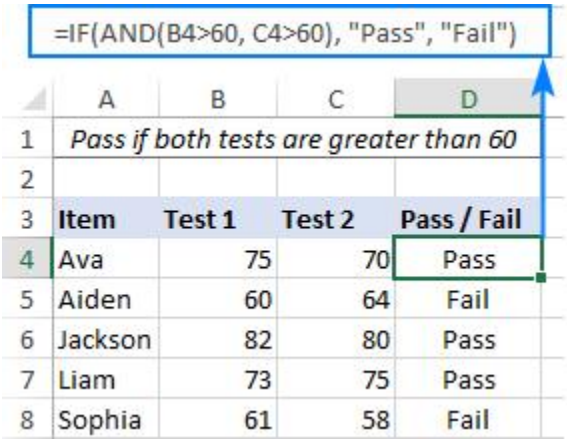
While rarely used on their own, these functions come in very handy as part of bigger formulas.

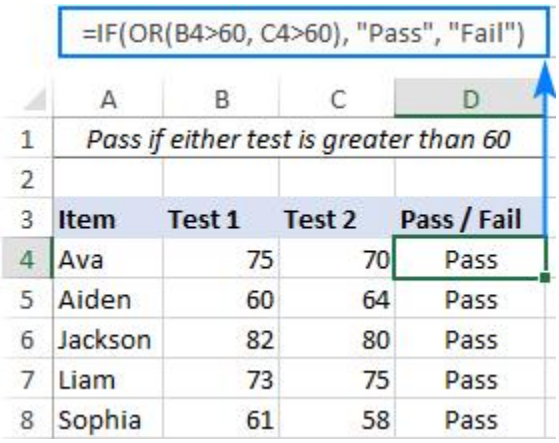
For example, to check the test results in columns B and C and return "Pass" if both are greaterthan 60, "Fail" otherwise, use the following IF formula with an embedded AND statement:

=IF(AND(B2>60, B2>60), "Pass", "Fail")

If it's sufficient to have just one test score greater than 60 (either test 1 or test 2), embed the ORstatement:

=IF(OR(B2>60, B2>60), "Pass", "Fail")





CONCATENATE

In case you want to take values from two or more cells and combine them into one cell, use theconcatenate operator (&) or the CONCATENATE function:

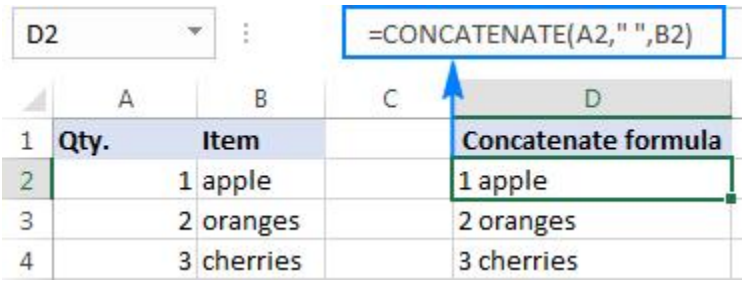
CONCATENATE(text1, [text2], …)

For example, to combine the values from cells A2 and B2, just enter the following formula in a different cell:

=CONCATENATE(A2, B2)

To separate the combined values with a space, type the space character (" ") in the argumentslist:

=CONCATENATE(A2, " ", B2)



TODAY & NOW

To see the current date and time whenever you open your worksheet without having to manuallyupdate it on a daily basis, use either:

=TODAY() to insert the today's date in a cell.

=NOW() to insert the current date and time in a cell.

The beauty of these functions is that they don't require any arguments at all, you type theformulas exactly as written above.

	A	B	C
1	Today's date	Wednesday, May 24, 2017	=TODAY()
2	Current date & time	05/24/2017 14:30	=NOW()