



See <https://staff.brighton.ac.uk/is/training/Pages/Excel/formulae.aspx> for videos and exercises to accompany this quick reference card.

Formulae & Functions Basics

When building a formula:

- All formulae and functions begin with =
- Use your mouse to select a cell or range of cells to be used in a formula
- The operators for building formulae are:

+	Add	*	Multiply
-	Subtract	/	Divide
- **BODMAS** rules apply to arithmetic (**B**rackets **O**ver **D**ivision, then **M**ultiplication, then **A**ddition, then **S**ubtraction).
- Avoid typing variables (such as tax rates) in formulae; instead type the variable in a separate cell and refer to that cell in the formula
- To repeat a formulae down a column, build the formula in the first cell of the column, then use autofill to copy the formula down the column.

Functions follow the format **=name(arguments)** where:

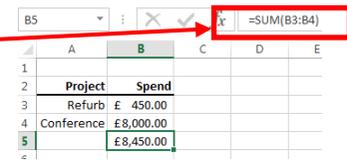
- name = the name of the function (e.g. SUM, VLOOKUP)
- arguments =the cell or range references containing the values used in the function

Where a function contains more than one argument, each argument must be separated by a , (comma).

Checking for formulae

If you are using a spreadsheet set up by someone else, before typing data into a cell, check whether the cell contains a formula.

If a cell contains a formula, the cell will usually show the result of the formula. The formula itself can be seen in the formula bar.

- Click on the cell to select it.
 

The formula bar will display the content of the selected cell.
- If the cell does contain a formula, double click on the cell. This will colour any cells on the current worksheet that feed into that formula, to help you work out what that formula does and how it works.
- Always press ESC to stop checking/editing a cell containing a formula. This guarantees that you will leave the formula as you found it.

Do **NOT** click your mouse elsewhere on the sheet to stop checking as this may break the formula.

How to check which cells on a sheet contain formulae

There is a way to show all formulae on a worksheet before you start using it:

- On the **Formulas** tab, click on the **Show Formulas** icon  Show Formulas
- Any cells with formulae will show the formula instead of the result
- To switch this off, go back to the **Formulas** tab and click on the **Show Formulas** icon

The shortcut for this is **CTRL `**

How to check what a formula is doing

Use this technique to check that your formulae are doing what you think:

- Click on the cell containing the formula.
- Click once on the formula in the formula bar. 
- The cells used in the formula will be colour coded within the sheet, making it easy to spot mistakes.

Building a formula to add

- Click in the cell where the result of the formula will appear
- Type =
- Click on the first cell containing data to be included in the sum
- Type +
- Click on the next cell containing data to be included in the sum
- Repeat steps 4 and 5 as required.
- Press **ENTER** on the keyboard.

hours	Rate	Gross Pay
43	35.60	1530.8
35	32.10	1123.5
28	12.50	350
15.5	32.40	502.2
22.5	10.25	230.625
40	10.25	410
		=E8+E9+E10+E11+E12+E13

Autosum to add row or column totals

This only works where the total is to appear at the end of the column or row of data. This technique will not work across worksheets.

- Select the range of cells to add up
- On the **Home** tab, click on the **Autosum**  AutoSum icon

The total will be put in the cell at the end of the selected cells.

	Auckland	Dublin
	1,050,254	1,547,000
	1,524,294	1,685,548
	3,521,487	2,985,448
	6,096,035	

Building a formula to subtract

- Click in the cell where the result of the formula will appear
- Type =
- Click on the first cell containing data to be included in the calculation
- Type -
- Click on the next cell containing data to be included in the calculation
- Press **ENTER** on the keyboard.

	A	B	C	D	E	F	G
6							
7	First Name	Last Name	Hours	Rate	Gross Pay	Tax	Net pay
8	Angelo	Marcuzzo	43	35.60	1530.8	306.16	=E8-F8
9	Riley	Griffin	35	32.10	1123.5	224.7	
10	Coloeta	O'Connor	28	12.50	350	70	

Building a formula to multiply or divide

- Click in the cell where the result of the formula will appear
- Type =
- Click on the first cell containing data to be included in the calculation
- Type * to multiply or / to divide
- Click on the next cell containing data to be included in the calculation
- Press **ENTER** on the keyboard.

	A	B	C	D	E
6					
7	First Name	Last Name	Hours	Rate	Gross Pay
8	Angelo	Marcuzzo	43	35.60	=C8*D8
9	Riley	Griffin	35	32.10	

Useful keyboard Shortcuts

Using your keyboard to navigate saves time when building formulae.

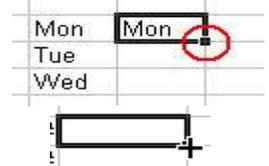
CTRL + Arrow keys	Jump to the beginning, end, top or bottom of a set of data.
CTRL + SHIFT + Down arrow	Select an entire column
CTRL + SHIFT + Right arrow	Select an entire row
CTRL+A	Select all data (one cell in data set must be selected)
CTRL + SHIFT + *	Selects an entire data table

Use insert function (formula builder) to make formulae easier

- Start to type your formula until the first bracket e.g. =VLOOKUP(
- On the formula bar, click on the function button 
- The pop-up window splits the formula into its arguments
- To select cells to add them to the formula click on the  icon to jump back to the worksheet. To return to the formula builder after selecting cells click on the  icon again.

Autofill to copy formula to other cells

- Select the cell(s) you want to copy. The fill handle will appear at the bottom right of the selection
- Point at the fill handle until it becomes a cross.
- Click and drag to copy the data **OR** Double-click to autofill all rows
- Click on  to change the type of fill (series, copy, formula only etc.)
- **Always** double-click on some of the newly populated cells to check that the copied formula is still doing what you expect.



If your copied formula is not behaving as it should, it is likely that your original formula references a single cell that should be used in all of the formula. In this case, you will need to make the cell reference absolute. See [Absolute references for common variables](#) for more information.

Relative cell references

When you use the autofill technique to copy a formula down a column or across a row, Excel will automatically update the cell references in the formula, relative to where the copied formula sits.

Cell reference	Copied down the column...	Copied across the row...
A2	...becomes A3	...becomes B2
A3	...becomes A4	...becomes B3
A4	...becomes A5	...becomes B4

Absolute references for common variables

Avoid typing variables (such as tax rates) in formulae; instead type the variable in a separate cell and refer to that cell in the formula.

The advantage of this is that, should the variable change, you only need update one cell and all formulae referencing that cell will updated automatically.

The disadvantage is that if you copy a formula that references that variable cell, your formula will not work properly unless you make the reference to the variable cell absolute (instead of [relative](#))

There are 2 ways to make a formula absolute (which you choose is up to you):

- Naming the variable cell
- Using \$ signs to indicate that a cell reference is absolute

Name cells or ranges for easier to read formulas

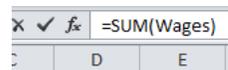
This technique has the advantage that formulae become easier to read.

The disadvantage is not many people understand the technique.

- Select the cell or range you want to name
- Click in the **Name** box (left of the formula bar)
- Type the name and press ENTER



To use, simply type the name wherever you would use a cell or range reference in a formula. e.g. =SUM(Wages)



\$\$ signs to make a cell reference absolute

The alternative to naming a cell is to use dollar signs within the cell reference to make the cell reference for the variable value absolute. A quick way to do this:

- Click on the cell containing the formula
- Click once on the cell reference in the formula bar
- Press F4 to add 2 dollar signs to your cell reference. Eg D2 will become \$D\$2.

You can type the dollar signs in manually.

Mixed cell references

When copying formulae to other cells, sometimes you only want to anchor the column letter or row number of a cell reference within the original formula. This is achieved by changing the position of the dollar signs mentioned above. A quick way to do this:

- Click on the cell containing the formula
- Click once on the cell reference in the formula bar
- Press F4 until the cell reference meets your requirements (see below)

Relative v absolute v mixed cell references

This table shows how the different \$ sign positions affect the cell references in a formula when copied:

Original cell reference...	...when copied becomes	Effect
D2	E4	Both the column and the row coordinates change as the formula is copied
\$D2	\$D4	The column coordinate is fixed, but the row coordinate changes
D\$2	E\$2	The column coordinate changes, but the row coordinate is fixed.
\$D\$2	\$D\$2	Both the column and row coordinates remain fixed

Function	Used for	Format	Example	Tips
SUM	Add values in a range of cells	=SUM(range of cells to add)	=SUM(A1:A10)	
AVERAGE	Average the values in a range of cells	=AVERAGE(range of cells to average)	=AVERAGE(A1:A10)	
MAX	Find the highest value in a range of cells	=MAX(range of cells)	=MAX(A1:A10)	
MIN	Find the lowest value in a range of cells	=MIN(range of cells)	=MIN(A1:A10)	
IF	Display different information depending on the outcome of a condition test	=IF(condition test, what to display if outcome is true, what to display if outcome is false)	=IF(A1>20, "Great!","Oops!") or =IF(A1>20, A1*E1,A1)	
AND	Test that more than one condition is true. Test result is TRUE only if all conditions are met.	=AND(condition test 1, condition test 2, ...)	=AND(A1>20,B1="Gold")	TRUE and FALSE are the only possible answers. To change the content of a cell as the result of an AND function, use the AND function as the condition test in an IF statement
OR	Test that more than one condition is true. Test result is TRUE if any of the conditions are met.	=OR(condition test 1, condition test 2, ...)	=OR(A1>20,B1="Gold")	
COUNT	Count numerical cells	=COUNT(range of cells to count)	=COUNT(A1:A10)	<i>COUNT does not count cells containing text, use COUNTA for this</i>
COUNTA	Count cells	=COUNTA(range of cells to count)	=COUNTA(A1:A10)	
COUNTBLANK	Count empty cells	=COUNTBLANK(range of cells to count)	=COUNTBLANK(A1:A10)	
COUNTIF	Count cells that meet a certain condition	=COUNTIF(range of cells to count,criteria to satisfy)	=COUNTIF(A1:A10,">20") <i>Counts all cells containing a value greater than 20</i>	
COUNTIFS	Count cells only if multiple conditions are met	=COUNTIFS(range of cells for criteria check 1, criteria 1 to satisfy, range of cells for criteria check 2, criteria 2 to satisfy,...)	=COUNTIFS(A1:A10,"Gold",B1:B10,">20") <i>Counts number of rows where column A contains the word Gold AND column B is greater than 20</i>	<i>Can use pivot table instead.</i>

Function	Used for	Format	Example	Tips
SUMIF	Add values in a range only if cells meet a certain condition	=SUMIF(range of cells for criteria check; criteria to satisfy, range of cells to add)	=SUMIF(A1:A10,"Gold",C1:C10) Adds all cells in column C if column A contains the word Gold	You only need the second range if the range to add is different to the range to be searched.
SUMIFS	Add values in a range only if cells meet multiple conditions	=SUMIFS(range of cells to add, range of cells for criteria check 1, criteria 1 to satisfy, range of cells for criteria check 2, criteria 2 to satisfy,...)	=SUMIFS(C1:C10,A1:A10,"Gold",B1:B10,">20") Adds all cells in column C if column A contains the word Gold AND column B is greater than 20	Can use pivot table instead

VLOOKUP

Where several spreadsheets use the same data, it is useful to have one sheet holding that data and then allow the other sheets to reference that information using the VLOOKUP function. This allows you to maintain data centrally. Any updates will automatically update the other sheets.

	A	B	C	D	E
			Course code	Fee	Award
1	Surname	Name	UB200	3500	BSc Hons
2	Lester	Faye	UB300	5000	BSc Hons
3	McCarthy	Brian	UB200	3500	BSc Hons
4	Shacklock	Jill	UB150	#N/A	#N/A
5	Dawes	Jane	UB150	#N/A	#N/A

	A	B	C	D
	Course Code	Course Title	Fee	Award
1	UB100	Health Studies	£3,000	BA Hons
2	UB200	Occupational Therapy	£3,500	BSc Hons
3	UB300	Physiotherapy	£5,000	BSc Hons

Main data sheet

The format of the VLOOKUP function is:

=VLOOKUP(lookup value, table range holding the master data, number of the column containing the answer to your question, FALSE)

For example, in the diagram above cell D2 would contain:

=VLOOKUP(C2,Main_data_sheet A2:D4, 3,FALSE)

to search the **table on the right**, for the relevant **fee** for course code **UB200**.

FALSE tells excel to only find an answer if an exact match is found for the lookup value.

If no match is found (e.g. course code UB150), Excel will display **#N/A**.

When using VLOOKUP for numerical data, you can omit FALSE from the function to find the closest match (next lowest value):

=VLOOKUP(lookup value, table range holding the master data, number of the column containing the answer to your question)

For VLOOKUP to work, the data table must be sorted in ascending order on the lookup column (e.g. the course code column A in the example above)

Flash Fill (Excel 2013 & 2016 only)

This tool is amazing for working with text in databases. In earlier versions, you needed to know several text functions to achieve the same results.

- Type the desired result in the first cell of the series and press ENTER
- Start typing the desired result in the second cell in the series.
Excel should suggest content for that and all other cells in the column.
- Press ENTER to fill the column.

Some examples:

To merge first name and last name in one column

- Type the full name in the first cell of a new column
- Start typing the full name in the second cell of the new column
- Press ENTER when Excel suggests the full name for every cell in the column

B	C	D
Name	Surname	Full name
Roger	Wilson	Roger Wilson
Mary	Driscoll	Mary Driscoll
Kate	Fu	Kate Fu
Julie	Gregory	Julie Gregory
Peter	Harrison	Peter Harrison
Harold	Lowe	Harold Lowe
Oscar	Renn	Oscar Renn
Melinda	Wrill	Melinda Wrill
Fred	Jackson	Fred Jackson

To extract the initials from 2 columns

- Type the initials in the first cell of a new column
- Start typing the initials in the second cell of the new column
- Press ENTER when Excel suggests the initials for every cell in the column

B	C	D	E
Name	Surname	Initials	Full name
Roger	Wilson	RW	Roger Wilson
Mary	Driscoll	MD	Mary Driscoll
Kate	Fu	KF	Kate Fu
Julie	Gregory	JG	Julie Gregory
Peter	Harrison	PH	Peter Harrison
Harold	Lowe	HL	Harold Lowe
Oscar	Renn	OR	Oscar Renn
Melinda	Wrill	MW	Melinda Wrill
Fred	Jackson	FJ	Fred Jackson

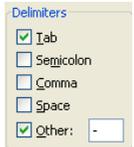
TOP TIP: if the technique above does not work:

- Type the desired result in the first cell of the series and press ENTER.
- Type the desired result in the second cell in the series and press ENTER.
- Select both cells.
- Use the [Autofill](#) technique to copy the cells down column.
- Click on the  icon and choose **Flash Fill**.

To split the contents of a column into 2 columns

For example, you can separate a column of full names into first and last name columns.

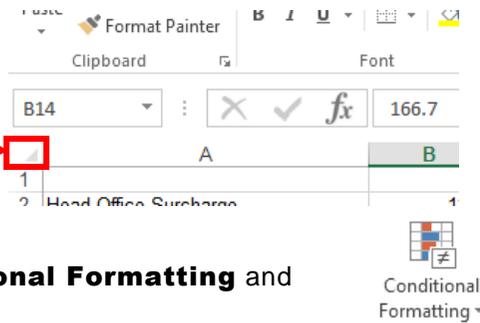
- Insert a new column to the right of the column you want to split
- Select the column that you want to split
- On the **Data** tab click on the text to columns icon
- In the pop-up window, check that **Delimited** is selected and click on **Next**
- In the *Delimiters* section, indicate what separates the first bit of text from the second.
 - E.g. if a space separates first and last name, click on **Space**
 - The example shows how to indicate that 2 pieces of information are separated by a hyphen
 - Click on **Next** and then on **Finish**



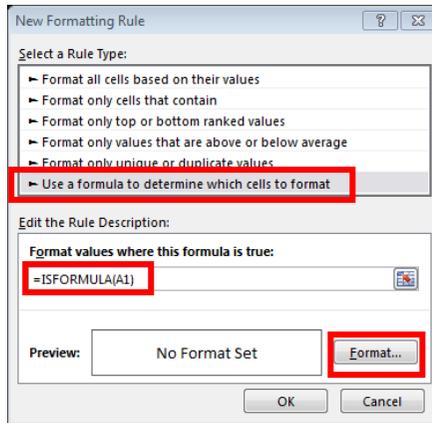
Colour all cells containing a formula (Excel 2013 only)

This may help you keep track of where you have added formulae to a sheet.

- Click on  to select the entire worksheet.
- On the **Home** tab, click on **Conditional Formatting** and choose **New Rule**.



- In the list, click to choose **Use a formula to determine which cells to format**
- In the formula box type **=ISFORMULA(A1)**
- Click on the **Format** button.
- Choose the format you require. e.g. to colour all cells containing a formula:
 - Click on the **Fill** tab
 - Click on a colour for the cell
 - Click **OK**.
- Click **OK**.



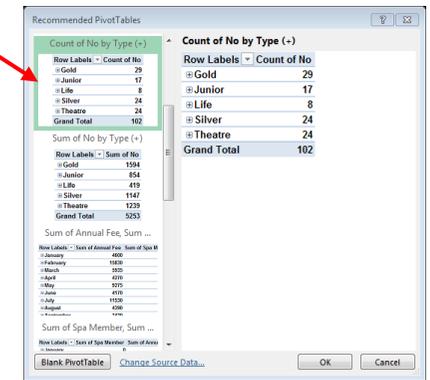
All cells containing a formula will be coloured.

	A	B	C	D	E	F	G
1							
2	Head Office Surcharge		12%				
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							

Recommended PivotTables (Excel 2013 and 2016)

Excel Pivot Tables summarise data without the need to build complex formulae. From Excel 2013 on, the Recommended PivotTables tool will suggest simple Pivot Tables to summarise your data without the need to know the details of how to build a PivotTable.

- Click anywhere within the table of data.
- Click on the **INSERT** tab.
- Click on the **Recommended PivotTables** icon.
- Click on the suggested PivotTables on the left of the pop-up window to see the table in more detail.
- To create a PivotTable, click on the PivotTable you require and click **OK**.
- The PivotTable will be created on its own worksheet.



Creating a chart from a Pivot Table

Once you've created a simple Pivot Table using the steps above, creating a chart to go with it is easy:

- Click on the Pivot Table to select it.
- On the Pivot Table Tools **ANALYZE** tab, click on the **PivotChart** icon
- Choose a chart type
- Click **OK**.

