



Australian
National
University

Digital literacy training

Excel

Working with data in Excel
2019

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Workshop files

Located at:

ql.anu.edu.au/training

Handy Shortcuts for Working with Data

Move around...

Worksheet: "Moving & Selecting"

Apart from being able to use the arrow keys and mouse to scroll through a worksheet, here are a few handy **Keyboard Shortcuts**:

Move within a worksheet

Ctrl + Home.....moves cursor to cell A1
 Ctrl + Endmoves cursor to end of data in active worksheet
 Home.....moves cursor to beginning of current row
 F5opens Go To dialog box

Move within a region

A region is a block of data on the sheet

Ctrl + →moves the cursor to the end of the region
 Ctrl + ←moves the cursor to the beginning of the region
 Ctrl + ↑moves the cursor to the top of the region
 Ctrl + ↓moves the cursor to the bottom of the region
 If there is blank cell in the region – press the keystroke until the end or beginning is reached.

Select data within a worksheet

Ctrl + click.....cells, row numbers or column letters to select non-contiguous cells / rows / columns
 Shift + Spacebar Select a row
 Ctrl + Spacebar..... Select a column
 Ctrl + A..... Select entire worksheet
 Shift + Home Select from current cell to beginning of row

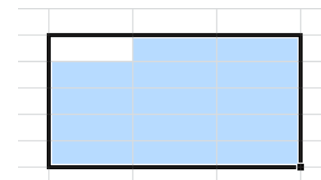
Select data within a region

Combine the keystrokes above with the Shift key and data will be selected to the end or beginning of the range
 Ctrl + Shift + ← or → or ↑ or ↓
 Ctrl + Shift + *selects the whole current region (*NOT the asterisk on the Number pad*)

Advanced Methods for entering data

Pre-select cells to enter data

1. **Select** the required **cells** > type the data (you can select non-contiguous using Ctrl+Click also).
2. Press <enter> or <tab> to lock in the data and move the cursor on.



Create a new line within a cell

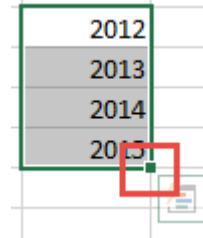
3. Press Alt + Enter

Auto Fill

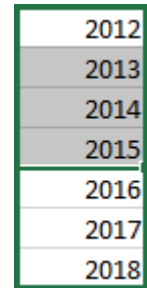
When a cell or cell range is selected a small black box appears at the bottom right corner of the last cell.

This box can be used to fill adjacent cells with content related to the selected cell(s). It can:

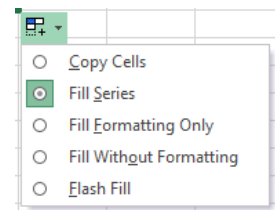
- copy the cell(s)
- copy just the formatting of the cell(s)
- fill a series based on the active cell(s)
- copy or fill a series without copying the formatting of the cells(s)



1. Hover the cursor over the small black box at bottom right corner of the selected cell(s). The cursor will change to a <+>
2. Hold down the **Left** mouse button and drag to adjacent cell(s) (down and/or right)



3. Click the small dialog box and select the required **Auto Fill** option



TIP: Double clicking on the small black box will autofill down to the end of data in the column immediately to the left of the active cell.

Freeze panes

When more data than can be seen has been entered on the screen, the **row** labels and **column** headings may scroll off the screen and disappear.

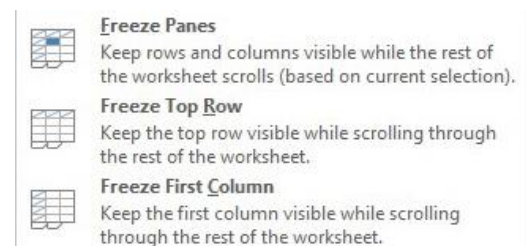
Freezing Panes provides a method of keeping the first one or more columns and / or rows on screen and in view. It allows the user to be more accurate when entering and reviewing data.

Freeze the top row or first column

1. Click anywhere in the **region**.
2. Activate **View** tab > **Window** group.
3. Choose Freeze Top Row or Freeze First Column.

Freeze both rows and columns at the same time

1. Click in the **cell** directly below the row and directly to the right of the column to be frozen, e.g. cell B2.
2. Activate **View** tab > **Window** group.
3. Choose Freeze Panes.



To unfreeze all rows and columns

1. Click anywhere in the **region**.
2. Activate **View** tab > **Window** group.
3. Choose **Unfreeze Panes**.

Tip: When panes are frozen the **Freeze Panes** option changes to **Unfreeze Panes**

Formulas and functions

Cell referencing

Cells are named by combining the column letter and the row number. Called the **cell reference** or **cell address**, it is the intersection of the Column Letter (e.g. A, B, etc.) and the Row Number (e.g. 1, 2, etc.). The address of the top left cell in an Excel spreadsheet is therefore A1. Selecting a cell will display the cell address in the **Name Box** (*on the left of the Formula bar*).

Using the cell address i.e. **cell reference** is the preferred method for specifying data when building formulas.

Formulas

A formula is a calculation of values and/or cell references.

Formulas are built by combining a mixture of numbers, cell addresses, operators (listed below) and Functions.

A formula MUST begin with '=' and have no spaces

Arithmetic operators

		Example
+	addition	=A1+B1
-	subtraction	=A1-B1
/	division	=A1/B1
*	multiplication	=A1*B1
%	percent	=A1%*B1
^	exponentiation	=A1^2

Order of evaluating operators

If a formula performs more than one operation Excel needs to know in what order to perform those operations to ensure the correct answer is obtained. To recap, the order of arithmetical operations is as follows:

Parentheses	All calculations within these are completed first
Negation	Making a number negative precedes any other operations
Percent	Percentages are calculated next, so result is used in remaining calculations
Exponentiation	Exponents (50^3, which is 50 cubed) next
Multiplication	After parenthetical and before all other calculations
Division	Follows any multiplication and is on the same level of precedence as multiplication
Addition	Performed after all divisions

To alter the order of evaluation use **Parentheses** to group expressions in a formula:

Formula	result
=(1+2)*3+4+5	18
=1+2*3+4+5	16
=1+2*(3+4)+5	20
=1+2*(3+4+5)	25
=(1+2)*(3+4)+5	26

Type a formula

Worksheet: "Formula_1"

When entering a formula into a worksheet observe the following rules.

Always start with the = **sign**

Never include **spaces**

If **parentheses** are used, they are always in **pairs**

The formula can be typed out longhand, e.g. =22+33+44 (*not an efficient method*).

You can enter the formula by typing in the Cell References e.g. =B2+B3+B4

You can use the mouse to select the cells you wish to include in the formula instead of typing them in.

Example

To **add** the numbers in cells **B2** to **B4** a formula may be typed in cell **B5**.

1. In B5 > type =
2. Select the first **cell** to be included > type + > select the next **cell** to be included > **repeat** until all cells are referenced. (**B2+B3+B4**)
3. Once all required cells are referenced > press <Enter> to see the result in B5.

	A	B	C	D
1		Amount	Percent	
2	May	22		
3	June	33		
4	July	44		
5	Total	99	4.95	
6				

Example

To **calculate 5%** of the value in cell **B5** in cell **B6**.

1. In C5 > type = 5%*
2. Click on cell B5 to enter its reference into the formula.
3. Press **Enter** key to see result in cell C5.

The Formula bar displays the formula.

	A	B	C	D
1		Amount	Percent	
2	May	22		
3	June	33		
4	July	44		
5	Total	99	4.95	
6				

Functions

Worksheet: "Formula_2"


Functions are built-in to Excel. They can be used to perform a wide variety of calculations. They are a tool that can be used within a formula.

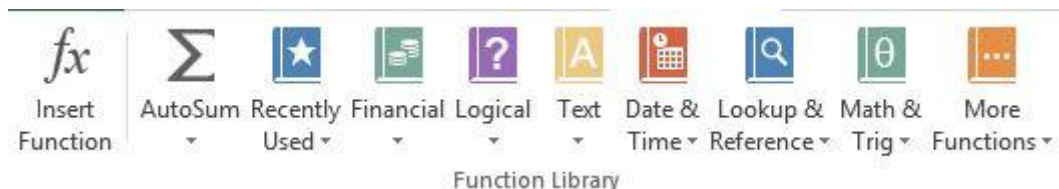
There are a vast number of built-in functions within Excel and the list is growing with every new version. They are categorised by discipline (e.g. Financial, Statistical, Lookup, Logical, etc.).

Built-in functions can be accessed by

selecting **Insert Function**  on the Formula tab

selecting from the **Function Library** group


Insert
Function




There are three ways of entering a function:

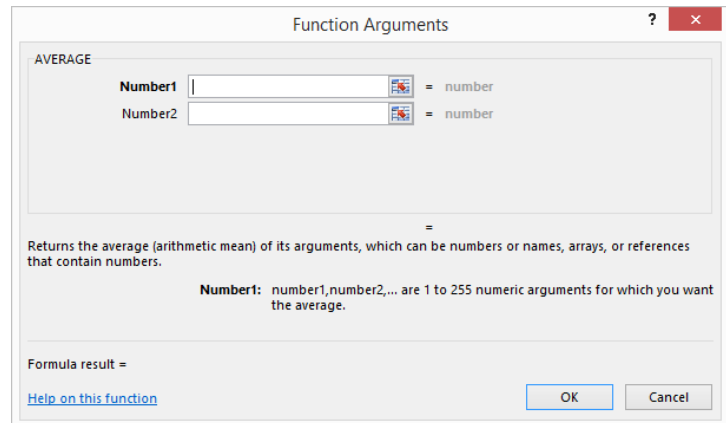
Using an 'Auto' function

Typing the function name

Using the Function dialog box

Function Arguments dialog box

- Each element required by the **syntax** of the function is listed separately
- A definition of its **purpose** is provided.
- A result for each element is provided as you make your choices.
- A formula result is also provided to guide your understanding of the choices you make.
- If the box gets in the way, select the Collapse button to the right of the argument. 



Tip: The [Help on this function](#) aid is very useful.

AutoSum function

The most commonly used Function is **AutoSum**. This function will try to predict the cells it is to 'add' so the cursor should be placed **under** or **beside** the cells to be calculated.

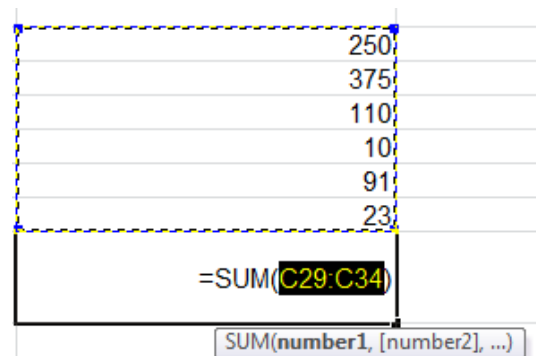
Example – use the **formula_2** worksheet

Position the cursor in the cell where the calculation is required.

1. Activate the **Formulas** tab.
2. In the **Functions Library** group.
3. Select the AutoSum button > press <Enter>.

OR

1. Activate the **Home** tab.
2. In the **Editing** group > Select the AutoSum button > press <Enter>.



Tip: pressing **ALT + =** will also activate the **AutoSum** function.

Type a function

1. Position the cursor where the **calculation** is to be placed.
2. Start typing **=sum** > as soon as the required function name is highlighted > press <Tab>. (*This inserts the first parenthesis.*)
3. Select the first **cell** to be referenced > type a **comma** > repeat until all required cells are listed (*finish with a cell reference, not a comma*) > press <Enter>. (*This inserts the closing parenthesis.*)

Note: If the cells to be calculated are contiguous (adjacent to each other, **drag** across the range rather than clicking and typing. If the cells are not contiguous, use the < CTRL > and click on the appropriate cell and Paste CTRL+V.

Copying and pasting the results of formulas

Sometimes you want to copy the results of your formulas and paste them somewhere else in Excel, but if you simply "copy and paste" you will be pasting the formula and NOT the result. You can use **Paste Special** instead to paste the values of the result only:

1. Select the cells containing the formula results, and copy them by either right-clicking on the selecting and choosing "Copy" from the menu, or use the short-cut keys CTRL+C.
2. Right-click on the cell where you want to paste the values, and select from the **Paste Special** from the menu, and click the **Values** radio button, then **OK**.

OR

You can right-click on the cell where you want to paste, and choose from the **Paste Options** the **Clipboard** symbol with **123** on it.

Absolute and Relative Cell Referencing

Worksheet: "Rows & Columns"

Relative cell referencing

A **Relative reference** is the default and simply uses the cell address, e.g. **A1**.

Simple formulas often use **Relative Cell Referencing**. The position of cells referred to in the formula are relative to the active cell (the selected cell). If that formula is copied to another location, Excel updates the cell references 'relative' to the new location.

Example - Use the **rows & columns** worksheet 

1. Select the **District total** cell **G14** > **Autosum** the North District total.
2. **Autofill** to the three cells below. (G15,G16,G17)

	A	B	C	D	E	F	G
	Districts	Sales person	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	District total
13							
14	North	Paul Jones	\$18,000	\$33,000	\$150,000	\$200,000	\$401,000
15	South	Peter Smith	\$25,000	\$18,000	\$32,000	\$17,000	
16	East	Tony Grant	\$16,500	\$25,000	\$8,000	\$11,000	
17	West	Sandra Kent	\$20,000	\$40,000	\$27,000	\$35,000	
18		Total					

When the formula in **G14** =SUM(C14:F14) is **copied** to G15 it will change to =SUM(G15:F15).

G15 will now correctly total the cells immediately to the left.

The references in the District totals for East and West adjust as well. This is because the original formula in **G14** was created using relative references

District total
 =SUM(C14:F14)
 =SUM(C15:F15)
 =SUM(C16:F16)
 =SUM(C17:F17)

Absolute cell referencing

Absolute cell referencing is used when a particular cell needs to be referenced. The formula can be copied to any other part of the worksheet and will always reference the required cell.

To make a cell reference **Absolute**, a (dollar) \$ symbol must precede the column letter and the row number, e.g. **\$A\$1**.

Create an absolute reference

1. Click within the **cell reference** in the formula bar.
2. Press **F4**. (This adds \$ symbols in front of the column letter and the row number.)

Tip: Keep pressing **F4** to cycle the \$ symbol between the letter, number and to switch off and on.

Example - Use the **rows & columns** worksheet 

1. Select the **Bonus total** cell **H14** > create a formula to calculate the bonus for North. =**G14*****K14** (When this formula is copied/autofilled down the calculation will be incorrect.)
2. To create the **absolute reference** to cell **K22** > select **H14**.
3. In the **Formula bar** > click in the **K14** reference > press **F4**. (This will add \$ symbols in front of H and 14. \$H\$14.)

	A	B	C	D	E	F	G	H	K
12	CORRECT								
13	Districts	Sales person	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	District total	Bonus total	
14	North	Paul Jones	\$18,000	\$33,000	\$150,000	\$200,000	\$401,000	\$20,050	
15	South	Peter Smith	\$25,000	\$18,000	\$32,000	\$17,000	\$92,000	\$4,600	
16	East	Tony Grant	\$16,500	\$25,000	\$8,000	\$11,000	\$60,500	\$3,025	
17	West	Sandra Kent	\$20,000	\$40,000	\$27,000	\$35,000	\$122,000	\$6,100	
18	Total								

The formula can now be copied/autofilled down and will always reference cell K14.

Bonus
total

=G14*\$K\$14
=G15*\$K\$14
=G16*\$K\$14
=G17*\$K\$14

Note: The dollar \$ symbol can also be typed.

Mixed referencing

Mixed references can be created by preceding only the column or row component of the address with a \$ symbol. When the formula is copied the **Relative** part of the formula will adjust relative to the new position and the **Absolute** part will not. eg

\$A1 creates a reference where the **column** reference is **absolute** but the **row** reference is **relative** to the position of the formula.

A\$1 creates a reference where the **column** reference is **relative** to the position of the formula but the **row** reference is **absolute**.

Sort and Filter

Worksheet: "Functions"

Sort and **Filter** tools are available to make data analysis easier.

Caution should be used when **sorting** data as a mistake can render the entire worksheet invalid as there may not be a way to sort back to the original order. If the result is unexpected > use **Undo** to restore the region.

Filters are a safer tool and provide powerful options.

Sort and **Filter** options can be accessed from two places.

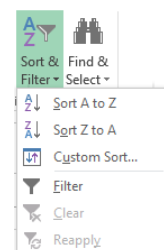
The Home tab > Editing group > Sort & Filter

The Data tab > Sort & Filter group

Sorting data

Sort by one column at a time:

1. Activate the **Home** tab > **Editing** group > choose a Sort option.



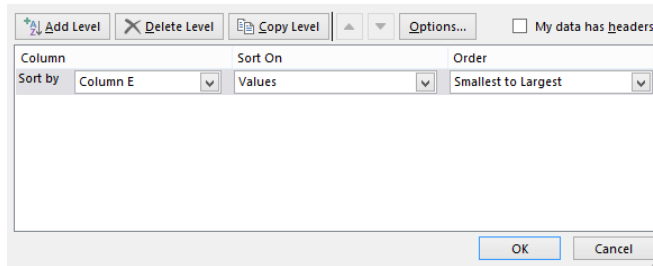
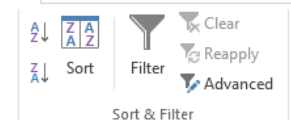
Working with data in Excel

Sort by multiple columns:

The **Custom** Sort feature allows for:

- multiple sorts within sorts
- sorting by cell colour
- sorting by font colour.

1. Select the data range to sort (not just the columns you want to sort by)
2. Activate the **Data** tab > **Sort & Filter** group > Sort. (This opens the Custom Sort option)
3. Tick the "My data has headers" box



4. Sort by Course, then click "Add Level"
5. In the new line, sort by Surname, then click "Add Level"
6. Then sort by Initial <OK>.

This will sort by Course, then within Course it sorts by Surname, and within Surname by Initial

Filtering data

Filters can be applied to columns which allow only certain data to be viewed. A list of all the **unique** values in each column is displayed.

Applying the filter headers

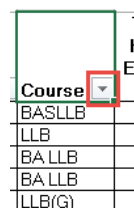
1. Select the row containing the **Column Headings**
2. Activate the **Data** group > select the <Filter> button
(The column headings now have a drop-down arrow.)

	A	B	C	D	E	F	G	H	I
1	UNI ID	SURNAME	INITIAL	Course	Take Home Exam 1 20	Take Home Exam 2 20	Tutorial Participation 10%	Essay 50	Total

Note: Your headings MUST be in the first row of the data set.

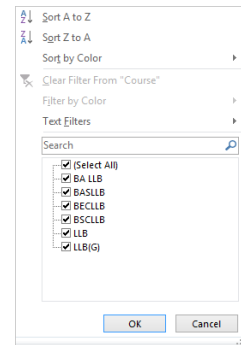
Filtering the data

1. Select the **drop-down** arrow in the **column** heading of interest.
2. Un-tick the **Select All** checkbox > select a **criteria checkbox** to view just those rows > <OK>.



Redisplay all data in the column

1. Select the **drop-down** arrow in the **column** heading.
2. Select the **Select All** checkbox.

**Custom Filters**

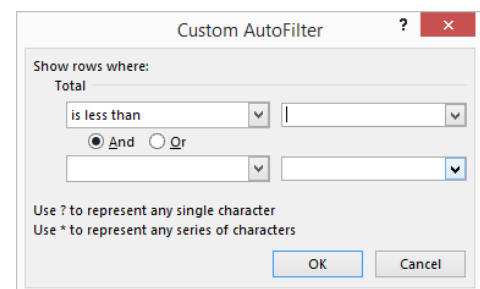
Custom filters can be applied to a column to select multiple values which meet certain criteria.

Specific **Custom Filters** can be applied to columns with either **Number** or **Text** values.

Custom Autofilter

Two criteria can be applied at once.
Wildcards can be used

- ? represents any single character
- * represents any series of characters



Example – use the **functions** worksheet 

This example uses the number filter in **column I**. Then grades can be applied in **column L**.

1. Select the **filter arrow** in the Total column (column I) > **Number filters** > choose an **option** to filter by.
2. Type the appropriate grade in column L and use autofill to fill all cells.
3. Repeat filtering **column I** for each score below.

Less than 50 = Fail

Between - greater than or equal to 50 and less than 60 = Pass

Between - greater than or equal to 60 and less than 70 = Credit

Between - greater than or equal to 70 and less than 80 = Distinction

Greater than or equal to 80 = High Distinction

Format a worksheet

Formatting categories

Cells can be formatted with attributes in six categories.

Number - all number formatting and custom formatting.

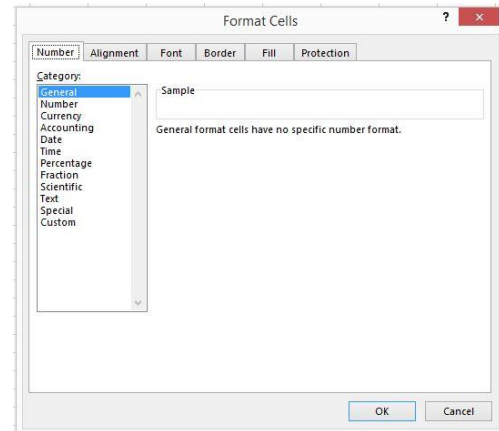
Alignment - for text orientation, text wrapping within a cell, merging cells and positioning of text.

Font - for changes with point size, type, colours and effect.

Border - to apply borders and line styles.

Patterns - changes to colour and background of cells.

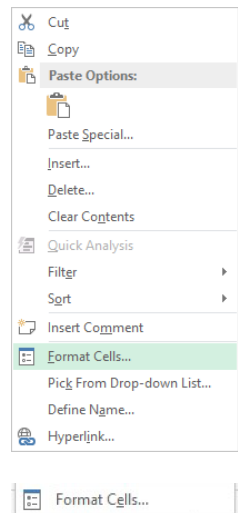
Protection - unlock/lock cells and turn hidden on/off used with worksheet protection.



Access the formatting tools

Select cell(s), column(s), row(s) or worksheet

- Method 1**
1. Click **Right** mouse button.
 2. Select **Format Cells**.



- Method 2**
1. Activate **Home** tab > **Cells** group.
 2. Select **Format Cells**.

- Method 3**
1. Activate the **Home** tab.
 2. Select a **launcher** button from the Font or Number group.



Formatting Options

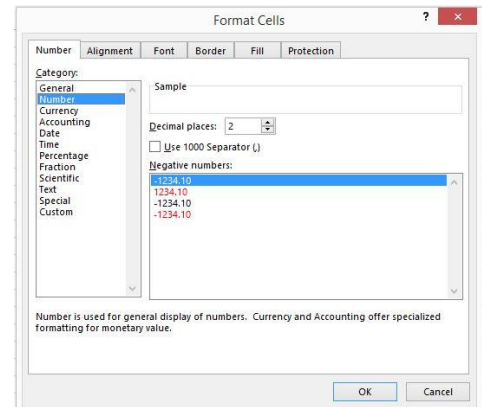
Formatting options can be applied to a cell, a range of cells, a column or row, or ranges of columns and rows, or entire worksheets.

Number Formatting

There are number formats that allow the presentation of numeric data as in a variety of ways.

Dates are stored in Excel as the number of days since 1 January 1900 (e.g. 40210 = 1 February 2010). By default, dates are recognized when entered and formatted to display with an appropriate date format.

Numbers may need to be stored as **Text** (e.g. ID Numbers).

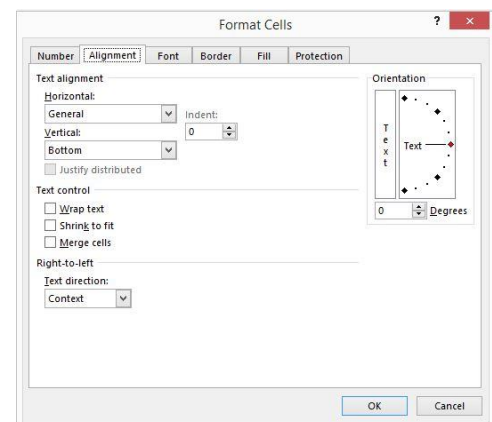


Alignment Formatting

Data can be formatted to display anywhere in the cell and in any direction.

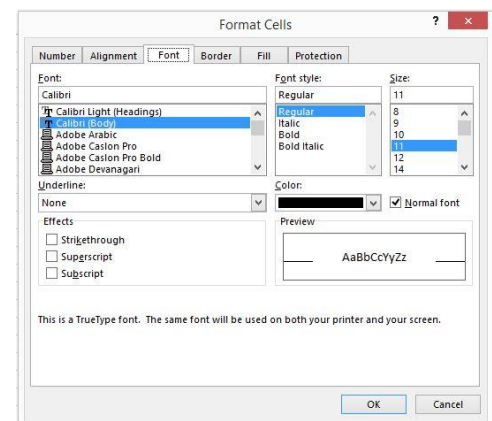
Wrap Text is useful for fitting the contents of a long heading into a narrower space. The height of the row of the cell is doubled to fit the text.

Merge Cells allows the content of a cell to occupy the space of adjacent cells.



Font Formatting

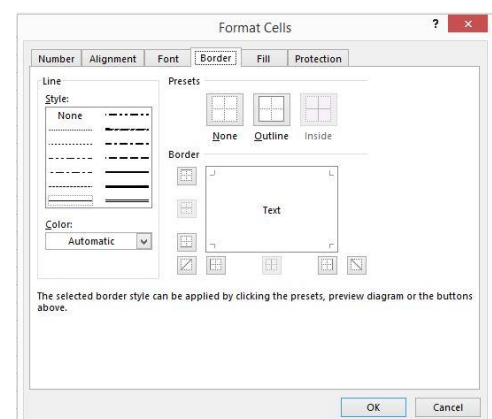
Standard MS Office Font formatting options are available.



Border Formatting

Borders can be applied.

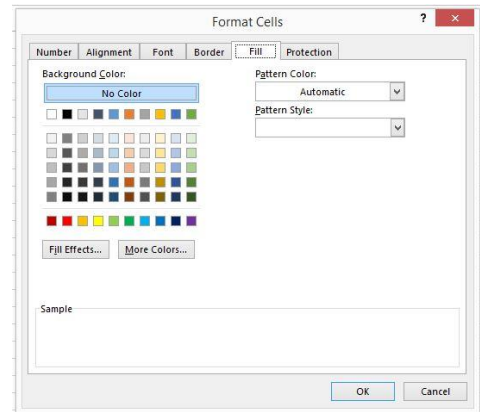
This is useful for differentiating data.



Fill Formatting

Background colours and patterns can be applied.

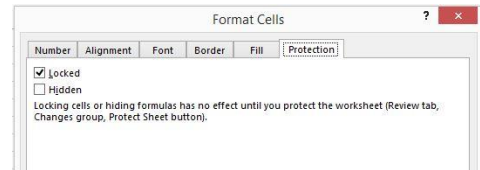
This is useful for differentiating data.



Protection Formatting

By default, all cells in a worksheet are locked

Locking cells or hiding formulas has no effect until you protect the worksheet (Review Ribbon, Changes Group, Protect Sheet).



Tip: Try to design your worksheet without blank rows and columns. An attractive layout is possible by using the formatting options above. Blank rows and columns will decrease the usefulness of some Excel functions.

Print a worksheet

Before printing a worksheet the layout of the printed worksheet can be defined.

1. Activate the **Page Layout** tab.
2. Select various buttons to format before printing. (The most useful are the <Orientation> button, Scale to fit group and Sheet option group.)

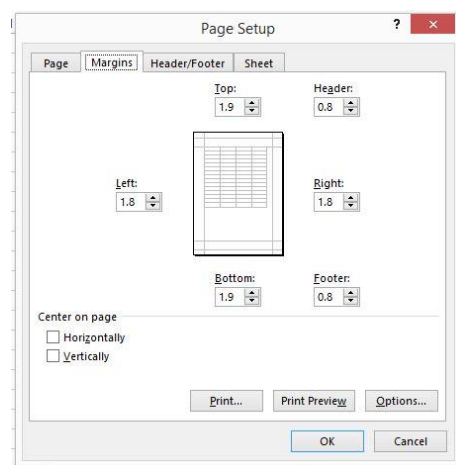
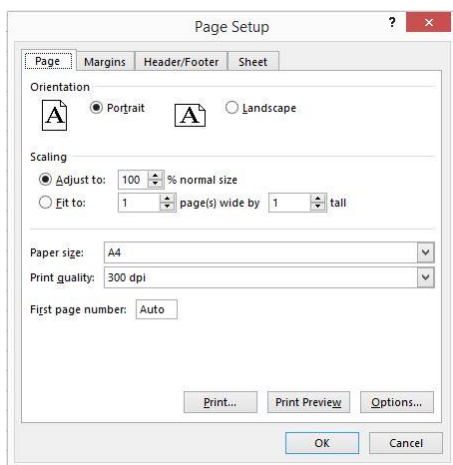
OR

Select the Launcher in the Page Setup group to view and make changes.

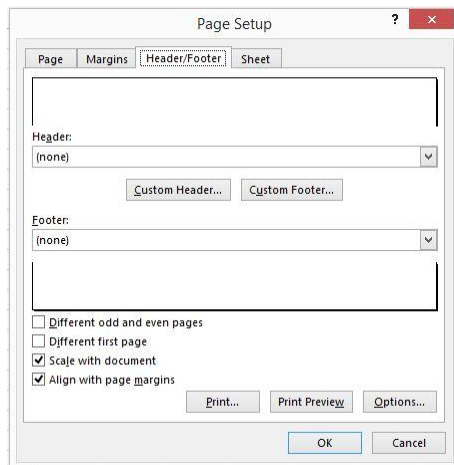


When the **Page** tab is selected the following options are available.

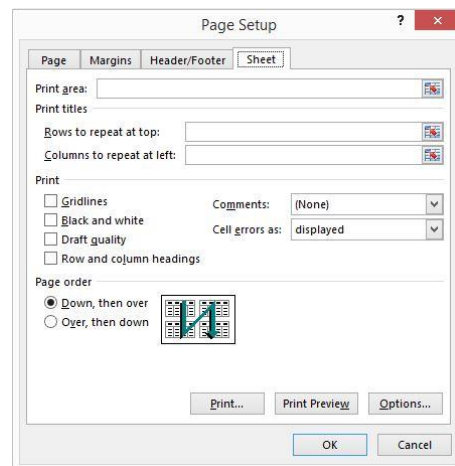
When the **Margins** tab is selected the following options are available.



When the **Header/Footer** tab is selected the following options are available.



When the **Sheet** tab is selected the following options are available. To print headings on each page – Select Row area under **Rows to repeat at top:** and **Select Columns to repeat at left**



Charts overview

Worksheet: "Display Data"

A chart is used to give a graphical representation of data in a worksheet. When first created it is placed on the same worksheet as the data.

The chart is linked to the data which it has been created from and will be updated automatically whenever a change to the worksheet data is made.

If the chart is not linked to the worksheet data it is created from, but has been copied and pasted into another application (e.g. MS Word), it may not be updated automatically when the worksheet data change.

Note: You will need to create summary statistical tables. If you want to chart statistics such as means, totals, percentages etc. Excel will not automatically chart this from raw data.

Create a chart

1. Select the data to chart.
 - This can be accomplished by dragging the mouse across the data with the left mouse button depressed
 - Alternatively, click the top left cell in the series and then Shift + click the bottom right cell in the series,
- OR**
- Click one cell with the data and press Ctrl+*. This will select all contiguous data cells.

Note: If you want to include labels for your data, select the cells containing these as well. If you forget you can always add this later by modifying the **Selected Data Range** (see p.5).

Note: In your selection you should include column headings. Every column should have a unique header. You now have a number of options

- 2. You can use the **Quick Analysis** tool that appears at the bottom right corner of a selected range to create a **Quick Chart**



OR

- If you are uncertain about the best type of chart to use for the selected range of data you can use the **'Recommended Charts'** feature (from **Insert > Charts**)



OR

- In addition, you can select from a number of chart types (from **Insert > Charts > drop-down options**) with which to display the data. Inspect a preview of each chart type as you hover above it with the mouse.



Identify chart elements

Element	Description
Chart area	The total chart area including all related elements.
Plot Area	The area in which Excel plots data.
Data Point	The plotted value associated with a category of data. A data point can be a bar, a line, a piece of pie etc.
Data Labels	Information displayed at data points to indicate value.
Data Series	The plotted range.
Chart Title	The title given to the chart.
Value Axis	Usually Y-Axis and 3-D charts can also have a Z-Axis (vertical axis) showing the values by which the data series is measured.
Category Axis	The X-Axis (horizontal axis) plots the category of data series.
Legend	Displays a description of what each category represents.
Tick Marks	Markers used as separators on both axis.
Category Axis Title	Describes the category of the plotted data (X-axis).
Value Axis Title	Describes the value against which the data is plotted (Y-axis).
Trendline	Shows the trend of the data series.

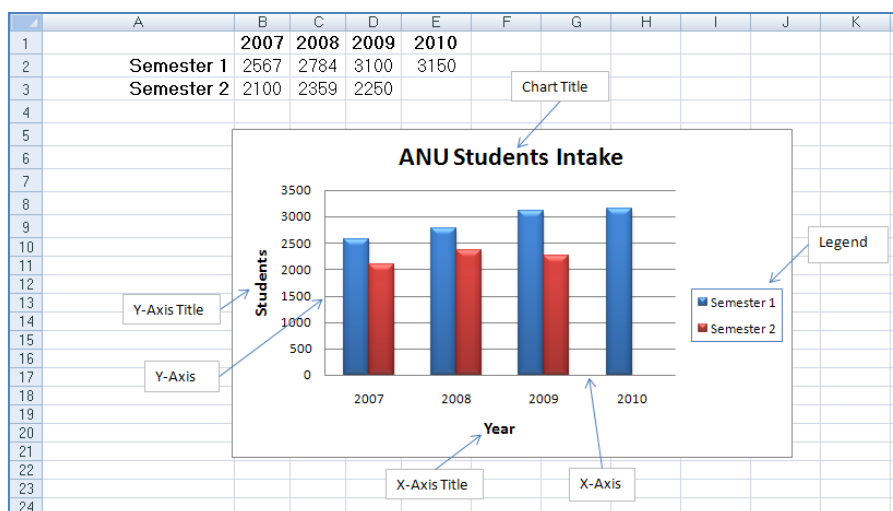


Chart elements

Modify a chart using Chart Tools

Once the chart is inserted, the **Chart Tools** ribbon appears with two tabs:

- Design
- Format

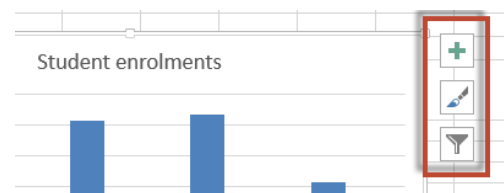


Tip: To display the **Chart Tools**, click inside the chart. When clicking outside the chart, the Chart Tools are not displayed.

Chart tools shortcut buttons

Chart Elements, Chart Styles and Chart Color, and Chart filtering options are also available from the three chart tools buttons that appear to the right of the chart. Each of the tools displays a series of commands or options on a fly-out menu that appears to the right when the tool is clicked. Hover the mouse pointer over each of the options and watch how Live Preview makes changes to the chart.

If you double-click on the chart, a new window pane opens to the right of the worksheet, and it will provide the appropriate editing options according to the area of the chart you click on.



Design tab

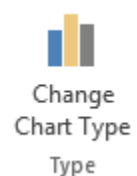
The **Design Tab** consists of five command groups.

- Chart Layouts
- Chart Styles
- Data
- Type
- Location

Change the chart type

To change the Chart Type for an existing chart.

1. Click in the chart
2. Choose the **Design** tab > **Type** Group > Click **Change Chart Type**
3. Choose a different type of chart



Swap series and categories

To change the chart view by swapping Series (represented by the rows in your data table) and Category data (represented by the columns in your table).

1. Click in the chart
2. Choose the **Design** tab > **Data** group > Click **Switch Row/Column**

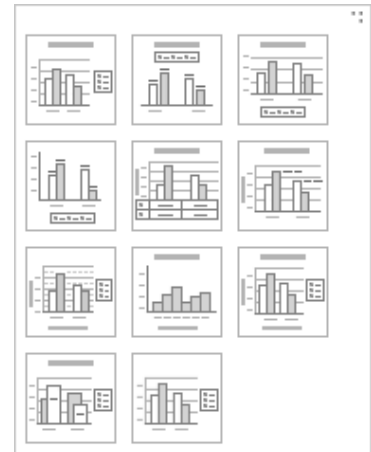


Change the layout for a chart

To change the options for a particular type of chart, choose between other predefined layouts in the gallery.

These affect the look of the axis title, data table, gridlines, data labels and more.

1. Click in the chart
2. Choose the **Design** tab > **Chart Layouts** group > **Quick Layout** drop-down



Change the chart colours and style

1. Click in the chart
2. Choose **Design** tab > **Chart Styles** group
 - **Change Colors** drop-down or
 - **More** button to change chart style
3. Choose a different colour set and/or style



Format tab

The **Format** tab consists of five groups.

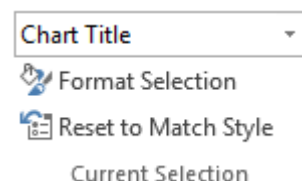
- Current Selection
- Insert Shapes
- Shape Styles
- WordArt Styles
- Arrange
- Size

Format parts of a chart

Charts comprise of different elements, e.g. series, plot area and labels. Each of these can be formatted separately to achieve a customised chart.

To format any part of the chart

1. Click in the appropriate chart element or choose it from the drop-down at the top of the **Current Selection** group, e.g. **Series Classes**
2. Click **Format Selection** and make the required changes on the formatting panel that expands on the right of the view (e.g. change the line colour and width)

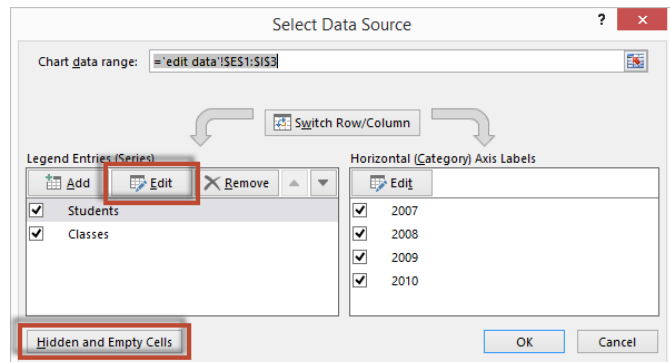


Other common chart modifications

Change the selected data range

For example, if a new series (row) of data is added for Semester 3 (for a 2 year course)

1. Click the chart
2. Choose the **Design** tab > **Data** group > click **Select Data**



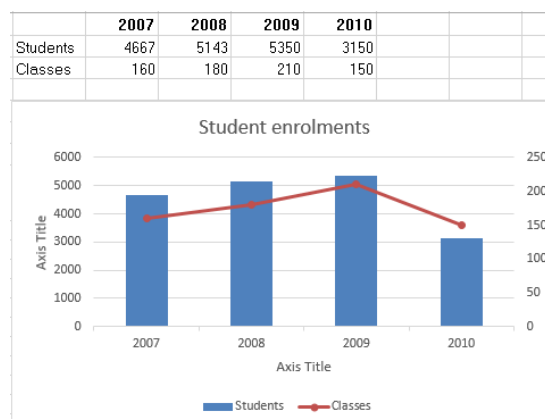
Tip: Alternatively, right click on the chart and choose 'Select Data'

To amend a data range:

- Click <Switch Row/Column> button to swap the rows and columns in the chart
- Select a series name > untick the box to remove the series from the chart or click <Remove> button to make it unavailable to the chart (you can always bring it back later).
(The data is not removed from the worksheet.)
- Select a series or category > click the <Edit> button and make required changes to the data range
- Click the <Hidden and Empty Cells> button to display any data where the row or column has been hidden (This does not display the actual data on the worksheet.)
- Click the <Edit> button in the *Horizontal (Category) Axis Labels* box to select the cells that contains the labels for your data points

Add a secondary axis to a chart

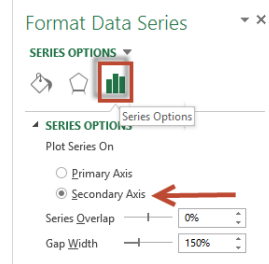
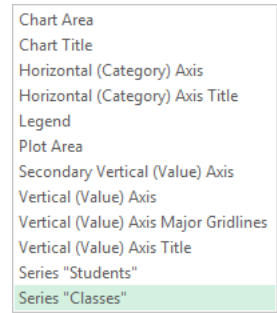
To compare two sets of data with different units or that have very different low and high values.



Example of a chart with a secondary axis

To create the secondary axis

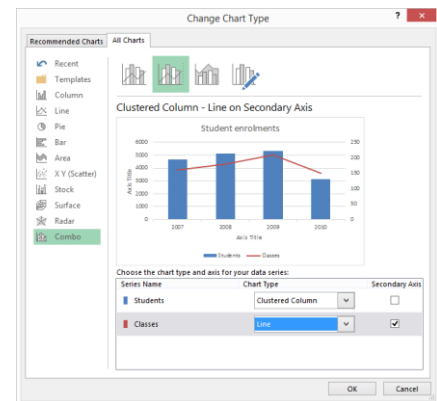
1. Click inside the chart and on the data series that you want to plot along a secondary vertical axis, or choose the data series from the drop-down at the top of the 'Current Selection' group of the **Format** tab, e.g. **Series "Classes"**
2. Click the <**Format Selection**> button in the 'Current Selection' group
3. On the '**Format Data Series**' panel that opens click the **Series Options** button and then select <**Secondary Axis**>
4. Change the **Gap Width** if there is a chance one series will hide another series



Create a Chart with a Secondary Axis

With the series selected

1. Select your data, then select Insert>Chart.
2. From 'All Charts' tab choose 'Combo'
3. Select the **Line** from the drop-down. You can also tick the '**Secondary Axis**' option here.
4. When the Chart is selected, click on the Plus icon on the right and select 'Add Axis Titles' so you can label both Y axes and the X axes.

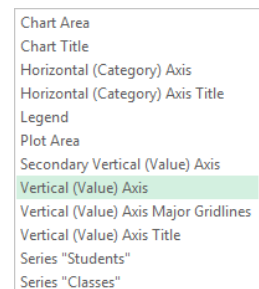


Axis scaling

The scaling of the axes controls visual characteristics. The **X** and **Y** axes have different options for scaling, as one represents categories and the other represents values.

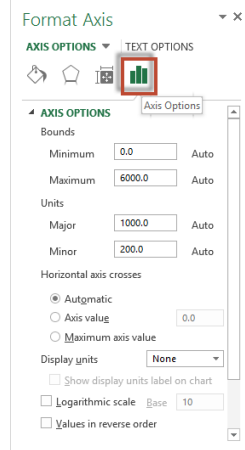
Value Axis

1. Select the **Y-Axis** (vertical axis) or choose the component from the drop-down at the top of the 'Current Selection' group of the **Format** tab, i.e. '**Vertical (Value) Axis**'
2. Click the <**Format Selection**> button in the 'Current Selection' group
3. On the '**Format Axis**' panel that opens click the **Axis Options** button
4. Make appropriate changes

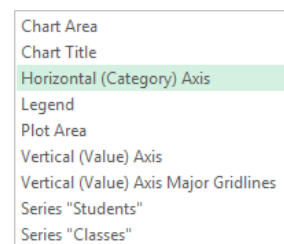


OR

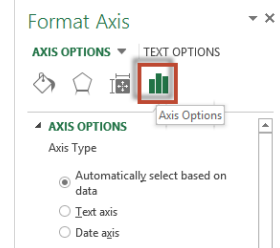
1. Right-click on the **Y** (vertical) **axis**
2. Select **Format Axis**
3. Make appropriate changes

**Category Axis**

1. Select the **X-Axis** (horizontal axis) or choose the component from the drop-down at the top of the '**Current Selection**' group of the **Format** tab, i.e. '**Horizontal (Category) Axis**'
2. Click the <**Format Selection**> button in the '**Current Selection**' group
3. On the '**Format Axis**' panel that opens click the **Axis Options** button
4. Make appropriate changes

**OR**

1. Right-click on **X** (horizontal) **axis**
2. Select **Format Axis**
3. Make appropriate changes

**Error bars****Worksheet: "Error Bars"**

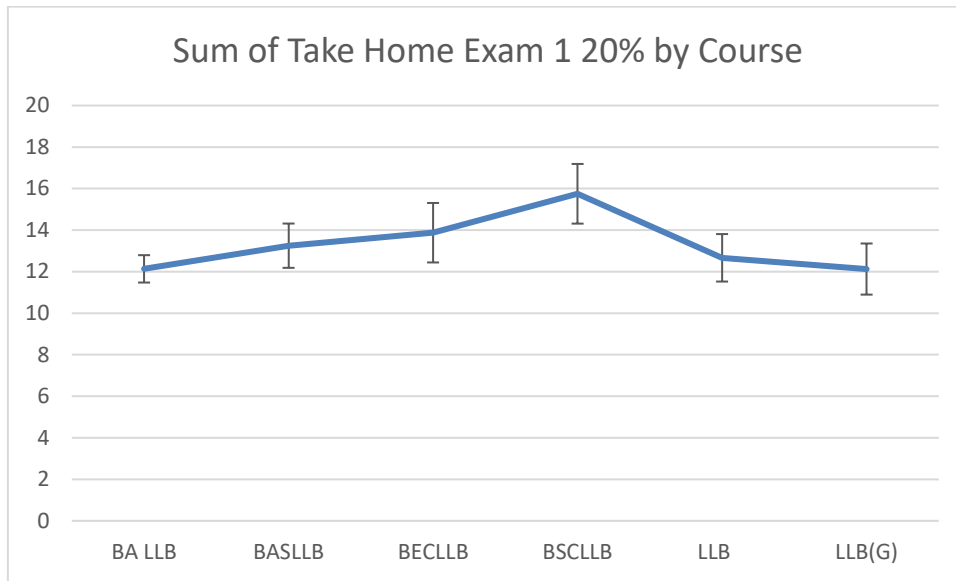
Error bars are used in statistical or scientific data to show potential error or degree of uncertainty relative to each data marker in a series. The automatic error bars for standard errors and standard deviations will be incorrect because they are based on totals rather than raw data. To plot means and correct standard errors you need to calculate means and standard errors before creating the chart.

Course	Mean	SE
BA LLB	12.13	0.66
BASLLB	13.25	1.07
BECLLB	13.88	1.43
BSCLLB	15.75	1.44
LLB	12.67	1.14
LLB(G)	12.13	1.23

To add error bars

1. Create a line chart of the means for each course.
2. Click on the chart and select the **Chart Elements** tools next to it
3. Tick '**Error Bars**' and select 'More Options' from the fly-out menu
4. Choose 'Custom' in the 'Error Amount' area, and click <Specify Value>.
5. Then select the standard error data series for BOTH the positive and negative 'Error Value' boxes. Then click <OK>

Error bars are added to the graph.



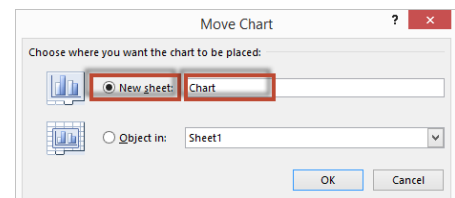
Tip: Additional formatting options are available from the **Format Error Bars** panel that opens after selecting **More options** from the fly-out menu.

Moving a chart to different worksheet

Charts are first added to the same worksheet as the data. They can then be placed on a new, separate worksheet.

Moving a chart to a dedicated chart sheet

1. **Select** the chart > **Design** tab > **Location** group > **<Move chart>** button
2. Click the **<New sheet>** button > type a name > **<OK>**
(The chart is now displayed on a separate sheet.)



Alternatively, click the **<Object in>** button > choose a worksheet from the dropdown list > **<OK>**.
(The chart is moved to the named worksheet.)

Embedded charts or separate chart sheets?

	Advantages	Disadvantages
<p>Embedded Charts</p> <p>This happens automatically when a chart is created. The chart has to be moved if required on a separate sheet.</p>	<ul style="list-style-type: none"> • Chart can be moved and manipulated on the sheet • It can be aligned with source data • Print data with chart • Comments and drawing items can be connected from data to chart 	<ul style="list-style-type: none"> • Easily deleted, remember the Undo command
<p>Charts on a dedicated chart sheet</p>	<ul style="list-style-type: none"> • More room for viewing and editing • Easy to print as it is a separate sheet within the workbook 	<ul style="list-style-type: none"> • Movement of chart is limited

Chart types and use

Type	Use
Column	<p>A column chart has vertical bars and shows data changes over a period of time or illustrates comparisons among items. Categories are organised horizontally, values vertically, to emphasise variation over time.</p> <p>Columns display as 2-D, 3-D and stacked.</p> <p>Axis can be repositioned to separate categories to display visual impact between categories.</p>
Line	<p>A line chart shows trends in data over time with one or two sets of data; more than two sets require creativity with styles so they do not blend together.</p> <p>Line charts combine well with column charts.</p>
Pie	<p>A pie chart shows the percentage of the whole. It always shows only one data series and is useful when you want to emphasise a significant element.</p> <p>The pie chart types are 2-D, 3-D and exploded.</p>
Bar	<p>A bar chart plots bars as separate points to illustrate comparisons among individual items. Categories are organised vertically, values horizontally, to focus on comparing values and to place less emphasis on time.</p> <p>Bars can be placed side-by-side, as a cluster, stacked or 3-D.</p> <p>Information is displayed bottom-to-top – This can be reversed by changing the series order.</p>
Area	Displays the magnitude of change over time.
X Y (Scatter)	<p>An XY (scatter) chart is used for plotting data over uneven time intervals. When arranging data place X values in one row or column and Y values in adjacent rows or columns.</p> <p>This chart type is commonly used in the scientific and engineering areas, though crosses over into other areas.</p>
Stock	The high-low-close chart is often used to illustrate stock prices. This chart can be used for scientific data, to indicate temperature changes, crop yield projections and product analyses.
Surface	A surface chart measures two changing variables, useful when you want to find optimum combinations between two sets of data. As in a topographic map, colours and patterns indicate areas that are in the same value range.
Doughnut	Like a pie chart, a doughnut chart shows the relationship of parts to a whole, and can contain multiple sets of data. Each ring of the doughnut chart represents a data series.
Bubble	Compares values in sets of three, the first two values are used in the chart the third value determines the size of the bubble. To arrange your data place the X values in one row or column, and enter corresponding Y values and bubble sizes in the adjacent rows or columns.
Radar	In a radar chart, each category has its own value axis radiating from the centre point. Lines connect all the values in the same series.

Pivot Tables

Worksheet: "Functions"

A Pivot Table is an interactive table that summarises, organises and compares data in a worksheet. It can reveal patterns and relationships needed to analyse trends. Pivot Tables allow you to transpose rows and columns to obtain different views of the same data. It is more than a simple data table as you can group information by date, by value, or by category and display varying levels of detail. This is useful for making informed decisions.

	A	B	C	D
1	Supplies	(All)		
2				
3	Sum of Units in Stock	Discontinued		
4	Category	No	Yes	Grand Total
5	Beverages	53	0	53
6	Condiments	222	29	251
7	Confectionary	25		25
8	Dairy Product	210		210
9	Produce	70	0	70
10	Grand Total	580	29	609

Pivot Table areas

- Row Labels** Defines what the rows in the table represent. In this example the **Units in Stock** and **Category** fields are displayed in a **row**
- Column Labels** Displays the items in a field vertically as column labels. In this example the **Discontinued** field is displayed as a **column**. The data is the same as the **x axis** of a chart
- Values** Contains the summarised data. These fields are usually **numeric**. The area where the data appears is called the data area. The different functions such as sum, average, max, min etc. can be applied to the data. The values are the same as the **y axis** of a chart.

Organise data

The data list must be well organised beforehand:

- First row of list **must** contain column labels
- Remove any totals (the Pivot Table will calculate them)
- No empty columns or rows
- Text columns, Number columns and dates cannot be mixed

Know what you want from the data

Pivot Tables can produce the following summary data: sums, counts, averages, maximum/minimum values, products, standard deviations and variances. You can also construct custom formulas if you wish. The most important part of creating an effective Pivot Table is to know what you want to see. So begin with specific questions you have about the data. For example:

- What is the total course result for students, broken down by Course Type?
- How many students Passed or Failed, broken down by Course Type?
- What is the average course result for each Course Type?

Create a Pivot Table

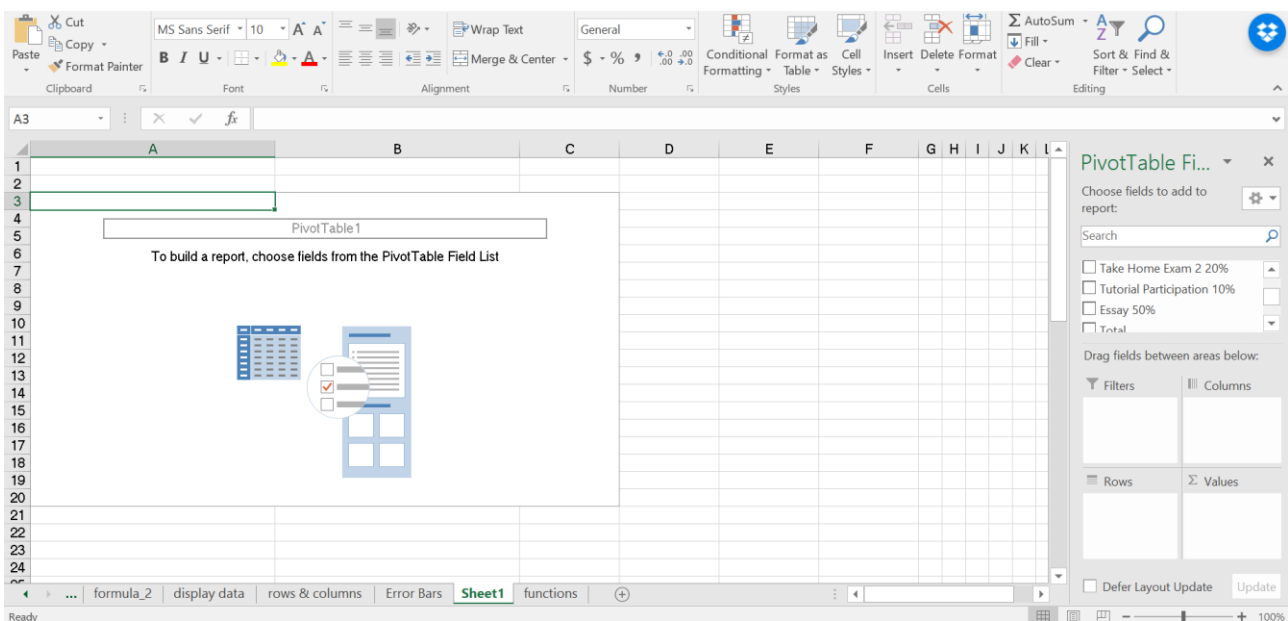
Open the "Functions" Spreadsheet tab.

- On the worksheet, select a range of data cells that you want to make into a table (this can also be set-up before entering the data). You can also just select the first cell of the table and it should automatically choose the appropriate data range.
 - On the **Insert** tab, in the **Tables** group, click **Pivot Table**. You can also browse through the **Recommended Pivot Tables** from the **Insert** tab.

TIP: The benefit of using a table for source data is that, if you add or remove a row of data, the source data range will automatically update.

- Choose to put the table in a **New Worksheet**.
- Click **OK**.

A new worksheet called "Sheet1" is added to the workbook. It displays the layout of the **Pivot Table** area and the **Pivot Table Field List** pane.



Pivot Table layout screen

To move fields to the pivot table, either:

- Click in the check box

OR

- Right** click field and select where you want it to go

OR

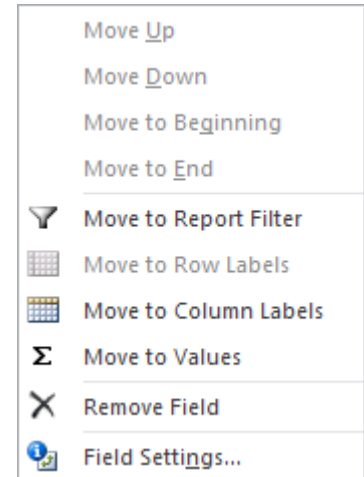
- Drag field from list to one of the categories at the bottom of the pane

Using the field area

- Fields that are **non-numeric** are automatically added to the **Row Labels** area of the report.
- **Numeric** fields are added as **Values**.
- The Report filter area is for fields that you want to use as a filter for the data: the table will display only row or column entries that match the filter criteria chosen.
- To remove a field from the report clear the check box next to the field name. Fields can be moved to other areas of the Pivot Table Field List by clicking and dragging them around.

OR


- Click the arrow at the right of the field name
- Use one of the options that appear in the dialog box



To arrange the panes in the **Pivot Table Field List** in a different layout use the **Tools** drop-down menu on top of the pane.

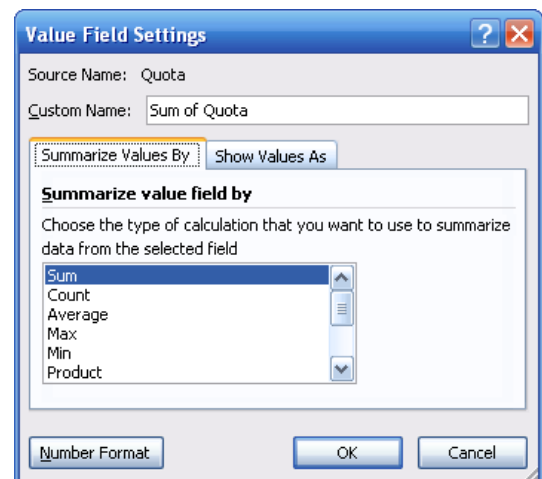
TIP: If a field is added to the **Values** area and **Excel** doesn't recognize that field as numeric values, **Excel** will show the values in the Pivot Table as a **count** of records of that field.

Change function for data items

- When you're in the **Pivot Table** click on the column header containing the summary data (e.g. "Sum of Total"), then on the **Analyze** tab, in the **Active field** group, click the **Field Setting** button  and select the summary type you want to change it to.

OR

- Right click on the field in the **Values** area of the **Pivot Table Field** window and choose **Value Field Settings** and change the statistic from the menu.



Add a report filter

Use a report filter to focus on a subset of data in the report, such as a time span, or a demographic variable.

- You can add filters for the whole pivot table, by placing a field into the **Filter** box in the **Pivot Table Field** area.

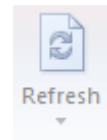
OR

- You can filter fields which are already in the table by clicking on the drop-down button of a pivot table's column header to display sort and filter options. Separate filter options are available based on whether the field is used as a row, column or value field.

Refresh data

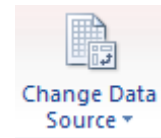
When the information in the source data list is changed the **Pivot Table must** be updated.

1. Go to source worksheet and make the change.
2. Return to **Pivot Table** worksheet and right-click on the table and select **Refresh**. You can also refresh the table in the **Analyze tab** for the Pivot Table, and in the **Data** group click the **Refresh** button.
3. The **Pivot Table** will update.



If records have been added to the data list, the data range used to create the Pivot Table must be redefined.


1. Select a cell in the **Pivot Table** and in the **Analyze** tab, in the **Data** group click the **Change Data Source** button and select **Change Data Source**.
2. Make correction to data range.

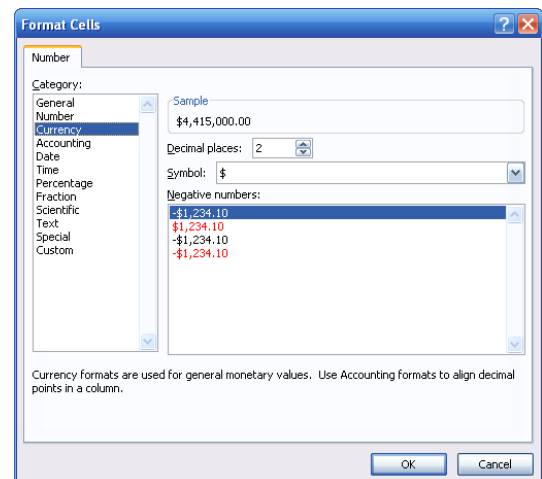


Please Note: If adding rows in the middle of the **Pivot Table's** data range, or if deleting rows, Excel will adjust the range. This is only necessary when rows have been added to the end of the cell range.

Using field settings

To change field number formats:

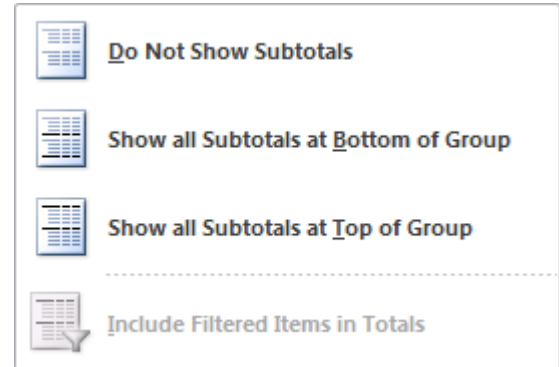
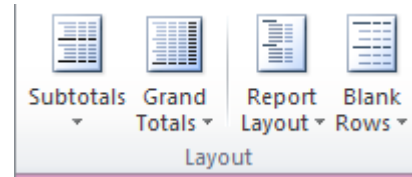
1. Select a cell within the data area
2. On the **Pivot Table Analyze** tab in the **Active field** group click the **Field Settings** button  and then click the **Number Format** button. Choose desired number format



To remove subtotals

Adding a second row or column field creates subtotals which might not be wanted.

- On **Pivot Table Design** tab in the **Layout** group, click the **Subtotals** button and select from Subtotal options.



TIP: If you turn off subtotals for a field and nothing seems to happen, you have made a common mistake. You need to turn off the subtotal from the field that **displays** the subtotal, not from the field that contributes the values for the subtotal.

[OPTIONAL] Grouping Pivot Table data

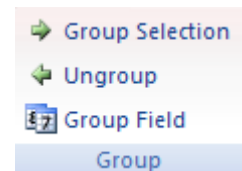
	A	B	C	D	E	F
1	Branch	(All)				
2						
3	Count of AcctType	AcctType				
4	Date	CD	Checking	Home Mortgage	Savings	Grand Total
5	2-Sep	5	55	7	20	87
6	3-Sep	5	50	13	26	94
7	4-Sep	6	47	7	15	75
8	5-Sep	5	37	2	19	63
9	6-Sep	9	30	12	19	70
10	7-Sep	3	36	10	12	61
11	9-Sep	7	49	7	23	86
12	10-Sep	4	40	11	16	71
13	11-Sep	5	41	7	15	68
14	12-Sep	6	52	10	19	87
15	13-Sep	5	33	6	13	57

If you have a variable, such as Dates, you can group different values together. In the example above the bank data is grouped by days.

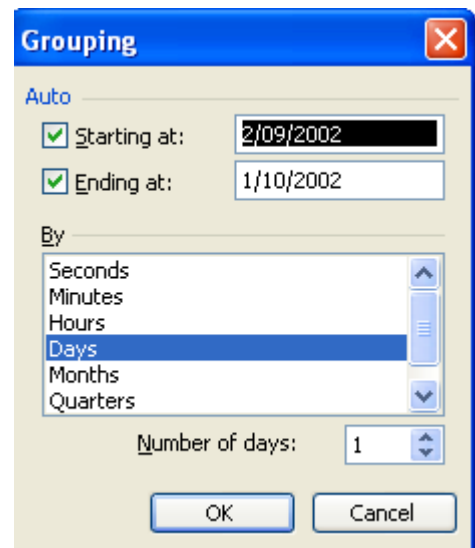
- Click on a field you can filter, and on the **Pivot Table Analyze** tab in the **Options** group, select **Group**.

OR

Right click **field** where grouping is required



2. Choose grouping type. If more than one type of group is required hold the **Ctrl** key while selecting types.
3. Enter values for **starting/ending** or choose time interval in **By** section or enter **Number of days**. Then click **OK**.



Creating data calculations

Sometimes you would like summaries for a combination of variables in your table (e.g., the total score for both Examinations only). You can do this by creating special calculations to use as fields in your Pivot Table, rather than calculating a whole new variable in the data itself.

Creating a calculated field

Calculated fields can only be used in the Values area of the table.

1. Select a **cell** in the Pivot Table.
2. On **Pivot Table Analyze** tab, in the **Calculations** group, click the **Fields, Items, & Sets** drop-down, then click **Calculated Field**.
3. Enter a name for the calculated field (e.g. "Exam Total")
4. Enter **formula** used to calculate field (e.g., ='Exam 1'+ 'Exam 2')
5. Click **Add** then **OK**.

Creating a calculated item

Calculated items differ from calculated fields, in that they add an extra calculated row to rows, or an extra column to columns (E.g., Total for all "BA" courses). Calculated items can only be placed in the **row** or **column** areas. **Please Note:** you cannot include a calculated item if you wish to report Averages, Standard Deviations or Variances.

1. Select a **cell** within a **row** or **column** field of the Pivot Table. The cell must represent what the **calculated item** is to be based upon (e.g., "Course").
2. Choose the **Pivot Table Analyze** tab, in the **Calculations** group, click the **Fields, Items, & Sets** drop-down, then click **Calculated Item**.
3. Enter a name for the calculated item (e.g. "BA Total").
4. Enter **formula** used to calculate field (e.g., ='BA LLB'+ 'BASLLB')
5. Click **Add** then **OK**

Shortcut keys

Workbook Basics

Ctrl + N	Opens a new workbook	F11	Creates a chart from worksheet data
Ctrl + O	Opens the default directory to access an existing workbook	Ctrl + 9	Hide selected rows
Ctrl + S	Saves a workbook	Ctrl + Shift + 9	Unhides hidden rows in selection
F12	Save as	Ctrl + 0	Hide selected columns
Ctrl + F4	Closes a workbook	Ctrl + Shift + 0	Unhides hidden columns in selection (Has been removed from official list. May work with Windows XP.)
Alt + F4	Exits application		

Navigation

Ctrl + F6	Move between workbooks	Home	Move to beginning of row
Ctrl + PgUp / PgDn	Move between worksheets	Ctrl + Home	Move to beginning of worksheet
→↑↓←	Move one cell up, down, right or left	Ctrl + End	Move to end of worksheet
Ctrl + →↑↓←	Move to edge of data region		

Selecting Cells

Shift + Spacebar	Select a row	Ctrl + A	Select entire worksheet
Ctrl + Spacebar	Select a column	Shift + Home	Select from current cell to beginning of row

Selecting a Region

Ctrl + Shift + ←→↑↓	Select to the end or beginning of the current row or column within the region	Ctrl + Shift + *	Select the whole current region
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Formatting

Ctrl + B	Bold the selection	Ctrl + Shift + %	Apply Percentage format
Ctrl + I	Italicise selection	Ctrl + Shift + #	Apply Date format
Ctrl + Shift \$	Apply Currency format	Ctrl + Shift + @	Apply Time format

General

Ctrl + C	Copies selected data	Ctrl + H	Opens replace dialog box
Ctrl + X	Cuts selected data	Ctrl + G or F5	Goto a cell or range name
Ctrl + V	Pastes from clipboard to where cursor is positioned	F7	Spelling
Ctrl+ P	Print	Ctrl + on number pad	Inserts a cell, row or column
Ctrl + F	Opens find dialog box	Ctrl – on number pad	Deletes a cell, row or column
Ctrl + Z	Undo	F4	Repeats last action

Other resources

Training notes

To access training notes, visit the Research & learn webpage anulib.anu.edu.au/research-learn and select the skill area followed by the relevant course. You can register for a workshop and find other information.

Research & learn how-to guides

Explore and learn with the ANU Library's how to guides (anulib.anu.edu.au/howto). Topics covered are:

- Citations & abstracts
- E-books
- EndNote
- Evaluating Sources
- Finding books and more
- Finding journal articles and more
- Finding theses
- Increasing your research impact
- ORCID iD (Open Researcher and Contributor ID)
- Research Data Management
- Text and Data Mining
- Topic analysis

Subject guides

Find subject-specific guides (anulib.anu.edu.au/subjectguides) and resources on broad range of disciplines. Such as:

- Asia Pacific, Southeast Asia and East Asian studies
- Business, economics, art, music and military studies
- Criminal, human rights and taxation law
- History, indigenous studies, linguistics and philosophy
- Biological, environment, physical & mathematical sciences, engineering & computer science, health & medicine

Navigating the sea of scholarly communication

An open access course designed to build the capabilities researchers need to navigate the scholarly communications and publishing world. Topics covered include finding a best-fit publisher, predatory publishing, data citations, bibliometrics, open access, and online research identity. Five self-paced modules, delivered by international and local experts/librarians (anulib.anu.edu.au/publishing).

Online learning

Online learning is available through ANU Pulse, which can be accessed from both on and off campus by all ANU staff and students (ql.anu.edu.au/pulse).

Modules available in ANU Pulse

- Microsoft Office (Access, Excel, OneNote, Outlook, PowerPoint, Project, Visio, Word)
- Microsoft Office (Mac)
- Adobe suite (Illustrator, Photoshop)
- Type IT

Training

A range of workshops are offered to help with your academic research and studies (anulib.anu.edu.au/training-register).

Feedback

Please provide feedback about workshops on the online feedback form (ql.anu.edu.au/survey).