www.jadehorizon.com

Microsoft Excel 2010

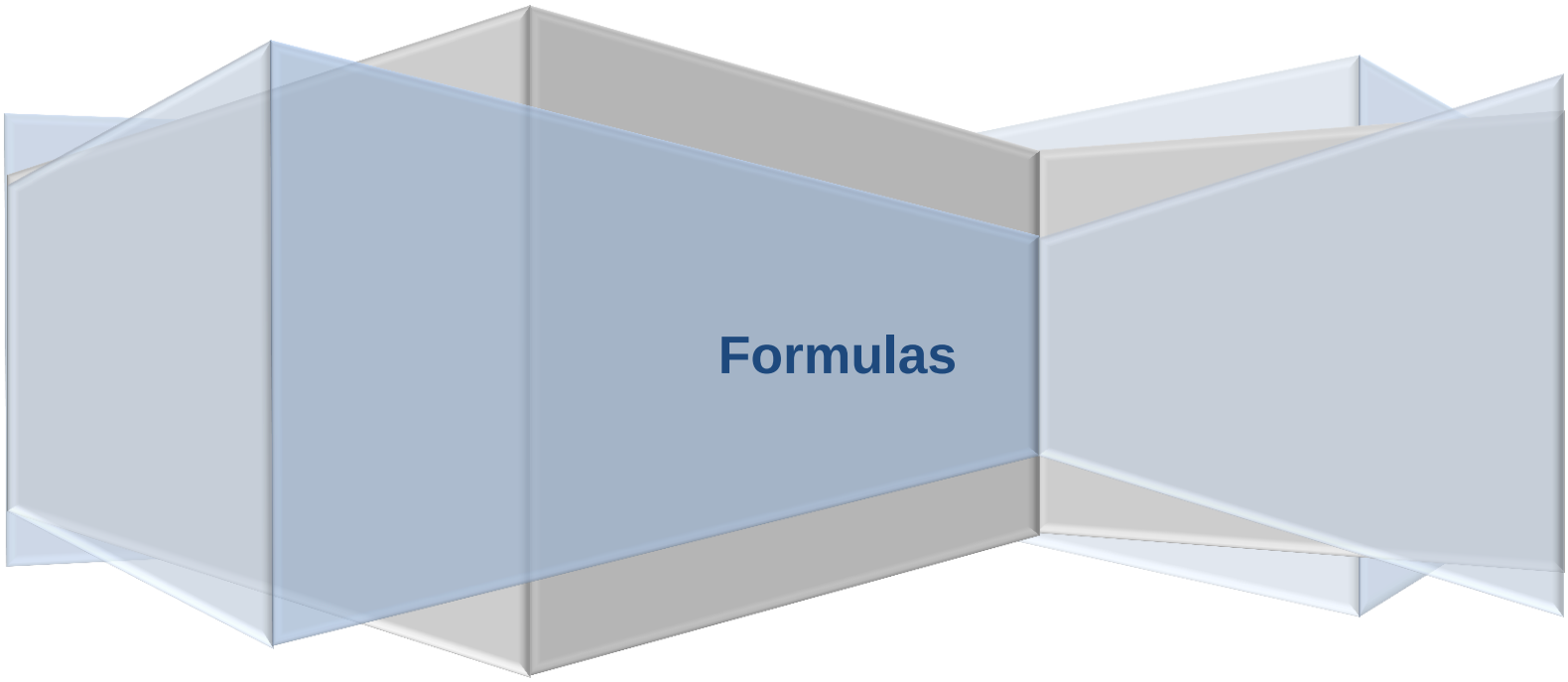


Table of Contents

INTRODUCTION

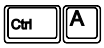
These notes describe how to create formulas in Microsoft Excel 2010 workbooks. These range from simple arithmetic to the use of complex functions.

Most formulas require the use of references to other cells and ranges containing data. Traditionally this has always been done using the co-ordinate system using column letters and row numbers. However, Excel 2007 introduced a new method of Structured Cell References that use names of regions within **Structured Tables**. These are not only different in their nature but also have an effect on the design of your spreadsheets.

Spreadsheets intended for use with Excel 2003 or earlier should avoid using **Structured Tables** and the spreadsheet designs they make possible; as earlier versions of Excel do not support them.

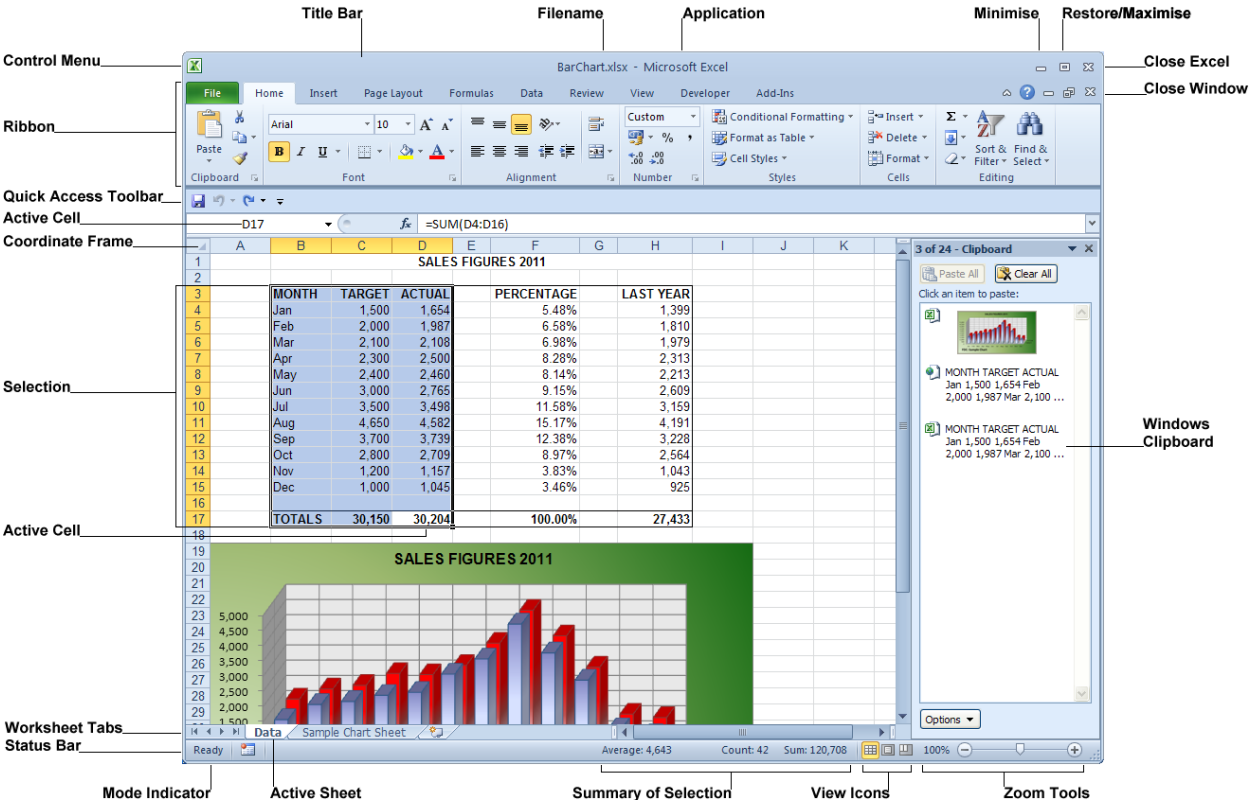
CONVENTIONS

The following are the conventions used in this manual.

		Press the named key.
		Press and hold the first named key while you press the second.
		Press and release the first named key before pressing the second.
		Point the mouse at a specified screen feature.
		**Click** Press and release the left or right mouse button.
		**Double Click** Click the left or right mouse button twice - quickly.
		**Drag** Click and hold the left of right mouse button while you move the mouse.
		Press and hold the named key while you click the mouse button.
`Filename.ext`		Reference to a named file stored on disk.
Text Entry		Typed text entry.
Ribbon		Select the specified Ribbon or option from a displayed quick menu.
Option		Select the specified option from a displayed dialog box or task pane etc.
Highlight		Highlight for important notes and comments.

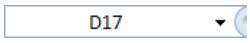
QUICK REFERENCE

SCREEN FEATURES



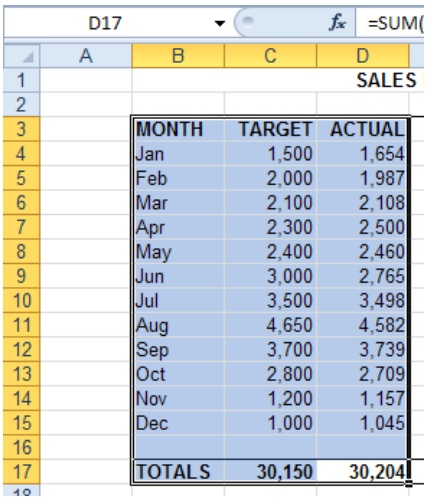
These notes only describe features relevant to Microsoft Excel. Those that are common to numerous Microsoft Office applications are described separately.

Name Box

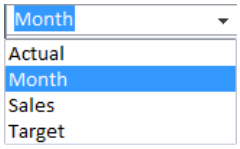


Indicates the co-ordinates of the Active Cell. This is the cell that is changed when you type a new entry.

Even when you select a range of cells one of them is still the Active Cell - indicated by the lack of shading in the highlighted range.



MONTH	TARGET	ACTUAL
Jan	1,500	1,654
Feb	2,000	1,987
Mar	2,100	2,108
Apr	2,300	2,500
May	2,400	2,460
Jun	3,000	2,765
Jul	3,500	3,498
Aug	4,650	4,582
Sep	3,700	3,739
Oct	2,800	2,709
Nov	1,200	1,157
Dec	1,000	1,045
TOTALS	30,150	30,204



Spreadsheet authors often Name important cells and ranges within their spreadsheets. The name box will display the Name in place of the cell reference, when the current selection has a Name.

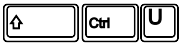
Selecting a Name from the list selects the cell or range in the spreadsheet.

Formula Bar

Allows you to view and edit the contents of the Active Cell - which is often not the same as the entry that is displayed and printed in the worksheet.

Symbols:  Displays the Insert function dialog box.

 Expands and collapses the vertical height of the Formula Bar to allow more space when editing very long entries.

Keyboard: 

Status Bar

Displays sundry Status Indicators and messages including:

Cell Mode: 

Indicates the Excel's mode of operation which can change the behaviour of some Keystrokes and Mouse actions:

e.g.

Ready Indicates that Excel is waiting for you.

Enter Indicates that you are entering data into a cell - you may navigate the worksheet cells but not the entry.

Edit Indicates that you are editing data in a cell - you may navigate the entry but not the worksheet cells.

Point Indicates that you are navigating the worksheet cells to point at a data cell or range while creating a formula.

Summary 

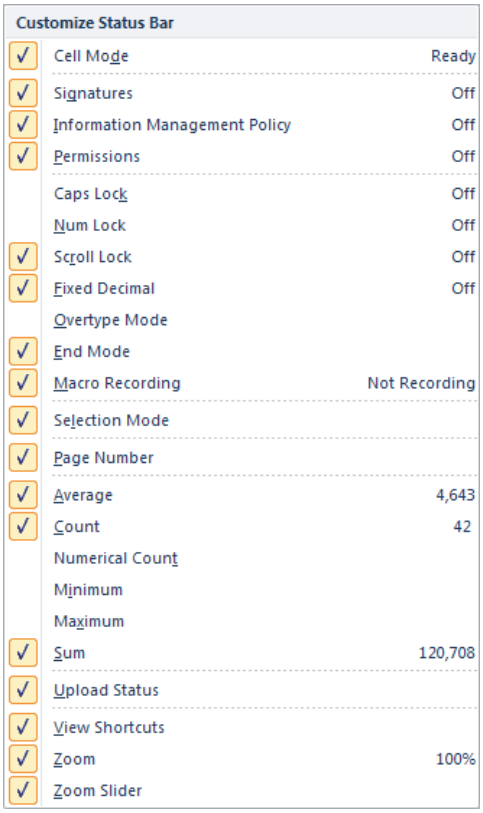
This feature summarizes any cell range(s) you have highlighted in the workbook, which contain two or more numbers.

Customizing the Status Bar

You may customize the content of the Status Bar using:

Mouse: In the Status Bar to display a menu of options.

Explore.



Smart Tags

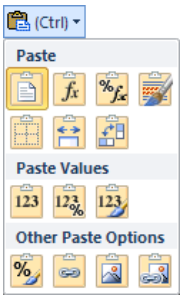
All Microsoft Office applications employ Smart Tags to help you. They provide an alternative way of changing your mind when a command does not quite work in the way intended.

For example: On pasting an item from the Windows Clipboard, Microsoft Excel will display a Smart Tag, accessing commands that can be used to change the way the data has been pasted. The choices vary depending on what you are pasting and where it came from. The illustration shows the options available when copying and pasting cells within an Excel worksheet.

Smart Tag: (Ctrl)

Mouse: To display the options.

Explore!



Note If you are happy with the action you performed you may entirely ignore the Smart Tag - and it will eventually disappear of its own accord.

FUNCTION KEYS

	F1	F2	F3	F4
Key	Help Task Pane	Edit	Paste Name	Repeat Last Action or Absolute
Shift		Edit Cell Comment	Insert Function	Find Next
Ctrl	Show/Hide Ribbon		Display Name Manager	Close Workbook Window
Shift Ctrl			Display Create Names	
Alt	Insert Chart Object	Save As		Exit Excel
Shift Alt	Insert Worksheet	Save File		

	F5	F6	F7	F8
Key	Go To	Next Window Pane	Spelling	Extend Selection
Shift	Find	Previous Window Pane		Add Selection
Ctrl	Restore Window	Next Workbook Window	Move Workbook Window	Size Workbook Window
Shift Ctrl		Previous Workbook Window		
Alt				Run Macro

	F9	F10	F11	F12
Key	Calculate All Sheets	Menu Bar	Insert Chart Sheet	Save As
Shift	Calculate Sheet	Quick Menu	Insert Worksheet	Save File
Ctrl	Minimize Workbook Window	Maximise/Restore Workbook Window	Insert Excel 4 Macro Sheet	Open File
Shift Ctrl				Print
Alt			Visual Basic Editor	
Shift Alt		Display Smart Tag Menu		
Alt Gr	Calculate All Sheets			
Shift Alt Gr	Check & Calculate All Sheets			

NAVIGATION KEYS

↑ ↓	Move up/down one row.	
← →	Move left/right one column.	
← or Enter	Move to next cell.	The direction can be changed or the effect disabled in the Excel Options window.
Home	Move to start of current row.	
End ←	Move to end of current row.	When not using Extend Mode.
End	Move to end of current row.	When using Extend Mode.
Page Up / Page Down	Move up one/down window full.	
Ctrl Home	Move to start of worksheet (top left corner).	
Ctrl End or End Home	Move to end of worksheet (bottom right corner).	
	Not available in Extend Mode.	
Ctrl → or End →	Move right to last filled cell in current section, or to the start of the next section, or to column IV.	
	Not available in Extend Mode.	
	Mouse: 	On the right hand border of active cell range.
Ctrl ← or End ←	Move right to first filled cell in current section, or to the start of the next section, or to column A.	
	Not available in Extend Mode.	
	Mouse: 	On the left hand border of active cell range.
Ctrl ↓ or End ↓	Move right to last filled cell in current section, or to the start of the next section, or to row 65536.	
	Not available in Extend Mode.	
	Mouse: 	On the bottom border of active cell.
Ctrl ↑ or End ↑	Move right to first filled cell in current section, or to the start of the next section, or to row 1.	
	Not available in Extend Mode.	
	Mouse: 	On the top border of active cell.

Alt Page Down	Alt Page Up	Move right/left one window full.
Ctrl Page Down	Ctrl Page Up	Move to next/previous sheet in the current workbook.
⇥	⇧ ⇥	Move to next/previous cell. Move to next/previous cell within a selected range. Move to next/previous unlocked cell in a protected worksheet.
Ctrl ←		Scrolls the display to show the active cell.
Ctrl ⇥ or	Ctrl F6	Move to the next window.
⇧ Ctrl ⇥ or ⇧ Ctrl F6		Move to previous window.
F5		Displays the Go To dialog box.
Scroll Lock		On/off toggle for scroll lock. When on, the status bar displays **Scroll Lock** and most movement keys will scroll the screen while keeping the same cell active.
	Also: Home	Move to first visible cell.
	End	Move to last visible cell.

CELL RANGES

Most Excel commands require you to select the cells to be affected in advance. Once selected, they remain so until the selection is cancelled - by selecting something else.

Selecting Cell Ranges

Use ⇧ (Shift key) with any of the normal movement keys (or mouse clicks) to select a range of cells, or use any of the following:

⇧ ←	Select active cell from a cell range.
Ctrl	Select current column(s).
⇧	Select current row(s).
Ctrl * or ⇧ Ctrl 8	Select data region at cursor.

Ctrl A	Select current Region, repeat to select current Worksheet.
⇧ Ctrl	When an object is selected this will select all objects, otherwise selects whole worksheet.
F8	On/off toggle for Extend Mode. When on, Status Bar displays **Extend Selection** and normal movement keys will extend the current selection.
⇧ F8	On/off toggle for Add Mode. When on, Status Bar displays **Add to Selection** and you will be allowed to select another separate range in addition to any currently selected ranges.
⇧ Ctrl O	Select all cells containing a Comment.
Ctrl ?	Select entire array containing the active cell.
⇧ {	Select cells in selected columns which differ from the cell in the same row as the active cell.
Ctrl {	As above, but works in rows, with comparison cells in same column as active cell.
Ctrl [	Select cells referenced directly by currently selected formulas.
⇧ Ctrl [	Select cells referenced directly and indirectly by currently selected formulae.
Ctrl]	Select cells containing formulas which directly reference the active cell.
⇧ Ctrl]	Select cells containing formulas which directly or indirectly reference the active cell.
Alt ;	Select visible cells from within the current selection.

Navigating within Selected Ranges

These keys allow you to navigate within and between highlighted cell ranges.

↵	or Enter	Move to next cell - vertically.
⇧ ↵		Move to previous cell - vertically.
⇥	⇧ ⇥	Move to next/previous cell - horizontally.

Ctrl + > . — Move clockwise around the corners of a range.

Alt Gr + ← or Ctrl + Alt + ← — Move to another selected range to the left.

Alt Gr + → or Ctrl + Alt + → — Move to another selected range to the right.

EDITING KEYS

These keys may be used from Enter, Edit and Point modes to complete an entry.

↵ or Enter — Complete cell entry.

Ctrl + ↵ — Enter into all selected cells.

⇧ + Ctrl + ↵ — Enter an Array formula into all selected cells.

These keys may be used from Ready Mode to edit the contents of cells in the workbook.

Delete — Delete cell contents for all cells currently selected.

← — Delete contents of active cell - and activate Enter Mode.

Ctrl + - or Ctrl + - — Display Delete dialog box.
The dialog box is bypassed if whole rows or columns are selected.

Ctrl + + or ⇧ + Ctrl + + = — Display Insert dialog box
The dialog box is bypassed if whole rows or columns are selected.

Ctrl + D

Either:	Copy down contents and formats of top row of selected range to all other rows.
Or:	Copy down contents and formats from the cell above.
Or:	Duplicate selected object(s).

Ctrl + R

Either:	Copy right contents and formats of left hand column of selected range to all other columns.
Or:	Copy right contents and formats from the cell to the left.

Ctrl + @ ' — Copy down the contents of the cell above the active cell (does not adjust cell references in formulas).

⇧ + Ctrl + : 2 — Copy down the value of the cell above the active cell.

Ctrl X or Shift Delete	Cut (and paste) the current selection to the Windows Clipboard.
Ctrl C or Ctrl Insert	Copy (and paste) the current selection to the Windows Clipboard.
Ctrl V or Shift Insert	Paste contents of Windows Clipboard at active cell.
Ctrl Alt V	Display Paste Special dialog box.
Ctrl Z or Alt ←	Undo previous edit(s) or command(s).
	Toolbar: 
Ctrl Y	Redo edit(s) you have just Undone.
	Toolbar: 
Alt ↓	Display AutoComplete list.
Ctrl ;	Enter current date into active cell.
Shift Ctrl ;	Enter the current time into the active cell.
Ctrl K	Insert a Hyperlink.
Alt =	AutoSum.
Ctrl `	On/off toggle for displaying formulae in cells instead of resulting values.
F2	On/off toggle for Edit Mode.
F4	Repeat last action.

Edit Mode

F2		On/off toggle for Edit Mode.
	Mouse: 	Inside the Formula Bar.
	Mouse: 	Inside the cell you wish to edit.
←	→	Move left/right one character.
↑	↓	Move up/down one line

Home End	Move text cursor to the start/end of the cell entry. (Edit mode).
Alt ↵	Line break, starts a new line of text in a cell and activates Word Wrap.
↵ or Enter	Complete cell entry.
Ctrl ↵	Enter the formula into all selected cells.
⇧ Ctrl ↵	Enter the formula into all selected cells as an array.
⇥ ⇧ ⇥	Complete the entry and move on to next/previous cell in the row or range.
Ctrl A	Display Function Arguments dialog box - after having typed a valid function name.
⇧ Ctrl A	Paste function arguments into formula - after having typed a valid function name.
Delete	Delete character to the right of the text cursor.
←	Delete character to the left of the text cursor.
Ctrl Delete	Delete to end of line.
Esc	Cancels changes to current entry.

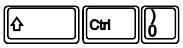
FORMATTING KEYS

Ctrl ! 1	Display Format dialog box for current selection.
Ctrl B	On/off toggle for Bold attribute.
Ctrl I	On/off toggle for Italic attribute.
Ctrl U	On/off toggle for Underline attribute.
Ctrl % 5	On/off toggle for strikethrough attribute.

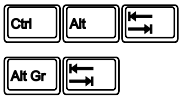
Hide rows.

Hide columns.

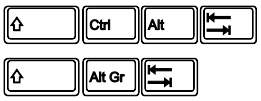
Unhide rows.



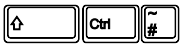
Unhide columns.



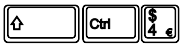
Indent the cell entry.



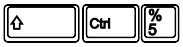
Outdent the cell entry.



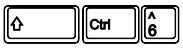
General number format.



Currency format to two decimal places.

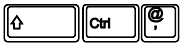


Percentage format to the nearest whole number.



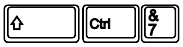
Scientific (exponential) format to two decimal places.

Format value as a date.

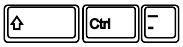


Format value as a time.

Comma format to two decimal places.



Apply outline border.



Remove all borders.

Move selected object up/down one pixel.

Move selected object right/left one pixel.

Dialog Box Quick Keys

In addition to the normal keystrokes that can be used in any dialog box, the Open, Save As and Insert Picture dialog boxes support the following keystrokes:

Alt 1	Previous folder.
Alt 2	Parent folder.
Alt 3	Search the Internet.
Alt 4	Create new folder.
Alt 5	Toggle between views.
Alt L	Display Tools menu.
F4	Expand drop down lists - whichever is currently active.
F5	Refresh (update) file list.
Esc	Cancel command.

OTHER QUICK KEYS

Numerous other keystrokes exist beyond those listed in this manual. The following are a few of the keystrokes that have not been mentioned in any of the above.

Ctrl 6	On/off toggle for display of objects.
Ctrl 8	On/off toggle for display of outline symbols.
Ctrl F	Display Find dialog box.
Ctrl H	Display Replace dialog box.
Ctrl N	Create new workbook.
Ctrl O	Display Open dialog box.
Ctrl P	Display Print commands.
Ctrl S	Save file.
Ctrl T Ctrl L	Display Create Table dialog box.

MOUSE CONTROLS

Cells & Ranges

Make cell at mouse pointer the active cell.

Mouse Pointer: 

Display quick menu for the selection at the mouse pointer.

Mouse Pointer: 

To activate cell at mouse pointer and turn on Edit mode.

Mouse Pointer: 

On the active cell border to move to the end of the data section in the direction defined by the side of the cell you use.

Mouse Pointer: 

Select a range of cells.

Mouse Pointer: 

On the edge of the range to Move the selected cell or range.

Mouse Pointer: 

Hold down the Ctrl key as you drag to Copy the selected cell or range.

Release the mouse button before the Ctrl key.

Mouse Pointer: 

On the Fill Handle (small square icon at the bottom right hand corner of the range) to Fill up, down, left or right.

Mouse Pointer: +

On the Fill Handle (small square icon at the bottom right hand corner of the range) to automatically Fill an entry down a table - level with the adjacent column.

Mouse Pointer: +

As for the above, to display the auto-fill or move quick menu to fill the cells with data.

Select from active cell to the cell at the mouse pointer.

Mouse Pointer: 

Select another range of cells.

Mouse Pointer: 

Worksheet Tabs

Select and display the worksheet at the mouse pointer.

Mouse Pointer: 

Display a Quick Menu.

Mouse Pointer: 

Rename the worksheet.

Mouse Pointer: 

To select a range of worksheets.

Mouse Pointer: 

To select/deselect individual worksheets.

Mouse Pointer: 

To move selected sheet(s) within and between visible workbooks.

Mouse Pointer: 

Hold down the Ctrl as you drag to Copy the selected sheet(s). Release the Mouse Button before the Ctrl key.

Mouse Pointer: 

Coordinate Frame

Select row, column or whole worksheet.

Mouse Pointer:  Rows

 Columns

 Worksheet

Display Quick Menu.

Select range of rows or columns.

On right hand column border, to change column width.

Mouse Pointer: 

On bottom border of row, to change row height.

Mouse Pointer: 

To set column(s) to auto-width.

Mouse Pointer: 

To set row(s) to auto-height.

Mouse Pointer: 

Ribbon

On icon, to perform command on selected cells.

Mouse Pointer: 

Display Quick Menu.

Mouse Pointer: 

Formula Bar

To edit cell contents.

Mouse Pointer: 

On active cell reference, to go to a new location in the worksheet.

Mouse Pointer: 

On icon between the above two features to display a pick list of named ranges.

Mouse Pointer: 

Charts

Select the Chart or other object.

Mouse Pointer:

Display Quick Menu.

Mouse Pointer:

On a Chart or object frame to Move it.

Mouse Pointer:

Hold down the key as you release the mouse to Copy the Chart or object.

On a Chart or object frames sizing handle to re-size it.

Mouse Pointer: Arrows indicate direction you can move mouse pointer.

Hold down any combination of the following keys as you drag to affect the way the mouse works:

Alt — Snap to grid.

Ctrl — Centred re-size.

Retain aspect (height:width) ratio.

To display the Format dialog box for the Chart feature at the mouse pointer.

Mouse Pointer:

TABLE DESIGN RULES

Before you write any formulas it is important to create a design which works with Excel's features to provide greatest reliability and flexibility when the workbook is used. This is of particular importance when you use tables to store data.

Since Excel 2007 (when Tables with Structured Cell References were introduced) the rules have changed.

- If your workbook is going to be used in Excel 2007 or later you should take advantage of the new **Structured Table** feature that provides better formatting options and access to Structured Cell References.

  These **Structured Tables** dictate the use of new design rules.

- If your workbook is going to be used in Excel 2003 or earlier your tables must adhere to traditional design rules that avoid the use of features introduced in Excel 2007.

  Opening and Saving a workbook containing one or more **Structured Tables**, in an older version of Excel, will remove the **Structured Table** definitions and all their benefits. The result will be a workbook that will not function properly in any version of Excel.

In other words: create designs that work in all versions of Excel that will be used to Open and Save the workbook.

STRUCTURED TABLES

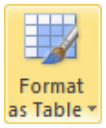
Structured Tables change the way a number of Microsoft Excel's commands work. This means that a **Table** designed to work in Excel 2003 is not always suitable for conversion to a **Structured Table** in Excel 2010 - without some modification.

Microsoft Excel 2003's **Tables** will still work the way they used to do - as long as they are not converted to Microsoft Excel 2010 **Tables**.

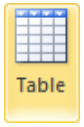
Converting a Range to a Table

A **Structured Table** is created when you convert a range of cells to a **Structured Table** using either of the illustrated Ribbon Tools.

Ribbon: **Home**

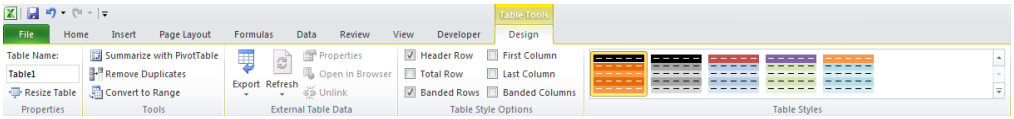


Insert



You can easily tell if a range has been converted to a **Structured Table**.

Excel will display the illustrated Ribbon when you select any cell within a **Structured Table**.



Structured Table tools are described separately.

Required Design Attributes

1. **Structured Table**s may start anywhere in the worksheet.

2. The first row and only the first row must be used for column headings (the Header Row).

   a. Table headings and Section headings are **not** part of the **Structured Table** and should not be included in any range that is converted to a **Structured Table**.

   b. Column headings may use Wrapped Text to create multiple lines of text within the heading row.

   c. If your cell range does not include a Header Row, Microsoft Excel will insert its own generic headings.

3. Column Headings may be text or numbers.

   a. Formulas will be replaced with static entries based on their results.

4. Every other row in the **Structured Table** is considered to be a data row.

5. One entry (record) per row.

   a. You may not split an entry over two rows.

   b. You may use wrapped text to place multiple lines of text in the row.

   c. You may include blank rows in a **Structured Table**.

6. Column Totals are **NOT** required - they are created using the **Structured Table** commands. If your spreadsheet has column totals - delete them!

   a. In fact there should not be any entries in the spreadsheet below the **Structured Table**.

      It is common to append data rows to the end of **Structured Table**s rather than insert new rows so there should be nothing in the way!

7. You may use calculated fields within the table that perform simple calculations within the row.

   a. For example: Differences between values, VAT calculations etc.

   b. If you intend to use Structured Cell References (recommended) in your formulas you must build these formulas after converting the cell range into a **Structured Table**.

8. The data entered into any column should be consistent throughout.

9. Do not merge cells within the **Structured Table**.

Desirable Design Attributes

1. Use the Freeze Panes feature to keep your Column Headings and the Columns which identify entries visible on the screen when you navigate large tables.

2. Design a table structure that provides unambiguous headings that show the users clearly where each item of data should go.

TIP
Before you sort any data - consider if you need to re-establish the original order afterwards.

If so, you may need to include a record number field in your design.

   a. Never allow the user to have a choice of columns for an item of data.

      For example. Use Address columns such as:

      House, Road, Town, County, Postcode

      Do not use:

      Address1, Address2, Address3 etc.

   b. Use separate columns for each item of data - do not design a column structure that requires two items of data in a single cell.

      For example. Use Name columns such as:

      Title, First Name, Surname

      Do not use:

      Name

TRADITIONAL TABLES

In order for formulas containing normal cell references to work well and react correctly when users edit the spreadsheet by inserting & deleting rows or columns, or sorting the records in the table it is important that your design complies with the following rules.

If you design all your spreadsheets to comply with these rules Excel will help you. If you break any of the rules Excel will give you and the people who use your spreadsheet problems that never go away!

Most spreadsheets involve a table which is used to collect data which can then be manipulated and charted etc. It is the design of these tables which is often critical to the success of your design.

Required Design Attributes

1. Tables may start anywhere in the worksheet.

2. The first row and only the first row may be used for column headings (Field Names).

   a. Table headings and section headings are not part of the table and should be separated from the column headings by at least one completely blank row.

   b. Column headings may use Wrapped Text to create multiple lines of text within the heading row.

3. Column Headings must be text, otherwise Excel may treat the headings row as a data row. Numbers can be entered as text using:

   a. Prefix the entry with a ' (apostrophe).

   b. Or pre-format the cells with the Number format of Text (which is not meant to be a contradiction in terms!)

4. Every other row in the table is considered to be a data row.

5. One entry per row.

   a. You may not split an entry over two rows.

   b. You may use wrapped text to place multiple lines of text in the row.

6. The table boundaries are automatically identified by Excel when it finds the edge of the spreadsheet or at the first completely blank row or column.

7. Column and Row Totals are not part of the table so must be separated from it by at least one blank row or column.

8. You may use calculated fields within the table that perform simple calculations within the row. e.g. Differences between values, VAT calculations etc.

9. The data entered into any column should be consistent throughout.

10. Do not merge cells within the table.

Desirable Design Attributes

1. Use the Freeze Panes feature to keep your Column Headings and the Columns which identify entries visible on the screen when you navigate large tables.

2. Design a table structure that provides unambiguous headings that show the users clearly where each item of data should go.

TIP
Before you sort any data - consider if you need to re-establish the original order afterwards.

If so, you may need to include a record number field in your design.

   a. Never allow the user to have a choice of columns for an item of data.

      For example. Use Address columns such as:

      House, Road, Town, County, Postcode

      Do not use:

      Address1, Address2, Address3 etc.

   b. Use separate columns for each item of data - do not design a column structure that requires two items of data in a single cell.

      For example. Use Name columns such as:

      Title, First Name, Surname

      Do not use:

      Name

EXAMPLE TABLES

Structured Tables

Notice the use of Structured Cell References in the formulas.

D5 =[@ACTUAL]-[@TARGET]

	A	B	C	D	E
1	SALES PERFORMANCES				
2					
3	SALESPERSON	TARGET	ACTUAL	DIFFERENCE	PERCENTAGE
4	Anne Other	£20,000	£21,345	£1,345	106.7%
5	Tom Cat	£21,000	£20,876	-£124	99.4%
6	Bee Sting	£25,000	£25,098	£98	100.4%
7	Kay Lee	£20,000	£24,964	£4,964	124.8%
8	Ali Cat	£18,000	£10,987	-£7,013	61.0%
9	Ed Case	£12,000	£13,056	£1,056	108.8%
10	Jay Walk	£30,000	£29,543	-£457	98.5%
11	Dee Van	£20,000	£23,410	£3,410	117.1%
12	Total	£166,000	£169,279	£3,279	102.0%
13					
14	Average	£20,750	£21,160	£410	102%
15	Best	£30,000	£29,543	£4,964	125%
16	Worst	£12,000	£10,987	-£7,013	61%

Structured Table definition uses the range **A3:E12**

Traditional Tables

Notice the use of traditional co-ordinates in the equivalent formulas.

D5 =C5-B5

	A	B	C	D	E
1	SALES PERFORMANCES				
2					
3	SALESPERSON	TARGET	ACTUAL	DIFFERENCE	PERCENTAGE
4	Anne Other	£20,000	£21,345	£1,345	106.7%
5	Tom Cat	£21,000	£20,876	-£124	99.4%
6	Bee Sting	£25,000	£25,098	£98	100.4%
7	Kay Lee	£20,000	£24,964	£4,964	124.8%
8	Ali Cat	£18,000	£10,987	-£7,013	61.0%
9	Ed Case	£12,000	£13,056	£1,056	108.8%
10	Jay Walk	£30,000	£29,543	-£457	98.5%
11	Dee Van	£20,000	£23,410	£3,410	117.1%
12					
13	TOTALS	£166,000	£169,279	£3,279	102.0%
14					
15	Average	£20,750	£21,160	£410	102.1%
16	Best	£30,000	£29,543	£4,964	124.8%
17	Worst	£12,000	£10,987	-£7,013	61.0%

Notice How both tables break one of the design rules –
The names should be split into two columns!

Structured Tables

Notice the use of Structured Cell References in the formulas.

B9 =SUBTOTAL(109,[2013])

	A	B	C	D	E	F	G
1	DESCRIPTION	2013	2014	2015	2016	2017	TOTALS
2	Computers	10,000	10,500	10,750	10,200	10,350	51,800
3	Printers	7,000	8,000	9,550	11,000	13,000	48,550
4	Software	14,000	16,000	15,500	17,000	17,000	79,500
5	Disc Drives	5,000	5,000	5,550	6,000	5,900	27,450
6	CD Roms	1,000	1,200	4,000	6,000	8,000	20,200
7	Consumables	8,000	8,000	8,400	8,700	9,000	42,100
8	Other	3,000	3,000	3,000	3,000	3,000	15,000
9	Total	48,000	51,700	56,750	61,900	66,250	284,600

Structured Table definition uses the range **A1:G9**

In this **Structured Table** the Year headings have been entered as numbers.

	A	B	C	D	E	F	G	H	I	J
1	Rec No.	Title	First Name	Surname	Gender	Date of Birth	Address	Town	Post Code	Home Phone
2	1	Mr	Daniel	Smith	m	29-Oct-80	3 High St	March	PE15 1SF	525021
3	2	Ms	Yvonne	Jones	f	09-May-75	25 March Road	Wisbech	PE13 4RT	195458
4	3	Mr	Christopher	Madsen	m	09-Apr-69	5 Strollers Way	Whittlesey	PE7 6YT	228682
5	4	Mr	Ian	Price	m	14-Aug-54	56 Coopers Close	Chatteris	PE19 7UT	781458
6	5	Ms	Emma	Macey	f	11-May-69	1 The Avenue	Manea	PE15 7RT	279717
7	6	Miss	Mandy	Johnson	f	17-Aug-77	89 London Road	Wimblington	PE15 1AM	788074
8	7	Mr	Glen	Golding	m	07-Apr-71	15 Lime Tree Avenue	Parson Drove	PE13 8UJ	858939
9	8	Dr	Lesley	Spencer	f	17-Dec-59	4 Fen Cottages	Elm	PE14 4WD	538462
10	9	Mr	Steven	Andrews	m	17-Mar-55	33 Gretton Road	March	PE15 8JJ	401541

Traditional Tables

Notice the use of traditional co-ordinates in the equivalent formulas.

B10 =SUM(B2:B9)

	A	B	C	D	E	F	G	H
1	DESCRIPTION	2013	2014	2015	2016	2017		TOTALS
2	Computers	10,000	10,500	10,750	10,200	10,350		51,800
3	Printers	7,000	8,000	9,550	11,000	13,000		48,550
4	Software	14,000	16,000	15,500	17,000	17,000		79,500
5	Disc Drives	5,000	5,000	5,550	6,000	5,900		27,450
6	CD Roms	1,000	1,200	4,000	6,000	8,000		20,200
7	Consumables	8,000	8,000	8,400	8,700	9,000		42,100
8	Other	3,000	3,000	3,000	3,000	3,000		15,000
9								
10	TOTAL	48,000	51,700	56,750	61,900	66,250		284,600

In this table the Year headings have been entered as text.

	A	B	C	D	E	F	G	H	I	J
1	Rec No.	Title	First Name	Surname	Gender	Date of Birth	Address	Town	Post Code	Home Phone
2	1	Mr	Daniel	Smith	m	29-Oct-80	3 High St	March	PE15 1SF	525021
3	2	Ms	Yvonne	Jones	f	09-May-75	25 March Road	Wisbech	PE13 4RT	195458
4	3	Mr	Christopher	Madsen	m	09-Apr-69	5 Strollers Way	Whittlesey	PE7 6YT	228682
5	4	Mr	Ian	Price	m	14-Aug-54	56 Coopers Close	Chatteris	PE19 7UT	781458
6	5	Ms	Emma	Macey	f	11-May-69	1 The Avenue	Manea	PE15 7RT	279717
7	6	Miss	Mandy	Johnson	f	17-Aug-77	89 London Road	Wimblington	PE15 1AM	788074
8	7	Mr	Glen	Golding	m	07-Apr-71	15 Lime Tree Avenue	Parson Drove	PE13 8UJ	858939
9	8	Dr	Lesley	Spencer	f	17-Dec-59	4 Fen Cottages	Elm	PE14 4WD	538462
10	9	Mr	Steven	Andrews	m	17-Mar-55	33 Gretton Road	March	PE15 8JJ	401541

Notice Again the Address column should be split into two columns – House & Road.

CELL FORMULAS

When writing any cell formula, make sure that you:

- Prefix each formula with a key (= symbol), before entering the formula.
- Press or Enter when it is complete.

  Other methods are available but do not always work!

TIP
You may also start a formula with the key - as commonly used in Lotus 1-2-3.

This key has the advantage of being on the number pad.

Formulas may contain:

- **Values**
  - **Numbers** (including Dates, Times & Percentages etc.)
  - **Text** - placed inside "Double Quotes".
  - **Logical** values (i.e. TRUE or FALSE).
  - Fixed values within formulas should be avoided unless the values will **never** change.
- **References**
  - Cell or Range references to cells containing variable data.
  - Structured cell references for information contained within a **Structured Table**.
  - **:** creates a range from two cell references
  - **,** separator between items in a list of values or references.
  - **Space** intersection of 2 range references.
- **Arithmetic Symbols**
  - **+** add
  - **-** subtract
  - ***** multiply
  - **/** divide
  - **^** raise to a power
  - **%** percentage value
  - **( )** used to change the order of calculations.
- **Text Symbols**
  - **" "** container for fixed text values
  - **&** concatenation – joins two text items into a single piece of text.
- **Comparison Symbols**
  - **=** equals
  - **>** greater than
  - **<** less than
  - **>=** greater than or equal to
  - **<=** less than or equals to
  - **<>** not equal to
- **Functions**
  - Excel provides well over 300 functions to perform advanced calculations.
    All are of the form: FUNCTIONNAME(data)
- **Absolute Cell References**
  - **$** used to control the way cell references are changed when formulas are copied.

All of the above are described in detail in appropriate parts of these notes.

CELL REFERENCES

Formulas can refer to data stored in other cells using cell references of the form:

Cell: Use normal co-ordinates.

e.g. A1 or B48 etc

Range: Two cell references with a Colon (**:**) separating them.

e.g. A1:B48 or A2:A30 etc

List: Some functions allow or require a list of references. Separate each with a Comma (**,**).

e.g. SUM(A1:B48,A2:A30,C5)

Worksheet: You may refer to cells on another worksheet by prefixing the cell or range reference with the name of the worksheet.

e.g.	Sheet2!B48	Notice the use of the **!** as a separator.
	Sheet2!A1:B48	
	'Sheet Name'!B48	When the Sheet Name contains characters that have other meanings in Excel formulas (e.g. spaces) the name must be contained within 'single quotes'.

See also
Absolute Cell References Page 54.
Named References Page 58.
Linking Worksheets Page 74.
Structured Cell References Page 78.

ORDER OF PRIORITY

Excel recognises all the normal arithmetic symbols, but when used in complex formulas you should be aware that formulas are not always read in left to right order - but in order of priority.

Each arithmetic operator is assigned a level of importance. Excel scans the formula for the most important operations that will be performed first.

EXAMPLE

=1+2*3	=(1+2)*3
=1+6	=3*3
=7	=9

Formulas containing more than one operator at the same level of priority are calculated in left to right position order.

The following table specifies the full list of priorities.

There are Toolbar icons available for most of the following symbols.

Priority	Operator		
1	**( )**	Brackets.	Overrides operator priorities.
2	**:**	Range.	Used between two cell references to define a range of cells.
3	**Space**	Intersection.	Specifies the cells in the intersection of two ranges.
4	**,**	Union.	Separates two items in a list.
			i.e. Two ranges in a function.
5	**+** **-**	Positive. Negative.	
6	**%**	Percentage.	Converts the number in front to the decimal equivalent of the percentage.
7	**^**	Powers.	
8	* **/**	Multiply. Divide.	
9	**+** **-**	Add. Subtract.	
10	**&**	Concatenation.	Join two text items together.
11	**=** **>** **>=** **<** **<=** **<>**	Equals. Greater than. Greater than or equal to. Less than. Less than or equal to. Not equal to.	

ARITHMETIC FORMULAS

This section considers the features and requirements for entering typical every day arithmetic formulas into cells (those which do not require the use of functions). Excel provides a multitude of methods for building such formulas, ranging from the traditional to the modern using both mouse and keyboard based methods. The following notes describe the most commonly used methods - take your pick!

Notes Arithmetic Formulas may use any of the arithmetic symbols: **( ) + - * / ^ %**

Formulas are not case sensitive.

Examples: =15*25-(4+3)
=A1*B6
=20%*B6
etc.

Avoid using fixed values in formulas - store the value in a cell and use the cell co-ordinate to refer to it. This allows you to change the value without having to edit the formula.

The biggest single mistake most users make is to build a spreadsheet using realistic data. This always makes it difficult to check if the results are accurate. Build your spreadsheet with really simple test data, that you can do sums in your head with. Ideally you should know what the result will be BEFORE you build the formula - so that it is easy to notice any mistakes.

Replace your test data with real data only when the spreadsheet is finished and ready for use.

Good formulas should NEVER need changing when the spreadsheet is being used.

KEYBOARD ENTRY

Any formula no matter how complicated can be entered simply by typing it and pressing  or  .
However, this is very prone to human error due to the entry of incorrect cell references and/or incorrect punctuation.

This method is not recommended.

USING POINT MODE

This method improves on the above by allowing you to ***point*** at the cells required by your formulas while Excel enters any punctuation for you. Both of these reduce the number of errors created by typing them.

In this method you use the keyboard to type the arithmetic symbols and either keyboard or mouse based methods for selecting the data. When pointing at data, Excel displays the mode indicator **Point** in the bottom left hand corner of the screen.

The following example shows how you would create a typical formula.

Formula: =C4-B4

Keyboard			Mouse		
Type:			Type:		
Point at:	**C4**	Use movement keys to highlight this cell. Stay there!	Point at:	**C4**	Click on this cell to highlight it. Stay there!
Type:		Brings display back to normal.	Type:		Brings display back to normal.
Point at:	**B4**	Use movement keys to highlight this cell. Stay there!	Point at:	**B4**	Click on this cell to highlight it. Stay there!
Press:		Enter the finished formula.	Click on:		Found on the formula bar. Enter the finished formula.

EDITING FORMULAS

You may use all normal text and cell editing methods to edit a formula - the following additional features are also available when editing formulas.

Select a cell containing a formula you wish to edit:

Access Edit mode using:

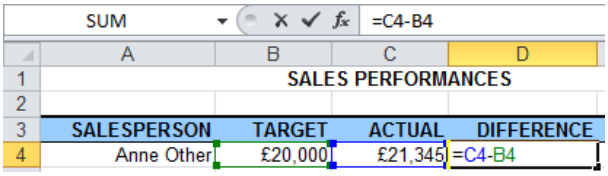
Mouse:		In the formula bar (illustrated). Enables editing in the Formula Bar.
		In the cell containing the formula. Enables editing in the cell at the mouse pointer.
Keyboard:		Enables editing in the active cell.

When editing you may use:

Mouse:		In the cell or Formula Bar to switch between the two as you edit.
Keyboard:		To toggle between Enter and Edit modes.

Use normal text editing methods to edit any characters in the formula.

You may use Point mode to edit the cell reference in the formula.



Mouse:  On any border on the edge of a range to move it to a new position.

On any ***sizing handle*** displayed in the corners of the range, to extend/reduce its size.

EXAMPLE ARITHMETIC FORMULAS

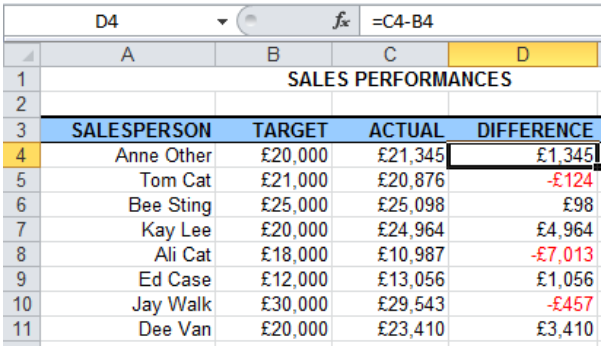
The following examples illustrate some of the more typical arithmetic formulas used in business spreadsheets. The list is by no means exhaustive as it is merely intended to illustrate typical formulas.

Difference Between Two Values

Whenever you are looking to find the difference between two values you need to subtract one from the other – the order you do this matters but only you can judge which way round is correct.

If you do take the values in the wrong order the answer will be the opposite sign. i.e. negative when it should be positive and vice versa.

A classic scenario for this type of formula is when finding the difference between an actual value and a target value.



Formula: ***=ActualValue-TargetValue***

Where ***ActualValue*** and ***TargetValue*** should be replaced with appropriate cell references.

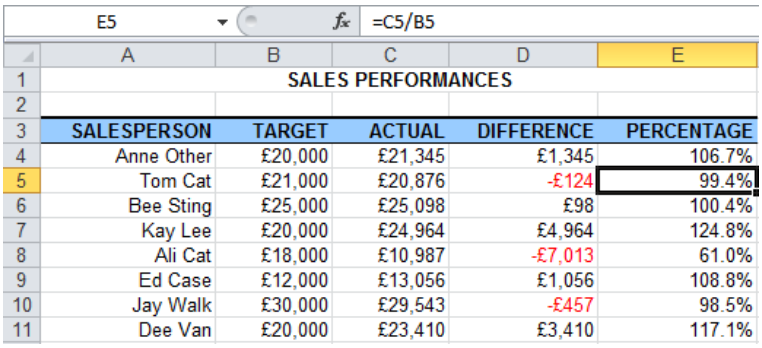
Percentage Difference Between Two Values

Similar to the above but instead of subtracting you divide.

Formula:

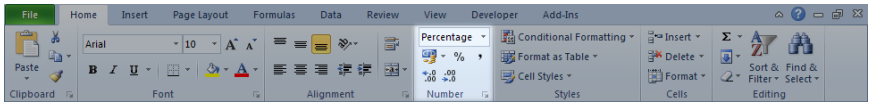
=ActualValue/TargetValue

Where ***ActualValue*** and ***TargetValue*** should be replaced with appropriate cell references.



The result will calculate a fraction which will often be displayed as a decimal.

You make it LOOK like a percentage by applying Percentage format.



Ribbon: **Home**

%	Apply percentage format
.00	Increase number of decimal places of accuracy.
.00	Decrease number of decimal places of accuracy.

Percentage of a Value

Whenever you use the word **of** to describe an operation you should always use multiply. In this case you multiply the original value by the percentage value.

A typical example for this is when calculating VAT:

Formula:

=NetPrice*VAT%

Where ***NetPrice*** is replaced with a cell reference and ***VAT%*** is replaced with the current VAT Rate. e.g. ***20%***

E2 =D2*20%

	A	B	C	D	E	F
1	INVOICE NO	QUANTITY	PRICE	NET	VAT	GROSS
2	32	102	£126.00	£12,852.00	£2,570.40	£15,422.40
3	33	233	£78.00	£18,174.00	£3,634.80	£21,808.80
4	34	301	£132.00	£39,732.00	£7,946.40	£47,678.40
5	35	143	£100.00	£14,300.00	£2,860.00	£17,160.00
6	36	99	£160.00	£15,840.00	£3,168.00	£19,008.00
7	37	164	£120.00	£19,680.00	£3,936.00	£23,616.00
8	38	434	£78.00	£33,852.00	£6,770.40	£40,622.40
9	39	521	£150.00	£78,150.00	£15,630.00	£93,780.00

Percentage Increase/Decrease

Similar to the above, except that you multiply by 1 + percentage rate to increase and by 1 - percentage rate to decrease.

Formulas: ***=Value*(1+Rate%)*** Increase by ***Rate%***

D3 =B3*(1+C3)

	A	B	C	D	E
1					
2		Value	Rate	Increase	Decrease
3		10	10%	11	9
4		20	10%	22	18
5		30	10%	33	27
6		40	10%	44	36

=Value*(1-Rate%) Decrease by ***Rate%***

E3 =B3*(1-C3)

	A	B	C	D	E
1					
2		Value	Rate	Increase	Decrease
3		10	20%	12	8
4		20	20%	24	16
5		30	20%	36	24
6		40	20%	48	32

Notes: The use of Brackets to ensure that the Add/Subtract operation is performed first.

It is much easier (and safer) to change the Percentage Rate when it is stored in a cell and not contained within the formula.

USING FUNCTIONS

Excel provides hundreds of functions that can be used in any combination in your formulas and they allow you to perform all manner of calculations that simple Arithmetic can't do. These functions are equivalent to the function keys you get on scientific calculators.

In general, Excel's functions can be divided into two main categories:

1. Those that allow you to perform calculations with ranges of data. (Arithmetic only works with individual cell references.)

2. Those that allow you to perform calculations that Arithmetic cannot hope to achieve. These tend to be more specialist but some of them are useful to most users.

These notes cannot possibly describe all the functions and so are confined to describing those that are of most use to the average business user of Excel.

Notes

The syntax of a function is as follows:

=FUNCTION(argument,argument,...,argument)

The formula still begins with a normal **=** sign.

Functions may require none, one, or more ***arguments***. Some use optional arguments.

Arguments provide the data that the function needs to perform the calculation.

An argument is any valid value, cell reference, range, range name or expression - as required by the nature of the function.

Some functions use optional arguments. This manual indicates optional ***[arguments]*** with square brackets.

The arguments are listed inside a pair of brackets, and are separated with commas - NOT spaces.

Functions which do not require any arguments must have a pair of dummy brackets - with no entries between them.

e.g. ***=TODAY()*** Failure to include the brackets results in a **#NAME?** error in the cell.

Text based arguments should be included in speech marks: ***"text".***

Spaces are allowed in text arguments.

A pair of quotes without an entry means no characters. i.e. ""

Text not included in speech marks is assumed to be a reference to a named range. If the name is not defined a **#NAME?** error is displayed in the cell.

KEYBOARD ENTRY

Any formula no matter how complicated can be entered simply by typing it and pressing  or  .
However, this is very prone to human error due to the entry of incorrect cell & range references and/or incorrect punctuation.

This method is not recommended.

USING POINT MODE

This method improves on the above by allowing you to ***point*** at the cells & ranges required by your formulas and allows Excel to enter much of the punctuation for you. Both of which reduce the number of errors created by typing them.

In this method you use the keyboard to type the function names and mathematical symbols etc, and either keyboard or mouse based methods for selecting the data. When pointing at data, Excel displays the mode indicator **Point** in the bottom left hand corner of the screen.

The following example shows how you would create a typical formula.

Formula: =AVERAGE(B4:B12)

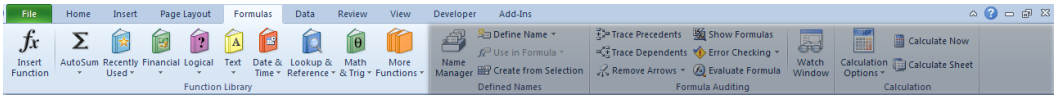
Keyboard			Mouse		
Type:	=**AVERAGE(**	Not case sensitive.	Type:	=**AVERAGE(**	Not case sensitive.
Point at:	**B12**	Use movement keys to highlight this cell. Start at the nearest cell in the range to the cell containing the formula.	Point at:	**B12**	Click and hold on this cell to highlight it.
Hold:		Allows you to select a cell range as you move.	Drag To:	**B4**	Dragging upwards is easier to control than dragging downwards, if the range goes off the edge of the screen.
Move To:	**B4**	Use movement keys to extend the range to this cell while the  (Shift) key is held down.	Click on:		Found on the formula bar. Enter the finished formula. Excel will close the Bracket for you.
Press:		Enter the finished formula. Excel will close the bracket for you.			

INSERTING FUNCTIONS

Excel provides another method for creating and editing formulas which is often used with functions as it helps to prompt you for all the information that the functions needs - the arguments.

Formulas Ribbon

Ribbon: **Formulas**



Excel provides access to a range of commonly used functions in the Formulas Ribbon:

Refer to the following sections for more detail.

See also: **AutoSum** page 42.

Insert Function Dialog Box

This dialog box can be used in two ways.

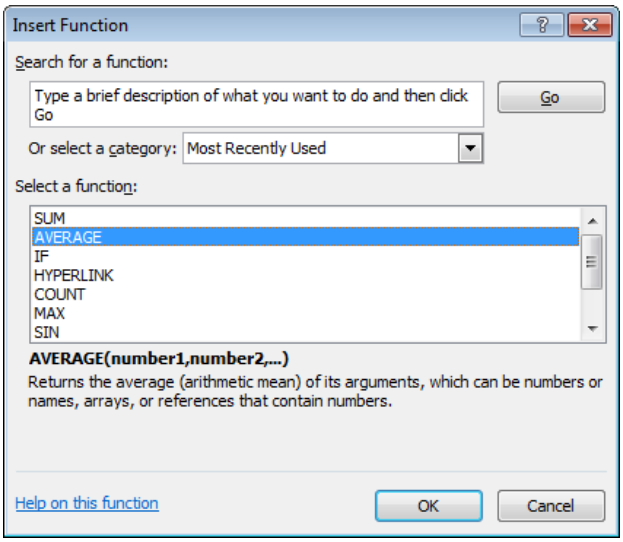
Firstly to build formulas in a two stage process:

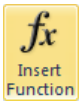
Stage One: Select a function from the dialog box.

Stage Two: Select the data required by the function - using the Function Arguments dialog box - see next section.

Secondly to explore the function list by browsing it and displaying the help screens to learn more about any function that looks as if it will be useful.

Access the dialog box using any of the following methods:



Ribbon: 

Formula Bar: 

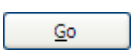
AutoSum: Select: **More Functions**

See later.

Keyboard: 

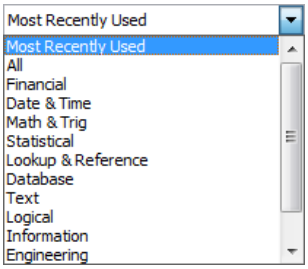
Search for a function

Enter a description of the calculation you want to perform and then use:



Displays a list of recommended functions for you to choose from.

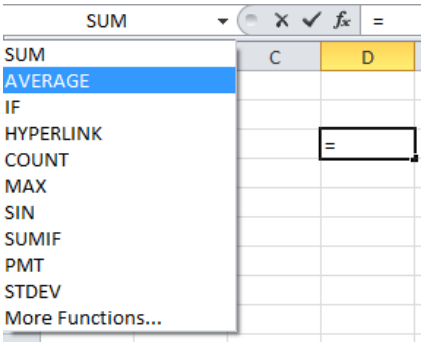
Or select a category



Indicates the current category, and displays a pick list of alternatives to choose from.

Most Recently Used

This list displays those functions you have used recently - and therefore learns which ones you need, making them easier to access.



You may access this list directly from the formula bar once you have pressed  to start a formula.

Initially Excel displays the most recent function of all, but provides access to a pick list of the other recently used functions.

The remaining options allow you to browse lists of functions that relate to a specific area of interest - explore!

Select a function

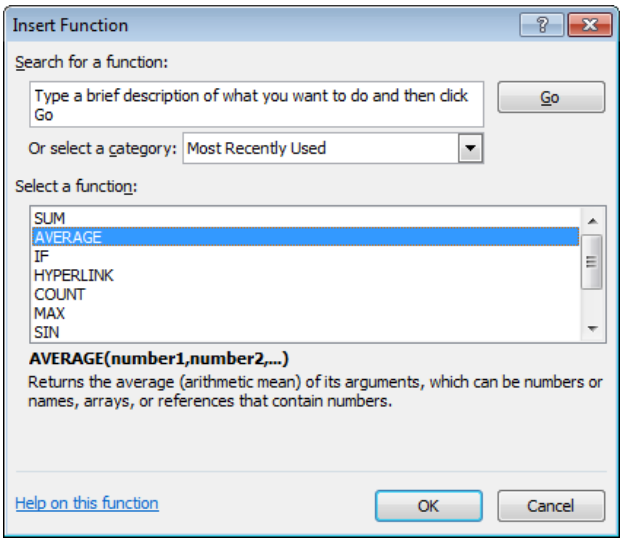
This panel displays a list of functions for the selected category.

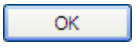
Select a function in the list, to display a brief description. Access the help screens for further information.

Help on this function

Displays the help for the highlighted function.

Not only do these help screens detail the selected function, but allow you to copy an example into a blank worksheet so that you may experiment with it - very useful!

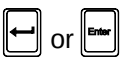




Use the highlighted function to build a formula.

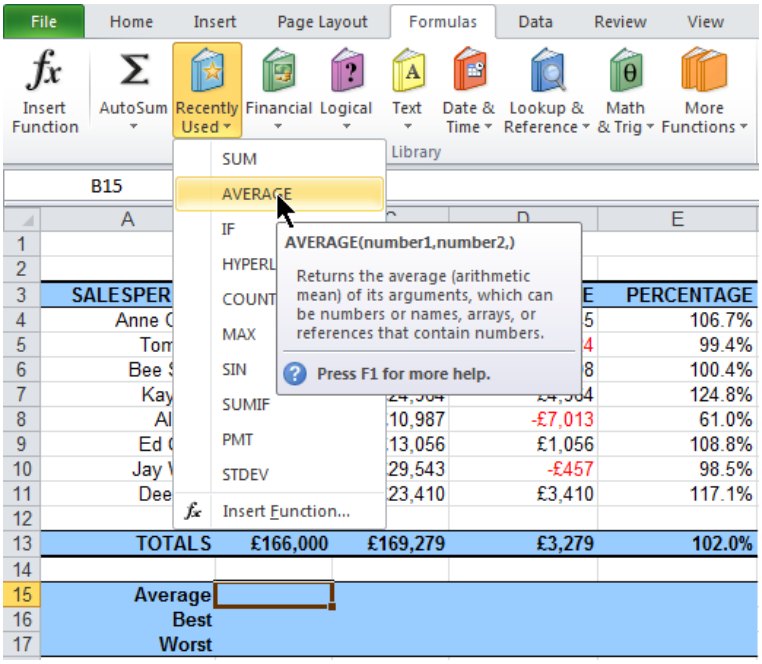
Excel will display the Function Arguments dialog box, allowing you to select the data required by the function. See below.

Mouse:  On the required function in the Function List.

Keyboard:  or

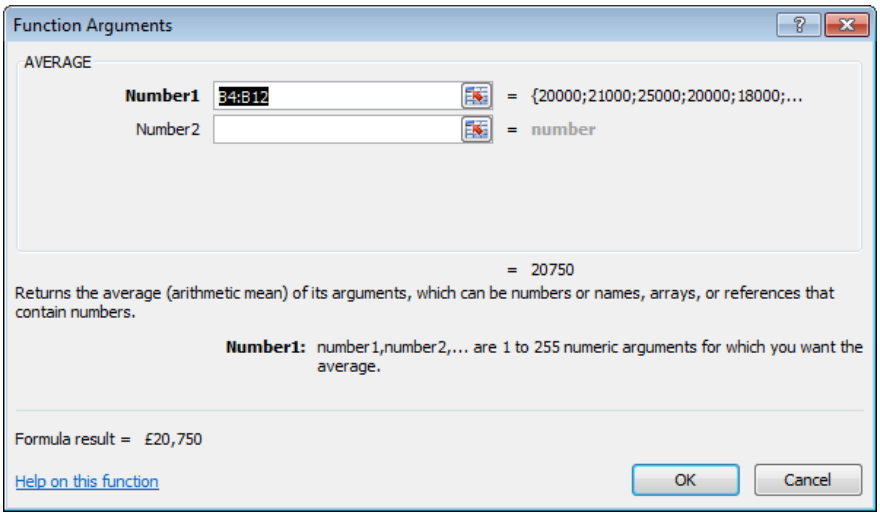
Function Arguments Dialog Box

This is displayed after closing the Insert Function dialog box (described in previous section), or when using any of the tools provided in the Ribbon:



You may enter/edit entries for the arguments from the keyboard or use Point Mode to select cells and ranges using all normal methods.

- Bold labels are used for compulsory arguments.
- Normal labels are used for optional arguments.
- The result of the Function is displayed when all compulsory entries are provided.



The right hand side shows:

- The type of data that is required when an argument panel is empty.
- The data referenced by the argument.
- An error message for invalid arguments.

The bottom of the panel shows:

- The formula result
- A description for the argument you are editing.

OK — To enter the finished formula into the active cell.

EXAMPLE FORMULAS USING FUNCTIONS

The following examples illustrate some of the more typical uses of functions used in business spreadsheets. The list is by no means exhaustive as it is merely intended to illustrate typical formulas.

Row and Column Totals

Probably the most common requirement in any spreadsheet is to calculate row and column totals for data displayed in a **Table**.

See also: **Subtotals** Page 66.
Structured Table Formulas Page 78.

The function used to calculate these totals is called **SUM**.

The **SUM** function normally has the form:

=SUM(range) e.g. ***=SUM(B2:B9)***

Where: ***SUM*** is the name of the function.

The brackets are required when using any function.

Range is a reference to a range of cells containing the data to be summed.

e.g. ***B2:B9***

Never use: ***=SUM(B2+B3+B4)*** This works but is better written as:

=***SUM(B2:B4)***

Or:

=B2+B3+B4

Optionally: The **SUM** function can take up to 30 arguments (separated by commas), each of which can be any of:

- A number.
- A calculation giving rise to a number.
- A reference to a cell containing a number.
- A reference to a range of cells containing numbers.

The **SUM** function will calculate the total of any numbers it sees.

e.g. ***=SUM(20,B2*17.5%, B4, C2:D20)***

It is unusual but valid to use the function in this way.

Notes: You should leave a blank row between the data and any column total.

In the same way you should leave a blank column between the data and any row total.

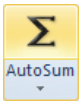
These blank cells should be included in the range referenced by the formula but never used to enter data. Ideally you will protect these cells to prevent users entering data into them.

Refer to: **Table Design Rules** Page 22.

AutoSum Tool

The AutoSum tool provides access to the most commonly used functions that nearly every user requires, and greatly helps you build basic formulas.

Ribbon: **Formulas**

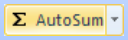


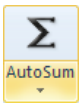
Click on the icon to use the **SUM** function.

Keyboard: 

Also:

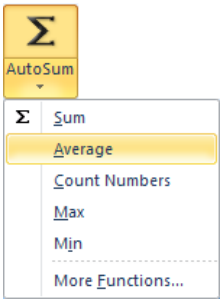
Ribbon: **Home**

Tool: 



Click on the arrow to drop down a list of commonly used functions.

Select: The required function, or:



More Functions Displays the Insert Function dialog box, when creating a new formula.

Displays the Function Arguments dialog box when editing an existing formula.

Notes This tool can be used in a variety of ways to build formulas. Most self-taught users use it very badly! Bear in mind that the tool is designed to work with rows of data as well as columns of data in your worksheet tables, if you let Excel find the data for you it may well find the wrong range. You must notice these errors before you enter them - or better still learn how to avoid the problems!

Never assume the formula has worked - check it!

Most experts and books encourage users to enter summary functions in the row immediately underneath the table (for column totals) or the column immediately to the right (for row totals).

B10 =SUM(B2:B9)

	A	B	C	D	E	F	G	H
1	DESCRIPTION	2013	2014	2015	2016	2017		TOTALS
2	Computers	10,000	10,500	10,750	10,200	10,350		51,800
3	Printers	7,000	8,000	9,550	11,000	13,000		48,550
4	Software	14,000	16,000	15,500	17,000	17,000		79,500
5	Disc Drives	5,000	5,000	5,550	6,000	5,900		27,450
6	CD Roms	1,000	1,200	4,000	6,000	8,000		20,200
7	Consumables	8,000	8,000	8,400	8,700	9,000		42,100
8	Other	3,000	3,000	3,000	3,000	3,000		15,000
9								
10	TOTAL	48,000	51,700	56,750	61,900	66,250		284,600

DON'T!

Unless you are using a **Structured Table**!

Notes: Always design your spreadsheet with a blank row underneath the table before the column totals (illustrated), and a blank column to the right before the row totals.

Always include these blank cells in the range used by the formulas.

Never use the empty cells for data - insert new rows and/or columns to make space for more data.

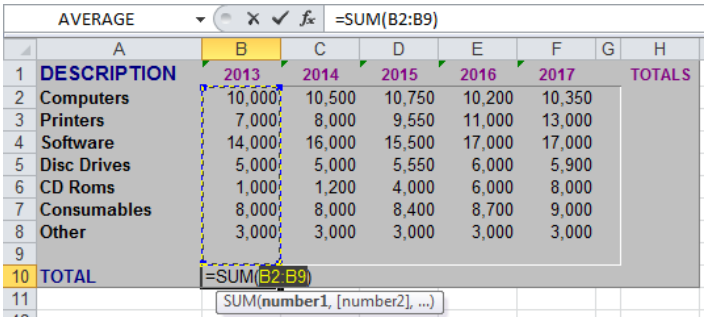
This design ensures that the formulas need no maintenance when new rows/column are inserted. Excels ability to adjust formulas for you is NOT 100% reliable if the formulas are adjacent to the table.

This design also ensures that your table will allow other table based commands to be performed far more easily - these include: Charts, Sorting, Filters, Pivot Tables and Lookup Tables.

The **Sum** function is often misused, when another function does the job better. The classic example being Sub-Totals and Grand Totals. Use the **Subtotal** function in place of the **Sum** function to calculate both sub & grand totals. In time you should find that the **Subtotal** function can be more flexible than the **Sum** function!

Single Total

Although this section uses the **Sum** function to illustrate the issue, the same applies to any of the functions you access via the AutoSum tool.



1. Select the cell where you want to create the formula - leaving a blank cell between the data and this formula cell.

2. Select the required Function using the AutoSum Tool.

   Excel will create the required formula - and leave you in Point Mode, highlighting the data Excel thinks you want to use.

3. **CHECK** the range offered and highlight an alternative if required.

4. Enter the finished formula in the normal way or by clicking on the AutoSum Tool again.

   Note Do not be tempted to double click on the icon as this misses out the stage when you can check the range offered by Excel. This often leads to mistakes.

5. **Never** repeat this process for multiple totals - see below.

Multiple Totals

Although this section uses the **Sum** function to illustrate the issue, the same applies to any of the functions you access via the AutoSum tool.

Never use the AutoSum tool repetitively to create a series of totals - it's slow and generates errors.

Use one of the following:

Column Totals

1. Highlight a blank row of cells - leaving a blank row between these cells and the table.
2. Select the required Function using the AutoSum Tool.

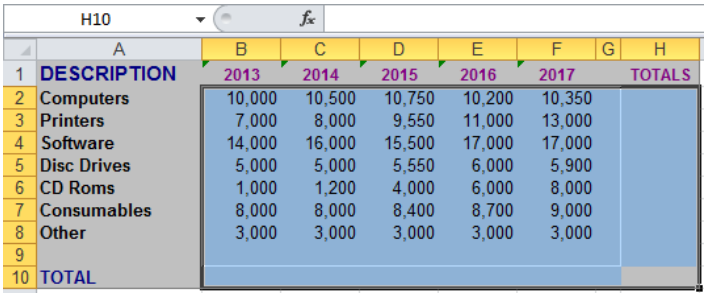
   Excel will create all the column totals: quickly and reliably.

Row Totals

As for column totals, but highlight a blank column of cells - leaving a blank column between these cells and the table.

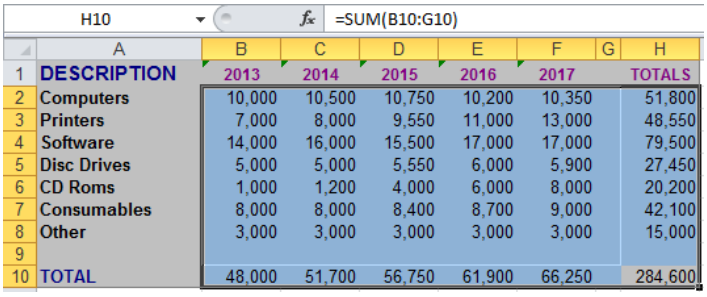
Both Totals

1. Highlight a rectangular range, which includes all the data cells, two blank rows at the bottom, and two blank columns on the right.



2. Select the required Function using the AutoSum Tool.

   Excel will create the Row & Column totals quickly and reliably, with a bonus - the grand total in the bottom right hand corner.



This method provides Excel with all the information it needs to create the formulas - the location of the data, the fact that both row and column totals are required and where to put them. In other words you are not requiring Excel to make any choices for you!

Common Statistics

These functions may be used in exactly the same way as the SUM function.

The only difference is that by using a different function name a different calculation is performed.

Function	Example	Description
AVERAGE	***=AVERAGE(B2:B9)***	Calculates the average of the data.
COUNT	***=COUNT(B2:B9)***	Counts the number of numeric values in the data.
COUNTA	***=COUNTA(B2:B9)***	Counts the numbers of entries of any type in the data.
MAX	***=MAX(B2:B9)***	Returns the highest value in the data.
MIN	***=MIN(B2:B9)***	Returns the lowest value in the data.

There are many more if you look through the Insert Function dialog box - see earlier.

DATE & TIME FORMULAS

UNDERSTANDING DATES & TIMES

Dates and Times are normal numbers FORMATTED to look like dates and times. So when performing calculations with dates and times you should always remember that Excel is dealing with normal numbers.

You never need to know what the numbers are as long as you understand the system:

1. Excel's Calendar starts on the 1st Jan 1900 and ends 31st Dec 9999

2. Excel cannot represent dates outside this range.

3. Dates are calculated by counting the number of days since the start of the Calendar.

   a. 1st Jan 1900 = 1

   b. 1st Jan 2000 = 36,520

   c. 1ST Jan 2010 = 40,179

4. Dates are always whole numbers greater than 0 - Integers.

5. Times are calculated as a fraction of a day.

   a. 03:00 = 0.1250000

   b. 12:00 = 0.5000000

   c. 17:00 = 0.7083333

6. Dates and times can be combined:

   a. 1st Jan 2010 17:00 = 40,179.7083333

Because Dates and Time are stored as normal numbers you can use normal arithmetic for many of the calculations you will need.

EXAMPLE DATE AND TIME FORMULAS

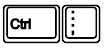
Current Date and Time

Two functions are useful here:

Function	Example	Description
TODAY	***=TODAY()***	Returns the whole number representing the current date as given by your computers clock. The result is only updated when the spreadsheet is recalculated. Use this function if times are not an issue.
NOW	***=NOW()***	Returns the number representing the current date and time as given by your computers clock. The result is only updated when the spreadsheet is recalculated.

Notes: That the functions require a pair of brackets (no spaces) without which Excel will not recognise them as functions. A **#NAME?** error will be displayed if they are omitted.

You may also enter the current date or time as a fixed value that never changes using:

Keyboard:  Current date

 Current time.

Examples:

Book2:2

	A	B	C
1		Date	Time
2	Functions	28/06/2011	28/06/2011 11:36
3	Fixed	28/06/2011	11:36

Book2:1

	A	B	C
1		Date	Time
2	Functions	=TODAY()	=NOW()
3	Fixed	40722	0.482638888888889

Fixed Date and Time

These functions are normally used as part of longer formulas – see next two sections for realistic examples of their use in formulas.

Function	Example	Description
DATE	***=DATE(2011,12,25)***	Christmas Day 2011 Where: ***2011*** is the year ***12*** is the month ***25*** is the day Use commas to separate.
TIME	***=TIME(17,15,0)***	Home time! Where: ***17*** is the hour (24 hour clock) ***15*** is the minute ***0*** is the second

Difference Between Two Dates and Times

Since dates and times are formatted numbers the difference between them is done in exactly the same way as with normal numbers - subtract one from the other!

e.g.	***=TODAY()-DATE(2011,1,1)***	Calculates the number of days between the start of 2011 and the current date.
	=NOW()-TIME(8,45,0)	Calculates the time elapsed since 8:45 in hours.
	=B4-C4	Calculates the difference between the two values, dates or times stored in the two cells.

Note: You may need to select an appropriate format for the cell containing such formulas to ensure the result LOOKS like a date or time.

See also: **Simple Comparisons** Page 52.

Calculate a Date/Time from another Date/Time

You may add or subtract a number of days to or from a date:

e.g.	***=DATE(2011,1,1)+28***	Adds 28 days.
	=C5-28	Subtracts 28 days from the date in C5

You may add or subtract a time from another time in much the same way.

e.g.	=***D5+TIME(2,30,00)***	Add 2 ½ hours to the time in D5.
	=D5-0.5	Subtract ½ a day (12hrs) from the time in D5

Note: You may need to select an appropriate format for the cell containing such formulas to ensure the result LOOKS like a date or time.

TEXT BASED FORMULAS

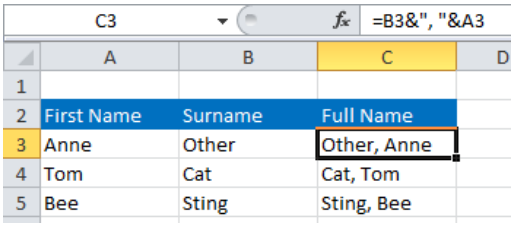
Many people do not realise that formulas can be used to perform calculations with text entries as well as numbers. Excel provides tools to Join Text Items together and to extract part of a longer text entry.

EXAMPLE TEXT BASED FORMULAS

Concatenation

This is a big word that means: joining text items together.

e.g. `=B3&", "&A3`



Where:

`&`	Is the operator that joins text items together.
`A3`	Contains the First Name.
`B3`	Contains the Surname.
`", "`	Text string to add a Comma and a space to separate the First Name from the Surname.

Extracting Part of a String

Excel provides 3 useful functions:

LEFT Extracts the first few characters of a string.

e.g. `=LEFT("String",2)` Extracts the first 2 letters.

RIGHT Extracts the last few characters of a string.

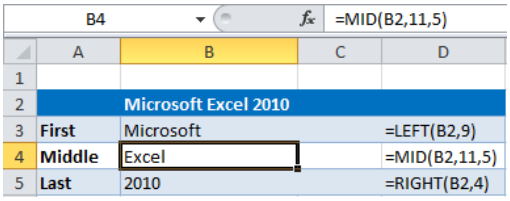
e.g. `=RIGHT("String",2)` Extracts the last 2 letters.

MID Extracts characters from the middle of a string

e.g. `=MID("String",Start,Count)`

Extracts `Count` characters starting from the `Start` position.

There are very many other functions in Excel that can be applied to text based data - explore the Excel help files for further information



COMPARISON FORMULAS (ASKING QUESTIONS)

It is common to compare values, dates and times to determine if they are equal, not equal bigger or smaller etc. This can be done at a primitive level using a direct comparison giving a true/false response (Logical data). It is more normal to incorporate this simple comparison into a more complex function so that more useful responses can be calculated.

COMPARISON OPERATORS

=	Equals
<	Less than
<=	Less than or equal to.
>	Greater than
>=	Greater than or equal to
<>	Not equal to

EXAMPLE FORMULAS USING COMPARISON OPERATORS

Simple Comparisons

Simple comparisons of two data items create logical data - True & False.

Although they are perfectly valid it is unusual to use logical data directly in a cell.

Simple Comparisons are more commonly used in the Data Validation and Conditional formatting features of Excel or as a component of a more complex formula - see next example.

E5 =TODAY()>D5

	A	B	C	D	E	F	G
1	ORDER PROCESSING						
2	15-Mar-2013	Today's Date					
3							
4	Invoice Date	Invoice Number	Customer	Payment Due	Overdue	Delivery Due	Overdue
5	24-Jan-2013	C100	D. Mented	23-Feb-2013	TRUE	07-Feb-2013	TRUE
6	29-Jan-2013	C101	A. Sales	28-Feb-2013	TRUE	12-Feb-2013	TRUE
7	04-Feb-2013	C102	I. Boreham	06-Mar-2013	TRUE	18-Feb-2013	TRUE
8	12-Feb-2013	C103	B. Sting	14-Mar-2013	TRUE	26-Feb-2013	TRUE
9	13-Feb-2013	C104	T. Cup	15-Mar-2013	FALSE	27-Feb-2013	TRUE
10	23-Feb-2013	C105	V. Neck	25-Mar-2013	FALSE	09-Mar-2013	TRUE
11	01-Mar-2013	C106	X. Ray	31-Mar-2013	FALSE	15-Mar-2013	FALSE
12	15-Mar-2013	C107	Hazel Nuts	14-Apr-2013	FALSE	29-Mar-2013	FALSE

Notice the formulas in the Overdue columns which are comparing the Due date with Today') date to highlight entries that need an action. (The highlight is provided by Conditional formatting).

e.g. ***=TODAY()>D5***

Where:

TODAY()	Is a function returning the current date – which is updated whenever the spreadsheet is recalculated.
D5	Is a cell containing a date stating when some action is/was due to happen.
>	Compares the two dates.

Formula:

Returns	**True**	When the current date has exceeded the due date.
	False	When the current date has not yet reached the due date.

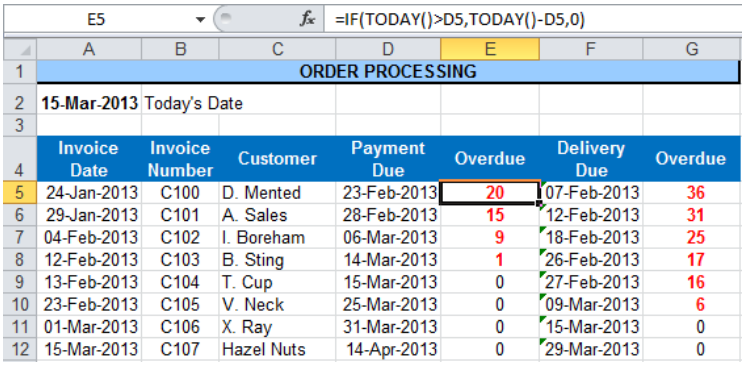
Note: Comparison formulas can be used to compare any two data items of the same type including, Text, Numbers, Dates, & Times etc.

Using the IF Function

A typical use of the IF function is to compare two values and react in two different ways depending on the result of the comparison.

The IF Function can use a Simple Comparison as one of its components.

This example is a more advanced version of the previous one which calculates the number of days overdue for problem entries.



E5 =IF(TODAY()>D5,TODAY()-D5,0)

	A	B	C	D	E	F	G
1	ORDER PROCESSING						
2	15-Mar-2013 Today's Date						
3							
4	Invoice Date	Invoice Number	Customer	Payment Due	Overdue	Delivery Due	Overdue
5	24-Jan-2013	C100	D. Mented	23-Feb-2013	20	07-Feb-2013	36
6	29-Jan-2013	C101	A. Sales	28-Feb-2013	15	12-Feb-2013	31
7	04-Feb-2013	C102	I. Boreham	06-Mar-2013	9	18-Feb-2013	25
8	12-Feb-2013	C103	B. Sting	14-Mar-2013	1	26-Feb-2013	17
9	13-Feb-2013	C104	T. Cup	15-Mar-2013	0	27-Feb-2013	16
10	23-Feb-2013	C105	V. Neck	25-Mar-2013	0	09-Mar-2013	6
11	01-Mar-2013	C106	X. Ray	31-Mar-2013	0	15-Mar-2013	0
12	15-Mar-2013	C107	Hazel Nuts	14-Apr-2013	0	29-Mar-2013	0

e.g. ***=IF(TODAY()>D5,TODAY()-D5,0)***

where: ***=IF(…)*** Is the function which uses the following parameters:

TODAY()>D5 Is the simple comparison that checks if the entry is overdue.

It replies **TRUE** or **FALSE** - as shown in the previous example.

TODAY()-D5 Is calculated when the comparison returns a **TRUE** value.

It calculates the number of days overdue.

0 Is the value used when the comparison returns a **FALSE** value

Other Functions

There are numerous other functions that compare data values and perform calculations depending on the results.

Two of the most useful are: **COUNTIF**
SUMIF

You can see an advanced use of the SUMIF function:

Refer to: **Selective Row Totals** page 57.

ABSOLUTE CELL REFERENCES

This feature only applies to cell references in formulae which have to be copied. It has no effect whatsoever if the formulas are not copied to other locations in the worksheet. It is also commonly used in dialog boxes that use ranges - notably in the Sheet tabbed page in the Page Setup dialog box.

This feature is important when worksheets use single cells to control the contents of tables of data. For example, the rate of pay for staff, exchange rates, or the current interest rate etc., are all situations when a value is stored in one cell, but is used by formulas copied throughout a large table of data. When copying references to cells inside the table, they normally need to adjust in order to refer to each entry in turn; references to cells outside the table normally need to stay fixed on them.

Cell addresses in formulae may be copied in one of three ways:

Relative Addressing: Cell addresses are adjusted automatically, when formulas are copied to new locations. This is the normal state of affairs.

Absolute Addressing: Cell addresses are not adjusted when formulas are copied to new locations.

i.e. They refer to one fixed cell/range in the worksheet.

Mixed Addressing: This is a halfway stage between the above two options, where one of the co-ordinates is treated as relative and the other is treated as absolute, so allowing the cell references to adjust when copied in one direction, but not when copied in the other direction.

Cell references which have been wholly or partially absoluted, are shown with $ symbols in front of each co-ordinate which has been fixed. In any one formula, individual cell references may be dealt with entirely independently of each other, and a mixture of the differing address types, listed above, may be used.

You may create absolute references by either:

Keyboard: 

The $ character can be typed at the appropriate position(s) in any formulae you enter or edit.

Toggles all four settings for Absolute, Relative and Mixed cell addressing.

Use in Enter/Edit mode to affect the cell reference containing the text cursor.

Use in Point Mode when pointing at the appropriate cell or range.

Note In Point Mode you cannot type the $ symbols.

The following four options are available - whichever method is used:

Relative:	***A1***	Normal relative address. Both row and column co-ordinates are allowed to adjust automatically.
Absolute:	***$A$1***	Absolute address. Both row and column co-ordinates are fixed, and so will not adjust automatically when copied in any direction.
Row Fixed:	***A$1***	Mixed address. The column co-ordinate is allowed to adjust when the formula is copied sideways, but the row co-ordinate is fixed and will not adjust when the formula is copied vertically.
Column Fixed:	***$A1***	Mixed address. The column co-ordinate is fixed and will not adjust when the formula is copied sideways, but the row co-ordinate is allowed to adjust automatically when the formula is copied vertically.

Notes

Row/Column ranges omit the reference to one of the co-ordinates.

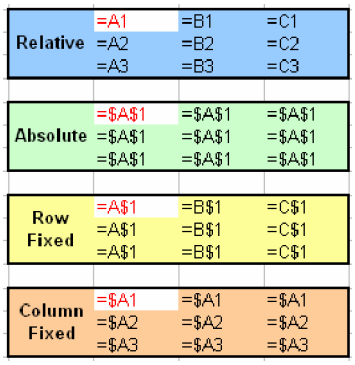
The $ symbols have no effect whatsoever on the calculated result from any formulae - they only affect the behaviour of the Copy commands.

Copied formulas, that have incorrect Absolute, Relative, and Mixed cell addressing, usually give themselves away very obviously as the results tend to look very obviously wrong - and may well be littered with a number of Excel error messages.

Range Name definitions normally assume Absolute Cell References.

EXAMPLE FORMULAS USING ABSOLUTE REFERNCES

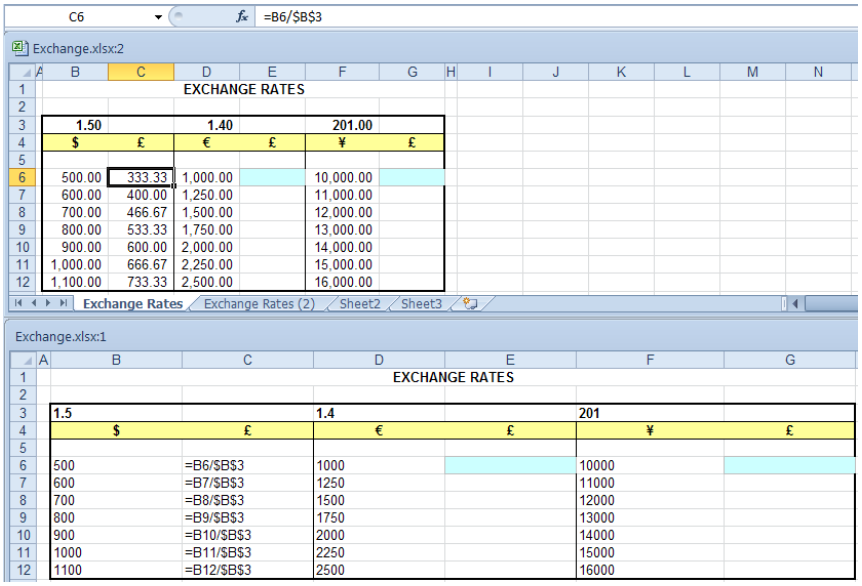
The illustration shows a simple worksheet in Formula Auditing Mode (formulas visible), indicating how the cell reference in the first cell in each section is adjusted when copied into the rest of the range.



Conversion Rates - Arithmetic Formula

This example illustrates the use of Absolute cell reference in an Arithmetic Formula to fix the reference to a single cell containing an Exchange rate - the principle can be applied to any Conversion rate.

The illustration shows two views, a normal view showing results and a formula view showing how the absolute references affected the way the formula was copied down the column.



Exchange.xlsx:2

	B	C	D	E	F	G
1	EXCHANGE RATES					
2						
3	1.50		1.40		201.00	
4	$	£	€	£	¥	£
5						
6	500.00	333.33	1,000.00		10,000.00	
7	600.00	400.00	1,250.00		11,000.00	
8	700.00	466.67	1,500.00		12,000.00	
9	800.00	533.33	1,750.00		13,000.00	
10	900.00	600.00	2,000.00		14,000.00	
11	1,000.00	666.67	2,250.00		15,000.00	
12	1,100.00	733.33	2,500.00		16,000.00	

Exchange.xlsx:1

	B	C	D	E	F	G
1	EXCHANGE RATES					
2						
3	1.5		1.4		201	
4	$	£	€	£	¥	£
5						
6	500	=B6/$B$3	1000		10000	
7	600	=B7/$B$3	1250		11000	
8	700	=B8/$B$3	1500		12000	
9	800	=B9/$B$3	1750		13000	
10	900	=B10/$B$3	2000		14000	
11	1000	=B11/$B$3	2250		15000	
12	1100	=B12/$B$3	2500		16000	

Notice: How the reference to **F3** is fixed so that when the formula was copied down the column it did not change.

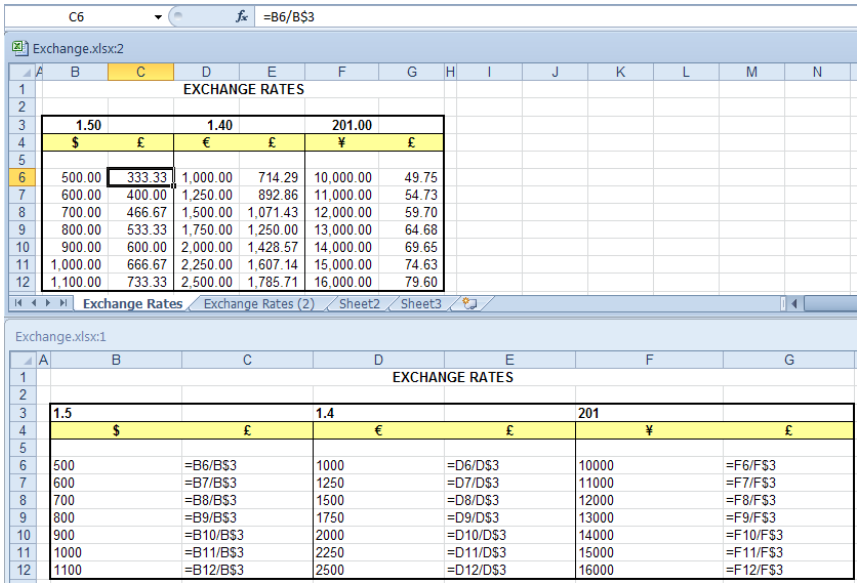
The reference to **B6** is not fixed so this did adjust as the formula was copied down the column.

A more advanced version of this spreadsheet allows the formula to be copied and pasted into Columns E and G as well as filled down column C.

This time mixed addressing has been used in the original formula in **C6** that references the cell **B3**.

The row number is fixed, so that the formula can be copied down the column without changing the reference to **B3**.

The column letter is not fixed to allow the reference to **B3** to change to **D3** and **F3** when the formulas in column C are copied and pasted into columns E and G.



Exchange.xlsx:2

	B	C	D	E	F	G
1	EXCHANGE RATES					
2						
3	1.50		1.40		201.00	
4	$	£	€	£	¥	£
5						
6	500.00	333.33	1,000.00	714.29	10,000.00	49.75
7	600.00	400.00	1,250.00	892.86	11,000.00	54.73
8	700.00	466.67	1,500.00	1,071.43	12,000.00	59.70
9	800.00	533.33	1,750.00	1,250.00	13,000.00	64.68
10	900.00	600.00	2,000.00	1,428.57	14,000.00	69.65
11	1,000.00	666.67	2,250.00	1,607.14	15,000.00	74.63
12	1,100.00	733.33	2,500.00	1,785.71	16,000.00	79.60

Exchange.xlsx:1

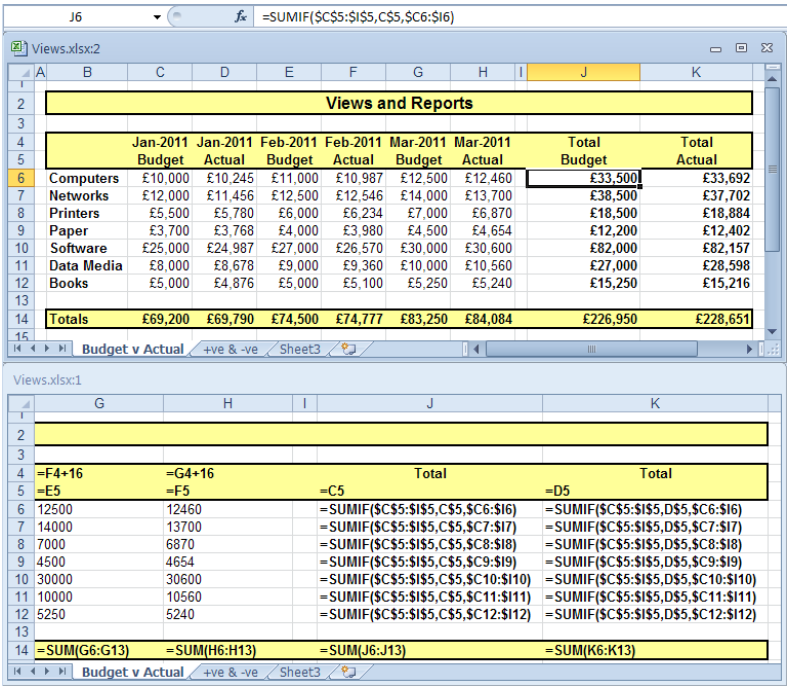
	B	C	D	E	F	G
1	EXCHANGE RATES					
2						
3	1.5		1.4		201	
4	$	£	€	£	¥	£
5						
6	500	=B6/B$3	1000	=D6/D$3	10000	=F6/F$3
7	600	=B7/B$3	1250	=D7/D$3	11000	=F7/F$3
8	700	=B8/B$3	1500	=D8/D$3	12000	=F8/F$3
9	800	=B9/B$3	1750	=D9/D$3	13000	=F9/F$3
10	900	=B10/B$3	2000	=D10/D$3	14000	=F10/F$3
11	1000	=B11/B$3	2250	=D11/D$3	15000	=F11/F$3
12	1100	=B12/B$3	2500	=D12/D$3	16000	=F12/F$3

Selective Row Totals - Using a Function.

This example shows an advanced use of Absolute cell references combined with the SUMIF function. It is designed to calculate row totals by column heading.

The formula in **J6** was copied into **J6:K12**.

SUMIF is a function that sums data selected using simple criteria.



J6 =SUMIF($C$5:$I$5,C$5,$C6:$I6)

Views.xlsx:2

	A	B	C	D	E	F	G	H	I	J	K
2		Views and Reports									
3											
4			Jan-2011	Jan-2011	Feb-2011	Feb-2011	Mar-2011	Mar-2011		Total	Total
5			Budget	Actual	Budget	Actual	Budget	Actual		Budget	Actual
6		Computers	£10,000	£10,245	£11,000	£10,987	£12,500	£12,460		£33,500	£33,692
7		Networks	£12,000	£11,456	£12,500	£12,546	£14,000	£13,700		£38,500	£37,702
8		Printers	£5,500	£5,780	£6,000	£6,234	£7,000	£6,870		£18,500	£18,884
9		Paper	£3,700	£3,768	£4,000	£3,980	£4,500	£4,654		£12,200	£12,402
10		Software	£25,000	£24,987	£27,000	£26,570	£30,000	£30,600		£82,000	£82,157
11		Data Media	£8,000	£8,678	£9,000	£9,360	£10,000	£10,560		£27,000	£28,598
12		Books	£5,000	£4,876	£5,000	£5,100	£5,250	£5,240		£15,250	£15,216
13											
14		Totals	£69,200	£69,790	£74,500	£74,777	£83,250	£84,084		£226,950	£228,651

Budget v Actual | +ve & -ve | Sheet3

Views.xlsx:1

	G	H	I	J	K
2					
3					
4	=F4+16	=G4+16		Total	Total
5	=E5	=F5		=C5	=D5
6	12500	12460		=SUMIF($C$5:$I$5,C$5,$C6:$I6)	=SUMIF($C$5:$I$5,D$5,$C6:$I6)
7	14000	13700		=SUMIF($C$5:$I$5,C$5,$C7:$I7)	=SUMIF($C$5:$I$5,D$5,$C7:$I7)
8	7000	6870		=SUMIF($C$5:$I$5,C$5,$C8:$I8)	=SUMIF($C$5:$I$5,D$5,$C8:$I8)
9	4500	4654		=SUMIF($C$5:$I$5,C$5,$C9:$I9)	=SUMIF($C$5:$I$5,D$5,$C9:$I9)
10	30000	30600		=SUMIF($C$5:$I$5,C$5,$C10:$I10)	=SUMIF($C$5:$I$5,D$5,$C10:$I10)
11	10000	10560		=SUMIF($C$5:$I$5,C$5,$C11:$I11)	=SUMIF($C$5:$I$5,D$5,$C11:$I11)
12	5250	5240		=SUMIF($C$5:$I$5,C$5,$C12:$I12)	=SUMIF($C$5:$I$5,D$5,$C12:$I12)
13					
14	=SUM(G6:G13)	=SUM(H6:H13)		=SUM(J6:J13)	=SUM(K6:K13)

Budget v Actual | +ve & -ve | Sheet3

e.g. ***=SUMIF($C$5:$I$5,C$5,$C6:$I6)***

Where: ***$C$5:$I$5***

Is the range containing the info that identifies the data to be summed i.e. the column headings.

This range needs Absolute references to fix it to the same range when it is copied down the column and in to the adjacent column.

C$5

Indicates the column heading to be included in the calculation.

It uses a fixed row to point at the column heading, but the column is not fixed so that it adjusts when the formula is copied into the adjacent column.

$C6:$I6

This is a reference to the row of cells to be summed for the row total. Only those values with the correct column heading will be included in the total.

The column is fixed to stop the reference changing when the formula is copied into the adjacent column. The row is not fixed to allow it to adjust when it is copied down the column.

NAMED REFERENCES

Microsoft Excel allows you to apply names to items that may be used in formulas:

Cell Ranges Named ranges (including single cells) are commonly used as a replacement for normal cell and range references.

They may be used in any circumstance where a cell or range reference may be used – including dialog box entries.

They have the advantage of being easier to remember, especially as the name never changes whereas cell references often do.

They can also make the logic of formulas easier to understand if you use names that have clear meanings.

At an advanced level there are some types of formula that will only work properly if range names are used.

Macros work better when they use names to reference cells.

See below.

Constants This is when a name is used to reference a fixed value. Rarely used but again can help make formulas more readable.

See page 63.

Formulas Named formulas are an advanced use of names. The most common use of formulas is to create dynamic named ranges that can react to insertion and deletion of rows. Though these notes provide an alternative solution for this.

See page 63.

NAMING CONVENTIONS

Any name you use must obey the following rules. In effect these rules are to ensure that any names you use do not have alternative meanings in formulas. Keeping to normal descriptive names will usually avoid any issues.

1. Names may contain letters, digits and some symbols e.g. underscore (_).
2. Names are not case sensitive but are displayed with the same case as is typed when the names are created.
3. Names must start with a letter.
4. Names may **not** contain arithmetic and other symbols that are used in formulas – e.g. **+**, **:**, **space** etc
5. Names may **not** form a cell co-ordinate. e.g. **A1**.
6. Names must be unique.

7. Some names are used by Excel for system purposes and should be avoided.

   e.g. **Print_Area**, **Print_Titles**, **Criteria**, **Extract**

8. Names may use the same name as Functions. Functions are identified by always using a pair of brackets.

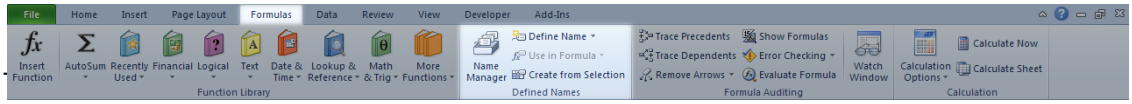
   e.g. **TODAY** & **SUM** Are valid names.

   TODAY() & **SUM()** Are functions.

9. Names must be unique within the worksheet or workbook. In earlier versions of Excel they need to be unique within the workbook.

RIBBON

Names are managed using the Defined Names section of the Formulas Ribbon.



RANGE NAMES

A Name can be applied to any cell or range, and afterwards used in place of the normal co-ordinates in any formula or dialog box.

Defining Range Names

This feature allows you to create, edit, or delete the definition of a range name.

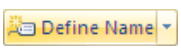
Defining a range name is the process of selecting a range, and giving it a name.

There are two methods for defining a named range.

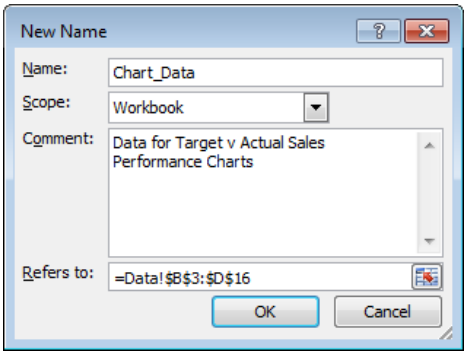
New Name Dialog Box

Select the cell or range to name, then use:

Ribbon: **Formulas**



Click on the Icon to define a new name (assumed in what follows) or click on the drop down arrow to display further choices.



Name Enter a suitable descriptive name for the highlighted cell or range. Excel may offer a name based on the contents of the first cell in the range.

Scope: Indicates and allows you to select the scope of the Name. The name must be unique within its scope.

The name may apply to the whole Workbook, or be limited to the current worksheet. The latter would allow the same name to be used on other worksheets within the same workbook.

Refers To The range referenced by the new name.

Note Range names are normally defined using Absolute Cell References. You may edit the entry to remove the **$** symbols to create relative addresses in the definition - not recommended without a good reason.

OK Defines the new named range.

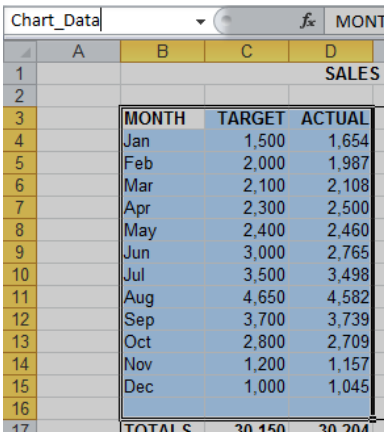
Cancel Cancels the dialog box without creating a new name

Formula Bar

You may also define a name for a cell or range by typing a name into the Name Box on the formula bar as follows:

1. Select the cell(s) to be named.
2. Mouse: Inside the Name Box - at the left hand side of the Formula Bar.
3. Type/edit the required name. Press ↵ or Enter when finished - required.

   Other methods of finishing the entry do not work.



Notes This method always creates range name definitions with Absolute Cell References.

The Name Box displays the name of a cell or range when it is selected.

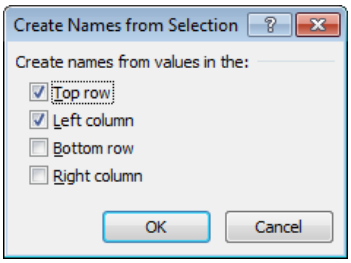
Typing an existing name will not change the definition of the name; instead it selects the range within the workbook - effectively a Go To Command.

Creating Range Names from Cell Entries

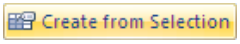
This feature allows you to use text entries (labels) contained within the worksheet to create named ranges for adjacent cell ranges. This allows you to create a number of range names quickly. Range names which have the same name as entries in the worksheet are even easier for the user to remember.

Select the range in advance. The text to be used as names should be stored in the first/last row and/or column in the selected range. Excel will create range names which are slightly different to the cell entries if they contain characters that are not valid in range names.

Display the Create Names from Selection dialog box as follows:



Ribbon: **Formulas**



Keyboard: Shift + Ctrl + F3

Top row When selected, Excel uses the text in the top row of the selected range to name the highlighted column(s) of cell(s) below.

Left column When selected, Excel uses the text in the first column of the selected range to name the highlighted row(s) of cell(s) to the right.

Bottom row When selected, Excel uses the text in the bottom row of the selected range to name the highlighted column(s) of cell(s) above.

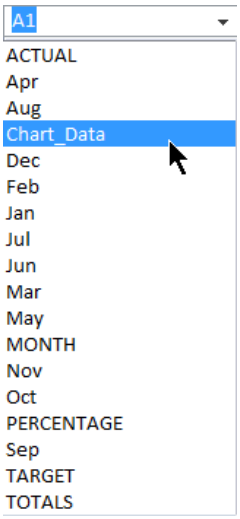
Right column When selected, Excel uses the text in the last column of the selected range to name the highlighted row(s) of cell(s) to the left.

Note The cells containing the text for the new Range Names are not included in the range name definition(s).

Select a Named Range

Name Box: 

Click on the Name Box drop down arrow to display a pick list of defined range names to select from, or simply type the name (or co-ordinates) in the Name Box.



Using Names in Formulas & Dialog Boxes

These methods all work whether you are typing the entry in Enter/Edit mode or when using a dialog box.

Keyboard: Type the range name into the Formula Bar or dialog box panel.

Paste Name: Select a range name from the Paste Name dialog box.

Display the Paste Name dialog box as follows:

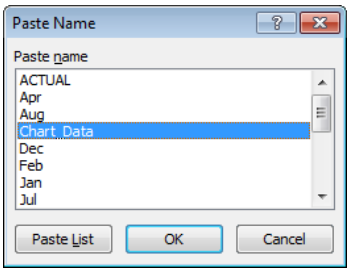
Ribbon: Use in Formula

Select from the list of names.

Or:

Paste names To display the Paste Names dialog box listing all the names.

Keyboard: F3



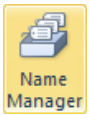
Managing Names

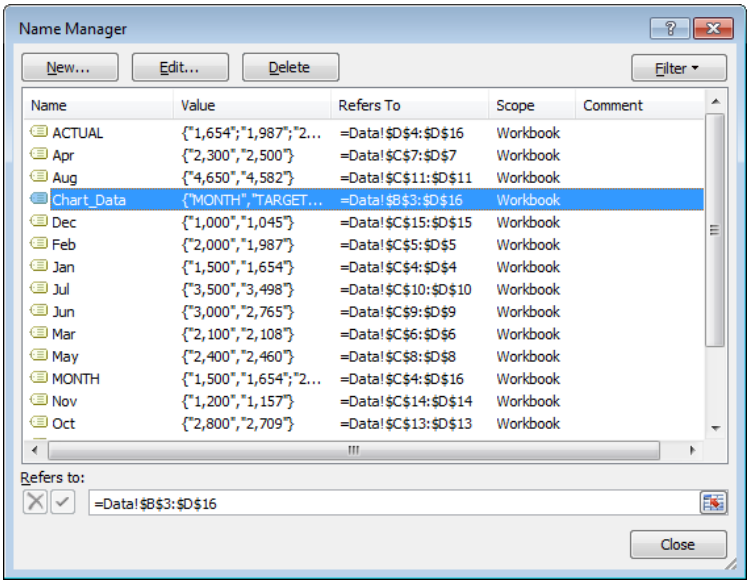
Excel 2010 provides a separate Name Manager dialog box where names can also be created, but this time it also allows you to edit and delete them.

Since these notes are intended to concentrate on Formulas, it is not fully explained here.

Refer to the Excel Help screens for further information.

Ribbon: **Formulas**

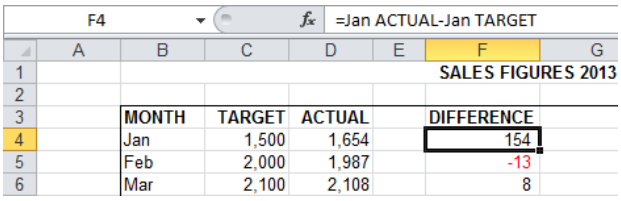




Notice That the definitions use Absolute Cell References.

EXAMPLE FORMULAS USING RANGE NAMES

Arithmetic Formula



e.g. ***=Jan ACTUAL-Jan TARGET***

Where:

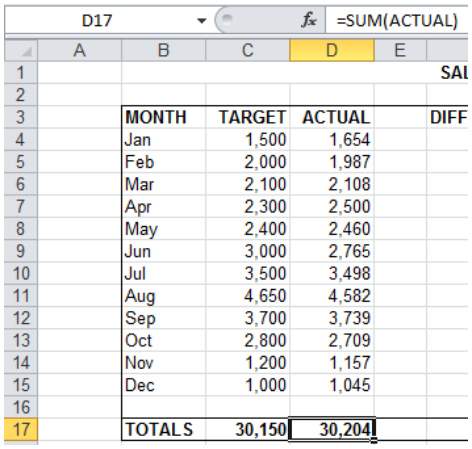
Jan	**C4:D4**
TARGET	**C4:C16**
ACTUAL	**D4:D16**

Note: Space is used as an operator to identify the intersection of ranges.

e.g. ***Jan TARGET*** identifies the intersection of these two ranges i.e. **C4**

This reference may be longer than one using co-ordinates but it is a lot easier to read and understand.

Using a Function



e.g. ***=SUM(ACTUAL)***

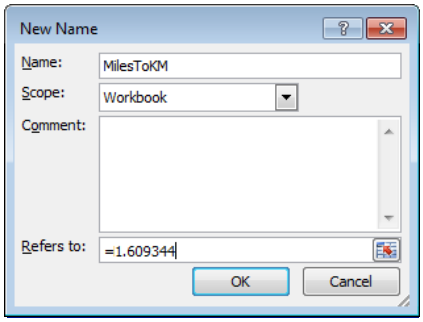
Sums the range **D4:D16**

Note: Excels tools for building formulas such as AutoSum - will automatically use the range name if one exists.

CONSTANT NAMES

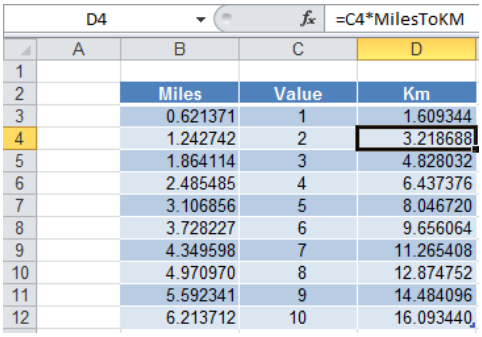
You may attach a name to any single value and use the name in place of the value in formulas.

Constant Names are defined in much the same way as Range names using the New Name dialog box (see page 59.)



Example Formula Using a Constant

This illustration uses the MilesToKM name as a conversion factor between miles and kilometres.



FORMULA NAMES

This use of names can be a bit brainstorming and is really only of use to advanced spreadsheet developers.

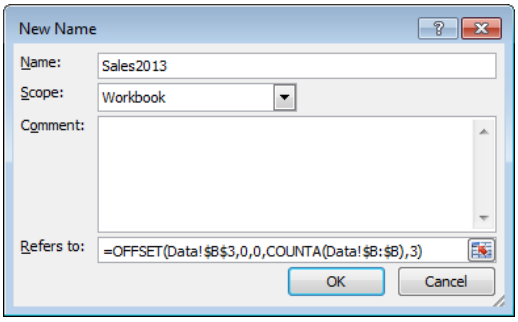
As before the name is created using the Define Name dialog box - only this time a formula is entered.

Note: In a way the Constant option show above is a primitive case of using a formula!

Dynamic Range Name Using a Formula

One of the problems traditionally associated with range names is getting the definition to update when new data is appended to the end of a range, (as opposed to inserting a row).

This formula calculates the number of rows to include in the range by counting how many entries contained in a table.



e.g. ***=OFFSET(Data!$B$3,0,0,COUNTA(Data!$B:$B),3)***

Where: ***OFFSET*** Is a function used to calculate the range.

Data!$B$3 Is a cell reference used as an origin for the range definition.

0,0 Defines an offset in rows and columns for the first cell in the range from the Origin.

Using 0,0 ensures the first cell and the origin are the same.

COUNTA(Data!$B:$B)
Counts the number of entries in Column B to define the number of rows in the range.

i.e. Dynamically works out how many rows to include in the range.

3 Indicates three columns in the range - this could also be counted if the number of columns needs to be dynamic as well.

e.g. ***COUNTA(Data!$4:$4)***

Once created such a range name can be used in much the same way as any other range name.

SUBTOTALS

When creating a large table with multiple Sub-Totals and a Grand Totals it becomes clear that the **SUM** function is good for creating the individual Sub-Totals but useless for creating the Grand Totals. This is due to the fact that when summing the whole column the **SUM** function sums the Sub-Totals as well as the individual values – so including values twice over.

In response to this, most people will resort to arithmetic to add the individual Sub-Totals. The correct solution is to use the **SUBTOTAL** function which is designed to calculate both the Sub-Totals and Grand Totals. The **SUBTOTAL** function is capable of doing nearly everything the **SUM** function can and a lot more:

1. The **SUBTOTAL** function does not include any other Sub-Totals in its calculations – so removing the problem of double counting.

2. The **SUBTOTAL** function can provide up to 11 different statistics - summing is only one of them.

3. The **SUBTOTAL** function can work with the AutoFilter command to perform calculations that exclude values hidden by filters.

   The **SUM** Function includes values hidden by filters.

The **SUBTOTAL** function requires two parameters:

1. ***=SUBTOTAL(number,range)***

2. A ***number*** from 1 - 11 to indicate the type of calculation required - see table.

   This allows the SUBTOTAL Function to be used as an alternative to the **AVERAGE**, **COUNT**, **COUNTA**, **MAX**, **MIN** and **SUM** functions.

   Note: You may add 100 to these numbers which forces the function to ignore data in any hidden rows or columns in the range.

3. A ***range*** indicating the values to include in the calculation. This is exactly the same range as you would use for the **SUM** function.

Number	Calculation
1	Average.
2	Count values - ignores text entries.
3	Count all - including text entries.
4	Maximum value.
5	Minimum value.
6	Product (multiplies the values).
7	Standard Deviation.
8	Population Standard Deviation.
9	Sum - normal sub-total!
10	Variance.
11	Population Variance.

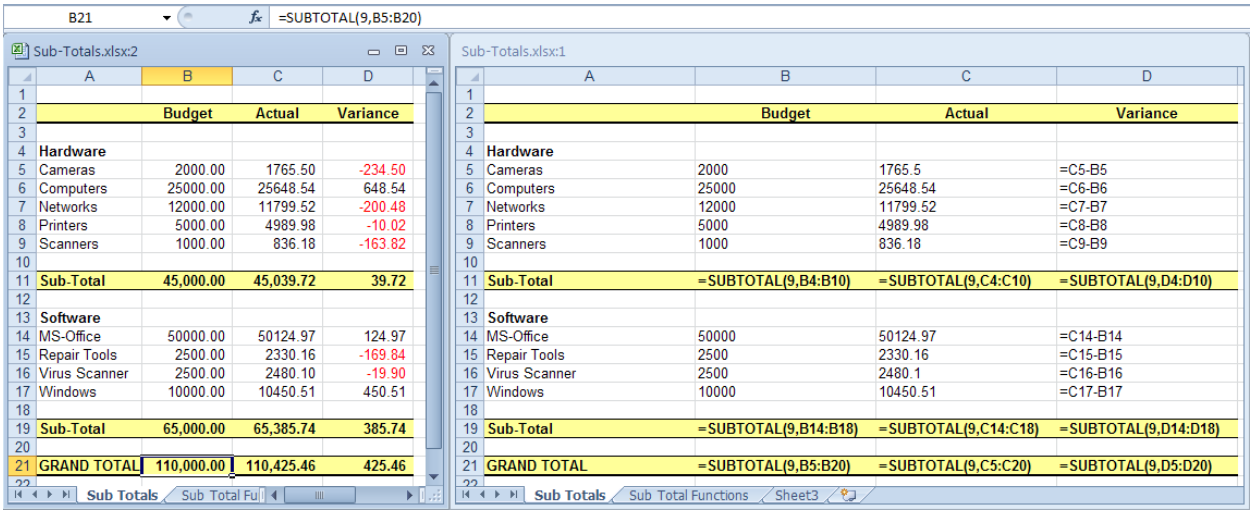
Note: The **SUBTOTAL** function is used by Excel in the Totals Row of **Structured Table**s

See page 84.

The following examples indicate some of the properties of the **SUBTOTAL** function.

EXAMPLE FORMULAS USING THE SUBTOTAL FUNCTION

Example 1



B21 =SUBTOTAL(9,B5:B20)

Sub-Totals.xlsx:2

	A	B	C	D
1				
2		Budget	Actual	Variance
3				
4	Hardware			
5	Cameras	2000.00	1765.50	-234.50
6	Computers	25000.00	25648.54	648.54
7	Networks	12000.00	11799.52	-200.48
8	Printers	5000.00	4989.98	-10.02
9	Scanners	1000.00	836.18	-163.82
10				
11	Sub-Total	45,000.00	45,039.72	39.72
12				
13	Software			
14	MS-Office	50000.00	50124.97	124.97
15	Repair Tools	2500.00	2330.16	-169.84
16	Virus Scanner	2500.00	2480.10	-19.90
17	Windows	10000.00	10450.51	450.51
18				
19	Sub-Total	65,000.00	65,385.74	385.74
20				
21	GRAND TOTAL	110,000.00	110,425.46	425.46

Sub Totals | Sub Total Fu

Sub-Totals.xlsx:1

	A	B	C	D
1				
2		Budget	Actual	Variance
3				
4	Hardware			
5	Cameras	2000	1765.5	=C5-B5
6	Computers	25000	25648.54	=C6-B6
7	Networks	12000	11799.52	=C7-B7
8	Printers	5000	4989.98	=C8-B8
9	Scanners	1000	836.18	=C9-B9
10				
11	Sub-Total	=SUBTOTAL(9,B4:B10)	=SUBTOTAL(9,C4:C10)	=SUBTOTAL(9,D4:D10)
12				
13	Software			
14	MS-Office	50000	50124.97	=C14-B14
15	Repair Tools	2500	2330.16	=C15-B15
16	Virus Scanner	2500	2480.1	=C16-B16
17	Windows	10000	10450.51	=C17-B17
18				
19	Sub-Total	=SUBTOTAL(9,B14:B18)	=SUBTOTAL(9,C14:C18)	=SUBTOTAL(9,D14:D18)
20				
21	GRAND TOTAL	=SUBTOTAL(9,B5:B20)	=SUBTOTAL(9,C5:C20)	=SUBTOTAL(9,D5:D20)

Sub Totals | Sub Total Functions | Sheet3

This illustration shows two views of the same workbook, one normal and one showing the formulas.

Subtotals - Cell B11

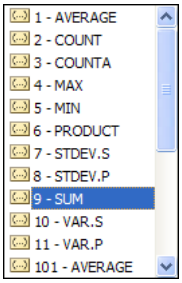
Formula: ***=SUBTOTAL(9,B4:B10)***

Where: ***9*** Indicates that the **SUBTOTAL** function should sum the data.

B4:B10 Indicates the range of values to be summed.

Note: That the Subtotals are calculated using the **SUBTOTAL** function as a direct replacement for the normal **SUM** function.

When typing the formula, Excel will prompt you to select the calculation you need the Subtotal Command to perform by displaying a list to choose from – illustrated.



Grand Totals – Cell B21

Formula: ***=SUBTOTAL(9,B4:B20)***

Where: ***9*** Indicates that the **SUBTOTAL** function should sum the data.

B4:B20 Indicates the range of values to be summed.

Note: This range includes the other Subtotals, but the **SUBTOTAL** function is designed to ignore them - so preventing double counting.

Example 2

In this illustration the Formulas have been created using the Subtotal Command on a simple Excel database table. This command has also provided the Outline Groups for the data. This Outline has been used to hide (But not filter) most of the table entries to show 2 of records for two departments and all the subtotals and grand totals.

The **SUBTOTAL** function has been used to count entries by department for various columns in the table.

L106 =SUBTOTAL(3,L94:L105)

	Rec No.	Title	First Name	Surname	Works Number	Department	Salary	Hourly Rate	Company Car
15					**Accounts Count**	13	13	0	2
27					**Admin Count**	11	11	0	0
34					**Management Count**	6	6	0	6
80					**Production Count**	45	0	45	0
81	13	Mr	Ray	Lay	C 2725	Purchasing	8,950		
82	31	Mr	Giles	Flood	N 90	Purchasing	12,000		
83	47	Mrs	Susan	Plum	C 3535	Purchasing	18,000		
84	68	Mrs	Vicky	Deer	N 3447	Purchasing	12,000		
85	84	Mr	Oliver	Compton	N 1112	Purchasing	12,000		
86					**Purchasing Count**	5	5	0	0
93					**R & D Count**	6	6	0	6
94	4	Mr	Ian	Price	A 3816	Sales			Ford
95	10	Mrs	Sharon	Andrews	N 2176	Sales			Ford
96	22	Mr	Kevin	Croft	A 1107	Sales			Ford
97	28	Mr	Trevor	Smith	N 4456	Sales			Ford
98	38	Mr	Peter	Rhule	C 4289	Sales			Ford
99	44	Mr	John	Smith-Jones	A 3868	Sales			Ford
100	59	Mr	Melvin	Knowles	C 299	Sales	35,000		BMW
101	65	Mr	Kevin	Lee	A 3464	Sales			Ford
102	75	Mr	Ted	Fish	N 4160	Sales			Ford
103	81	Miss	Kim	Geer	A 2305	Sales			Ford
104	91	Mrs	Hazel	Flemming	N 1658	Sales			Ford
105	97	Mrs	Carole	Stalker	N 299	Sales			Ford
106					**Sales Count**	12	1	0	12
107					**Grand Count**	98	42	45	26

Subtotals: **Cell L106**

Formula: ***=SUBTOTAL(3,L94:L105)***

Provides a head count for the number of people in the department.

Where: ***3*** Indicates that the **SUBTOTAL** function should count all cells containing data within the range.

L94:L95 The range used for the calculation.

Note: That the Subtotals are calculated using the **SUBTOTAL** function as a direct replacement for the normal **COUNTA** function.

Grand Totals: **Cell L107**

Formula: ***=SUBTOTAL(3,L2:L105)***

Provides a head count for the number of people in the department.

Where: ***3*** Indicates that the **SUBTOTAL** function should count all cells containing data within the range.

L2:L95 The range used for the calculation.

Note: This range includes the other Subtotals, but the **SUBTOTAL** function is designed to ignore them - so preventing double counting.

SUBTOTAL COMMAND

This command provides an easy way of inserting Subtotal and Grand Total calculations into a table. It uses a dialog box where you select what you need and lets Excel do the hard bit of creating the formulas and grouping entries into an Outline.

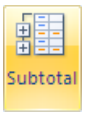
Before using the command the table needs to be sorted using the column that will be used to identify the groups.

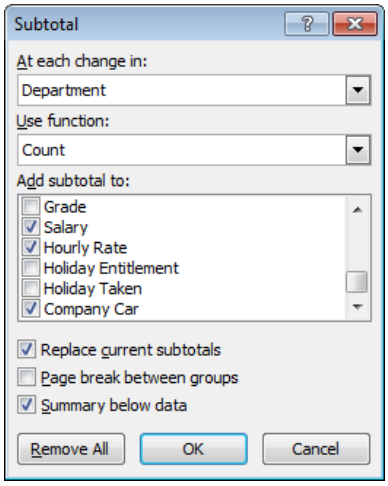
In the example illustrated above the table was sorted into Department Order so that the command could provide subtotals by Department.

Access the command using:

Ribbon: **Data**

Section: **Outline**

Tool: 



At each change in

Indicates the field (column) that will be used to group the data.

Select the column that you used to sort the table by prior to accessing the dialog box.

Use function Indicates and allows you to select one of the eleven different functions that you want to use in your sub-totals. - see earlier for full list.

Add subtotal to

Tick/untick the check boxes to select/deselect the fields (columns) that Excel will apply subtotals to.

Replace current subtotals

When selected, any subtotals previously applied by this dialog box will be replaced.

When not selected, the subtotals will be applied in addition to any that already exist - this allows you to create a series of different sub-totals providing difference statistics.

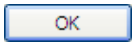
Page break between groups

When selected, Excel will add page breaks to your table that will ensure that each group starts on a new printed page.

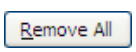
Summary below data

When selected, Subtotals and Grand totals are positioned below the ranges they relate to.

When not selected, the formulas are placed above the ranges.



Creates the subtotals as specified in the dialog box.



Removes all subtotals applied by this command to leave you with the original plain table.

LOOKUP TABLES

A **Lookup Table** is a normal table that contains data that can be accessed from and used by formulas elsewhere in the workbook. They provide a way of storing information once that allows you to use it many times. This makes it much easier to manage the information that they store.

There are various ways of creating Lookup Tables depending on the exact requirement but by far the most common is a Vertical Lookup Table which is achieved using the **VLOOKUP** function.

Other functions that you might want to explore in Excel's help system include **LOOKUP**, **HLOOKUP** and **MATCH**.

The **VLOOKUP** function is described in the following examples.

EXAMPLE FORMULAS FOR LOOKUP TABLES

When Looking Up an entry in a Lookup Table, the search process can work in one of two ways.

Exact Match: Excel searches the first column of the Lookup Table for an exact match (case sensitive) and replies back with data if it finds a match or an error if no match is found.

For this purpose the Lookup Table does not need to be sorted.

Exact Matches are most commonly used when searching for text entries.

Range: Excel searches the first column until it either finds and exact match or the last entry it finds before the search goes beyond what it is looking for.

This implies that the Lookup Table must be sorted into ascending order on the first column. Otherwise it may never reach entries at the bottom of the table.

Range lookups are commonly used when looking up numeric values - including dates, where it is impractical to list every possible value.

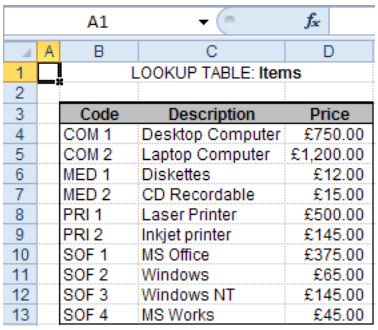
Exact Match Lookup

This example uses a product database as a Lookup Table. Another simplistic table looks up product details based on a Product Code.

Lookup Table: The Lookup functions search down the first column of the table and return values for matching entries from any of the other columns.

Notes: References to the Lookup Table should not include the column headings - just the raw data.

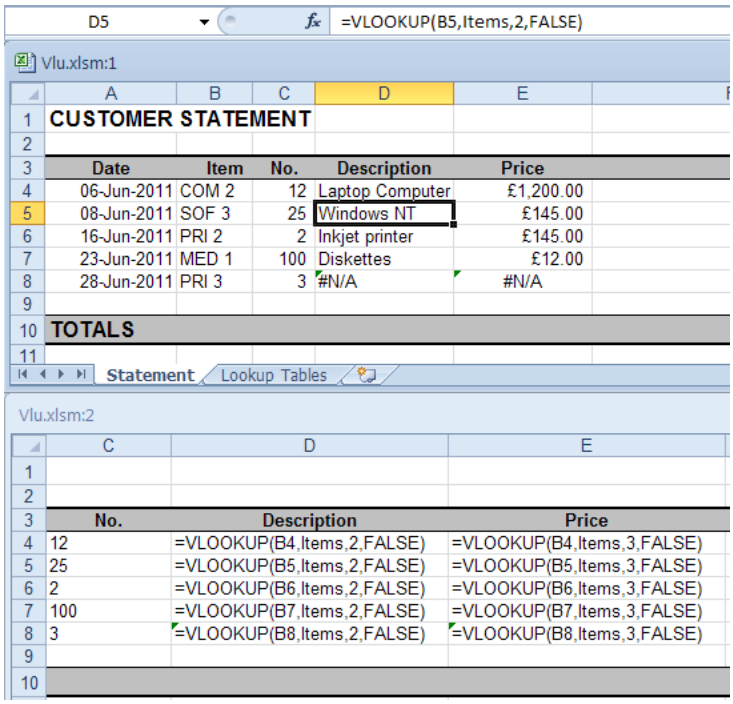
This Lookup Table has been assigned a range name of **Items**.



	A	B	C	D
1		LOOKUP TABLE: **Items**		
2				
3		Code	Description	Price
4		COM 1	Desktop Computer	£750.00
5		COM 2	Laptop Computer	£1,200.00
6		MED 1	Diskettes	£12.00
7		MED 2	CD Recordable	£15.00
8		PRI 1	Laser Printer	£500.00
9		PRI 2	Inkjet printer	£145.00
10		SOF 1	MS Office	£375.00
11		SOF 2	Windows	£65.00
12		SOF 3	Windows NT	£145.00
13		SOF 4	MS Works	£45.00

Formulas

Two views of the same worksheet that uses the VLOOKUP function to lookup a Product Code in the Lookup Table and return details such as Description and Price.



D5 =VLOOKUP(B5,Items,2,FALSE)

Vlu.xlsm:1

	A	B	C	D	E
1	CUSTOMER STATEMENT				
2					
3	Date	Item	No.	Description	Price
4	06-Jun-2011	COM 2	12	Laptop Computer	£1,200.00
5	08-Jun-2011	SOF 3	25	Windows NT	£145.00
6	16-Jun-2011	PRI 2	2	Inkjet printer	£145.00
7	23-Jun-2011	MED 1	100	Diskettes	£12.00
8	28-Jun-2011	PRI 3	3	#N/A	#N/A
9					
10	TOTALS				
11					

Statement | Lookup Tables

Vlu.xlsm:2

	C	D	E
1			
2			
3	No.	Description	Price
4	12	=VLOOKUP(B4,Items,2,FALSE)	=VLOOKUP(B4,Items,3,FALSE)
5	25	=VLOOKUP(B5,Items,2,FALSE)	=VLOOKUP(B5,Items,3,FALSE)
6	2	=VLOOKUP(B6,Items,2,FALSE)	=VLOOKUP(B6,Items,3,FALSE)
7	100	=VLOOKUP(B7,Items,2,FALSE)	=VLOOKUP(B7,Items,3,FALSE)
8	3	=VLOOKUP(B8,Items,2,FALSE)	=VLOOKUP(B8,Items,3,FALSE)
9			
10			

e.g. ***=VLOOKUP(B5,Items,2,FALSE)***

B5 Contains the product code to find in the Lookup Table.

Items A reference to the Lookup Table. This reference must use Absolute Cell References - these are assumed in range names.

2 Returns the entry from the 2nd column of the lookup table for the first matching entry.

FALSE Forces an Exact Match lookup.

Notice: the **#NA** errors in row 8 of the illustration arise because the code **PRI 3** cannot be found in the Lookup Table.

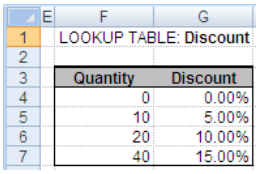
If a Range Lookup was used here the formula would return details for the item **PRI 2** – the one before the item it was looking for. Returning details belonging to the wrong item could be very bad news!

See also: **Absolute Cell References** Page 54.
Range Names Page 59.

Range Lookup

This example expands on the above and introduces the idea of volume discounts. The more items customers buy the more discount they get.

Lookup Table: A Table showing the ranges of values that qualify for a discount.



	F	G
1	LOOKUP TABLE: **Discount**	
2		
3	**Quantity**	**Discount**
4	0	0.00%
5	10	5.00%
6	20	10.00%
7	40	15.00%

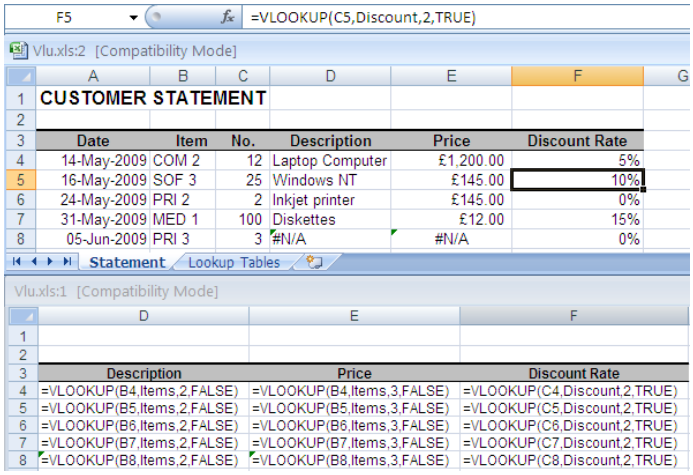
e.g. 10 - 19 Qualifies for a 5% discount.

Notes: References to the Lookup Table should not include the column headings - just the raw data.

The table must be sorted into ascending order of the first column.

This Lookup Table has been assigned a range name of **Discount**.

Formulas: Two views of the same worksheet that uses the **VLOOKUP** function to lookup a quantity purchased in the Lookup Table and return the Discount Rate.



F5 =VLOOKUP(C5,Discount,2,TRUE)

Vlu.xls:2 [Compatibility Mode]

	A	B	C	D	E	F	G
1	**CUSTOMER STATEMENT**						
2							
3	**Date**	**Item**	**No.**	**Description**	**Price**	**Discount Rate**	
4	14-May-2009	COM 2	12	Laptop Computer	£1,200.00	5%	
5	16-May-2009	SOF 3	25	Windows NT	£145.00	10%	
6	24-May-2009	PRI 2	2	Inkjet printer	£145.00	0%	
7	31-May-2009	MED 1	100	Diskettes	£12.00	15%	
8	05-Jun-2009	PRI 3	3	#N/A	#N/A	0%	

Statement | Lookup Tables

Vlu.xls:1 [Compatibility Mode]

	D	E	F
1			
2			
3	**Description**	**Price**	**Discount Rate**
4	=VLOOKUP(B4,Items,2,FALSE)	=VLOOKUP(B4,Items,3,FALSE)	=VLOOKUP(C4,Discount,2,TRUE)
5	=VLOOKUP(B5,Items,2,FALSE)	=VLOOKUP(B5,Items,3,FALSE)	=VLOOKUP(C5,Discount,2,TRUE)
6	=VLOOKUP(B6,Items,2,FALSE)	=VLOOKUP(B6,Items,3,FALSE)	=VLOOKUP(C6,Discount,2,TRUE)
7	=VLOOKUP(B7,Items,2,FALSE)	=VLOOKUP(B7,Items,3,FALSE)	=VLOOKUP(C7,Discount,2,TRUE)
8	=VLOOKUP(B8,Items,2,FALSE)	=VLOOKUP(B8,Items,3,FALSE)	=VLOOKUP(C8,Discount,2,TRUE)

e.g. ***=VLOOKUP(C5,Discount,2,TRUE)***

C5 Contains the number of items ordered that the **VLOOKUP** Function searches for in the Lookup Table.

Discount The range name of the Lookup Table. This reference must use Absolute Cell References - these are assumed in range names.

2 Returns the entry in the second column for the matching entry or last entry that is less than the value being looked up.

In this case the quantity is **25**, which is not found in the table so Excel returns a discount rate for a quantity of **20** or more.

TRUE Forces a Range Lookup.

See also: **Absolute Cell References** Page 54**Error! Bookmark not defined.**.
Range Names Page 59.

LINKING WORKSHEETS

You can create any normal formula that happens to reference a cell or a range on a different worksheet. All the formula needs is a reference to the worksheet name as well as the co-ordinate.

Worksheet names that include spaces or other characters that have other meanings in Excel formulas must be enclosed in single quotes.

The worksheet name and cell reference is separated with an exclamation mark.

e.g. **=worksheet!B4**

='worksheet name'!B4

These form the simplest and often the most useful formulas in that they allow you to connect a cell on worksheet to a cell on another.

Functions may access a range on a different worksheet:

e.g. **=SUM('worksheet name'!B4:C10)**

Note: The Lookup functions described in the previous sections refer to a range on a different worksheet using a Range name.

Excel is more limited when it comes to using ranges than span 2 or more worksheets.

The only functions that support this are the simple Statistics functions such as **AVERAGE**, **COUNT**, **COUNTA**, **MAX**, **MIN**, and **SUM** etc.

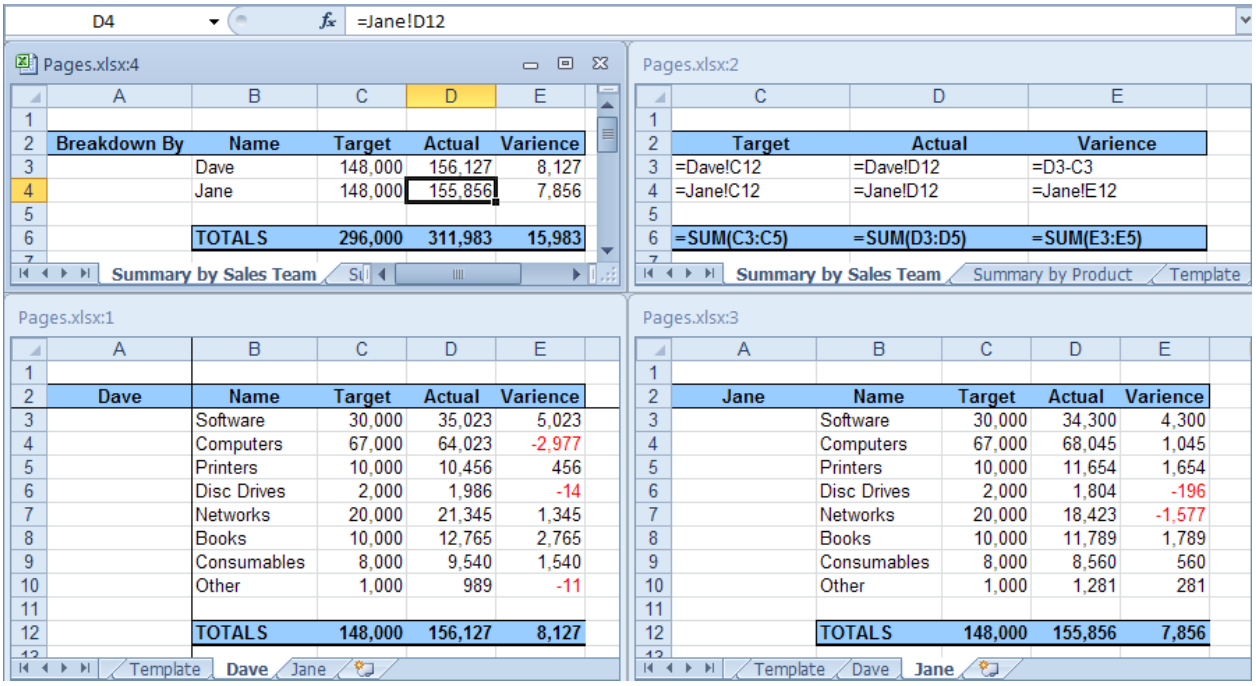
Here you may use a range of sheets combined with a cell or range on those sheets:

e.g. **=SUM('First worksheet:Last worksheet'!B4)**

=MAX('First worksheet:Last worksheet'!B4:C10)

EXAMPLE FORMULAS LINKING WORKSHEETS

Using Simple Links to Create a Summary Table



D4 =Jane!D12

Pages.xlsx:4

	A	B	C	D	E
1					
2	Breakdown By	Name	Target	Actual	Varience
3		Dave	148,000	156,127	8,127
4		Jane	148,000	155,856	7,856
5					
6		TOTALS	296,000	311,983	15,983

Summary by Sales Team

Pages.xlsx:2

	C	D	E
1			
2	Target	Actual	Varience
3	=Dave!C12	=Dave!D12	=D3-C3
4	=Jane!C12	=Jane!D12	=Jane!E12
5			
6	=SUM(C3:C5)	=SUM(D3:D5)	=SUM(E3:E5)

Summary by Sales Team | Summary by Product | Template

Pages.xlsx:1

	A	B	C	D	E
1					
2	Dave	Name	Target	Actual	Varience
3		Software	30,000	35,023	5,023
4		Computers	67,000	64,023	-2,977
5		Printers	10,000	10,456	456
6		Disc Drives	2,000	1,986	-14
7		Networks	20,000	21,345	1,345
8		Books	10,000	12,765	2,765
9		Consumables	8,000	9,540	1,540
10		Other	1,000	989	-11
11					
12		TOTALS	148,000	156,127	8,127

Template | Dave | Jane

Pages.xlsx:3

	A	B	C	D	E
1					
2	Jane	Name	Target	Actual	Varience
3		Software	30,000	34,300	4,300
4		Computers	67,000	68,045	1,045
5		Printers	10,000	11,654	1,654
6		Disc Drives	2,000	1,804	-196
7		Networks	20,000	18,423	-1,577
8		Books	10,000	11,789	1,789
9		Consumables	8,000	8,560	560
10		Other	1,000	1,281	281
11					
12		TOTALS	148,000	155,856	7,856

Template | Dave | Jane

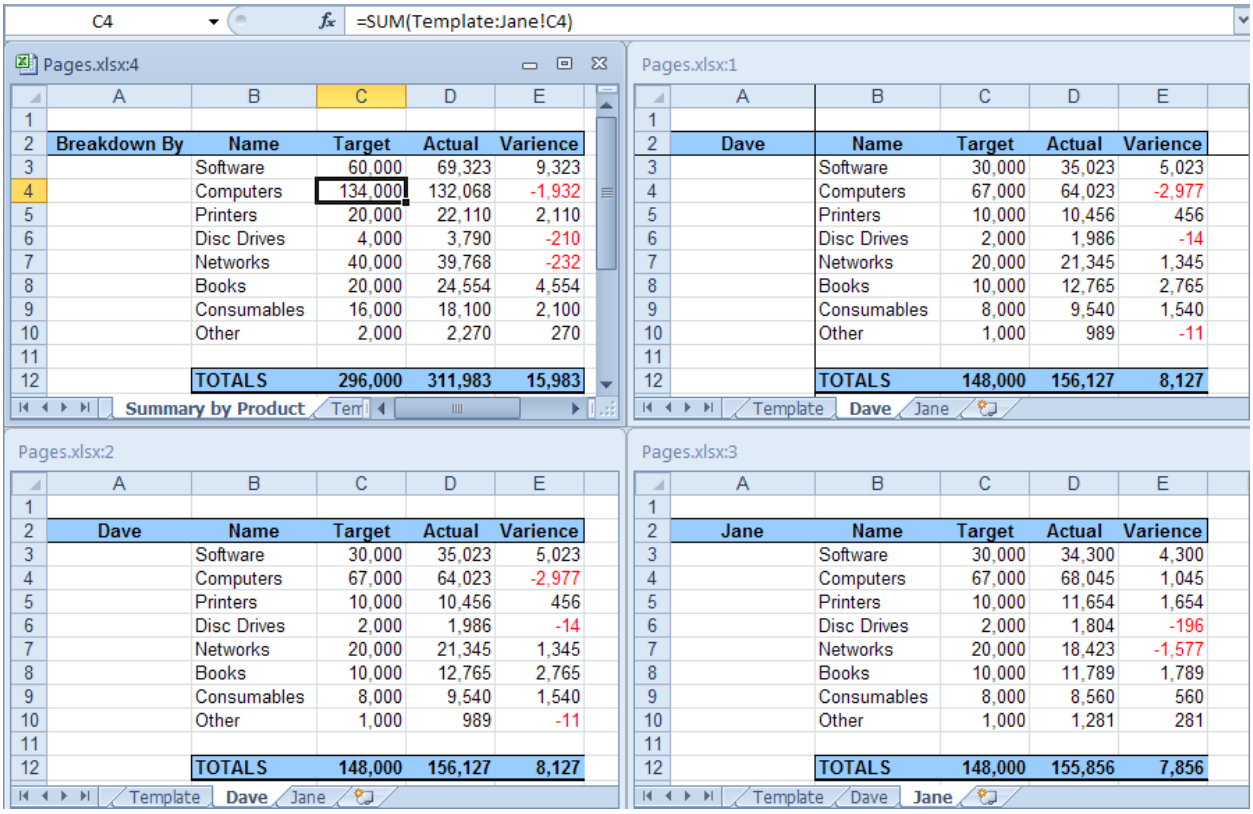
This example uses separate sheets to collect data for different individuals (bottom 2 windows) and a summary sheet to consolidate their individual totals (top 2 windows - normal and formula views).

e.g. ***=Jane!D12***

Links to cell ***D12*** on the sheet called ***Jane***.

Such formulas allow you to link the bottom line totals from any number of worksheets to a single summary table where they can be easily compared, graphed and used to calculate grand totals.

Summing Through a Range of Sheets



Pages.xlsx:4 — Summary by Product

Breakdown By	Name	Target	Actual	Varience
	Software	60,000	69,323	9,323
	Computers	134,000	132,068	-1,932
	Printers	20,000	22,110	2,110
	Disc Drives	4,000	3,790	-210
	Networks	40,000	39,768	-232
	Books	20,000	24,554	4,554
	Consumables	16,000	18,100	2,100
	Other	2,000	2,270	270
	TOTALS	296,000	311,983	15,983

Pages.xlsx:1 — Dave

Dave	Name	Target	Actual	Varience
	Software	30,000	35,023	5,023
	Computers	67,000	64,023	-2,977
	Printers	10,000	10,456	456
	Disc Drives	2,000	1,986	-14
	Networks	20,000	21,345	1,345
	Books	10,000	12,765	2,765
	Consumables	8,000	9,540	1,540
	Other	1,000	989	-11
	TOTALS	148,000	156,127	8,127

Pages.xlsx:2 — Dave

Dave	Name	Target	Actual	Varience
	Software	30,000	35,023	5,023
	Computers	67,000	64,023	-2,977
	Printers	10,000	10,456	456
	Disc Drives	2,000	1,986	-14
	Networks	20,000	21,345	1,345
	Books	10,000	12,765	2,765
	Consumables	8,000	9,540	1,540
	Other	1,000	989	-11
	TOTALS	148,000	156,127	8,127

Pages.xlsx:3 — Jane

Jane	Name	Target	Actual	Varience
	Software	30,000	34,300	4,300
	Computers	67,000	68,045	1,045
	Printers	10,000	11,654	1,654
	Disc Drives	2,000	1,804	-196
	Networks	20,000	18,423	-1,577
	Books	10,000	11,789	1,789
	Consumables	8,000	8,560	560
	Other	1,000	1,281	281
	TOTALS	148,000	155,856	7,856

This version is more limiting than the above, because it requires the equivalent values to be positioned in exactly the same place on each worksheet. This design is of no use what so ever for tables which have variable entries.

e.g. `=SUM(Template:Jane!C4)`

Sums all the values in Cell C4 in every worksheet from Template to Jane inclusive.

Where: ***Template:Jane***

The range of worksheets.

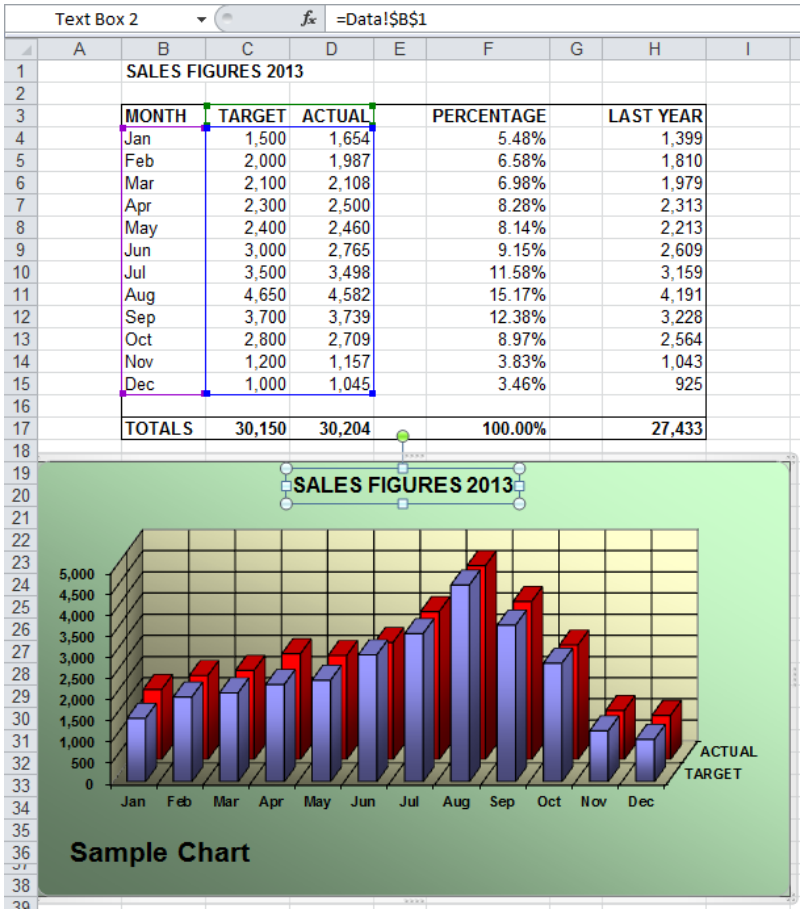
C4 The cell to include in the calculation from every worksheet in the range.

Formulas In Text Boxes

Any Text Box including Auto-Shapes and Chart Labels, allow you to enter a simple formula linking the text box to a single cell in a worksheet within the workbook.

By linking text boxes to the cells in your workbook you can create entries that change to reflect the information collected in your workbook - dynamic labels.

The linked cell may contain any normal cell entry - so here you can have any formula you like calculating a message to display in the text box.



MONTH	TARGET	ACTUAL	PERCENTAGE	LAST YEAR
Jan	1,500	1,654	5.48%	1,399
Feb	2,000	1,987	6.58%	1,810
Mar	2,100	2,108	6.98%	1,979
Apr	2,300	2,500	8.28%	2,313
May	2,400	2,460	8.14%	2,213
Jun	3,000	2,765	9.15%	2,609
Jul	3,500	3,498	11.58%	3,159
Aug	4,650	4,582	15.17%	4,191
Sep	3,700	3,739	12.38%	3,228
Oct	2,800	2,709	8.97%	2,564
Nov	1,200	1,157	3.83%	1,043
Dec	1,000	1,045	3.46%	925
TOTALS	30,150	30,204	100.00%	27,433

Notice: How the Chart Label in the illustration is linked to **B1** in the worksheet.

To create a Text Box formula use:

1. Select the Text Box.
2. Click in the Formula Bar.
3. Press (Equals) to start a formula.
4. Navigate to and select the required cell.
5. Press (Enter).

Any text contained within the text box will be ignored in favour of the contents of the linked cell.

STRUCTURED TABLE FORMULAS

When creating formulas to perform calculations with data stored in a **Structured Table**, Microsoft Excel uses Structured Cell References in place of normal cell and range references.

You can still use normal cell and range references if you wish but these will only work properly if you comply with the Traditional Design Rules that apply to normal tables.

To reduce the number of formula problems it is strongly recommended that you use Structured Cell References whenever possible.

Compatibility Mode

Excel 2003 does not support Structured Cell References.

In Compatibility Mode all methods for creating formulas use normal Cell and Range References.

Also, in **Structured Table**, Microsoft Excel's Total Row (see later) defaults to using the SUBTOTAL function in place of the traditional SUM function. Again you can use the SUM function if you wish - but the SUBTOTAL function is more flexible.

STRUCTURED CELL REFERENCES

Structured Cell References use the Table Name and Column Headings to identify cells and ranges in place of the normal cell coordinates.

Using labels rather than coordinates makes formulas more readable and less prone to going wrong when new data is added to the Table.

In fact, Structured Cell References offer a number of other advantages and very few disadvantages. These are pointed out in the following notes.

Fully Qualified Cell Reference

A fully qualified Structured Cell Reference looks like this:

TableName[[#Rows],[ColumnHeading]]

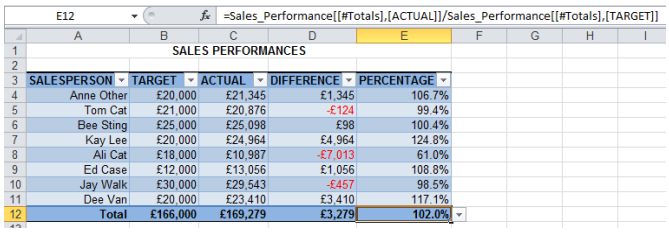
Where: #Rows may be any of:

#All	The entire table.
#Data	The data rows within the table.
#Headers	The Header row within the table.
#Totals	The Totals row within the Table.
#This Row	The same row as the one containing the formula. Often this is replaced with an @ symbol. [@ColumnHeading] This is normally only used for Calculated Fields within the **Structured Table.**

e.g. Sales_Performance[[#Totals],[TARGET]] Is a Reference to the cell containing the Total in the Target column.

Where: Sales_Pereformance Is the name of the Table.

#Totals Refers to the Totals row in the Table.



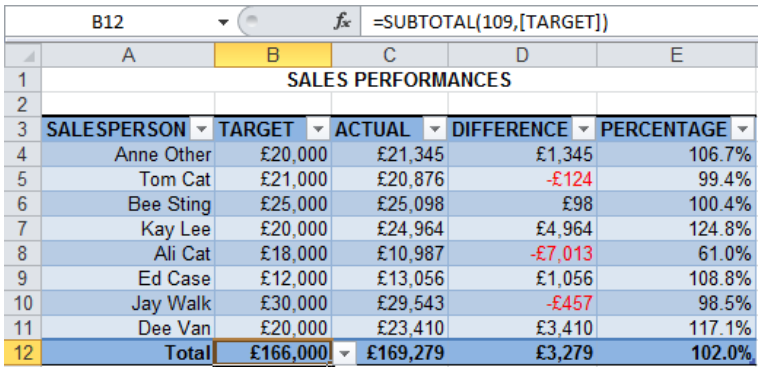
TARGET Is a reference to a Column Heading.

To refer to a range of columns the Structured Cell Reference becomes:

TableName[#TablePart],[[FirstColumn]:[LastColumn]]

Notice how each component is placed inside square brackets, which are then nested one within the other!

Structured Cell References may look complicated, but there is lots of good news:



1. The Fully Qualified Structured Cell reference is normally only required by formulas outside the **Structured Table**.

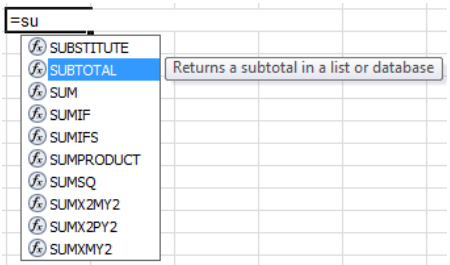
2. References within the **Structured Table** are normally abbreviated.

   Notice the use of [TARGET] in the illustration.

3. If you use Point Mode to create your formulas, Microsoft Excel will write the references for you. Including all the punctuation

4. If you type your formulas, Excel displays drop down lists to select components as you type - but you will have to type the punctuation for yourself.

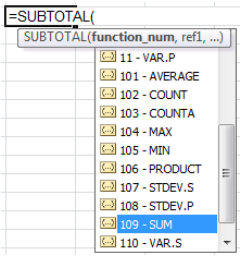
   You can ignore the lists or use:



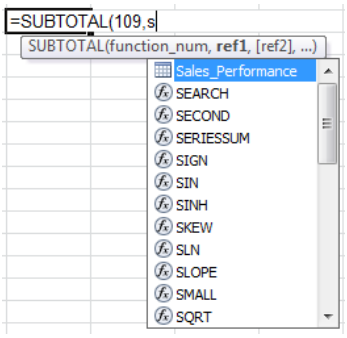
Double click on the item you want to use.

or: Use the ↑ ↓ keys to highlight an entry

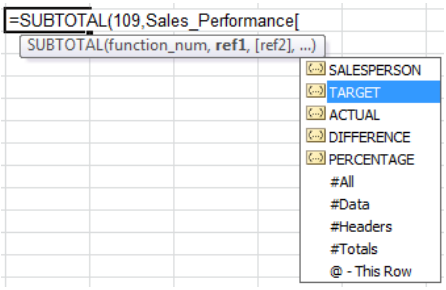
Use ⇥ key to use the highlighted entry.



This list is offering the name of the **Structured Table**.



This list shows the components of the Sales_Performance Table to select from.



Column References

The Total Row is commonly used to calculate statistics for each column, so they only need to indicate the column(s) to include in the calculation.

Single Column: [ColumnHeading]

This allows you to reference the range of cells containing the data in a column.

For example: To sum the data in the Target column of the illustrated spreadsheet you can use:

=SUM([TARGET]) equivalent to =SUM(B4:B11)

Or:

=SUBTOTAL(109,[TARGET])

Column Range: TableName[[FirstColumn]:[LastColumn]]

This allows you to reference the range of cells containing data in the range of columns

For example To find the maximum value in the Target and Actual columns you can use:

=MAX(Sales[[TARGET]:[ACTUAL]])

Or:

=SUBTOTAL(104,Sales[[TARGET]:[ACTUAL]])

Row References

Structured Cell References use qualifiers to identify particular rows within a table:

When a qualifier is used you must also provide the Table Name:

Header Row TableName[#Headers]

This allows you to refer to the Header Row containing the Column Headings.

For example: To Count the number of columns in the illustrated Table you can use:

=COUNTA(Sales[#Headers])

Or:

=SUBTOTAL(103,Sales[#Headers])

Data Rows TableName[#Data]

This allows you to refer to the rows containing the data.

Often this is assumed and omitted.

For example: To count the number of empty cells in the Table you can use:

=COUNTBLANK(Sales[#Data])

Total Row TableName[#Totals]

This allows you to refer to the Total Row that is optionally displayed at the bottom of a Table (see page **Error! Bookmark not defined.**.)

For example: To Sum all the Column Totals in the illustrated Table to calculate a Table Total you can use:

=SUM(Sales[#Totals])

Or:

=SUBTOTAL(109,Sales[#Totals])

Note: You cannot use this formula in the Total Row or it will create a Circular Reference.

See later for a working example.

All Rows TableName[#All]

This allows you to refer to all the rows in the table.

For example: To Count the number of values (excluding text entries) in the whole table in the illustrated Table you can use:

=COUNT(Sales(#All])

Or:

=SUBTOTAL(102,Sales[#All])

Current Row TableName[@]

This allows you to refer to a specific row within the Data Rows - the same row as the one containing this formula.

Note: Formulas referring to the whole row should not be placed inside the Table otherwise it will include itself within the selected range and will create a Circular Reference.

For example: To find the Minimum value in the current row in the illustrated Table you can use:

=MIN(Sales[@])

Or:

=SUBTOTAL(105,Sales[@])

Cell & Range References

You can refer to a specific cell in a Table by combining the Structured References for a Row and a Column.

Column Total TableName[[#Totals],[ColumnHeading])

This allows you to refer to a specific Column Total in the Table.

For example: To refer to the Actual column total in the illustrated Table you can use:

=Sales[[#Data],[ACTUAL]]

Column Range TableName[[#Totals],[FirstColumn]:[LastColumn]])

This allows you to refer to a range of column totals. This can be useful if you want the last total to be a grand total of the other totals:

For example: To Sum the Target and Actual column totals in the illustrated spreadsheet you can use:

=SUM(Sales[[#Totals],[TARGET]:[ACTUAL]])

Or:

=SUBTOTAL(109,Sales[[#Totals],[TARGET]:[ACTUAL]])

BEWARE: The SUBTOTAL function will not sum other Subtotals!

Data Cell TableName[@ColumnHeading]

This allows you to refer to a particular value in the same row as the formula.

Notice how this reference has a slightly different syntax.

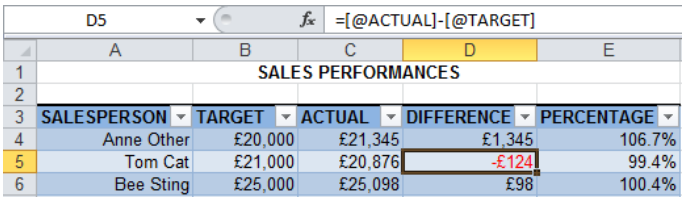
The Table name is omitted if the formula is contained within the table.

For example: To calculate the difference between the Actual and Target values in the illustrated Table you can use:

=Sales[@ACTUAL]-Sales[@TARGET] If the formula is outside the Table.

Or:

=[@ACTUAL]-[@TARGET] If the formula is within the table - a calculated field.



COLUMN TOTALS - TOTAL ROW

Once you have created and named a Table, you may optionally add a Total Row at the bottom of the Table.

Column Totals are one of the most common requirements in any Table, and the Total Row makes this very easy.

Example Table

This spreadsheet is used to illustrate how you may add and set up the formulas in a Total Row.

	A	B	C	D	E	F
1	DESCRIPTION	2013	2014	2015	2016	2017
2	Computers	10,000	10,500	10,750	10,200	10,350
3	Printers	7,000	8,000	9,550	11,000	13,000
4	Software	14,000	16,000	15,500	17,000	17,000
5	Disc Drives	5,000	5,000	5,550	6,000	5,900
6	CD Roms	1,000	1,200	4,000	6,000	8,000
7	Consumables	8,000	8,000	8,400	8,700	9,000
8	Other	3,000	3,000	3,000	3,000	3,000

Add a Total Row

Design Ribbon

Tick this box.

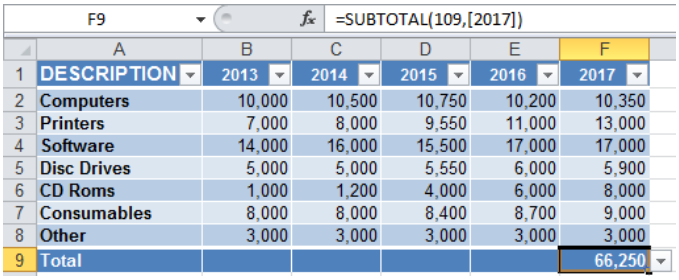
Acts as an on/off switch for displaying the Total Row.

Note Your Formulas are not lost when the Total Row is hidden.

Result

The Total Row is added.

The last column is highlighted with Bold text. You can turn this off if you wish.



	A	B	C	D	E	F
1	DESCRIPTION	2013	2014	2015	2016	2017
2	Computers	10,000	10,500	10,750	10,200	10,350
3	Printers	7,000	8,000	9,550	11,000	13,000
4	Software	14,000	16,000	15,500	17,000	17,000
5	Disc Drives	5,000	5,000	5,550	6,000	5,900
6	CD Roms	1,000	1,200	4,000	6,000	8,000
7	Consumables	8,000	8,000	8,400	8,700	9,000
8	Other	3,000	3,000	3,000	3,000	3,000
9	Total					66,250

Microsoft Excel creates a formula for a Column Total in the Last Column using Structured Cell References and the SUBTOTAL function.

This may be useful, if not change it as follows.

Changing the Totals

You may add, remove or edit the formulas in any of the cells in the Total Row.

The most obvious are Column Totals or some other Statistic such as Average, Maximum, Minimum etc.

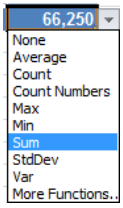
The Total Row makes these formulas easy to create:

Click in any cell in the Total Row:

The cell will display a drop down arrow on the right hand edge.

Click on the arrow to display a list of options.

Click on the Total you require.



Note: You can also use the traditional AutoSum Tool.

In the Total Row, this tool will also default to creating formulas that use the SUBTOTAL function, with structured cell references.

Result

Microsoft Excel will create the appropriate formula using the SUBTOTAL function.

You may change your mind at any time.

B9 =SUBTOTAL(109,[2013])

	A	B	C	D	E	F
1	DESCRIPTION	2013	2014	2015	2016	2017
2	Computers	10,000	10,500	10,750	10,200	10,350
3	Printers	7,000	8,000	9,550	11,000	13,000
4	Software	14,000	16,000	15,500	17,000	17,000
5	Disc Drives	5,000	5,000	5,550	6,000	5,900
6	CD Roms	1,000	1,200	4,000	6,000	8,000
7	Consumables	8,000	8,000	8,400	8,700	9,000
8	Other	3,000	3,000	3,000	3,000	3,000
9	Total	48,000				66,250

This formula can be copied across the row in the normal way, or you can repeat the process for each column.

B9 =SUBTOTAL(109,[2013])

	A	B	C	D	E	F
1	DESCRIPTION	2013	2014	2015	2016	2017
2	Computers	10,000	10,500	10,750	10,200	10,350
3	Printers	7,000	8,000	9,550	11,000	13,000
4	Software	14,000	16,000	15,500	17,000	17,000
5	Disc Drives	5,000	5,000	5,550	6,000	5,900
6	CD Roms	1,000	1,200	4,000	6,000	8,000
7	Consumables	8,000	8,000	8,400	8,700	9,000
8	Other	3,000	3,000	3,000	3,000	3,000
9	Total	48,000	51,700	56,750	61,900	66,250
10						

ROW TOTALS

Microsoft Excel makes Column Totals easy to generate - using the Total Row.

Unfortunately there is no equivalent feature for Row Totals - these you have to build for yourself.

Example Table

This spreadsheet is used to illustrate how you may add and set up a new column for Row Totals.

	A	B	C	D	E	F
1	DESCRIPTION	2013	2014	2015	2016	2017
2	Computers	10,000	10,500	10,750	10,200	10,350
3	Printers	7,000	8,000	9,550	11,000	13,000
4	Software	14,000	16,000	15,500	17,000	17,000
5	Disc Drives	5,000	5,000	5,550	6,000	5,900
6	CD Roms	1,000	1,200	4,000	6,000	8,000
7	Consumables	8,000	8,000	8,400	8,700	9,000
8	Other	3,000	3,000	3,000	3,000	3,000

Add a New Totals Column

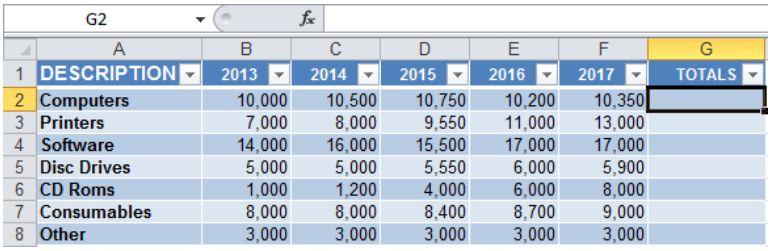
It is easy to append a new Column on the right hand side of the Table.

Simply type a new Column Heading!

Microsoft Excel automatically extends the Table definition to include the new column.

Result

You are ready to enter a formula in the first row.

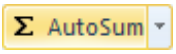


	A	B	C	D	E	F	G
1	DESCRIPTION	2013	2014	2015	2016	2017	TOTALS
2	Computers	10,000	10,500	10,750	10,200	10,350	
3	Printers	7,000	8,000	9,550	11,000	13,000	
4	Software	14,000	16,000	15,500	17,000	17,000	
5	Disc Drives	5,000	5,000	5,550	6,000	5,900	
6	CD Roms	1,000	1,200	4,000	6,000	8,000	
7	Consumables	8,000	8,000	8,400	8,700	9,000	
8	Other	3,000	3,000	3,000	3,000	3,000	

AutoSum Tool

Ribbon:

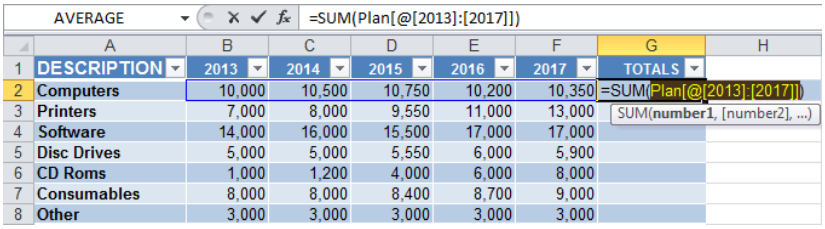
Found on the **Home** Ribbon.



Found on the **Formulas** Ribbon.

Excel will create a formula using the SUM function (SUBOTAL is used for Column Totals)

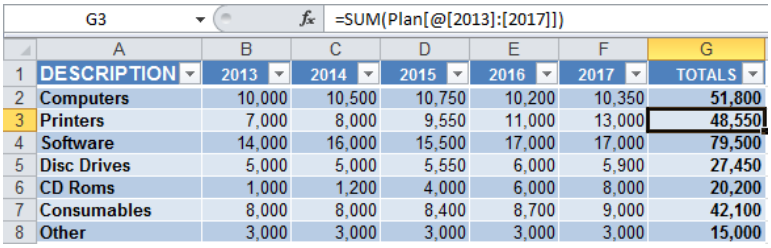
Enter the formula.



	A	B	C	D	E	F	G	H
1	DESCRIPTION	2013	2014	2015	2016	2017	TOTALS	
2	Computers	10,000	10,500	10,750	10,200	10,350	=SUM(Plan[@[2013]:[2017]])	
3	Printers	7,000	8,000	9,550	11,000	13,000		
4	Software	14,000	16,000	15,500	17,000	17,000		
5	Disc Drives	5,000	5,000	5,550	6,000	5,900		
6	CD Roms	1,000	1,200	4,000	6,000	8,000		
7	Consumables	8,000	8,000	8,400	8,700	9,000		
8	Other	3,000	3,000	3,000	3,000	3,000		

Result

When you enter any formula into a cell in a data row it is automatically filled into the whole column - no need to copy it down yourself!



	A	B	C	D	E	F	G
1	DESCRIPTION	2013	2014	2015	2016	2017	TOTALS
2	Computers	10,000	10,500	10,750	10,200	10,350	51,800
3	Printers	7,000	8,000	9,550	11,000	13,000	48,550
4	Software	14,000	16,000	15,500	17,000	17,000	79,500
5	Disc Drives	5,000	5,000	5,550	6,000	5,900	27,450
6	CD Roms	1,000	1,200	4,000	6,000	8,000	20,200
7	Consumables	8,000	8,000	8,400	8,700	9,000	42,100
8	Other	3,000	3,000	3,000	3,000	3,000	15,000

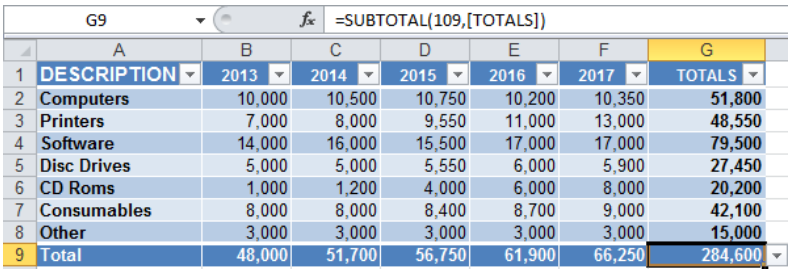
You can optionaly turn on the Last Column Style Option to highlight the entries in this last column of the table.

ROW AND COLUMN TOTALS

You can of course combine both Row and Column Totals to create a spreadsheet that has both.

You may also add additional formats as required.

For example: I have added Bold format to the row totals, and comma format to all the totals.



	A	B	C	D	E	F	G
1	DESCRIPTION	2013	2014	2015	2016	2017	TOTALS
2	Computers	10,000	10,500	10,750	10,200	10,350	51,800
3	Printers	7,000	8,000	9,550	11,000	13,000	48,550
4	Software	14,000	16,000	15,500	17,000	17,000	79,500
5	Disc Drives	5,000	5,000	5,550	6,000	5,900	27,450
6	CD Roms	1,000	1,200	4,000	6,000	8,000	20,200
7	Consumables	8,000	8,000	8,400	8,700	9,000	42,100
8	Other	3,000	3,000	3,000	3,000	3,000	15,000
9	Total	48,000	51,700	56,750	61,900	66,250	284,600

CALCULATED FIELDS

It is common to have Tables that contain a mixture of text, values and calculations.

The only difference is that Microsoft Excel will use Structured Cell References in place of coordinates if you use Point Mode.

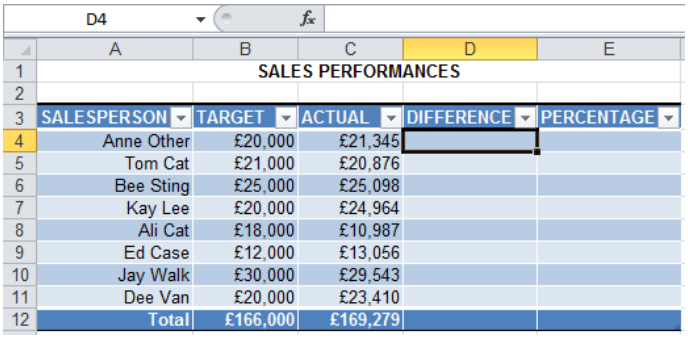
The formulas for Calculated Fields should be created after the converting a cell range to a Table. This will allow them to use Structured Cell References.

Note: The Row Totals column described earlier is an example of a Calculated Field.

Example Table

This shows a typical Table containing raw data that needs some simple calculations for each record.

Your Table may need VAT or other common calculations.



	A	B	C	D	E
1	SALES PERFORMANCES				
2					
3	SALESPERSON	TARGET	ACTUAL	DIFFERENCE	PERCENTAGE
4	Anne Other	£20,000	£21,345		
5	Tom Cat	£21,000	£20,876		
6	Bee Sting	£25,000	£25,098		
7	Kay Lee	£20,000	£24,964		
8	Ali Cat	£18,000	£10,987		
9	Ed Case	£12,000	£13,056		
10	Jay Walk	£30,000	£29,543		
11	Dee Van	£20,000	£23,410		
12	Total	£166,000	£169,279		

Difference Between Two Values

With traditional formulas the illustrated spreadsheet needs the formula:

=C4-B4 entering into D4, which would then be copied down the column.

This will still work but should only be used for spreadsheets in Compatibility Mode that will be used in Excel 2003 or earlier.

With a Table, you should use a formula that uses Structured Cell References:

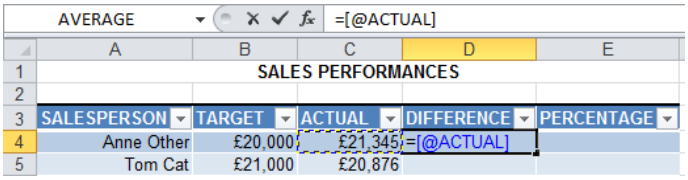
=[@ACTUAL]-[@TARGET]

If you use Point Mode to build your formula, it is created in EXACTLY the same way as before. Microsoft Excel simply enters the Structured Cell References in place of coordinates as you point at cells and ranges.

1. Start your formula in D4 Press: 

2. Point at the ACTUAL value Press: 

   Or:  in C4



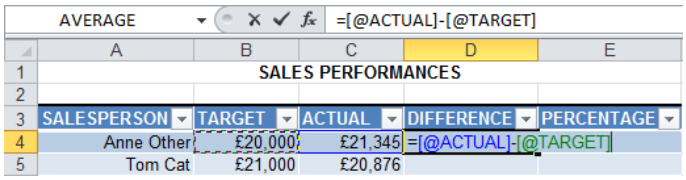
	A	B	C	D	E
1	SALES PERFORMANCES				
2					
3	SALESPERSON	TARGET	ACTUAL	DIFFERENCE	PERCENTAGE
4	Anne Other	£20,000	£21,345	=[@ACTUAL]	
5	Tom Cat	£21,000	£20,876		

Microsoft Excel adds the Structured Cell Reference [@ACTUAL] to the formula.

3. Type the Subtract symbol — Press: 

4. Point at the TARGET value — Press: 

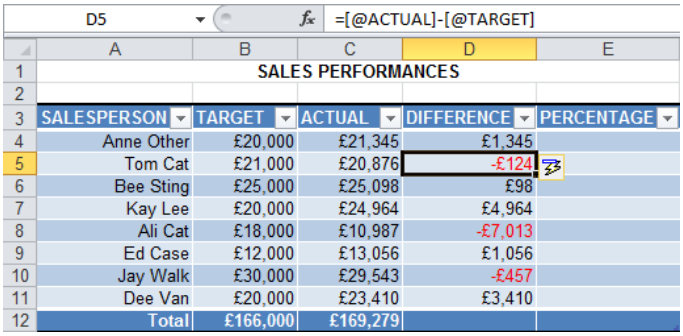
Or:  in B4



Microsoft Excel adds the Structured Cell Reference [@TARGET] to the formula.

5. Enter the finished formula — Microsoft Excel automatically fills the formula down the column for you.

You can add a Column Total as described earlier.



Note: The Red for Negatives format has been applied using normal cell formatting.

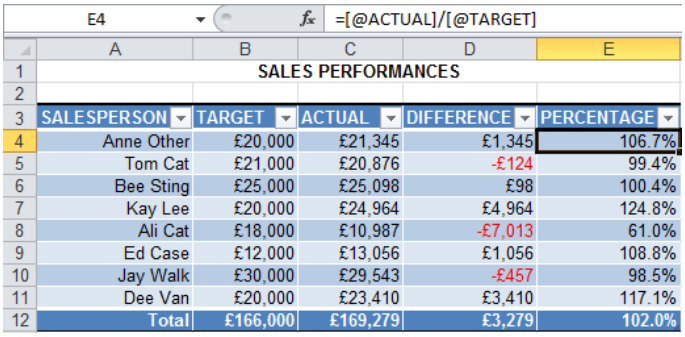
Percentage Difference Between Two Values

A percentage is a fraction.

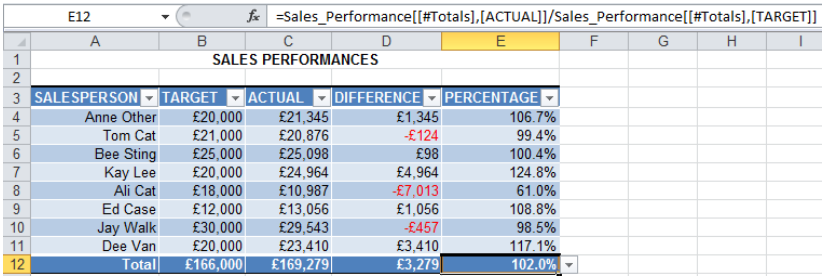
The fraction is created by dividing the two values rather than subtracting them.

The result can then be formatted to look like a percentage.

The formula is created in exactly the same way as before, except the Divide sign is used in place of Subtract.



Note: In this example the Total Row does not contain a Column Total for the PERCENTAGE column.



Instead the percentage difference between the TARGET and ACTUAL totals is calculated.

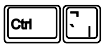
This formula is created in exactly the same way, but Microsoft Excel uses fully qualified Structured Cell References.

FORMULA ERRORS

FORMULA AUDIT MODE

This mode changes the view of the spreadsheet so that you can see (and print) formulas in the cells.

These notes have made use of this feature to display the formulas in the illustrations.

Keyboard:  On/Off Toggle.

Being able to see the formulas is the single most useful debug tool in Excel.

CELL ERRORS

The following Errors are displayed in cells when your formula references invalid data.

#DIV/0!	Division by Zero Error.	Sometimes a sign that a cell is empty when it should contain a value. Sometimes a symptom of a formula referencing the wrong cell.
#REF!	Reference Error.	Occurs when a formula references a cell in a row, column or worksheet that has been deleted.
#N/A	Not Available.	No suitable data available. Or when a Lookup function can not find any suitable data to return.
#NAME?	Name Error.	Your formula contains a name that is not recognised by Excel. This can be due to a spelling mistake or a failure to use brackets in a function name.
#NUM!	Number Error.	Your formula is trying to perform a calculation with invalid data. For example, trying to find the square root of a negative value or using the wrong type of data as a parameter in a function.
#VALUE!	Value Error.	You are trying to perform an arithmetic calculation with text based data.

Example Formulas that Detect Errors

Formulas involving division, where there is no data, will generate a Division by Zero error. Not because of any fault in the formula - but because empty cells are treated as Zero values.

The only way to prevent such errors is to detect the problems and react to them before the problems occur.

Example1: ***=A1/B1*** Valid formula that will generate an error if **B1** is empty or contains a zero.

=IF(B1=0,"",A1/B1)

Where: ***B1=0*** Tests the value in ***B1***.

Returns **TRUE** if **B1** is zero or empty.

Otherwise returns **FALSE**.

"" Empty text string - gives a blank cell when the calculation can not be performed.

A1/B1 Performs the calculation when **B1** contains valid data.

Example2: ***=IF(ISERROR(A1/B1),"Check Your Data",A1/B1)***

This variation can be used to capture any type of error and react to it.

Where: ***ISERROR(A1/B1)***
Detects any error generated by the expression.

A1/B1 Can be replaced with any expression.

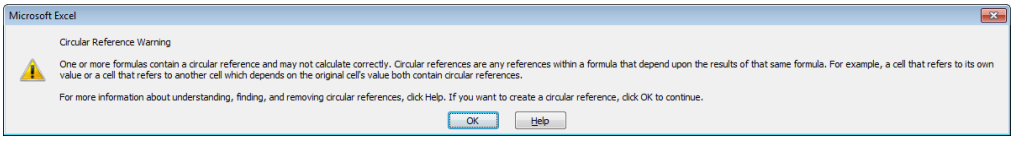
"Check Your Data"
Is displayed when an error is detected.

A1/B1 Performs the calculation when no error is detected.

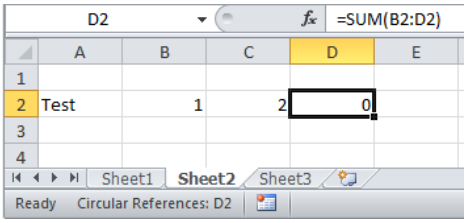
CIRCULAR REFERENCES

Circular reference occur when a formula references its own cell as data or links to a series of other formulas that lead back to the formula - so that again the formula is used as data that effects the formula that becomes new data, that effects the formula … round and round in circles!

Excel normally warns you of these errors and displays a cell reference in the Status Bar to one of the cells in the chain that is creating the problem.



You should examine the whole of the circle to find the cell that is causing the problem.



ROUNDING ERRORS

Formulas use the full internal accuracy of Excel.

Cells are often formatted to round values off to a set level of accuracy.

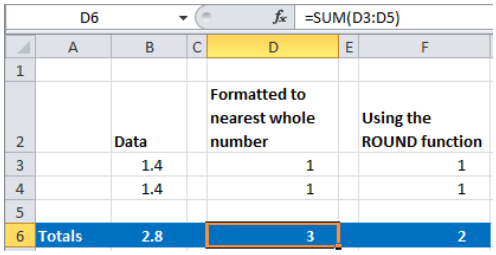
This can lead to discrepancies between what you see and what Excel sees.

You should use the **ROUND** function to force calculations to work to the same level of accuracy as the cell format.

In this example the SUM function is used to say one and one is three.

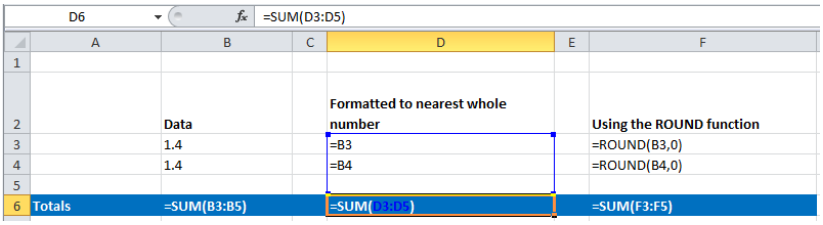
The values 1.4 round down to 1.

The result (2.8) rounds up to 3.



	A	B	C	D	E	F
1						
2		Data		Formatted to nearest whole number		Using the ROUND function
3		1.4		1		1
4		1.4		1		1
5						
6	Totals	2.8		3		2

The same worksheet displayed in Formula Audit mode.



	A	B	C	D	E	F
1						
2		Data		Formatted to nearest whole number		Using the ROUND function
3		1.4		=B3		=ROUND(B3,0)
4		1.4		=B4		=ROUND(B4,0)
5						
6	Totals	=SUM(B3:B5)		=SUM(D3:D5)		=SUM(F3:F5)

Notice The use of the **Round** function to round the values off before they are summed.

e.g. ***=ROUND(B3,0)***

Rounds the value found in ***B3*** to the nearest whole number.

0 Indicates the number of decimal places of accuracy.

INDEX OF FUNCTIONS