

Excel Skills

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Introduction

This book is part of an Excel[®]Skills course presented by Tykoh Group. *[Excel[®] and Microsoft[®] are either trademarks or registered trademarks of Microsoft Corporation].*

Exercises

A selection of the course exercises may be freely downloaded from the following location:

www.tykoh.com/downloads/Excel-Skills-Exercises.xls

Level of these notes

These notes cover both the essentials of Excel and more advanced topics. The earlier sections of the notes cover core / essential features. Later parts address topics that are more advanced.

Style of these notes

These notes have a “walkthrough” style: Excel features are illustrated by “walking through” concise examples.

Notation

The following notations are used in these notes to describe user key presses.

CTRL + SPACE means: Press the CTRL key down and keep it down, then press the SPACE key, then release the SPACE key and then release the CTRL key.

ALT, H, A means: Press the ALT key, release it, then press the H key, release it, then press the A key and release it.

Home | Alignment | Wrap text means: In the Home ribbon, in the Alignment section of that ribbon, click on Wrap Text.

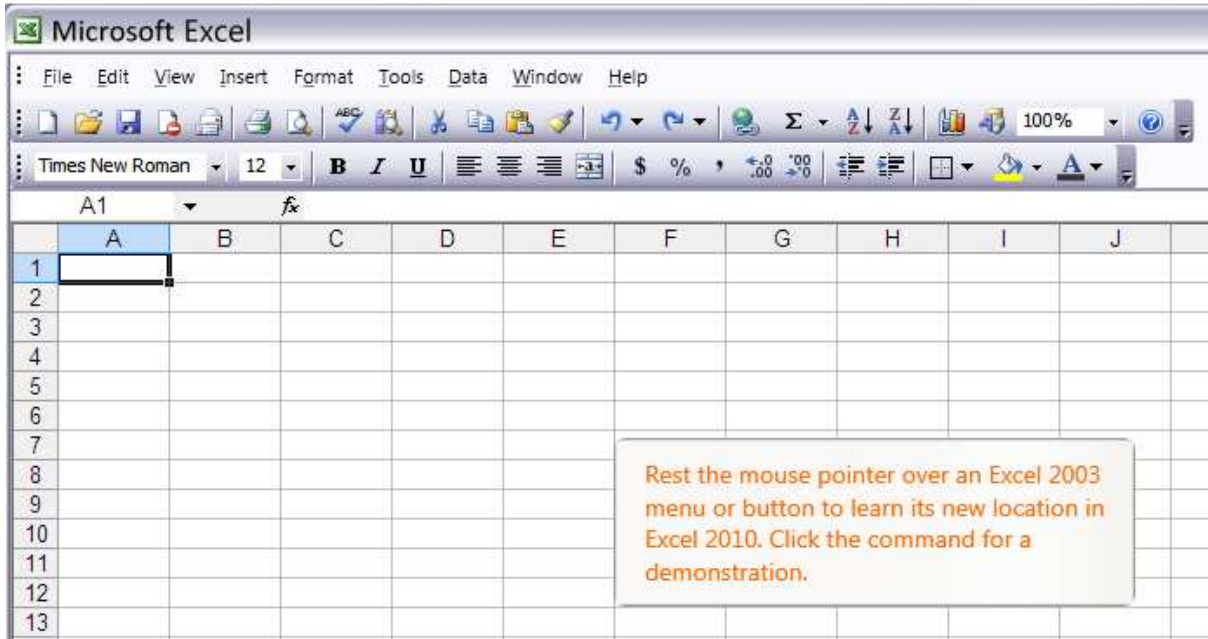
Re-skilling from earlier versions of Excel (e.g. 2003)

Microsoft provides a number of resources aimed at easing the “learning curve” from earlier versions of Excel to 2010 and later versions. A selection of those resources is described next.

Interactive menu guide

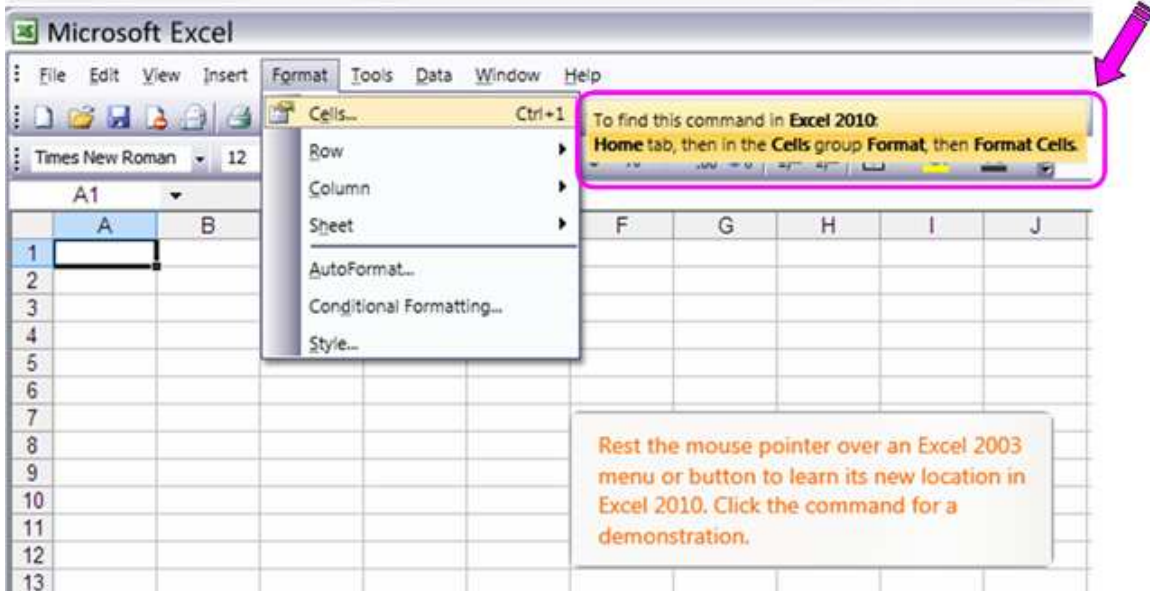
Microsoft provides a simulator that allows the user to navigate through Excel 2003’s menus and shows the corresponding menu items in Excel 2010. A snapshot of the guide is shown next ...

To find this command in Excel 2010:



Move the mouse to a Excel 2003 menu item and the guide will show the location of the corresponding 2010 menu item ...

To find this command in Excel 2010: **Home** tab, then in the **Cells** group **Format**, then **Format Cells**.

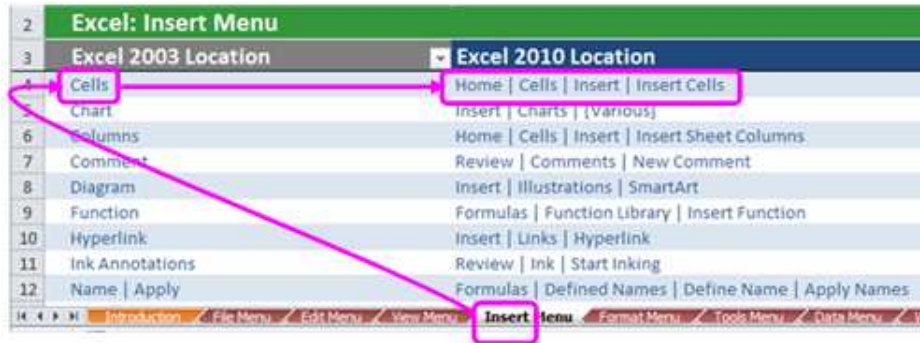


This resource can be found on the internet by searching for the phrase: "Learn where menu and toolbar commands are in Office 2010".

Menu-to-ribbon reference workbook

Microsoft provides a cross reference workbook that translates old-style menu items to new-style ribbons. The workbook has a tab for each 2003 main-menu-item. Within each tab is a list of the corresponding locations in 2010. A snapshot of the workbook is shown next ...

Excel: Insert Menu	
Excel 2003 Location	Excel 2010 Location
Cells	Home Cells Insert Insert Cells
Chart	Insert Charts (Various)
Columns	Home Cells Insert Insert Sheet Columns
Comment	Review Comments New Comment
Diagram	Insert Illustrations SmartArt
Function	Formulas Function Library Insert Function
Hyperlink	Insert Links Hyperlink
Ink Annotations	Review Ink Start Inking
Name Apply	Formulas Defined Names Define Name Apply Names



The workbook shows, for example, that the Excel 2003 Insert | Cells menu maps to Home | Cells | Insert | Insert Cells in 2010.

To find this resource use the search phrase: “Excel 2010: Menu to ribbon reference workbook”.

Getting started

Microsoft has a site intended to ease user’s transitions to newer versions. The site is at this address:

<http://office.microsoft.com/gettingstarted>

Navigation and Selection

Excel provides many keyboard shortcuts for navigating through worksheets and workbooks. These shortcuts can be quicker than using a mouse.

The following two are general “undo” and “redo” shortcuts.

Undo last action

Press CTRL + Z

Redo last action

CTRL + Y

Select the first cell on the worksheet

Press CTRL + HOME

Select last used cell on a worksheet

CTRL + END

Select next worksheet tab in the workbook

CTRL + PGDN

Select preceding worksheet tab in the workbook

CTRL + PGUP

Create a new workbook

CTRL + N

Select next open workbook

CTRL + TAB

Select previous open workbook

CTRL + SHIFT + TAB

Extend selection to last used cell on the worksheet

CTRL + SHIFT + END

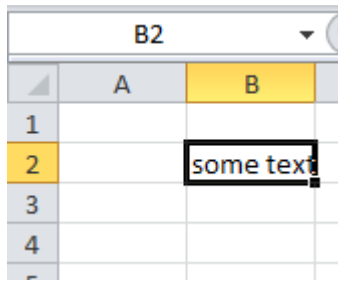
Extend selection to first cell on the worksheet

CTRL + SHIFT + HOME

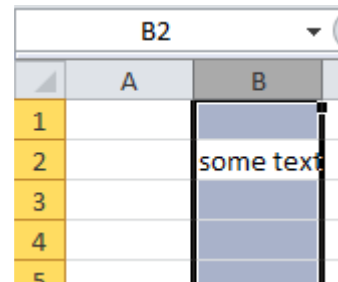
Select whole column

To select a whole column using keys only press CTRL + SPACE. The following diagram illustrates. Suppose cell B2 is currently selected ..

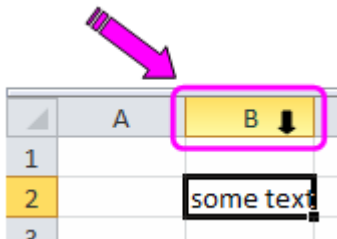
Excel Skills – Navigation and Selection



.. and CTRL + SPACE is pressed. The figure to the right shows the result – the entire B column has been selected.



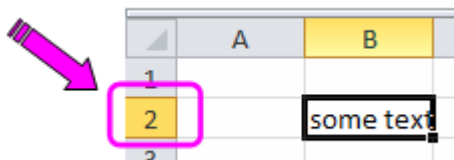
Alternatively, to select the whole column by using the mouse simply left-mouse-click on the column title ...



Select whole row

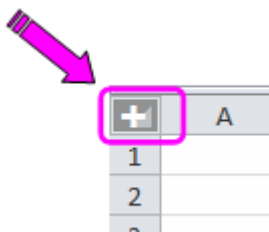
To select a whole row by using keys only select any cell in the row and then press SHIFT + SPACE.

To select a whole row with the mouse left-mouse-click on the row number ...



Select entire worksheet

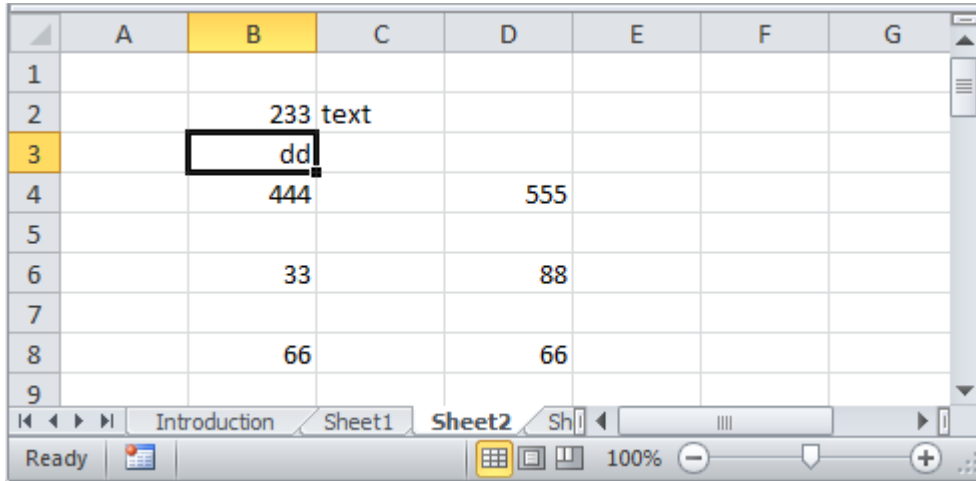
To select the entire worksheet with the mouse left-mouse-click on the top-left corner of the worksheet ...



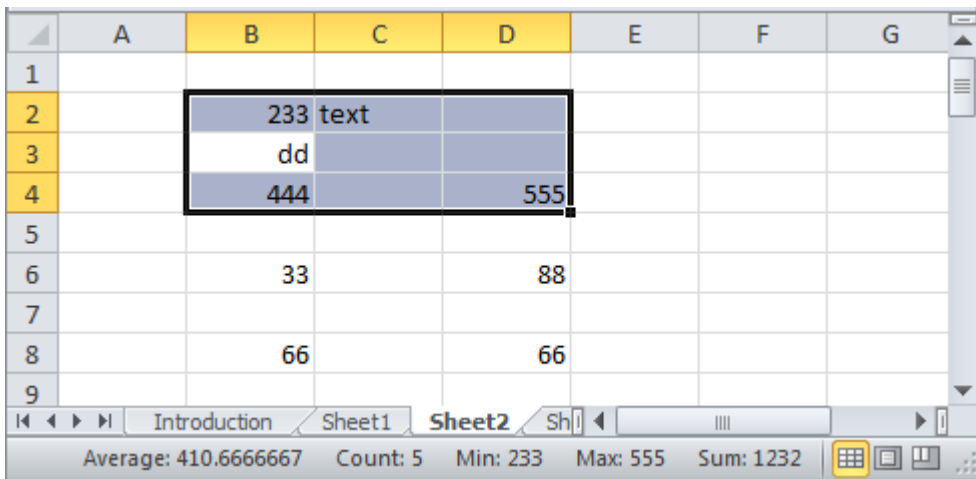
Alternatively, to do this by using keys press CTRL + A. As illustration is shown next.

Currently cell B3 is selected ...

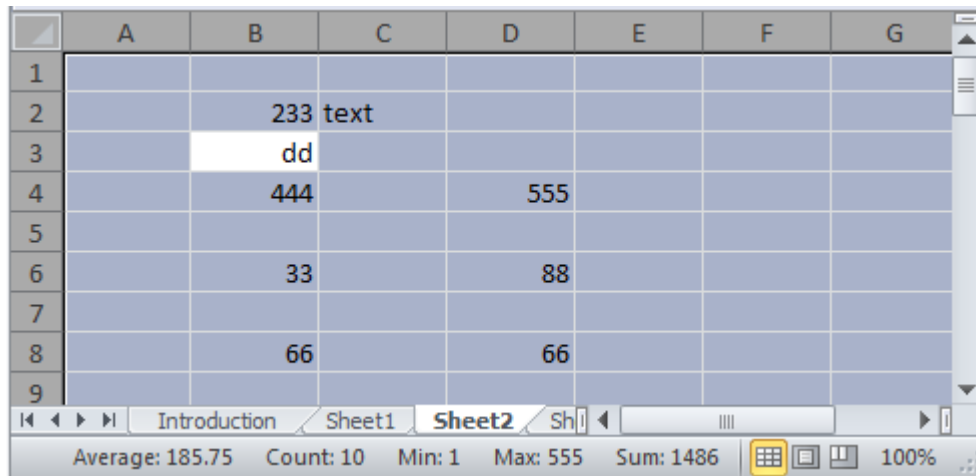
Excel Skills – Navigation and Selection



Pressing CTRL + A will select the entire “block” B2:D4 ...



Pressing CTRL + A again will select the entire sheet ...



CTRL + A might be a bit “finicky” in selecting the whole sheet. If it doesn’t select the whole sheet select another cell and try again – alternatively – just use the mouse.

Excel Skills – Navigation and Selection

Extend selection one position to the right

To extend a selection one position to the right press SHIFT + →

As an example, consider this: Suppose B2 is currently selected ...

	A	B	C	D
1				
2		some text	more	and more

Pressing SHIFT and the right arrow extends the selection one cell to the right ...

	A	B	C	D
1				
2		some text	more	and more

Select rightmost cell in a group

Press CTRL + →

Consider the following example. Cell A2 is currently selected. Press CTRL and the right-arrow key to move the selection to the rightmost cell in the current group of cells – which is cell C2.

	A	B	C	D	E	F	G
1		Forecast			Another section		
2	2013	2014	2015		2013	2014	2015
3	34	45	56		67	78	89

After pressing the CTRL and right-arrow key the selection will look like this ...

	A	B	C	D	E	F	G
1		Forecast			Another section		
2	2013	2014	2015		2013	2014	2015
3	34	45	56		67	78	89

There is now “white space” (D2) to the right of the selected cell. Repeating the command will “hop over” the white space to the next non-empty cell on the right ...

	A	B	C	D	E	F	G
1		Forecast			Another section		
2	2013	2014	2015		2013	2014	2015
3	34	45	56		67	78	89

Repeating will move the selection to the rightmost cell in the current group ...

	A	B	C	D	E	F	G
1		Forecast			Another section		
2	2013	2014	2015		2013	2014	2015
3	34	45	56		67	78	89

Excel Skills – Navigation and Selection

Selecting multiple non-adjacent cells

Suppose you wish to apply a common formatting or other operation to a set of non-adjacent cells. You first need to select that set. This can be done by keys and mouse together or just by using keys. We'll look first at using keys and mouse together. We'll work with the following example in which we wish to select two non-adjacent "blocks" (B2:C4 and E2:G4). Begin by moving the mouse to the top-left cell in the first block – B2 , press the left-mouse-button down and hold it down ...

	A	B	C	D	E	F	G
1							
2		aaa	bbb		122	333	555
3		ccc	ddd		555	333	111
4		111	222		sss	fff	hhh

Keeping the left-mouse-button down sweep the mouse down and to the right over cell C4.

B2		fx aaa					
	A	B	C	D	E	F	G
1							
2		aaa	bbb		122	333	555
3		ccc	ddd		555	333	111
4		111	222		sss	fff	hhh

Release the mouse, press the CTRL key and keep it down. Move the mouse over the top-left-cell of the second block and press and keep down the left-mouse-button ...

	A	B	C	D	E	F	G
1							
2		aaa	bbb		122	333	555
3		ccc	ddd		555	333	111
4		111	222		sss	fff	hhh

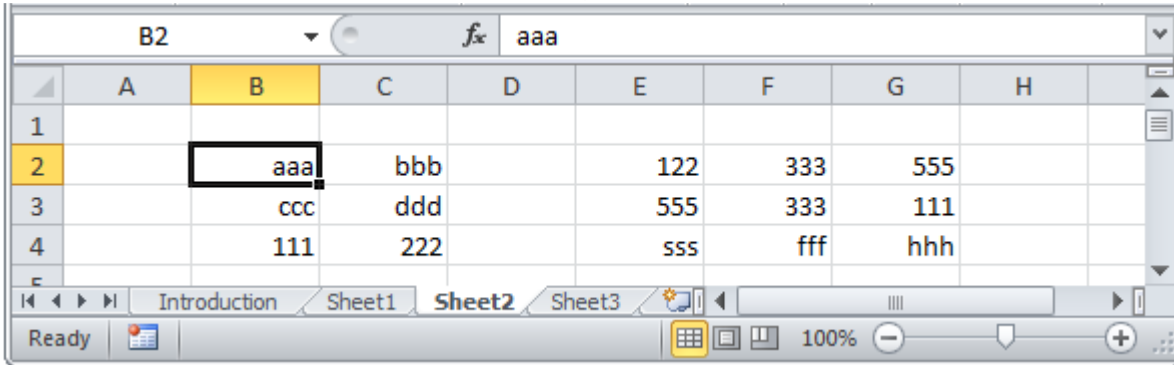
Sweep the mouse down and to the right over cell G4. Release the mouse button and then release the CTRL key ...

E2		fx 122					
	A	B	C	D	E	F	G
1							
2		aaa	bbb		122	333	555
3		ccc	ddd		555	333	111
4		111	222		sss	fff	hhh

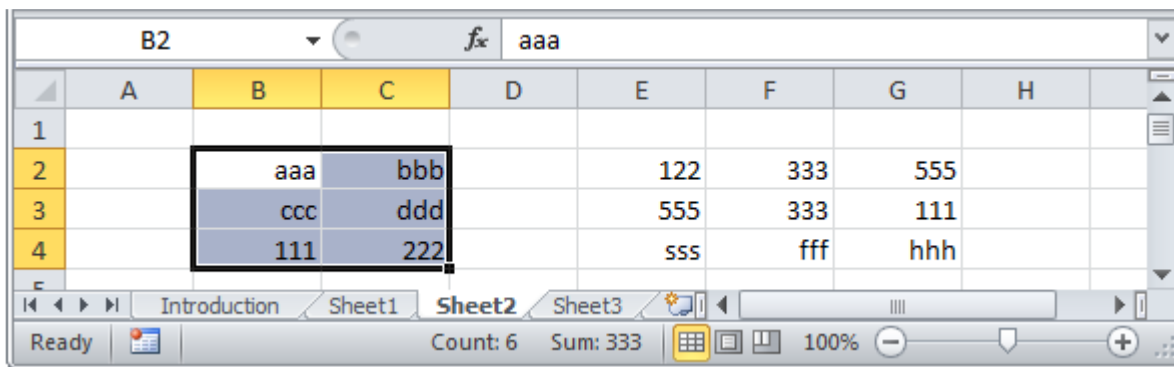
The multiple selection has been made.

To perform the multiple selection using only keys follow these steps. Begin by using the arrows keys to navigate to and select the first top-left-cell – B2 ...

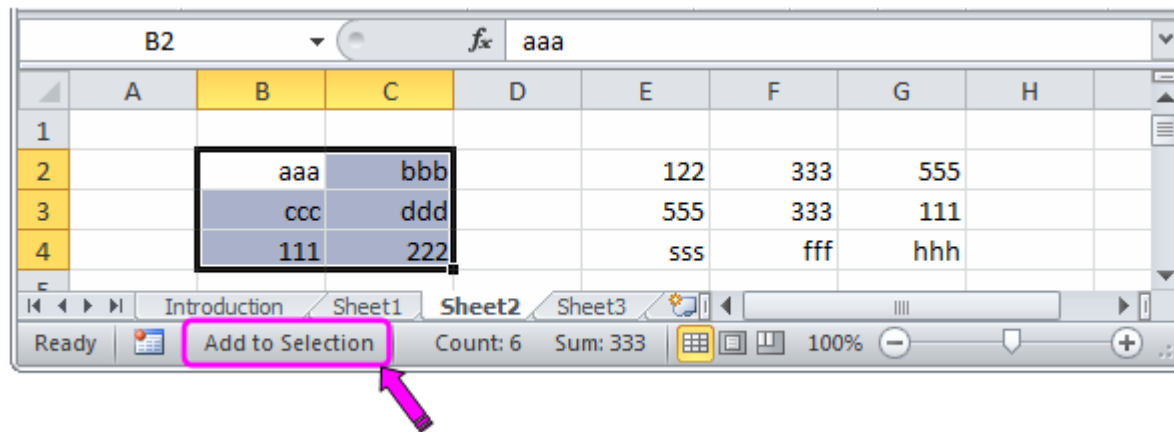
Excel Skills – Navigation and Selection



Press CTRL + SHIFT + down-arrow and then CTRL + SHIFT + right-arrow to select the first block ...

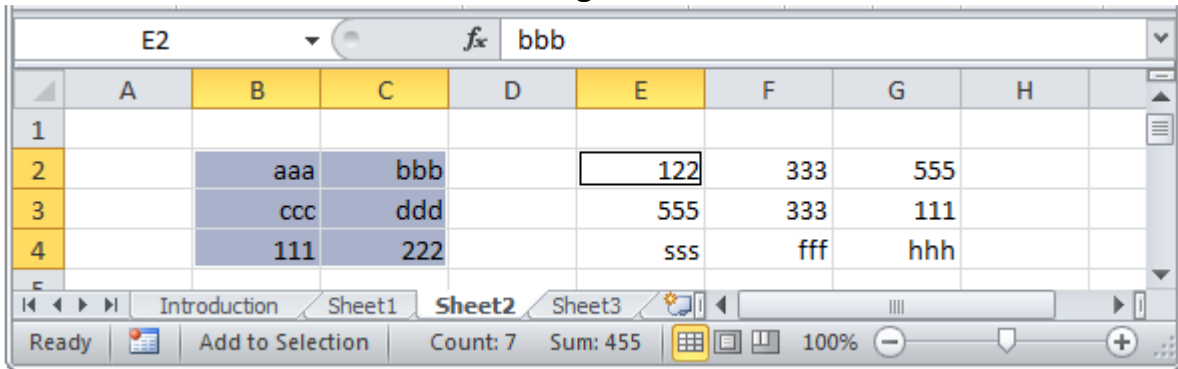


Press SHIFT + F8 to put Excel into “Add to Selection” mode ...

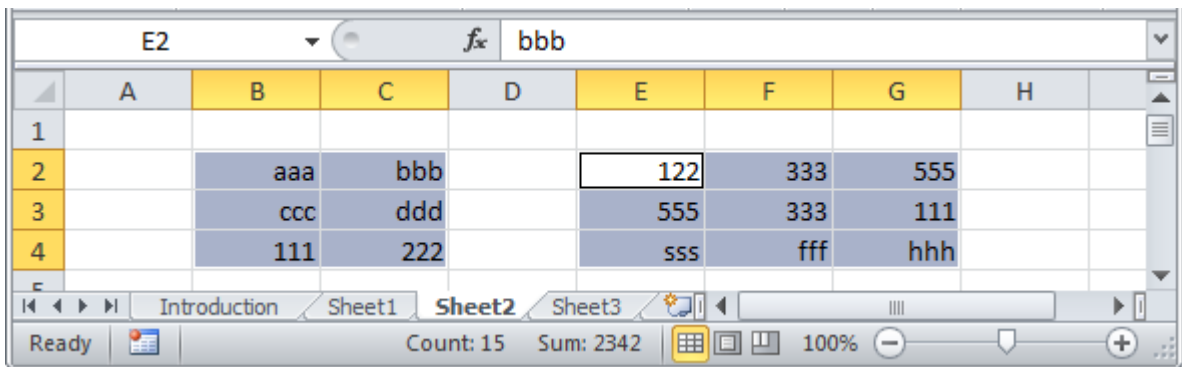


Press CTRL + right-arrow (twice) to move the first part of the extended selection to the top-left cell of block 2 ...

Excel Skills – Navigation and Selection



Press CTRL + SHIFT + down-arrow and then CTRL + SHIFT + right-arrow to select the second block ...



The non-adjacent cells have now been selected using only the keyboard.

Entering and filling data

Typing values into adjacent cells

There is a quick way of entering data into groups of cells. The following diagram illustrates ...

	A	B	C
1	Forecast		
2	2013	2014	2015
3			

We want to put data into cells A3, B3 and C3. We could do that by selecting A3, typing into that cell, press ENTER, select B3, typing, press ENTER again, etc. But here is a quicker way: First, select A3:C3.

Type into A3 and press ENTER (or TAB) ...

	A	B	C
1	Forecast		
2	2013	2014	2015
3	34		

Excel accepts the data and moves focus to the next cell. Type into the second cell and press ENTER again ...

	A	B	C
1	Forecast		
2	2013	2014	2015
3	34	45	

Excel accepted the second item and moved focus again. Type the contents of the last cell and press ENTER again ...

	A	B	C
1	Forecast		
2	2013	2014	2015
3	34	45	56

The data entry is complete. If your selection contains rows and columns then TAB moves focus to the right whereas ENTER moves focus down. So TAB fills by row and ENTER fills by column.

Autofill

Excel has an Autofill feature that allows you to continue or extend cells.

Following is an example of how Autofill can be used ...

Excel Skills - Entering and Filling Data

C14		fx =C12+C13		
	A	B	C	D
10				
11		2014	2015	2016
12	Admin cost	\$ 45	\$ 12	\$ 67
13	Other cost	\$ 23	\$ 78	\$ 14
14	Total cost	\$ 68	\$ 90	

Cell C14 contains a formula that we want to “fill” to the right – to cell D14. To do that move your mouse to the bottom right-hand corner of C14. The cursor will change to a “+” autofill cursor ...

C14		fx =C12+C13		
	A	B	C	D
10				
11		2014	2015	2016
12	Admin cost	\$ 45	\$ 12	\$ 67
13	Other cost	\$ 23	\$ 78	\$ 14
14	Total cost	\$ 68	\$ 90	

Drag your mouse one cell to the right ...

C14		fx =C12+C13		
	A	B	C	D
10				
11		2014	2015	2016
12	Admin cost	\$ 45	\$ 12	\$ 67
13	Other cost	\$ 23	\$ 78	\$ 14
14	Total cost	\$ 68	\$ 90	

... and release it ...

C14		fx =C12+C13		
	A	B	C	D
10				
11		2014	2015	2016
12	Admin cost	\$ 45	\$ 12	\$ 67
13	Other cost	\$ 23	\$ 78	\$ 14
14	Total cost	\$ 68	\$ 90	\$ 81
15				

Excel Skills - Entering and Filling Data

C14 has been auto-filled to the right. The small “+” icon below and to the right of the auto-filled cell in D14 gives you additional options – we’ll look at those options now, but with a new example.

We’ll begin with a single data item in cell A1...

	A	B	C	D	E
1	2013				

We want to extend A1 to the right and generate a series of numbers. As before, move the mouse to bottom-right corner of the cell, press the mouse button down, drag to the right, and release. The data series has been extended to cell D1...

	A	B	C	D	E
1	2013	2013	2013	2013	
2					

You can now refine the extended series by pressing on the small icon that has appeared to the right of the filled area. The next illustration shows what happens when you press on the icon ...

	A	B	C	D	E	F	G
1	2013	2013	2013	2013			
2							
3							
4							
5							
6							
7							

“Copy Cells” is currently selected. That makes Excel extend the data by simply copying it. You have other choices though: The second choice in the list is “Fill Series”. That option will make Excel “extrapolate” the data as well as extending it. If you click on that choice Excel will re-fill the series ...

	A	B	C	D	E	F	G
1	2013	2014	2015	2016			
2							
3							
4							
5							
6							
7							

Excel Skills - Entering and Filling Data

Instead of simply copying 2013, as Excel did before, it now increments the numbers: 2013 in A1 becomes 2014 in B1, 2015 in C1, and so on.

Excel is intelligent enough to extrapolate other data types also: If A1 contains “Jan” then “Jan” would become “Feb” in B1, “Mar” in C1, and so on.

If the data being extended is a pure date (e.g. 1-Jan-14) then Excel gives you extra fill options.

Autofill used with dates

Suppose we extend the date in A1 to the right in the following example ...

	A	B	C	D	E
1	1-Jan-14				

After doing the fill Excel gives extra date choices. “Fill Series” increments dates by one day ...

	A	B	C	D	E	F	G	H
1	1-Jan-14	2-Jan-14	3-Jan-14	4-Jan-14	5-Jan-14			
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								

- Copy Cells
- Fill Series
- Fill Formatting Only
- Fill Without Formatting
- Fill Days
- Fill Weekdays
- Fill Months
- Fill Years

B1 is one day after A1, C1 is one day after B1, etc.

“Fill Months” increments by one month intervals ...

Excel Skills - Entering and Filling Data

	A	B	C	D	E	F	G	H
1	1-Jan-14	1-Feb-14	1-Mar-14	1-Apr-14	1-May-14			
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								

B1 is one month after A1, C1 is one month after B1, and so on.

But suppose you wish to increment in three month intervals? This is how to do that: Put the first date (1-Jan-14) into A1 and the second date (1-Apr-14) into B1 ...

	A	B	C	D	E	F
1	1-Jan-14	1-Apr-14				

Select **both** cells ...

	A	B	C	D	E	F
1	1-Jan-14	1-Apr-14				

And extend to the right ...

	A	B	C	D	E	F	G	H	I
1	1-Jan-14	1-Apr-14	1-Jul-14	1-Oct-14	1-Jan-15	1-Apr-15			
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									

Make sure "Fill Series" is selected. The dates in the filled series are all three month apart: Excel has been clever enough to discern that you wanted dates spaced at three month intervals.

Excel Skills - Entering and Filling Data

Autofilling down – double-clicking

Autofilling can be used to fill down as well as across. There's one extra feature available when filling down. That feature is illustrated in the following diagram ...

E2		fx =SUM(B2:D2)			
	A	B	C	D	E
1		Jan	Feb	Mar	Total
2	A	71	74	32	177
3	B	57	27	62	
4	C	66	89	19	
5	D	30	13	80	
6	E	98	67	59	
7	F	57	40	81	
8	G	48	48	51	

We wish to autofill cell E2 down. A quick way of doing that is to move the mouse to the bottom right corner of E2 and then double-click. Excel will autofill down. How far does it fill? It keeps track of what is to the left and fills down as long as the cells to the left have something in them. In this case it will autofill down to row 8 ...

E2		fx =SUM(B2:D2)			
	A	B	C	D	E
1		Jan	Feb	Mar	Total
2	A	71	74	32	177
3	B	57	27	62	146
4	C	66	89	19	174
5	D	30	13	80	123
6	E	98	67	59	224
7	F	57	40	81	178
8	G	48	48	51	147
9					

Note that the double-clicking autofill only works in a downwards direction and not across.

Moving, inserting and deleting

Inserting rows

Rows can be inserted by using either the keyboard or mouse. Consider the following example: We wish to insert two rows between rows 2 and 3 ...

	A	B	C	D
1		Jan	Feb	Mar
2	White industries	23	34	45
3	Black industries	56	67	78
4				
5				

Begin by selecting the top row before which the inserting will be done (i.e. row 3) ...

	A	B	C	D
1		Jan	Feb	Mar
2	White industries	23	34	45
3	Black industries	56	67	78
4				
5				

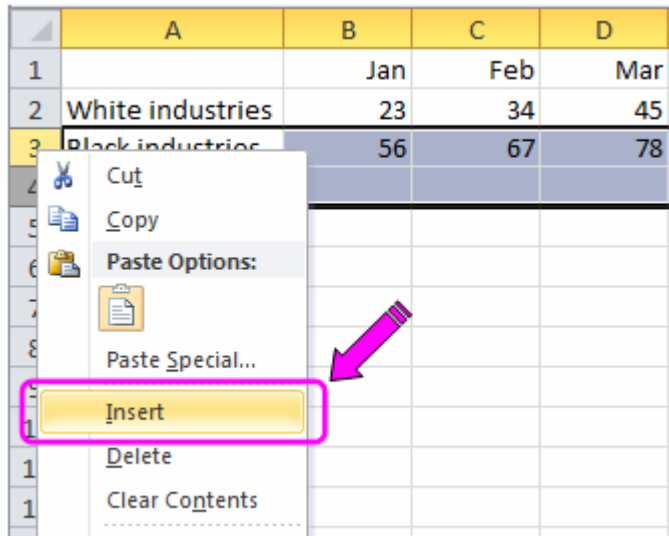
Extend the selection down so that two rows are selected (to indicate we want to insert two rows) ...

	A	B	C	D
1		Jan	Feb	Mar
2	White industries	23	34	45
3	Black industries	56	67	78
4				
5				

Now do the insertion. It's easiest done with a keyboard shortcut: Press CTRL and SHIFT and + together. Alternatively to insert with the mouse right-click anywhere in the selected area (i.e. in rows 3 or 4). A popup-menu appears ...

Excel Skills - Moving, inserting and deleting

	A	B	C	D
1		Jan	Feb	Mar
2	White industries	23	34	45
3	Black industries	56	67	78



Then click on “Insert” (or press the I key).

The spreadsheet looks like this after the insertion is done ...

	A	B	C	D
1		Jan	Feb	Mar
2	White industries	23	34	45
3				
4				
5	Black industries	56	67	78

Two rows have been inserted as desired.

Inserting columns

The same technique is used for columns as for rows.

Deleting rows

The following example shows how to delete rows: We wish to delete rows 3 and 4 ...

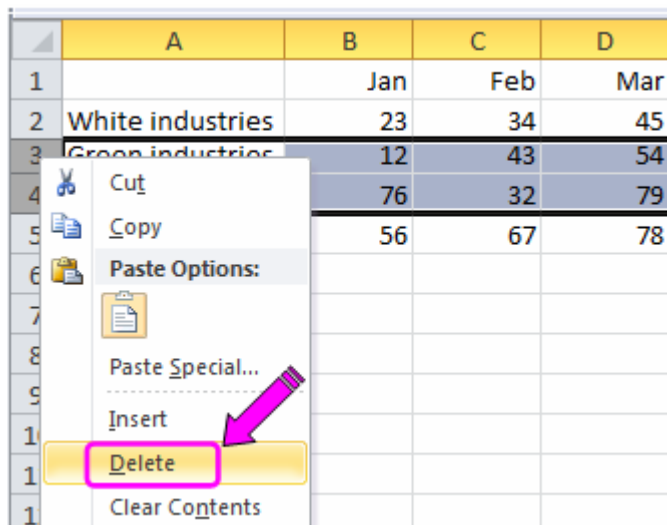
	A	B	C	D
1		Jan	Feb	Mar
2	White industries	23	34	45
3	Green industries	12	43	54
4	Blue industries	76	32	79
5	Black industries	56	67	78

First, select the rows to be deleted ...

Excel Skills - Moving, inserting and deleting

	A	B	C	D
1		Jan	Feb	Mar
2	White industries	23	34	45
3	Green industries	12	43	54
4	Blue industries	76	32	79
5	Black industries	56	67	78

Now do the deletion. It's easiest done with a keyboard shortcut: Press CTRL and the minus key together. Alternatively to delete with the mouse right-click anywhere in the selected area (i.e. in rows 3 or 4). In the popup-menu that appears click on "Delete" ...



	A	B	C	D
1		Jan	Feb	Mar
2	White industries	23	34	45
3	Green industries	12	43	54
4	Blue industries	76	32	79
5	Black industries	56	67	78

The selected rows are deleted ...

	A	B	C	D
1		Jan	Feb	Mar
2	White industries	23	34	45
3	Black industries	56	67	78
4				
5				

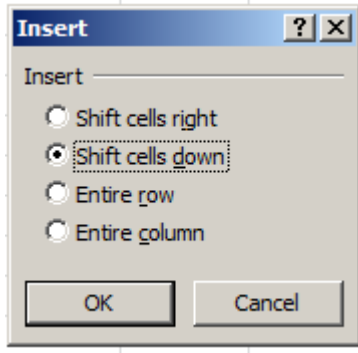
Deleting columns

Columns can be deleted using the same methods as for rows.

Inserting rows or columns or cells

In the previous example we inserted entire rows. Before inserting we selected one or more rows. If instead, we had selected individual cells then Excel would have shown us this ...

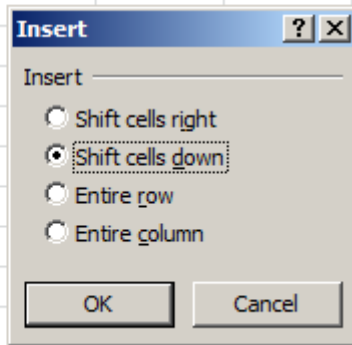
Excel Skills - Moving, inserting and deleting



We need to specify what kind of insertion we want. Select one of the four options. Then press the ENTER key or click on the OK button - the insertion will be done. A couple of examples follow. In the next example we will insert a cell and shift down cells below the insertion point. We start with this

...

	A	B	C	D	E
1		Jan	Feb	Mar	
2	White industries	23	34	45	
3	Black industries	56	67	78	
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					



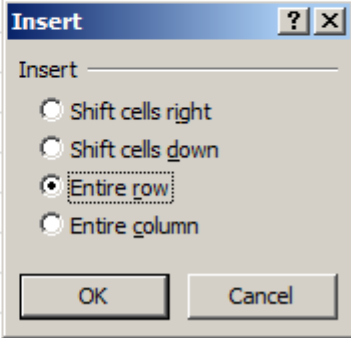
And after the insertion the spreadsheet looks like this ...

	A	B	C	D
1		Jan	Feb	Mar
2	White industries	23	34	45
3	Black industries	56		78
4			67	

In the next example we will insert an entire row ...

Excel Skills - Moving, inserting and deleting

	A	B	C	D	E
1		Jan	Feb	Mar	
2	White industries	23	34	45	
3	Black industries	56	67	78	
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					



The dialog box is titled "Insert" and has a question mark and close button in the top right. It contains four radio button options: "Shift cells right", "Shift cells down", "Entire row" (which is selected and highlighted with a dashed border), and "Entire column". At the bottom are "OK" and "Cancel" buttons.

And after the insertion the spreadsheet looks like this ...

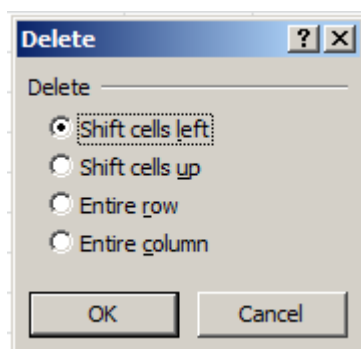
	A	B	C	D	E
1		Jan	Feb	Mar	
2	White industries	23	34	45	
3					
4	Black industries	56	67	78	

Deleting rows or columns or cells

First bring up the Delete dialog. Press the CTRL and minus keys together.

Alternatively right-mouse-click and choose "Delete" from the popup menu that appears.

A Delete dialog box appears that looks like this ...



Choose the operation you want and press the ENTER key or click on the OK button. The deletion will be performed.

Excel Skills - Moving, inserting and deleting

Swapping rows

To swap rows in a spreadsheet follow the steps outlined next. In this example we will swap rows 2 and 3 ...

	A	B	C	D
1		Jan	Feb	Mar
2	White industries	23	34	45
3	Black industries	56	67	78

Begin by selecting either of the swap rows. We'll select row 2 ...

	A	B	C	D
1		Jan	Feb	Mar
2	White industries	23	34	45
3	Black industries	56	67	78

Move your mouse to bottom of the selected row. The cursor will change shape ...

	A	B	C	D
1		Jan	Feb	Mar
2	White industries	23	34	45
3	Black industries	56	67	78

Press the SHIFT key and keep it down. Press the left mouse button and keep it down and drag it down one row. Then release the mouse button and the shift key. The rows will be swapped ...

	A	B	C	D
1		Jan	Feb	Mar
2	Black industries	56	67	78
3	White industries	23	34	45

Swapping columns

Swapping columns is done the same way as rows except you select columns rather than rows.

Excel Skills - Copying and pasting

Copying and pasting

Excel provides a number of ways of copying and pasting. We'll look at some of those. The following diagram shows where copy and paste is useful ...

	A	B	C	D
10				
11		2014	2015	2016
12	Admin cost	\$ 45	\$ 12	\$ 67
13	Other cost	\$ 23	\$ 78	\$ 14
14	Total cost	\$ 68	\$ 90	

We want to put a formula in D14. We could type the formula. But it's quicker instead to copy the existing formula from the cell to the left - C14 - and paste it into cell D14.

Copy and paste using control keys

Continuing with the preceding example, to copy and paste first select cell C14. Then press CTRL + C to copy. A dotted line will appear around the copied cell ...

C14		fx =C12+C13		
	A	B	C	D
10				
11		2014	2015	2016
12	Admin cost	\$ 45	\$ 12	\$ 67
13	Other cost	\$ 23	\$ 78	\$ 14
14	Total cost	\$ 68	\$ 90	

Press the right-arrow key to select the cell to the right - D14 ...

D14		fx		
	A	B	C	D
10				
11		2014	2015	2016
12	Admin cost	\$ 45	\$ 12	\$ 67
13	Other cost	\$ 23	\$ 78	\$ 14
14	Total cost	\$ 68	\$ 90	

Last, press CTRL + V to paste the copied formula into D14 ...

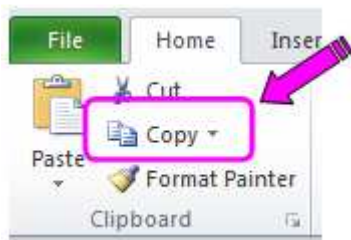
Excel Skills - Copying and pasting

	A	B	C	D
10				
11		2014	2015	2016
12	Admin cost	\$ 45	\$ 12	\$ 67
13	Other cost	\$ 23	\$ 78	\$ 14
14	Total cost	\$ 68	\$ 90	\$ 81

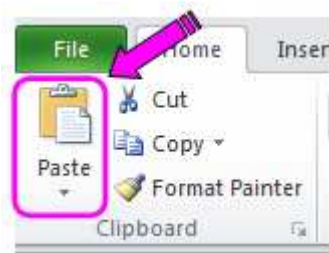
The formula has been pasted. Note that Excel was clever in pasting the formula: Even though the formula it copied was **=C12+C13** the formula it pasted was **=D12+D13**. The formula in C14 - **=C12+C13** - added the two cells above C14 and the new formula in D14 - **=D12+D13** - adds the two cells above D14.

Copy and paste using the ribbon

Another way of copying is by using the ribbon. To copy this way press the Copy icon in the Clipboard section of the Home ribbon ...



And to paste press the Paste icon ...



Pasting options

When you paste you have a number of options available. The options specify what is to be pasted. Formulas? Values? Formats? Or a combination? Consider the following example. We copy from cell B1 ...

	A	B	C	D
1	2013	2014		

.. and paste into cell C1 ...

Excel Skills - Copying and pasting

	A	B	C	D
1	2013	2014	2015	
2				

Formula bar: C1 fx =B1+1

You can see that the formula is B1 was pasted into C1. The formatting of B1 was also pasted into C1. So both formula and format were pasted. But what if we only want the formula pasted? Or only the format? We can specify what to paste by clicking on the small icon next to the pasted cell ...

	A	B	C	D	E
1	2013	2014	2015		
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					

Context menu for cell C1:

- (Ctrl) [down arrow]
- Paste (highlighted with a pink box and arrow)
- fx
- %fx
- Paste Values
- Other Paste Options

There are a range of pasting options. The current one (highlighted) pastes formulas and formats. Suppose we wish to paste the formula but not the format. Then we click on the second icon (highlighted in the next diagram) ...

	A	B	C	D	E
1	2013	2014	2015		
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					

Formula bar: C1 fx =B1+1

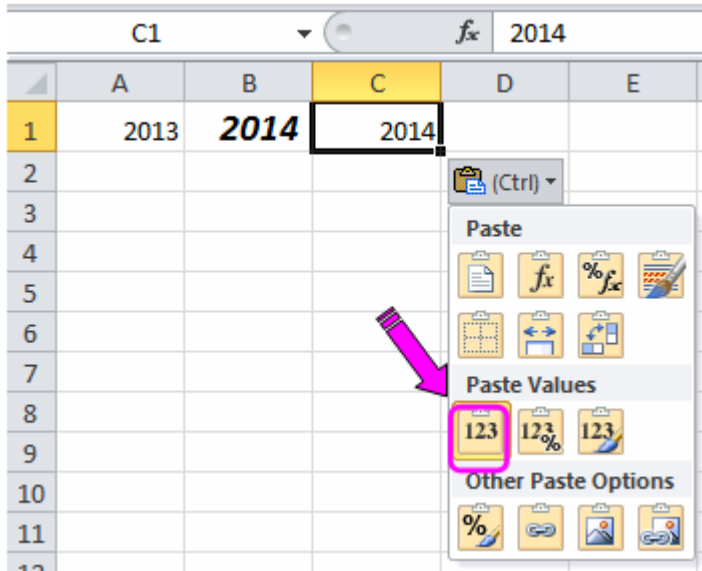
Context menu for cell C1:

- (Ctrl) [down arrow]
- Paste
- fx (highlighted with a pink box and arrow)
- %fx
- Paste Values
- Other Paste Options

Excel Skills - Copying and pasting

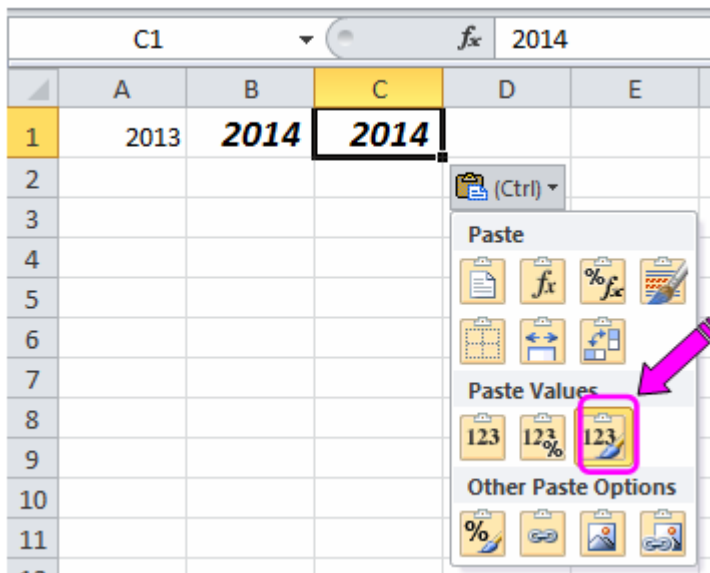
Now look at C1 in the preceding diagram: Its format hasn't been copied from B1 – only the formula has. So, as we wanted, the formula but not the format has been pasted.

Suppose we want to paste values and not formulas or formats. Then the following option does that ...



C1 contains B1's value but not its formula or format.

And if we wish to paste values and formats then the following option will do that ...



Note that C1 has B1's value and format.

Copy and pasting by using the edit popup menu

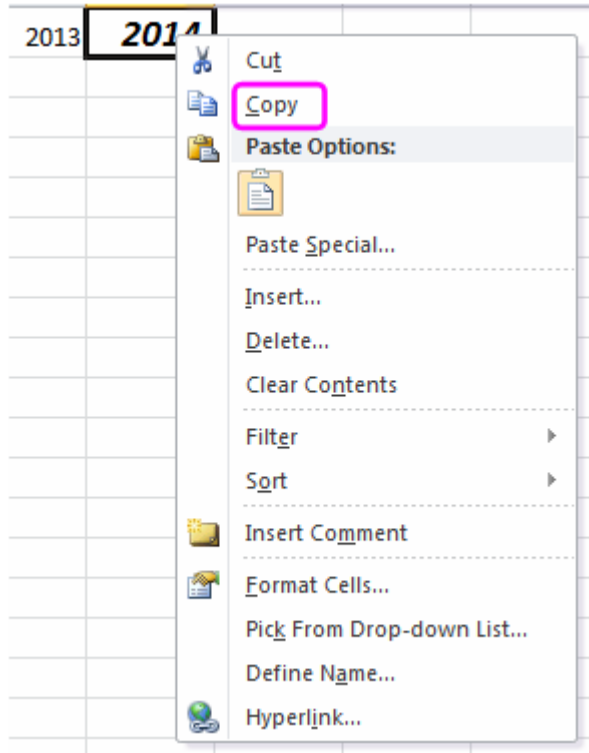
Another way of copying and pasting is by using the edit popup menu. To use the menu first right-mouse-click. Then click on the Copy item on the popup menu that appears ...

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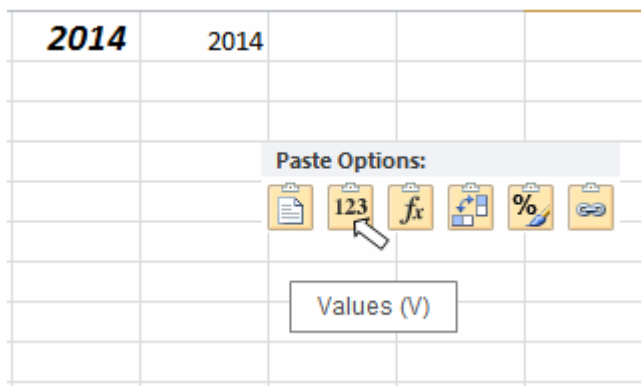
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Excel Skills - Copying and pasting



To paste - click on the Paste Options menu item. When you do that a number of pasting options become available ...

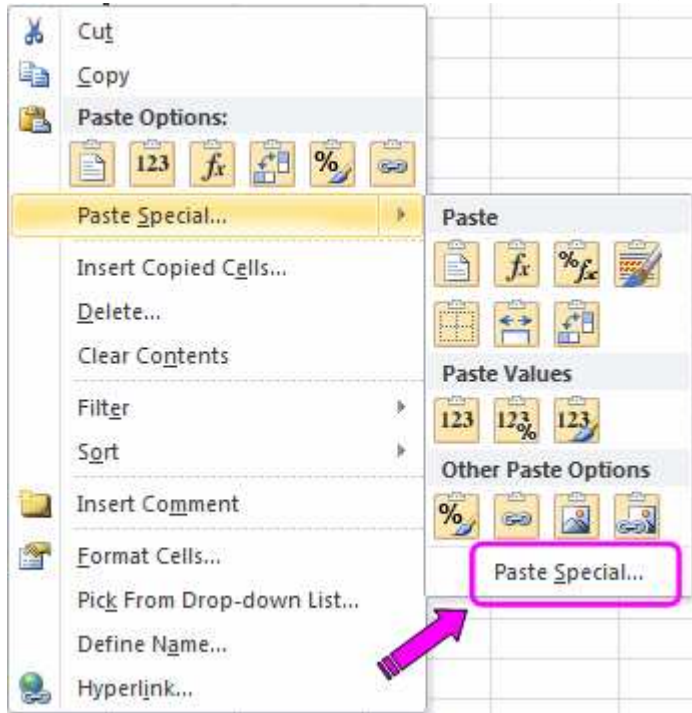


These options are the same as those already described. An advantage of pasting this way, however, is that the options work immediately: The pasted cell redisplay in the corresponding format as you move your mouse from icon to icon.

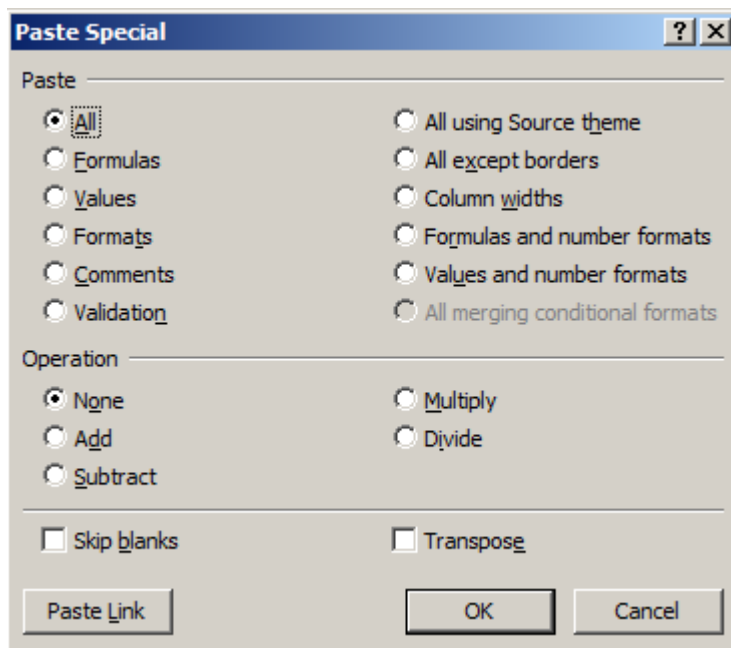
Paste Special

When pasting ,instead of clicking on “Paste Options”, you can instead click on Paste Special ...

Excel Skills - Copying and pasting



When you do that a dialog box appears ...

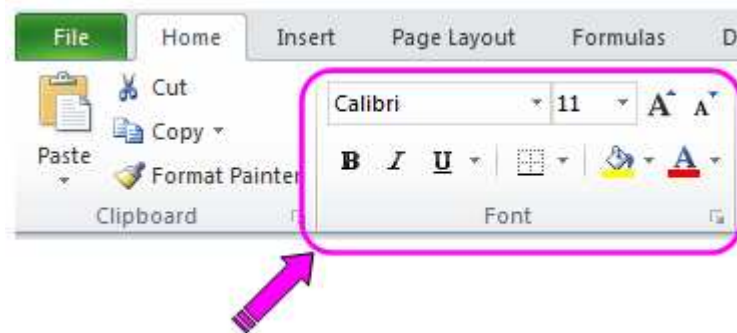


Choose the option you want from those available and press the OK button. Pasting will be done according to the options you specify.

Formatting

Fonts

In spreadsheets we sometimes need to change the appearance of text (its size, colour, font, etc). We'll look at a variety of ways of doing that. You can use the Font section of the Home ribbon to format text ...



Many of the functions in the Font section are obvious: Press the B icon to make the text bold in currently selected cell(s). Press I to italicise, press the “bucket” icon to set the background colour, and so on.

Often-used font operations have keyboard shortcuts: The quickest way of underlining, italicising and making bold is with CTRL key shortcuts: To underline press CTRL + U, to italicise press CTRL + I and to set text bold press CTRL + B. Press again to reverse the operation.

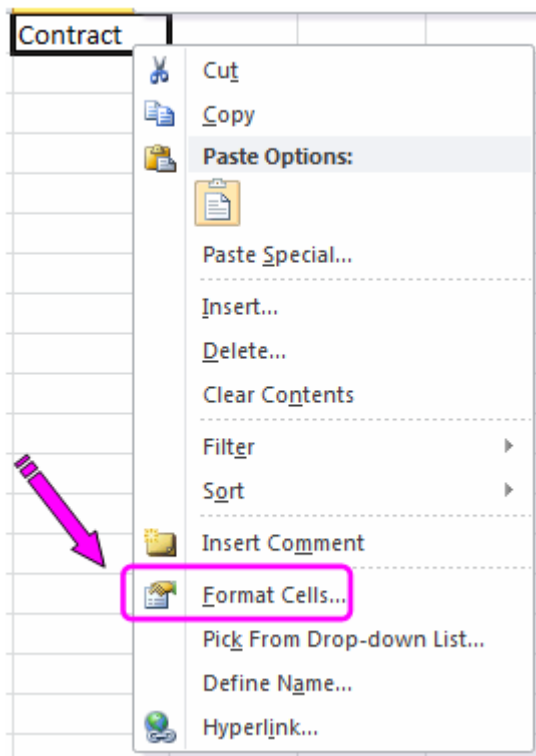
Format Cells dialog

The Format Cells dialog is “Format central” – a collection of many of the common formatting operations collected together in one package. There are several ways of bringing up the Format Cells dialog.

Format Cells dialog started by right-mouse-clicking

Right-mouse-click and a popup menu will appear ...

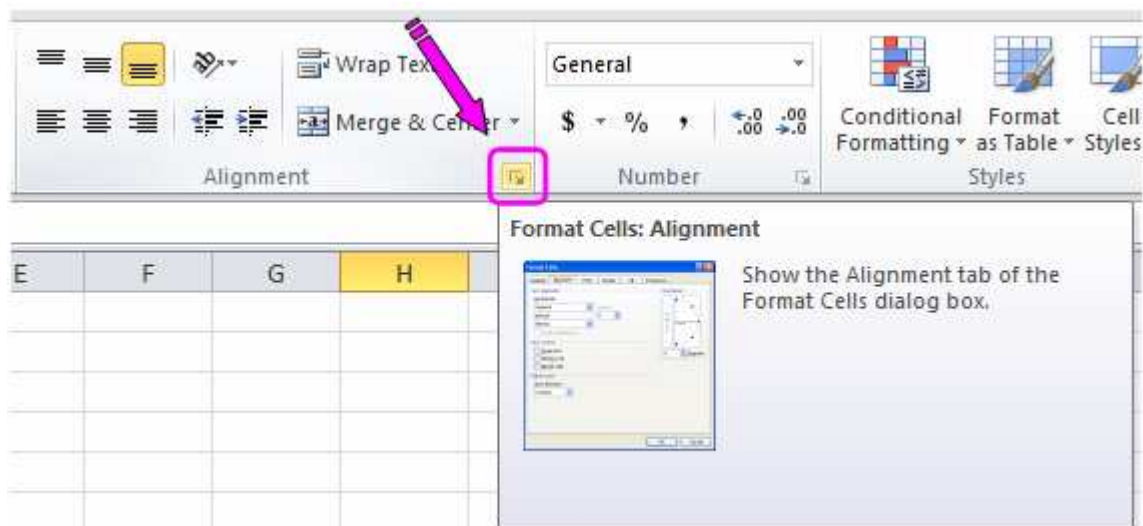
Excel Skills - Formatting



Select "Format Cells" from the list. You can select that menu item by clicking your mouse on the item or simply by pressing the F key. (Underlined cells in menus – the "F" in this example – indicate you can use a keyboard shortcut for the menu item.)

Format Cells dialog started from the Ribbon

Click on the small icon on the lower-right of the Alignment section of the Home ribbon ..

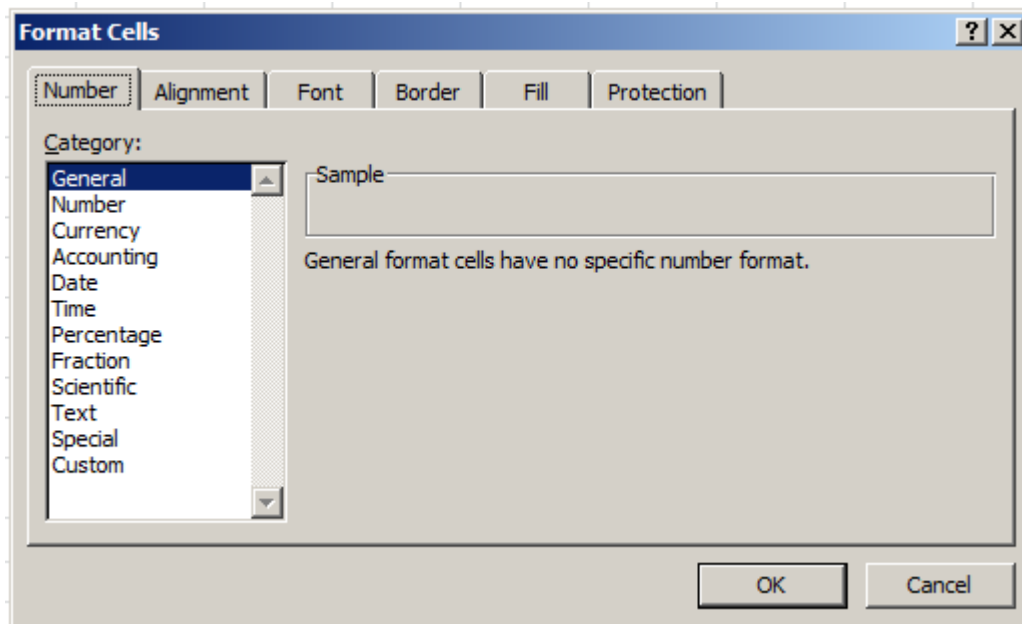


Format Cells dialog started from keyboard shortcut

Another way of bringing up the Format Cells dialog is to use the keyboard shortcut CTRL + SHIFT + F. Alternatively ALT, H, F, N also works.

Excel Skills - Formatting

After it is started, the Format Cells dialog is as shown next ...



Tabs at the top of the dialog let you format Numbers, Alignment, Fonts, Borders and so on. We'll look at some tabs now in more detail. We begin with number formats.

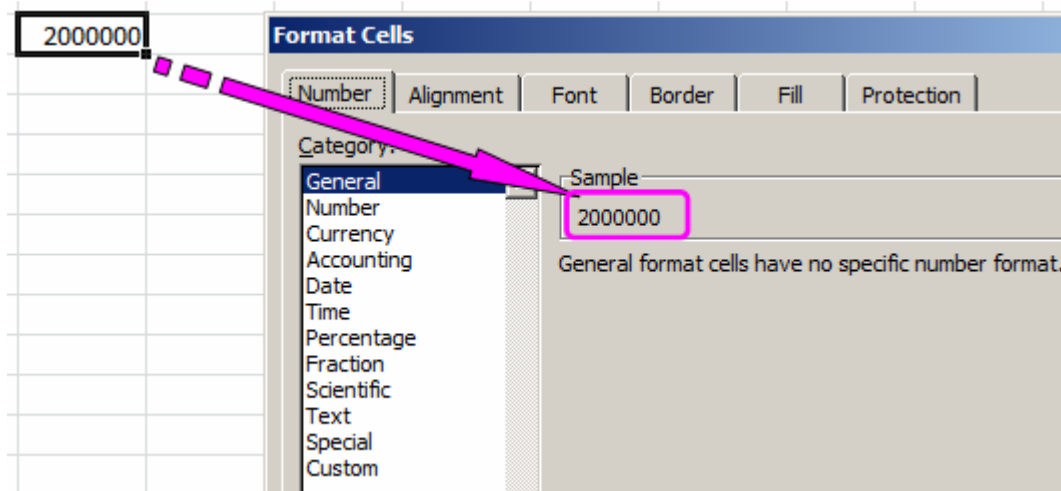
Setting number format

Consider the number 1000. That number can be shown in a spreadsheet in many different ways. It can be shown as 1000. As 1,000. As \$1,000. As \$ 1000.00. And so on. Positive numbers can be shown in black and negative in red (or purple or hot pink – if you want). Excel lets you specify how a number will appear. As an example, the following table shows the number -2000000 formatted to display in various ways.

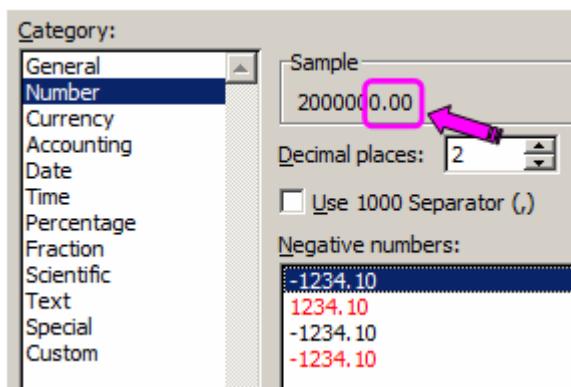
<i>Displayed number</i>	<i>Format</i>
-2000000	General
-2000000.00	Number, 2 decimal places
-\$ 2,000,000	Accounting, 0 decimal places, \$ currency symbol
(2,000,000)	Custom: #,##0 ;(#,##0);-
-2,000	Custom: #,##0,
-2 (m)	Custom: #,, (\m)

To set a number format first choose a category from the list on the left side of the dialog. By default, formats are "General". Excel gives a "preview" of how the cell currently selected on the worksheet will be formatted ...

Excel Skills - Formatting



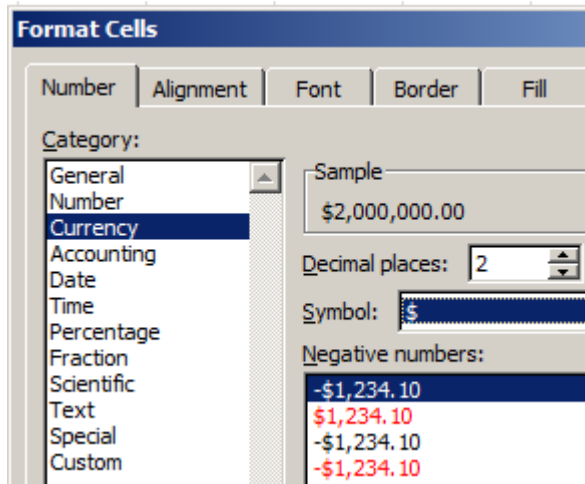
We'll look at some of the formats in the Category list -beginning with the "Number" format. That format allows us to specify two parameters: 1) The number of decimal points to display. And 2) the way negative numbers are shown. In the following illustration we have specified that numbers will have two decimal places and that negative numbers will have a leading minus sign.



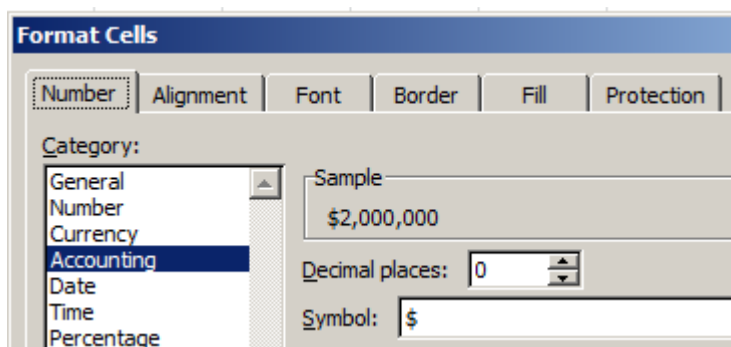
There is an additional option - "Use 1000 Separator" – which, if selected, places commas at every third position in the number.

The next, Currency, format allows similar choices to those of the Number format. However, "," is automatically set as a 1000 separator. Additionally you can select a currency symbol.

Excel Skills - Formatting



The Accounting category also gives the choice of currency symbol and number of decimal places ...



The alignment of cells differs between Currency and Accounting formats. The following illustration shows the difference between the two.

<i>Accounting format</i>	<i>Currency format</i>
\$ 200	\$200
\$ 2,000,000	\$2,000,000

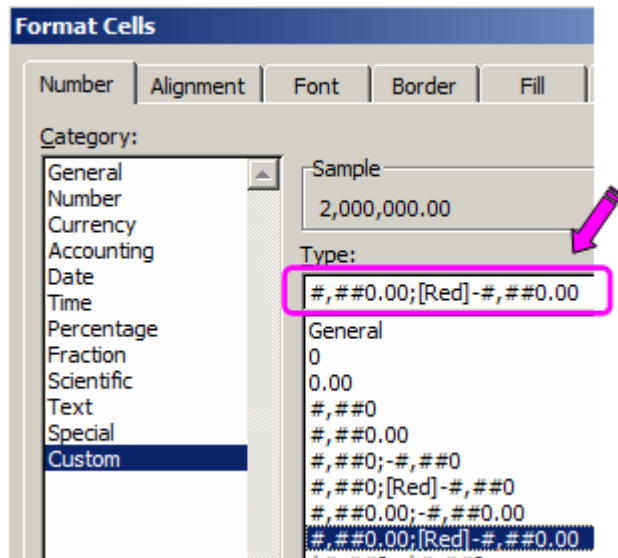
The accounting format left-aligns the currency symbol whilst the currency format does not. And there's a more subtle difference too: The accounting format has a one-space indent after the rightmost digit and the currency format does not.

Of the remaining formats we'll leave Date and Time until later, Percentage is self-explanatory and Fraction, Special, Scientific and Text are rarely used. Which leaves us with Custom. Custom lets you define your own formats and can be very useful and powerful.

Custom formats

Custom formats look somewhat strange ...

Excel Skills - Formatting



What does that strange assortment of characters - #,##0.00;[Red]-#,##0.00 - mean? We'll break the format down and explain its parts. The most important symbol in the format is the semi-colon “;”. The “;” separates different parts of a custom format. Custom formats allow you to specify up to four separate formats for a cell. Which format is applied depends on whether the cell has a positive number, a negative number, contains zero or contains text. The “;” separates the format descriptions from each other. Custom formats are organised like this..

Positive number format ; Negative number format ; zero format ; text format

The order is “hard-coded”. Excel always treats the first format as applying to positive numbers, the second to negative. And so on. If you want only to define a “later” format (e.g. the third one – format for zero) then you can put “null” descriptions in for the earlier formats. For example consider the following format ...

;;“zero”

This means to use the default “general” format for positive numbers, default for negative numbers and to show 0s as the word “zero”.

Let's return to the earlier custom format: #,##0.00;[Red]-#,##0.00. The first part of that format (the part before the “;”) describes positive numbers. Positive numbers will have this format: #,##0.00.

The custom format following the first “;” describes negative numbers. Negative numbers will have this format: [Red]-#,##0.00.

Consider the positive number format first: #,##0.00. The “.00” at the end means that two decimal places must be displayed. The “,” in “##0” means that commas should be used as 1000's separators. The #’s mean to show a digit in the corresponding position but not to show unnecessary leading zeros. The 0 before the “.” means to show a digit in that position and to show zero even if there is no digit to show (e.g. if the number is small – like 0.1).

Excel Skills - Formatting

As an illustration of the difference between # and 0 in a number format in the following table we show the numbers 1, 10, 100 and 1000 in both “#,##0” and “#,000” formats.

Number	Format		Number	Format
1	#,##0		001	#,000
10	#,##0		010	#,000
100	#,##0		100	#,000
1,000	#,##0		1,000	#,000

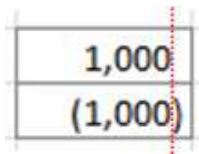
Going back to the full format we mentioned earlier: We’ve described the positive number part. Now consider the second, negative number, part. That part of the format was ..

[Red]-#,##0.00

In that format [Red] means to show negative numbers in red. The only other difference between positive and negative number formats is that the negative format also includes a leading “-”.

Example of designing a custom number format

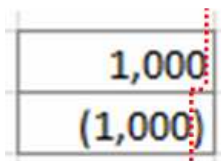
We’ll show next how a custom number format can be designed. We want a format that will display numbers as shown next.



1,000
(1,000)

Negative numbers are to be shown with brackets around them. We want the rightmost digits of both positive and negative numbers to be vertically aligned.

Our first attempt is this format: #,##0;(#,##0). When we apply that format to two cells containing 1000 and minus 1000 we see the following.



1,000
(1,000)

The brackets are as we want but the rightmost digits are not aligned. Currently the rightmost digit of the positive number is aligned with the closing bracket of the negative number. To fix that we modify the custom format to this: #,##0_);(#,##0). We have added “_)” to the format for positive numbers. The “_)” tells Excel to print a space at that position with the same width as a closing bracket symbol. [So neither “_” nor “)” are actually displayed.]

The final result is as we want ...

Excel Skills - Formatting



Custom format for thousands and millions

Numbers can be displayed in units of thousands or millions by using a custom format. For example, you might want 2,000,000 to be displayed as 2 (m). Or you might want to display 237,000 as simply 237. To display a number as thousands you can use this format: #,##0,

We have added a “,” at the end of the custom format. That makes Excel display 237,000 as 237. If you add two “,”s at the end of the format, numbers will be displayed in millions.

As an example of millions format consider this format: #,##0.00,,

In that format numbers will be displayed to 2 decimal places. The two “,”s at the end will display in units of millions. With this custom format the number 12345678 will display as 12.35.

What if we’d like to display 12345678 as 12.35 (m)

Then this would be a suitable custom format: #,##0.00,, (\m)

We have appended (\m) at the end of the format. Why did we use “\” before the “m”? The reason is that “m” has a special significance in custom formats (indicating “months”) and we need to tell Excel to interpret “m” literally. The “\” is an “escape” character and must precede special characters if they are to be interpreted literally.

Custom format currency symbol alignment

If you want a currency symbol in a custom format then include that symbol at the start of the format. For example, like this: \$#,##0

The currency symbol in the preceding example will be right-aligned. It will look like this ...



If you want the currency symbol left-aligned then follow it with an asterisk and a space. A suitable format would be like this: \$* #,##0.0,

The result would look like this:



DATE and TIME format

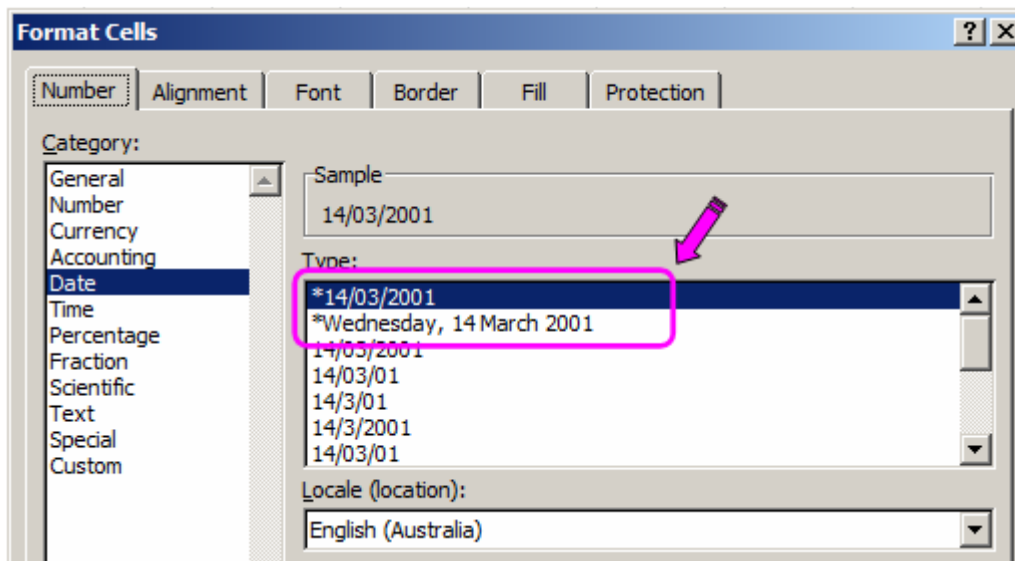
Dates and times in Excel are simply numbers. 11:59:59 PM on the 3rd of August 2013, for example, is represented in Excel as the number 41489.99998843. Why that number? The fractional part - 0.99998843 - indicates that at 11:59:59 PM 99.998843% of the current day has passed. And what’s the interpretation of the whole number part – 41489? 41489 is the number of days that have

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elapsed from a particular “base date” to the 3rd of August 2013. And what is the “base date” – day zero in Excel? It is the 31st of December 1899. The first “real” date in Excel is day 1 - the 1st of January 1900.

Representing dates and times as numbers gives an advantage: To find the interval between two days or times you can simply subtract one from the other. And to move forward or back in time you simply add or subtract the appropriate number. For example to move forward three days simply add 3. To move back 36 hours (i.e. 1 ½ days) simply subtract 1.5.

To format a cell as a date choose the Date category in the Format Cells dialog. The first two date options will probably have asterisks in front of them ...



Those date formats are “locale specific” – their display on your computer will depend on your computer’s regional or internationalisation settings. A date with that format could appear like 14/03/2001 if you are in the United Kingdom and could appear like 3/14/2001 if you are in the United States.

The display of non-asterisked dates will be the same irrespective of which region the user is in.

You can use custom formats to define your own date / time formats. The following table shows the a date and time displayed in various custom formats.

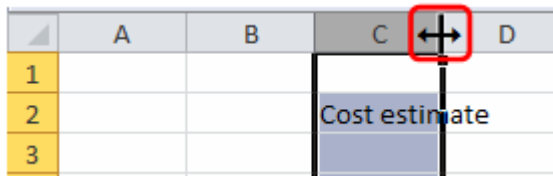
<i>Date / time displayed</i>	<i>Custom format</i>
Saturday 3/08/2013 3:13 PM	dddd d/mm/yyyy h:mm AM/PM
Sat 3/08/2013 3:13 PM	ddd d/mm/yyyy h:mm AM/PM
03-08-13 3:13 PM	dd-mm-yy h:mm AM/PM
03-08 2013 15:13:09	dd-mm yyyy hh:mm:ss
4-Aug-13	d-mmm-yy
04-August-13	dd-mmmm-yy

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The interpretation of these custom formats is fairly obvious. “dddd” represents a day in “long form” – e.g. “Saturday”. “ddd” displays in shorter form as “Sat”. “dd” displays as “03”. “d” displays as “3”. And so on.

Auto-sizing columns

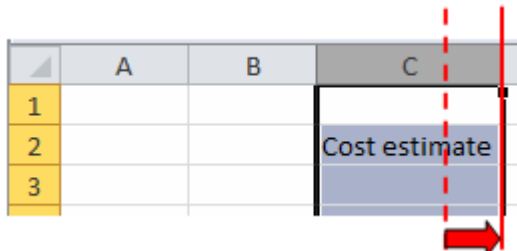
Columns can be sized automatically to fit the widest cells in those columns. The following diagram shows how to do that.



	A	B	C	D
1				
2			Cost estimate	
3				

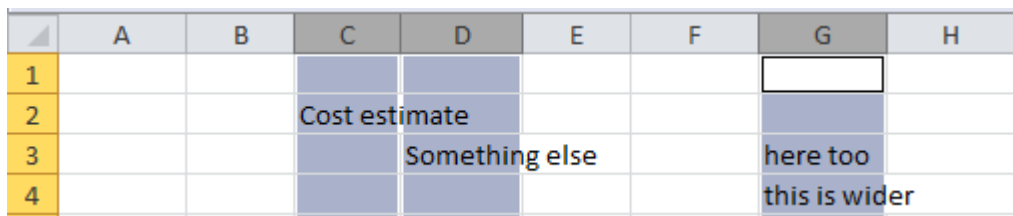
Cell C2 has an item that is wider than the column. To auto-size the column move the cursor to the top of the worksheet and “hover” the cursor at the right end edge of the column you want to size. The cursor changes shape.

You can now “drag” the cursor to resize the column. Alternatively, you can double-click on the icon and the column will automatically resize to fit the widest item in that column ...



	A	B	C	D
1				
2			Cost estimate	
3				

You can also use this technique with multiple columns. Simply select all the columns you wish to resize, on the column titles area move your mouse to the right edge of any selected column, double-click and the columns will be resized. If the columns are not adjacent press the CTRL key and select the columns individually. The following illustration shows the result of selecting individual columns ...



	A	B	C	D	E	F	G	H
1								
2			Cost estimate					
3				Something else			here too	
4							this is wider	

... and this is how the spreadsheet appears after auto-sizing ...

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	A	B	C	D	E	F	G
1							
2			Cost estimate				
3				Something else			here too
4							this is wider

Auto-sizing rows

Rows can also be re-sized. To do that position to the row you wish to size, move your cursor to the boundary ...

	A	B	C	D
1				
2		This is large text		
3				

... and double-click. The result is ...

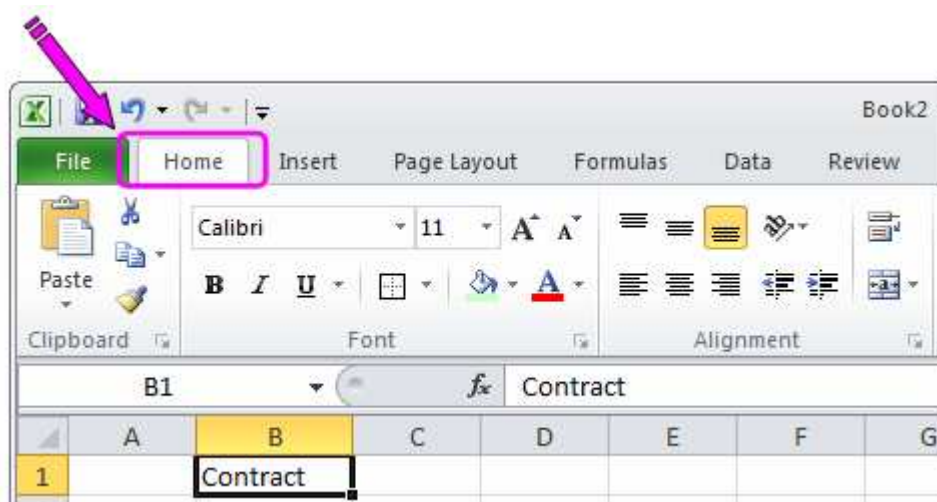
	A	B	C	D
1				
2		This is large text		

Aligning horizontally

There are a number of ways setting horizontal alignment. We'll look at some.

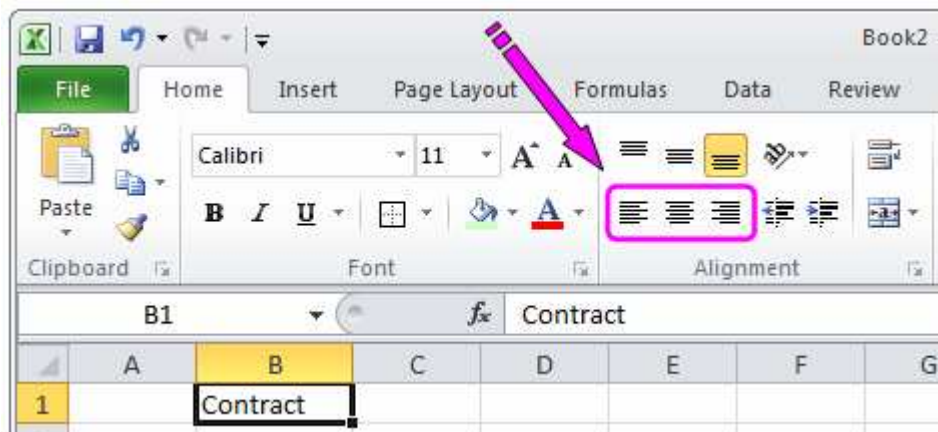
Home ribbon icon

The alignment section of the Home ribbon has three icons that let you set left, centre and right alignment. First click on the Home ribbon ...



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... and then on one of the alignment icons in the Alignment section ...

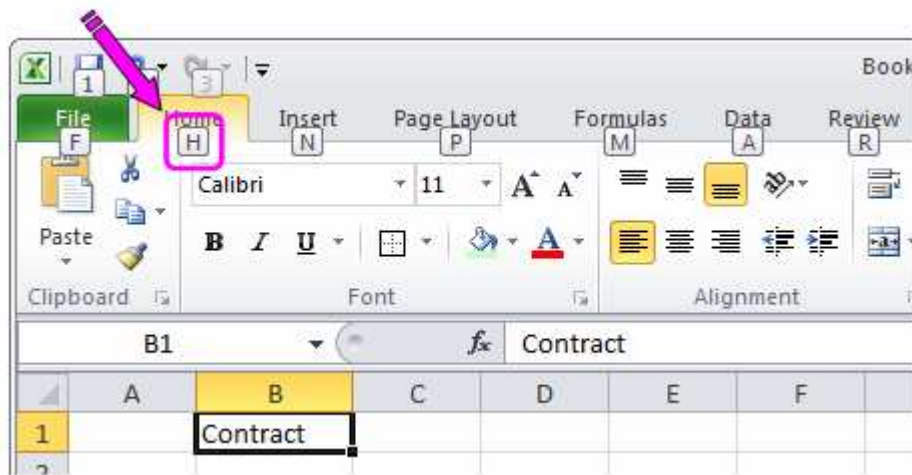


Click on one of the three icons to choose the type of alignment you want.

Keyboard shortcut

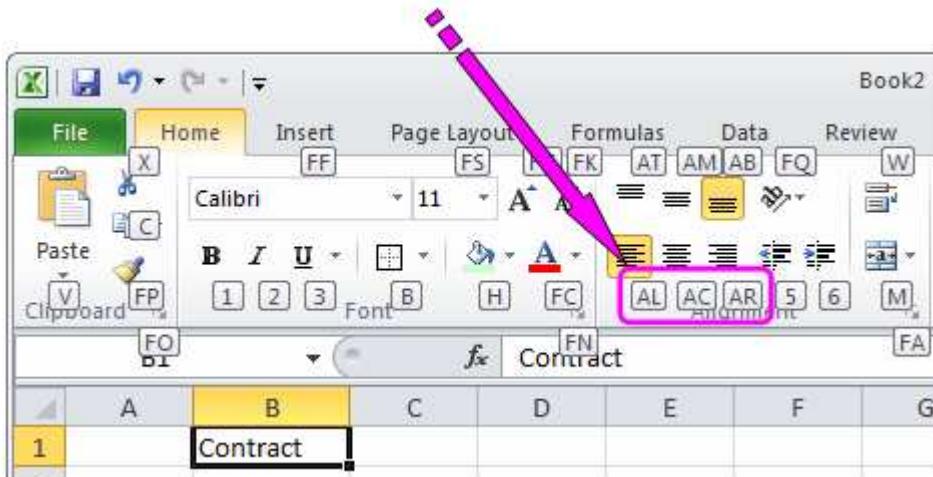
You can set alignment by using a keyboard shortcut. Press ALT, H, A and the L (for left) or C (for centre) or R (for right).

Begin by pressing the ALT key. After you press that key the screen looks like this ...



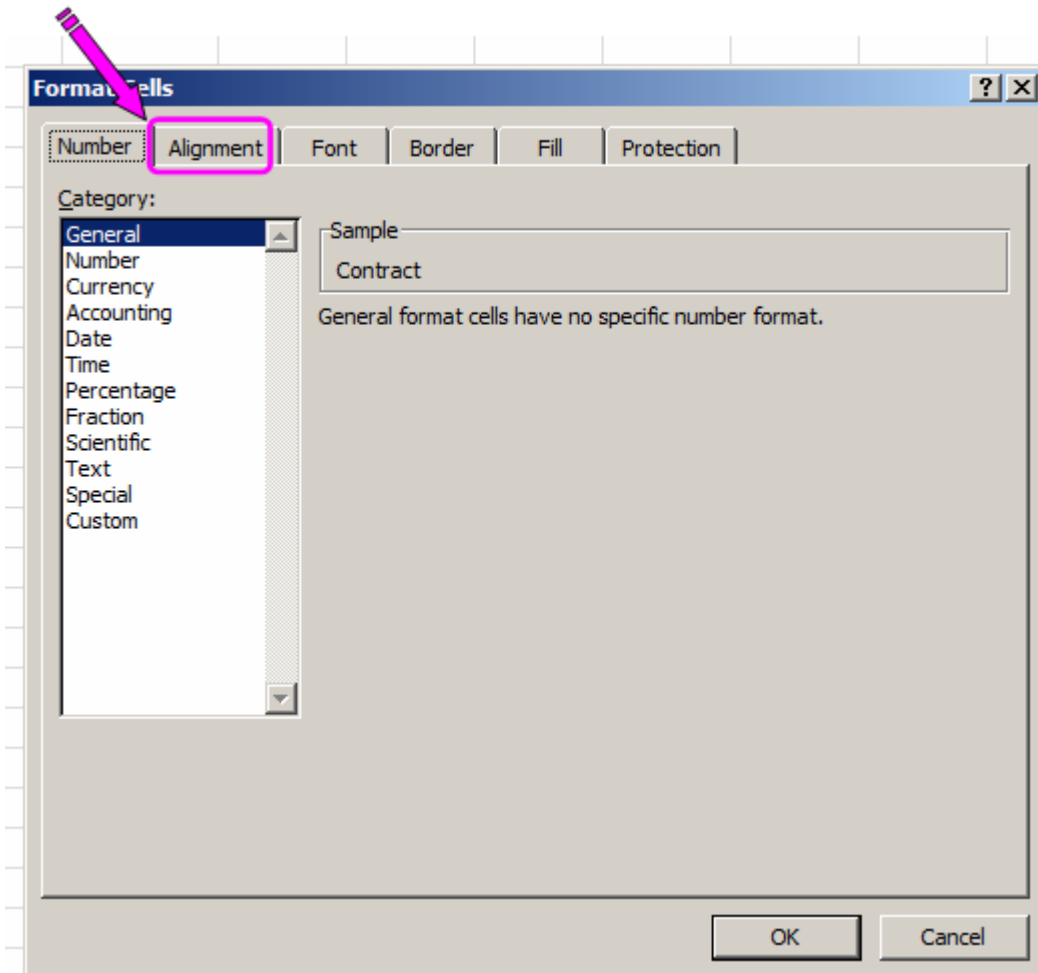
Small squares have appeared and these guide you as to which keys you can now press and where those keys will take you. Press H to take you to the Home ribbon (in case you're not currently on the ribbon) ...

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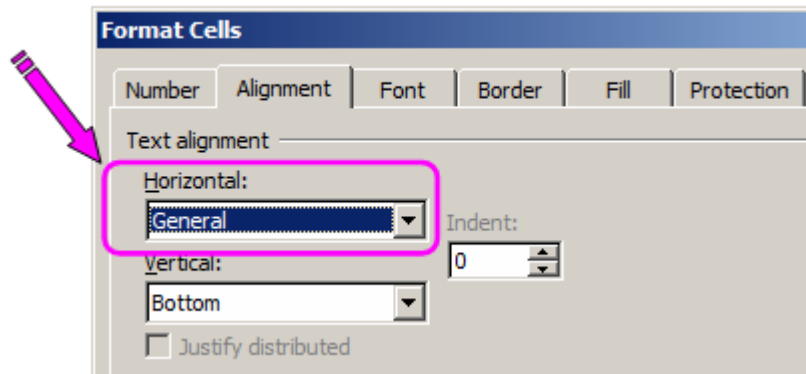
Press A and then L (for left), C (for centre) or R (for right).

Format Cells dialog

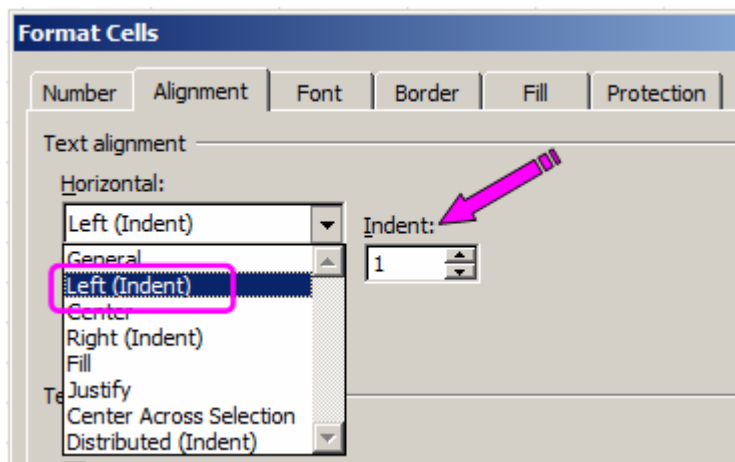


Click on the Alignment tab to show the alignment options. On that tab is a list-box that shows horizontal alignment options ...

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Click on the downward pointing arrow at the right of the list-box to display the alignment options ...



If you choose left or right alignment you can additionally specify an indent. The number in the indent specifies the number of spaces to indent. In the following illustration the cell on the top row is left aligned with a default (zero) indent and the cells on the following two rows are left aligned with an indent of 1.

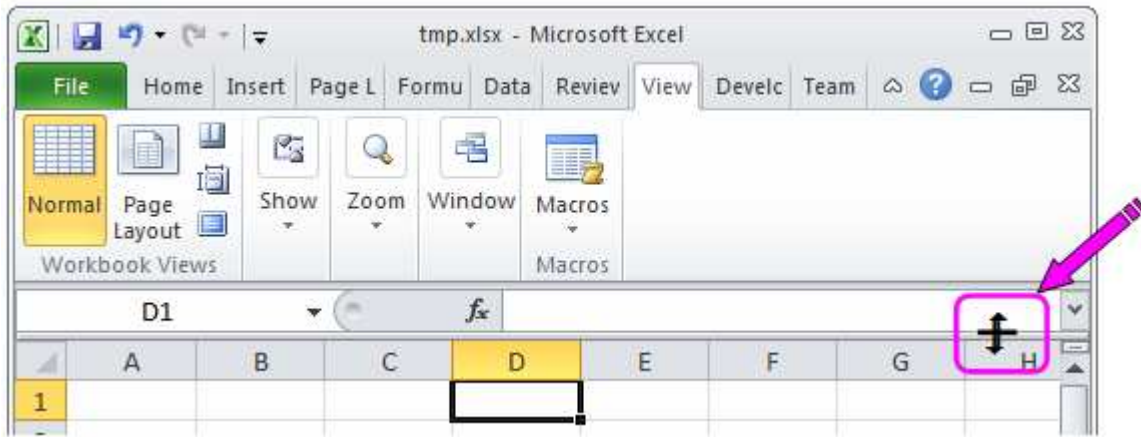
B
Main group
subgroup 1
subgroup 2

Alignment – Wrap and merge

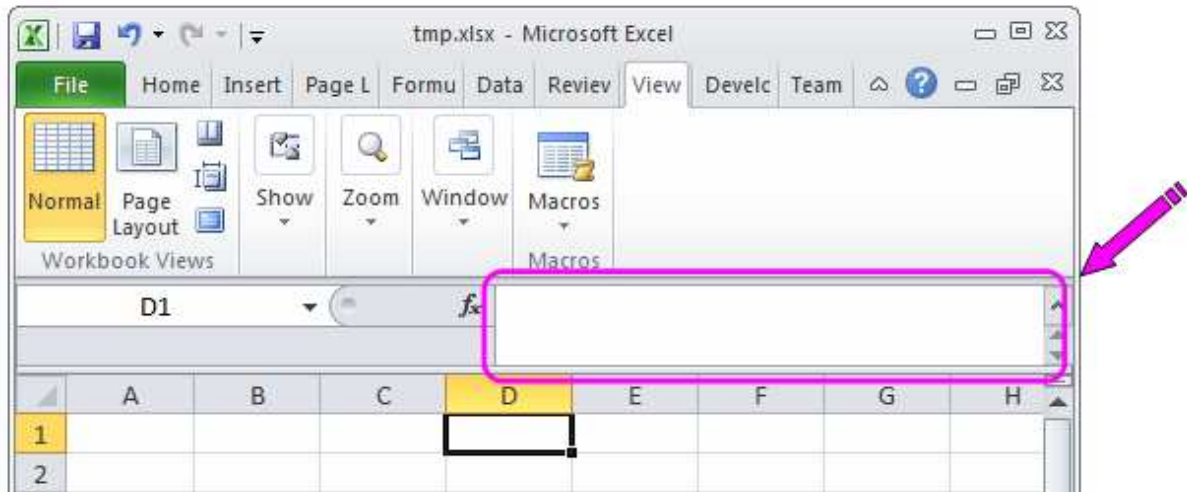
The Format Cells dialog allows you to set the “wrap” and “merge” properties of one or more cells. We’ll look at both of those properties – beginning with “wrap”. The following diagram shows cell A1 containing the words “This is some text”.

A1		fx This is some text			
	A	B	C	D	E
1	This is some text				

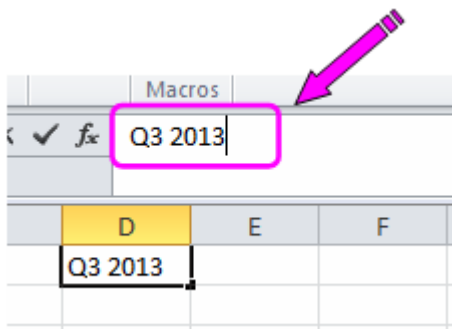
Excel Skills - Formatting



Drag the lower edge down to extend the formula bar to two (or more) rows ...

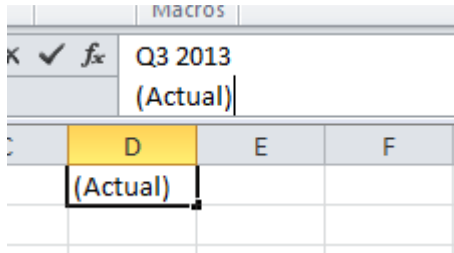


Type the top row of the cell ...

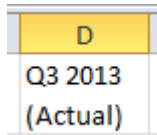


Press ALT + ENTER and then the next row ...

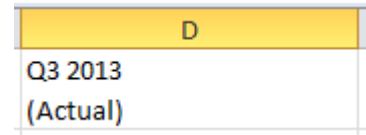
Excel Skills - Formatting



The ALT + ENTER has forced a new line. Last, press ENTER and the wrapped text will be shown on a double-height row ...



Even if the column is widened the wrap remains ...

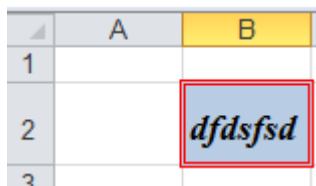


Styles

If you have a style of formatting that you use often you can save that style and easily re-use it.

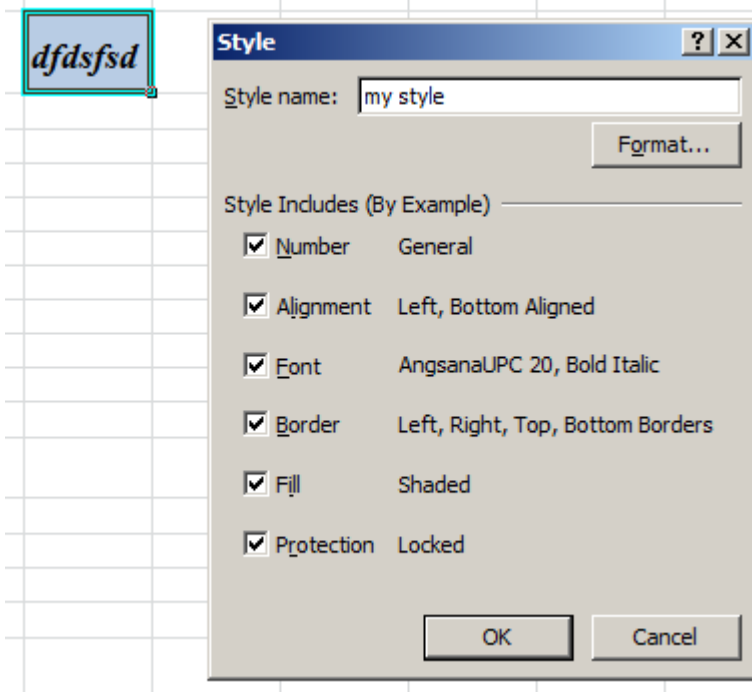
Defining a style

Format a cell in the style that you wish to save. The following diagram shows a cell formatted with a red border, a grey fill and a certain font name and size ...



Next select the cell whose format you have define and then press ALT + ' (single apostrophe). The style dialog box will appear ...

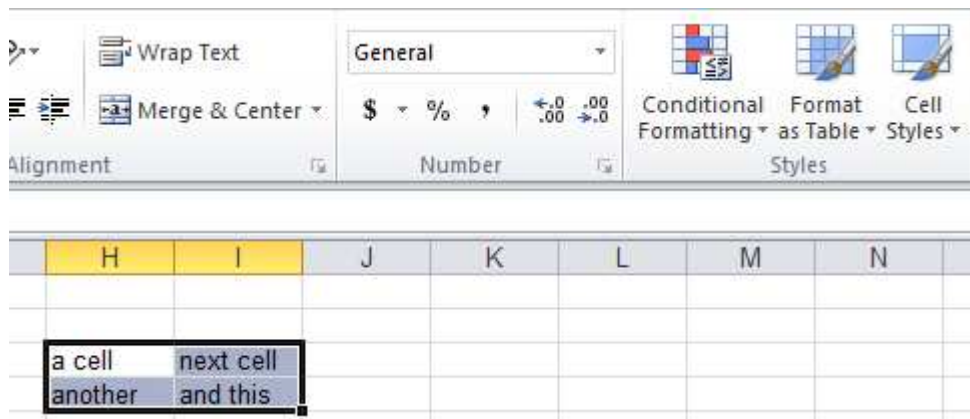
Excel Skills - Formatting



The dialog shows the current style (the font, for example, is AngsanaUPC 20, Bold Italic). You can now, if you want, change the format if it's not exactly as you wish. When the format is exactly as you want give the style a name and press OK. The style will be saved.

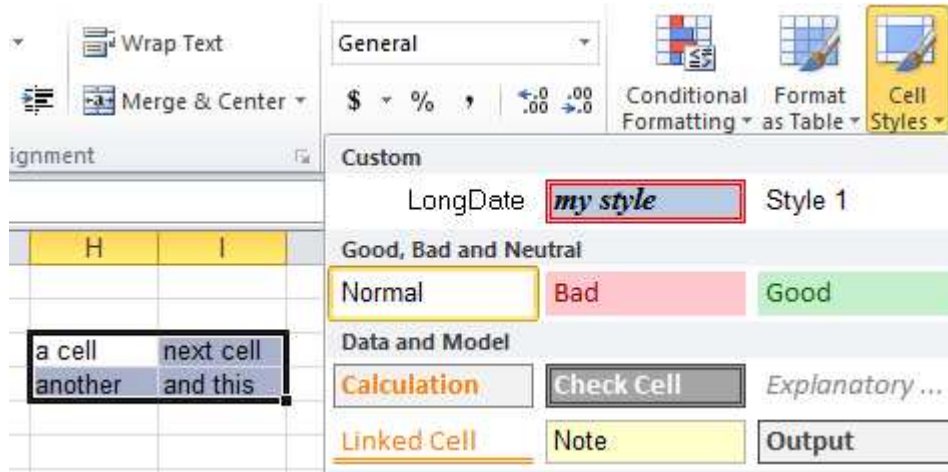
Applying a style

Begin by selecting the cell or cells you want to style.

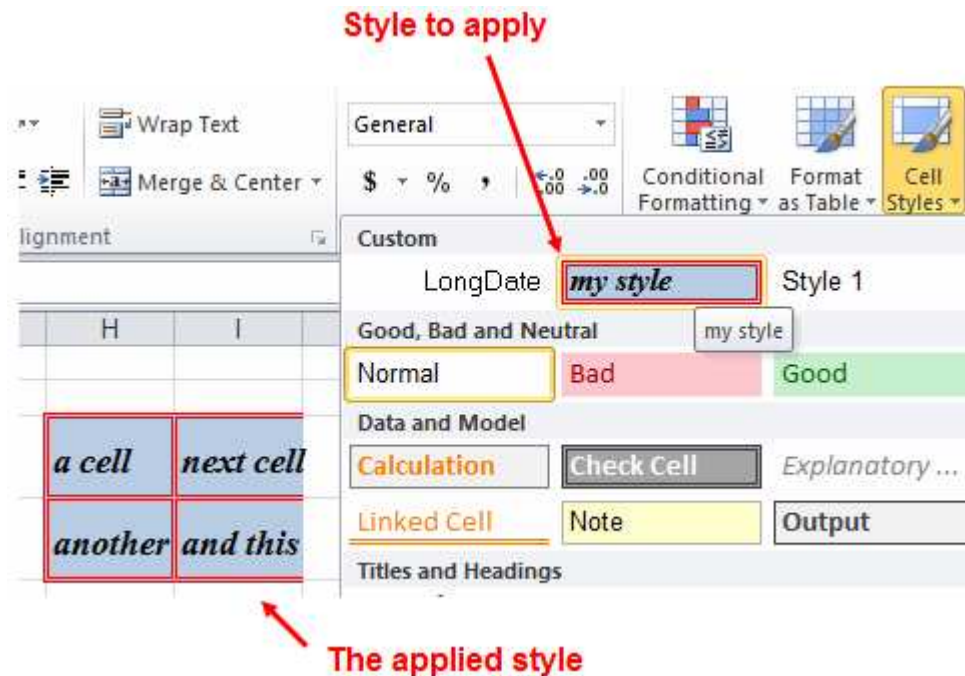


Then choose Home | Styles | Cell Styles.

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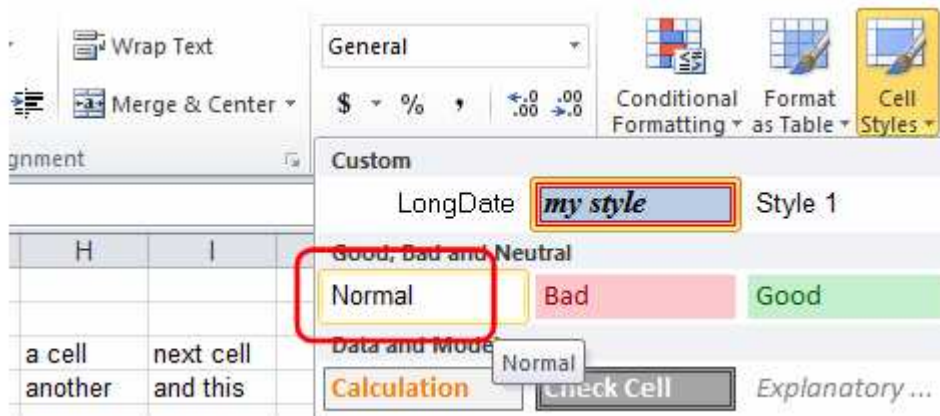
Move your mouse over the style you wish to apply, click, and the style will be applied.



Removing a style

To remove a style you need to set the style of the cell to "Normal". Proceed as before and choose "Normal" as the style.

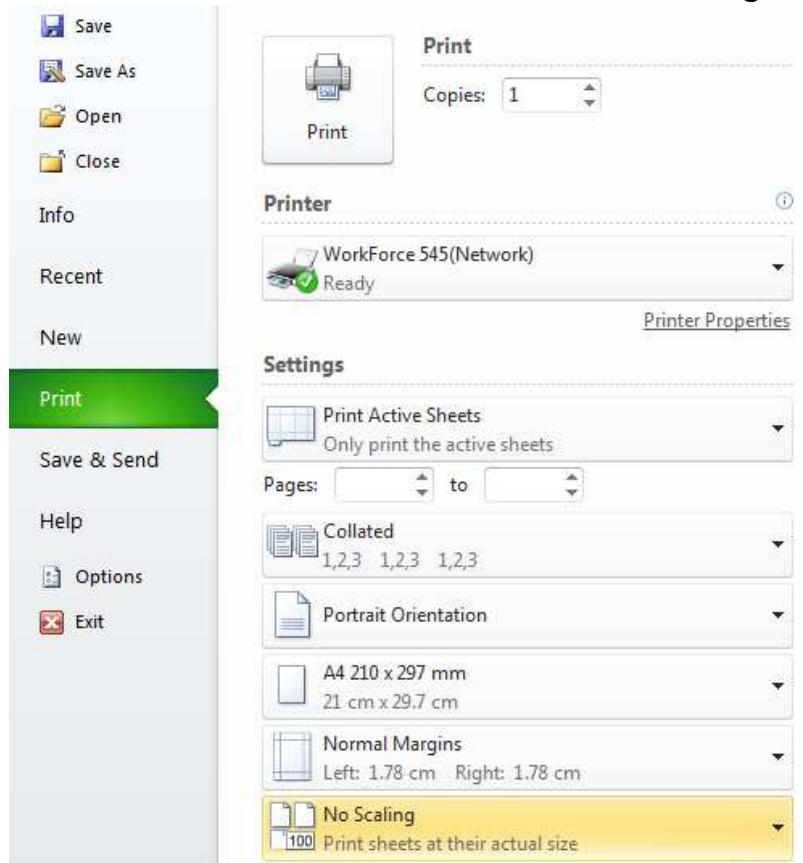
Excel Skills - Formatting



The screenshot shows the Excel ribbon with the Styles group selected. The 'Normal' style is highlighted with a red box. The 'my style' custom style is also highlighted with a red box. The ribbon includes options for Wrap Text, Merge & Center, and various formatting options like Currency, Percentage, and Conditional Formatting.

H	I
a cell another	next cell and this

Excel Skills - Printing



The Print menu allows you to print and to set print options. Also, on the right hand side of the page, is a print preview.

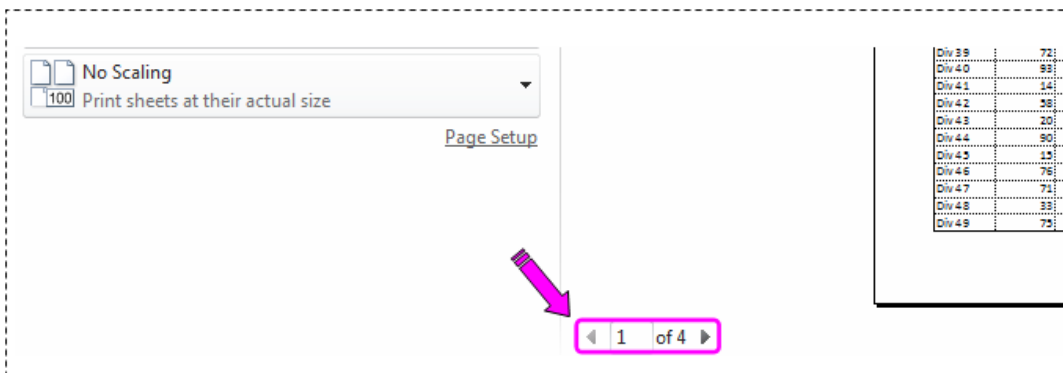
Print preview

The print preview lets you scroll through and preview each page (of a multi-page worksheet) ...

Excel Skills - Printing

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
Div 1	73	70	55	68	56	75	50	75
Div 2	36	56	99	24	64	86	55	38
Div 3	51	25	75	3	50	47	90	32
Div 4	31	56	17	6	44	0	86	47
Div 5	53	27	54	64	18	43	85	23
Div 6	58	31	48	22	10	9	73	11
Div 7	68	23	40	71	33	5	94	32
Div 8	94	54	75	85	6	24	48	14
Div 9	79	41	14	33	38	42	73	85
■								
■								
Div 43	20	4	40	47	98	80	30	0
Div 44	90	40	72	31	96	27	0	52
Div 45	15	10	2	6	80	68	37	8
Div 46	76	3	98	82	69	50	20	42
Div 47	71	1	27	48	47	94	80	41
Div 48	33	21	78	99	14	87	56	65
Div 49	75	34	81	35	37	46	91	25

To scroll through the previewed pages click on the scroll-bar at the bottom of the preview page...



No Scaling
100 Print sheets at their actual size

Page Setup

1 of 4


Div 39	72
Div 40	88
Div 41	84
Div 42	88
Div 43	90
Div 44	25
Div 45	76
Div 47	71
Div 48	33
Div 49	75

Alternatively use scroll-bar on the right ...

Excel Skills - Printing

Preliminary - For review

	Jan	Feb	Mar	Apr	May	Jun
Div 50	88	56	23	17	80	46
Div 51	13	33	23	98	38	13
Div 52	28	6	18	78	28	56
Div 53	0	77	21	24	48	62
Div 54	19	41	20	58	58	68
Div 55	32	2	38	14	7	74
Div 56	88	22	27	97	34	31
Div 57	10	44	1	63	19	34
Div 58	69	69	97	30	12	23
Div 59	10	34	18	95	95	69
Div 60	62	27	92	63	17	92
Div 61	89	13	56	81	68	34
Div 62	60	42	73	14	6	77
Div 63	30	67	84	33	23	38
Div 64	40	47	49	93	72	86
Div 65	68	90	83	94	83	95
Div 66	91	2	13	30	39	32
Div 67	64	91	29	60	33	31
Div 68	28	10	69	4	23	6
Div 69	30	93	99	13	66	7
Div 70	69	24	33	33	74	42
Div 71	17	31	87	40	10	68
Div 72	7	97	84	71	50	34
Div 73	1	43	20	44	39	70
Div 74	43	74	49	36	81	31
Div 75	81	39	55	33	82	45
Div 76	30	33	21	83	1	33
Div 77	1	23	63	77	62	81
Div 78	93	80	21	13	52	30

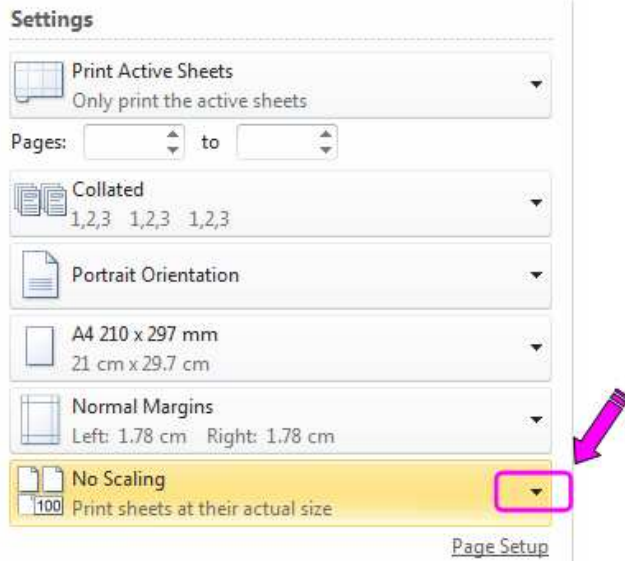


Or you can press the PGUP or PGDN keys to scroll through the previewed pages.

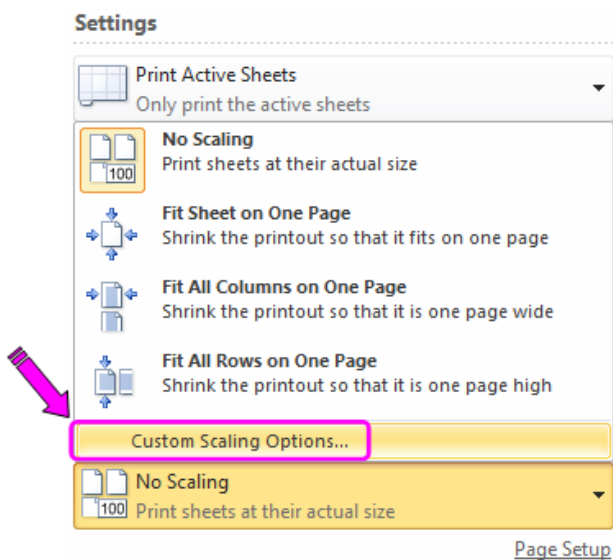
You can now adjust the layout of the page and the positions of the page breaks. And that is what we will do. We begin by setting the print scaling.

Click on the icon next to the “No Scaling” menu item ...

Excel Skills - Printing

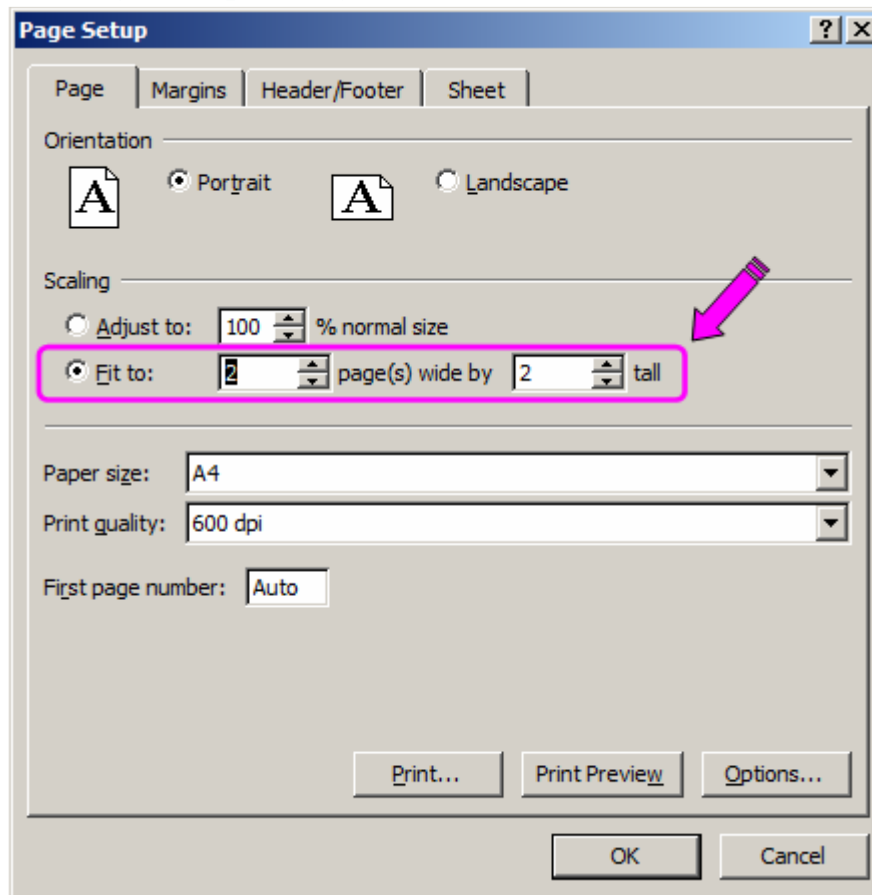


Click on the “Custom Scaling Options” menu item that appears ...



The Page Setup dialog appears.

The Page Setup dialog

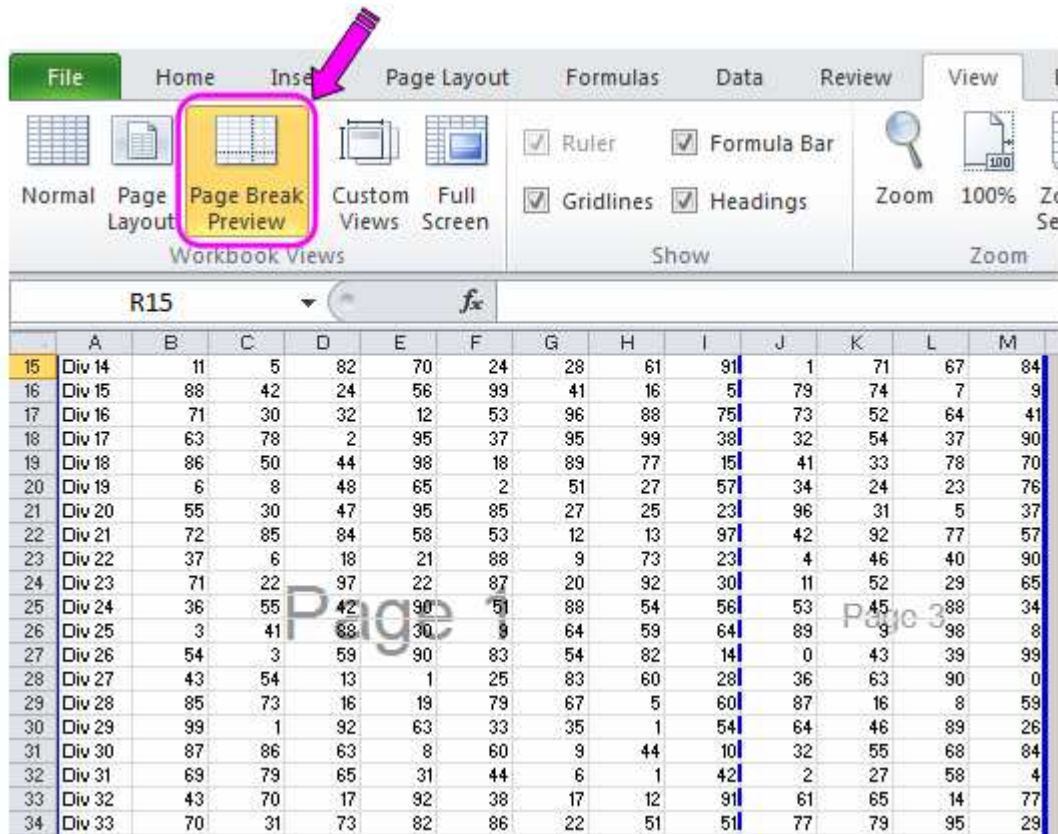


The dialog lets you set the orientation of the page (Portrait or Landscape) and other properties. In our example we have set the scaling to two pages wide by two pages tall. Press the OK button after you've finished.

Page breaks

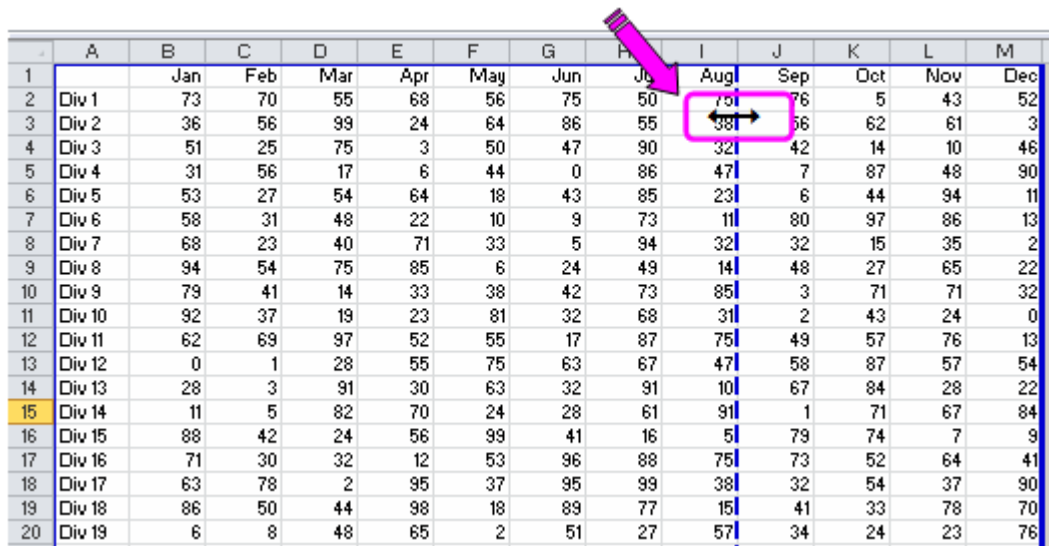
You can now preview the resulting page breaks: Click on the Page Break Preview icon in the Workbook Views section of the View ribbon ...

Excel Skills - Printing



	A	B	C	D	E	F	G	H	I	J	K	L	M
15	Div 14	11	5	82	70	24	28	61	91	1	71	67	84
16	Div 15	88	42	24	56	99	41	16	5	79	74	7	9
17	Div 16	71	30	32	12	53	96	88	75	73	52	64	41
18	Div 17	63	78	2	95	37	95	99	38	32	54	37	90
19	Div 18	86	50	44	98	18	89	77	15	41	33	78	70
20	Div 19	6	8	48	65	2	51	27	57	34	24	23	76
21	Div 20	55	30	47	95	85	27	25	23	96	31	5	37
22	Div 21	72	85	84	58	53	12	13	97	42	92	77	57
23	Div 22	37	6	18	21	88	9	73	23	4	46	40	90
24	Div 23	71	22	97	22	87	20	92	30	11	52	29	65
25	Div 24	36	55	42	90	51	88	54	56	53	45	88	34
26	Div 25	3	41	88	30	9	64	59	64	89	9	98	8
27	Div 26	54	3	59	90	83	54	82	14	0	43	39	99
28	Div 27	43	54	13	1	25	83	60	28	36	63	90	0
29	Div 28	85	73	16	19	79	67	5	60	87	16	8	59
30	Div 29	99	1	92	63	33	35	1	54	64	46	89	26
31	Div 30	87	86	63	8	60	9	44	10	32	55	68	84
32	Div 31	69	79	65	31	44	6	1	42	2	27	58	4
33	Div 32	43	70	17	92	38	17	12	91	61	65	14	77
34	Div 33	70	31	73	82	86	22	51	51	77	79	95	29

Page breaks are shown as dark blue lines. The far boundaries of the page are shown in solid lines and the other page breaks as dashed lines. You can adjust the positions of the breaks. To do that move your mouse over a page break and the cursor will change shape ...



	A	B	C	D	E	F	G	H	I	J	K	L	M
1		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2	Div 1	73	70	55	68	56	75	50	79	76	5	43	52
3	Div 2	36	56	99	24	64	86	55	58	66	62	61	3
4	Div 3	51	25	75	3	50	47	90	32	42	14	10	46
5	Div 4	31	56	17	6	44	0	86	47	7	87	48	90
6	Div 5	53	27	54	64	18	43	85	23	6	44	94	11
7	Div 6	58	31	48	22	10	9	73	11	80	97	86	13
8	Div 7	68	23	40	71	33	5	94	32	32	15	35	2
9	Div 8	94	54	75	85	6	24	49	14	48	27	65	22
10	Div 9	79	41	14	33	38	42	73	85	3	71	71	32
11	Div 10	92	37	19	23	81	32	68	31	2	43	24	0
12	Div 11	62	69	97	52	55	17	87	75	49	57	76	13
13	Div 12	0	1	28	55	75	63	67	47	58	87	57	54
14	Div 13	28	3	91	30	63	32	91	10	67	84	28	22
15	Div 14	11	5	82	70	24	28	61	91	1	71	67	84
16	Div 15	88	42	24	56	99	41	16	5	79	74	7	9
17	Div 16	71	30	32	12	53	96	88	75	73	52	64	41
18	Div 17	63	78	2	95	37	95	99	38	32	54	37	90
19	Div 18	86	50	44	98	18	89	77	15	41	33	78	70
20	Div 19	6	8	48	65	2	51	27	57	34	24	23	76

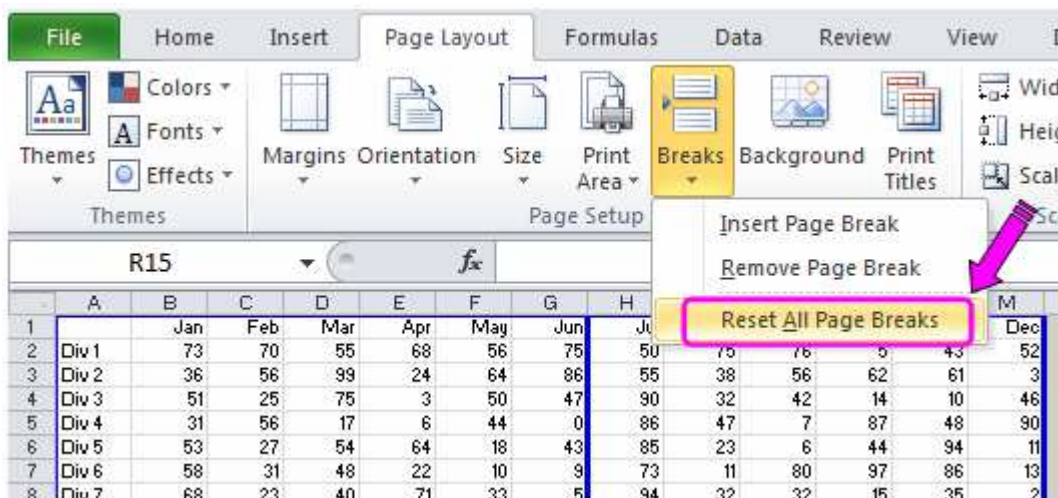
Then drag the page break to a new position. The page break that was to the right of column I has been moved two columns to the left ...

Excel Skills - Printing

	A	B	C	D	E	F	G	H	I	J	K	L	M
1		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2	Div 1	73	70	55	68	56	75	50	75	76	5	43	52
3	Div 2	36	56	99	24	64	86	55	38	56	62	61	3
4	Div 3	51	25	75	3	50	47	90	32	42	14	10	46
5	Div 4	31	56	17	6	44	0	86	47	7	87	48	90
6	Div 5	53	27	54	64	18	43	85	23	6	44	94	11
7	Div 6	58	31	48	22	10	9	73	11	80	97	86	13
8	Div 7	68	23	40	71	33	5	94	32	32	15	35	2
9	Div 8	94	54	75	85	6	24	49	14	48	27	65	22
10	Div 9	79	41	14	33	38	42	73	85	3	71	71	32
11	Div 10	92	37	19	23	81	32	68	31	2	43	24	0
12	Div 11	62	69	97	52	55	17	87	75	49	57	76	13
13	Div 12	0	1	28	55	75	63	67	47	58	87	57	54
14	Div 13	28	3	91	30	63	32	91	10	67	84	28	22
15	Div 14	11	5	82	70	24	28	61	91	1	71	67	84
16	Div 15	88	42	24	56	99	41	16	5	79	74	7	9
17	Div 16	71	30	32	12	53	96	88	75	73	52	64	41
18	Div 17	63	78	2	95	37	95	99	38	32	54	37	90
19	Div 18	86	50	44	98	18	89	77	15	41	33	78	70
20	Div 19	6	8	48	65	2	51	27	57	34	24	23	76

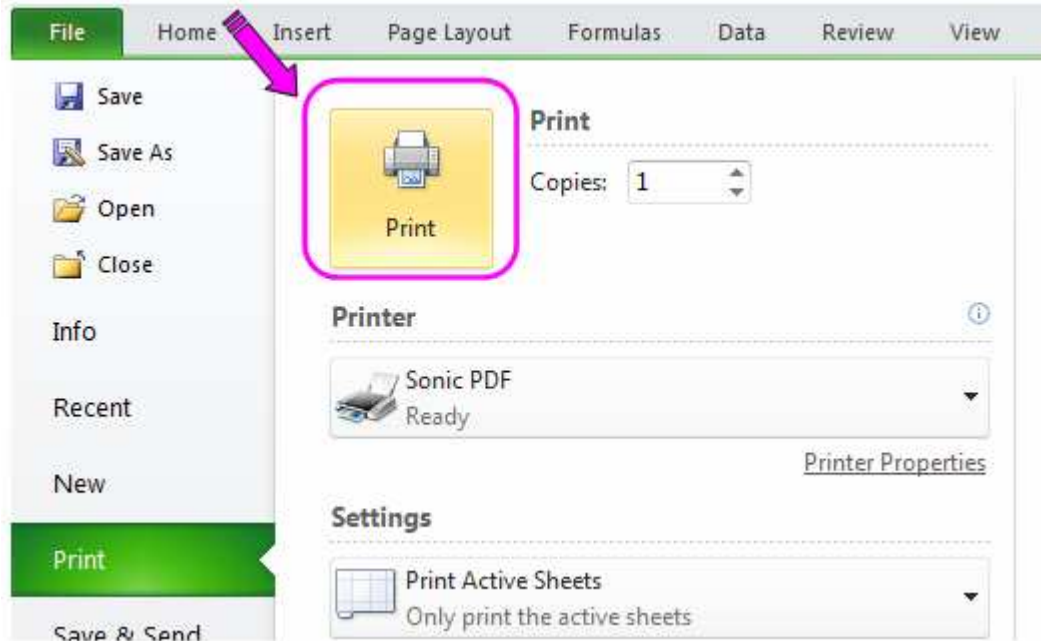
The page break is now shown as a solid line rather than dashed as a visual indication that the break has been moved from its default position.

To reset page breaks to their default positions choose the “Reset All Page Breaks” menu item from the Breaks icon in the Page Setup section of the Page Layout ribbon ...



After page breaks have been set we can print the spreadsheet by pressing the Print icon ...

Excel Skills - Printing



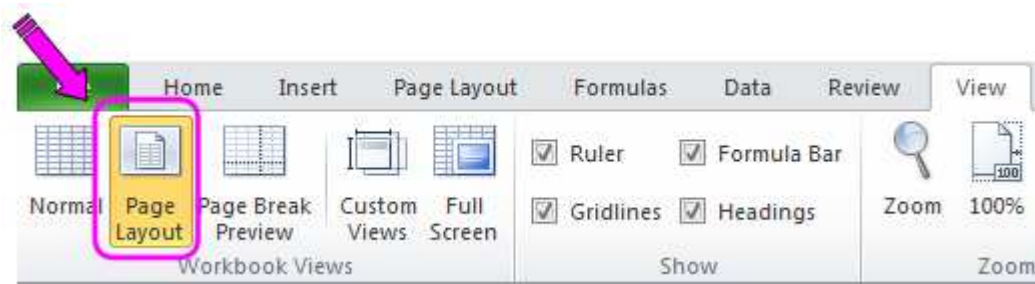
The spreadsheet is printed ...

	Jan	Feb	Mar	Apr	May	Jun
Div 1	73	70	55	68	56	75
Div 2	36	56	99	24	64	86
Div 3	51	25	75	3	50	47
Div 4	31	56	17	6	44	0
Div 5	53	27	54	64	18	43
Div 6	58	31	48	22	10	9
Div 7	68	23	40	71	33	5
Div 8	94	54	75	85	6	24
Div 9	79	41	14	33	38	42

We can refine the layout if we wish: We will add headings and row and column titles to the printed output. Additionally we will display the spreadsheet's gridlines.

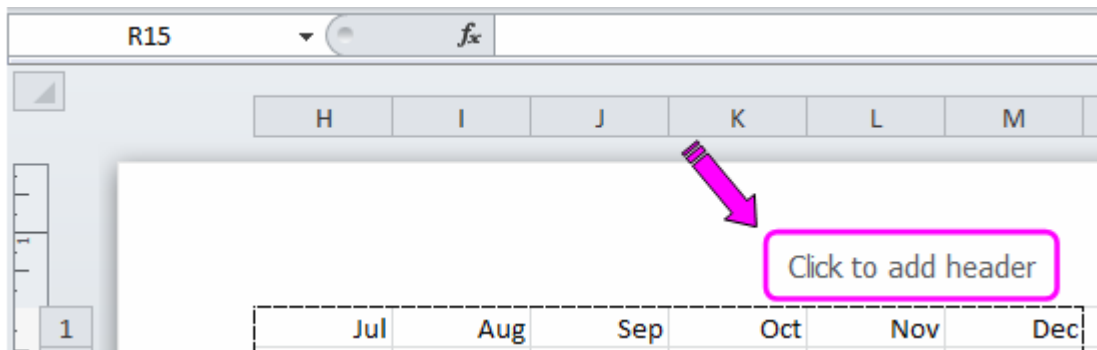
Page layout

To set the page layout click on the Page Layout icon ...

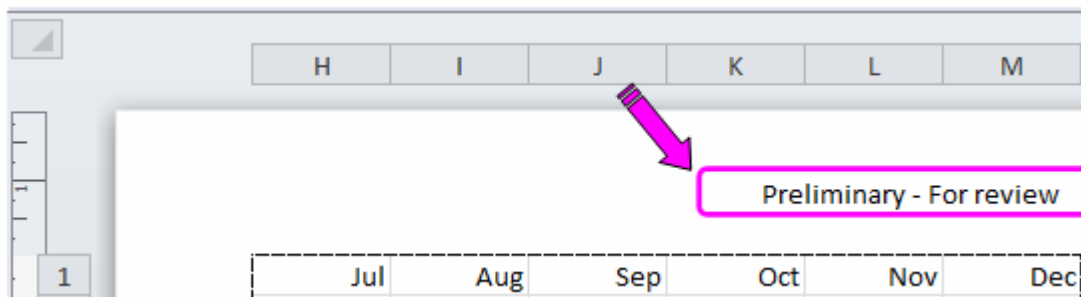


Excel Skills - Printing

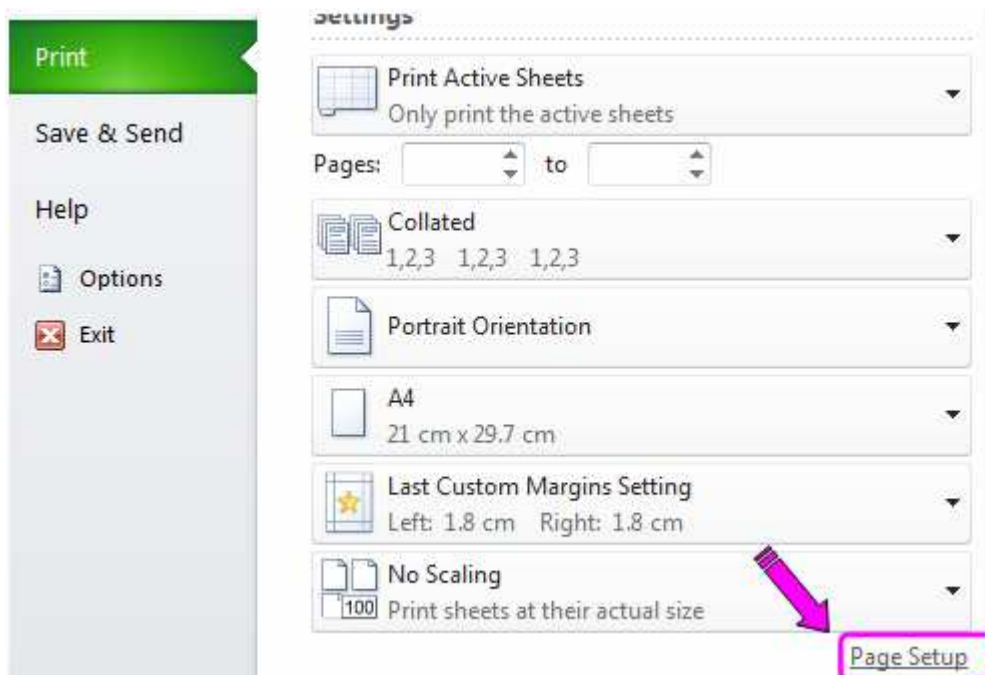
Excel switches to Page Layout view mode. You can now define the layout. We will specify a header to be printed. The header is specified in the header area outlined in the next illustration ...



Click on the highlighted field and type in the new header text ...

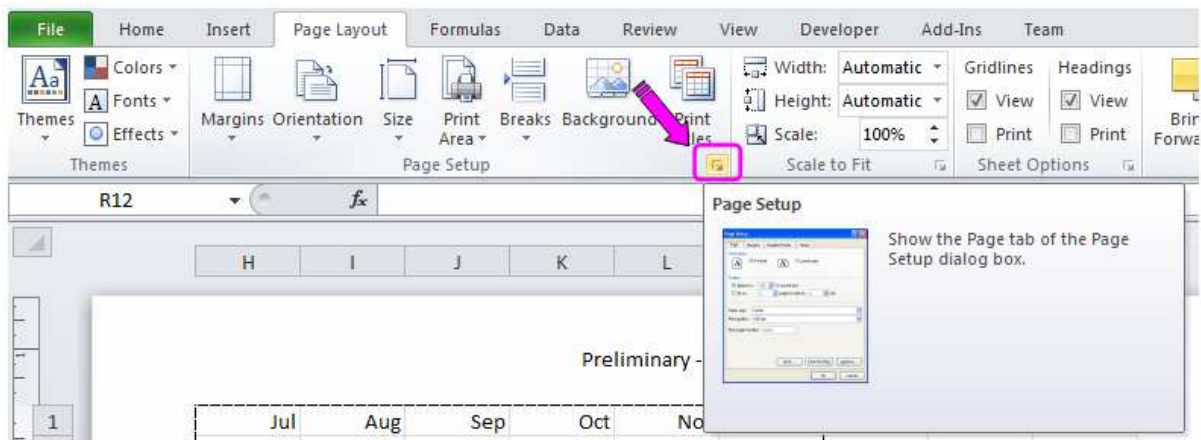


Next we will specify a row to be printed at the top and a column to be printed at the left of each page. To do that we bring up the Page Setup dialog: Click on the Page Setup link highlighted next ...



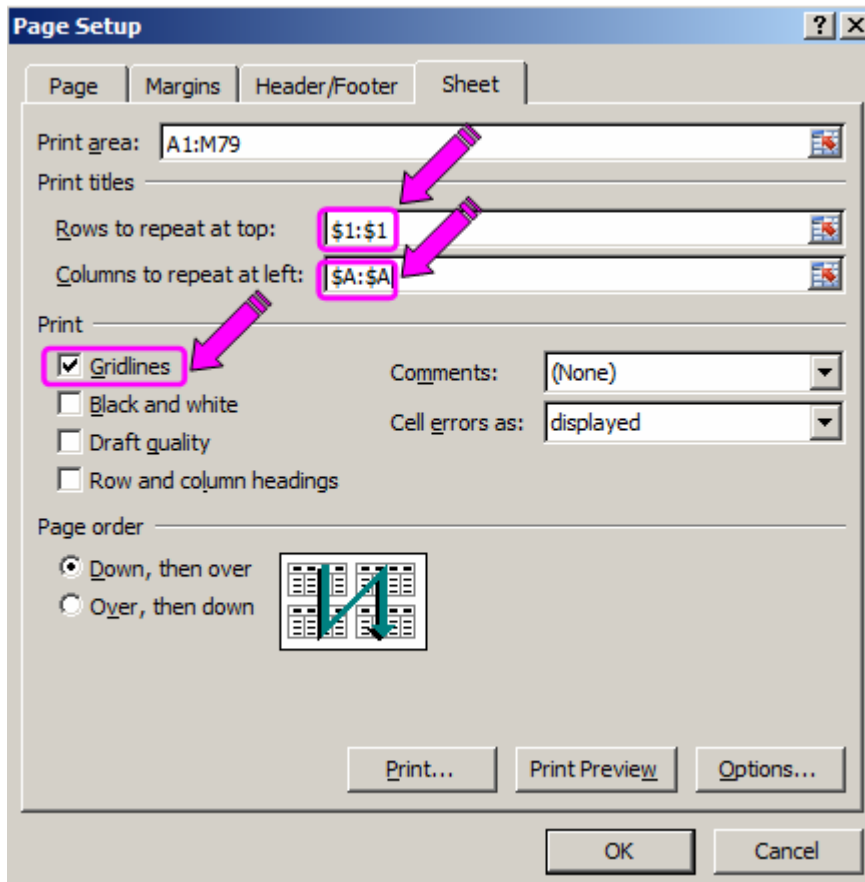
Excel Skills - Printing

Alternatively click on the highlighted icon on the bottom right of the Page Setup section in the Page Layout ribbon ...



Or, another way still, is to use the keyboard shortcut: ALT, P, S, P

The Page Setup dialog appears. Select the Sheet tab, specify the row that will be printed at the top of each page (row 1 in our example) and the column to be printed on the left of each page (column A). Also, tick the checkbox labelled "Gridlines" to turn on gridlines.



Excel Skills - Printing

We have finished defining the page layout. Press the OK button and print. The result is as shown on the following diagram ...

Preliminary - For review						
	Jan	Feb	Mar	Apr	May	Jun
Div 1	73	70	55	68	56	75
Div 2	36	56	99	24	64	86
Div 3	51	25	75	3	50	47
Div 4	31	56	17	6	44	0
Div 5	53	27	54	64	18	43
Div 6	58	31	48	22	10	9

▪
▪
▪

The output is in the form we desired.

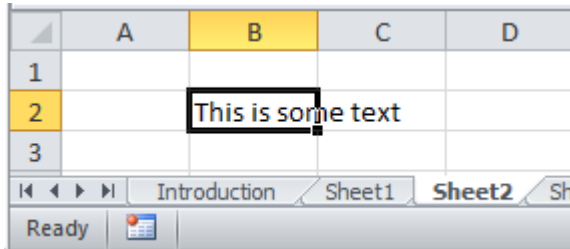
Editing and replacing

Editing a single cell

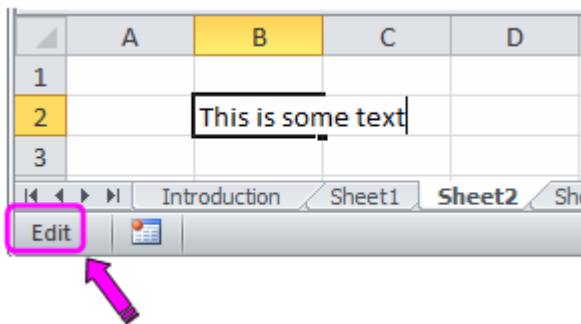
To edit a single cell select the cell first and then press the F2 key.

Editing text in a cell

If the selected cell contains text then you can edit the properties of that text. Suppose we wish to underline the word "text" in cell B2...

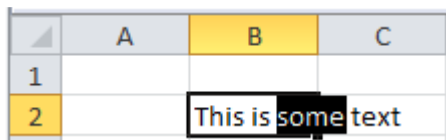


Begin by pressing F2. Alternatively double-click on the cell. Excel will report it is now in edit mode ...

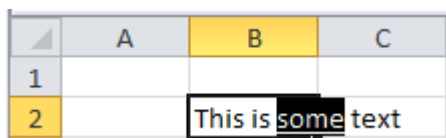


[The only difference between pressing F2 and double-clicking is the resulting position of the cursor: F2 will place the cursor at the end of the text whilst double-clicking will place the cursor at the mouse's position.]

Next select the part of the text you wish to edit. You can use the keyboard arrow keys or use the mouse ...



Press CTRL + U to underline the selected text ...



Excel Skills - Editing and replacing

And ENTER to finish. The text has been modified as desired ...

	A	B	C
1			
2		This is <u>some</u> text	

Editing a formula in a cell

If the selected cell contains a formula then edit mode lets you easily see (and change) the cells referred to in the formula. The following diagram illustrates how this works.

D9		fx =D\$6*\$E2/4			
	A	B	C	D	E
1	Yearly management expense as % of asset value:				1.20%
2	Yearly insurance expense as % of asset value:				0.70%
3	Admin expense per quarter:				1.7
4					
5			Q1	Q2	Q3
6	Asset value		450	450	465
7					
8	Management expense		1.35	1.35	1.40
9	Insurance expense		0.79	0.79	0.81
10	Admin expense		1.70	1.70	1.70
11	Total		3.84	3.84	3.91

We want to examine (and possibly edit) the formula in cell D9. We have clicked on that cell and the formula bar shows the formula in that cell. By pressing F2 we can see a more visual and useful description of the formula ...

	A	B	C	D	E
1	Yearly management expense as % of asset value:				1.20%
2	Yearly insurance expense as % of asset value:				0.70%
3	Admin expense per quarter:				1.7
4					
5			Q1	Q2	Q3
6	Asset value		450	450	465
7					
8	Management expense		1.35	1.35	1.40
9	Insurance expense		0.79	=D\$6*\$E2/4	
10	Admin expense		1.70	1.70	1.70
11	Total		3.84	3.84	3.91

Excel has coloured the cells in the formula (D\$6 is blue and \$E2 is green) and Excel also draws coloured markers around the cells that are referred to. This makes it easy to see where the cells referred to are placed on the worksheet. Not only can we see which cells are referred to – we can also easily change those cells. Suppose, for example, we wanted to change the formula in cell D9 to refer to \$E3 instead on \$E2. To do that we can “drag and drop” the coloured marker around cell E2 down to E3 ...

Excel Skills - Editing and replacing

	A	B	C	D	E
1	Yearly management expense as % of asset value:				1.20%
2	Yearly insurance expense as % of asset value:				0.70%
3	Admin expense per quarter:				1.7
4					
5			Q1	Q2	Q3
6	Asset value		450	450	465
7					
8	Management expense		1.35	1.35	1.40
9	Insurance expense		0.79	=D\$6*\$E3/4	
10	Admin expense		1.70	1.70	1.70
11	Total		3.84	3.84	3.91

Excel has updated the formula in D9 with the changed reference to E3.

Finding and replacing text

To edit one or more items in a range of cells you can use Excel's "Find and Replace". We'll show how to do that by editing the data shown to the left below. We want to change "<\$1 M" to "1,000,000".

	A
	Indicative price
1	<\$1M
2	<\$1M
3	<\$1M
4	<\$10M
5	<\$1M
6	<\$100K
7	<\$100K

Begin by selecting the cells you wish to edit. We'll simply select the entire column (as shown to the right) ...

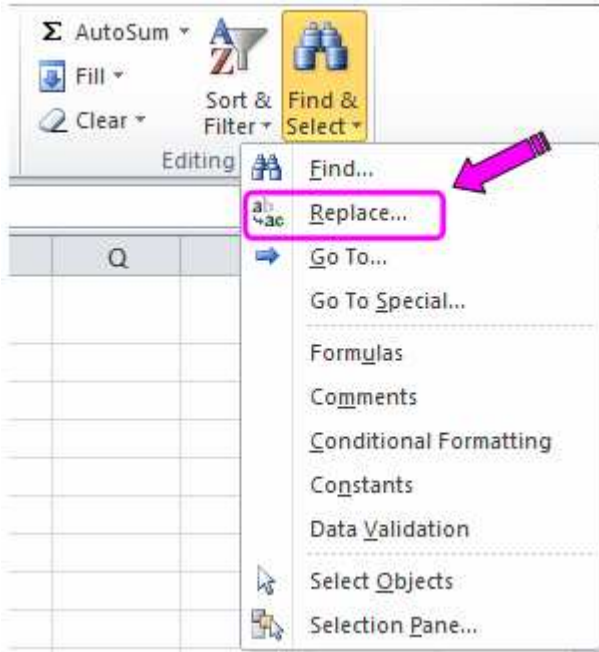
	A
	Indicative price
1	<\$1M
2	<\$1M
3	<\$1M
4	<\$10M
5	<\$1M
6	<\$100K
7	<\$100K

Next, start the Find and Replace dialog. One way is by clicking the "Find & Select" icon in the Editing section of the Home ribbon ...



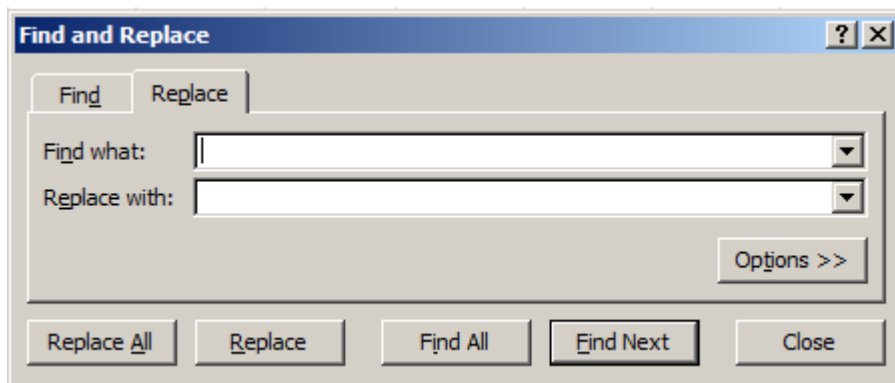
Then press the "Replace" menu item ...

Excel Skills - Editing and replacing

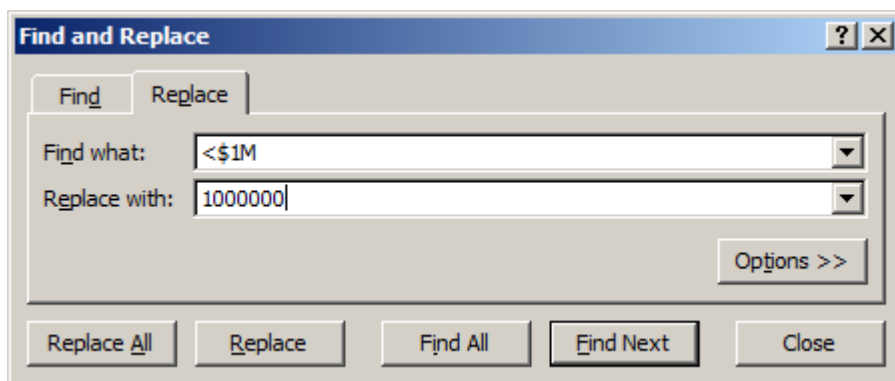


Alternatively you can just press press CTRL + H.

The Find and Replace dialog looks like this ...

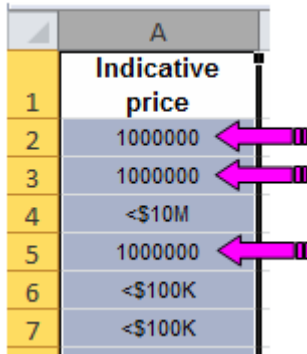


Type the text you want to replace into the "Find what" field. Type the replacing text into the "Replace with" field ...



Excel Skills - Editing and replacing

Then press the Replace All button. All occurrences in the selected cells of the “Find what” text will be replaced by the “Replace with” text ...



	A
1	Indicative price
2	1000000
3	1000000
4	<\$10M
5	1000000
6	<\$100K
7	<\$100K

In Excel most dialogs must be exited from before you can do something else. The Find and Replace dialog is different: You can use the dialog at the same time as navigating and working in the worksheet. This is useful if you wish to make several edits without having to keep bringing up and exiting the dialog.

Sorting and tabulating

Sorting

Excel lets you sort tabular data in various ways. We'll use the following data set to illustrate how sorting works.

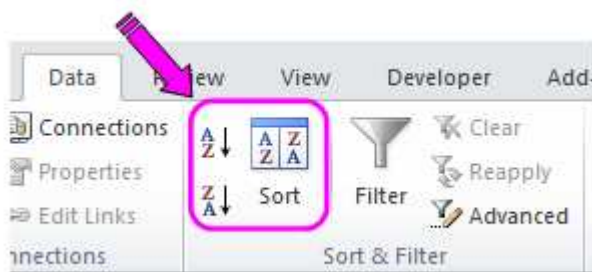
	A	B	C	D	E
1	Company	Category	Date registered	Number contracts	Value of contracts
2	Northstar	RFP	1-Jun-12	3	567
3	Eastways	RFT	15-Aug-13	12	12,345
4	Southwest	EOI	23-Feb-14	6	1,238
5	Westlines	RFT	15-May-13	10	6,213
6	Green Industries	EOI	1-Sep-11	5	673
7	Blue Industries	RFP	12-Dec-12	8	678

Suppose we wish to sort the preceding data so that the company with the highest value of contracts (column E) appears first, the next-highest value of contracts second, and so on. In other words – we wish to sort by value of contracts in descending order.

Begin by selecting the data to be sorted ...

	A	B	C	D	E
1	Company	Category	Date registered	Number contracts	Value of contracts
2	Northstar	RFP	1-Jun-12	3	567
3	Eastways	RFT	15-Aug-13	12	12,345
4	Southwest	EOI	23-Feb-14	6	1,238
5	Westlines	RFT	15-May-13	10	6,213
6	Green Industries	EOI	1-Sep-11	5	673
7	Blue Industries	RFP	12-Dec-12	8	678

Then start the Sort dialog. You can do that by clicking on the Sort icon in the Sort & Filter section of the Data ribbon.

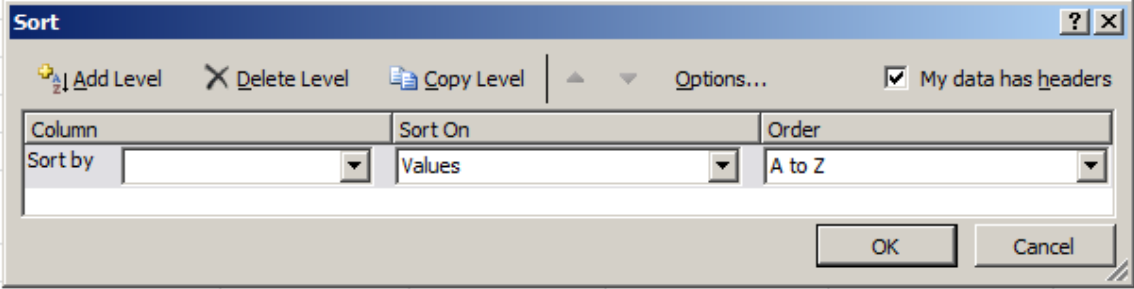


Alternatively you can press the ALT, D and S keys.

The Sort dialog appears ...

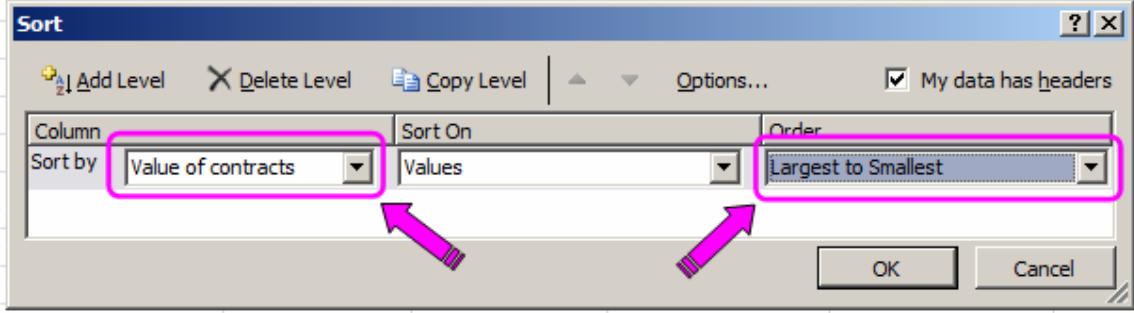
Excel Skills - Sorting and tabulating

	A	B	C	D	E	F
1	Company	Category	Date registered	Number contracts	Value of contracts	
2	Northstar	RFP	1-Jun-12	3	567	
3	Eastways	RFT	15-Aug-13	12	12,345	
4	Southwest	EOI	23-Feb-14	6	1,238	
5	Westlines	RFT	15-May-13	10	6,213	
6	Green Industries	EOI	1-Sep-11	5	673	
7	Blue Industries	RFP	12-Dec-12	8	678	



Notice that the Sort dialog has a tick-box named “My data has headers”. Make sure that is ticked if you data has column titles on the first row (as we do in this example). Next, specify which column you wish to sort by and the order (smallest to largest, or largest to smallest) ...

	A	B	C	D	E	F
1	Company	Category	Date registered	Number contracts	Value of contracts	
2	Northstar	RFP	1-Jun-12	3	567	
3	Eastways	RFT	15-Aug-13	12	12,345	
4	Southwest	EOI	23-Feb-14	6	1,238	
5	Westlines	RFT	15-May-13	10	6,213	
6	Green Industries	EOI	1-Sep-11	5	673	
7	Blue Industries	RFP	12-Dec-12	8	678	



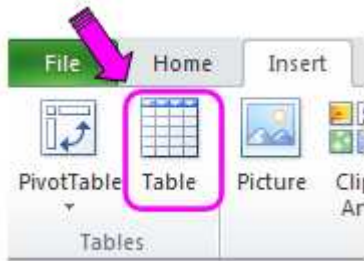
When you have finished specifying the sort options press the OK button. The data will be sorted ...

Excel Skills - Sorting and tabulating

	A	B	C	D	E
1	Company	Category	Date registered	Number contracts	Value of contracts
2	Eastways	RFT	15-Aug-13	12	12,345
3	Westlines	RFT	15-May-13	10	6,213
4	Southwest	EOI	23-Feb-14	6	1,238
5	Blue Industries	RFP	12-Dec-12	8	678
6	Green Industries	EOI	1-Sep-11	5	673
7	Northstar	RFP	1-Jun-12	3	567

Tables

Tables (also called Lists) let you select specified subsets of data for display and analysis. We will show how tables work by using the data set introduced earlier. We highlight the data to be tabulated and bring up the Create Table dialog. To do that either press CTRL + L or press the Table icon in the Tables section in the Insert Ribbon ...



The Create Table dialog appears ...

	A	B	C	D	E
1	Company	Category	Date registered	Number contracts	Value of contracts
2	Eastways	RFT	15-Aug-13	12	12,345
3	Westlines	RFT	15-May-13	10	6,213
4	Southwest	EOI	23-Feb-14	6	1,238
5	Blue Industries	RFP	12-Dec-12	8	678
6	Green Industries	EOI	1-Sep-11	5	673
7	Northstar	RFP	1-Jun-12	3	567
8					
9					
10					
11					
12					
13					
14					
15					

Create Table [?] [X]

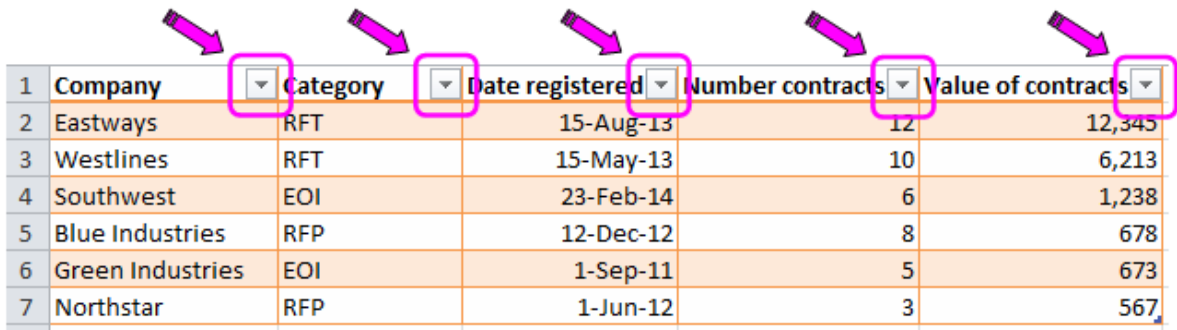
Where is the data for your table?

My table has headers

OK Cancel

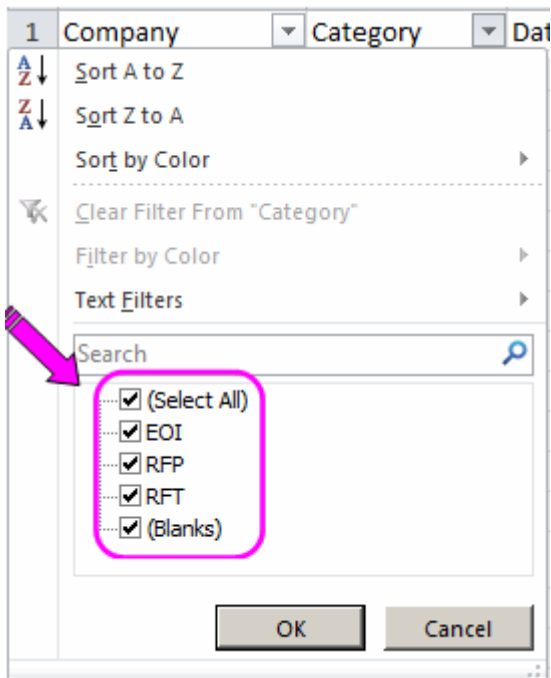
In the Create Table dialog specify the cells containing the data to be tabulated. Also specify whether the data has a header row. Then press the OK button. The table will be created ...

Excel Skills - Sorting and tabulating

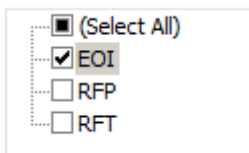


1	Company	Category	Date registered	Number contracts	Value of contracts
2	Eastways	RFT	15-Aug-13	12	12,345
3	Westlines	RFT	15-May-13	10	6,213
4	Southwest	EOI	23-Feb-14	6	1,238
5	Blue Industries	RFP	12-Dec-12	8	678
6	Green Industries	EOI	1-Sep-11	5	673
7	Northstar	RFP	1-Jun-12	3	567

Icons appear at the top of each table column. Press an icon at the top of a column to sort or “filter” that column. Filtering hides items you are not interested in and shows only items you choose to see. Suppose you press the second, “Category”, icon. Excel lists the Category items. You can then select which items you wish to see.

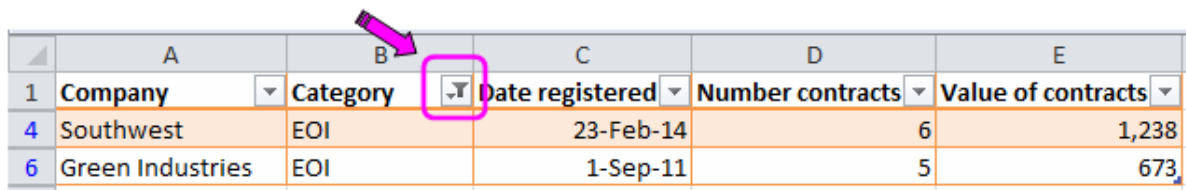


Suppose you wish to see only “EOI” category items. Press the Select All choice once (to de-select all choices) and then click on EOI ...



Press the OK button and the table will be displayed showing all data that meets the filter criteria (Category = “EOI”) ...

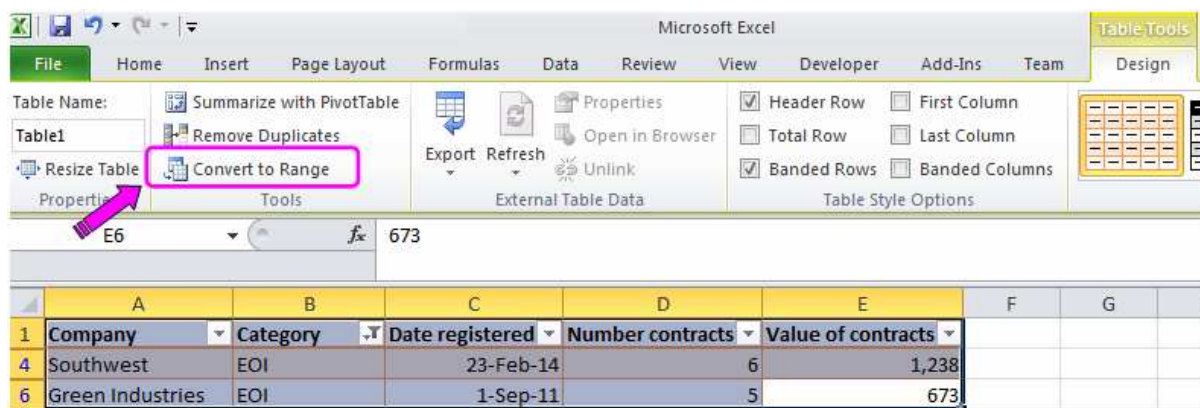
Excel Skills - Sorting and tabulating



	A	B	C	D	E
1	Company	Category	Date registered	Number contracts	Value of contracts
4	Southwest	EOI	23-Feb-14	6	1,238
6	Green Industries	EOI	1-Sep-11	5	673

Notice in the preceding illustration the Category icon has now changed to a filter symbol to give a visual indication that the column is now filtered.

To remove a table (whilst leaving the data intact) do the following: Select all cells in the table, in the Table Tools ribbon that appears press the Design sub-ribbon, and then in the Tools section press "Convert to Range" ...



Microsoft Excel - Table Tools Design ribbon

Table Name: Table1

Tools: Summarize with PivotTable, Remove Duplicates, Convert to Range, Resize Table, Properties, Open in Browser, Unlink, External Table Data

Table Style Options: Header Row, First Column, Total Row, Last Column, Banded Rows, Banded Columns

	A	B	C	D	E
1	Company	Category	Date registered	Number contracts	Value of contracts
4	Southwest	EOI	23-Feb-14	6	1,238
6	Green Industries	EOI	1-Sep-11	5	673

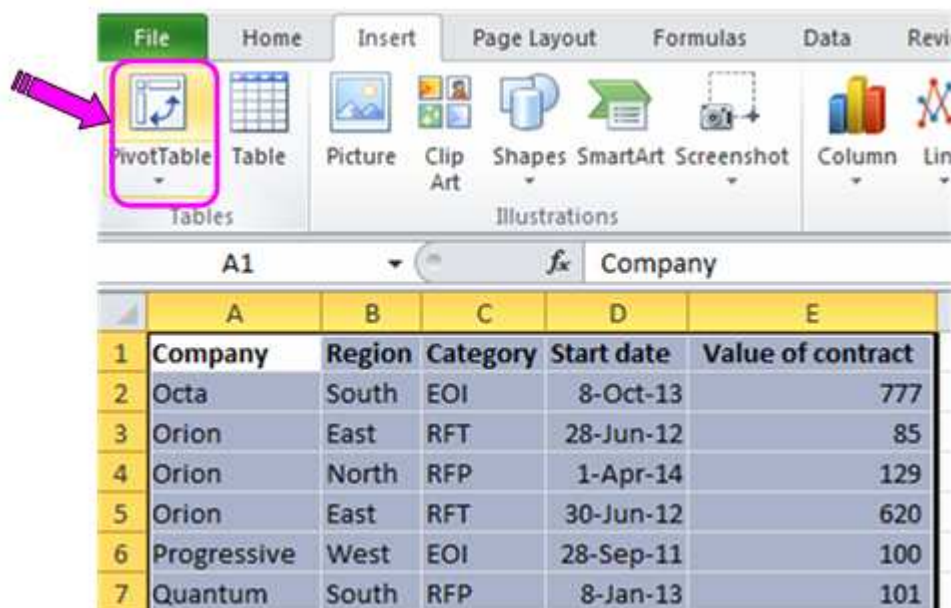
PIVOT tables

Pivot tables allow you to "slice and dice" data easily and interactively. We will demonstrate how to work with PIVOT tables by using the following data set.

Excel Skills - Sorting and tabulating

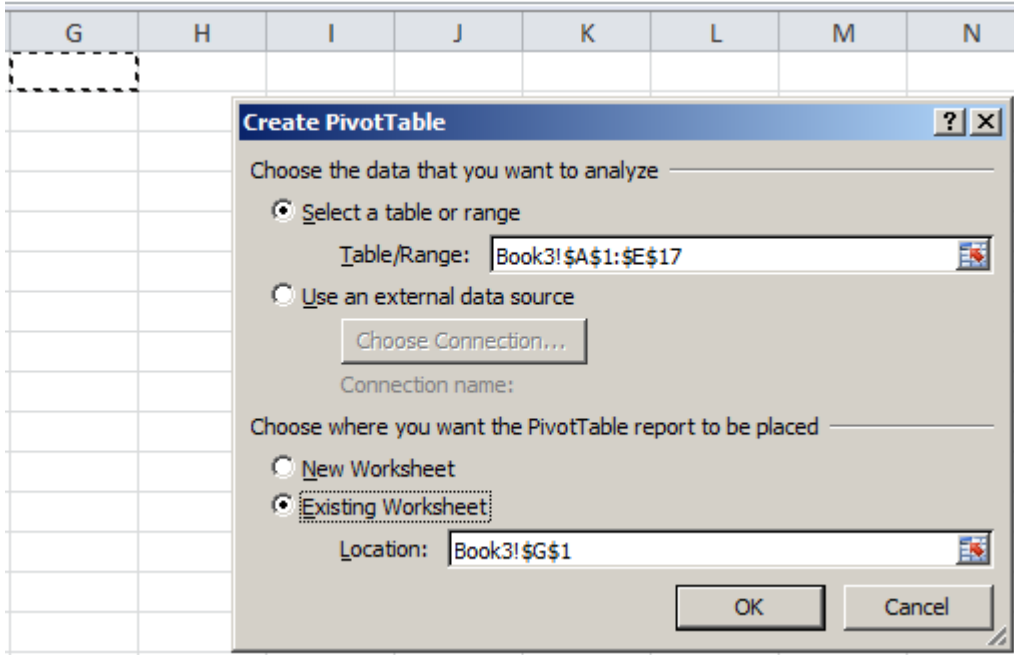
	A	B	C	D	E
1	Company	Region	Category	Start date	Value of contract
2	Octa	South	EOI	8-Oct-13	777
3	Orion	East	RFT	28-Jun-12	85
4	Orion	North	RFP	1-Apr-14	129
5	Orion	East	RFT	30-Jun-12	620
6	Progressive	West	EOI	28-Sep-11	100
7	Quantum	South	RFP	8-Jan-13	101
8	TVG	North	EOI	11-Sep-13	567
9	TVG	North	RFT	12-Jun-14	238
10	TVG	West	RFP	6-Feb-13	451
11	TVG	East	EOI	14-Sep-13	252
12	Veridian	East	EOI	2-Jul-14	191
13	Veridian	South	RFP	12-Jun-14	92
14	Veridian	West	RFT	13-Nov-13	532
15	Westminster	South	RFT	22-Mar-14	185
16	Westminster	North	RFT	13-Jan-14	210
17	Westminster	West	EOI	17-May-14	185

Begin by selecting the entire data set (or any cell within it). Then insert a pivot table. To insert the Pivot table you can click on the PivotTable icon in the Tables section of the Insert ribbon.

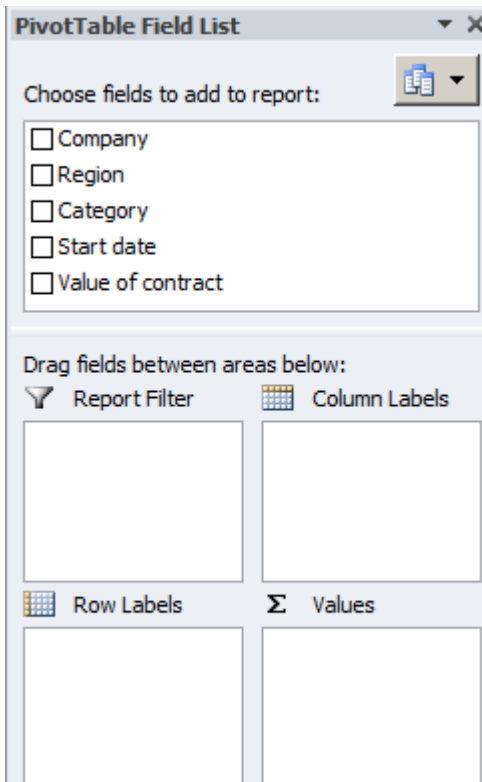


Alternatively press the keys ALT, N, V, T. The Create Pivot table wizard appears.

Excel Skills - Sorting and tabulating

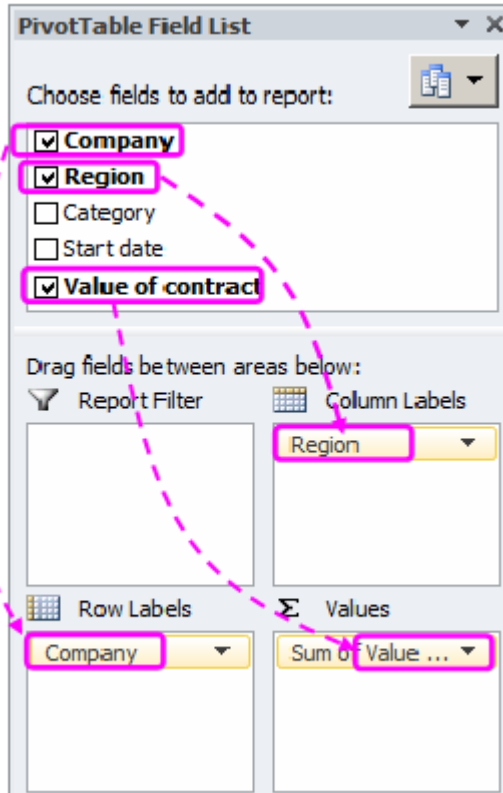


Specify where the data resides and where you wish to place the pivot table. Then press the OK button. Excel will scan your data for column headers and list those in a dialog ...

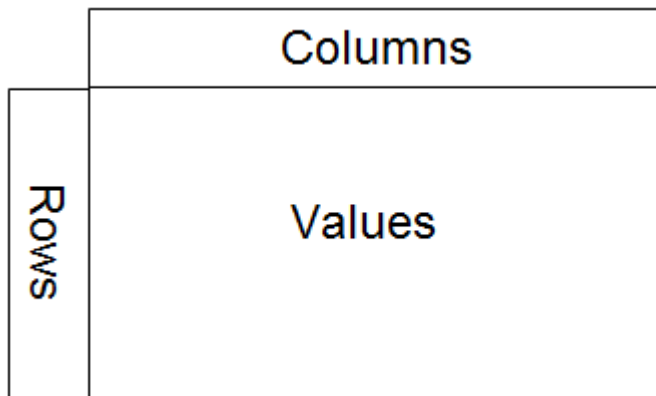


You can now design the pivot table by “dragging and dropping” fields from the top panel of the dialog into “Rows”, “Columns” and “Values” parts of the pivot table.

Excel Skills - Sorting and tabulating



Rows, Columns and Values areas are as shown in the following illustration.



The following pivot table is generated by dragging and dropping “Company” into rows, “Region” into columns and “Value of contract” into values ...

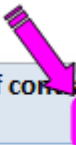
Excel Skills - Sorting and tabulating

Sum of Value of contract	Region				
Company	East	North	South	West	Grand Total
Octa			777		777
Orion	705	129			834
Progressive				100	100
Quantum			101		101
TVG	252	805		451	1508
Veridian	191		92	532	815
Westminster		210	185	185	580
Grand Total	1148	1144	1155	1268	4715

The figures in the table give the total contract value for each company and region. The “705” figure, for example in the “East” column and “Orion” row is the total contract value in the “East” region for the company “Orion”.

Having constructed the pivot table we can now work with it. There are many filtering, sorting, subtotalling, grouping, slicing, re-organising and other operations now available. We’ll look at some of these.

Suppose we wish to show only selected companies in the pivot table. To do that click on the Company icon in the pivot table header ...



Sum of Value of contract	Region				
Company	East	North	South	West	Grand Total
Octa			777		777
Orion	705	129			834

A list of companies appears. Select the companies you wish to display ...

Excel Skills - Sorting and tabulating

Sum of Value of contract		Region				
Company	East	North	South	West	Grand Total	
			777		777	
	705	129			834	
				100	100	
			101		101	
	252	805		451	1508	
	191		92	532	815	
		210	185	185	580	
	1148	1144	1155	1268	4715	

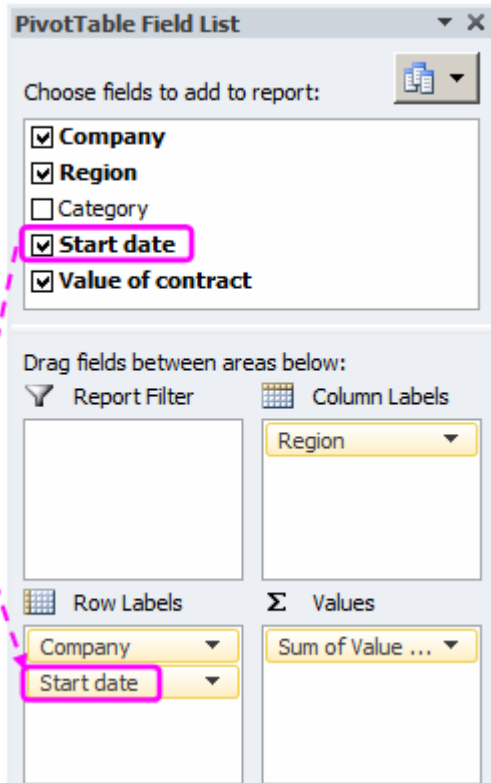
... and press the OK button. The pivot table updates to show selected companies ...

Sum of Value of contract		Region				
Company	East	North	South	West	Grand Total	
Octa			777		777	
Orion	705	129			834	
Progressive				100	100	
Quantum			101		101	
Grand Total	705	129	878	100	1812	

Only the four selected companies are shown.

The pivot table can be reorganised at any time. To illustrate we will elaborate on the table's row structure. Currently the rows represent company totals across all contract dates. We will add subtotalling by contract date. To do that we drag and drop the "Start date" field to below the "Company" field in the Row Labels section ...

Excel Skills - Sorting and tabulating

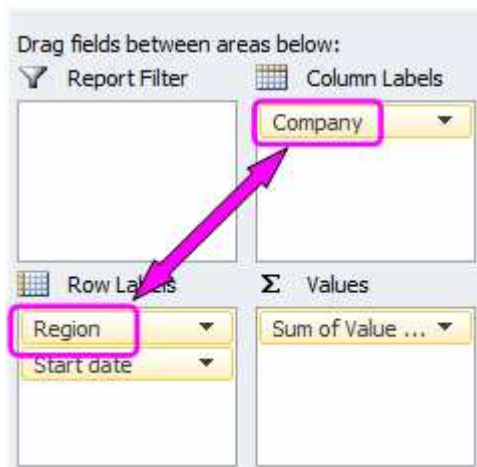


The pivot table updates to show Companies and Contract dates for each region ...

Sum of Value of contract		Region				
Company		East	North	South	West	Grand Total
Octa				777		777
8-Oct-13				777		777
Orion		705	129			834
28-Jun-12		85				85
30-Jun-12		620				620
1-Apr-14			129			129
Progressive					100	100
28-Sep-11					100	100
Quantum				101		101
8-Jan-13				101		101
TVG		252	805		451	1508
6-Feb-13					451	451
11-Sep-13			567			567
14-Sep-13		252				252
12-Jun-14			238			238
Veridian		191		92	532	815
13-Nov-13					532	532
12-Jun-14				92		92
2-Jul-14		191				191

Excel Skills - Sorting and tabulating

We can continue to organize the pivot table. We could, for example, swap the Company and Region fields ...



Now Companies are shown in columns and rows show contract dates within regions ...

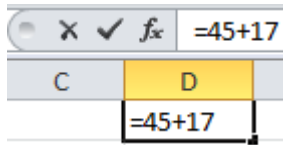
Sum of Value of contract		Region						Grand Total
Company	Octa	Orion	Progressive	Quantum	TVG	Veridian	Westminster	Grand Total
East	705				252	191		1148
28-Jun-12	85							85
30-Jun-12	620							620
14-Sep-13					252			252
2-Jul-14						191		191
North	129				805		210	1144
11-Sep-13					567			567
13-Jan-14							210	210
1-Apr-14	129							129
12-Jun-14					238			238
South	777			101		92	185	1155
8-Jan-13				101				101
8-Oct-13	777							777
22-Mar-14							185	185
12-Jun-14						92		92

Formulas and referencing

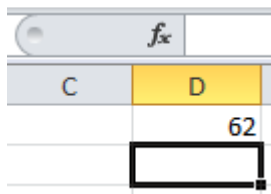
Excel is very powerful – but it can also be used as a simple calculator – and doing so introduces some important concepts. We'll begin by looking at Excel as a calculator.

Arithmetic

To add two numbers together, say 45 and 17, you can type **=45+17** into an Excel cell ...



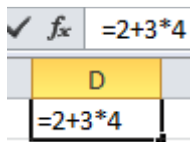
... and press the ENTER key ...



Excel has shown the answer: 62.

Order of operations

Consider the following calculation ...



The answer to this calculation is 14, not – as one might expect – 20. Excel multiplies 3 by 4 first to give 12 and then adds the 2 to give the result 14. Excel doesn't add the 2 to the 3 to give 5 and then multiply by 4 to give 20.

Why does Excel work this way? Excel follows the standard rules of arithmetic / mathematics which specify that different operations (addition, subtraction, multiplication, etc) have different priorities. The higher priority operations are done first even if they are "later" in the formula. The following table shows the priorities of operations.

Operation	Priority (1= highest)
Brackets ()	1
Multiplication * and Division /	2
Addition + and subtraction -	3

Examples of Excel formulae and their results are shown in the following table.

Excel Skills - Formulas and referencing

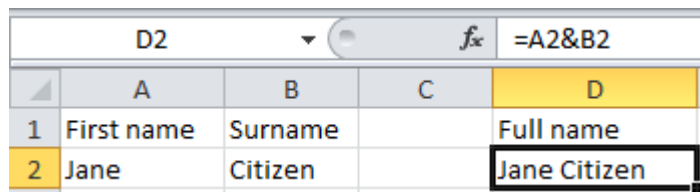
Formula	Result
=2+3*4	14
=(2+3)*4	20
=2+3*4+5	19
=2+3*(4+5)	29
=(2+3)*4+5	25
=6/2+1	4
=6/(2+1)	2

Although Excel can be used simply as a calculator it has more power and usefulness when used another way: Instead of directly typing numbers into a formula we often type in a cell reference e.g. D3. When Excel sees D3 in a formula it understands that D3 refers to a cell and Excel uses the contents of that cell. For example if cell D3 has 10 in it then the formula **=D3 + 5** will give the answer 15.

Text

Cells in Excel can contain text. To enter text into a cell simply select the cell, type the text and press ENTER.

We have seen that you can work with numbers in formulae (e.g. as in **=A3+B3**). You can also work with text. An example follows ...



	A	B	C	D
1	First name	Surname		Full name
2	Jane	Citizen		Jane Citizen

Cell A2 contains the text “Jane “ and B2 contains “Citizen”. The formula in D2 is **=A2&B2** . The “&” in the formula instructs Excel to append B2 to A2. So “Citizen” is appended to “Jane “ giving the result “Jane Citizen”.

We’ll look more at text later. For the time being, though, we’ll concentrate on numbers and working with them in Excel formulae.

The following illustration shows a spreadsheet that performs a simple cost calculation: Individual costs are added and generate a total cost.

Excel Skills - Formulas and referencing

	A	B	C	D
1		2014	2015	2016
2	Admin cost	\$ 45	\$ 12	\$ 67
3	Other cost	\$ 23	\$ 78	\$ 14
4	Total cost	\$ 68	\$ 90	
5				
6		2014	2015	2016
7	Admin cost	\$ 45	\$ 12	\$ 67
8	Other cost	\$ 23	\$ 78	\$ 14
9	Total cost	\$ 68	\$ 90	
10				
11		2014	2015	2016
12	Admin cost	\$ 45	\$ 12	\$ 67
13	Other cost	\$ 23	\$ 78	\$ 14
14	Total cost	\$ 68	\$ 90	

We want to add “Admin cost” to “Other cost” and generate a “Total cost”. The calculation has been done using three different methods. All of the methods give the same answer but, as we shall see, only one of them is the “best” way of doing the calculation: Only that calculation uses the full power of Excel and minimises the user’s workload. To compare the methods we’ll look at the formulas used in the earlier illustration.

The following diagram shows the formulas.

	A	B	C	D
1		2014	2015	2016
2	Admin cost	45	12	67
3	Other cost	23	78	14
4	Total cost	68	90	
5				
6		2014	2015	2016
7	Admin cost	45	12	67
8	Other cost	23	78	14
9	Total cost	=45+23	=12+78	
10				
11		2014	2015	2016
12	Admin cost	45	12	67
13	Other cost	23	78	14
14	Total cost	=B12+B13	=C12+C13	

First method

There are no calculations performed by Excel in the first method on row 4. The totals were calculated independently of Excel and simply typed into cells B4 and C4. This is a not a good method

Excel Skills - Formulas and referencing

and uses none of the power and functions available in Excel. Excel here is simply being used as a word processor.

Second method

In the second method on row 9 Excel calculates the totals: The formula **=45+23** in cell B9 instructs Excel to add 45 and 23. Excel displays the answer (68) in cell B9. Although this is a better method than the first it is still not the best: It's a manual process that needs to be repeated for cell that needs totalling. Furthermore if any of the "source" figures (45 and 23) are changed then the totalling formula needs to be retyped.

Third method

This is the "proper" method. Consider the formula in cell B14: **=B12+B13** That formula tells Excel to calculate cell B14 by taking the number in B12 and add to it the number in B13: Excel reads the 45 in cell B12 and adds it to the 23 in B13 and shows the result in B14. Used in this way cell B14 contains two things: A formula (or method) for calculating a result [**=B12+B13**] and the result itself [68]. Excel is clever enough to recalculate the formula if any of the cells it depends on (B13 & B14 in this case) – change. Another advantage of this method is the formula can be "copied and pasted" to the right and will work correctly, automatically, with no further work required.

In Excel terminology this is called relative addressing. There is another form called absolute addressing and we will look at that now.

Absolute and relative referencing

We've seen that Excel "adjusts" formulas when copying and pasting (or Autofilling) so that the formula stays correct in its new location. For example, the formula **=B3+B4**, when copied and pasted one column to the right, becomes **=C3+C4**. Similarly, the formula **=C3+D3** when copied and pasted down one row becomes **=C4+D4**. This is called "relative referencing". Sometimes, though, it's not appropriate for Excel to work this way. In those cases – when references need to be "anchored" and immovable – referencing is "absolute". Following is example illustrating where absolute referencing is needed. Row 2 lists the value of an asset month by month.

		NORMDIST					
		=C2-B2					
	A	B	C	D	E	F	G
1		Jan	Feb	Mar	Apr	May	Jun
2	Asset value	15	17	19	23	24	28
3	YTD increase in asset value		=C2-B2				

On row 3 we'd like to calculate the year to date increase in the value of the asset. An appropriate formula to do that calculation – for the month of February at least – is shown in the preceding diagram: The increase is C2 (the February value) less B2 (the January value). Whilst that formula is correct for February we can't copy and paste the formula into the March column. If we did we'd arrive at this ...

Excel Skills - Formulas and referencing

NORMDIST							
✕ ✓ f _x =D2-C2							
	A	B	C	D	E	F	G
1		Jan	Feb	Mar	Apr	May	Jun
2	Asset value	15	17	19	23	24	28
3	YTD increase in asset value			2 =D2-C2			

The formula is incorrectly subtracting the February asset value from the March asset value. It should, instead, be subtracting the January asset value. We need to “anchor” the reference to January so that it isn’t adjusted when the formula is copied and pasted to the right. This is how we achieve that ...

NORMDIST							
✕ ✓ f _x =C2-\$B2							
	A	B	C	D	E	F	G
1		Jan	Feb	Mar	Apr	May	Jun
2	Asset value	15	17	19	23	24	28
3	YTD increase in asset value		=C2-\$B2				

Notice that there is a “\$” in front of the B in the formula. The “\$” signifies to Excel not to change the reference if the formula is copied and pasted across. When the formula is copied and pasted we get this result ...

NORMDIST							
✕ ✓ f _x =D2-\$B2							
	A	B	C	D	E	F	G
1		Jan	Feb	Mar	Apr	May	Jun
2	Asset value	15	17	19	23	24	28
3	YTD increase in asset value			2 =D2-\$B2	8	9	13

The \$B2 has been “anchored” and the March YTD calculation now, correctly, subtracts the January figure from the current one.

The preceding formula can be copied and pasted across for all months from January through to June. The formula when viewed in the January column might look somewhat odd ...

NORMDIST							
✕ ✓ f _x =B2-\$B2							
	A	B	C	D	E	F	G
1		Jan	Feb	Mar	Apr	May	Jun
2	Asset value	15	17	19	23	24	28
3	YTD increase in asset value	=B2-\$B2	2	4	8	9	13

Excel Skills - Formulas and referencing

The formula is **=B2-\$B2** Although the formula looks odd it is perfectly correct and generates the correct result – 0.

We have seen that a \$ in front of a column reference “anchors” that column. The \$ makes Excel preserve that reference when the formula is copied and pasted across (to the left or right). Similarly, a \$ in front of a row (as in A\$3, for example) anchors the row. In that case if the formula is copied and pasted up (or down) the row reference doesn’t change.

Toggle absolute and relative references - F4

Pressing the F4 key will toggle absolute and relative referencing of a cell. Consider the following example.

NORMDIST				
	A	B	C	D
1	Budget	23		
2	Actual	27		
3	Variance	=B2-B1		

We have selected a cell reference in a formula (B1). Currently the reference is a relative one (i.e. the “B” will change to a “C” if the formula is copied to the C column, and the “1” will change to a “2” if the formula is copied down one row). Pressing the F4 key will make the reference absolute with respect to rows and columns ...

NORMDIST				
	A	B	C	D
1	Budget	23		
2	Actual	27		
3	Variance	=B2-\$B\$1		

Note there is a “\$” in front of both the row and the column. Pressing the key again will make the column reference relative (no “\$”) and the row reference absolute (with “\$”) ...

NORMDIST				
	A	B	C	D
1	Budget	23		
2	Actual	27		
3	Variance	=B2-B\$1		

Pressing the key again will make the column reference absolute (with “\$”) and the row reference relative (no “\$”) ...

NORMDIST				
	A	B	C	D
1	Budget	23		
2	Actual	27		
3	Variance	=B2-\$B1		

Excel Skills - Formulas and referencing

And that is all of the four possible referencing modes. Pressing F4 again will take you back to where you started ...

NORMDIST				
	A	B	C	D
1	Budget	23		
2	Actual	27		
3	Variance	=B2-B1		

Named ranges

Cell references can be given a name and can be referred to by name. This can make formulas easier to read. For example

=SUM(GroupTotal)

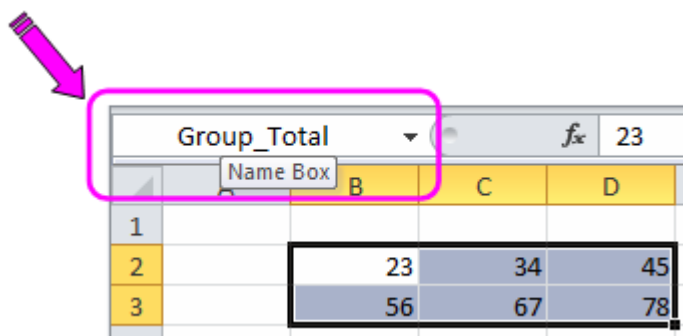
... is easier to read than ...

=SUM(\$E\$23:\$Z\$56)

To name a range begin by selecting it.

B2				
	A	B	C	D
1				
2		23	34	45
3		56	67	78

Then type the name into the name box ...



Group_Total				
	A	B	C	D
1				
2		23	34	45
3		56	67	78

Names cannot start with a digit, must not have spaces or characters other than digits, alphabetic characters or the underscore character and must not be interpretable as a cell reference (e.g. B2).

After the range is defined it can be referred to by name ...

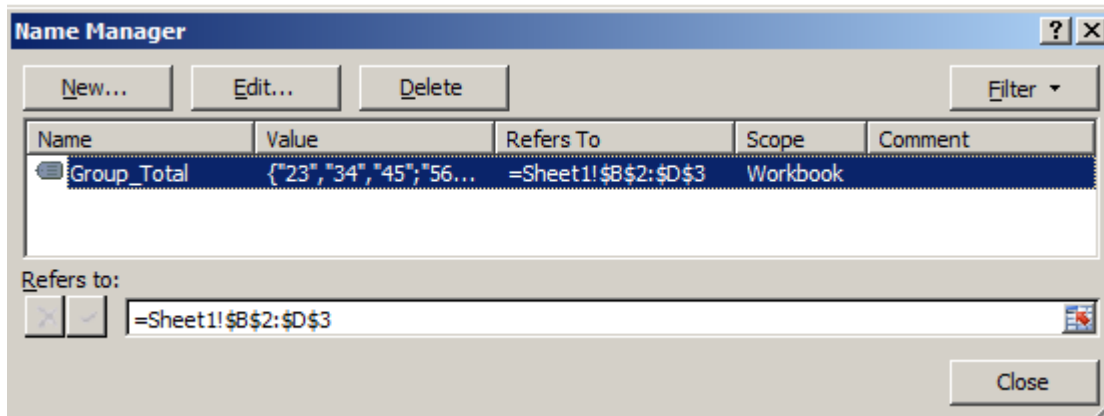
Excel Skills - Formulas and referencing

	A	B	C	D	E
1					
2		23	34	45	
3		56	67	78	
4					
5		=sum(Group_Total)			
6					

To manage the list of named ranges click on the Name Manager icon in the Defined Names section of the Formulas toolbar ...



Clicking on the icon brings up a dialog that allows you to edit, delete and create new names ...



The

Tools for examining formulas and references

Auditing toolbar

The auditing toolbar lets you examine the dependencies between formulae and also helps in tracking down circular references if they occur. The auditing toolbar is in the Formula Auditing section of the Formulas tab. The toolbar looks like this:

Excel Skills - Formulas and referencing



Trace Precedents

Suppose you have this arrangement of cells and formulae.

	A	B	C	D
1				
2	2	3	4	5
3				
4		=B2+A2		=D2+C2
5				
6			=B4+D4	

and you press the Trace Precedents icon. Then the immediate precedents will be displayed ...

	A	B	C	D
1				
2	2	3	4	5
3				
4		=B2+A2		=D2+C2
5				
6			=B4+D4	

If you press the button again then the precedents of the precedents will be displayed, i.e. you will "go up another level".

	A	B	C	D
1				
2	2	3	4	5
3				
4		=B2+A2		=D2+C2
5				
6			=B4+D4	

If you now press the downward pointing triangle on the right of the Remove Arrows menu item and then the Remove Precedent Arrows sub-menu the precedents will go back one level.

Excel Skills - Formulas and referencing



	A	B	C	D
1				
2	2	3	4	5
3				
4		=B2+A2		=B2+C2
5				
6			=B4+D4	
7				

If the precedent is on another worksheet tab then a dotted arrow is shown ...

	A	B	C	D
1	Expenses			
2	Q1	Q2	Q3	Q4
3	3.84	3.84	10.54	3.91
4				

To see the precedents double-click on the dotted arrow ...

	A	B	C	D	E	F	G
1	Expenses						
2	Q1	Q2	Q3	Q4			
3	3.84	3.84	10.54	3.91			
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							

Go To [?] [X]

Go to:

- [Intro_Answers.xls]Calcs!\$F\$24
- [Intro_Answers.xls]Calcs!\$F\$19
- [Intro_Answers.xls]Calcs!\$F\$20
- [Intro_Answers.xls]Calcs!\$F\$21

Reference:

Special... OK Cancel

Excel Skills - Formulas and referencing

A dialog box appears listing the cells the formula refers to. To go to any of those cells select the cell in the dialog and press the OK button. Excel will “jump” to the appropriate worksheet and cell and selects that cell. After having done that, to go back to the original cell press ALT + E, G, ENTER.

Show immediate precedents

If you want to see (and select) the precedents of a cell but don't want the clutter of the arrows as shown by the formula auditing toolbar then you can press CTRL + [. The precedents will be selected and highlighted.

For example, if your spreadsheet is currently as shown next ...

	A	B	C	D	E
1	1	2		3	4
2		=B1+A1		=D1+E1	
3					
4			=B2+D2		

... and you press CTRL + [then the spreadsheet will change to show ...

	A	B	C	D	E
1	1	2		3	4
2		=B1+A1		=D1+E1	
3					
4			=B2+D2		

The precedents have been selected and highlighted.

If the cell refers both to cells on other sheets and to cells on the current sheet only the precedents on the current sheet will be shown. If none of the cells referred to are on the current worksheet then only the first cell referred to on another sheet will be selected.

Show all precedents

Press CTRL + SHIFT + [to see all the precedent cells – not just the immediate precedents. In our example you'd see ...

	A	B	C	D	E
1	1	2		3	4
2		=B1+A1		=D1+E1	
3					
4			=B2+D2		

Trace Dependents

Tracing dependents is very similar in style to tracing precedents. To trace dependents with the formula auditing toolbar press the Trace Dependents icon. To trace immediate dependents using the CTRL key press CTRL +]. To trace all dependents with the CTRL key press CTRL + SHIFT +]

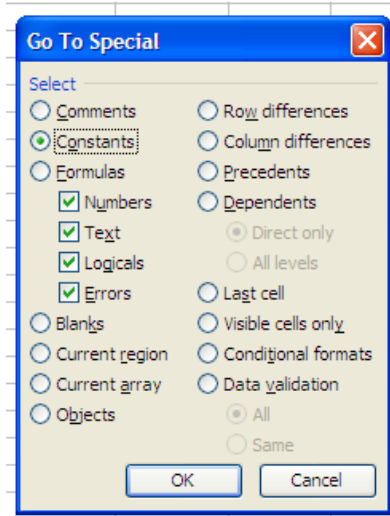
Excel Skills - Formulas and referencing

Edit | GoTo | Special

Press ALT + E, G and then press the Special button to highlight cells in the currently selected range that meet a particular criterion.

The Go To Special dialog is shown to the right. You can, for example, highlight constants, cells that contain data validation, cells with conditional formatting and so on.

This can be useful in detecting inconsistencies and errors in worksheets.



In the following example we've highlighted constants. The highlighting indicates cell D4 bears further examining as it seems to be inconsistent with its neighbours to the right and left.

	A	B	C	D	E	F	G
1	Growth:	6%					
2							
3	Year:	2010	2011	2012	2013	2014	2015
4	Forecast revenue:	9.20	9.66	9.70	10.19	10.69	11.23

Formula view mode

Formula view mode reveals all of the formulae on the currently selected worksheet. One way of selecting formula view mode is to press CTRL + ` . To go back to normal mode press CTRL + ` again. Another way of selecting formula view mode is by using the formula auditing toolbar and pressing the Show Formulas icon. Press the icon again to turn off the formula view mode.

If we used formula view mode with the preceding spreadsheet example we'd see the following ...

	A	B	C	D	E	F	G
1	Growth:	0.06					
2							
3	Year:	2010	=B3+1	=C3+1	=D3+1	=E3+1	=F3+1
4	Forecast revenue:	9.2	=B4*1.05	9.7	=D4*1.05	=E4*1.05	=F4*1.05

We can see there is a hard-coded number in D4 – that bears further investigating.

Principles of good design

Good spreadsheet design pays off: Well designed spreadsheets are easier to maintain and extend. They are easier to master. And they are less likely to have errors.

Adhering to a small number of core principles will aid in achieving a good design. We will illustrate these core principles by considering case studies. Each case study relates to a design principle.

Consistency

Spreadsheet users find it easiest to work with spreadsheets that are consistent. Consider colouring for example. If colouring is used consistently then colour carries useful information: Cells with red text, for example, might indicate negative numbers. In contrast, if red is used haphazardly then it becomes an interference rather than an aid.

The following illustration shows a spreadsheet that shows consistency. The illustration is of two tabs (Operations and Tax) in same spreadsheet (the Operations tab is on the top half of the diagram and a Tax tab in the lower half). Notice that the tabs are consistent in their use of columns and dates: In both tabs column E is used for 2010 dates, column F for 2011 and so on. So if a formula in column F in one tab refers to a cell in column F in another tab we know the formula is referring to the same date in the other tab. And if the formula refers to column E we know – without even needing to look – that it must be referring to the prior period’s data.

	A	B	C	D	E	F	G	H	I	J	K	L
3	Annual Operations											
4												
5	Year Ending				31-Dec-10	31-Dec-11	31-Dec-12	31-Dec-13	31-Dec-14	31-Dec-15	31-Dec-16	31-Dec-17
6												
7	Operating Revenue											
8												
9	Units Sold	[000]			1,000	1,000	800	800	800	800	800	800
10	Unit Price	[\$]			1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
11	Sales Revenue	[\$'000]			1,000	1,000	800	800	800	800	800	800
12	Total Operating Revenues	[\$'000]			1,000	1,000	800	800	800	800	800	800
13												Back to top
14	Operating Expenses											
15												
16	Cost of goods sold	[\$'000]			(550)	(550)	(440)	(440)	(440)	(440)	(440)	(440)
17	Selling, General and Admin Expenses	[\$'000]			(150)	(150)	(150)	(150)	(150)	(150)	(150)	(150)
Introduction Summary Checks Assumptions Annual Assumptions Operations Depreciation Debt Tax Cashflow Acco												
Model_Start_Answers.xls1 [Compatibility Mode]												
	A	B	C	D	E	F	G	H	I	J	K	L
3	Tax											
4												
5	Year Ending				31-Dec-10	31-Dec-11	31-Dec-12	31-Dec-13	31-Dec-14	31-Dec-15	31-Dec-16	31-Dec-17
6												
7	Tax											
8												
9	Assessable Income											
10												
11	Sales Revenue	[\$'000]			1,000	1,000	800	800	800	800	800	800
12	Interest Revenue	[\$'000]			-	4	6	15	17	19	20	22
13	Total Assessable Income	[\$'000]			1,000	1,004	806	815	817	819	820	822
14	Deductions											
15												
16												
17	Cost of goods sold	[\$'000]			(550)	(550)	(440)	(440)	(440)	(440)	(440)	(440)
Introduction Summary Checks Assumptions Annual Assumptions Operations Depreciation Debt Tax Cashflow Acco												

Even the widths of the columns are consistent between tabs – this avoids visual “jarring” if the user needs to switch back and forth between tabs.

Excel Skills - Principles of good design

Copy-and-pasteability

This is another aspect of consistency: We want formulas to be consistent with their neighbours so that formulae can be copied and pasted across (or down, or possibly both across and down).

Minimise unnecessary dependencies

All formulae will refer to cells elsewhere in the spreadsheet – and will therefore depend on those cells. But it's possible (but not advisable) to build in unnecessary dependencies. We will look shortly at an example of this.

Illustration applying design principles

We will now look at an example showing how to apply the earlier design principles to a practical problem. Our problem is to calculate year-to-date (YTD) costs in a spreadsheet.

	A	B	C	D	E	F
1			Jan	Feb	Mar	Apr
2	Monthly cost		34	57	68	67
3	Total cost YTD		34	91	159	

On row 3 we want to calculate total year to date costs. The January YTD cost in C3 is the same as the January cost on the row above – 34. The February YTD cost in D3 is the January YTD cost plus the February cost, and so on. One way of calculating the row 3 figures is as shown next ...

	A	B	C	D	E	F
1			Jan	Feb	Mar	Apr
2	Monthly cost		34	57	68	67
3	Total cost YTD		=C2	=D2+C3	=E2+D3	

The January YTD formula refers only to C2 – the January cost. The other YTD formulae differ – they refer both to the current month's cost and the preceding YTD cost.

How well do the preceding formulae meet the design goal of consistency? Not very well – the first formula differs from the remaining ones and so the formulas are inconsistent. This could cause a problem if formulae on row 3 are copied and pasted to the right: Suppose we copy and paste to the right to fill out the formula for April YTD. If we copy and paste from D3 or E3 the formula will be correct. However, if we copy and paste from C3 then the formula will be wrong – that formula is appropriate only for the first YTD calculation.

We can conclude that the method above doesn't meet the design goal of consistency. Let's attempt to make the formula consistent: We'll make the January YTD figure depend on B3 ...

	A	B	C	D	E	F
1			Jan	Feb	Mar	Apr
2	Monthly cost		34	57	68	67
3	Total cost YTD		=C2+B3	=D2+C3	=E2+D3	

Excel Skills - Principles of good design

B3 is empty and so the January YTD figure is the sum of the empty cell (0) and the January figure in C2 – which is 34. The correct answer is returned. Although this revised set of formulae now meet our design goal of consistency it breaks another principle – avoiding depending on unnecessary cells. Since the formula in C3 now depends on B3 it will be affected if something is put into B3 at a later date. Suppose you were to put the word “Section” into B3 ...

	A	B	C	D	E	F
1			Jan	Feb	Mar	Apr
2	Monthly cost		34	57	68	67
3	Total cost YTD	Section	=C2+B3	#VALUE!	#VALUE!	

The calculations on row 3 no longer work correctly. “Section” – being a word – cannot be added to a number and this causes an error.

A different problem could arise if the user puts a number into B3. Perhaps the user decides to use column B for section numbers and puts 3 into B3 as the section number ...

	A	B	C	D	E	F
1			Jan	Feb	Mar	Apr
2	Monthly cost	Section	34	57	68	67
3	Total cost YTD	3	37	94	162	

We can see that the section number in B3 is treated as a YTD figure by the formula in C3 and is added – unnecessarily and incorrectly – to the YTD totals.

We can conclude the method shown above fails to meet the design goal of avoiding unnecessary dependencies.

How then can we design a solution to this problem that meets both preceding design goals? The following illustration shows how ...

	A	B	C	D	E	F
1			Jan	Feb	Mar	Apr
2	Monthly cost		34	57	68	67
3	Total cost YTD		=SUM(\$C2:C2)	=SUM(\$C2:D2)	=SUM(\$C2:E2)	

We use a SUM function to sum costs-to-date on row 2. We “anchor” the leftmost cell of the sum (with “\$C”) and leave the second cell relative. The formula meets our design goals: It is consistent, copy-and-pasteable and avoids unnecessary dependencies.

Add consistency and error checking

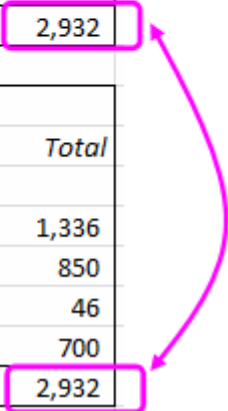
To prevent or detect errors creeping into spreadsheets it is good practice to build in error and consistency checking. Following is an example of how this technique can help pick up and report errors.

Excel Skills - Principles of good design

The spreadsheet shown next lists transactions made in various regions on various dates. A summary is shown below that list and the summary totals transactions by region and type. The totals in both lists match ...

Transaction list			
Date	Region	Type	Amount
1/01/14	North	A	567
2/01/14	East	B	34
3/01/14	North	A	679
6/01/14	West	A	700
7/01/14	East	B	12
8/01/14	South	A	850
9/01/14	North	B	90
Total			2,932

Transaction summary			
	Type		Total
	A	B	
North	1,246	90	1,336
South	850	-	850
East	-	46	46
West	700	-	700
Total	2,796	136	2,932



One of the transactions in the list then needs to be re-classified: The transaction on the 7th in the East region needs to change to a new "C" type ...

Excel Skills - Principles of good design

Transaction list			
Date	Region	Type	Amount
1/01/14	North	A	567
2/01/14	East	B	34
3/01/14	North	A	679
6/01/14	West	A	700
7/01/14	East	C	12
8/01/14	South	A	850
9/01/14	North	B	90
Total			2,932

Was changed to a "C"

Transaction summary			
	Type		Total
	A	B	
North	1,246	90	1,336
South	850	-	850
East	-	34	34
West	700	-	700
Total	2,796	124	2,920

The transaction summary is now inconsistent with the transaction list: The revised "C" transaction is included in the list but is now missing from the summary (because the summary is summarising only A and B type transactions).

This error is not at all obvious to the user though – it could easily be missed.

To pick up and report on this error we can easily check consistency between the transaction list and the transaction summary: Simply compare the two totals. If they differ an error has occurred and can be reported. The error could be reported in this way, for example:

Excel Skills - Principles of good design

Transaction list			
Date	Region	Type	Amount
1/01/14	North	A	567
2/01/14	East	B	34
3/01/14	North	A	679
6/01/14	West	A	700
7/01/14	East	C	12
8/01/14	South	A	850
9/01/14	North	B	90
Total			2,932
Error: Summary doesn't include all transactions			
Transaction summary			
	Type		Total
	A	B	
North	1,246	90	1,336
South	850	-	850
East	-	34	34
West	700	-	700
Total	2,796	124	2,920

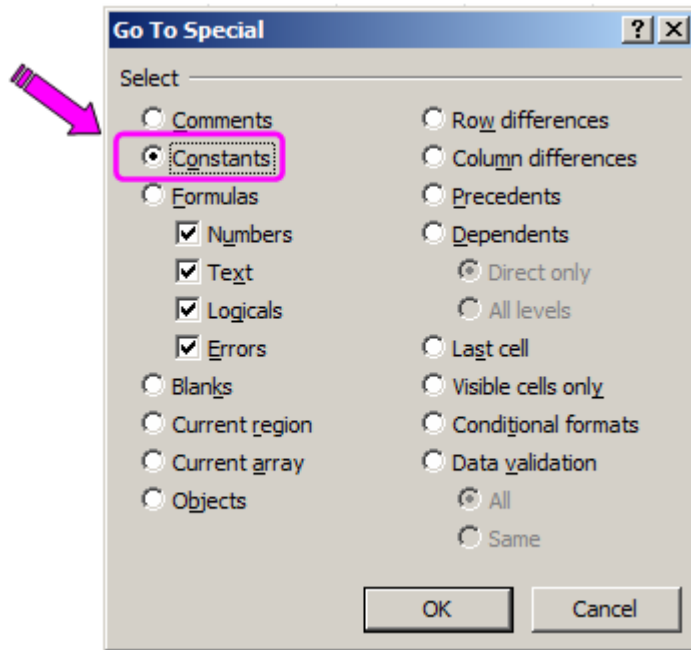
Separate numbers from formulae

Any spreadsheet has two main components: 1) Data / numbers, and 2) formulae. Formulae are “rules” that define how data is to be processed. Generally speaking it is not a good idea to mix rules with data. Rules will be relatively constant during the life of a worksheet whilst data will be more volatile. Excel has a useful tool to check whether numbers and formulae are mixed. We’ll illustrate how that tool works by considering the following spreadsheet ...

	A	B	C	D	E	F	G	H	I
1									
2		Period ending	31/12/13	31/03/14	30/06/14	30/09/14	31/12/14	31/03/15	30/06/15
3									
4		Blue industries	56	34	56	44	45	75	34
5		Green industries	64	65	34	65	36	54	34
6		Total	120	99	90	109	81	129	68

Choose Home | Editing | Find & Select | Go To Special. The Go To Special dialog will appear ...

Excel Skills - Principles of good design



Select “Constants” and click on OK. Constants will be highlighted.

	A	B	C	D	E	F	G	H	I
1									
2		Period ending	31/12/13	31/03/14	30/06/14	30/09/14	31/12/14	31/03/15	30/06/15
3									
4		Blue industries	56	34	56	44	45	75	34
5		Green industries	64	65	34	65	36	54	34
6		Total	120	99	90	109	81	129	68

Cells with grey background contain numbers and those with no background contain formulae. Cells F2 and G6 are anomalous and bear further inspection. Cell G6 is particularly worrying – someone has “hard-coded” the number 81 into that cell. Whilst 81 is currently correct, if either of the two numbers above it change, then G6 will become incorrect – and with no obvious visual indication that it is so.

Test / check your work

This is a self-evident principle but it is rarely followed. A good rule of thumb with respect to testing and checking is this: If a spreadsheet has not been checked and verified then it is probably wrong – simple as that.

Around the edges

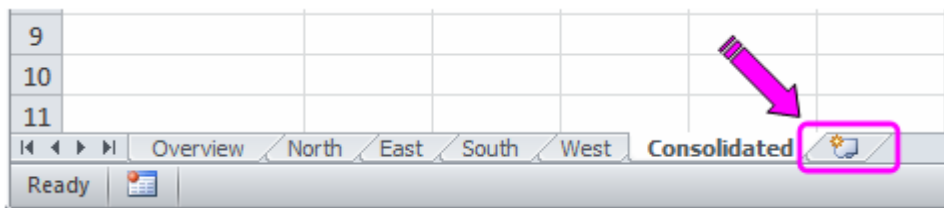
On the top, bottom and right edges of the Excel window are useful tools and features. This section introduces the most important of those.

TAB names

Following are actions you can take in the TAB names section.

Adding a worksheet

Adding a worksheet. To add a worksheet click on the icon highlighted in the following diagram.

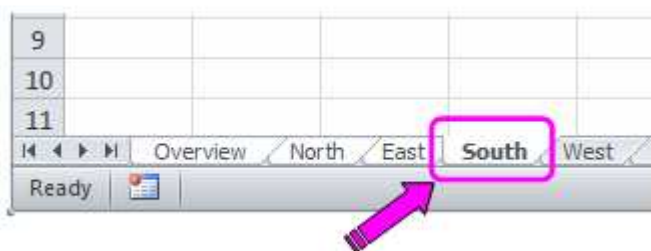


Alternatively you can press the keys SHIFT + F11. The result is as shown next: A new worksheet has been added.

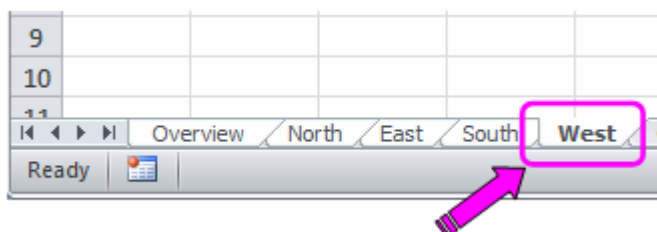


Select the next worksheet

Suppose sheet South is currently selected ...



To select the next worksheet press CTRL + SHIFT + PGDN ...



Excel Skills - Around the edges

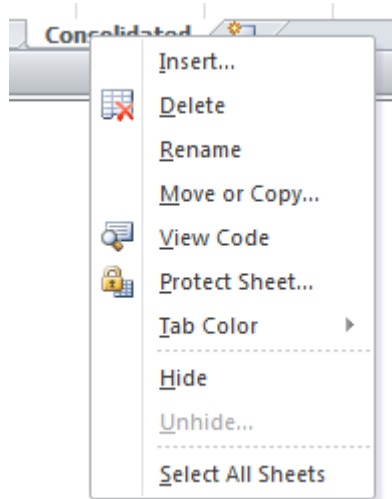
The next sheet has been selected.

Select the previous worksheet

To select the previous worksheet press CTRL + SHIFT + PGUP.

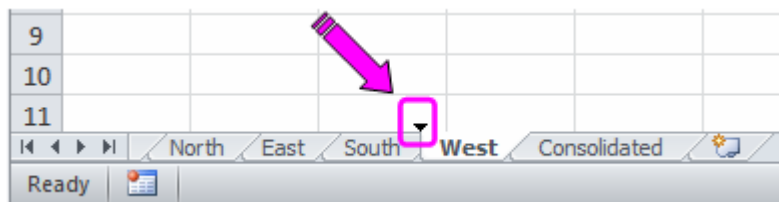
Delete, rename, move or copy a worksheet

To perform any of these operations right-mouse-click on a worksheet tab. A popup menu will appear ...



Make a selection as appropriate from the menu and complete the operation.

To move a worksheet you can “drag-and-drop” it. To do that left-mouse-click on the worksheet tab and keep the mouse down. An arrow icon will appear ...

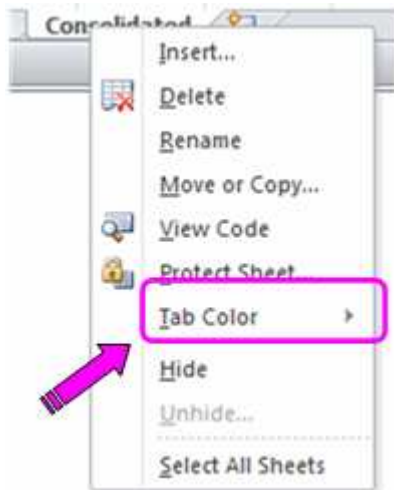


Drag the arrow icon to the left or right as appropriate and release the mouse. The worksheet will be moved.

Colourise a worksheet tab

Worksheet tabs can be coloured. Choose the “Tab Color” menu item in the popup menu described earlier ...

Excel Skills - Around the edges



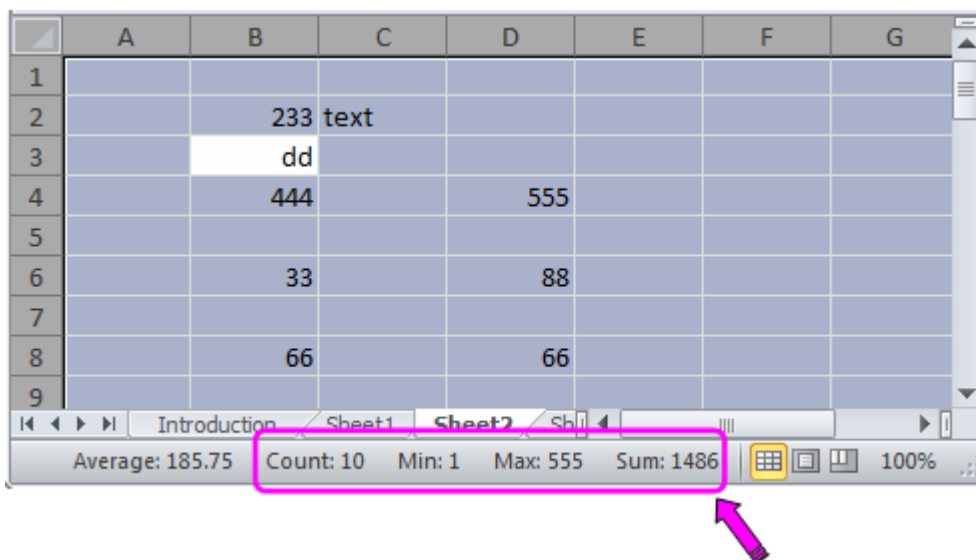
The following illustration shows the result of colourising the East, South and West tabs. [If you are reading this in black-and-white the East tab has a blue background, South is green and West is red.]



Note that if you change the colour the change will not be shown until you select another tab – Excel seems to be a bit “lazy” in repainting the tab the first time.

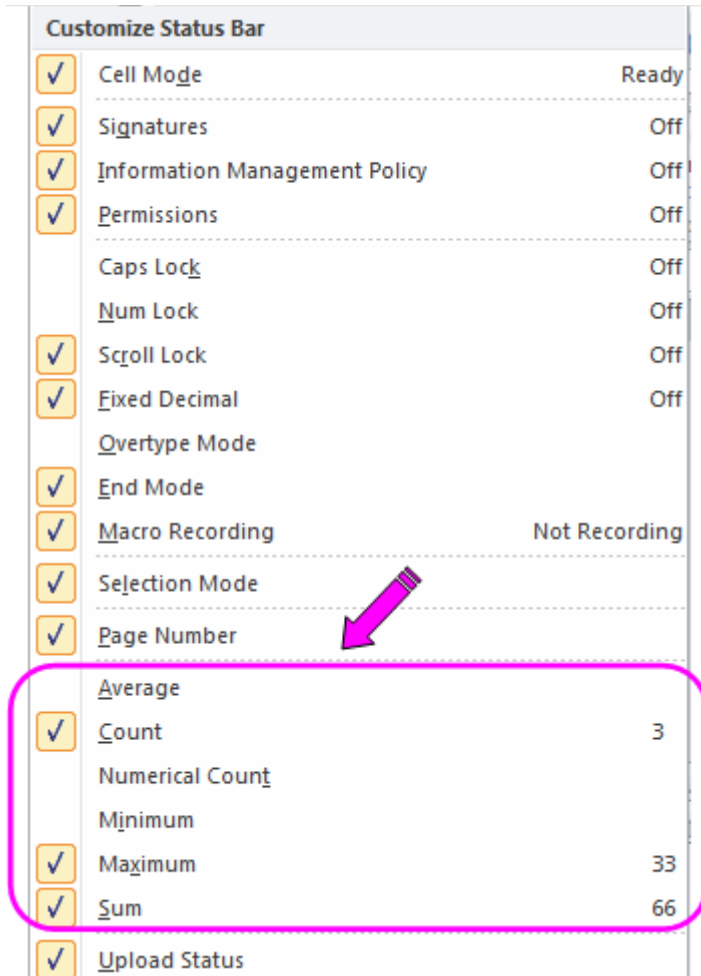
Status bar count, sum and other information

For whichever cells are selected Excel shows their number and their sum on the status bar ...



Only non-empty cells are counted. You can specify what is to be displayed on the status bar by right-mouse-clicking on the status bar. A popup menu will appear ...

Excel Skills - Around the edges



As you can see there are many items of information that can be turned on or off. The highlighted items let you specify whether the average, count, minimum and maximum will be displayed.

Zooming

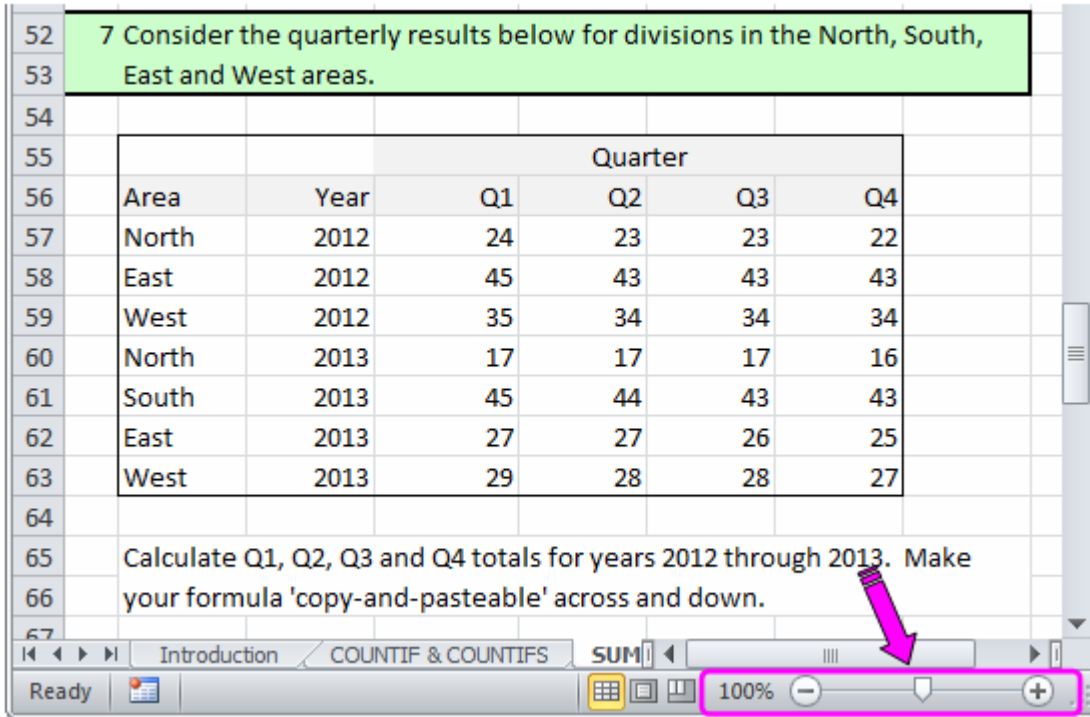
To zoom in or out of a spreadsheet use the slider at the right-hand side of the status bar ...

Excel Skills - Around the edges

7 Consider the quarterly results below for divisions in the North, South, East and West areas.

Area	Year	Quarter			
		Q1	Q2	Q3	Q4
North	2012	24	23	23	22
East	2012	45	43	43	43
West	2012	35	34	34	34
North	2013	17	17	17	16
South	2013	45	44	43	43
East	2013	27	27	26	25
West	2013	29	28	28	27

Calculate Q1, Q2, Q3 and Q4 totals for years 2012 through 2013. Make your formula 'copy-and-pasteable' across and down.



The default position of the slider is 100%. Move the slider to the left to zoom out and to the right to zoom in. The following illustration shows the slider at its 50% zoom position ...

Expenditure grouped into 7 day intervals.

	1/01/14	8/01/14	15/01/14	22/01/14	29/01/14	5/02/14	12/02/14
	166	10	123	65	0	0	0

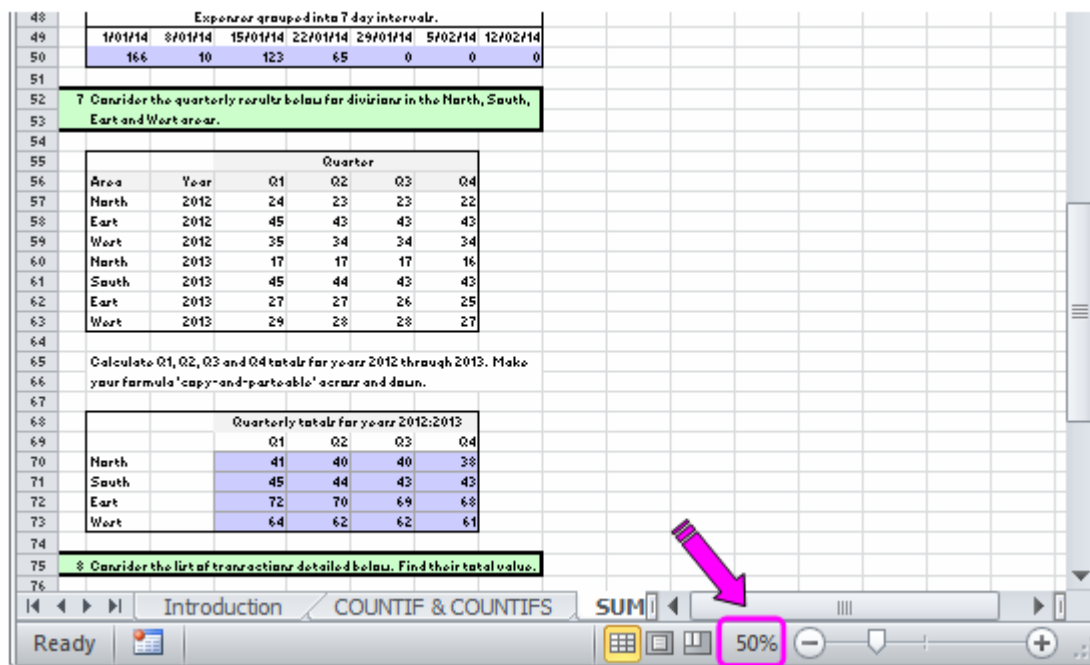
7 Consider the quarterly results below for divisions in the North, South, East and West areas.

Area	Year	Quarter			
		Q1	Q2	Q3	Q4
North	2012	24	23	23	22
East	2012	45	43	43	43
West	2012	35	34	34	34
North	2013	17	17	17	16
South	2013	45	44	43	43
East	2013	27	27	26	25
West	2013	29	28	28	27

Calculate Q1, Q2, Q3 and Q4 totals for years 2012 through 2013. Make your formula 'copy-and-pasteable' across and down.

Quarterly totals for years 2012:2013				
	Q1	Q2	Q3	Q4
North	41	40	40	38
South	45	44	43	43
East	72	70	69	68
West	64	62	62	61

8 Consider the list of transactions detailed below. Find their total value.

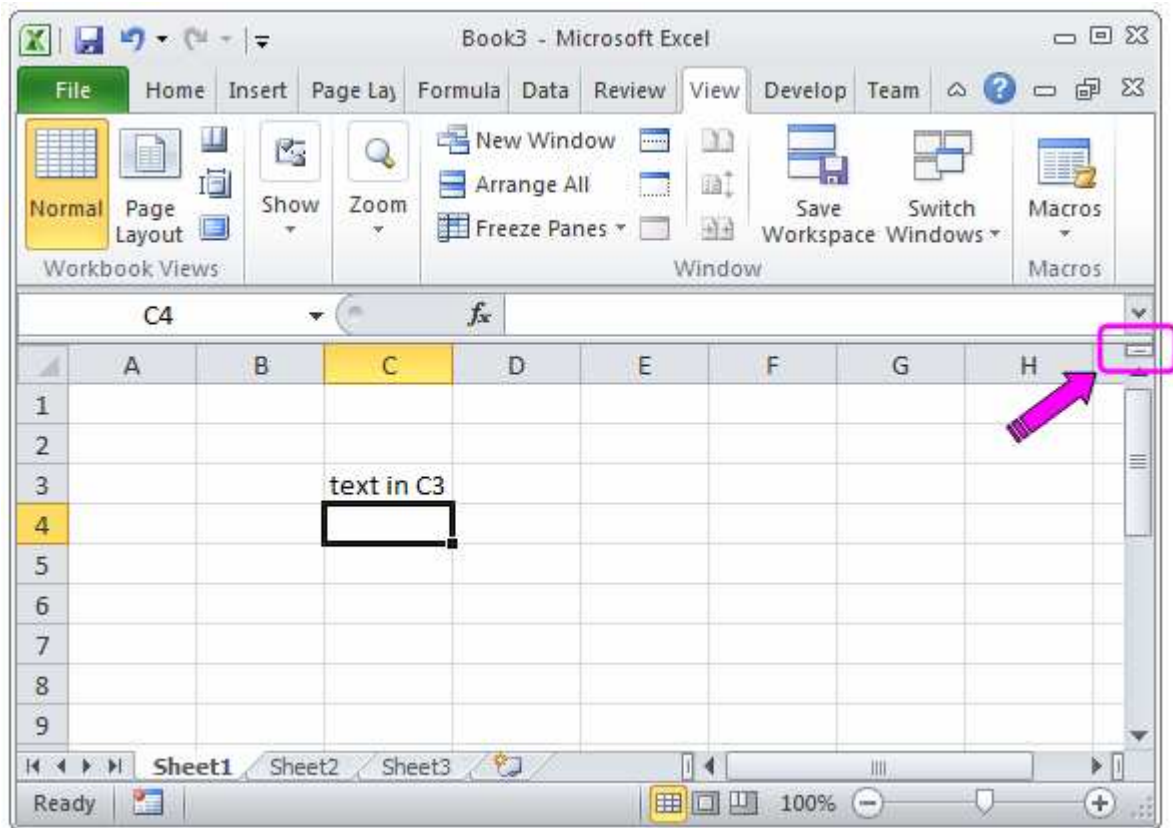


Split window

On occasion it is useful to have two views of the same worksheet. You might for example be changing rows near the top but also need to refer to rows near the bottom. In such cases you can split the window. Then you can have two windows into the same worksheet. And you can scroll

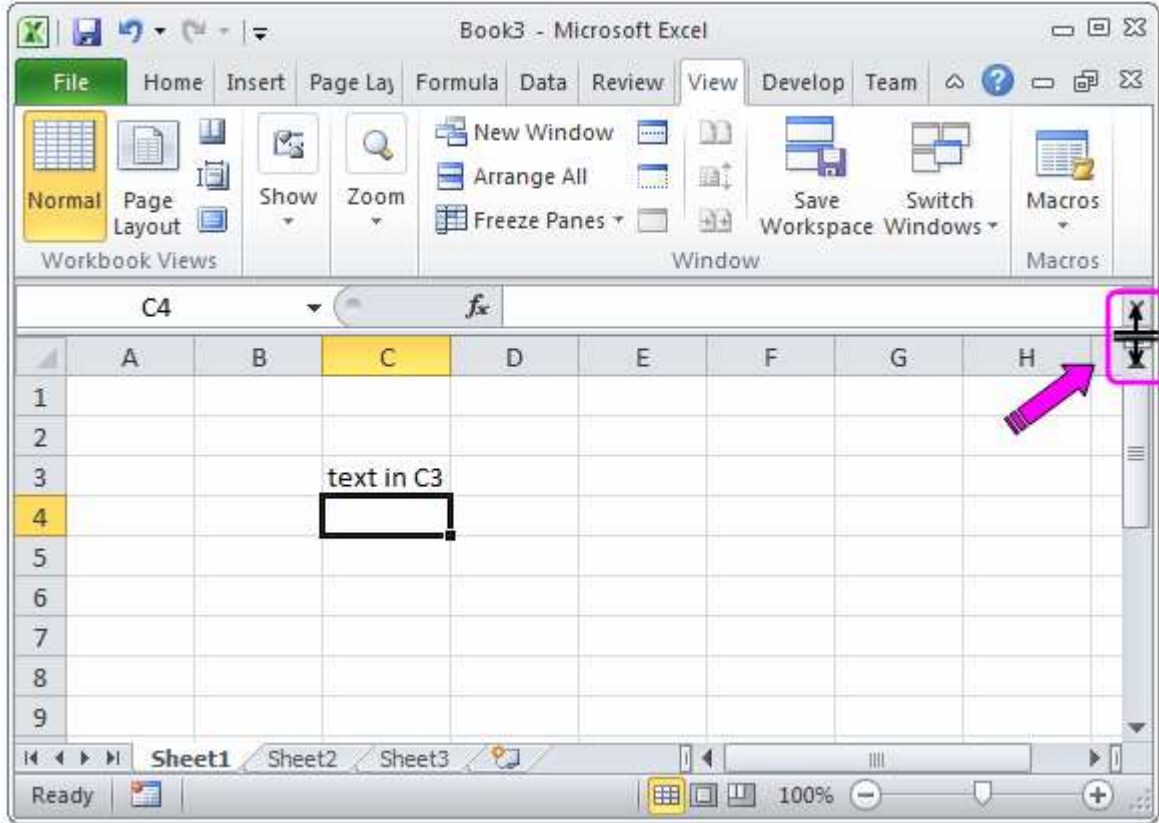
Excel Skills - Around the edges

each window independently of the other. To split a worksheet you can use the split icon highlighted on the following diagram ...

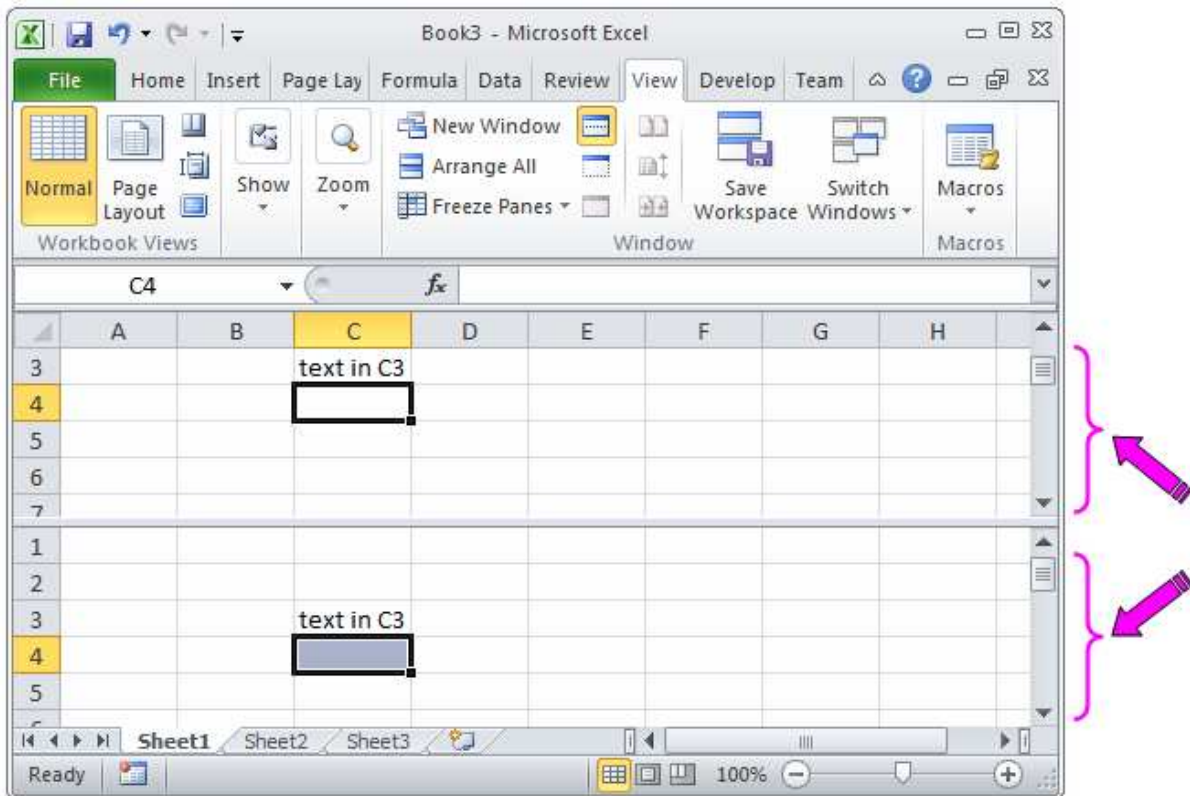


Move your mouse over the icon. The cursor will change shape ...

Excel Skills - Around the edges



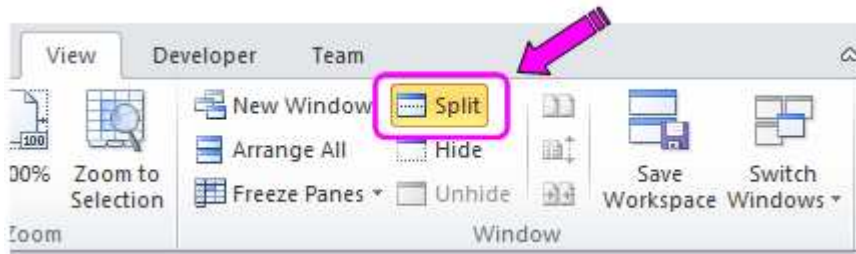
Then drag the cursor down to where you want the split to occur ...



Excel Skills - Around the edges

You now have two views onto the same tab. Each view can be scrolled independently.

An alternate way of splitting is to select where you want the split to occur. You can select a row if you want a horizontal split, a column if you want a vertical split or a cell if you want both horizontal and vertical splits. Then press the Split icon in the Window section of the View ribbon ...



To remove a split drag it off the page.

Excel Skills - Charts

Charts

Charts can be useful ways of looking at data – Charts are good for showing trends, anomalies, patterns and relationships that would be otherwise be difficult to see. Following is an example showing how to construct a chart. The data to be charted is shown in the next illustration. Two series – “Contract Green” and “Contract Black” are to be charted ...

	A	B	C	D	E	F
1		Q1 2014	Q2 2014	Q3 2014	Q4 2014	Q1 2015
2	Contract Green	67	78	76	85	90
3	Contract Black	56	52	59	51	55

Begin by highlighting the data ...

	A	B	C	D	E	F
1		Q1 2014	Q2 2014	Q3 2014	Q4 2014	Q1 2015
2	Contract Green	67	78	76	85	90
3	Contract Black	56	52	59	51	55

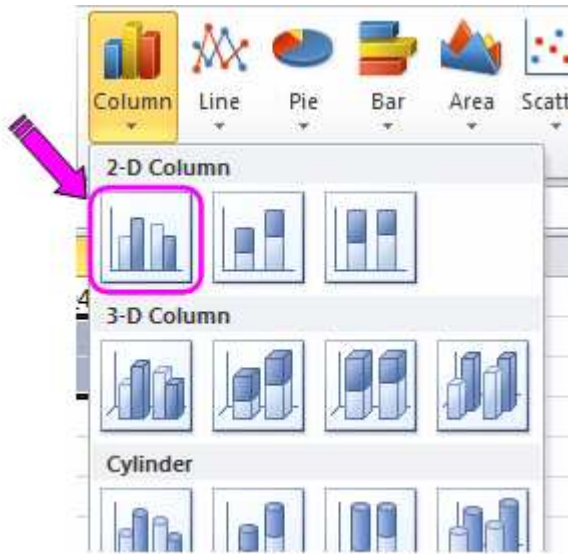
Adding a chart

Next, add a chart. To do that go to the Charts section of the Insert ribbon. Various types of charts can be added. We will choose a column chart ...

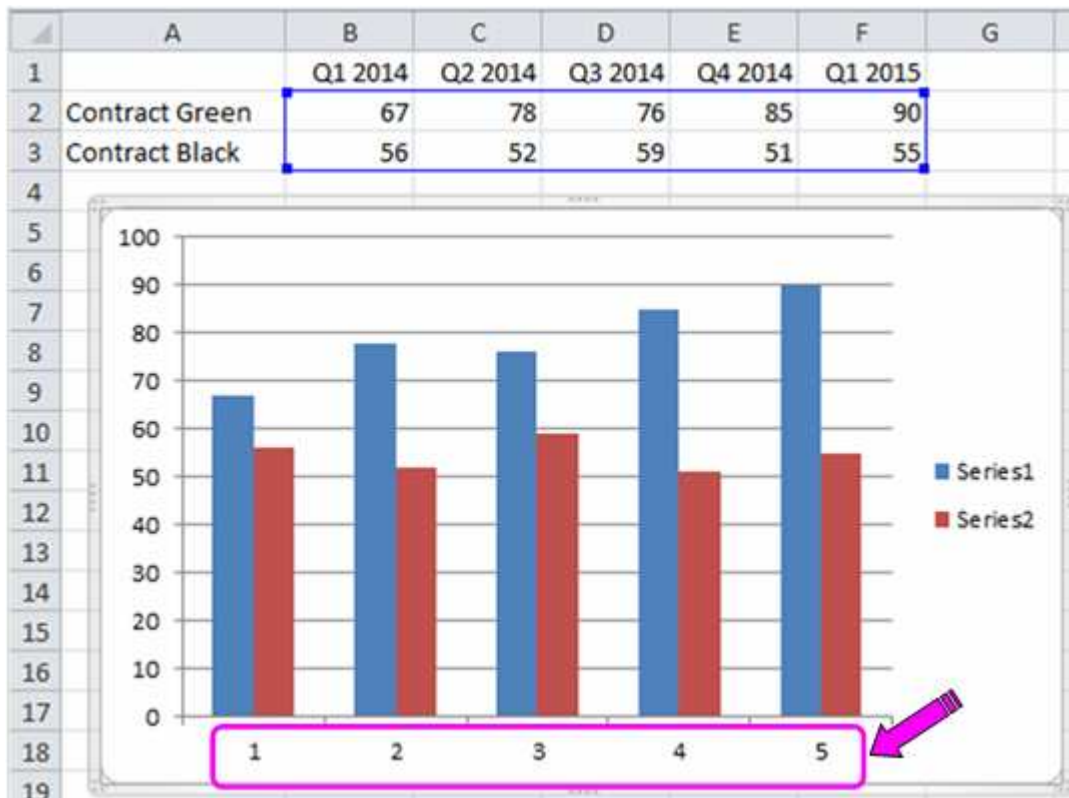


Click on the Column icon. A list is shown of different types of column charts. We'll choose a chart showing two series side-by-side ...

Excel Skills - Charts



Click on the icon in the preceding diagram. The chart is constructed ...

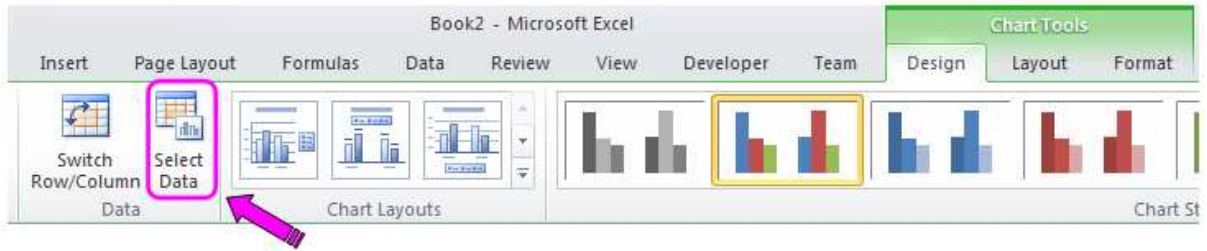


Changing horizontal axis labels

We will refine the chart. Currently the horizontal axis is “generic” – just giving the column number (highlighted in the preceding illustration). We will replace those labels with the column titles from row 1 of the spreadsheet (Q1 2014, etc).

Refer to the Data section of the Design ribbon within the ChartTools ribbon. Click on the “Select Data” icon in the Data section ...

Excel Skills - Charts



A “Select Data Source” dialog appears. Click on the “Edit” icon in the section of the dialog titled “Horizontal (Category) Axis Labels” ...

	A	B	C	D	E	F	G	H	I
1		Q1 2014	Q2 2014	Q3 2014	Q4 2014	Q1 2015			
2	Contract Green	67	78	76	85	90			
3	Contract Black	56	52	59	51	55			

Select Data Source

Chart data range: `=Sheet1!B2:F3`

Switch Row/Column

Legend Entries (Series)

- Series1
- Series2

Horizontal (Category) Axis Labels

Edit

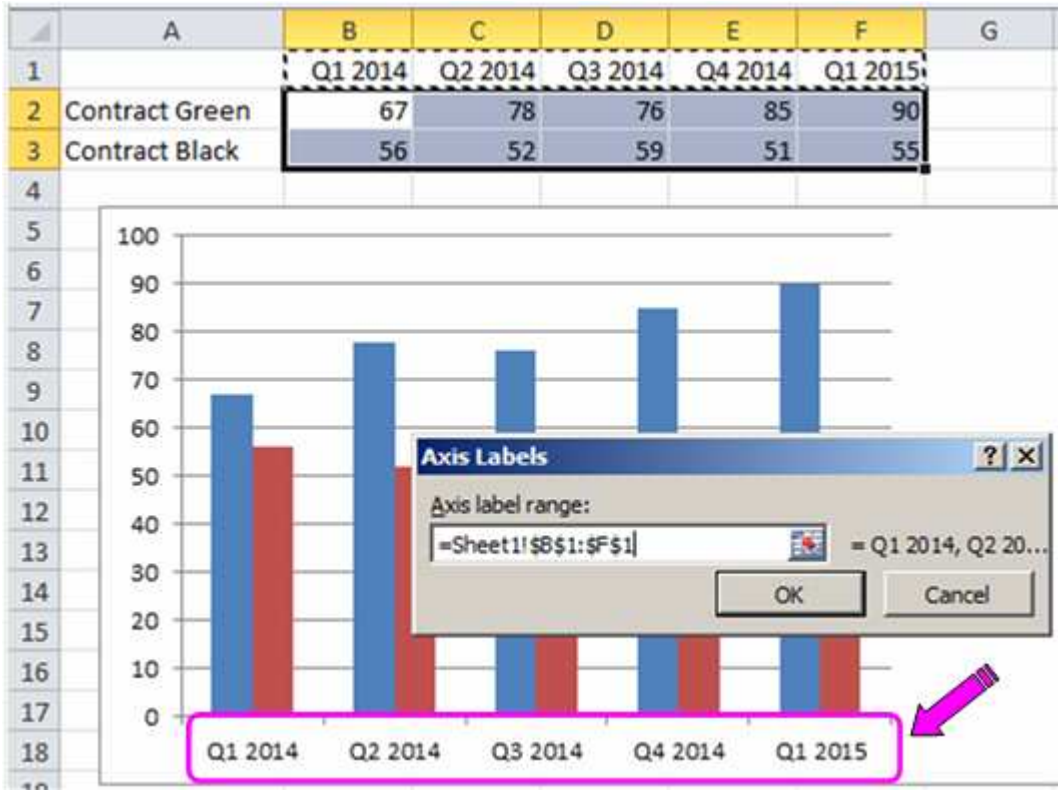
1
2
3
4
5

Hidden and Empty Cells

OK Cancel

An “Axis Labels” dialog appears. Select the range containing the Axis Labels ...

Excel Skills - Charts

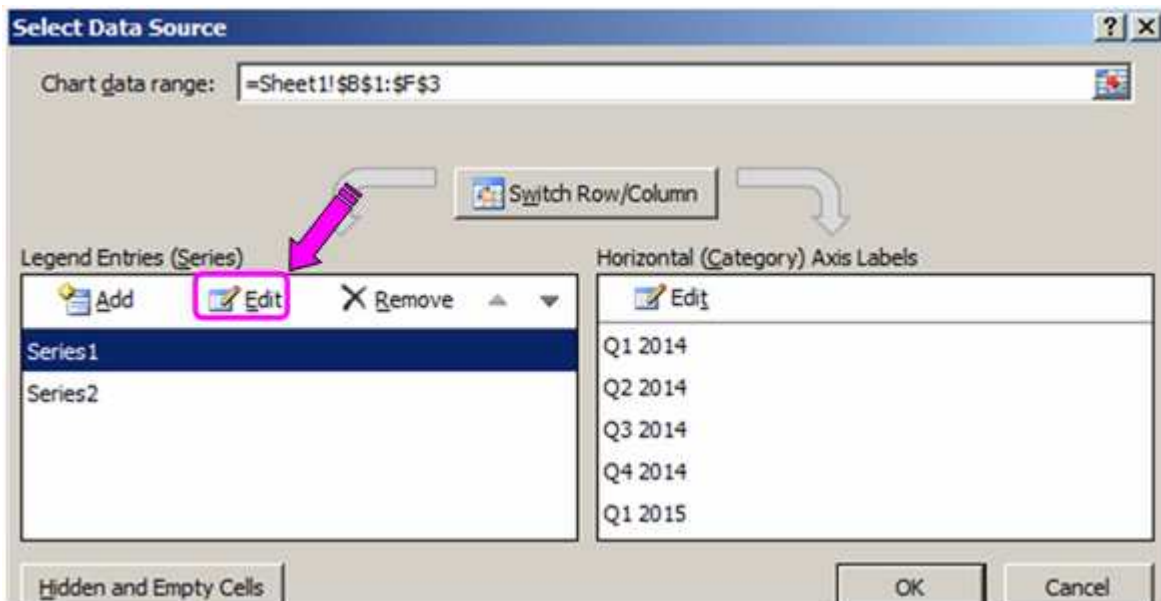


The horizontal labels will be updated (highlighted in the preceding diagram). Press the OK button to finish setting the horizontal labels.

Changing legend labels

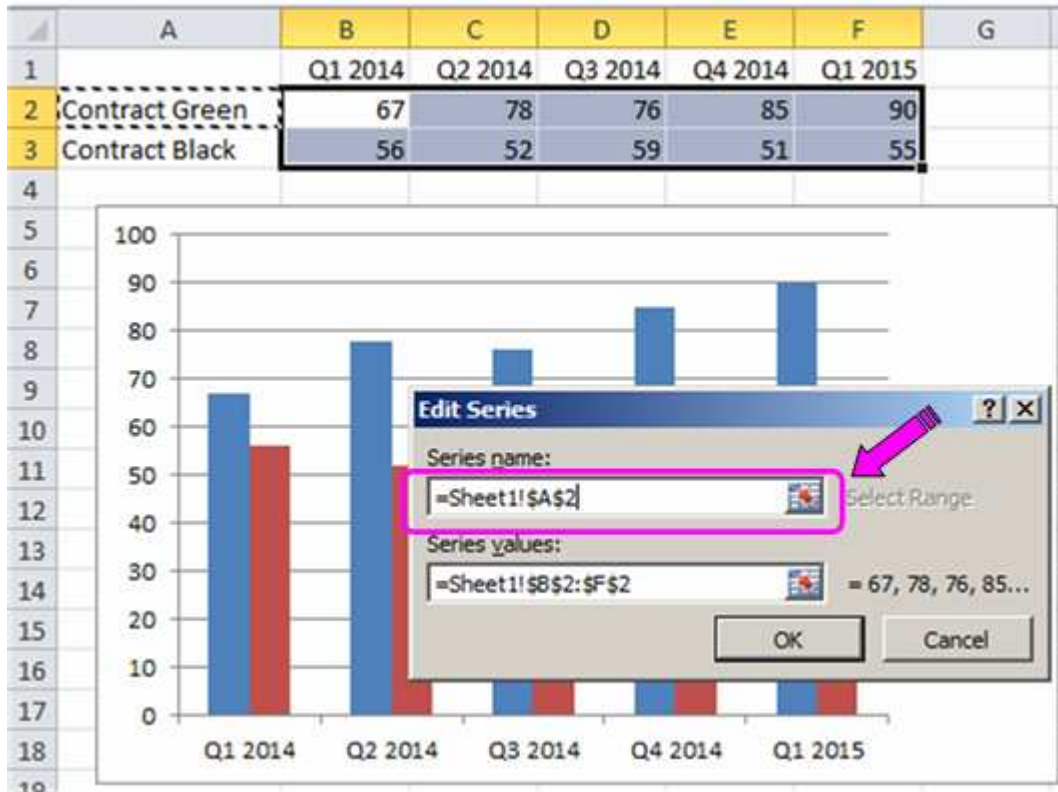
Next we'll change the series legends from their current generic form ("Series 1" and "Series 2").

In the "Legend Entries (Series)" section of the dialog select "Series1" and then click the Edit button ...



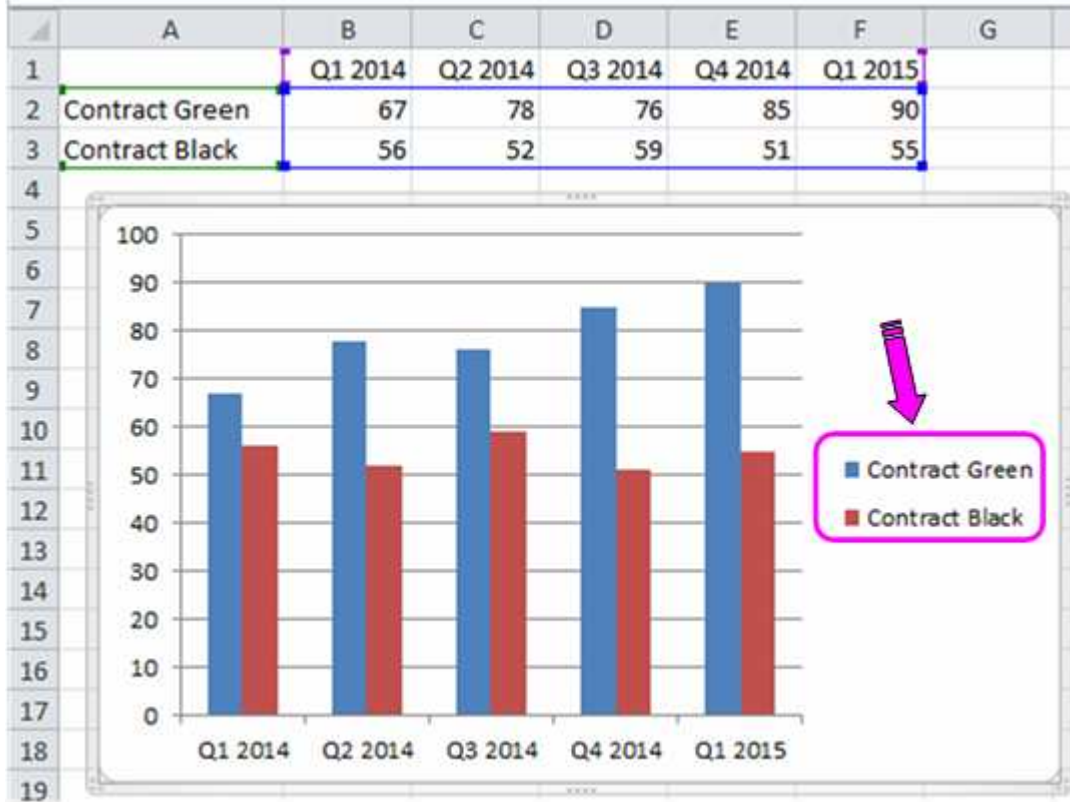
Excel Skills - Charts

An “Edit Series” dialog appears. Click in the “Series name” field of the dialog and then on the cell in the worksheet that contains the series name ...



Click on OK and then repeat for the other series. The series legends update and the chart is complete ...

Excel Skills - Charts



Functions

Counting and Summing functions

SUM

To add numbers in the three cells A1, A2 and A3 we could use the formula **=A1+A2+A3** But what if we wanted to add fifty numbers? In that case a better solution would be to use the SUM function. To add all 50 numbers in cells A1 through to A50 we could use this formula: **=SUM(A1:A50)**

SUM can also add several groups of numbers together. For example **=SUM(A1:A12, C3:C5, D6)** adds the twelve numbers in A1 through A12, the three numbers in C3 through C5 and the single number in D6 and calculates the grand total.

The SUM function “ignores” cells if they don’t contain numbers. This feature of SUM’s can be occasionally useful. An example is given next.

	A	B	C	D
1		Jan	Feb	Mar
2	Revenue	34	56	67
3	Revenue YTD	34	90	=SUM(C3,D2)

We are calculating year-to-date (YTD) revenues. The year to date revenue for any month is the sum of the prior period’s YTD revenue and the current month’s revenue. In the preceding illustration, for example, the March YTD revenue (in cell D3) is the sum of the February YTD revenue (in C3) and the March revenue (in D2).

That formula, applied to the the January YTD revenue in cell B3 is as illustrated next.

	A	B	C	D
1		Jan	Feb	Mar
2	Revenue	34	56	67
3	Revenue YTD	=SUM(A3,B2)		157

Note that the formula refers to cell A3 – which doesn’t contain a number but rather contains the text “Revenue YTD”. SUM ignores that text and treats the cell as containing zero. So the first, January, YTD figure is simply the January revenue in cell B2.

If we had used an alternative adding formula – as illustrated next – Excel would have generated an error ...

Excel Skills - Functions

NORMDIST				
	A	B	C	D
1		Jan	Feb	Mar
2	Revenue	34	56	67
3	Revenue YTD	=A3+B2	#VALUE!	#VALUE!

If a formula has arithmetic in it – as this one does – then all parts of the formula need to refer to numbers. If any of the cells the formula refers to do not contain numbers then an error will be generated.

3D summing

The SUM function (and others) can work in a “3D” mode. That allows you to easily reference the same cells in different worksheets. We’ll illustrate with the following example ...

B2						
	A	B	C	D	E	F
1		Jan	Feb	Mar		
2	Admin	130	91	155		
3						
4						

Overview North East South West Consolidated

In the preceding diagram we’re looking at a formula on the “Consolidated” tab. That formula adds together numbers from cells B2 on four tabs: North, East, South and West. We can do the same calculation more concisely by using SUM in its 3D mode ...

B2				
	A	B	C	D
1		Jan	Feb	Mar
2	Admin	130	91	155
3				
4				

Overview North East South West Consolidated

The formula **=SUM(North:West!B2)** adds cells B2 on all tabs between (and including) tabs North and West.

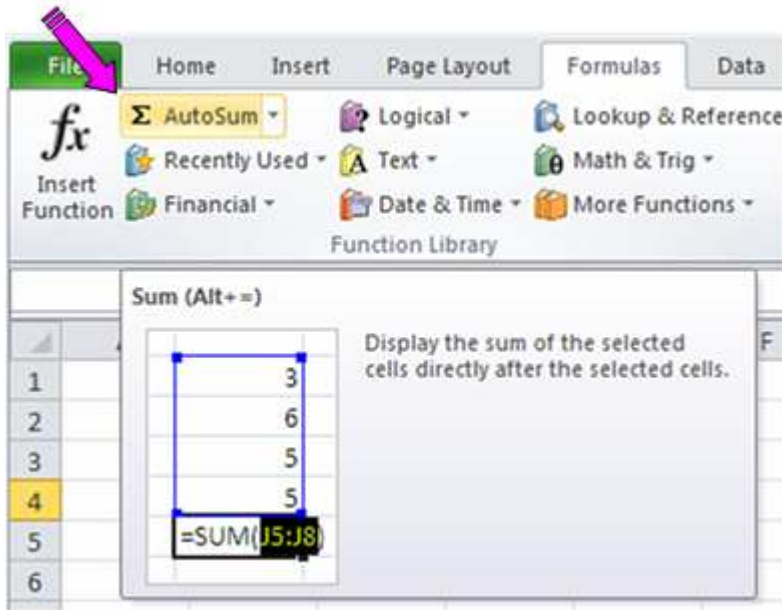
AutoSum

To make it easier and quicker to enter SUM (and other) functions Excel provides an “AutoSum” facility. The following examples illustrates how that works. We wish to put a SUM function into cell D4 to add the two cells above it. We could simply type the function in, but there is a quicker way. Begin by selecting the cell into which the function will be put ...

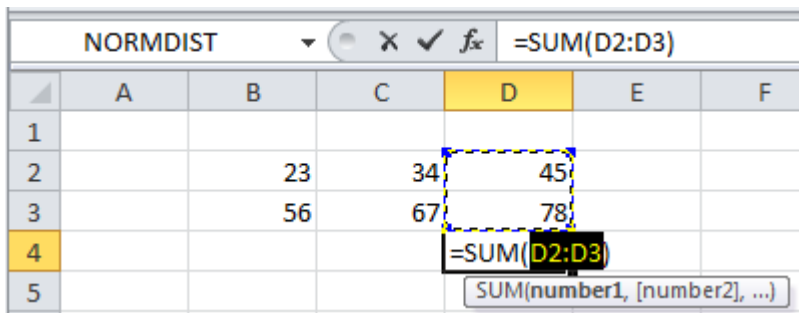
Excel Skills - Functions

	A	B	C	D
1				
2		23	34	45
3		56	67	78
4				

Then click on the AutoSum icon in the Function Library section of the Formulas ribbon ...



Excel "guesses" which numbers you wish to sum ...



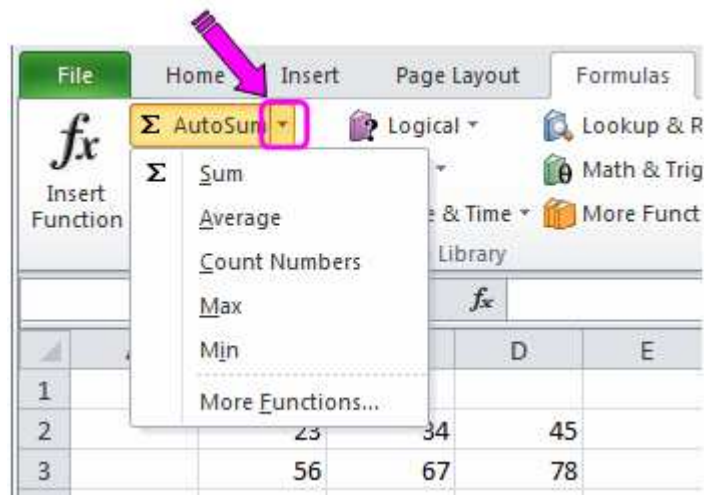
Press ENTER if the guess is correct or change the suggested cells to the ones you really want. Then press ENTER. The function will be put into the cell without any typing on your part.

Excel is reasonably intelligent in its guessing. In the following example it has deduced that it should be summing horizontally and to the left instead of vertically ...

Excel Skills - Functions

	A	B	C	D	E	F	G
1							
2		23	34	45	=SUM(B2:D2)		
3		56	67	78	SUM(number1, [number2], ...)		

Other functions as well as SUM can be entered in this way. If you want one of these other functions then press the small icon to the right of AutoSum ...



COUNT

The COUNT function gives the number of numbers in a range.

Look at the following example: A range has four cells in it. Two cells contain numbers, one cell contains text and the fourth is empty.

	A	B	C	D	E
1	3	4			
2	cat				
3					
4	2				

The COUNT function returns 2 because only two of the cells have numbers in them.

COUNTA

To count both numbers and text cells use the COUNTA function. Following we have two numbers and one text item. So COUNTA returns 3.

	A	B	C	D	E
1	3	4			
2	cat				
3					
4	3				

COUNTIF

The COUNTIF function counts the number of times cells in a given range meet a certain criterion. Following is an example.

		NORMDIST				=COUNTIF(B3:E6,">250")	
	A	B	C	D	E	F	
1		Quarter					
2		Q1	Q2	Q3	Q4		
3	2011	236	209	267	264		
4	2012	305	204	190	345		
5	2013	187	278	179	160		
6	2014	200	230	178	246		
7							
8		=COUNTIF(B3:E6,">250")					

The first parameter in the COUNTIF function defines the range being examined. Here range is the 16 cells in B3:E6.

The second parameter specifies a test or criterion. The criterion is ">250". ">" means greater than so this criterion means greater than 250.

So this COUNTIF function counts the number of numbers in the range B3:E6 that are greater than 250. [In this case – the answer is 5.]

Criteria (the second parameter)

We have seen that ">250" means greater than 250. Other possible criteria and their interpretations are shown in the following table.

Criterion	Meaning
"<250"	Less than 250
"<=250"	Less than or equal to 250
"=<250"	<i>Not allowed – only the preceding version is valid</i>
">=250"	Greater than or equal to 250
"=>250"	<i>Not allowed – only the preceding version is valid</i>
"=250"	Equal to 250
250	Equal to 250 (an alternative and valid form)
"<"250	<i>Not allowed – if "<", "=", or ">" are used then the number also must be within quotes</i>
">200<250"	<i>This and other such multiple criteria are not allowed. Instead use the COUNTIFS function.</i>
"<R"	Alphabetically precedes R (A, PZ, Palmerston) would meet this criterion, (R, r2, T12) would not.
"<" & B1	Less than the number in cell B1 (the & "joins" the "<" to whatever is the number in cell B1)
"<B1"	This means alphabetically preceding B1 (in this case B1 is not interpreted

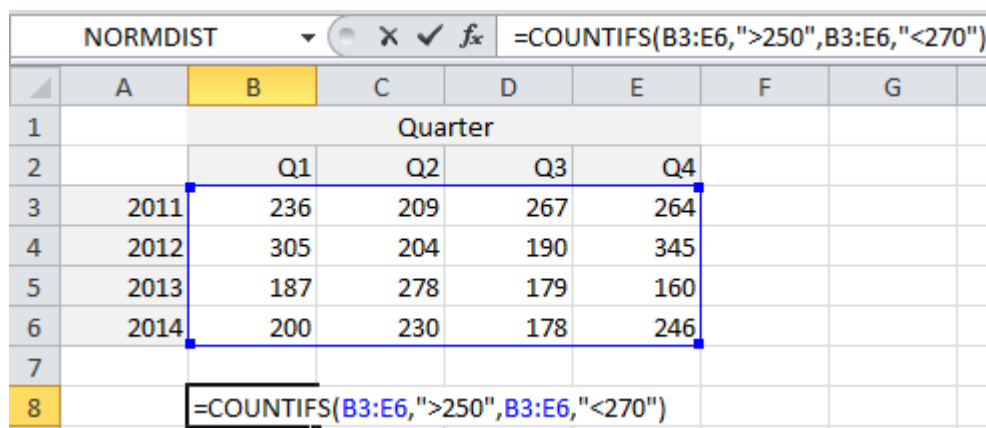
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as being a cell reference)

Note that in Excel formulas <, > and = usually do not have quotes (") around them. However, the COUNTIF, COUNTIFS, SUMIF and SUMIFS functions do require quotes.

COUNTIFS

The COUNTIFS function is similar to the COUNTIF function but allows multiple criteria. The COUNTIFS function was introduced in Excel 2007 so this function is available only in 2007 and later versions of Excel.



	A	B	C	D	E	F	G	
1		Quarter						
2		Q1	Q2	Q3	Q4			
3	2011	236	209	267	264			
4	2012	305	204	190	345			
5	2013	187	278	179	160			
6	2014	200	230	178	246			
7								
8		=COUNTIFS(B3:E6, ">250", B3:E6, "<270")						

The preceding diagram illustrates how the COUNTIFS function is used. The first parameter is a range, the second is a criterion, the third parameter is another range and the fourth is another criterion. More pairs of ranges and criteria can follow however, here, we'll consider just two pairs.

The COUNTIFS function counts the number of times all criteria are met. So the preceding COUNTIFS function counts the number of numbers in the range B3:E6 that are greater than 250 and less than 270. In other words the preceding function counts the number of numbers between 250 and 270.

Another example using COUNTIFS is shown next.

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	A	B	C	D	E	F	G
1	Property	Lease ends	Area	Region	Rent		
2	R312-789	Sep-15	3	Wgtn	200		
3	L119-876	Oct-15	4	Chch	250		
4	R992-015	Sep-15	3	BOP	255		
5	R267-916	Aug-16	4	Ak	375		
6	L572-672	Mar-15	4	PlmNth	205		
7	L456-716	Jun-16	3	Ak	220		
8	R913-012	Feb-15	4	Wgtn	195		
9	R812-737	Feb-16	3	BOP	230		
10	L182-810	Aug-15	4	Ak	290		
11	L178-013	Dec-16	3	Chch	275		
12	R028-739	Nov-15	4	Ak	330		
13							
14	Number of properties in Ak with an area of 4:				=COUNTIFS(C2:C12,4,D2:D12,"Ak")		

Here we count the number of times that C2:C12 is 4 and D2:D12 is "Ak".

SUMIF

The SUMIF function sums cells that meet a certain criterion. Unlike the SUM function which sums unconditionally, the SUMIF is a conditional summation. The following illustration gives an example.

	A	B	C	D
		Lease		
1	Property	ends	Region	Rent
2	R312-789	Sep-15	Wgtn	200
3	L119-876	Oct-15	Chch	250
4	R992-015	Sep-15	BOP	255
5	R267-916	Aug-16	Ak	375
6	L572-672	Mar-15	PlmNth	205
7	L456-716	Jun-16	Ak	220
8	R913-012	Feb-15	Wgtn	195
9	R812-737	Feb-16	BOP	230
10	L182-810	Aug-15	Ak	290
11	L178-013	Dec-16	Chch	275
12	R028-739	Nov-15	Ak	330
13				
14		=SUMIF(C2:C12,"Ak",D2:D12)		

We want to find the total rent of properties in the "Ak" region. The formula required is **=SUMIF(C2:C12,"Ak",D2:D12)**

The first parameter in the SUMIF function specifies a range. In this case the range is C2:C12. The second parameter specifies a criterion. The cells in C2:C12 will be tested to see if they meet the

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defined criterion - "Ak" in this case. The third parameter is a range that will be summed only if the criterion is met. In this case the cells that will be summed are D2:D12.

In summary, the SUMIF function scans through C2:C12, looks for "Ak" and if "Ak" is found then the corresponding number from D2:D12 is added to the sum.

Consider another example. Suppose we want to find the total rent paid on properties whose leases expire before February 2016. The SUMIF function to do that is shown next.

	A	B	C	D	E
		Lease ends	Region	Rent	
1	Property				
2	R312-789	Sep-15	Wgtn	200	
3	L119-876	Oct-15	Chch	250	
4	R992-015	Sep-15	BOP	255	
5	R267-916	Aug-16	Ak	375	
6	L572-672	Mar-15	PlmNth	205	
7	L456-716	Jun-16	Ak	220	
8	R913-012	Feb-15	Wgtn	195	
9	R812-737	Feb-16	BOP	230	
10	L182-810	Aug-15	Ak	290	
11	L178-013	Dec-16	Chch	275	
12	R028-739	Nov-15	Ak	330	
13					
14		=SUMIF(B2:B12,"<Feb-2016",D2:D12)			

The SUMIF scans the lease end dates in B2:B12 (first parameter). It tests those cells to see whether they are before February 2016 (second parameter) and, if so, sums the rent from D2:D12 (third parameter).

SUMIF can test for only a single criterion. If there are two or more criteria then the SUMIFS function must be used. That function is described next.

SUMIFS

The parameters used by the SUMIFS function are as follows:

=SUMIFS(summing range, search range 1, criterion 1, ...)

The first parameter is the range of cells that will be summed. The second parameter is a range of cells that will be searched or scanned. The third parameter is the criterion or test that will be applied to the range specified in the preceding parameter. And more pairs of search ranges and criteria can follow. Only if all criteria are met will the summing be done.

An example should make this clearer. We'll carry on with the rent example of earlier. We want to find total rent of properties in the "Ak" region whose leases expire before February 2016. The following diagram shows the solution to this problem.

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	A	B	C	D	E	F	
		Lease ends	Region	Rent			
1	Property						
2	R312-789	Sep-15	Wgtn	200			
3	L119-876	Oct-15	Chch	250			
4	R992-015	Sep-15	BOP	255			
5	R267-916	Aug-16	Ak	375			
6	L572-672	Mar-15	PlmNth	205			
7	L456-716	Jun-16	Ak	220			
8	R913-012	Feb-15	Wgtn	195			
9	R812-737	Feb-16	BOP	230			
10	L182-810	Aug-15	Ak	290			
11	L178-013	Dec-16	Chch	275			
12	R028-739	Nov-15	Ak	330			
13							
14		=SUMIFS(D2:D12,B2:B12,"<Feb-2016",C2:C12,"Ak")					

The first parameter to the SUMIFS function is the range that will be summed. In this case it is the rents in D2:D12. The next parameter is the range that will be scanned to see whether a criterion is met. In this case that range is the lease end dates in B2:B12. The next parameter is the criterion applied to the preceding parameter. In this case the criterion is that the lease end dates be before February 2016. The next parameter is the second range that will be scanned. The range is the regions in C2:C12. And the last parameter is the criterion applied to the preceding parameter. In this case the region must match "Ak".

SUMPRODUCT

The SUMPRODUCT function multiplies two (or more) rows (or columns) of numbers and sums the individual results. Consider the following illustration.

	A	B	C	D
	Cost per unit	Number of units		
1				
2	3.00	4		
3	5.00	3		
4	2.00	6		
5				
6	Total cost	=SUMPRODUCT(A2:A4,B2:B4)		

In this example the SUMPRODUCT function has two parameters. The first parameter is a list of costs per unit and the second parameter is a list of numbers of units. The function multiplies each cost per unit by number of units and sums the result. From these operations comes the name of the function: Multiplication (PRODUCT) and SUM = SUMPRODUCT.

Arithmetic functions

MAX

The MAX function finds the maximum of a set of numbers. Following are two examples showing how MAX can be used.

MAX(A1,B2) - Find the maximum of A1 and B2

MAX(A1:A5, B2) - Find the maximum of the numbers in A1:A5 and B2

The MAX function ignores cells that don't contain numbers. For example, if A1 contains the text "supplier" and A2 contains 7 then MAX(A1,A2) will return 7.

MIN

The MIN function returns the minimum of a set of numbers. Its usage is of the same style as for the MAX function.

AVERAGE

The AVERAGE function returns the average (i.e. mean) of one or more groups of numbers. Consider the following example

=AVERAGE(A5:B7)

This will return the mean of the numbers in the range A5:B7.

Now consider the next example

=AVERAGE(A5, C6, D8:F12)

This will return the average of the numbers in the single cells A5 and C6 and the rectangular group of cells D8:F12.

Text items are ignored by the AVERAGE function.

LARGE

The LARGE function finds the Nth largest item in a range. The function takes two parameters. The first specifies a range and the second is a number that specifies "how large". Examples follow.

LARGE(A1:A10, 1) - Returns the largest number in the range A1:A10

LARGE(A1:A10,3) - Returns the 3rd largest number in the range A1:A10

Logical functions

Logical functions allow formulas to test for various conditions and adapt accordingly. The main logical function is the IF function.

IF

The IF function lets you perform one action or another based on whether or not a specified condition is satisfied.

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The IF function has three parameters: The first specifies the condition or test, the second is the calculation to perform if the condition is satisfied and the third parameter is the calculation to perform if the condition is not satisfied.

Following is an illustration.

	A	B	C
1	Actual	23	
2	Budget	21	
3			
4	Actual exceeds budget	=IF(B1>B2,"yes","no")	

We wish to compare an actual figure (in cell B1) with a budget figure (in cell B2) and to report whether the actual exceeds the budget. If the actual exceeds the budget then we wish to show “yes” in cell B4. If the actual does not exceed the budget then we wish to show “no” in cell B4. The IF function in cell B4 will achieve that for us.

The IF function’s first parameter is highlighted ...

	A	B	C
1	Actual	23	
2	Budget	21	
3			
4	Actual exceeds budget	=IF(B1>B2,"yes","no")	

Here we’re testing to see whether B1 (actual) is greater than B2 (budget). The result of this test will be TRUE (actual is greater than budget) or FALSE (actual is not greater than budget). In this case the result is TRUE.

If the first parameter is TRUE the IF function calculates and returns the second parameter. If the first parameter is FALSE then the third parameter is calculated and returned. In this case the second parameter is returned ...

B4		fx		=IF(B1>B2,"yes","no")	
	A	B	C	D	
1	Actual	23			
2	Budget	21			
3					
4	Actual exceeds budget	yes			

Let’s look at another example using the IF function. We have a series of budget and actual numbers and wish to report on the amount by which actuals exceed budget. Our spreadsheet looks like this

...

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	A	B	C
1		Q1	Q2
2	Actual	23	27
3	Budget	21	31
4	Actual exceeds budget by:	=B2-B3	=C2-C3

Quarter 1 figures are in column B and quarter 2 in column C. Actual and budget figures are on rows 2 and 3 respectively. Row 4 shows the formulas we're using to calculate the amount by which actual exceeds budget. Each formula simply takes the actual figure on row 2 and subtracts the budget figure on row 3.

The preceding illustration was made with Excel switched into its "formula view mode". When switched back to its normal mode the spreadsheet looks like this ...

	A	B	C
1		Q1	Q2
2	Actual	23	27
3	Budget	21	31
4	Actual exceeds budget by:	2	-4

B4 (the amount by which the actual exceeds budget for Q1) shows 2 – that is what we'd expect to see. However, C4 (highlighted), isn't satisfactory – it's showing minus 4. Rather than seeing minus 4 we'd like the spreadsheet to show "-". The "-" would signify "actual didn't exceed budget". So we want Excel to work one way if actual is greater than budget and another if actual is not greater – An IF function can achieve that. The following illustration shows how we can use the IF function.

B11		fx	
	A	B	C
1		Q1	Q2
2	Actual	23	27
3	Budget	21	31
4	Actual exceeds budget by:	2	-

Note that in cell C4 we now see "-" instead of -4 as before. How did we achieve this? The following illustration shows the IF function that was used ...

	A	B	C
1		Q1	Q2
2	Actual	23	27
3	Budget	21	31
4	Actual exceeds budget by:	=IF(B2>B3,B2-B3,"-")	=IF(C2>C3,C2-C3,"-")

Consider the IF function in cell B4. The first part is highlighted next ...

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	A	B	C
1		Q1	Q2
2	Actual	23	27
3	Budget	21	31
4	Actual exceeds budget by:	=IF(B2>B3,B2-B3,"-")	=IF(C2>C3,C2-C3,"-")

The first part tests to see whether B2 (actual) is greater than B3 (budget). The result of this test will be TRUE or FALSE. For the case shown in column B (Q1) the result of the test will be TRUE since actual (23) is greater than budget (21). Since the test is TRUE the IF function calculates and returns the second part (highlighted) ...

	A	B	C
1		Q1	Q2
2	Actual	23	27
3	Budget	21	31
4	Actual exceeds budget by:	=IF(B2>B3,B2-B3,"-")	=IF(C2>C3,C2-C3,"-")

The second part of the IF function takes the actual figure in B2 and subtracts from it the budget figure in B3 to give the amount by which the actual exceeds the budget.

Next consider the IF function in C4. The test in that function is C2>C3. This is FALSE since C2 (27) is not greater than C3 (31). So the third part of the IF function is calculated and returned. The third part is “-” and that is the result seen in cell C4.

IF nested

We have seen that an IF function is “binary” – you can do one calculation or another. But what if you want to do one of three things (e.g. in one condition to do “A”, in a second to do “B” and in a third to do “C”)? There are various ways of achieving this and one way is to have an IF function “inside” another IF. Following is an illustration ...

	A	B	C	D	E	F
1	Upper limit	12				
2	Lower limit	10				
3	Amount	4				
4		=IF(B3>B1,"above upper",IF(B3<B2,"below lower","between"))				

We have an upper limit (in cell B1) and a lower limit (in B2) and an amount (in B3). If the amount is greater than the upper limit we want to report “above upper”. If the amount is less than the lower limit then we want to report “below lower”. Otherwise we want to report “between”. There are three possible results and since a single IF can do only one of two things we know that we will need two IF functions to achieve what we want.

Look at the formula in cell B4 in the preceding diagram. The three parts of the “outer” IF function are highlighted next ...

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	A	B	C	D	E	F
1	Upper limit	12				
2	Lower limit	10				
3	Amount	4				
4		=IF(B3>B1,"above upper",IF(B3<B2,"below lower","between"))				

Excel evaluates this function in the following way. The test in the first parameter is done. Is B3 greater than B1? If this is TRUE then the second parameter is evaluated and returned. In that case cell B4 would show "above upper". If the test is FALSE then the third parameter is evaluated. In this case the third parameter is the "inner" IF function. The three parts of the "inner" IF function are as highlighted next ...

	A	B	C	D	E	F
1	Upper limit	12				
2	Lower limit	10				
3	Amount	4				
4		=IF(B3>B1,"above upper",IF(B3<B2,"below lower","between"))				

Excel tests to see if B3 is less than B2. If it is then "below lower" is returned. Otherwise "between" is returned.

The following illustration shows the preceding example extended. We can see that the IF functions return the correct results for all three possible conditions (above upper, between and below lower) ...

	A	B	C	D
1	Upper limit	12	12	12
2	Lower limit	10	10	10
3	Amount	4	16	11
4		below lower	above upper	between

IFERROR

The IFERROR function can be used to check whether an error has occurred (e.g. a failed lookup). The function has two parameters ..

=IFERROR(first statement, second statement)

The function evaluates its first parameter. The first parameter can be any valid Excel statement (e.g. A2+B2). The function returns the result of the statement (e.g. 5). However, if the statement causes an error then the second statement is done and its result is returned.

This function was introduced in Excel 2007 and is not available in earlier versions.

An example of how the function can be used is shown next.

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	A	B	C	D	E	F	G
1	Supplier:	TRR					
2	Supplier region:	=IFERROR(VLOOKUP(B1,A5:B7,2,FALSE),"No such supplier")					
3							
4	<i>Supplier</i>	<i>Region</i>					
5	TRR	North					
6	TDR	South					
7	TRD	East					

In cell B1 we are given the name of a supplier. We then want to look up that supplier's region in the table in cells A5:B7. If the lookup succeeds we want to show the supplier's region in cell B2. But if the lookup fails we want to see the message: "No such supplier".

A suitable formula to achieve that is shown in B2 above. The formula uses the IFERROR function. The function's first parameter is a VLOOKUP. If the VLOOKUP succeeds then the value generated by the lookup (the supplier's region) is returned by the IFERROR function. However, if the VLOOKUP generates an error then the IFERROR function returns its second parameter: "No such supplier".

If a valid supplier is given in cell B1 then that supplier's region is shown in B2 ...

	A	B
1	Supplier:	TRR
2	Supplier region:	North
3		
4	<i>Supplier</i>	<i>Region</i>
5	TRR	North
6	TDR	South
7	TRD	East

And if an invalid supplier is given in cell B1 then a message is shown in B2 ...

	A	B	C
1	Supplier:	RTD	
2	Supplier region:	No such supplier	
3			
4	<i>Supplier</i>	<i>Region</i>	
5	TRR	North	
6	TDR	South	
7	TRD	East	

AND

The AND function is used to test whether multiple conditions are true. If all are TRUE then the AND function returns TRUE. Otherwise it returns FALSE.

Take this example:

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= AND(8>2, 5>1)

Both parameters are TRUE so the AND statement will return TRUE.

=AND(8<3, 5< 1) will return FALSE

=AND(8>3, 5< 1) will return FALSE

=AND(8< 3, 5>1) will return FALSE

The AND function can be used inside an IF function. Following is an example

=IF(AND(C1 > 34, C1 < 39), "In range", "Out of range")

The AND function generates a TRUE if C1 is between 34 and 39. In that case the IF function returns "In range". Otherwise the function returns "Out of range".

OR

The OR function is used to test whether any of several conditions are true. If any are TRUE then the OR function returns TRUE. Otherwise it returns FALSE.

Take this example:

= OR(15 > 3, 17 < 2)

The first of the parameters evaluates to TRUE and the second to FALSE. The OR statement will return TRUE.

=OR(15>3, 17 < 2) will return TRUE

=OR(15 < 3, 17 > 2) will return TRUE

=OR(15<3, 17 < 2) will return FALSE

Date functions

EOMONTH

The EOMONTH function returns the last day of the month which is a given number of months after a reference date. The following example shows how the EOMONTH function is used.

	A	B
1	Date	1/12/2015
2	31/12/2015 ->	=EOMONTH(B1,0)

The reference date (in B1) is the first day in December 2015. The second parameter specifies how many months to advance. In this case the parameter is zero. So we advance zero months (i.e. we stay in December) and obtain the last day in that month: 31/12/2015.

If the second parameter of the EOMONTH function was 1 we would have obtained this result ...

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	A	B
1	Date	1/12/2015
2	31/01/2016 ->	=EOMONTH(B1,1)

We now have the last day in January 2016.

To generate the date of the first day in a month simply generate the date of the last day in the preceding month and add one to that date.

WORKDAY

The WORKDAY function calculates a workday (i.e. a day that is not a weekend or a holiday) a given number of days after a reference date. The first parameter to the function is the reference date, the second specifies the number of workdays ahead and the third (optional) specifies a list of holidays. The following diagram shows how the WORKDAY function can be used.

	A	B	C	D
1	Start date	3/02/2015		
2				
3	Number workdays ahead	10		
4				
5	Holidays:	9/02/2015	10/02/2015	
6				
7	Workday 10 workdays after 03/02/2015:	=WORKDAY(B1,B3,B5:C5)		

The first parameter – B1 – is the reference date. That date is the third of February. The second parameter – B3 – is the number of workdays ahead. The third (optional) parameter – B5:C5 – is a list of holidays. The WORKDAY function returns the date that is the specified number of workdays ahead. In our example the date that is 10 workdays after 03/02/2015 is 19/02/2015.

NETWORKDAYS

The NETWORKDAYS function gives the number of business days between two dates. The following diagram illustrates how the NETWORKDAYS function can be used.

	A	B	C
1	Start date:	3/02/2015	
2			
3	End date:	19/02/2015	
4			
5	Holidays:	9/02/2015	10/02/2015
6			
7	Networkdays:	=NETWORKDAYS(B1,B3,B5:C5)	

The NETWORKDAYS function has three parameters. The first is a start date. The second is an end date. The third (optional) is a list of holidays. The function returns the number of working (i.e. non-weekend, non-holiday) days between the start and end date.

WEEKDAY

The WEEKDAY function returns the day of the week of a specified date. The day is returned as a number. Consider the following example.

	A	B	C
1	Date	31/12/2009	
2			
3	5 -->	=WEEKDAY(B1)	

We want to know what day of the week the 31st of December 2009 is. The WEEKDAY function returns 5. The numbering convention used by the WEEKDAY function is shown in the following table.

	WEEKDAY(date) or WEEKDAY(date,1)	WEEKDAY(date,2)	WEEKDAY(date,3)
Sunday	1	7	6
Monday	2	1	0
Tuesday	3	2	1
Wednesday	4	3	2
Thursday	5	4	3
Friday	6	5	4
Saturday	7	6	5

The WEEKDAY function takes an optional second parameter which can be 1, 2 or 3. The interpretation of the returned values is shown in the preceding table.

Text functions

Concatenation operator

The concatenation operator works with strings. String means text. In this and the following sections we'll look at Excel functions that work with strings.

The concatenation operator is the ampersand (&). It joins two string together. So

```
= "division" & " south"
```

.. evaluates to ..

```
"division south"
```

TRIM

The TRIM function removes leading and trailing spaces from the start and end of a string. If there are any sections within the string that contain multiple spaces then those are replace by single spaces. So

```
=TRIM(" aaa bbb ccc ")
```

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.. evaluates to ..

"aaa bbb ccc"

LEFT function

The LEFT function returns the leftmost characters in a string. The function takes one or two parameters. If two parameters are used then the first is the string and the second determines the number of leftmost characters that will be returned. So

=LEFT("ABCDEFGH", 4)

.. evaluates to ..

"ABCD"

If the second parameter is larger than the number of characters in the string then the entire string is returned. So

=LEFT("ABC", 7)

.. evaluates to ..

"ABC"

If the second parameter is absent then the leftmost character is returned. So

=LEFT("ABC")

.. evaluates to ..

"A"

RIGHT

The RIGHT function returns the rightmost characters in a string. The function takes one or two parameters. If two parameters are used then the first is the string and the second determines the number of rightmost characters that will be returned. So

=RIGHT("ABCDEFGH", 4)

.. evaluates to ..

"EFGH"

If the second parameter is larger than the number of characters in the string then the entire string is returned. So

=RIGHT("ABC", 7)

.. evaluates to ..

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"ABC"

If the second parameter is absent then the rightmost character is returned. So

=RIGHT("ABC")

.. evaluates to ..

"C"

MID

The MID function returns the middle characters in a string. The function takes three parameters. The first is the string. The second is the position in the string from which the first character will be returned. If the second parameter is 3, for example, then the characters from the 3rd on will be returned. The third parameter is the number of characters to be returned. So,

=MID("ABCDEFG", 2, 3)

.. will evaluate to ...

"BCD"

UPPER function

The UPPER function translates a string to upper case. So

=UPPER("abCDe34")

.. will evaluate to ..

"ABCDE34"

LOWER function

The LOWER function translates a string to lower case. So

=LOWER("abCDe34")

.. will evaluate to ..

"abcde34"

LEN function

The LEN function returns the length of a string. So

=LEN("ABC")

.. evaluates to ..

3

Referencing functions

These functions allow you to access ranges in spreadsheets in a dynamic way. Functions in this group including lookup functions and matching and offset functions.

VLOOKUP

The VLOOKUP function looks for a cell in a vertically oriented table (i.e. a table laid out in columns). We'll look at an example.

	A	B	C	D	E
1		Jan	23		
2		Feb	42		
3		Mar	16		
4		Apr	43		
5		May	18		
6					
7			=VLOOKUP("Mar",B1:C5,2,FALSE)		

The first parameter defines what we're looking for: "Mar".

The second parameter defines the table we're looking up: B1:C5. The leftmost column of this table (i.e. B in this case) is the column that VLOOKUP will search. The third parameter specifies how many columns to the right the answer is obtained from. In our example it is 2. So the answer will be obtained from column C – the answer is 16 in this case.

The fourth parameter is optional. It determines whether the VLOOKUP requires an exact match or a "nearest match". If the fourth parameter is FALSE then VLOOKUP looks for an exact match to the item being searched for. If the search item is not found then an error - #N/A – will be returned.

If the fourth parameter is TRUE or is omitted then a "nearest" lookup is done. In this case – even if there is not an exact match – VLOOKUP will return the "nearest". If a nearest match lookup is performed VLOOKUP requires the first column to be in sorted ascended order. [In contrast, if an exact match is specified the search column does not need to be in sorted order.] We'll look at an example to give more detail about nearest match lookups. Consider the tax rate table shown next.

	A	B
1	Income	Marginal tax rate
2	0	0%
3	33,000	15%
4	55,000	35%
5	80,000	45%
6	150,000	49%

The table in the preceding illustration lists personal income marginal tax rates. In working with tabular lookups it is important to be clear about the interpretation of data in the table – so we'll begin by defining precisely how the preceding table is meant to be interpreted.

Excel Skills - Functions

Tax on the first \$33,000 of income is zero (i.e. the tax rate on income in the band from A2 to A3 is given by the percentage in B2). Tax on income from \$33,000 to \$55,000 is 15% (i.e. the tax rate on income in the band A3 to A4 is given by the percentage in B3). Tax on income from \$55,000 to \$80,000 is 35%. And so on. And, finally, marginal tax on incomes above \$150,000 is 49%.

With this interpretation of the table total tax due on an income of \$45,000 would be calculated this way:

Tax on first \$33,000 of income = \$33,000 * 0% = \$0

Tax on next \$12,000 of income (i.e. \$45,000 - \$33,000) = \$12,000 * 15% = \$1,800

Tax due = \$0 + \$1,800 = \$1,800

We will now design a VLOOKUP formula to return the marginal tax rate for a given income level. For example ,for an income of \$54,000 we want to return 15% because 15% is the marginal tax rate due on income from \$33,000 to \$55,000. (i.e. \$54,000 falls into the \$33,000 - \$55,000 band.)

	A	B	C
1	Income	Marginal tax rate	
2	0	0%	
3	33,000	15%	
4	55,000	35%	
5	80,000	45%	
6	150,000	49%	
7			
8	Income:	50,000	
9	Marginal tax rate:	=VLOOKUP(B8,A2:B6,2,TRUE)	

The formula is shown in the preceding diagram. The first parameter to the VLOOKUP is B8 – the cell containing the income we wish to look for (\$50,000 in this case). The second parameter specifies the table being looked up (A2:B6). The third parameter specifies the column of the lookup table the answer will be obtained from (second column of the table). The fourth parameter is TRUE and that directs Excel to find the “nearest” match to the income being searched for. (If an exact match were specified the VLOOKUP would fail because \$50,000 does not appear in the lookup table.)

This is how Excel processes the VLOOKUP function: VLOOKUP starts scanning through the leftmost column of the lookup table (column A) and inspects the topmost cell (A2). It compares what it finds there with what it’s looking for. It finds 0 in A2 but is looking for 50,000. It hasn’t found what it was looking for so moves on to the next cell A3. In A3 it finds 33,000. VLOOKUP is looking for 50,000, hasn’t found it, and so moves to the next row in the A column. In A4 it finds 55,000. It is looking for 50,000 and has found 55,000. So it has found a number larger than what it is looking for. It assumes the A column is in sorted increasing order and “realises” it has gone too far: It is now at 55,000 and is looking for 50,000. VLOOKUP backs up one row – to A3. Last, it moves across to column 2, and returns the number found there.

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This chain of logic, represented pictorially, looks like this ...

	A	B	C
1	Income	Marginal tax rate	
2	0	0%	
3	33,000	15%	
4	55,000	35%	
5	80,000	45%	
6	150,000	49%	
7			
8	Income:	50,000	
9	Marginal tax rate:	=VLOOKUP(B8,A2:B6,2,TRUE)	

Note that VLOOKUP has its own definition of “nearest” and the Excel user must work with that definition rather than with their own intuition or preferences. For example, even though \$54,499 is much closer to \$55,000 than it is to \$33,000 the marginal tax returned for \$54,499 is the same as that for \$33,000 rather than that for \$55,000.

Restrictions

When Excel searches a VLOOKUP table to find a specified item it always searches the leftmost column of the table for the required item. The lookup answer is then obtained from one or more columns to the right of the search column. So you cannot design a VLOOKUP formula to return a result that is to the left of the search column.

Search column	Results
	✓

Results	Search column
	✗

HLOOKUP

HLOOKUP works in a similar fashion to VLOOKUP except that the tables being looked up are laid out horizontally in rows instead of vertically in columns. The following diagram shows a sample application of HLOOKUP.

Excel Skills - Functions

	A	B	C	D	E	F	G
1							
2		2010	2011	2012	2013	2014	2015
3	Revenue	56	63	70	69	75	78
4	Expenses	34	45	55	65	75	81
5	Net	22	18	15	4	0	-3
6							
7	Year	2013					
8	Expenses	=HLOOKUP(B7,B2:G5,3,FALSE)					

The table being looked up is arranged in rows and spans the range B2:G5. The lookup is performed by the HLOOKUP function in cell B8. The first parameter of the HLOOKUP specifies the value being looked up. The first parameter is 2013 – the value in B7. So 2013 is the item being looked up. The second parameter defines the table being looked up – the range B2:G5. HLOOKUP will scan the top row of the lookup table (i.e. the cells B2:G2) searching for 2013. The third parameter specifies the row of the lookup table that the lookup result will be retrieved from. In this case we’re looking for “expenses” and they are on the third row. So the third parameter is 3. The fourth parameter – FALSE - specifies that an exact match is required.

Restrictions

As with VLOOKUP there is a restriction on where the search row can be relative to the lookup table. In VLOOKUPS the search column is the leftmost column of the lookup table. In HLOOKUPS the search row is the top row of the lookup table.

LOOKUP

The lookup function is another way of performing lookups.

The following diagram illustrates how LOOKUP works.

	A	B	C	D	E	F
1		Marginal tax rate		Income		
2		0%		0		
3		15%		33,000		
4		35%		55,000		
5		45%		80,000		
6		49%		150,000		
7						
8		Income:		50,000		
9		Marginal tax rate:	=LOOKUP(D8,D2:D6,B2:B6)			

The LOOKUP function has three parameters. The first parameter specifies the item being looked for. Here the first parameter is D8 and D8 contains 50,000. So LOOKUP is looking for 50,000. The second parameter specifies a search column (or row). Here the search column is D2:D6. LOOKUP will search D2:D6 looking for 50,000. LOOKUP uses the same search method as VLOOKUP does when

Excel Skills - Functions

VLOOKUP is doing a nearest match lookup: LOOKUP starts at the top of the search column, scans down till it realises it has gone too far, and then backs up one. In this case LOOKUP will start at D2, go to D3, then D4 and then back up to D3. LOOKUP then takes note of how far down the search range it has moved. It started at D2 and ended at D3. So it's at the second position in the search column.

LOOKUP's third parameter specifies a result column (or row). In our example LOOKUP found the nearest match to 50,000 in the second position of the search column. LOOKUP returns the item in second position of the result column – 15%.

The result column can be to the left or right of the search column. It doesn't need to be adjacent and doesn't even need to have the same alignment: You could, for example, have the search range in a column and the result in a row (although it's difficult to see where you'd actually want to do this).

The LOOKUP function has some advantages and some disadvantages compared with VLOOKUP and HLOOKUP. These are detailed next.

Advantages of LOOKUP vs VLOOKUP and HLOOKUP

LOOKUP can be used for tables of either horizontal or vertical orientation. There's no need for two different versions of essentially the same function.

Unlike with VLOOKUP (or HLOOKUP) the search column can be to the right of (or below) the lookup table.

If you insert a row or column into table referenced by VLOOKUP or HLOOKUP you need to manually adjust the third parameter (as illustrated in the following diagram).

	A	B	C	D	E	F	G
1							
2		2010	2011	2012	2013	2014	2015
3	Revenue	56	63	70	69	75	78
4	Expenses	34	45	55	65	75	81
5	Net	22	18	15	4	0	-3
6							
7	Year	2013	... you need to change this to 4				
8	Expenses	=HLOOKUP(B7,B2:G5,3,FALSE)					

If you insert a row here ...

In contrast, if you insert into or delete from a table referenced with LOOKUP Excel will automatically adjust the references for you.

Disadvantages of LOOKUP vs VLOOKUP and HLOOKUP

VLOOKUP and HLOOKUP allow two lookup options: "exact match" and "nearest match". In contrast, LOOKUP provides only a "nearest match" search. As with VLOOKUP and HLOOKUP – LOOKUP's search column must be in sorted ascending order.

Excel Skills - Functions

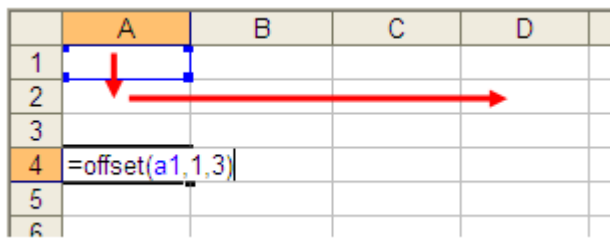
OFFSET

The OFFSET function calculates a “shifted” cell reference. The function can take three parameters. Take this example:

`=OFFSET(A1, 1, 3)`

The first parameter is a starting cell. The second parameter defines a shift down by a specified number of rows. The third parameter is a shift to the right by a specified number of columns.

The following illustration shows the result of the OFFSET



	A	B	C	D
1				
2				
3				
4	=offset(a1,1,3)			
5				
6				

So `=OFFSET(A1, 1, 3)` generates a reference to the cell D2.

The following example shows how OFFSET can be used in practice.

	A	B	C	D	E	F	G
1	Year	2014			2015		
2	Quarter in year	1	2	3	4	1	2
3	Payables	35	36	38	40	43	45
4	Increase in payables in current year	0	1	3	5	0	2

Row 3 lists quarterly payables data. On row 4 we want to calculate the increase in payables over the current year. When a new year starts we want to “reset” and use the first period of the new year as the new payables baseline. We also want the formulas on row 4 to be “copy-and-pastable” (i.e. consistent) across.

We can use the OFFSET function to achieve that. This is how. Look at the formula in cell D4. The formula takes the current payables figure (in cell D3) and subtracts from that the payables in an earlier period. Which earlier period? That’s determined by the OFFSET function:

`OFFSET(D3,0,1-D2).`

Let’s look at the three parameters in the function. The first parameter is D3: the current quarter.

The second parameter is 0: that specifies how many rows down we move – none in this case.

Excel Skills - Functions

The third parameter is 1-D2. That specifies how many columns to the right we move. However, if the third parameter is negative – as it is in this case – then the move is to the left. D2 is 3 – the current quarter in the D column is 3. So 1-D2 is 1-3 which is minus two. So the third parameter specifies a move to the left of two columns.

So in this case the OFFSET function generates a reference to a cell zero rows below D3 and two columns to the left: Cell B3. And that is correct – B3 is the payables figure for the start of the year.

And the net result of the formula $D3 - \text{OFFSET}(D3,0,1-D2)$ is to calculate the increase in payables over the current year.

MATCH

The MATCH function finds the position of an item in a list. Take the following example.

	A	B	C
1			
2	peach		almond
3			blue
4	=MATCH(A2,C2:C9,0)		orange
5			peach
6			straw
7			magenta
8			purple
9			aqua
10			

The first parameter - A2 (peach) - is the item being searched for. The second parameter - C2:C9 - is the range being searched. The third parameter - 0 - defines the match criteria. In our example we are searching for "peach". "peach" is fourth in the list and so MATCH will return 4.

If the third parameter is 0 then MATCH requires an exact match and will return an error if the item is not found.

	A	B	C
1			
2	cerise		almond
3			blue
4	=MATCH(A2,C2:C9,0)		orange
5			peach
6			straw
7			magenta
8			purple
9			aqua
10			

Here the third parameter is 0 and so MATCH requires an exact match for "cerise". However "cerise" isn't in the list and the error #N/A will be returned.

If the third parameter is 1 MATCH finds the position of the largest value that is less than or equal to the searched item. For this MATCH to work the list must be sorted in ascending order.

Excel Skills - Functions

	A	B	C	D	E
1	almond				
2	aqua				
3	blue				
4	magenta		3 <-- =MATCH("cerise",A1:A8,1)		
5	orange				
6	peach				
7	purple				
8	straw				

In the preceding example the largest item that is less than or equal to "cerise" is "blue" and "blue" is third in the list. So MATCH returns 3.

If the third parameter is -1 then MATCH finds the position of the smallest value that is greater than or equal to the lookup value. For this to work the list must be in sorted descending order.

	A	B	C	D	E
1	straw				
2	purple				
3	peach				
4	orange		5 <-- =MATCH("cerise",A1:A8,-1)		
5	magenta				
6	blue				
7	aqua				
8	almond				

In the example above the smallest item greater than or equal to "cerise" is "magenta" and "magenta" is fifth on the list. So MATCH returns 5.

CHOOSE

The CHOOSE function accepts up to thirty parameters. The first parameter specifies which of the following parameters to return. If the first parameter is 1 then CHOOSE will return the first parameter after the first (i.e. the second). If the first parameter is 2 then it returns the second parameter after the first (i.e. the third). And so on.

=CHOOSE(1, 17, 23, 15) will return 17

=CHOOSE(2, 17, 23, 15) will return 23

=CHOOSE(3, 17, 23, 15) will return 15

Advanced features

Conditional formatting

Conditional formatting lets you dynamically set and change the format of a cell. That allows you to highlight things you want to draw the user's attention to - errors or exceptions - for example.

Some examples follow.

Highlighting top "N" values

Highlight the top "N" amounts:

Date	Transaction	Amount
1/12/09	DII-34	36.74
5/01/10	HEJ-61	3.92
4/02/10	JFG-72	83.02
23/01/10	HGD-98	2.30
10/02/10	BIB-77	94.06
24/02/10	ADC-58	80.93
8/01/10	FED-17	69.58
13/12/09	FGD-28	28.15
14/01/10	EID-69	79.88

Date	Transaction	Amount
1/12/09	EAD-53	68.98
26/02/10	HFF-90	25.93
24/02/10	ICC-26	64.74
13/12/09	IHE-25	52.75
6/12/09	GIE-35	35.87
9/01/10	CAA-60	95.67
13/02/10	CJF-32	44.01
9/02/10	EGE-33	91.38
6/01/10	ACD-74	81.85

Highlighting duplicates

Highlight duplicate transaction codes

Date	Transaction	Amount
1/12/09	DII-34	36.74
5/01/10	HEJ-61	3.92
4/02/10	JFG-72	83.02
23/01/10	HGD-98	2.3
10/02/10	BIB-77	94.06
24/02/10	ADC-58	80.93
8/01/10	FED-17	69.58
13/12/09	FFB-37	28.15
14/01/10	EID-69	79.88

Date	Transaction	Amount
1/12/09	EAD-53	68.98
26/02/10	HFF-90	25.93
24/02/10	ICC-26	64.74
13/12/09	DII-34	52.75
6/12/09	GIE-35	35.87
9/01/10	CAA-60	95.67
13/02/10	DII-34	44.01
9/02/10	EGE-33	91.38
6/01/10	FFB-38	81.85

Date	Transaction	Amount
1/12/09	BIC-30	14.54
12/01/10	AHG-81	89.01
24/02/10	JHC-24	49.96
23/02/10	FFB-38	77.52
16/01/10	CGJ-33	45.08
24/12/09	FCI-84	65.1
13/02/10	HHE-97	58.66
9/02/10	ABD-80	87.32
21/12/09	HCG-33	88.07

Highlighting cells beginning with "E"

Highlight transactions beginning with

Date	Transaction	Amount
1/12/09	DII-34	36.74
5/01/10	HEJ-61	3.92
4/02/10	JFG-72	83.02
23/01/10	HGD-98	2.30
10/02/10	BIB-77	94.06
24/02/10	ADC-58	80.93
8/01/10	FED-17	69.58
13/12/09	FGD-28	28.15
14/01/10	EID-69	79.88

Date	Transaction	Amount
1/12/09	EAD-53	68.98
26/02/10	HFF-90	25.93
24/02/10	ICC-26	64.74
13/12/09	IHE-25	52.75
6/12/09	GIE-35	35.87
9/01/10	CAA-60	95.67
13/02/10	CJF-32	44.01
9/02/10	EGE-33	91.38
6/01/10	ACD-74	81.85

We'll do a walkthrough showing how to conditionally format.

Excel Skills - Advanced features

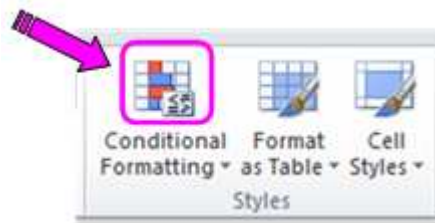
In the example to the right we will add conditional formatting to highlight columns where the “Actual” figure is greater than the “Budget” figure.

	A	B	C	D
1		Jan	Feb	Mar
2	Budget	23	24	25
3	Actual	34	35	23

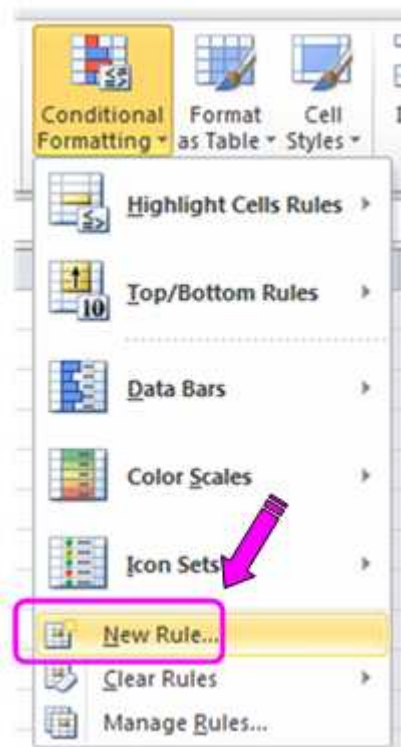
Begin by selecting the range of cells to be formatted.

	A	B	C	D
1		Jan	Feb	Mar
2	Budget	23	24	25
3	Actual	34	35	23

Next go to the Styles section of the Home ribbon and click on the Conditional Formatting icon.



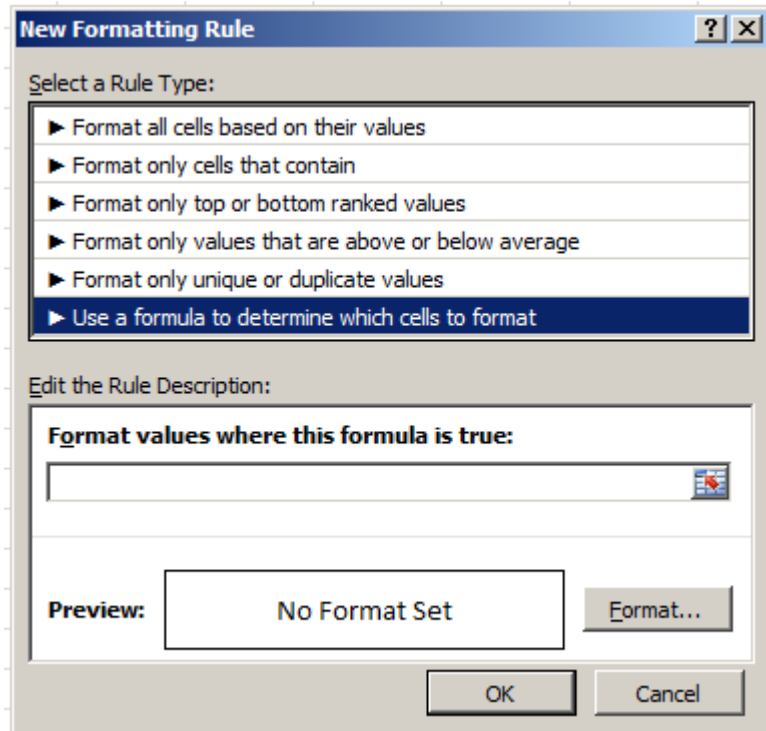
Next, click on the New Rule item in the popup menu that appears.



Excel Skills - Advanced features

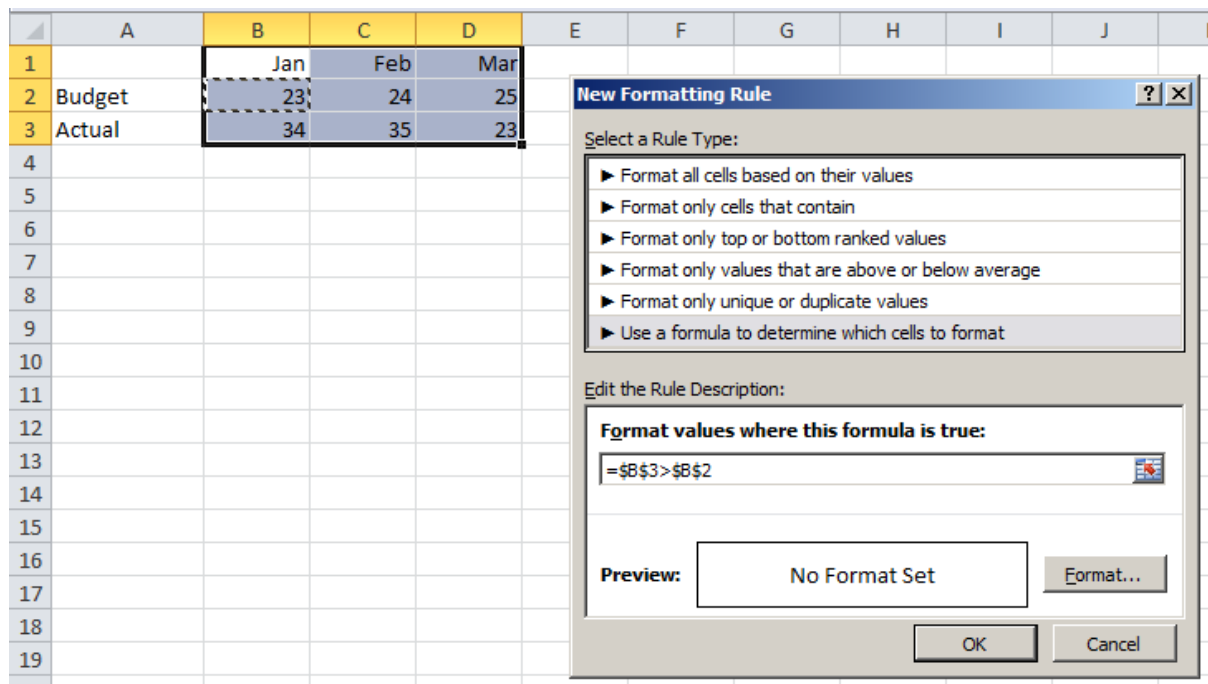
Various types of rules can now be applied. The most powerful and flexible rule type is the last "Use a formula to determine which cells to format".

We choose that.



Type an "=" sign into the "Edit the Rule Description" field. Then click on the first "Actual" figure in cell B3, then type a greater than sign, then click on the first "Budget" figure in cell B2.

As you type and click Excel fills out the "Edit the Rule Description" field.



The preceding diagram shows the result. The rule that Excel has built up is: **=B3>B2**

Excel Skills - Advanced features

When you clicked on cell B3 Excel put \$B\$3 into the formula: Excel always puts absolute references (with \$) into the formula when you click on a cell. That may or may not be appropriate for a given problem. You need to examine the formula and decide whether all \$'s are needed. If they're not then you have to manually delete the ones that shouldn't be there.

In this example the \$'s in front of the B's should not be there: Column C's formatting should depend on column C and not on B. With the formula as it is, all formatting will be driven by column B. So remove the \$'s in front of the B's. The result is as follows.

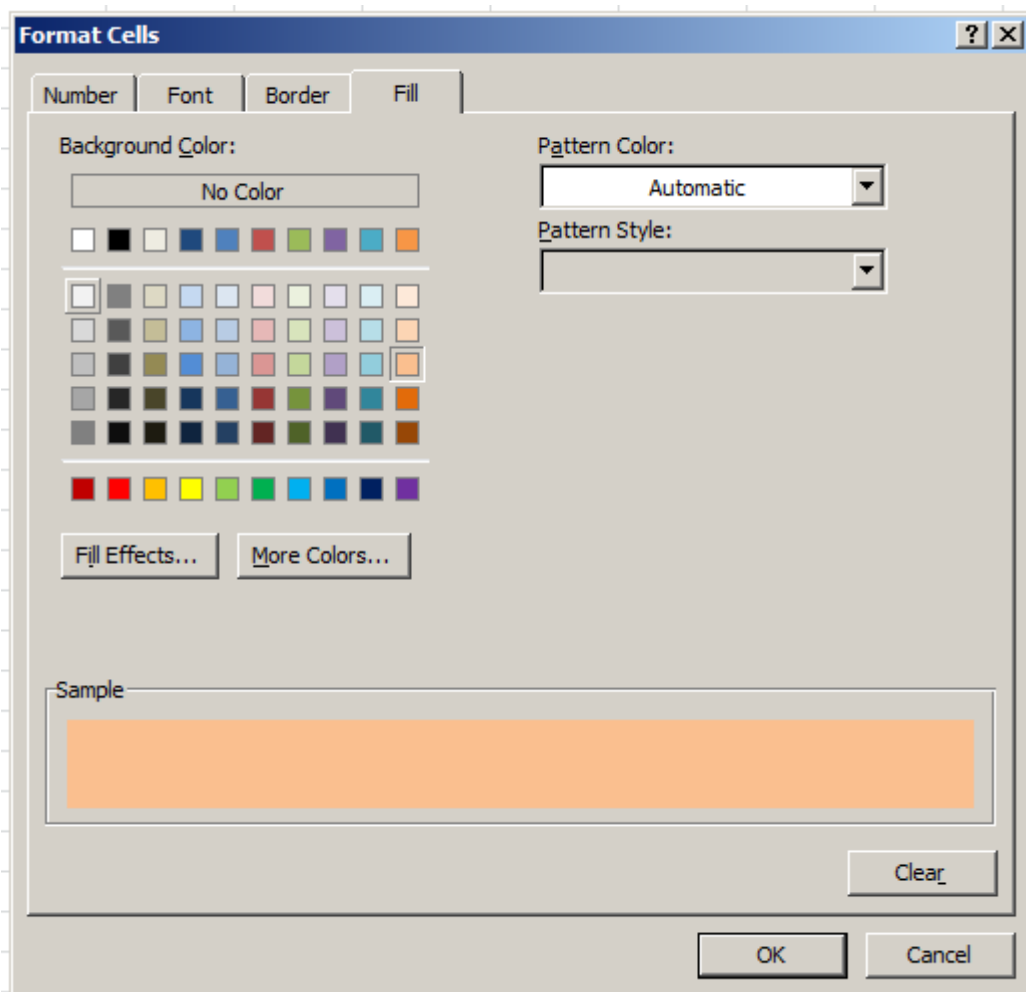
Format values where this formula is true:

Preview:

No Format Set

Format...

Next, press the Format button to define the desired conditional format. A dialog like the following appears. You can specify the conditional format's number format, font, border and fill. We choose to set the fill to a certain colour ...




Excel Skills - Advanced features

Press OK to end the dialog and OK again to end conditional formatting. The formatting is applied ...

	A	B	C	D
1		Jan	Feb	Mar
2	Budget	23	24	25
3	Actual	34	35	23

Conditional formatting is dynamic so that if a budget or actual figure is changed the format updates automatically. In the following example we have change the Feb and Mar actual figures. With these updated figures the formatted columns change from B and C to B and D.

	A	B	C	D
1		Jan	Feb	Mar
2	Budget	23	24	25
3	Actual	34	23	26



User Input

Excel includes features to ensure only valid data goes into spreadsheets. The following sections describe some of those features.

Data validation

Data validation lets you restrict the inputs a user may enter. Following is an example of how data validation can be used. Columns B through G show data for periods Q1 2014 through Q2 2015.

	A	B	C	D	E	F	G
1		Q1 2014	Q2 2014	Q3 2014	Q4 2014	Q1 2015	Q2 2015
2	Div A	9	11	10	23	37	10
3	Div B	43	16	3	19	33	31
4	Div C	38	39	46	47	13	11
5	Total	90	66	59	89	83	52
6							
7	Period:	Q2 2014					
8	Total:	66					

In cell B7 the user can enter one of the quarterly periods from the list above. Cell B8 then reports the total (row 5) figure for the chosen period.

Excel Skills - Advanced features

	A	B	C	D	E	F	G
1		Q1 2014	Q2 2014	Q3 2014	Q4 2014	Q1 2015	Q2 2015
2	Div A	9	11	10	23	37	10
3	Div B	43	16	3	19	33	31
4	Div C	38	39	46	47	13	11
5	Total	90	66	59	89	83	52
6							
7	Period:	Q2 2014					
8	Total:	66					

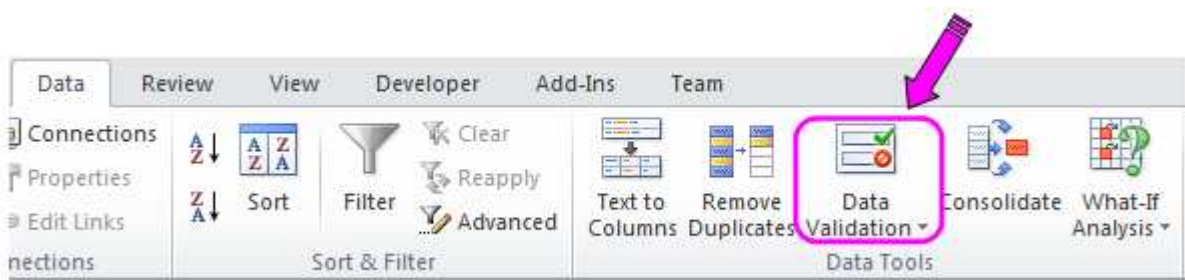
What happens if the user specifies a period that isn't in the list – as in the following illustration ...

	A	B	C	D	E	F	G
1		Q1 2014	Q2 2014	Q3 2014	Q4 2014	Q1 2015	Q2 2015
2	Div A	9	11	10	23	37	10
3	Div B	43	16	3	19	33	31
4	Div C	38	39	46	47	13	11
5	Total	90	66	59	89	83	52
6							
7	Period:	Q2 2016					
8	Total:	0					

The user specified the period “Q2 2016” and an incorrect total has been generated (0).

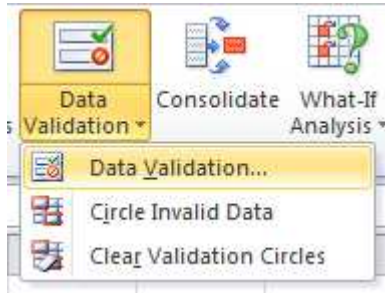
Using data validation we can prevent this from happening and can ensure the user enters only valid data. This is how.

Select the cell that will be data validated – B7 – in this case. Then go to the Data Validation icon in the Data Tools section of the Data ribbon ...

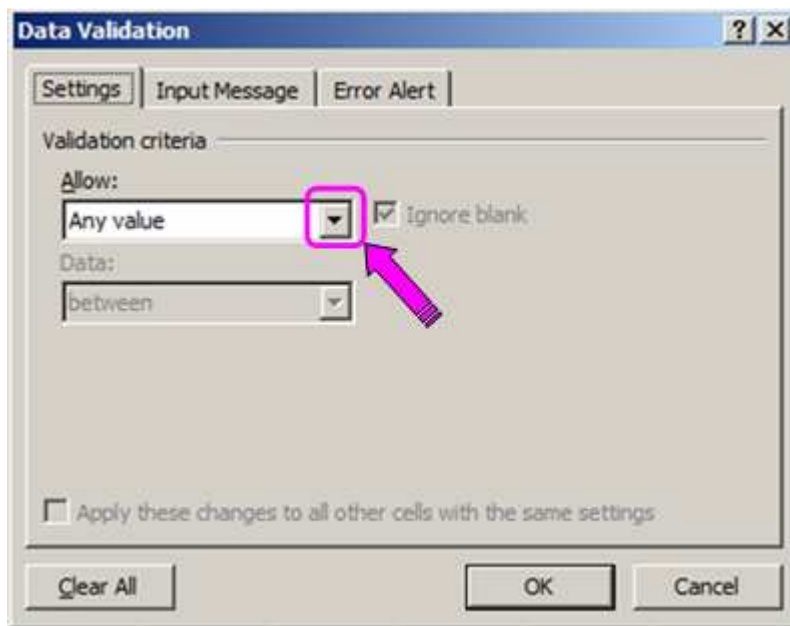


Click on the icon. A popup menu appears ...

Excel Skills - Advanced features

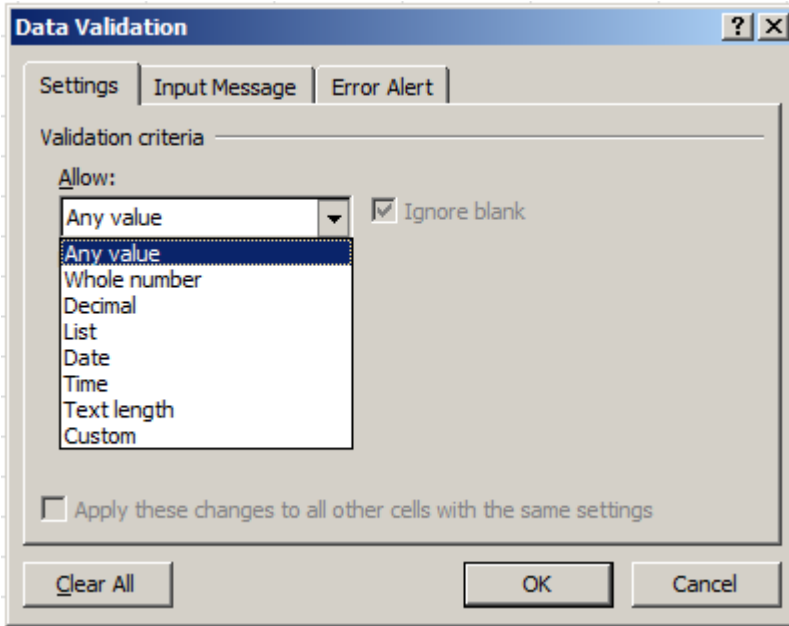


Click on the “Data Validation” menu item and the Data Validation dialog appears. The dialog lets you specify the criteria that data must meet for that data to be accepted as valid. Click on the drop-down icon to the right of the “Allow” field ...

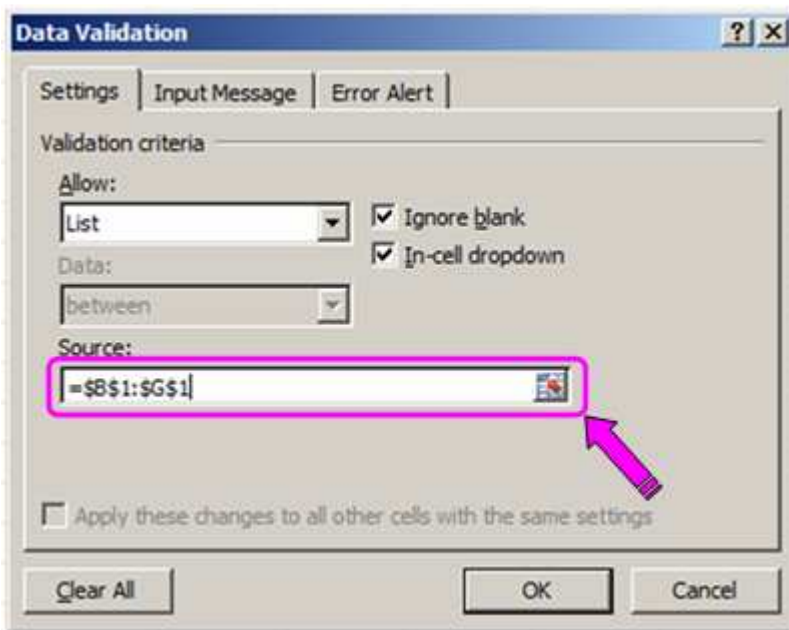


A list of validation types is shown ...

Excel Skills - Advanced features



The default validation type is to allow “Any value”. We’ll change this to “List” and specify a source range ...



This validation type will accept an input only if it matches an item in the source range. The source range comprises the cells B1:G1. Those cells contain the quarterly periods ...

	A	B	C	D	E	F	G
1		Q1 2014	Q2 2014	Q3 2014	Q4 2014	Q1 2015	Q2 2015
2	Div A	9	11	10	23	37	10
3	Div B	43	16	3	19	33	31

Excel Skills - Advanced features

Press the OK button to exit the dialog.

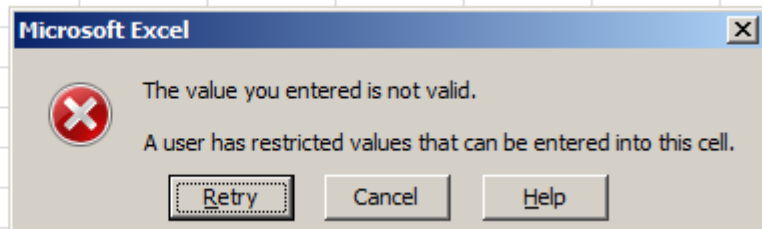
When the user next selects the data validated cell a list of allowed choices is displayed ...

	A	B	C	D	E	F	G
1		Q1 2014	Q2 2014	Q3 2014	Q4 2014	Q1 2015	Q2 2015
2	Div A	9	11	10	23	37	10
3	Div B	43	16	3	19	33	31
4	Div C	38	39	46	47	13	11
5	Total	90	66	59	89	83	52
6							
7	Period:	Q1 2014					
8	Total:	Q1 2014					
9		Q2 2014					
10		Q3 2014					
11		Q4 2014					

The user cannot now – accidentally or deliberately – make a choice other than from this list.

What if the user types a invalid period into the cell? In that case an error message appears and the user must re-enter the data ...

	A	B	C	D	E	F	G	H
1		Q1 2014	Q2 2014	Q3 2014	Q4 2014	Q1 2015	Q2 2015	
2	Div A	9	11	10	23	37	10	
3	Div B	43	16	3	19	33	31	
4	Div C	38	39	46	47	13	11	
5	Total	90	66	59	89	83	52	
6								
7	Period:	Q2 2016						
8	Total:	0						
9								
10								
11								



There is yet another way the user can set the value of the data validated cell – and that is by copying and pasting to it. Unfortunately, in this case, data validation is somewhat weak – and will allow an invalid input to be pasted into the cell ...

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	A	B	C	D	E	F	G
1		Q1 2014	Q2 2014	Q3 2014	Q4 2014	Q1 2015	Q2 2015
2	Div A	9	11	10	23	37	10
3	Div B	43	16	3	19	33	31
4	Div C	38	39	46	47	13	11
5	Total	90	66	59	89	83	52
6							
7	Period:	Q2 2016					
8	Total:	(Ctrl)					

Protecting cells and worksheets

You can “lock” cells and worksheets to prevent inadvertent (or deliberate) changes being made. This protects the integrity of workbooks. Following is an example of how to do this. The spreadsheet shown is to be updated monthly. Next month’s data (for April) will be put into cells E3 and E4. E5 already contains a SUM function to total the April data. E5 does not need to be changed. To prevent inadvertent changes being made to E5 (e.g. by accidentally typing one of the April figures directly into it) we can “lock” row 5.

E5		fx =SUM(E3:E4)						
	A	B	C	D	E	F	G	H
1	Month	Jan	Feb	Mar	Apr	May	June	July
2								
3	Sub-total A	92	68	44				
4	Sub-total B	41	44	66				
5	Grand total	133	112	110	0	0	0	0

As well as locking row 5 we can lock everything else – other than the cells shown next that will accept the monthly data ...

	A	B	C	D	E	F	G	H
1	Month	Jan	Feb	Mar	Apr	May	June	July
2								
3	Sub-total A	92	68	44				
4	Sub-total B	41	44	66				
5	Grand total	133	112	110	0	0	0	0

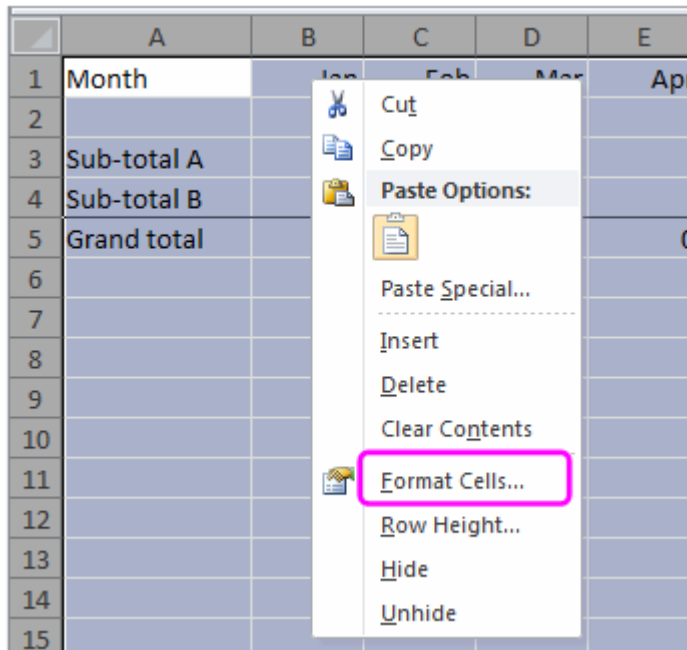
We begin by locking everything. Then we will selectively unlock the cells the user should be able to change.

Select the entire sheet (see the earlier chapter on Navigation and Selection for how to do this) ...

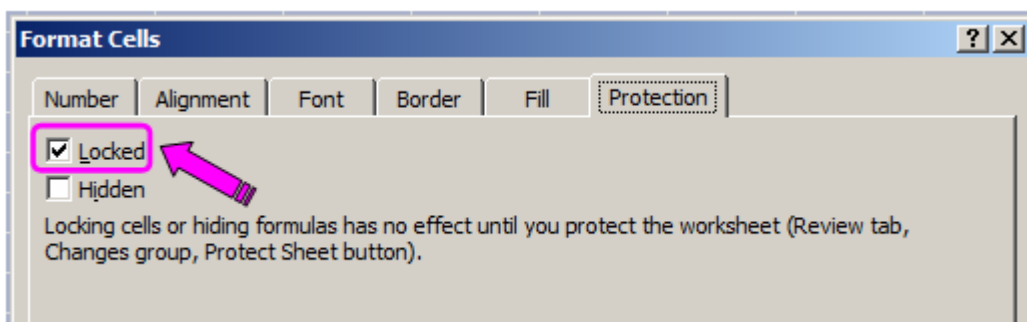
Excel Skills - Advanced features

	A	B	C	D	E	F	G	H
1	Month	Jan	Feb	Mar	Apr	May	June	July
2								
3	Sub-total A	92	68	44				
4	Sub-total B	41	44	66				
5	Grand total	133	112	110	0	0	0	0

Right-mouse-click anywhere on the sheet and a popup menu appears ...



Left-mouse click on the Format Cells menu item and the Format Cells dialog appears. Alternatively you can press CTRL + SHIFT + F. Select the protection tab and ensure the “Locked” choice is ticked. [Make sure the tick is black – if the tick is grey that means some cells are locked and some are not.]



All cells are now locked. Press the OK button to exit from the dialog.

Next we unlock the cells highlighted in the next illustration. Select the cells to be unlocked ...

Excel Skills - Advanced features

	A	B	C	D	E	F	G	H
1	Month	Jan	Feb	Mar	Apr	May	June	July
2								
3	Sub-total A	92	68	44				
4	Sub-total B	41	44	66				
5	Grand total	133	112	110	0	0	0	0

Bring up the Format Cells dialog as before and un-tick the “Locked” checkbox ...

	A	B	C	D	E	F	G	H	I
1	Month	Jan	Feb	Mar	Apr	May	June	July	
2									
3	Sub-total A	92	68	44					
4	Sub-total B	41	44	66					
5	Grand total	133	112	110	0	0	0	0	

Format Cells [?] [X]

Number | Alignment | Font | Border | Fill | Protection

Locked

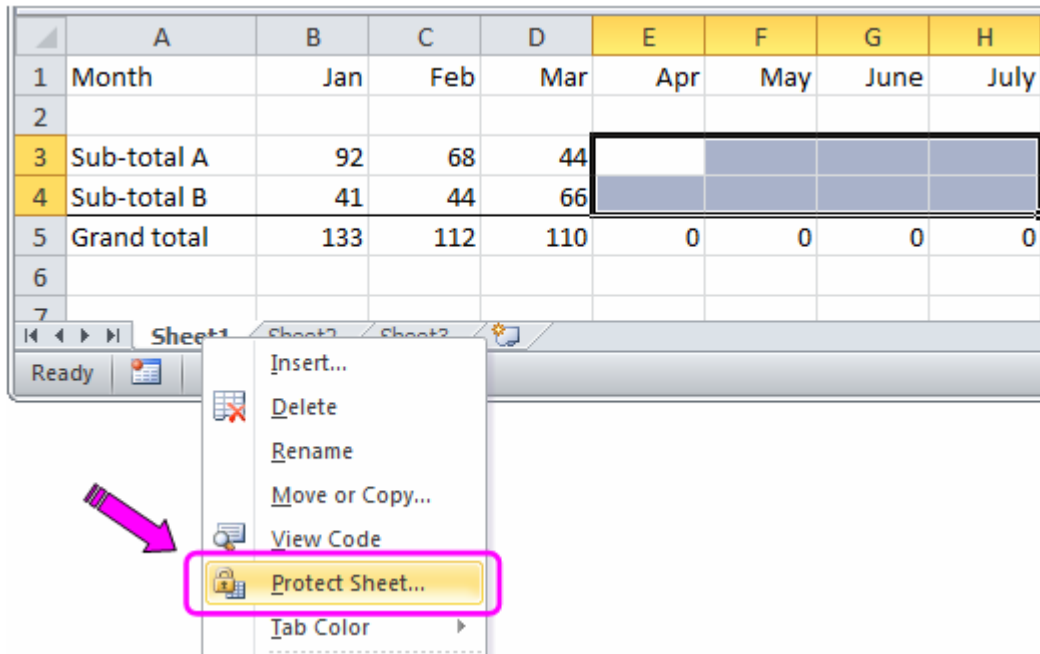
Hidden

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

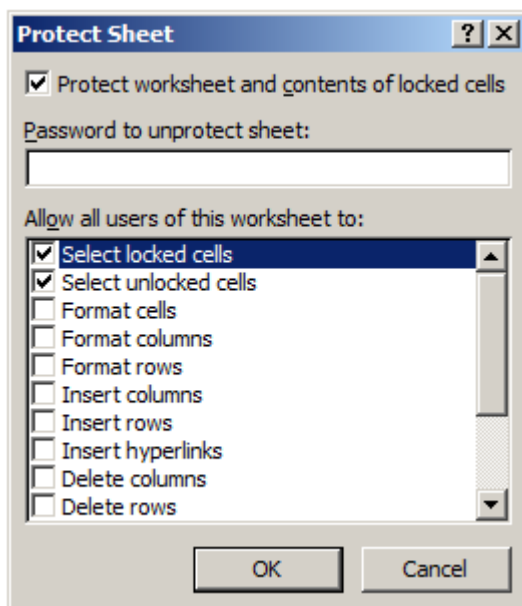
Press OK to exit the dialog. To “activate” the locks we have specified we need to protect the worksheet.

Move your mouse over the worksheet tab at the bottom of the spreadsheet (i.e. over “Sheet 1”) and right-mouse-click. A popup menu appears ...

Excel Skills - Advanced features



Click on the “Protect Sheet” menu item. The Protect Sheet dialog appears ...



The dialog gives you a number of choices about what to protect and also asks for a password. You can choose a password if you wish or you can leave the field blank – in which case there will be no password set. Then press the OK button to exit then dialog.

If you now try to type something into a locked cell on the protected sheet Excel will give an error message and will not overwrite the cell ...

Excel Skills - Advanced features

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1	Month	Jan	Feb	Mar	Apr	May	June	July						
2														
3	Sub-total A	92	68	44	56									
4	Sub-total B	41	44	66	78									
5	Grand total	133	112	110	134	0	0	0						

Tried to type into this cell

Microsoft Excel

The cell or chart that you are trying to change is protected and therefore read-only.

To modify a protected cell or chart, first remove protection using the Unprotect Sheet command (Review tab, Changes group). You may be prompted for a password.

OK

Arrays

As its name implies an array works with a “block” or array of numbers.

The following illustration shows an array formula in cells A3:C3. This is the formula: **=A1:C1*A2:C2**

	A	B	C	D
1	3	4	5	
2	5	6	7	
3	=A1:A2:C2			

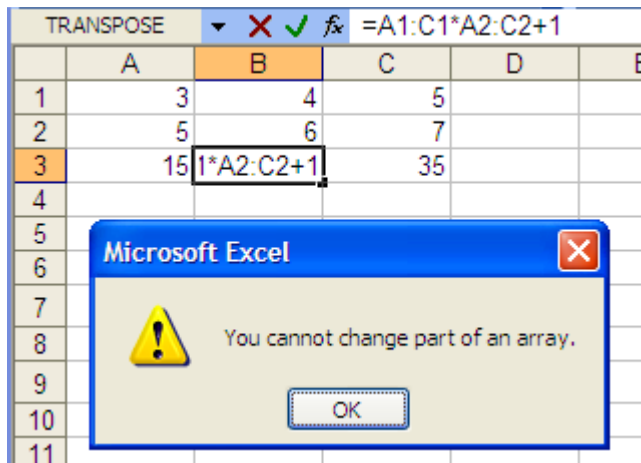
Instead of referring to individual cells (e.g. as in =A1*A2) the formula refers to “blocks” or “arrays” of cells. Array formulas are entered in a special way: While the cursor is in the formula bar CTRL + SHIFT + ENTER are pressed.

	A	B	C	D
1	3	4	5	
2	5	6	7	
3	15	24	35	

The curly brackets that appear around the formula are put there automatically by Excel to indicate the formula applies to an array. Note that you cannot put the curly brackets in by typing them.

Cells A3:C3 contain an indivisible array formula. The cells cannot now be made inconsistent with each other. If you try to change just one of the cells an error message appears.

Excel Skills - Advanced features



Arrays are a convenient and compact way of doing a complex calculation in a single cell that might otherwise take many different cells and formulae.

We will demonstrate with an example. We'll consider the following spreadsheet.

	A	B	C	D	E	F
1						
2	Division	A	B	C	D	E
3	Budget	34	56	25	78	99
4	Actual	33	55	34	79	90

We want the answer to this question: How many division's actual figures are greater than their budget figures? We will answer the question two ways: 1) The "normal" (and long) way. 2) Using arrays. First, the usual way. We use IF to determine whether each actual is greater than the corresponding budget. If it is then we generate a 1 and otherwise generate a 0 ...

	A	B	C	D	E	F
1						
2	Division	A	B	C	D	E
3	Budget	34	56	25	78	99
4	Actual	33	55	34	79	90
5						
6	Is over budget	=if(B4>B3,1,0)				

We then copy and paste the IF statement to the right so that the calculation is repeated for all divisions ...

	A	B	C	D	E	F
1						
2	Division	A	B	C	D	E
3	Budget	34	56	25	78	99
4	Actual	33	55	34	79	90
5						
6	Is over budget	0	0	1	1	0

Excel Skills - Advanced features

Last, we sum the individual 1's and 0's to count the number of divisions over budget ...

	A	B	C	D	E	F
1						
2	Division	A	B	C	D	E
3	Budget	34	56	25	78	99
4	Actual	33	55	34	79	90
5						
6	Is over budget	0	0	1	1	0
7						
8	Number over budget	=sum(B6:F6)				

That is the normal way of doing the calculation. Now we'll re-do it using the same underlying principles but this time using an array.

We use IF to determine if the actual figure is greater than the budget. But notice in the IF we compare all the actuals with all the budgets in the one statement ...

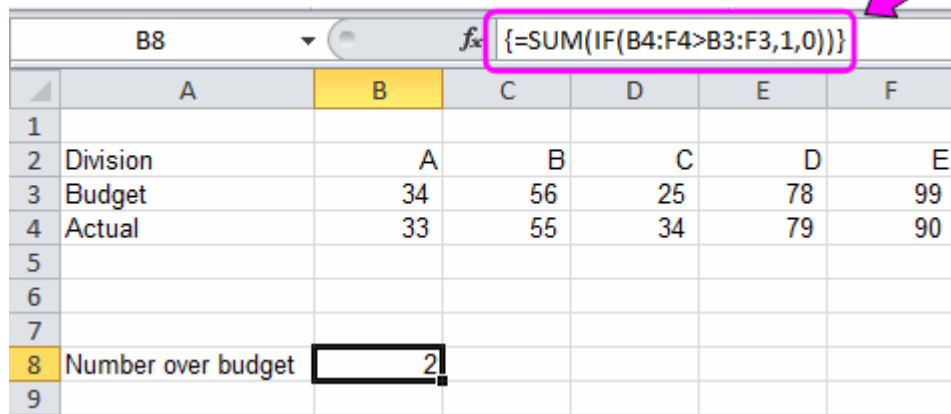
	A	B	C	D	E	F
1						
2	Division	A	B	C	D	E
3	Budget	34	56	25	78	99
4	Actual	33	55	34	79	90
5						
6						
7						
8	Number over budget	=if(B4:F4>B3:F3,1,0)				

Excel will generate five 1's and 0's based on whether the individual numbers in B4:F4 are greater than the individual numbers in B3:F3. We need to sum the stream of 1's and 0's. We do it this way ...

	A	B	C	D	E	F
1						
2	Division	A	B	C	D	E
3	Budget	34	56	25	78	99
4	Actual	33	55	34	79	90
5						
6						
7						
8	Number over budget	=SUM(IF(B4:F4>B3:F3,1,0))				

We've added a SUM at the front of the formula to add the 1's and 0's. That has completed the formula. We need to tell Excel that this is an array formula. We do that by now pressing CTRL + SHIFT + ENTER ...

Excel Skills - Advanced features



	A	B	C	D	E	F
1						
2	Division	A	B	C	D	E
3	Budget	34	56	25	78	99
4	Actual	33	55	34	79	90
5						
6						
7						
8	Number over budget	2				
9						

The array formula is complete and does in a single cell what took six cells otherwise.

Advantages of arrays

Arrays can be very compact ways of doing calculations that would otherwise take many cells to do.

Disadvantages of arrays

Array formulas can be complex and difficult for someone to understand if they are not familiar with arrays.

There is a risk that when an array formula is entered the user forgets to press CTRL + SHIFT + ENTER and instead presses just ENTER. The formula will then work in a non-array mode and will either generate an error or may generate an incorrect result.

Financial functions

Excel contains a number of functions useful in financial analysis and decision-making. This section describes some of those functions.

We'll begin by looking at two finance concepts: "Present value" and "Future value". Suppose \$100 is borrowed today for one year at 5% interest per year. How much is to be repaid? The answer is obviously \$105 – The original \$100 that was borrowed plus \$5 interest. \$100 can be thought of as being a "present value" and \$105 as a "future value".

We could rephrase the previous question: If the future value (in one year) is \$105 then what is the present value (assuming an interest rate of 5%)? The answer is \$100.

Excel provides a number of financial functions that – given an interest or "discount" rate - calculate present or future values. We'll review some of those functions.

NPV

The NPV function calculates the present value of regularly spaced cash flows.

The NPV function can take two parameters. The first parameter is a discount/interest rate and the second is a set of cash flows. Each cash flow is discounted at the given rate and the total of the discounted values is returned. The NPV function assumes:

- Cash flows occur at regular intervals
- The first cash flow occurs in one interval's time
- The same discount rate applies to all cash flows
- If cash flows occur yearly then the discount rate is assumed to be a yearly rate. If the cash flows occur monthly then the discount rate is assumed to be a monthly rate. Whatever the interval between cash flows is – it is assumed the discount rate is for that interval.

The following diagram shows the NPV function being used to calculate the present value of a future cash flow of \$105.

	A	B
1	Rate	5%
2		
3	Year	2014
4	Future value	105
5		
6	Present value	=NPV(B1,B4)

The NPV function's first parameter is the discount rate – 5%. The second parameter is the future cash flow - \$105. The NPV function returns the present value. The value returned is the same as that discussed in the introduction to this topic - \$100.

Excel Skills - Financial functions

Note that the date of the future cash flow – 2014 – in cell B3 – is not passed to the NPV function. The NPV function has no concept of dates – only of “intervals” – and it assumes the first cash flow occurs one period in the future.

The next diagram shows the NPV function being used to calculate the present value of two cash flows. The first cash flow is in one period and its value is \$105. And the second cash flow occurs in two periods and its value is \$70.

	A	B	C
1	Rate	5%	
2			
3	Year	2014	2015
4	Future value	105	70
5			
6	Present value	=NPV(B1,B4:C4)	

XNPV

If you want the present value of cash flows occurring at specific dates then instead of using the NPV function you should use the XNPV function.

The XNPV function returns the present value of a series of dated cash flows.

Following is an example.

	A	B	C
1	Rate	5%	
2			
3	Year	1/01/2014	1/06/2015
4	Future value	105	70
5			
6	Present value	=XNPV(B1,B4:C4,B3:C3)	

The first parameter is the discount rate, the second is the series of cash flows and the third is the date series.

Note that the value returned by the function is the value as at the date of the first cash flow. Note also that because explicit (i.e. calendar) dates are used the discount rate should be an annual rate.

Applications of NPV and XNPV

NPV and XNPV can be used in making investment decisions. We'll look at an example.

Suppose the cost of refurbishing a property is “X” and the benefit of refurbishing is that future maintenance, insurance and utility costs are reduced by “Y”. Is it worth refurbishing the property? We'll do an analysis. The analysis spreadsheet is shown next.

Excel Skills - Financial functions

B7		fx =NPV(B5,B2,C3:I3)								
	A	B	C	D	E	F	G	H	I	
1	Year	2014	2015	2016	2017	2018	2019	2020	2021	
2	Refurbishment cost	-200,000								
3	Refurbishment benefit		50,000	50,000	50,000	30,000	20,000	10,000	5,000	
4										
5	Discount rate	0%								
6										
7	Net present value	15,000								

The cost of refurbishing the property is \$200,000. That number (with a minus in front since it is a cost) is in cell B2. The first benefit of the refurbishment is in 2015 and is estimated to be \$50,000. This comprises reduced maintenance, insurance and utility costs. That figure is in C3. The following year's benefits are in E3, F3 and so on.

Is it worth refurbishing? We use the NPV function in B7 to answer. The NPV function's first parameter is a discount rate in cell B5. Currently the discount rate is 0% (but we'll change it later – for reasons to be explained).

The NPV function's second and following parameters specify cash flows (real or imputed). The second parameter is B2 and is the refurbishment cost. The third parameter is the set of refurbishment benefits and comprises the numbers in cells C3 to I3.

With those parameters the NPV function gives an answer greater than zero: \$15,000 thus indicating the refurbishment has a net positive economic value.

However, we have made a very crude and probably unrealistic assumption: We assumed the discount rate was 0%. That means we value a dollar in five years time the same as a dollar today. But, if we invest a dollar today it will be worth more than a dollar in five years time and conversely a dollar in five year's time must be worth less than a dollar today. The discount factor models the extent to which a future dollar is worth less than a present dollar. A high discount factor means a future dollar is worth a lot less than a present dollar. A low discount factor means a future dollar is worth a little bit less than a present dollar. And a zero discount factor means a future dollar is worth the same as a present dollar.

Let's use a discount rate that is more realistic than the 0% we used earlier – let's say it is 10%. With this discount rate our model looks like this ...

Excel Skills - Financial functions

	A	B	C	D	E	F	G	H	I
1	Year	2014	2015	2016	2017	2018	2019	2020	2021
2	Refurbishment cost	-200,000							
3	Refurbishment benefit		50,000	50,000	50,000	30,000	20,000	10,000	5,000
4									
5	Discount rate	10%							
6									
7	Net present value	-31,398							

Net present value is minus 31,398 – not an economically viable investment.

We saw that NPV with a discount rate of 0% was \$15,000 and with a discount rate of 10% was minus \$32,000. What is the “breakeven” discount rate i.e. that discount rate that gets a zero net present value? We can use another function – IRR – to answer that.

IRR

IRR means “internal rate of return”. As an introduction to that concept consider this: An investment is made today of \$100. In one year’s time the investment matures and returns \$105. What is the return on the investment? The return is defined as the profit ($105 - 100 = \$5$) divided by the initial investment (100). So the return is 5%.

What if – as well - there was an interest payment of \$1 at six months. What would the return be? It would have to be more than 5%. But how much more? Excel’s IRR function will calculate that for us.

As does the NPV function – the IRR function assumes cash flows are evenly spaced in time. Pass the cash flows to the IRR function and it will return the IRR. If the cash flows occur at six monthly intervals, say, then the IRR function will return the 6 monthly IRR. Normally, though, IRR is expressed on a yearly basis.

XIRR

The XIRR function returns the yearly IRR of a dated series of cash flows. The XIRR parameters are as follows.

=XIRR(values, dates)

The first parameter is a range containing a series of cash flows. The second is a range containing the dates of the cash flows.

The XIRR returns the annual effective internal rate of return. Following is an example.

Excel Skills - Financial functions

	A	B	C
1	Date	Cash flow	
2	1/01/2009	-100	
3	1/04/2009	40	
4	1/07/2009	75	
5			
6	41% -->	=XIRR(B2:B4,A2:A4)	

Applications of IRR and XIRR

To show an application of the IRR function we'll continue with our refurbishment analysis from earlier. We've made some updates to the model ...

B7		fx =IRR(B5:I5)								
	A	B	C	D	E	F	G	H	I	
1	Year	2014	2015	2016	2017	2018	2019	2020	2021	
2	Refurbishment cost	-200,000								
3	Refurbishment benefit		50,000	50,000	50,000	30,000	20,000	10,000	5,000	
4										
5	Net	-200,000	50,000	50,000	50,000	30,000	20,000	10,000	5,000	
6										
7	Internal rate of return	2.6%								

On row 5 we calculate net cash flows. In each period the net cash flow is simply the sum of the refurbishment cost and the refurbishment benefit.

The IRR function's only parameter is the set of cash flows in cells B5:I5.

The IRR function returns a value of 2.6%. That is the "breakeven" discount rate. If the discount rate is more than 2.6% then the refurbishment has net negative value. If the rate is less than 2.6% it has net positive value. And if it is zero then it has zero net value.

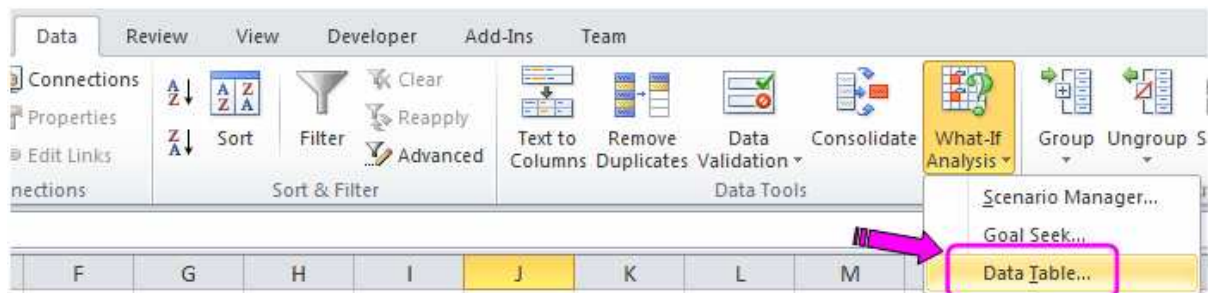
So should we refurbish or not? If we value \$100 in one year's time at more than \$97.4 today then refurbish – otherwise don't. And where did the 97.4 come from? It is $100\% - 2.6\%$.

What-If analysis

Excel provides a number of tools for performing “What-If” analysis. In this section we review some of those tools and show how they can be applied to solve problems.

Data Tables

The Data table icon is found in the Data Tools section of the Data ribbon. The Data Tools section contains an icon labelled “What-If” Analysis. Click on that icon and a menu appears. The third item in that menu is “Data Table” ...



The following example illustrates how Data tables can be used. Imagine we have a simple model that forecasts costs ...

	A	B	C	D	E	F
1						
2	<i>Assumptions</i>					
3	Yearly growth in costs:		5%			
4						
5	<i>Forecast</i>					
6		2013	2014	2015	2016	
7		Actual	Estimated	Estimated	Estimated	
8	Costs	45.0	47.3	49.6	52.1	

Cell D3 allows us to input an assumption about yearly growth in costs.

The formulas in cells D8 to F8 forecast costs by increasing them year by year by the growth factor assumption in cell D3.

Suppose we are interested in the 2016 forecast cost: We want to know how sensitive that is to our growth assumption. We will use a data table to find out.

Begin by listing a set of different growth assumptions. We'll put the assumptions in a column (highlighted in the next figure) ...

Excel Skills - What-If analysis

	A	B	C	D	E	F
1						
2		Assumptions				
3		Yearly growth in costs:	2%			
4						
5		Forecast				
6			2013	2014	2015	2016
7			Actual	Estimated	Estimated	Estimated
8		Costs	45.0	45.9	46.8	47.8
9						
10		Estimated 2016 costs				
11		Growth rate	Cost			
12		0%				
13		1%				
14		2%				
15		3%				
16		4%				
17						

We will make a data table fill out the “Cost” column to the right of the “Growth rate” column. The cost column is currently empty. At the top of the column we will define what the data table is to tabulate (the 2016 forecast cost). To do that select the top cell in the second column (C12). Type an = into the cell and then click on the 2016 forecast cost cell (F8) ...

	A	B	C	D	E	F
1						
2		Assumptions				
3		Yearly growth in costs:	2%			
4						
5		Forecast				
6			2013	2014	2015	2016
7			Actual	Estimated	Estimated	Estimated
8		Costs	45.0	45.9	46.8	47.8
9						
10		Estimated 2016 costs				
11		Growth rate	Cost			
12			=F8			
13		0%				
14		1%				
15		2%				
16		3%				
17		4%				

Excel Skills - What-If analysis

Then press the ENTER key. We have defined what the data table will tabulate. Next, select the area the data table will occupy. The leftmost column of the data table is the set of growth rate assumptions in column B. And the second column is the cost column. The top row of the data table is row 12 – which details what is to be tabulated ...

	A	B	C	D	E	F
1						
2		<i>Assumptions</i>				
3		Yearly growth in costs:	2%			
4						
5		<i>Forecast</i>				
6			2013	2014	2015	2016
7			Actual	Estimated	Estimated	Estimated
8		Costs	45.0	45.9	46.8	47.8
9						
10		<i>Estimated 2016 costs</i>				
11		<i>Growth rate</i>	<i>Cost</i>			
12			47.8			
13		0%				
14		1%				
15		2%				
16		3%				
17		4%				

Next, bring up the Data Table dialog. Do that from the Data ribbon as described earlier or use the keyboard: ALT, A, W, T ...

Excel Skills - What-If analysis


	A	B	C	D	E	F
1						
2	Assumptions					
3		Yearly growth in costs:		2%		
4						
5	Forecast					
6		2013	2014	2015	2016	
7		Actual	Estimated	Estimated	Estimated	
8	Costs	45.0	45.9	46.8	47.8	
9						
10	Estimated 2016 costs					
11		Growth rate	Cost			
12			47.8			
13		0%				
14		1%				
15		2%				
16		3%				
17		4%				

Data Table [?] [X]

Row input cell:


Column input cell:

OK Cancel



Data tables can be arranged in columns or rows. Here we are using a column layout. Leave the "Row input cell" blank in the dialog and click in the "Column input cell" field. Then click on the cell that the data table will "drive" – cell D3 – the growth assumption. Press the OK button ...

	A	B	C	D	E	F
1						
2	Assumptions					
3		Yearly growth in costs:		2%		
4						
5	Forecast					
6		2013	2014	2015	2016	
7		Actual	Estimated	Estimated	Estimated	
8	Costs	45.0	45.9	46.8	47.8	
9						
10	Estimated 2016 costs					
11		Growth rate	Cost			
12			47.8			
13		0%	45.0			
14		1%	46.4			
15		2%	47.8			
16		3%	49.2			
17		4%	50.6			



Excel Skills - What-If analysis

The data table has taken the growth rates in cells B13 to B17 and put them – one by one – into the driven cell D3. Excel recalculates each time. After each re-calculation the data table samples the data to be tabulated and puts the result into the cost column in cells C13 to C17.

The data table automatically recalculates if any of its inputs change. [This is in contrast to Pivot tables that need to be manually updated.] In the following example we've changed the baseline 2013 cost and that has triggered an update of the table ...

	A	B	C	D	E	F
1						
2		<i>Assumptions</i>				
3		Yearly growth in costs:		2%		
4						
5		<i>Forecast</i>				
6			2013	2014	2015	2016
7			Actual	Estimated	Estimated	Estimated
8		Costs	48.0	49.0	49.9	50.9
9						
10		<i>Estimated 2016 costs</i>				
11		<i>Growth rate</i>	<i>Cost</i>			
12			50.9			
13		0%	48.0			
14		1%	49.5			
15		2%	50.9			
16		3%	52.5			
17		4%	54.0			

Goal seek and Solver

The flow of information through many spreadsheets is like this:

Data -> Calculations -> Result

We put data and assumptions into the spreadsheet, define calculations that work with the data and then analyse the results.

However, for some problems, we'd like Excel to work "backwards". We'd like to specify a result (or goal) and ask Excel to find what combination of data would lead to that result. Goal seek and solver are tools available in Excel to do that. We will illustrate how Goal seek and solver work by considering our forecasting model again ...

Excel Skills - What-If analysis

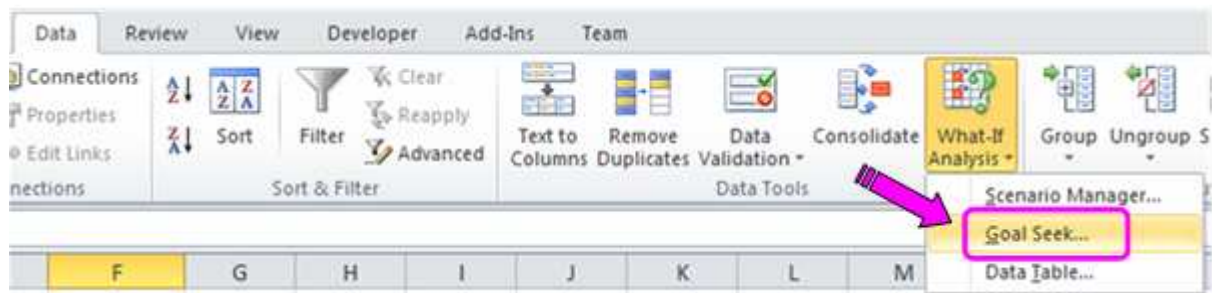
F8		fx =E8+E8*\$D\$3				
	A	B	C	D	E	F
1						
2		<i>Assumptions</i>				
3		Yearly growth in costs:		2.00%		
4						
5		<i>Forecast</i>				
6			2013	2014	2015	2016
7			Actual	Estimated	Estimated	Estimated
8		Costs	48.0	49.0	49.9	50.9

Cell D3 allows us to input an assumption about the yearly growth in costs.

The formulas in cells D8 to F8 forecast costs by increasing them year by year by the growth factor in cell D3. The model is forecasting a 2016 cost of 50.9. Suppose we want to know this: What growth rate would lead to a 2016 cost of 52? We will use goal seek to find the answer.

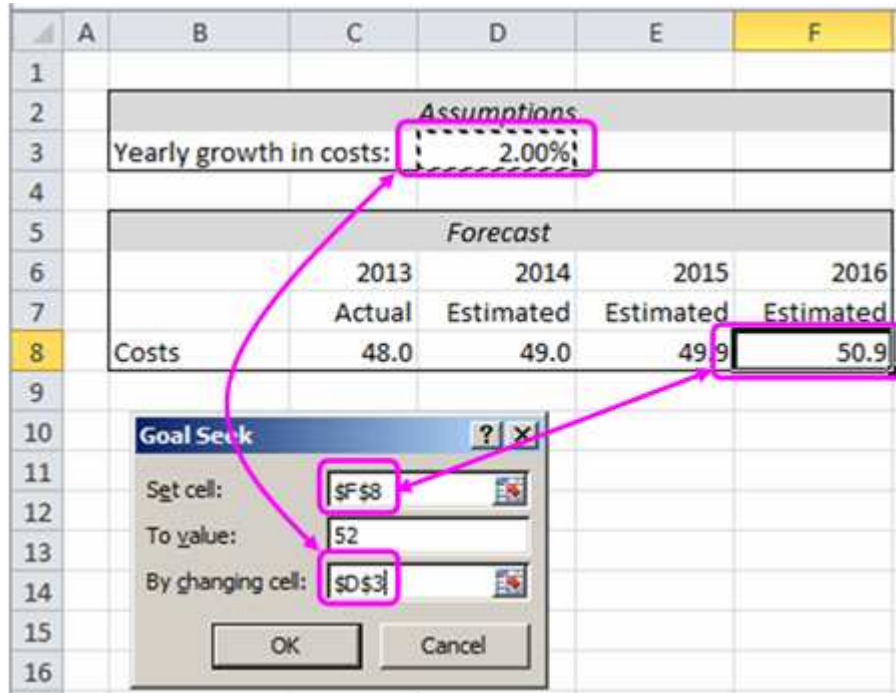
Goal seek

Begin by selecting the "Goal Seek" menu item ...



The Goal Seek dialog appears ...

Excel Skills - What-If analysis



	A	B	C	D	E	F	
1							
2				Assumptions			
3			Yearly growth in costs:	2.00%			
4							
5				Forecast			
6			2013	2014	2015	2016	
7			Actual	Estimated	Estimated	Estimated	
8			Costs	48.0	49.0	49.9	50.9
9							
10							
11							
12							
13							
14							
15							
16							

Set the “Set cell” reference to the “goal cell”. Our goal is to set the 2016 cost to 52. The 2016 cost is in cell F8. So the goal cell is F8.

Next we specify what the goal is. It’s 52. That is typed into the field in the dialog labelled “To value”.

Last, we specify which cell Excel can vary to try to achieve the goal. In this case it’s the growth assumption in cell D3. Set the field “By changing cell” to D3.

We have given Goal Seek all the information it needs. Press the OK button to finish. Goal seek will vary D3 until the goal is achieved: F8 having a value of 52. Goal seek reports the result:

Excel Skills - What-If analysis

	A	B	C	D	E	F
1						
2		Assumptions				
3		Yearly growth in costs:		2.70%		
4						
5		Forecast				
6			2013	2014	2015	2016
7			Actual	Estimated	Estimated	Estimated
8		Costs	48.0	49.3	50.6	52.0
9						
10		<div style="border: 1px solid gray; padding: 5px;"> <p>Goal Seek Status [?] [X]</p> <p>Goal Seeking with Cell F8 found a solution.</p> <p>Target value: 52</p> <p>Current value: 52.0</p> <p style="text-align: right;"> <input type="button" value="Step"/> <input type="button" value="Pause"/> <input type="button" value="OK"/> <input type="button" value="Cancel"/> </p> </div>				
11						
12						
13						
14						
15						
16						

A 2.7% growth rate will cause the 2016 cost to be 52. If we press the OK button the growth rate assumption in D3 will be set to Goal seek's result. If we press the Cancel button the value in D3 will be set back to its original value: 2%.

Solver

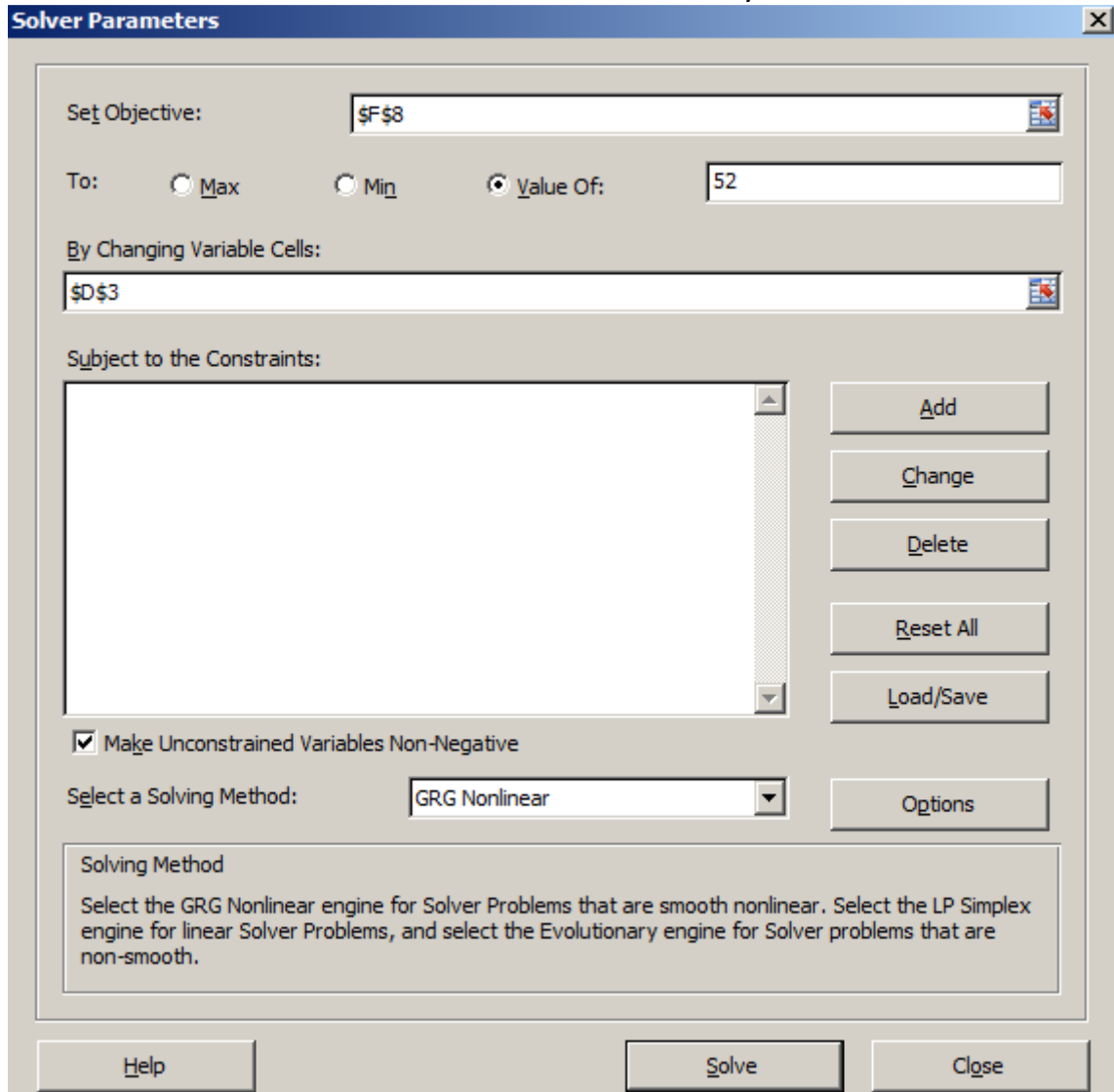
Instead of using Goal seek to answer our original question (growth rate to achieve a 2016 cost of 52) we could have used another Excel tool: Solver.

Solver is more powerful than Goal seek. Its advantages over Goal seek include the following.

- Goal seek can only vary one input to achieve a goal whereas Solver can vary several
- Goal seek "forgets" the problem you're solving after you close your workbook. So if you close and re-open the workbook and want to goal seek again then you need to re-define the goal seeking problem. In contrast, Solver "remembers".
- Solver allows you to specify "constraints" which can be used to guide Solver in finding a goal.

Because Solver is more flexible and powerful than Goal seek it also has a more complicated user interface. Following is the same problem we solved with Goal seek but specified as a Solver problem. In this example the "Objective" is to set cell F8 to a particular value (52) by changing variable cell(s) D3 ...

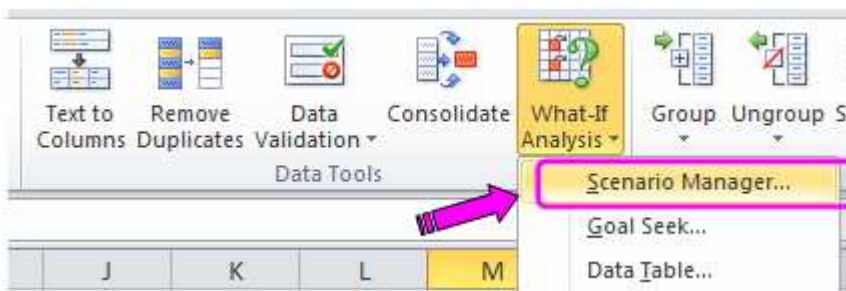
Excel Skills - What-If analysis



Scenario Manager

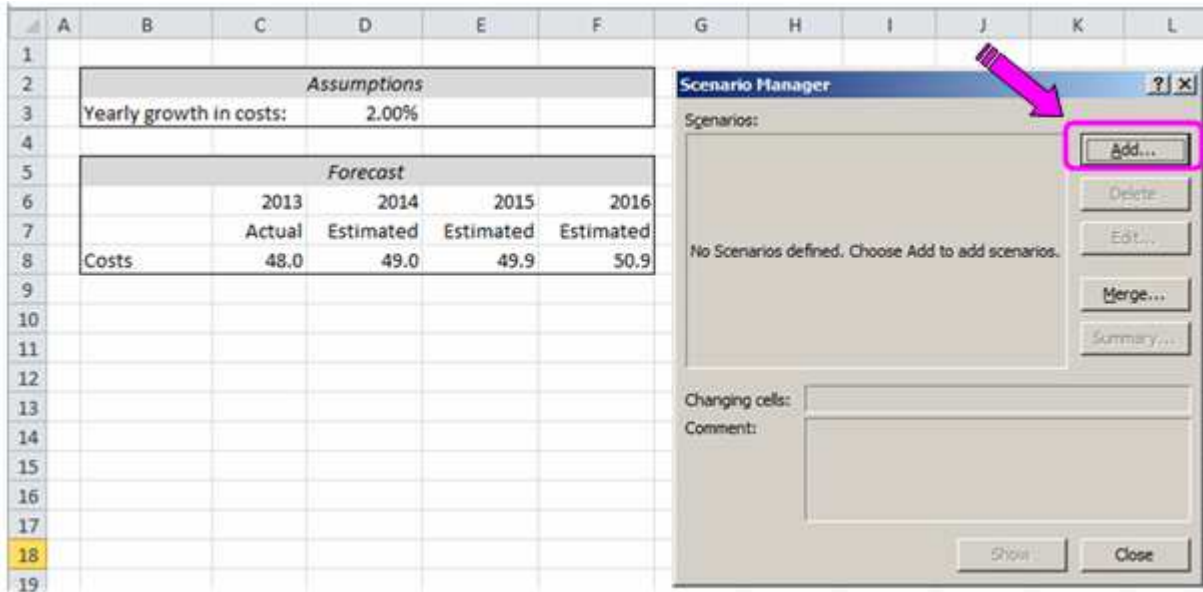
The scenario manager lets you define two or more scenarios and shows key outputs for each of the scenarios. To illustrate how scenarios work we'll continue with our forecasting model.

Begin by bringing up the Scenario Manager. Scenario Manager is the first item on the "What-If" analysis menu ...



Click the Add button to define one or more scenarios ...

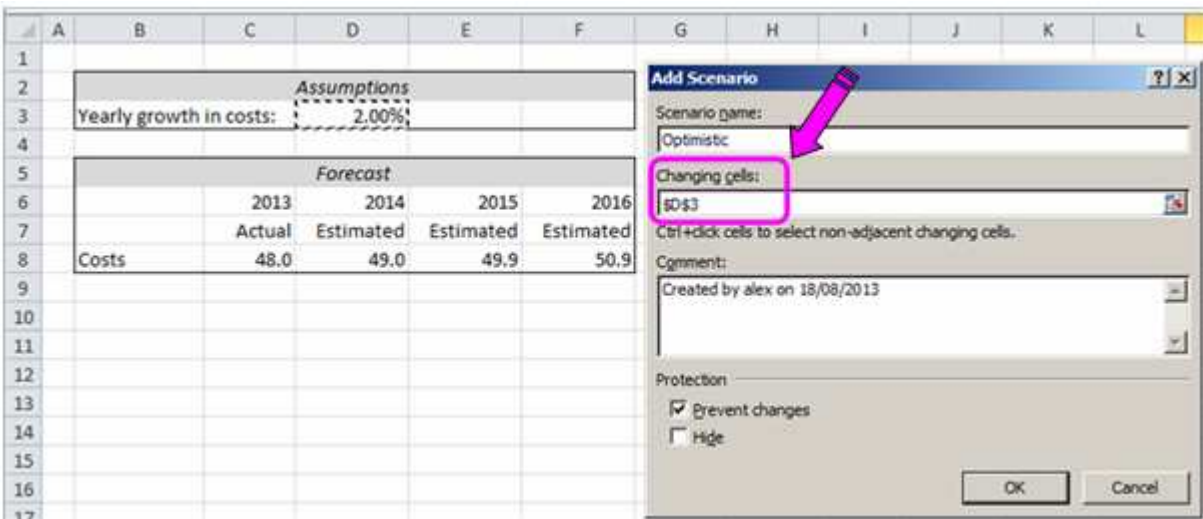
Excel Skills - What-If analysis



Assumptions	
Yearly growth in costs:	2.00%

Forecast				
	2013	2014	2015	2016
	Actual	Estimated	Estimated	Estimated
Costs	48.0	49.0	49.9	50.9

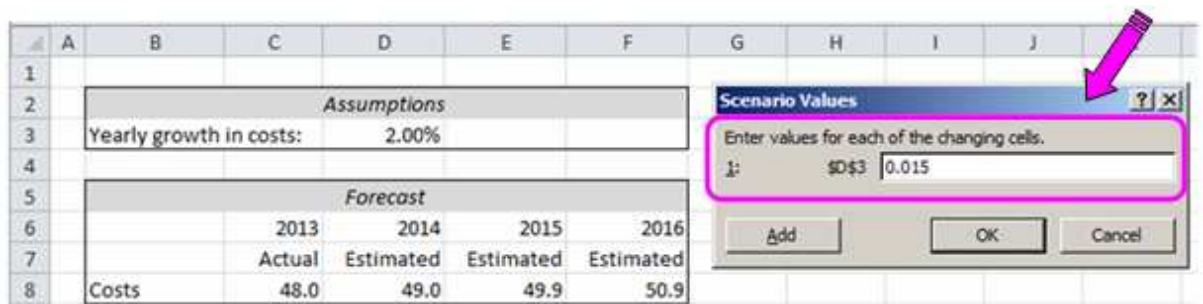
Give the scenario a name (“Optimistic” – in our example). Then define the cell (or cells) that will be changed from their current values by the scenario ...



Assumptions	
Yearly growth in costs:	2.00%

Forecast				
	2013	2014	2015	2016
	Actual	Estimated	Estimated	Estimated
Costs	48.0	49.0	49.9	50.9

Click on the OK button and you will be asked to provide values for the chosen cells ...



Assumptions	
Yearly growth in costs:	2.00%

Forecast				
	2013	2014	2015	2016
	Actual	Estimated	Estimated	Estimated
Costs	48.0	49.0	49.9	50.9

After providing values press the Add button to define a new scenario. We will define a “Pessimistic” scenario ...

Excel Skills - What-If analysis

	A	B	C	D	E	F	G	H	I	J	K	L	
1													
2		<i>Assumptions</i>											
3		Yearly growth in costs:		2.00%									
4													
5		<i>Forecast</i>											
6			2013	2014	2015	2016							
7			Actual	Estimated	Estimated	Estimated							
8		Costs	48.0	49.0	49.9	50.9							
9													
10													
11													
12													
13													
14													
15													
16													
17													

Add Scenario [?] [X]

Scenario name:

Changing cells:

Ctrl+click cells to select non-adjacent changing cells.

Comment:

Protection

Prevent changes

Hide

OK Cancel

As before we have given the scenario a name and defined which cells will be changed by the scenario. Press the OK button ...

	A	B	C	D	E	F	G	H	I	J	K	
1												
2		<i>Assumptions</i>										
3		Yearly growth in costs:		2.00%								
4												
5		<i>Forecast</i>										
6			2013	2014	2015	2016						
7			Actual	Estimated	Estimated	Estimated						
8		Costs	48.0	49.0	49.9	50.9						
9												
10												
11												
12												
13												
14												
15												
16												
17												

Scenario Values [?] [X]

Enter values for each of the changing cells.

1: \$D\$3

Add OK Cancel

We have defined the scenario values. Press OK to complete the scenario definition. A list of the defined scenarios is shown ...

	A	B	C	D	E	F	G	H	I	J	K	L	
1													
2		<i>Assumptions</i>											
3		Yearly growth in costs:		2.00%									
4													
5		<i>Forecast</i>											
6			2013	2014	2015	2016							
7			Actual	Estimated	Estimated	Estimated							
8		Costs	48.0	49.0	49.9	50.9							
9													
10													
11													
12													
13													
14													
15													
16													
17													
18													
19													

Scenario Manager [?] [X]

Scenarios:

- Optimistic
- Pessimistic

Add...
Delete
Edit...
Merge...
Summary...

Changing cells: \$D\$3

Comment: Created by alex on 18/08/2013

Show Close

To generate a scenario report next press the Summary button ...

Excel Skills - What-If analysis

	A	B	C	D	E	F	G	H	I	J
1										
2		<i>Assumptions</i>								
3		Yearly growth in costs:		2.00%						
4										
5		<i>Forecast</i>								
6			2013	2014	2015	2016				
7			Actual	Estimated	Estimated	Estimated				
8		Costs	48.0	49.0	49.9	50.9				
9										
10										

Scenario Summary ? X

Report type:

Scenario summary

Scenario PivotTable report

Result cells:

F8

OK Cancel

We have been asked to nominate which cells' values are to be shown in the report. We nominated one cell only – F8. Last, press the OK button to generate the report ..

Scenario Summary			
	Current Values:	Optimistic	Pessimistic
Changing Cells:			
\$D\$3	2.00%	1.50%	3.00%
Result Cells:			
\$F\$8	50.9	50.2	52.5

The report has been generated. It lists the names of the scenarios, the addresses and values of the cells changed in each scenario and the values of the nominated result cells.

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