



Microsoft Excel

Engineering Applications &
Study Skills

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What Excel is

Microsoft Excel is a Spreadsheet program

Extremely commonly used

Easy to use interface, quick to learn

Excel is a brilliant tool for working with data

- Organising data
- Performing calculations
 - Creating graphs
- Complex operations

- **Columns**
- **Rows**
- **Cells**

Organising your data properly in these ways saves time

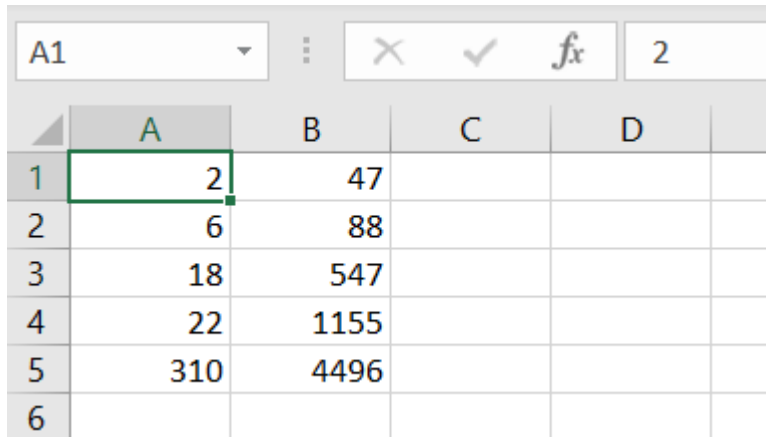
Excel Features

The diagram shows a grid representing an Excel spreadsheet. The columns are labeled A through I at the top, and the rows are labeled 1 through 20 on the left. A red arrow points to the intersection of column A and row 1, labeled "Cell". A red arrow points to the entire row 10, labeled "Row". A red arrow points to the entire column I, labeled "Column".

Basic Data Handling

You can enter data in any cell in the sheet

Click into the cell and type the number you want to



The screenshot shows a spreadsheet interface. At the top, a formula bar displays 'A1' in a dropdown, followed by a menu icon, a cancel button (X), a confirm button (checkmark), a function button (fx), and the value '2'. Below this is a grid of cells. Column A is highlighted in green. Row 1 is highlighted in grey. Cell A1 is selected and contains the number '2'. Other cells in the grid contain numbers: B1=47, B2=88, B3=547, B4=1155, B5=4496. Rows 6 and columns C and D are empty.

	A	B	C	D
1	2	47		
2	6	88		
3	18	547		
4	22	1155		
5	310	4496		
6				

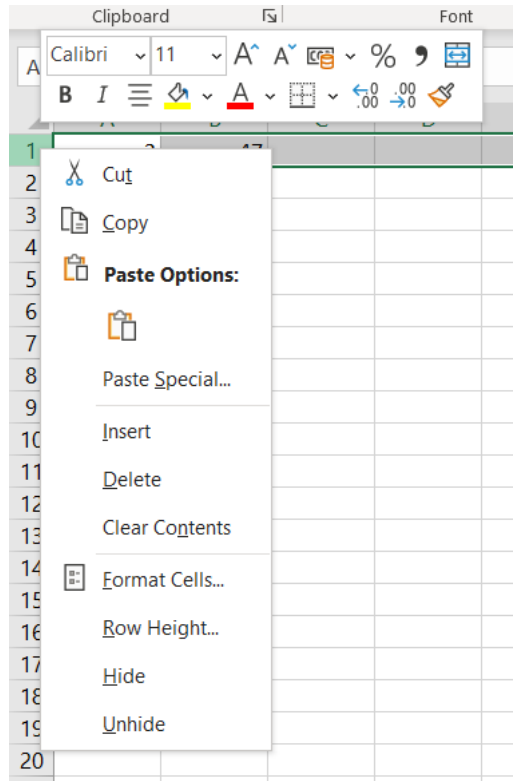
Once done, click into another cell or hit Return/Enter button

When you enter your data, keep it organised.

Think about whether your data is better organised in rows or columns



Basic Data Handling



Right clicking on a row or column header brings up more options like deleting or inserting new ones

	A	B	C
1		Test 1	Test 2
2	Sensor 1	2	47
3	Sensor 2	6	88
4	Sensor 3	18	547
5	Sensor 4	22	1155
6	Sensor 5	310	4496
7			

You can also enter text into cells.
Good practice to add labels to your columns and rows to label your data



Basic Data Handling

A1							
	A	B	C	D	E	F	G
1		Test 1	Test 2				
2	Sensor 1	2	47				
3	Sensor 2	6	88				
4	Sensor 3	18	547				
5	Sensor 4	22	1155				
6	Sensor 5	310	4496				
7							
8							
9							
10							
11							
12							
13							

 **Quick Analysis (Ctrl+Q)**

Use the Quick Analysis tool to quickly and easily analyze your data with some of Excel's most useful tools, such as charts, color-coding, and formulas.

Highlight specific cells containing data

A Quick Analysis icon will show to the bottom right of the highlighted data

Clicking on that will give quick access to some of the main features for dealing with data



Formatting | Charts | Totals | Tables | Sparklines

 Data Bars

 Color Scale

 Icon Set

 Greater Than

 Top 10%

 Clear Format

Conditional Formatting uses rules to highlight interesting data.

- Formatting options
- Charts/Graphs
- Totals/Averages



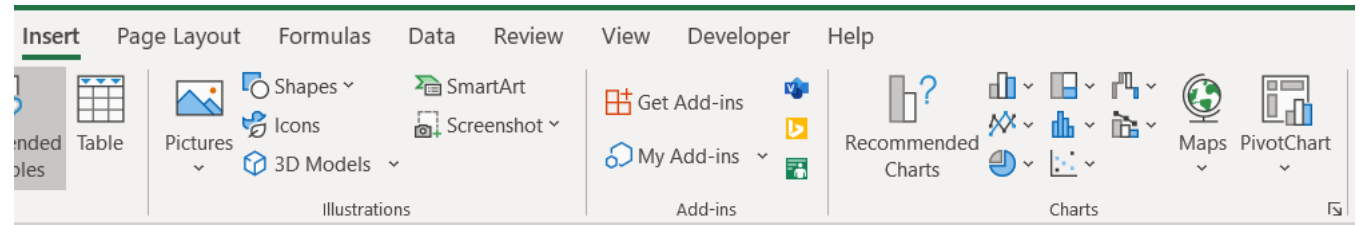
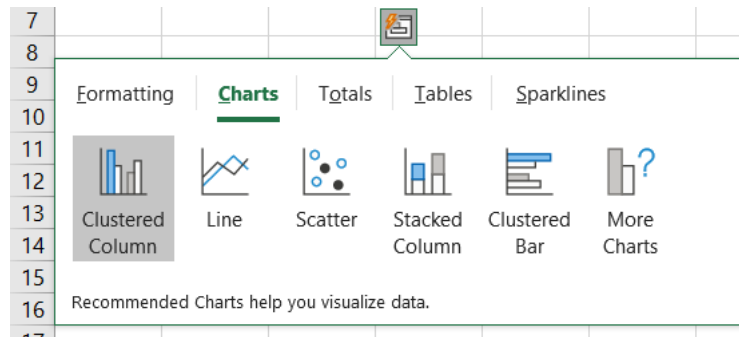
Creating Graphs

Graphically displaying your data is always a good idea

Excel has simple to use functions for doing this

Two main methods:

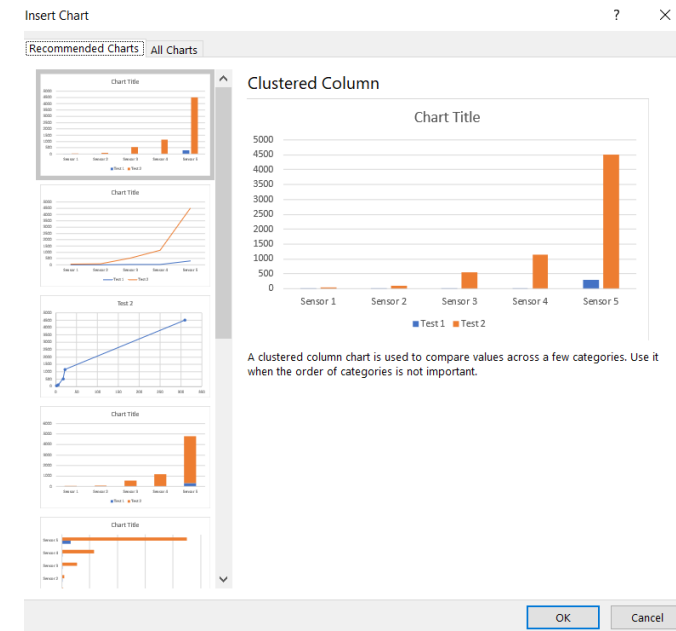
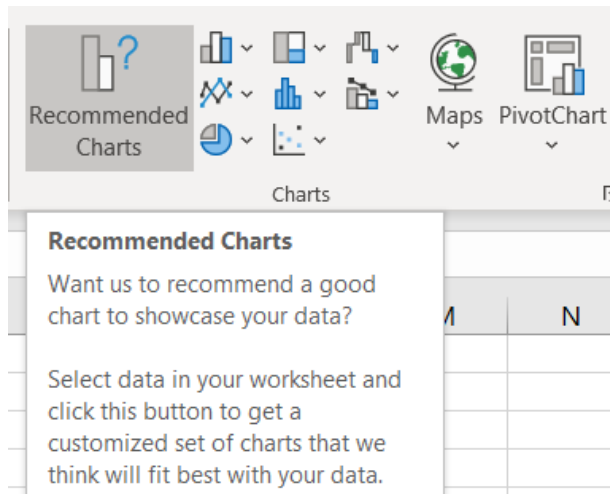
- Highlight your data and use the Quick Analysis menu
- Go to Insert on toolbar and add a Chart from there





Creating Graphs

If you select your data first, then go to Insert and Recommended Charts, Excel will show you different options for charts that it thinks best suit the data you have selected



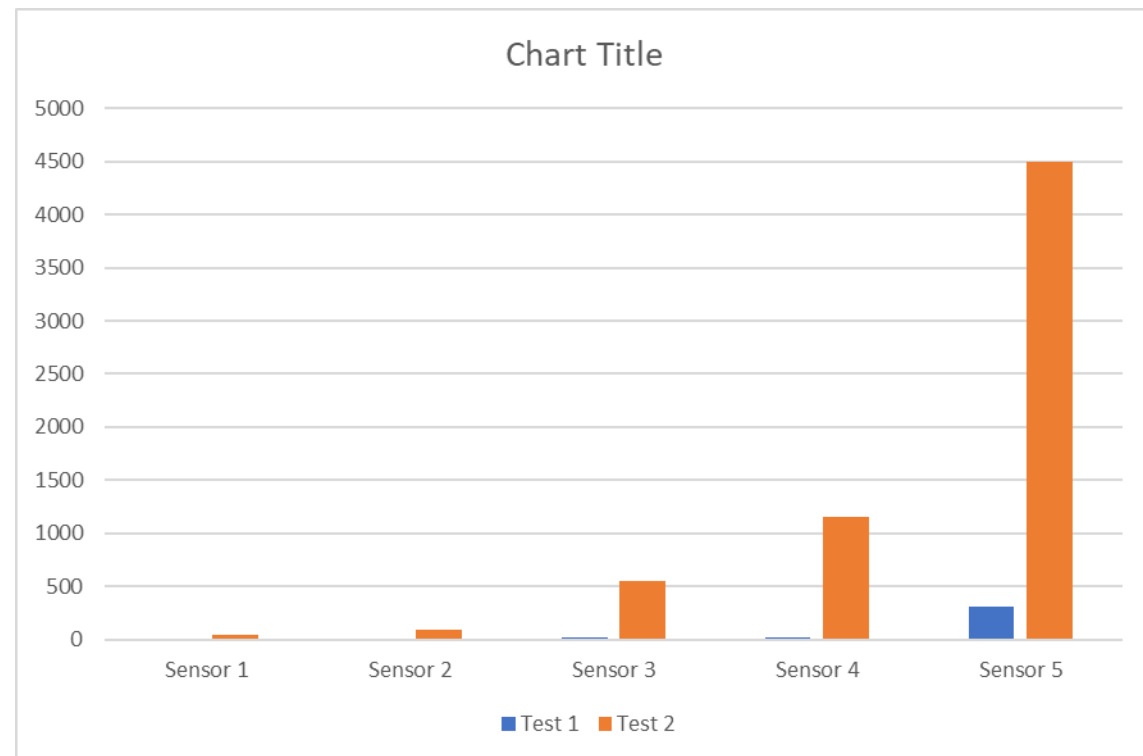


Creating Graphs

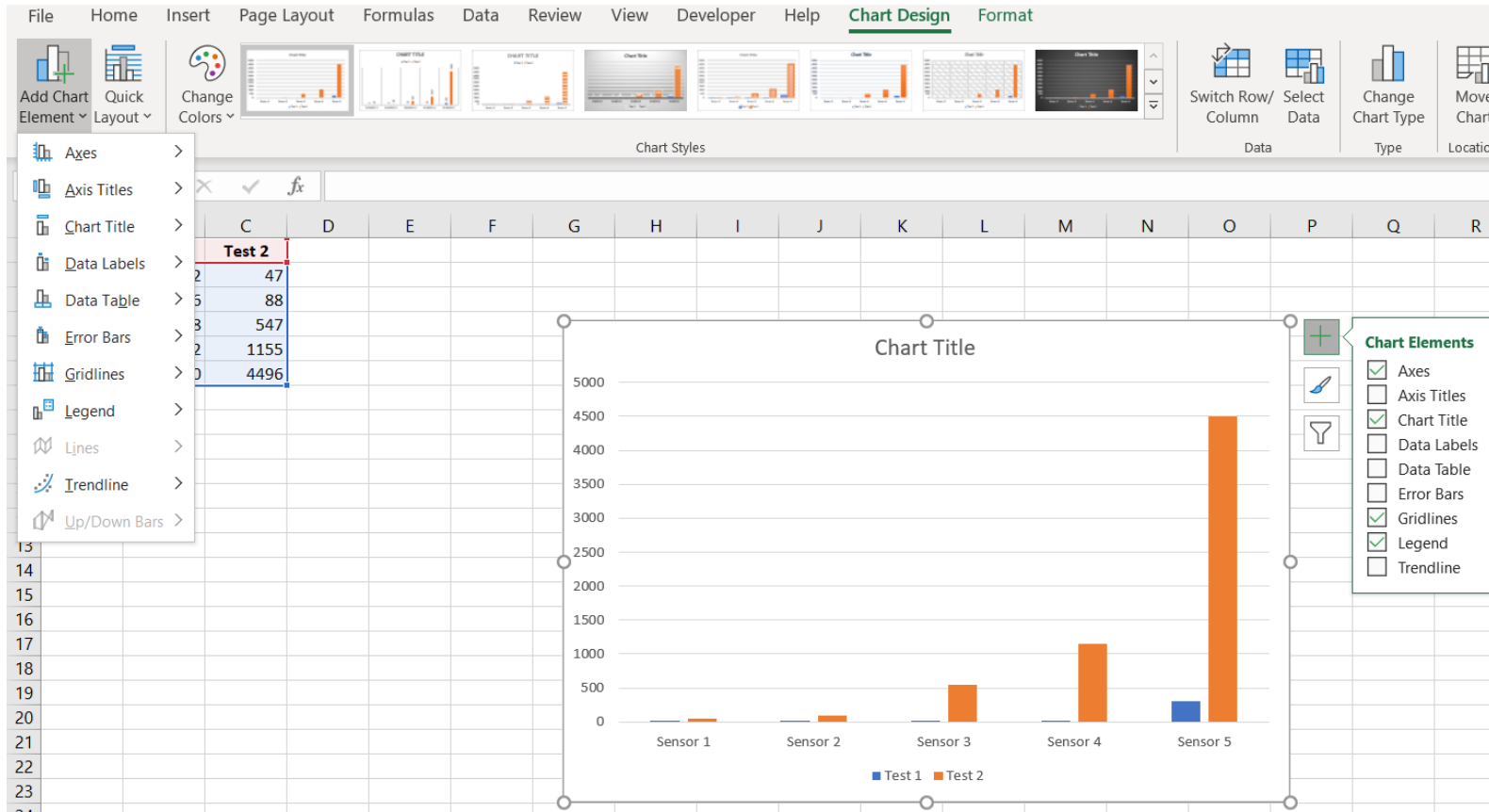
Once you select the chart type you want, Excel will create it and insert it onto the Sheet

If you have selected your labels as well, Excel will automatically detect these labels and show them on your chart

You still need to label your chart and axis



Creating Graphs



Adding Chart Title & Axis Labels:

From the toolbar, use Add Chart Element dropdown and add the features you want

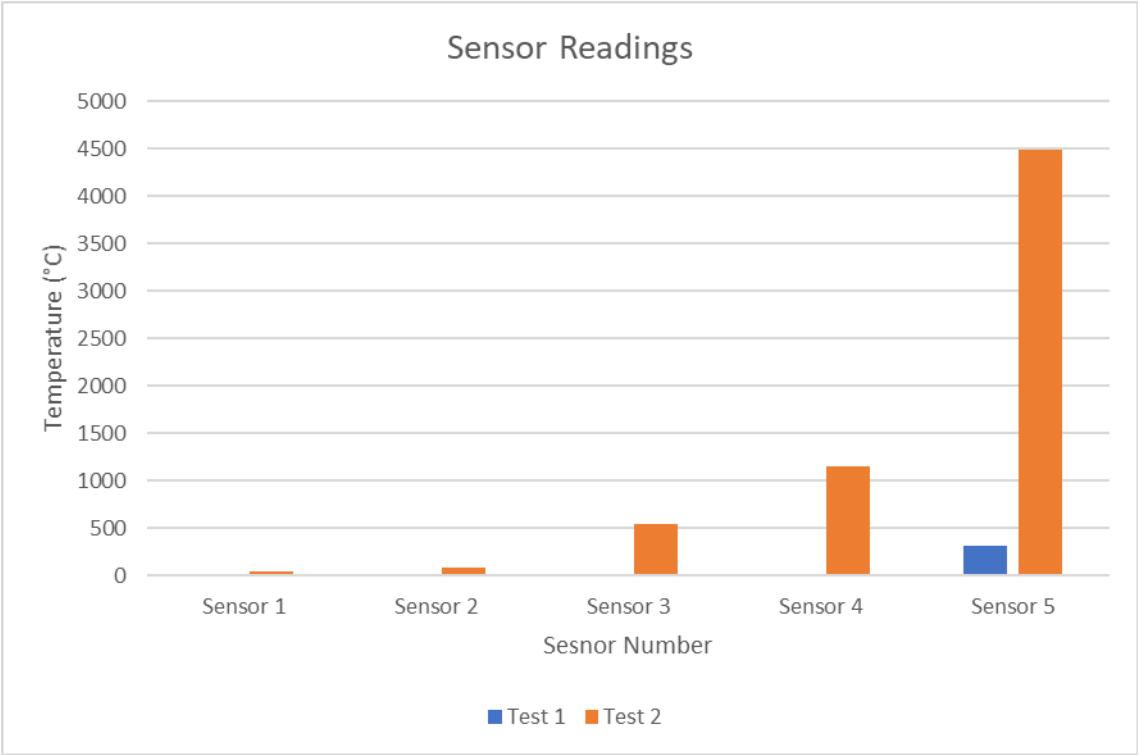
Or

Click on the chart, click the + icon next to it, and add Chart Elements through the menu

Click on the Title or Axis Label and type your description.



Creating Graphs



Make sure to include units when you label your axis!

Axis labels should be obvious and clear to the reader

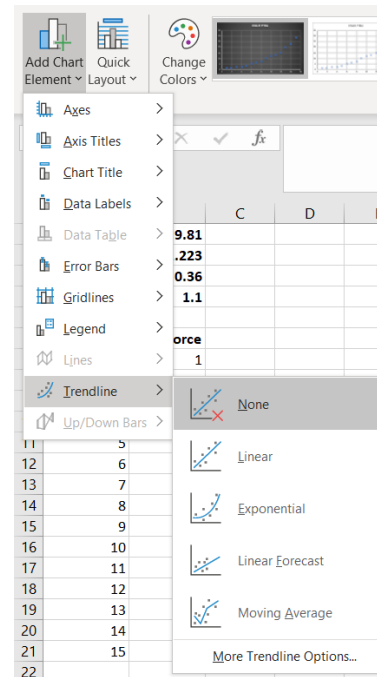
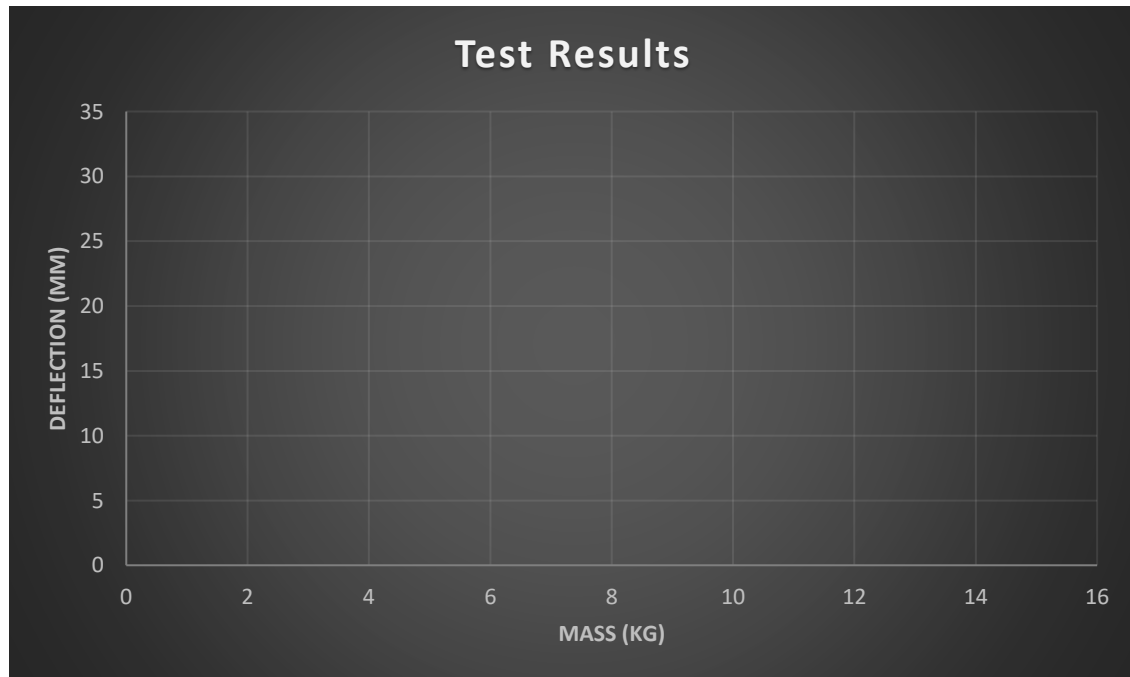
Chart title should leave no ambiguity in what the chart is showing

If you have multiple data sets on the same chart, make sure you include a legend to show the reader how they are colour coded

Trendlines

Presenting data graphically is much easier to understand, but trendlines can help see trends much better

Trendlines can also be used to fit an equation to the data which can be used for interpolation

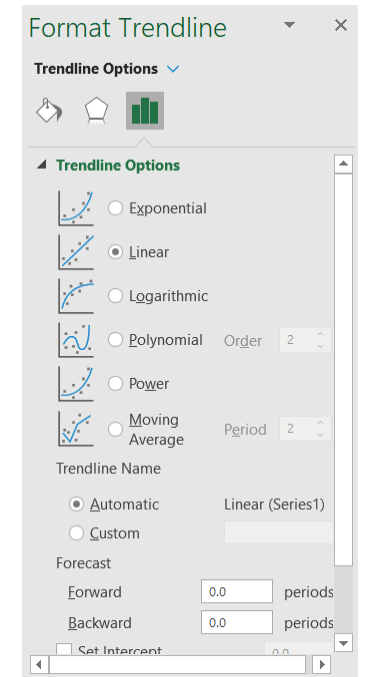


Add Chart Element

Trendline

Select appropriate one, or select More Trendline Options

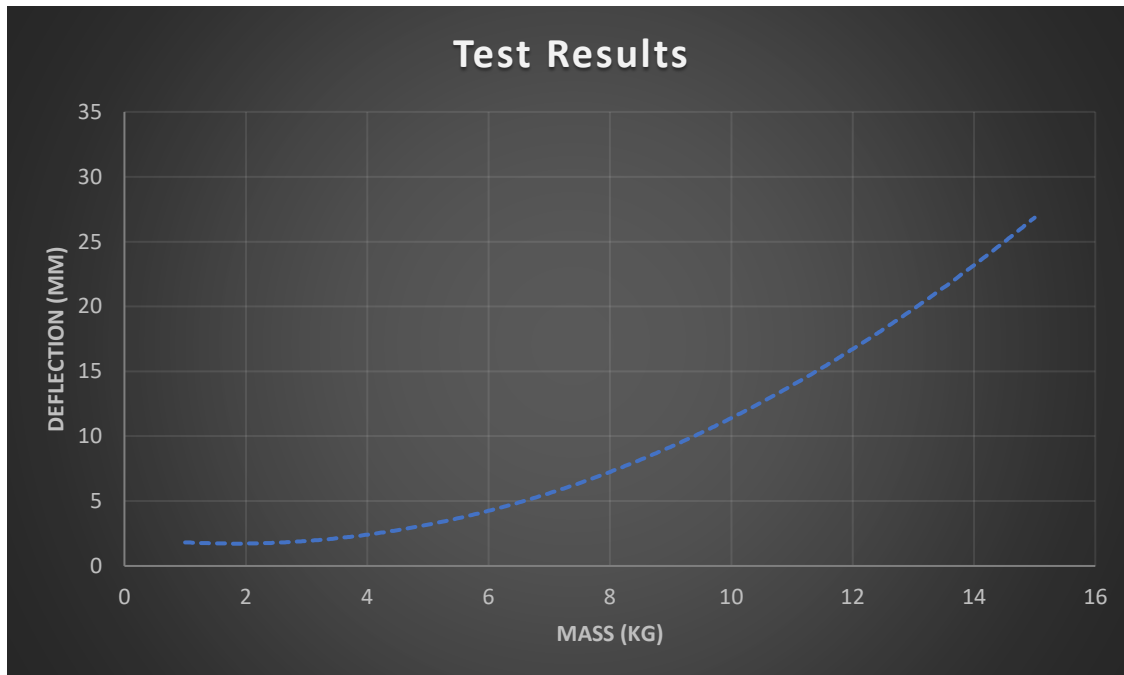
Options bar on the right allows customisation



Trendlines

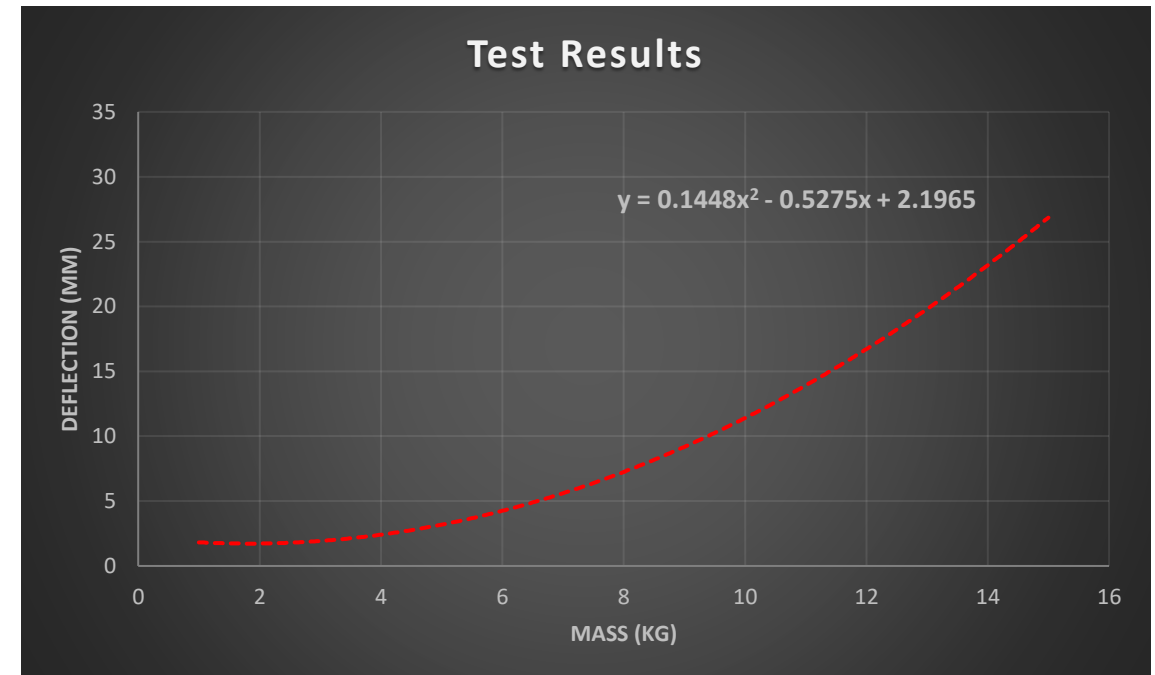
Different types of trendline, select the one that fits the data best

Example here is 2nd order polynomial



Once the best fit trendline is selected you can see the trend in the data and identify anomalies

Ticking option to 'Display Equation on Chart' gives the formula for the trendline





Sorting Data in Excel

Sorting data, especially large amounts of data can be very helpful. This is easy to do in Excel.

Example of expenses claims list, you may wish to sort the data to see who is claiming the most, or who has the most claims rejected....

Highlight the data, but NOT the column headings.

On the HOME tab, click on the SORT & FILTER button under the Editing section of the ribbon

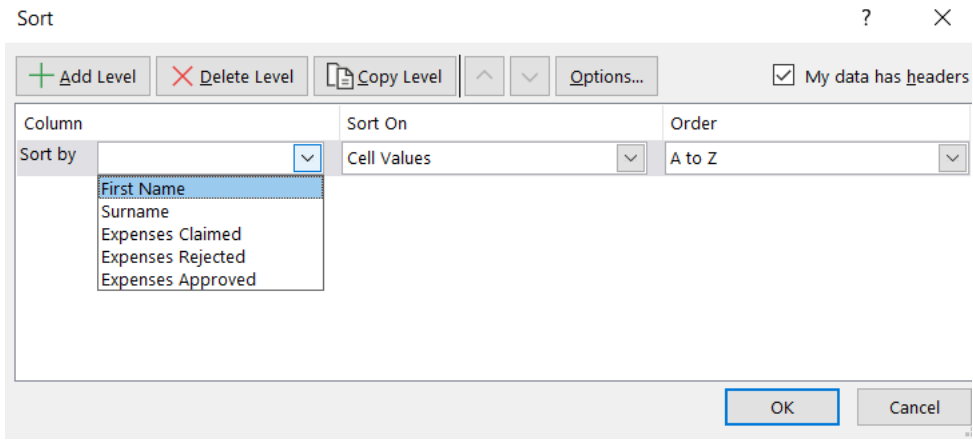
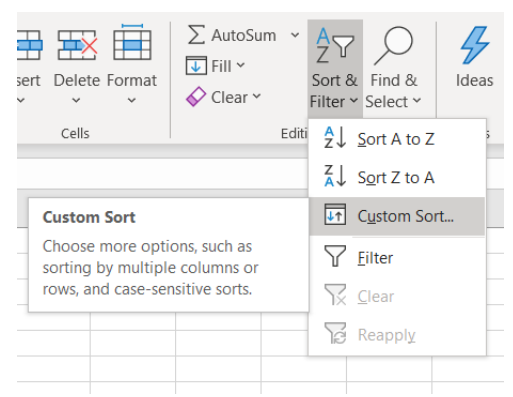
Select CUSTOM SORT from the list of options

	A	B	C	D	E
1	First Name	Surname	Expenses Claimed	Expenses Rejected	Expenses Approved
2	James	Lowe	1458.23	0	1458.23
3	Steve	Ames	2297.12	31.99	2265.13
4	Alan	Marks	660.84	0	660.84
5	Jessica	Smith	1820.99	24.99	1796
6	Mike	Lewis	3043.01	687.43	2355.58
7	Michelle	Howard	231.86	0	231.86

	A	B	C	D	E
1	First Name	Surname	Expenses Claimed	Expenses Rejected	Expenses Approved
2	James	Lowe	1458.23	0	1458.23
3	Steve	Ames	2297.12	31.99	2265.13
4	Alan	Marks	660.84	0	660.84
5	Jessica	Smith	1820.99	24.99	1796
6	Mike	Lewis	3043.01	687.43	2355.58
7	Michelle	Howard	231.86	0	231.86



Sorting Data in Excel



In the Sort window that opens, you can decide which column you want to sort by.

Then you can select the Order the data is sorted by, A-Z, Large-Small, Small-Large.....

In this example, sorted by Expenses Approved, Largest-Smallest. Excel has now rearranged the table of data based on those criteria.

	A	B	C	D	E
1	First Name	Surname	Expenses Claimed	Expenses Rejected	Expenses Approved
2	Mike	Lewis	3043.01	687.43	2355.58
3	Steve	Ames	2297.12	31.99	2265.13
4	Jessica	Smith	1820.99	24.99	1796
5	James	Lowe	1458.23	0	1458.23
6	Alan	Marks	660.84	0	660.84
7	Michelle	Howard	231.86	0	231.86



Formula Introduction

Formulas within Excel are expressions that operate on values

This can be in a single cell or a range of cells

Formulas can operate across different Sheets in a Workbook

Example:

=A1 + A2 + A3

This gives the sum of the values in Cells A1, A2 and A3



Inputting Formulas

This means that all formulas in Excel must start with the EQUALS symbol

=

By clicking into a cell and starting your entry with = Excel will know you are entering a formula and that it needs to perform a calculation

Example:

=A1+A2

Excel will then add the values in cells A1 and A2 and return the result in the cell you have entered the formula into



Inputting Formulas

There is a certain syntax to how formulas must be entered in Excel

You would write a formula in this format:

$$A = B + C$$

In Excel this would be:

$$A = B + C$$

Cell formula
is going in



First Cell to
add



2nd Cell to
add



Using Brackets in Formulas

Using brackets in your formulas is very important to getting the correct result

Excel follows mathematical standard order or precedence when performing calculations

Precedence	Operator	Type/Function
1	–	Negation
2	%	Percent
3	^	Exponentiation
4	* and /	Multiplication and division
5	+ and –	Addition and subtraction
6	&	Concatenation
7	=, <, >, <=, >=, <>	All comparison operators



Using Brackets in Formulas

Because of this, Excel will not always perform the calculations how you want

Example:

$$=5+10*2$$

Excel will perform the multiplication first, then the addition

$$10*2 = 20 + 5 = 25$$

What you actually wanted was:

$$5+10 = 15 * 2 = 30$$

Using brackets (parenthesis) to group parts of your formula will ensure Excel performs the calculation in the order that you want

$$=(5+10)*2$$

The above formula, using brackets will give the right answer

You may find that you need to use multiple set of brackets in a nested manner for larger formulas:

$$=(A2+(A3*B2))/2$$

Incorrect use of brackets can give the wrong results, be careful!

Formula Operators

Excel uses a specific set of operators for performing calculations in formulas:

Add: +

Subtract: -

Divide: /

Multiply: *

Exponents: ^

Examples:

=A1+A2 Adds Cells A1 & A2

=B2-B3 Subtracts cell B3 from cell B2

=A4/3 Divides cell A4 by 3

=B10*3.5 Multiplies cell B10 by 3.5

=A5^2 Squares the value in cell A5

	A	B	C	D	E	F	G	H	I	J
1	X	Y								
2		1	1							
3		2	4							
4		3	9							
5		4	16							
6		5	25							
7		6	36							
8		7	49							
9		8	64							
10		9	81							
11		10	100							
12		11	121							
13		12	144							
14		13	169							
15		14	196							
16		15	225							
17		16	256							
18		17	289							
19		18	324							
20		19	361							
21		20	400							

=0.5*\$B2*B\$3*\$B\$4*(A7^2)|

Functions Introduction

Functions are predefined formulas in Excel

Using Functions can be a real timesaver

Eliminates the need to perform laborious, repetitive formula entry

Example:

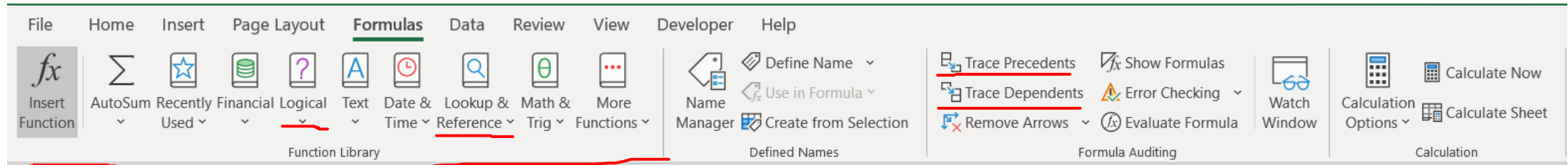
=SUM(A1:A300)

This function gives the sum of all the values in Cells A1 to A300

Does the same job as the Formula on the last page, but saves you entering the Cell reference for each Cell you want to add up



Inserting Functions



One of the main tabs in the Excel toolbar is for Formulas & Functions

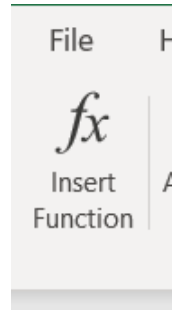
This section contains lots of quick access options for entering formulas

Different sections contain relevant formulas grouped by their use

You can go through the drop-down lists for each type, a description of what each formula is used for will show when you hover your mouse over the formula, then select the correct one



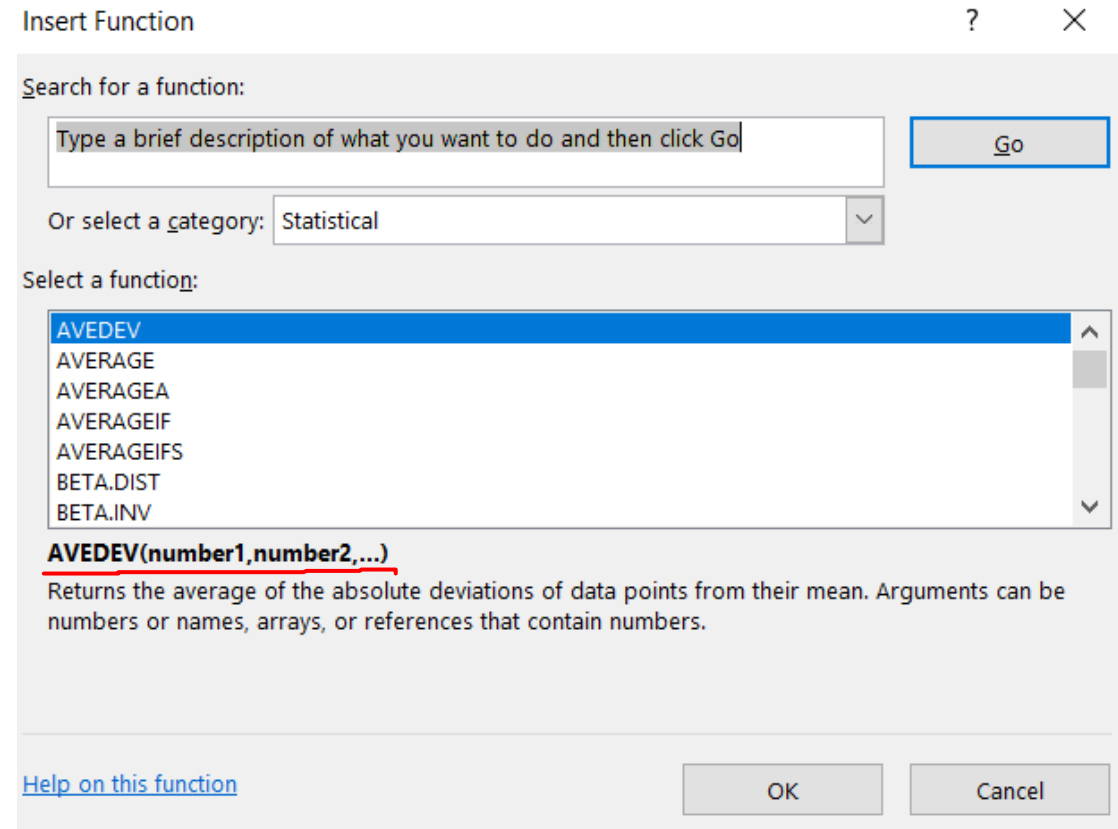
Inserting Functions



If you aren't sure which function you need to use,
you can click on the INSERT FUNCTION button

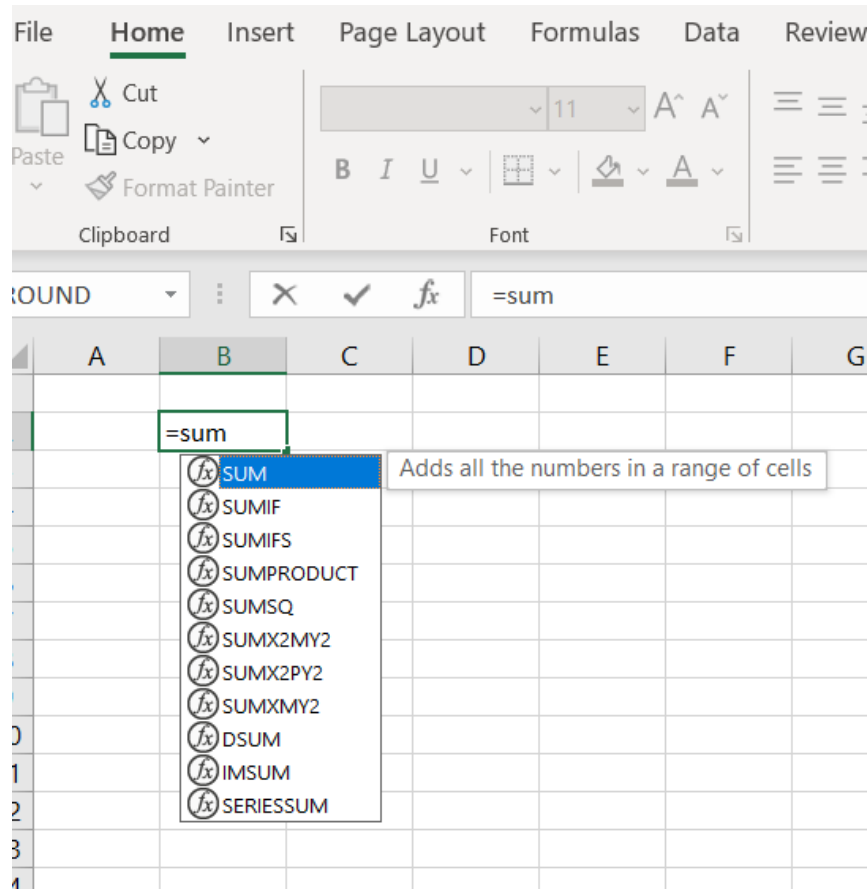
A new window opens where you can search the
functions by the description of what you want to
do

Excel will find the correct function for you





Inserting Functions



You can also manually enter a function

Click into the cell you want the function to appear in

All formulae and Functions must start with '='

Start typing the function name

Excel will automatically then show you a list of functions based on what you are typing

You can click on each one in the list to see a description of what the function does

Typical Functions

SUM

The sum function is possibly the best known in Excel. It will add up the cell values from a range of cells you select.

Examples:

=SUM(B2,G2,F8) – A simple selection that sums three values.

=SUM(A2:A8) – A simple selection that sums the values of a range of cells.

=SUM(A2:A7, A9, A12:A15) – A sophisticated collection that sums values from range A2 to A7, skips A8, adds A9, jumps A10 and A11, then finally adds from A12 to A15.

=SUM(A2:A8)/20 – Shows you can also turn your function into a formula.

Typical Functions

AVERAGE

The Average function does as the name suggests. It will calculate an average value from the values in the range of cells you select.

You can achieve the same by using the SUM function to add them all up, then dividing by the number of cells. The AVERAGE function saves time.

Examples:

=AVERAGE(B2:B11) – Shows a simple average, also like $(=SUM(B2:B11)/10)$

=AVERAGE(B2,C3,G10,H1) – Calculates an average from cells in different locations in the Sheet



Typical Functions

MAX or MIN

The MAX and MIN functions are extremely useful if you are working with large tables of data

Will find the maximum or minimum value in the range of cells you select

Examples:

=MAX(B2:B11) – Finds the maximum value of any cell in the range B2:B11

=MIN(B2,C3,G10,H1) – Finds the minimum value from cells in different locations in the Sheet



Typical Functions

IF

If functions are logical statements. Can be used to return a different result depending on if the statement is true or false.

Useful for situations where you want a different result depending on if a value is above or below a threshold or meets certain logical conditions

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

Examples:

=IF(C3<C2,C1,D1) – If the value of cell C3 is less than the value of cell C2 then it returns the value in cell C1. If C3 is larger than C2, it returns the value in cell D1.

=IF(D2<40,"Fail","Pass") – If the value of cell D2 is below 40, it will show **Fail**. If D2 has a value greater than 40 it will show **Pass**. Use double quotation marks for text



Conditional Formatting

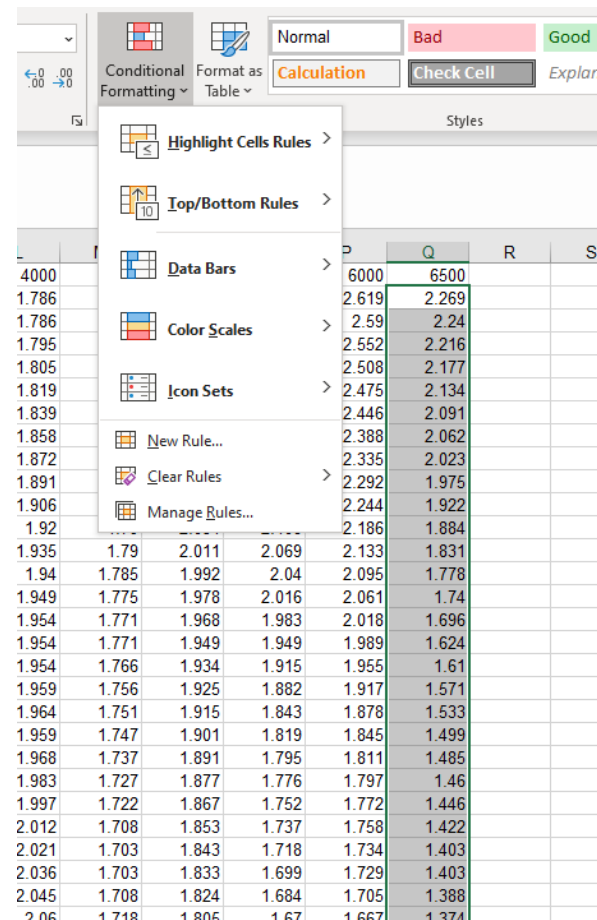
Conditional formatting allows you to change the format of the cells based on the values contained in them

Highlight the cells you want to add conditional formatting to

From the HOME tab, select **CONDITIONAL FORMATTING**

Some default options are available, or you can specify your own rule

NEW RULE





Conditional Formatting

When adding a new formatting rule, separate window will open

Select the type of rule most appropriate.

Graded colour scales are useful for showing how values change in magnitude

Formatting based on CELLS THAT CONTAIN is a useful way of highlighting values above or below a threshold

This only changes the formatting of the cells, it will not alter the values in the cells

New Formatting Rule

Select a Rule Type:

- Format all cells based on their values
- Format only cells that contain
- Format only top or bottom ranked values
- Format only values that are above or below average
- Format only unique or duplicate values
- Use a formula to determine which cells to format

Edit the Rule Description:

Format all cells based on their values:

Format Style: 2-Color Scale

Minimum

Type: Lowest Value

Value: (Lowest value)

Color: [Orange]

Maximum

Type: Highest Value

Value: (Highest value)

Color: [Yellow]

Preview: [Orange to Yellow gradient bar]

OK Cancel



Conditional Formatting

In this case, let's say we want to highlight values equal to or above a certain threshold (1.5)

Select **FORMAT ONLY CELLS THAT CONTAIN** option

In the Edit Rule section, define that the formatting will be based on cell value

Select greater than or equal to

Set value as 1.5

Click **FORMAT** and change it so the **FILL COLOR** will be green for values 1.5 or over

New Formatting Rule

Select a Rule Type:

- Format all cells based on their values
- Format only cells that contain**
- Format only top or bottom ranked values
- Format only values that are above or below average
- Format only unique or duplicate values
- Use a formula to determine which cells to format

Edit the Rule Description:

Format only cells with:

Cell Value greater than or equal to 1.5

Preview: AaBbCcYyZz **Format...**

OK Cancel

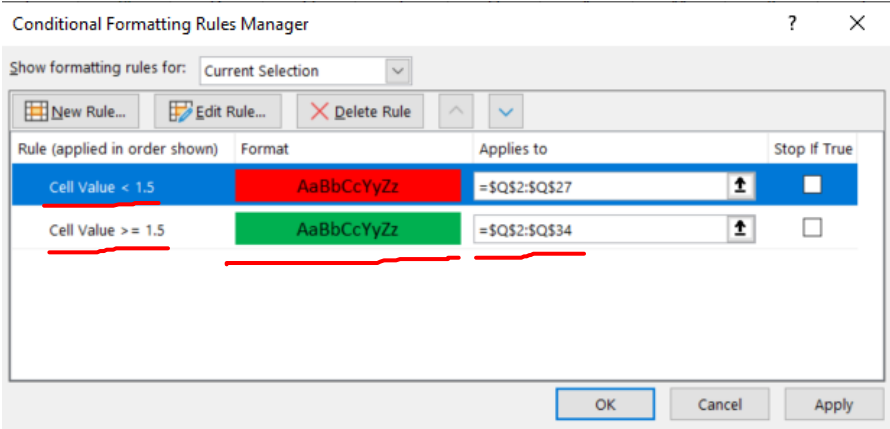


Conditional Formatting

You can also **MANAGE RULES** to add additional ones.

Adding another rule that sets values below 1.5 to red

Now have 2 active conditional formatting rules for the selected cells



M	N	O	P	Q
4500	5000	5500	6000	6500
1.852	2.286	2.488	2.619	2.269
1.843	2.252	2.454	2.59	2.24
1.828	2.218	2.42	2.552	2.216
1.824	2.189	2.382	2.508	2.177
1.809	2.161	2.348	2.475	2.134
1.799	2.136	2.315	2.446	2.091
1.795	2.112	2.281	2.388	2.062
1.795	2.093	2.228	2.335	2.023
1.795	2.069	2.194	2.292	1.975
1.795	2.05	2.151	2.244	1.922
1.79	2.031	2.108	2.186	1.884
1.79	2.011	2.069	2.133	1.831
1.785	1.992	2.04	2.095	1.778
1.775	1.978	2.016	2.061	1.74
1.771	1.968	1.983	2.018	1.696
1.771	1.949	1.949	1.989	1.624
1.766	1.934	1.915	1.955	1.61
1.756	1.925	1.882	1.917	1.571
1.751	1.915	1.843	1.878	1.533
1.747	1.901	1.819	1.845	1.499
1.737	1.891	1.795	1.811	1.485
1.727	1.877	1.776	1.797	1.46
1.722	1.867	1.752	1.772	1.446
1.708	1.853	1.737	1.758	1.422
1.703	1.843	1.718	1.734	1.403