

MS EXCEL 2016



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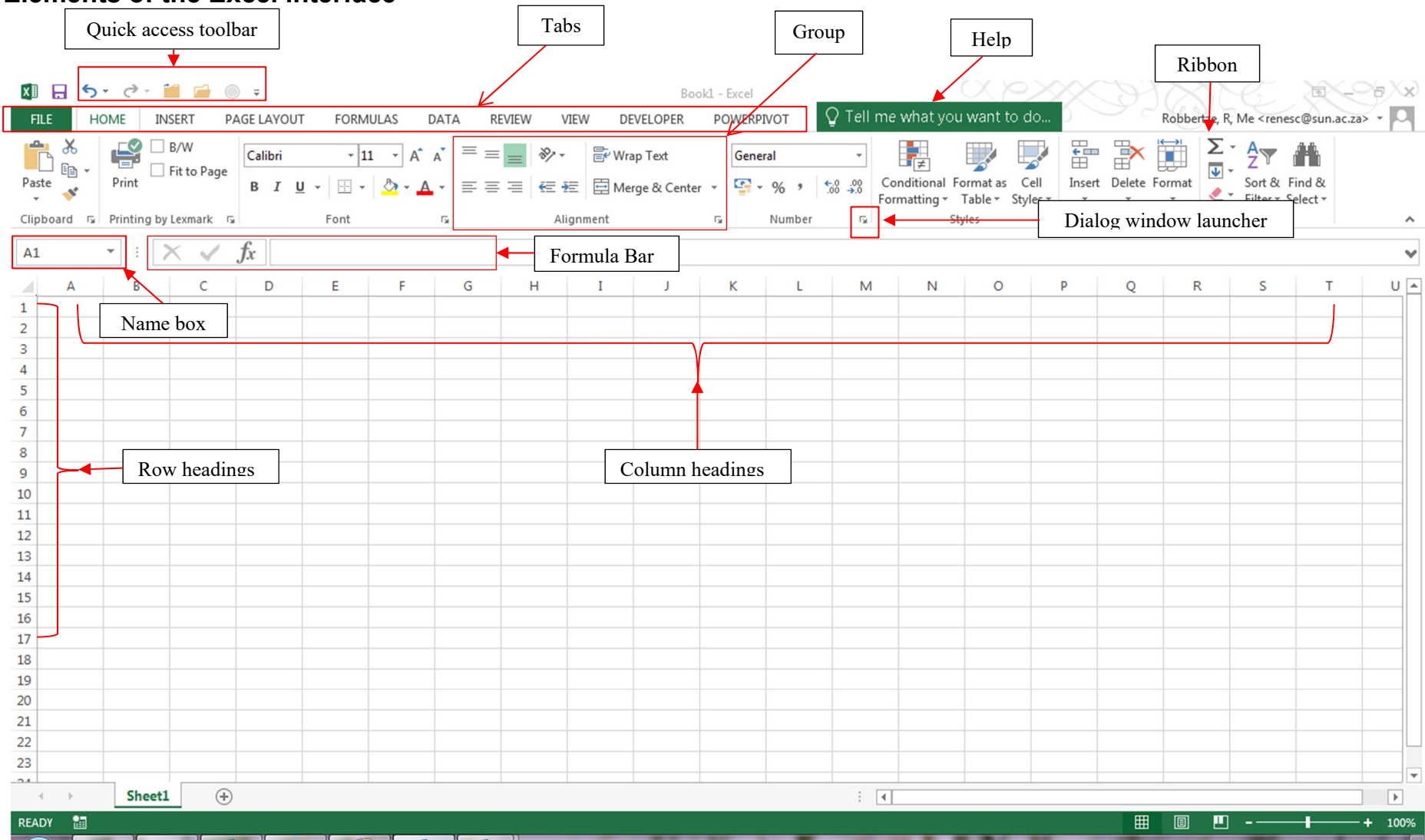
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Worksheet Editing & Formatting

Elements of the Excel interface



Worksheets

A worksheet is an electronic spreadsheet that is used for entering and storing data in Excel. An Excel worksheet contains columns and rows which intersect like a grid to form cells. Excel designates columns with alphabetical headers running across the top of the worksheet, and rows with numerical headers running down the left of the worksheet.

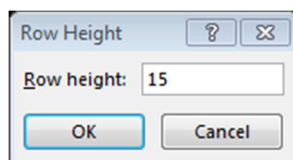
Rows & Columns

How to insert a row: Click on the row number where the row must be inserted, then right click and select Insert on the short-cut menu

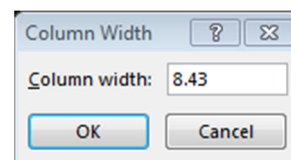
How to insert a column: Click on the column heading where the column must be inserted, then right click and select Insert on the short-cut menu.

Rows – Height & Column – Width

The height of rows can be adjusted by selecting the row heading (number) that needs adjusting > right click > select Row height on the short-cut menu > insert the row height

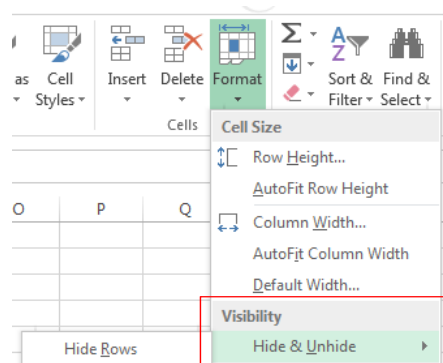


The width of columns can be adjusted by selecting the column heading that needs adjusting > right click > select Column Width on the short-cut menu > insert the column width



Visibility: Hide & Unhide

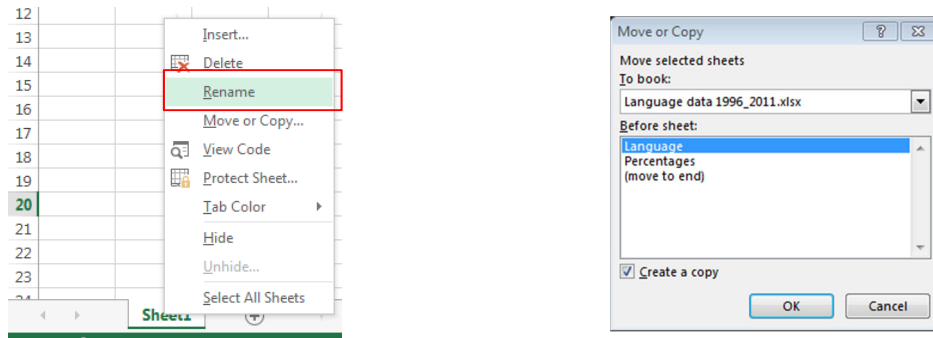
Home tab > Cells group > Format > Visibility



Exercise: Hide column C on the Formatting worksheet

Rename and/or copy a worksheet

Right click on Sheet 1 (sheet name) > click on Rename and type in the new name of the sheet. Worksheets can be copied and placed in the same workbook or in a new/other existing workbook.

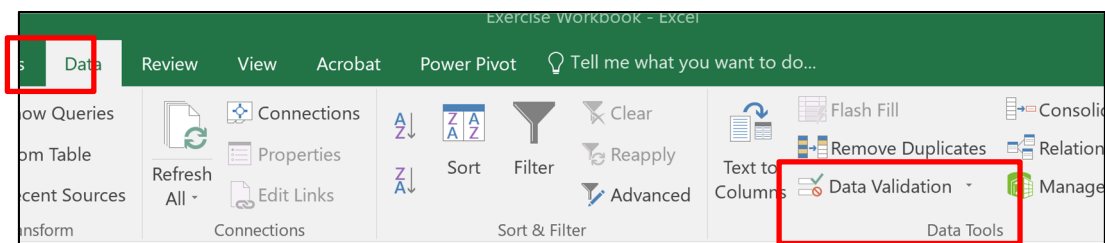


Exercise: Rename worksheet S1 to “Formatting” in the Exercise Workbook and change the tab colour to red

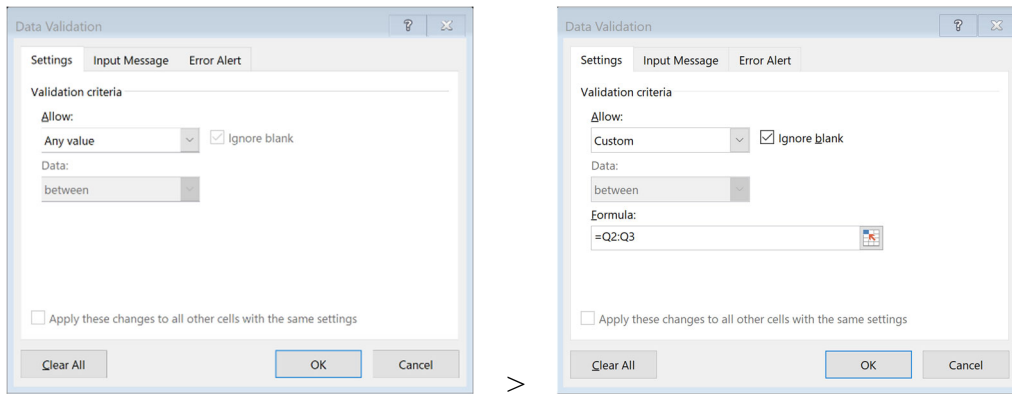
Data Validation

Data Validation is an effective tool in Microsoft Excel when you need to share a spreadsheet with other people and want to keep the content unified. In cells with validation enabled, creator of the spreadsheet can prompt users to choose data from a list, restrict cells to certain data types, or do a few other things that involve complicated custom settings. Basic data validation is easy to setup.

Data Validation is on the Data Tools group on the Data tab



- On the Settings tab, under Allow, select an option:
 - Whole Number - to restrict the cell to accept only whole numbers.
 - Decimal - to restrict the cell to accept only decimal numbers.
 - List - to pick data from the drop-down list.
 - Date - to restrict the cell to accept only date.
 - Time - to restrict the cell to accept only time.
 - Text Length - to restrict the length of the text.
 - Custom – for custom formula.



- Under Data, select a condition:
 - between
 - not between
 - equal to
 - not equal to
 - greater than
 - less than
 - greater than or equal to
 - less than or equal to
- On the Settings tab, under Allow, select an option:
 - Set the other required values, based on what you chose for Allow and Data.
For example, if you select between, then select the Minimum: and Maximum: values for the cell(s).
 - Select the Ignore blank checkbox if you want to ignore blank spaces.
 - If you want to add a Title and message for your rule, select the Input Message tab, and then type a title and input message.
 - Select the Show input message when cell is selected checkbox to display the message when the user selects or hovers over the selected cell(s).
 - Select OK.

Now, if the user tries to enter a value that is not valid, a pop-up appears with the message, “This value doesn’t match the data validation restrictions for this cell.”

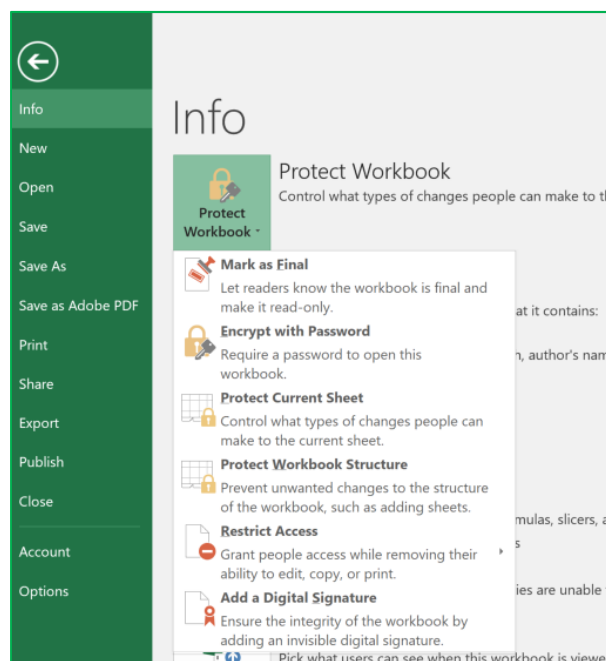
Exercise: Open Sheet S7 (2). Use Data validation to select a list for “OK” and “Poor” (Q2:Q3) to allow the user to select a comment from a dropdown list for column G (Homework comment).

Protection and security in Excel

Excel gives you the ability to protect your work, whether it's to prevent someone from opening a workbook without a password, granting Read-Only access to a workbook, or even just protecting a worksheet so you don't inadvertently delete any formulas.

Warning:

- If you forget or lose your password, Microsoft can't retrieve it for you.
- You should not assume that just because you protect a workbook or worksheet with a password that it is secure - you should always think twice before distributing Excel workbooks that could contain sensitive personal information.
- Worksheet level protection is not intended as a security feature. It simply prevents users from modifying locked cells within the worksheet.

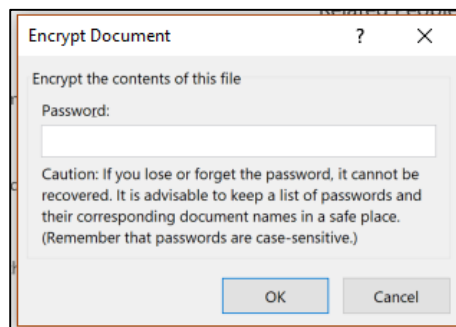


Following are the different options available for protecting your Excel data:

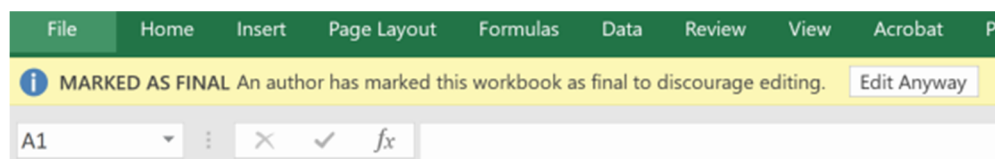
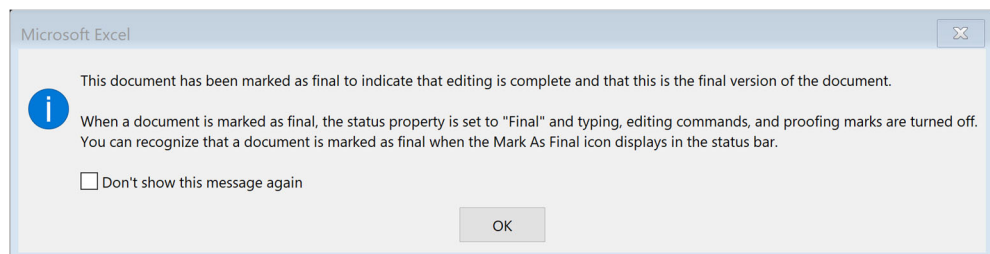
- File-level: This refers to the ability to lock down your Excel file by specifying a password so that users can't open or modify it. You have two choices here:
 - File encryption: When you choose this option, you specify a password and lock the Excel file. This prevents other users from opening the file.

- **Setting a password to open or modify a file:** You specify a password to open or modify a file. Use this option when you need to give Read-only or edit access to different users.

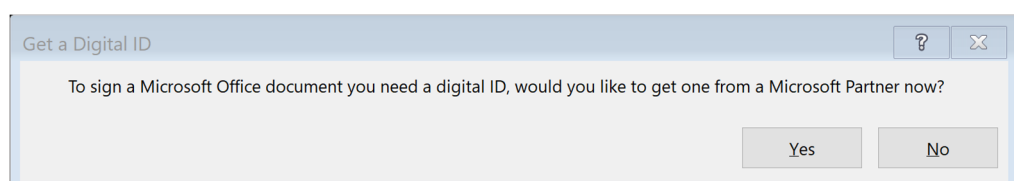
1. Select File > Info.
2. Select the Protect Workbook box and choose Encrypt with Password.
3. Enter a password in the Password box, and then select OK.
4. Confirm the password in the Re-enter Password box, and then select OK.



- **Mark as Final:** Use this option if you want to mark your Excel file as the final version and want to prevent any further changes by other users.

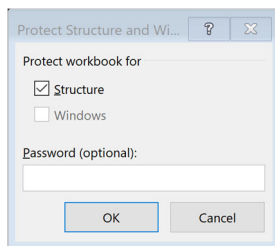
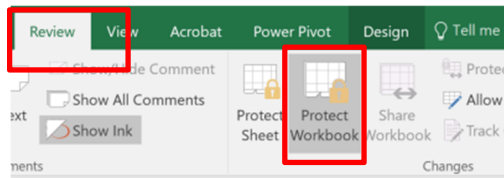


- **Restrict Access:** If your organization has permissions set up using Information Rights Management (IRM), you can apply any of the available IRM permissions to your document.
- **Digital signature:** You can add digital signatures to your Excel file.

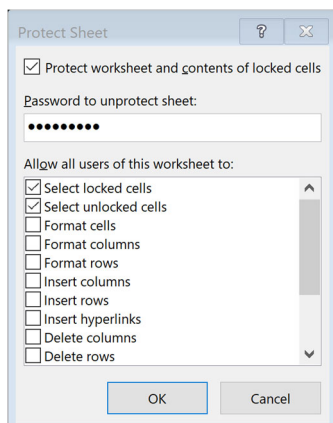


A digital signature is an electronic, encrypted, stamp of authentication on digital information such as e-mail messages, macros, or electronic documents. A signature confirms that the information originated from the signer and has not been altered.

- **Workbook-level:** You can lock the structure of your workbook by specifying a password. Locking the workbook structure prevents other users from adding, moving, deleting, hiding, and renaming worksheets.
 1. Open the Review tab > click on Protect Workbook in the Changes group.
 2. Enter a password in the Password box.
 3. Click OK, and retype the password to confirm it, and then click OK.



- **Worksheet-level:** With sheet protection, you can control how a user can work within worksheets. You can specify what exactly a user can do within a sheet, thereby making sure that none of the important data in your worksheet are affected. For example, you might want a user to only add rows and columns, or only sort and use AutoFilter. Once sheet protection is enabled, you can protect other elements such as cells, ranges, formulas, and ActiveX or Form controls.



Protect a worksheet

To prevent other users from accidentally or deliberately changing, moving, or deleting data in a worksheet, you can lock the cells on your Excel worksheet and then protect the sheet with a password. With worksheet protection, you can make only certain parts of the sheet editable and users will not be able to modify data in any other region in the sheet.

Enable worksheet protection

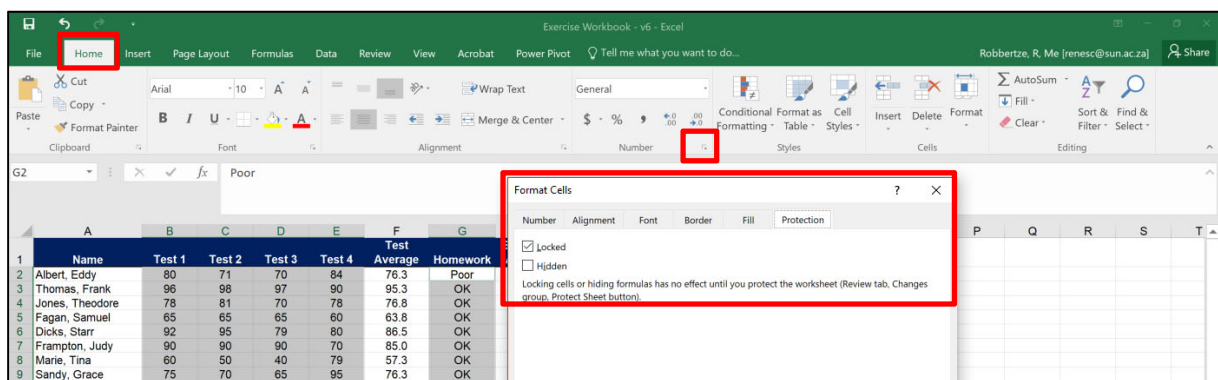
Worksheet protection is a two-step process: the first step is to unlock cells that others can edit, and then you can protect the worksheet with or without a password.

Step 1: Unlock any cells that needs to be editable

- In your Excel file, select the worksheet tab that you want to protect.
- Select the cells that others can edit.

To lock or unlock cells in Microsoft Excel 2016 and 2013.

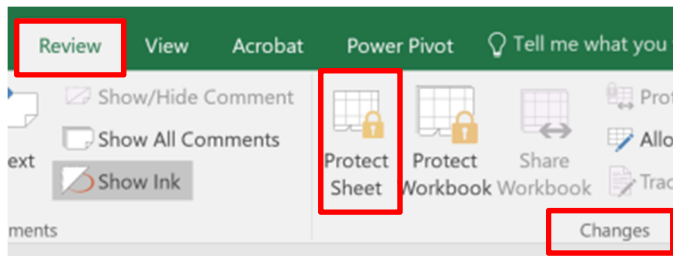
- Select the cells you wish to modify.
- Open the Home tab > In the Cells area, select Format > Format Cells
- Select the “Protection” tab.
- Uncheck the box for “Locked” to unlock the cells. Check the box to lock them. Select “OK”.



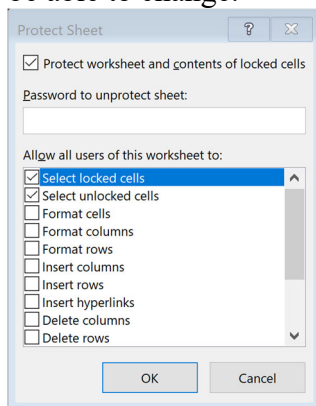
Step 2: Protect the worksheet

Next, select the actions that users should be allowed to take on the sheet, such as insert or delete columns or rows, edit objects, sort, or use AutoFilter, to name a few. Additionally, you can also specify a password to lock your worksheet. A password prevents other people from removing the worksheet protection—it needs to be entered to unprotect the sheet.

- Open the Review tab > click on Protect Sheet in the Changes group



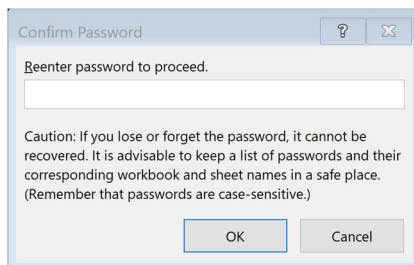
- In the Allow all users of this worksheet to list, select the elements you want people to be able to change.



Option	Allows users to
Select locked cells	Move the pointer to cells for which the Locked box is checked on the Protection tab of the Format Cells dialog box. By default, users are allowed to select locked cells.
Select unlocked cells	Move the pointer to cells for which the Locked box is unchecked on the Protection tab of the Format Cells dialog box. By default, users can select unlocked cells, and they can press the TAB key to move between the unlocked cells on a protected worksheet.
Format cells	Change any of the options in the Format Cells or Conditional Formatting dialog boxes. If you applied conditional formatting before you protected the worksheet, the formatting continues to change when a user enters a value that satisfies a different condition.
Format columns	Use any of the column formatting commands, including changing column width or hiding columns (Home tab, Cells group, Format button).
Format rows	Use any of the row formatting commands, including changing row height or hiding rows (Home tab, Cells group, Format button).
Insert columns	Insert columns.
Insert rows	Insert rows.
Insert hyperlinks	Insert new hyperlinks, even in unlocked cells.
Delete columns	If Delete columns is protected and Insert columns is not protected, a user can insert columns but cannot delete them.
Delete rows	If Delete rows is protected and Insert rows is not protected, a user can insert rows but cannot delete them.
Sort	Use any commands to sort data (Data tab, Sort & Filter group). Users can't sort ranges that contain locked cells on a protected worksheet, regardless of this setting.
Use AutoFilter	Use the drop-down arrows to change the filter on ranges when AutoFilters are applied. Users cannot apply or remove AutoFilter on a protected worksheet, regardless of this setting.

Use PivotTable reports	Format, change the layout, refresh, or otherwise modify PivotTable reports, or create new reports.
Edit objects	Doing any of the following: Make changes to graphic objects including maps, embedded charts, shapes, text boxes, and controls that you did not unlock before you protected the worksheet. For example, if a worksheet has a button that runs a macro, you can click the button to run the macro, but you cannot delete the button. Make any changes, such as formatting, to an embedded chart. The chart continues to be updated when you change its source data. Add or edit comments.
Edit scenarios	View scenarios that you have hidden, making changes to scenarios that you have prevented changes to, and deleting these scenarios. Users can change the values in the changing cells, if the cells are not protected, and add new scenarios.

- Optionally enter a password in the Password to unprotect sheet box and click OK. Re-enter the password in the Confirm Password dialog box and click OK.



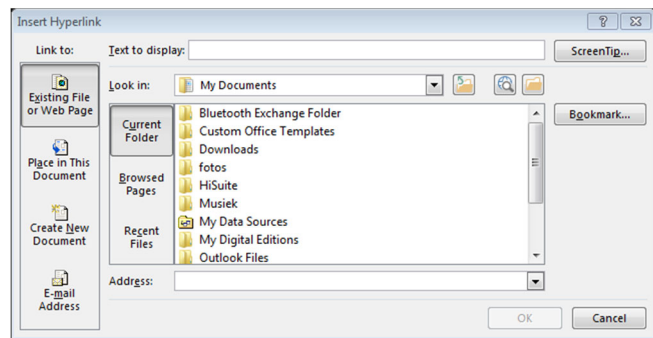
(<https://support.office.com/en-us/article/protection-and-security-in-excel-be0b34db-8cb6-44dd-a673-0b3e3475ac2d>)

Exercise: Unlock the cells A2:E15 & G2:G15 on Sheet7 in the workbook. Then protect the worksheet by allowing the user to do everything except to insert and delete columns.

Hyperlinks

Hyperlinks automate Excel 2016 worksheets by making the opening of other Office documents and Excel workbooks and worksheets just a mouse click away. It doesn't matter whether these documents are located on your hard drive, a server on your LAN (Local Area Network), or web pages on the Internet or a company's intranet. You can also set up e-mail hyperlinks that automatically address messages to co-workers with whom you routinely correspond, and you can attach Excel workbooks or other types of Office files to these messages.

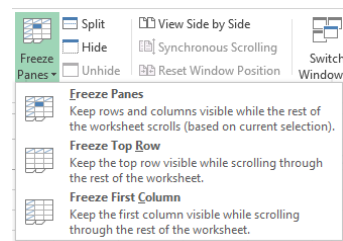
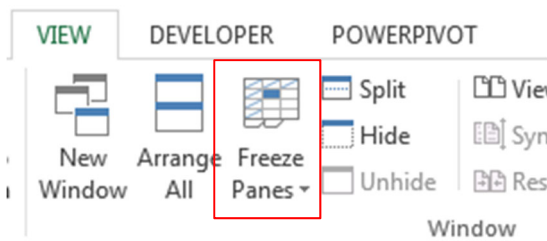
The Hyperlink function is situated on the Links group on the Insert tab.



Exercise: Add a hyperlink in cell A1 on worksheet S9 in the Exercise Workbook to worksheet S8 cell A1 in the same workbook

Freeze panes

By freezing panes, you can keep a particular portion of a worksheet static, while you scroll through other areas. You can access the Freeze Panes option from the Freeze Panes drop-down list in the Windows group on the View tab.

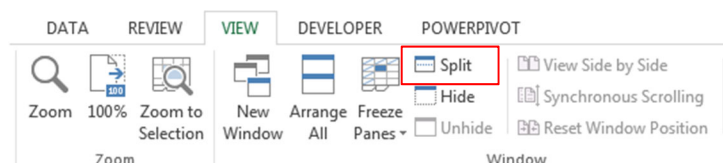


Exercise: Freeze row 1 on worksheet S2 in the Exercise Workbook

The Split Command

When you work with large worksheets, you may need to view different portions of a worksheet simultaneously. Using the Split command, you can split the worksheet into multiple resizable panes to view its various parts by scrolling through different panes. You can resize these panes by dragging the split bars that separate them.

The Split command is in the Windows group on the View tab.



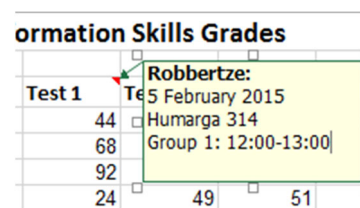
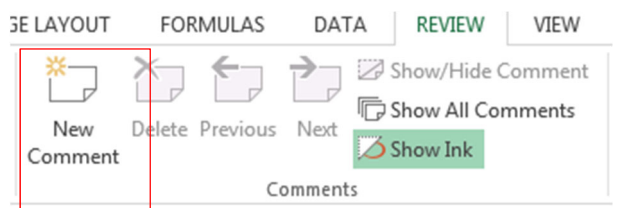
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
1	WATD_ID	Afrikaans	English	isiNdebele	isiXhosa	isiZulu	Sepedi	Sesotho	Setswana	Sign language	isiSwati	Tshivenda	isiXitsonga	Other	Unspecified	TOTAL
2	210001001	4000	187	2	724	3	1	22	22	1	1	2	0	39	49	5348
3	210001002	2333	605	2	1405	7	1	14	19	8	1	0	0	40	896	5336
4	210001003	1279	43	0	85	3	1	6	4	10	3	1	0	14	0	3428
5	210001004	1271	118	6	126	0	1	6	29	4	0	1	0	12	782	4360
6	210001005	3548	44	2	41	5	1	6	17	2	0	1	0	15	0	3681
7	210001006	1188	40	5	2463	6	3	9	12	9	4	0	0	16	0	3575
1403	63802010	8	27	31	60	20	1	78	1328	10	5	5	3	9	0	1585
1404	63802011	355	50	24	14	6	1	45	3705	10	3	4	6	36	120	4387
1405	63802012	34	55	42	235	101	1	552	2753	9	16	3	1	16	0	5625
1406	63802013	248	81	78	88	34	3	240	4810	9	5	4	1	16	0	5632
1407	63802014	58	73	42	53	48	2	143	4591	26	2	7	6	28	0	5101
1408	63802021	686	209	32	154	72	3	60	4414	8	3	2	18	16	1	5612
1409	63802022	6	46	29	169	56	1	99	1845	9	1	0	0	17	0	4285
1410	63802023	117	53	25	30	54	1	316	2887	42	0	2	0	7	0	2537
1411	63802024	16	66	24	81	71	3	155	3697	18	1	2	2	45	0	4332
1412	63802025	34	25	11	131	57	3	112	3257	11	1	0	3	13	0	3665
1413	63802026	30	52	31	299	40	3	154	3746	6	0	0	0	18	0	4384
1414	63802027	135	101	17	68	52	3	238	4164	7	0	11	10	42	90	4853
1415	63802028	666	47	21	105	25	1	68	1854	10	0	1	8	65	74	2946
1416	63802029	943	144	56	108	84	3	794	2461	14	1	0	1	17	0	5495

Exercise: Split worksheet S15 in the Exercise workbook and see how it works

Comments

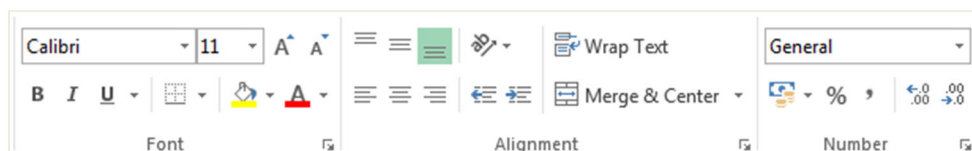
Microsoft Excel has the ability of creating comments in each of the cells. Comments enable a user to get additional information about the cell such as what the value represents.

Click on the cell where the comment needs to be inserted > Click on New Comment in the Comments group on the Review tab



Exercise: Add comments on worksheet S5 (test info)

Formatting

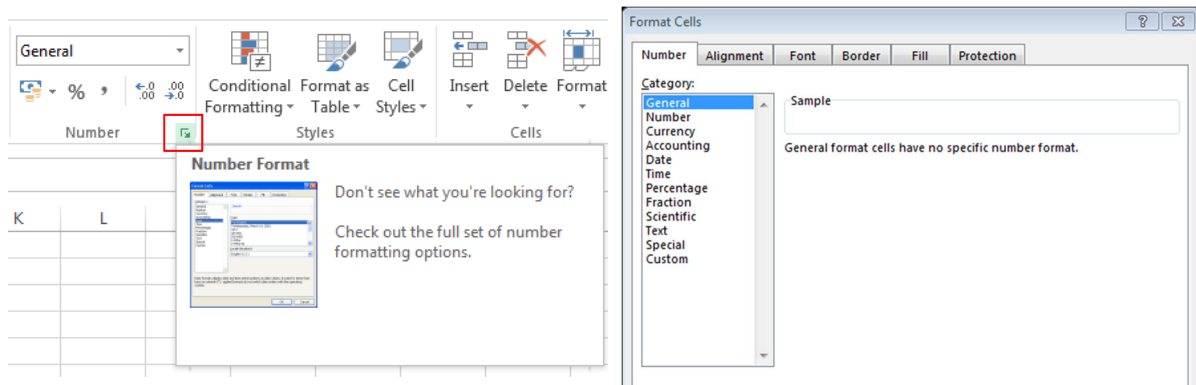


Formatting cells

Home tab > Number group > Format cells dialog window

When you type something into a cell in a worksheet, Excel makes use of one of the following decisions regarding the type of data you entered:

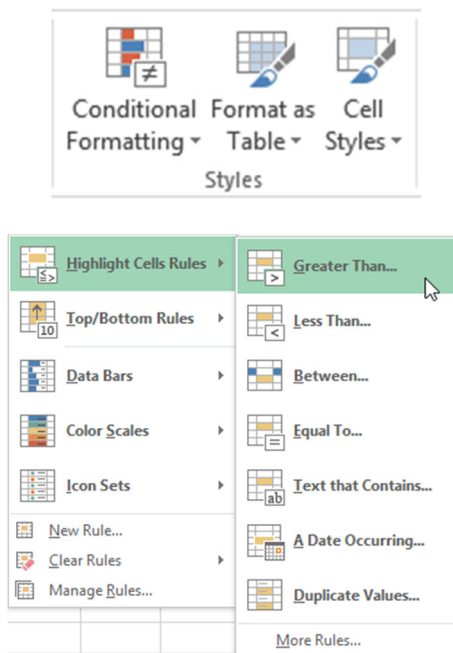
- You entered a value.
- You entered a date or time.
- You entered some text.
- You entered a formula. [You signal that you're entering a formula by beginning the cell entry with an equal sign (=).]



Exercise: Follow the instructions on worksheet S1

Conditional formatting: Highlight Cells Rules, Data bars & Icon Sets

Let's imagine you have a worksheet with thousands of rows of data. It would be extremely difficult to see patterns and trends just from examining the raw information. Similar to charts and sparklines, conditional formatting provides another way to visualize data and make worksheets easier to understand. Conditional formatting allows you to automatically apply formatting—such as colours, icons, and data bars—to one or more cells based on the cell value. Conditional formatting is situated in the Styles group on the Home tab.



Exercise:

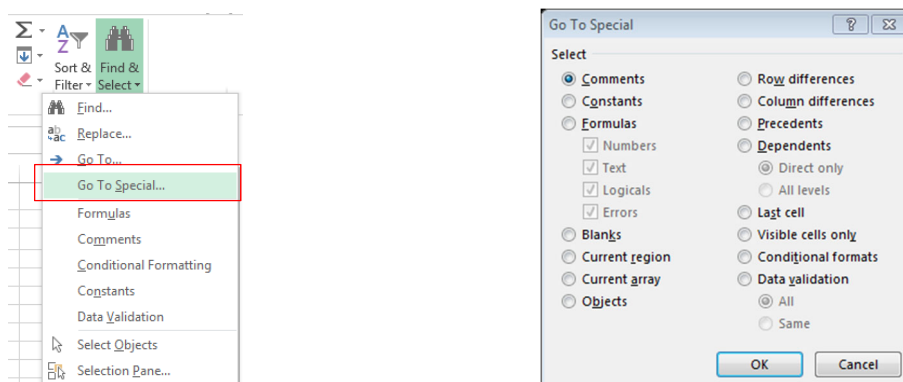
Insert Data bars on worksheet S5 for test 1, test 2 and test 3.

Use the Highlight Cells Rules function to change all marks that is below 50% to red on worksheet S5.

Go To dialog box

Use the Go To dialog box when you want to locate specific types of cells in your worksheets.

The Go To dialog box is in Editing group on the Home tab.



The options available in the Go To Special dialog box.

Option	What It Selects
Comments	Only the cells that contain cell comments.
Constants	All non-empty cells that don't contain formulas. This option is useful if you have a model set up and you want to clear out all input cells (so you can enter new values), but keep the formulas intact. Use the check boxes under the Formulas option to choose which cells to include.
Formulas	Cells that contain formulas. Qualify this choice by selecting the check box for the type of result: Numbers, Text, Logicals (the logical values TRUE or FALSE), or Errors.
Blanks	All empty cells.
Current	Region A rectangular range of cells around the active cell. This range is determined by surrounding blank rows and columns. You can also use the Ctrl+A shortcut key combination.
Current Array	The entire array (used for multicell array formulas).
Objects	All graphical objects on the worksheet. This is useful if you want to delete all objects.
Row Differences	If one row is selected, cells that are different from the active cell. If more than one row is selected, the same comparison is done, but the comparison cell for each row is the cell in the same column as the active cell.
Column Differences	If one column is selected, cells that are different from the active cell. If more than one column is selected, the same comparison is done, but the comparison cell for each column is the cell in the same rows as the active cell.
Precedents	Cells that are referred to in the formulas in the active cell or selection (limited to the active sheet). You can select either direct precedents or precedents at any level.
Dependents	Cells with formulas that refer to the active cell or selection (limited to the active sheet). You can select either direct dependents or dependents at any level.
Last Cell	The lower right cell in the worksheet that contains data or formatting.

Option		What It Selects
Visible Only	Cells	Only visible cells in the selection. This option is useful when dealing with outlines or a filtered list.
Conditional Formats		Cells that have a conditional format applied (by using the Home→Styles→Conditional Formatting command).
Data Validation		Cells that are set up for data entry validation (by using the Data→Data Tools→Data Validation command). The All option selects all cells of this type. The Same option selects only the cells that have the same validation rules as the active cell.

(Walkenbach, 2010:21)

Exercise: Use the Go to function and look for comments on worksheet S5

Finding and replacing text

You may want to remove a common leading string, such as a label followed by a colon and space, or a suffix, such as a parenthetic phrase at the end of the string that is obsolete or unnecessary. You can do this by finding instances of that text and then replacing it with no text or other text.

The Find command thus allows you to locate specific data within a workbook. The Find tab of the Find and Replace dialog box contains various options that allow you to perform the search.

You can use wildcard characters, such as an asterisk (*) or a question mark (?), in your search criteria:

- Use the asterisk to find any string of characters. For example, s*d finds "sad" and "started".
- Use the question mark to find any single character. For example, s?t finds "sat" and "set".

You can find asterisks, question marks, and tilde characters (~) in worksheet data by preceding them with a tilde character in the Find what box. For example, to find data that contains "?", you would type ~? as your search criteria.

Click Options to further define your search, and then do any of the following:

- To search for data in a worksheet or in an entire workbook, in the Within box, select Sheet or Workbook.
- To search for data in specific rows or columns, in the Search box, click By Rows or By Columns.

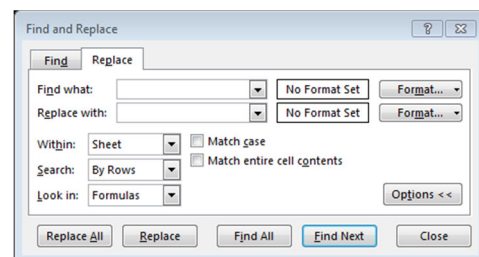
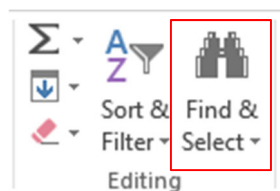
- To search for data with specific details, in the Look in box, click Formulas, Values, or Comments.
- To search for case-sensitive data, select the Match case check box.
- To search for cells that contain just the characters that you typed in the Find what box, select the Match entire cell contents check box.

If you want to search for text or numbers that also have specific formatting, click Format, and then make your selections in the Find Format dialog box.

- If you want to find cells that just match a specific format, you can delete any criteria in the Find what box, and then select a specific cell format as an example. Click the arrow next to Format, click Choose Format From Cell, and then click the cell that has the formatting that you want to search for.

The Replace command allows you to replace existing data in a workbook with new data. To replace text or numbers, type the replacement characters in the Replace with box (or leave this box blank to replace the characters with nothing), and then click Find or Find All.

The Find & Replace dialog box is in Editing group on the Home tab.



Exercise: Replace the surname Smit with Smith in S5

Find Blank Cells In Excel With A Colour

In Excel you can have a data set that comes from an external source which is not always formatted to your liking. One of the most common things you may encounter are blank cells in your Excel data which can hinder your analysis, especially if you are using a Pivot Table to analyse the data.

To find blank cells in Excel you will need to highlight all your data set and bring up the Go To Special ...> Blanks.

Then you can fill in the blank cells with a colour and filter by that same colour to drill down to these blank cells and take some formatting action.

Exercise: Open sheet S15. Stand in A1, press Ctrl & Shift & End together to select the dataset and then use Go to Special to find all the blank cells and delete them.

Automatically Filling a Range with a Series

Excel has an Autofill feature that can complete a series:

1. Enter 1 into cell A1.
2. Enter 2 into cell A2.
3. Select A1:A2.
4. Move the mouse cursor to the lower right corner of cell A2 (the cell's fill handle) and when the mouse pointer turns into a black plus sign, drag down the column to fill in the cells.

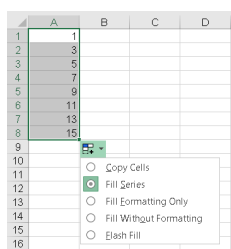
The data entered in Steps 1 and 2 provide Excel with the information it needs to determine which type of series to use. If you entered 3 into cell A2, the series would then consist of odd integers: 1, 3, 5, 7, and so on.

Autofill also works with dates and even a few text items — day names and month names. The following table lists a few examples of the types of data that can be Autofilled.

First Value	Autofilled Values
Sunday	Monday, Tuesday, Wednesday, and so on
Quarter-1	Quarter-2, Quarter-3, Quarter-4, Quarter-1, and so on
Jan	Feb, Mar, Apr, and so on
January	February, March, April, and so on
Month 1	Month 2, Month 3, Month 4, and so on

(Walkenbach, 2010:85)

Enter a series > select the last 2 numbers in the range > right click and copy down to get the following options from the mini toolbar:

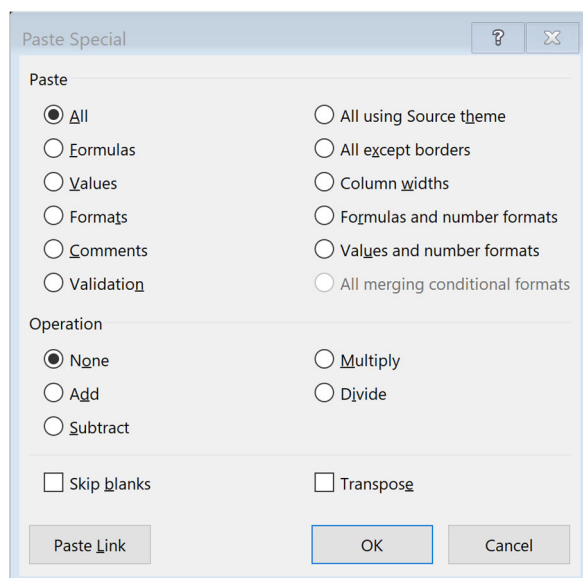


Exercise: Open worksheet S4 and type 1 in cell A1 and 3 in cell A2. Select A1 and A2 and copy a few cells down. Use the Fill series option to complete the series.

Paste special

If you want to paste only a specific aspect of the copied data like its formatting or value, you would use one of the Paste Special options.

Open the Home tab > Clipboard group > Paste > Paste Special. [Or press Ctrl+Alt+V to open the Paste Special dialog.]



To pick an option, press the underlined letter for that option. For example, press the letter C to pick the Comments option.

Pick this option	To	Keyboard shortcut
All	Paste all cell contents and formatting.	Press A
Formulas	Paste only the formulas as entered in the formula bar.	Press F
Values	Paste only the values (not the formulas).	Press V
Formats	Paste only the copied formatting.	Press T
Comments	Paste only comments attached to the cell.	Press C
Validation	Paste only the data validation settings from copied cells.	Press N
All using Source theme	Paste all cell contents and formatting from copied cells.	Press H
All except borders	Paste all cell contents without borders.	Press X
Column widths	Paste only column widths from copied cells.	Press W
Formulas and number formats	Paste only formulas and number formats from copied cells.	Press R
Values and number formats	Paste only the values (not formulas) and number formats from copied cells.	Press U

Mathematical Operation

Specify which mathematical operation, if any that you want to apply to the copied data. For example, put 10 in a cell, press Ctrl+C to copy it. Next, select the cells you want to apply the operation to, and go to Home > Clipboard > Paste > Paste Special > select the Operation you want, such as Multiplication, and press OK.

Paste Operation	Action
None	Specifies that no mathematical operation will be applied to the copied data.
Add	Adds the copied data to the data in the destination cell or range of cells.
Subtract	Subtracts the copied data from the data in the destination cell or range of cells.
Multiply	Multiplies the copied data with the data in the destination cell or range of cells.
Divide	Divides the copied data by the data in the destination cell or range of cells.

Other

Paste Operation	Action
Skip blanks	Avoids replacing values in your paste area when blank cells occur in the copy area when you select this check box.
Transpose	Changes columns of copied data to rows and vice versa when you select this check box.
Paste Link	Links the pasted data on the active worksheet to the copied data.

Transforming and rearranging columns and rows - Transpose

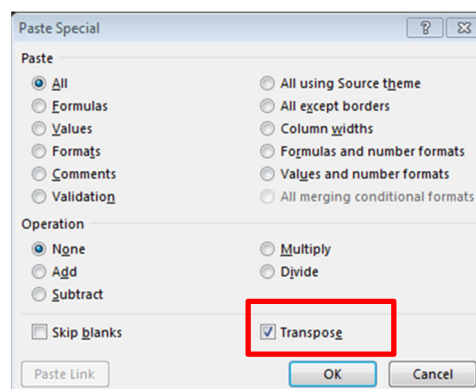
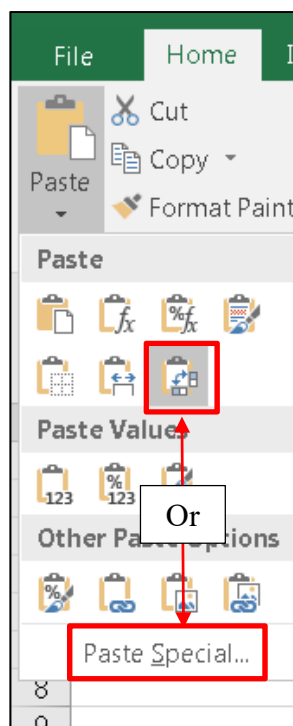
Most of the analysis and formatting features in Office Excel assume that the data exists in a single, flat two-dimensional table. Sometimes you may want to make the rows become columns, and the columns become rows. At other times, data is not even structured in a tabular format, and you need a way to transform the data from a nontabular to a tabular format.

Use the Transpose function to make the rows become columns, and the columns become rows.

- There is an easy way to convert your rows to columns and vice versa using the Transpose feature in Excel.
- Select the cells containing the headings and data you want to transpose.
- Click Copy or press Ctrl + C.
- Click in a blank cell on the worksheet. This cell will be the top, left corner of the new table of data.

- Click the down arrow on the Paste button and select Paste Special from the drop-down menu.
- On the Paste Special dialog box, select the Transpose check box so there is a check mark in the box and click OK.
- The rows become the columns and the columns become the rows. The original set of data still exists. You can select those cells and delete the headings and data, if desired.

Sales Group:	Northeast		Southeast		Northwest		Southwest	
Consulting	R	14 307	R	13 121	R	14 831	R	16 988
Marketing	R	15 045	R	14 772	R	11 045	R	10 715
Outsourcing	R	24 261	R	26 593	R	23 192	R	21 789
Bundling	R	12 377	R	9 200	R	13 056	R	8 512
Region	Consulting	Marketing	Outsourcing	Bundling				
Northeast	R	14 307	R	15 045	R	24 261	R	12 377
Southeast	R	13 121	R	14 772	R	26 593	R	9 200
Northwest	R	14 831	R	11 045	R	23 192	R	13 056
Southwest	R	16 988	R	10 715	R	21 789	R	8 512



Quarter 1					Quarter 2				
Sales Group	Northwest	Southeast	Northwest	Southwest	Sales Group	Northwest	Southeast	Northwest	Southwest
Consulting	R 14 307	R 13 121	R 14 831	R 16 988	Consulting	R 16 307	R 17 121	R 18 831	R 16 500
Marketing	R 15 045	R 14 772	R 11 045	R 10 715	Marketing	R 25 045	R 12 772	R 10 545	R 17 715
Outsourcing	R 24 261	R 26 593	R 23 192	R 21 789	Outsourcing	R 24 261	R 26 593	R 27 201	R 21 001
Bundling	R 12 377	R 9 200	R 13 056	R 8 512	Bundling	R 15 377	R 10 401	R 13 056	R 10 512
Quarter 3					Quarter 4				
Sales Group	Northwest	Southeast	Northwest	Southwest	Sales Group	Northwest	Southeast	Northwest	Southwest
Consulting	R 15 307	R 17 351	R 19 500	R 14 500	Consulting	R 19 921	R 13 201	R 14 231	R 17 108
Marketing	R 20 045	R 13 901	R 12 457	R 12 365	Marketing	R 18 035	R 19 374	R 14 846	R 15 289
Outsourcing	R 24 450	R 30 593	R 17 201	R 23 201	Outsourcing	R 21 012	R 25 406	R 21 351	R 25 048
Bundling	R 14 677	R 8 401	R 12 072	R 11 512	Bundling	R 9 783	R 7 267	R 11 144	R 12 681
Quarter	Region	Consulting	Marketing	Outsourcing	Bundling				
1	Northwest	R 14 307	R 15 045	R 24 261	R 12 377				
1	Southeast	R 13 121	R 14 772	R 26 593	R 9 200				
1	Northwest	R 14 831	R 11 045	R 23 192	R 13 056				
1	Southwest	R 16 988	R 10 715	R 21 789	R 8 512				
2	Northwest	R 16 307	R 25 045	R 24 261	R 15 377				
2	Southeast	R 17 121	R 12 772	R 26 593	R 10 401				
2	Northwest	R 18 831	R 10 545	R 27 201	R 13 056				
2	Southwest	R 16 500	R 17 715	R 21 001	R 10 512				
3	Northwest	R 15 307	R 20 045	R 24 450	R 14 677				
3	Southeast	R 17 351	R 13 901	R 30 593	R 8 401				
3	Northwest	R 19 500	R 12 457	R 17 201	R 12 072				
3	Southwest	R 14 500	R 12 365	R 23 201	R 11 512				
4	Northwest	R 19 921	R 18 035	R 21 012	R 9 783				
4	Southeast	R 13 201	R 19 374	R 25 406	R 7 267				
4	Northwest	R 14 231	R 14 846	R 21 351	R 11 144				
4	Southwest	R 17 108	R 15 289	R 25 048	R 12 681				

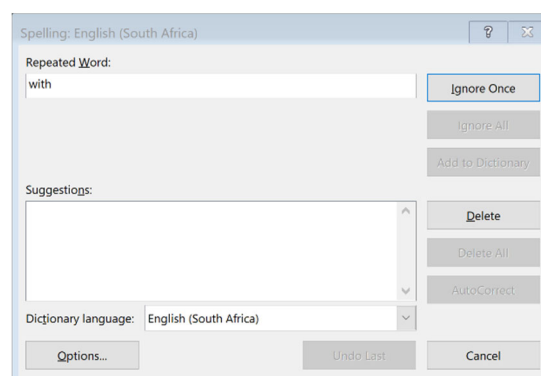
Exercise: Use the Transpose function to switch the rows and columns on worksheet S10 to form a more usable, integrated table.

[Source: <https://support.office.com/en-us/article/paste-special-when-copying-from-excel-6eafd4c6-388c-4938-a7a9-a76afcd5f5c3>]

Spell checking

You can use a spell checker to not only find misspelled words, but to find values that are not used consistently, such as product or company names, by adding those values to a custom dictionary.

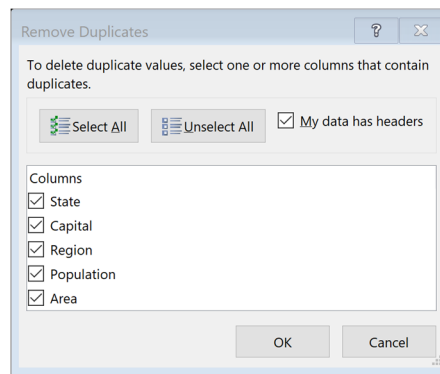
Open the Review tab > Proofing group > Spelling



Removing duplicate rows

Duplicate rows are a common problem when you import data. It is a good idea to filter for unique values first to confirm that the results are what you want before you remove duplicate values.

Open the Data tab > Data Tools group > Remove Duplicates



In Excel, you have several ways to filter for unique values or remove duplicate values:

- To filter for unique values, use the Advanced command in the Sort & Filter group on the Data tab.
- To remove duplicate values, use the Remove Duplicates command in the Data Tools group on the Data tab.
- To highlight unique or duplicate values, use the Conditional Formatting command in the Style group on the Home tab.

Exercise: Find the duplicate entry on sheet S3 and remove it (look at Capital).

Cell & Range Names

A straightforward way of constructing complex formulas lies in using names instead of cell addresses to refer to ranges.

A range name is a descriptive label assigned to one or more cells for referring to them in a formula. The cells may be located anywhere in a workbook; in case of multiple cell ranges, they may be adjacent or nonadjacent. When you select a range of cells that have been assigned a name, the range name is displayed in the Name Box. A range name must start with a letter, cannot contain spaces, and can be up to 255 characters long.

How to apply Cell and Range Names

- Select the range you want to name
- Click in the name box, type a range name of your choice and press Enter

How to verify that the range is correctly named:

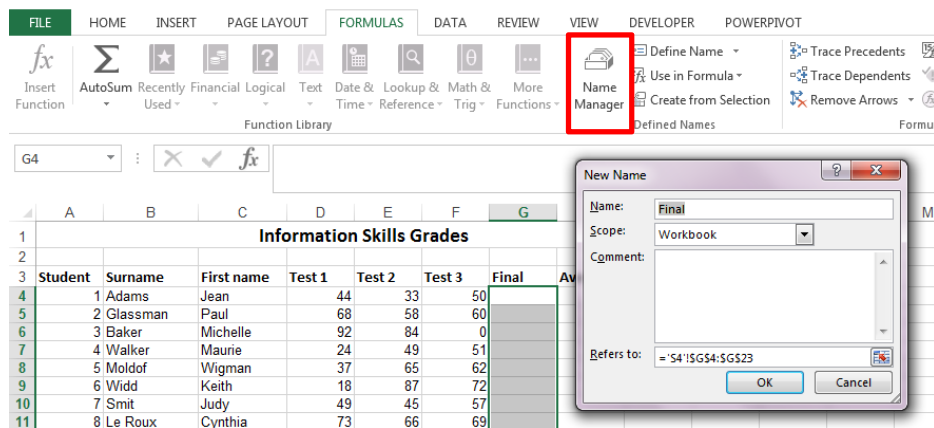
- Click any cell outside the selected range
- Click the Name box Drop-down arrow and select the range name

			Test1			
						44
	A	B	C	D	E	F
1						
2						
3	Student	Surname	First name	Test 1	Test 2	Test 3
4	1	Adams	Jean	44	33	50
5	2	Glassman	Paul	68	58	60
6	3	Baker	Michelle	92	84	0
7	4	Walker	Maune	24	49	51
8	5	Moldof	Wigman	37	65	62
9	6	Widd	Keith	18	87	72
10	7	Smit	Judy	49	45	57
11	8	Le Roux	Cynthia	73	66	69
12	9	Solomon	Wynand	64	63	71
13	10	Van Wyk	Koos	39	55	49
14	11	Potgieter	Susan	75	70	68
15	12	Arendse	Pieter	55	49	61
16	13	Colon	Sandy	57	65	68
17	14	Kirstie	Simon	69	73	75
18	15	Swart	Louis	62	0	66
19	16	Van Aswegen	Lourens	54	51	50
20	17	Maas	Debregt	51	59	64
21	18	Outhuizen	Antonia	66	68	71

Exercise: Add Range names for the Tests 1-3 on worksheet S5.

Name Manager

The Name Manager on the Formulas tab can be used to Edit, Delete and/or create new name ranges

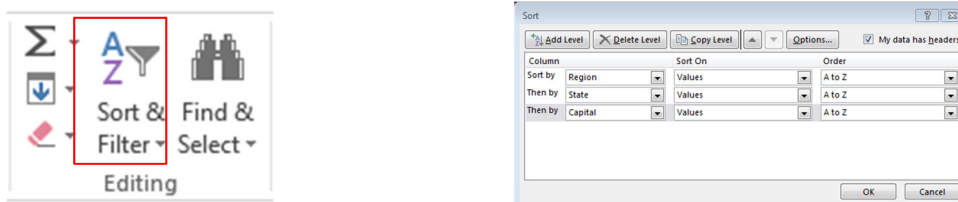


Exercise: Add a Range name for the Final marks on worksheet S5 using the Name Manager.

Sort & Filter

Custom Sort – Sorting on more than one column

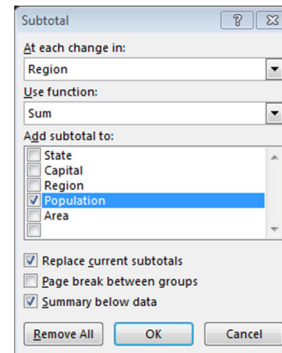
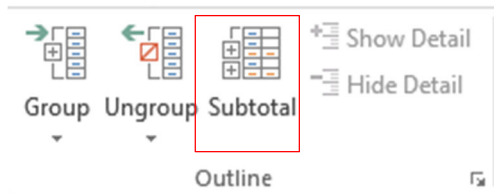
The Custom Sort function is in the Editing group under Sort & Filter on the Home tab



Exercise: Sort the information on worksheet S2 in the Exercise workbook first according to Region and then State.

Add Subtotals

Work out the total of several rows of related data by automatically inserting subtotals for the selected cells. The Subtotal function is in the Outline group on the Data tab



	A	B	C	D	E	F
1	State	Capital	Region	Population	Area	
2	Delaware	Dover	Middle Atlantic	783600	2057	
3	Maryland	Annapolis	Middle Atlantic	5296486	10577	
4	New Jersey	Trenton	Middle Atlantic	8414350	7836	
5	New York	Albany	Middle Atlantic	18976457	49576	
6	Pennsylvania	Harrisburg	Middle Atlantic	12281054	45333	
7			Middle Atlantic Total	45751947		
8	Arizona	Phoenix	Mountain	5130632	113989	
9	Colorado	Denver	Mountain	4301261	104247	
10	Idaho	Boise	Mountain	1293953	83557	
11	Montana	Helena	Mountain	902195	147138	
12	Nevada	Carson City	Mountain	1998257	110540	
13	New Mexico	Santa Fe	Mountain	1819046	121666	
14	Utah	Salt Lake City	Mountain	2233169	84916	
15	Wyoming	Cheyenne	Mountain	493782	97914	
16			Mountain Total	18172295		
17	Connecticut	Hartford	New England	3405565	5009	
18	Maine	Augusta	New England	1274923	33215	
19	Massachusetts	Boston	New England	6349097	8257	
20	New Hampshire	Concord	New England	1235786	9304	
21	Rhode Island	Providence	New England	1048319	1214	
22	Vermont	Montpelier	New England	608827	9609	
23			New England Total	13922517		
24	Illinois	Springfield	North Central	12414993	66400	

	A	B	C	D
1	State	Capital	Region	Population
7			Middle Atlantic Total	45751947
16			Mountain Total	18172295
23			New England Total	13922517
37			North Central Total	70473261
43			Pacific Total	45025637
50			South Atlantic Total	45117015
59			South Central Total	48467660
60			Grand Total	286930332

Exercise: Insert Subtotals on S2 in the Exercise workbook

Make the following selections:

At each change in Region

Add subtotals to the Population

Working with tables

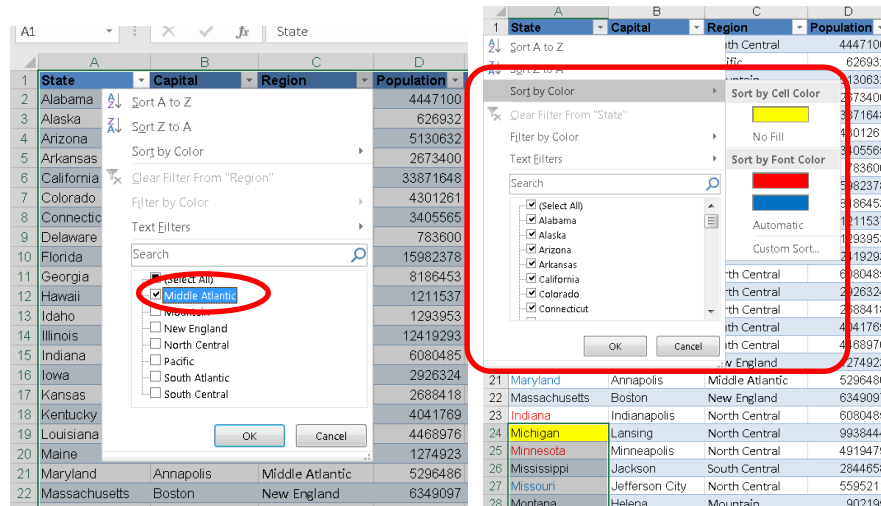
A table is a rectangular range of data that has a row of text headings to describe the contents of each column. In Excel, you can arrange data into an 'official' table by selecting any cell within the data range and click Table in the Tables group on the Insert tab.

Converting a data range into a table extends functionality, which you can then use to work more efficiently and effectively.

Reasons why you should consider using a table instead of an ordinary data range.

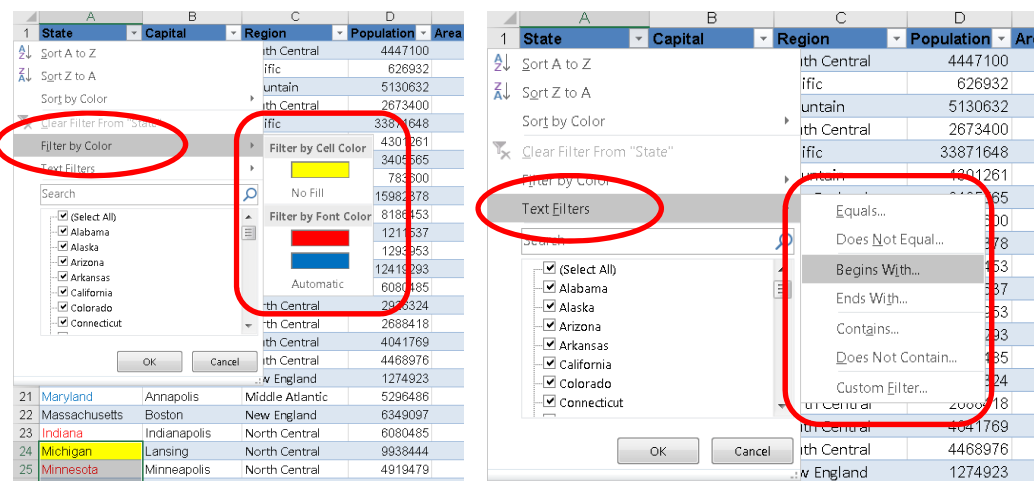
1. Easy sorting and filtering

Excel automatically adds filter controls to the header row when you convert a range into a table. You do not have to do a thing but use them to sort and filter the table's records. You can execute a sort quickly by choosing a criteria item or colour from the drop-down.



If I wanted to see information in red, just filter that colour (but keep in mind that you could just as easily also filter by various text values, characters, etc.)

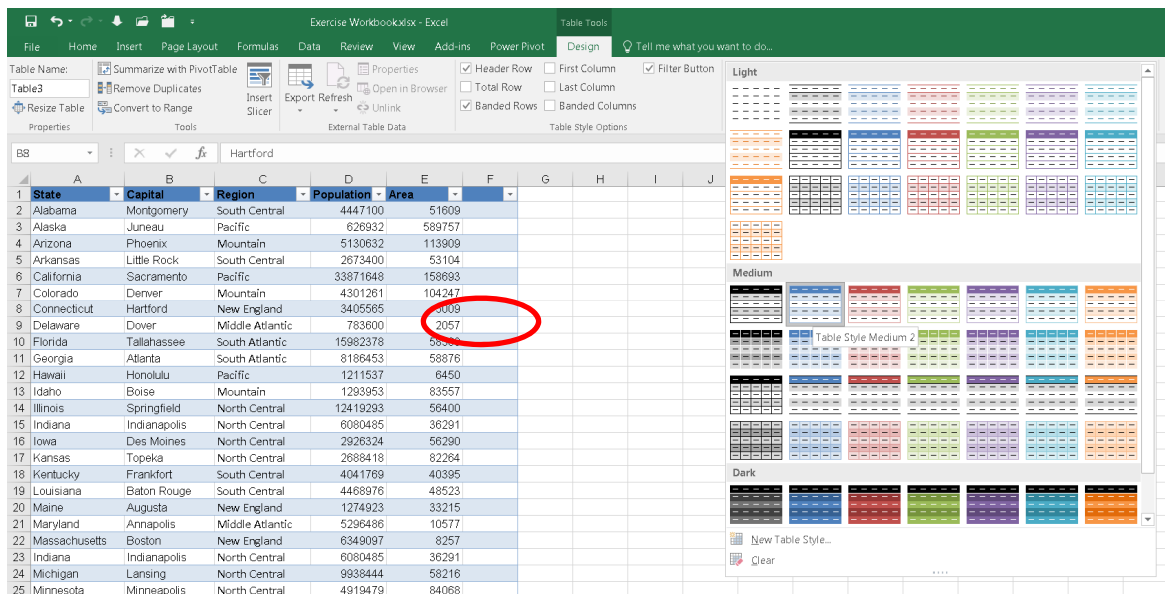
The totals always adjust to suit the filter/sort.



Exercise: Filter the information on sheet S3 in column B to show only the yellow cells.

2. Quick formatting

Excel automatically applies a banded row format to new tables. If you do not like that format, you can choose a new one from 60 predefined formats in the Table Styles gallery on the contextual Design tab. You can also use the Format As Table option on the Home tab. As you hover over each option, Live Preview updates the actual table. That means less experimentation and reformatting.



Exercise: Choose a new format for the table on sheet S2 (Table Style Medium 4)

3. Effortless data entry

You can easily extend a table, making data entry much easier. To insert a new record, select any cell in the row below the table's last row and enter a value. Excel will automatically extend the table's formatting to the new row. It also works with columns.

The screenshot shows an Excel spreadsheet with a table of US states. The table has columns for State, Capital, Region, Population, and Area. The cell containing 'Texas' in the State column for row 53 is circled in red.

	State	Capital	Region	Population	Area
48	Virginia	Richmond	South Atlantic	7078515	40817
49	Washington	Olympia	Pacific	5894121	68192
50	West Virginia	Charleston	South Atlantic	1808344	24181
51	Wisconsin	Madison	North Central	5363675	56154
52	Wyoming	Cheyenne	Mountain	493782	97914
53	Texas				
54					
55					
60					
61					

Exercise: Add a column after to the right of column E and call it Population density.

4. Automatic nomenclature

When entering formulas, you use cell references and range names. When working with a table, Excel works all that out for you.

State	Capital	Region	Population	Area
Alabama	Montgomery	South Central	4447100	51609
Alaska	Juneau	Pacific	626932	589757
Arizona	Phoenix	Mountain	5130632	113909
Arkansas	Little Rock	South Central	2673400	53104
California	Sacramento	Pacific	33871648	158693

Excel also extended the table's formatting to the new column. When referring to the table from outside the table, Excel will include the table's names in the reference.

5. No copy necessary

Excel always anticipates what your next move is going to be. After adding a column and filling in the formula for the first line, it automatically fills in the rest of the column so that it totals up each row. These columns are called calculated columns.

Region	Population	Area	
South Central	4447100	51609	86.16908
Pacific	626932	589757	1.063034
Mountain	5130632	113909	45.0415
South Central	2673400	53104	50.34272
Pacific	33871648	158693	213.4413
Mountain	4301261	104247	41.26029
New England	3405565	5009	679.8892
Middle Atlantic	783600	2057	380.9431
South Atlantic	15982378	58560	272.9231
South Atlantic	8186453	58876	139.0457

In the AutoCorrect Options section, click the AutoFormat As You Type tab.

Check the Fill Formulas In Tables To Create Calculated Columns option.

The next time you enter a formula into a table, Excel will automatically copy it to the remaining cells in the column.

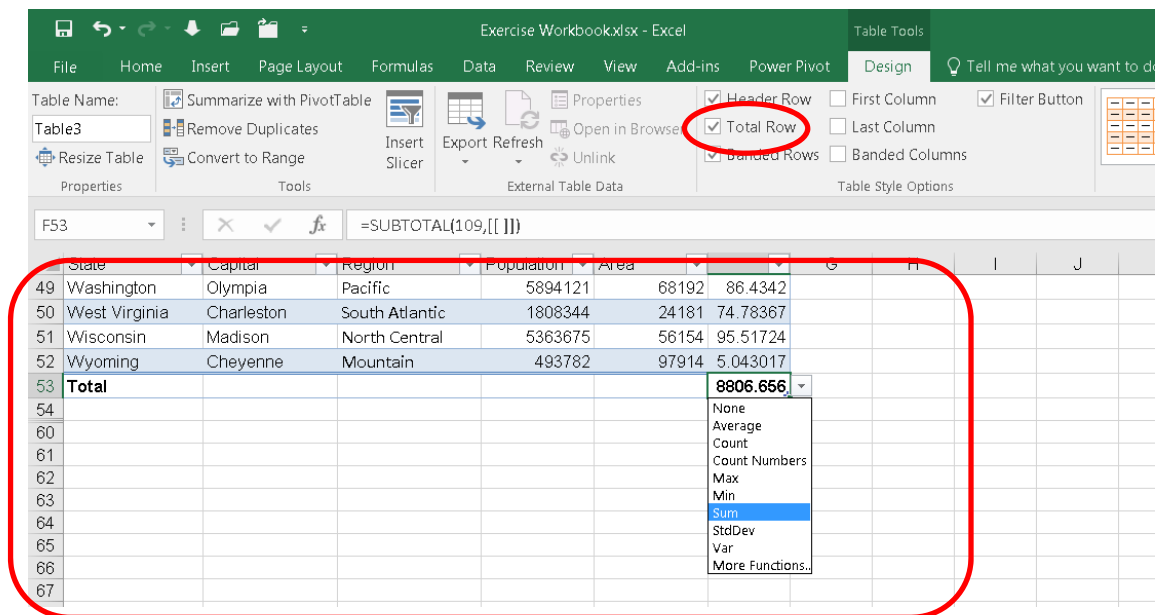
Exercise: Add a function in the Population density column by dividing the population by the area to work out the population density of each capital.

6. Quick totals

Add a Totals row to the table as follows:

Click anywhere inside the table and then click the contextual Design tab.

Check the Total Row option in the Table Style Options group.



This toggling option displays and hides a row of formulas. You can toggle it off for easier data entry. Excel does its best to guess your needs by evaluating the actual data. In this case, the only total added is a SUM() function. Using that function's drop-down, you can easily change the function. Each field has a drop-down from which you can choose or change a function.

Exercise: Add a total row for the table and use the average function under area and population.

7. Always visible headers

In a data range, header cells disappear as you scroll, but table headers are always visible — with absolutely no work on your part. Excel replaces the column header cells with the table's header row.

	State	Capital	Region	Population	Area	
40	Pennsylvania	Harrisburg	Middle Atlantic	12281054	45333	2
41	Rhode Island	Providence	New England	1048319	1214	8
42	South Carolina	Columbia	South Atlantic	4012012	31055	1
43	South Dakota	Pierre	North Central	754844	77047	9

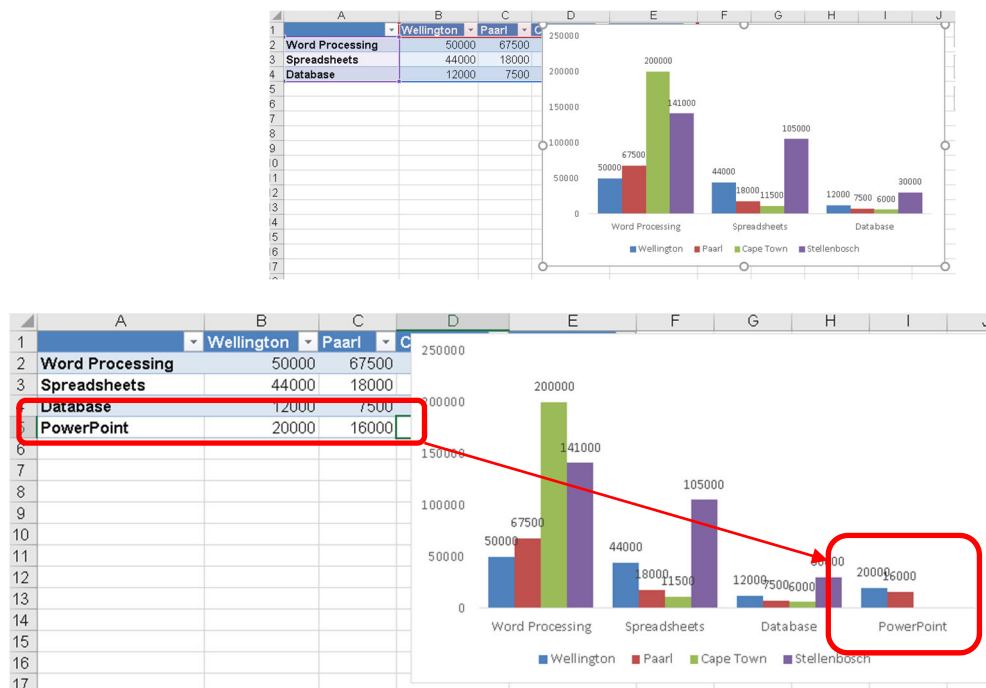
8. Formula autofill

When you extend a table to include a new row, it does not just extend the formatting. The table will also copy any formulas.

1	Wisconsin	Madison	North Central	5363675	56154	95.51724
2	Wyoming	Cheyenne	Mountain	493782	97914	5.043017
3	Texas	Austin	South Central	20851820	267338	77.99797
4	Total					8884.654

9. Dynamic charts

If you base a chart on a table, Excel will update the chart automatically as you change and enter new data into the table.



Exercise: Open sheet S11. Place the data in a table and create a simple column chart. Add a new row under Database and call it PowerPoint and fill the cells with fictitious information.

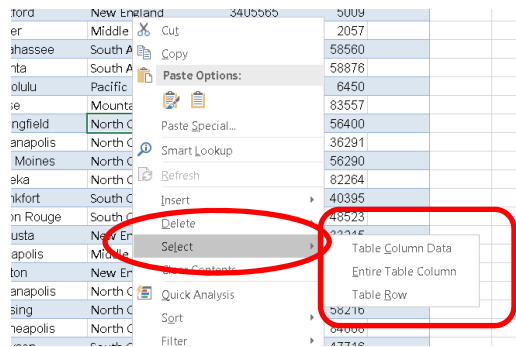
10. One-click select

To select a table with a single click, hover the mouse over the top-left corner of the top-left cell until the small southeast-pointing arrow shown in Figure M appears. Then, simply click to select the entire table.

Clipboard		Font		Alignment	
H10					
1	State	Capital	Region	Population	Area
2	Alabama	Montgomery	South Central	4447100	51609 86.16908
3	Alaska	Juneau	Pacific	626932	589757 1.063034
4	Arizona	Phoenix	Mountain	5130632	113909 45.0415

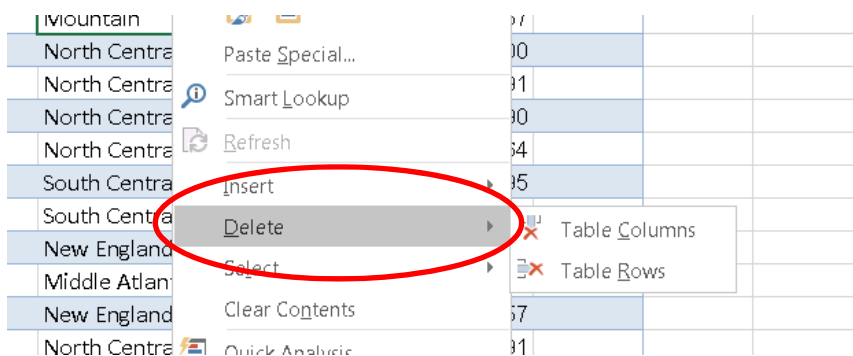
11. Selecting

Selecting is easier with tables. If you place your cursor on any cell(s) on the table, right-click, place your cursor over Select and you will find yourself three choices. Here you can select the column, the row, or the entire table (or click on Ctrl+A). This will be most useful when your Excel spreadsheet has a large table.



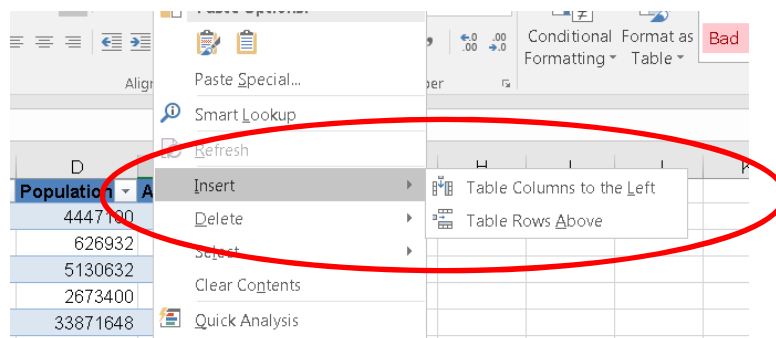
12. Deleting

If we needed to get rid of an unnecessary row or column, go through the same steps as selecting and only this time pick Delete. There you will find that you can delete either the column or row. Just remember that the cell(s) that are selected will be the ones affected.



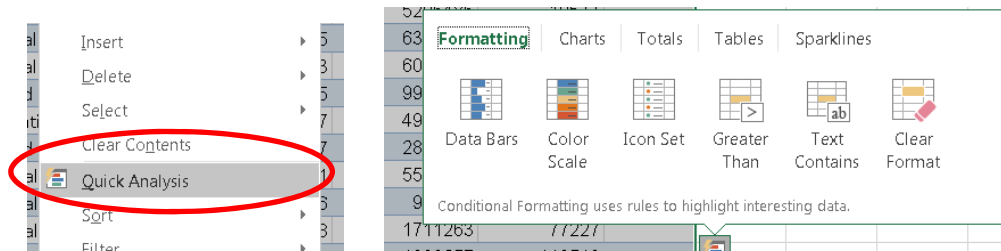
13. Inserting

Right-click, find Insert and the sub-menu will allow you to insert a row or column either above or to the left of the currently selected cell. Another quick way of inserting a new row is by selecting the last cell in the last row (before the totals row) and pressing tab.



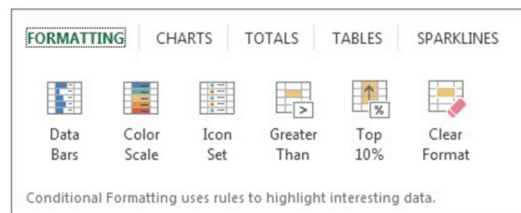
14. Quick Analysis > Analyse your data instantly

Quick Analysis provides you the opportunity to insert Formatting, Carts, Totals, Tables and Sparklines.

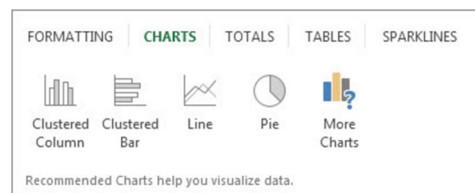


Which analysis feature should I use?

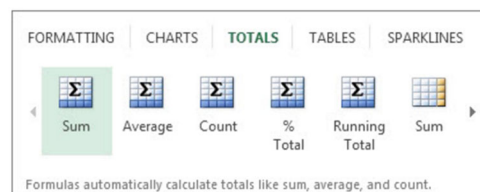
Formatting lets you highlight parts of your data by adding things like data bars and colours. This lets you quickly see high and low values, among other things.



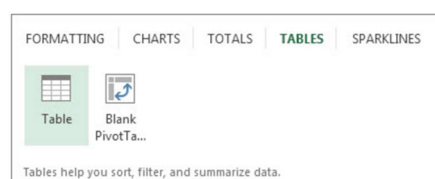
Charts Excel recommends different charts, based on the type of data you have selected. If you do not see the chart you want, click More Charts.



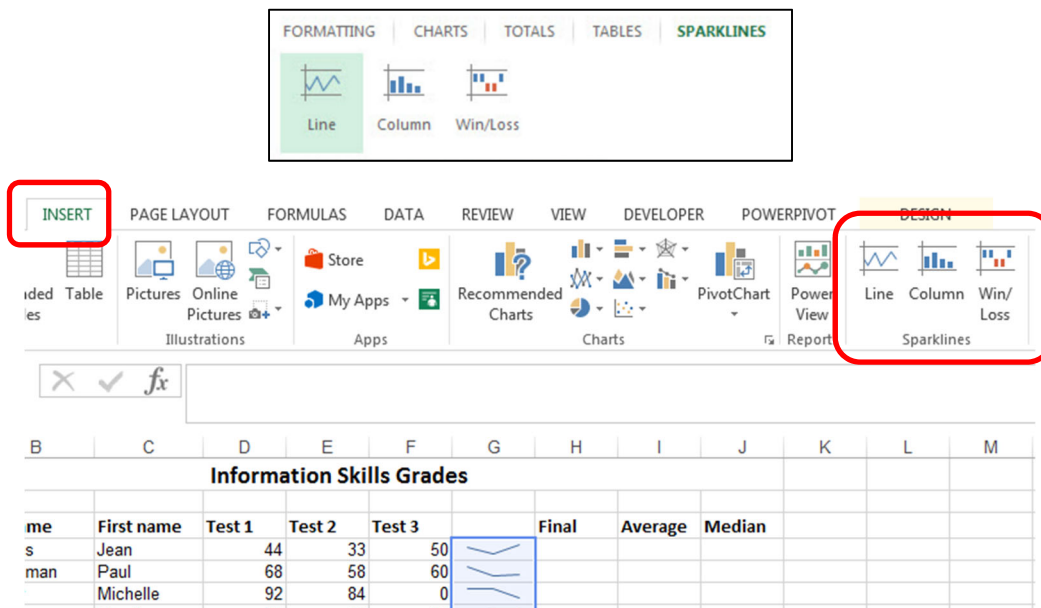
Totals let you calculate the numbers in columns and rows. For example, Running Total inserts a total that grows as you add items to your data. Click the little black arrows on the right and left to see additional options.



Tables make it easy to filter and sort your data. If you do not see the table style you want, click More.



Sparklines are like tiny graphs that you can show alongside your data. They provide a quick way to see trends. You can create a Sparkline for a single range and then extend it to multiple ranges using the fill handle. Sparklines are also on the Insert tab in the Sparklines group.



[Haskins, S. 2013; Mendez-Perez, V; Support.Office]

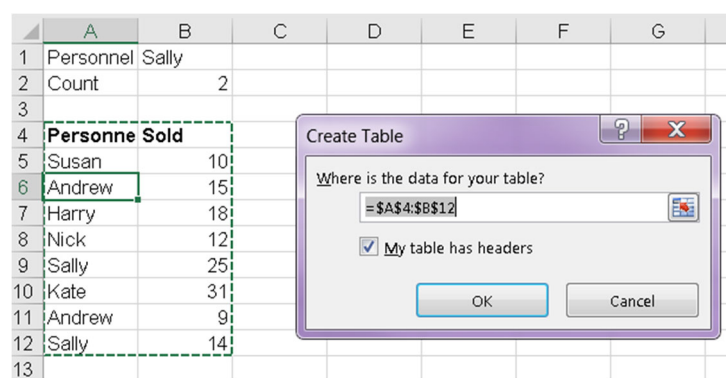
Exercise:

Insert a column on worksheet S5 after Test 3 and add Sparklines that reflect the first 3 test scores.

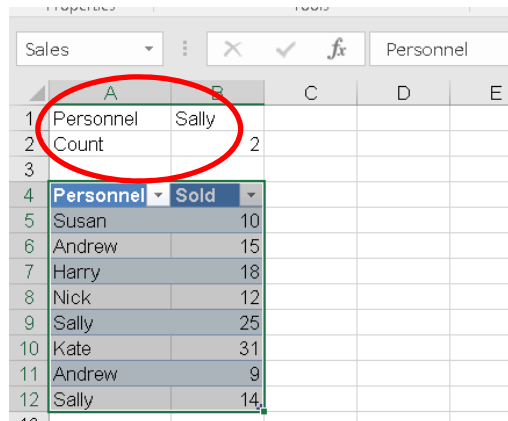
Use Excel's table nomenclature to quickly create dynamic formulas

Count the number of sales per person.

First, you need a table. To create a table, select any cell in a data range. Then, click the Insert tab and click Insert in the Tables group.



Next, name the table by clicking the contextual Design tab and entering a name into the Table Name control in the Properties group.



	A	B	C	D	E
1	Personnel	Sally			
2	Count		2		
3					
4	Personnel	Sold			
5	Susan	10			
6	Andrew	15			
7	Harry	18			
8	Nick	12			
9	Sally	25			
10	Kate	31			
11	Andrew	9			
12	Sally	14			

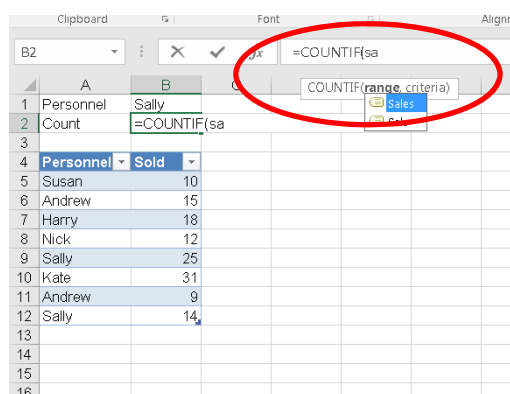
Use a dynamic COUNTIF() function that counts the number of sales per person. (The formula will work the same as it would if you were not referencing a table.) You can put the formula most anywhere you like.

Enter =COUNTIF(

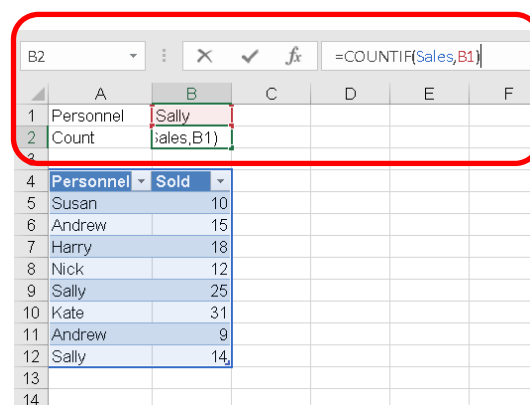
in cell B2

After entering the opening parenthesis, enter the name of the table, followed by an opening bracket, enter a comma to separate the range and criteria arguments and then specify the criteria argument by pointing to cell B1. Finish it off by entering a closing parenthesis and pressing Enter.

=COUNTIF(Sales,B1)



	A	B
1	Personnel	Sally
2	Count	=COUNTIF(sa
3		
4	Personnel	Sold
5	Susan	10
6	Andrew	15
7	Harry	18
8	Nick	12
9	Sally	25
10	Kate	31
11	Andrew	9
12	Sally	14



	A	B	C	D	E	F
1	Personnel	Sally				
2	Count	=COUNTIF(Sales,B1)				
3						
4	Personnel	Sold				
5	Susan	10				
6	Andrew	15				
7	Harry	18				
8	Nick	12				
9	Sally	25				
10	Kate	31				
11	Andrew	9				
12	Sally	14				

Personnel	Sally
Count	2
Personnel	Sold
Susan	10
Andrew	15
Harry	18
Nick	12
Sally	25
Kate	31
Andrew	9
Sally	14

[Harkins, S. 2011]

Exercise: Open S4 on the Excel workbook and use the COUNTIF() function to count the number of sales per person.

Calculate data across worksheets

Another way of increasing the complexity of your formulas is by using formulas that pull data from several worksheets.

You may find that you have data located in several worksheets. You could cut and paste the data into a single worksheet for calculations purposes, but then you run the risk of changing the original data. Instead, you can make your calculation span worksheets and not be restricted to one. This way, your calculations will be accurate.

A three-dimensional (3-D) cell reference is a cell reference located in the same place on multiple worksheets. It can be used only in a workbook with multiple worksheets.

B5

:

✕

✓

fx

='Qtr1'!B5+'Qtr2'!B5+'Qtr3'!B5+'Qtr4'!B5

	A	B	C	D	E
1	Our Global Company				
2	Sales performance: Department wise report				
3					
4	Sales Group:	Consulting:	Marketing:	Outsourcing:	Bundling:
5	Northeast	R 65 840	R 78 171	R 93 986	R 52 213
6	Southeast	R 60 794	R 60 819	R 109 184	R 35 269
7	Northwest	R 54 586	R 48 892	R 88 944	R 49 329
8	Southwest	R 65 098	R 56 085	R 91 039	R 43 218
9	TOTAL	R 246 318	R 243 967	R 383 152	R 180 029
10					

Exercise: Use Qtr1, Qtr2, Qtr3 and Qtr4 to work out the total for the year on worksheet Sales Performance.

Referencing in Excel

Cells are referenced based on the intersection of the respective column and row. For example, a cell in column B and row 3 is referenced to as B3. The cell that is selected is called an active cell and the reference of the active cell appears in the Name Box of the Formula Bar.

	A	B	C
1			
2			
3			
4			
5			

Relative Cell Reference

	Test 1	Test 2	Test 3	Final	Aver
	44	33	50	= (D4+E4+F4)	
	68	58	60		

Absolute Cell Reference

=IF(G4="OK",F4+\$G\$19,F4)

Relative references – refer to cells by their position in relation to the cells that contains the formula. A relative reference to cell A1, for example looks like this: =A1. A relative cell reference adjusts to its new location when the formula is copied and pasted.



Absolute references refer to cells by their fixed position in the worksheet, such as “the cell located at the intersection of column and row”. An absolute cell reference does not change, even when the formula is copied and pasted elsewhere. An absolute reference is specified with two dollar signs; for example: =\$A\$1.

Mixed references contain relative and absolute reference, such as “the cell located in column A and two rows above this cell”. A mixed reference to cell A1 looks like this: =\$A1 or =A\$1.

Dollar sign in a cell reference indicates its “absoluteness”. If the dollar sign precedes only the letter, the column coordinate is absolute, and the row is relative. If the dollar sign precedes only the number, the column coordinate is relative, and the row is absolute.

Absolute and mixed references are important when you begin coping formulas from one location to another in your worksheet. When you copy and paste, relative references adjust automatically, but absolute references do not. (F4 is a shortcut for adding dollar signs)

Coping a formula

1. Move your mouse over the cell with the formula until the mouse changes from  into  in the right hand corner of the cell

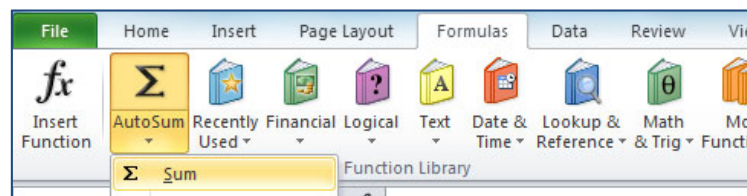
2. Then hold the mouse in and move down the column

Student	Surname	First name	Test 1	Test 2	Test 3	Final	Average	Median
1	Adams	Jean	44	33	50			
2	Glassman	Paul	68	58	60			
3	Baker	Michelle	92	84	0			
4	Walker	Maurie	24	49	51			
5	Moldof	Wigman	37	65	62			
6	Wild	Keith	18	87	72			
7	Smit	Judy	49	45	57			
8	Le Roux	Cynthia	73	66	69			

Exercise: Create your own function on worksheet S5 to work out the average of the students marks by adding the marks of tests 1-3 and then divide the answer by 3. Place the answer in the Final column. Example: $=\text{(Test1+Test2+Test3)}/3$

SUM Function

The SUM function provides a quick way to sum columns or rows of numbers in an Excel worksheet. The SUM Function can be found under Auto Sum in the Function Library group on the Formulas tab.



SUMPRODUCT

The SUMPRODUCT function multiplies corresponding components in the given arrays, and returns the sum of those products. However, SUMPRODUCT is a much more versatile function and it is not limited to the summation of products.

In this context, an array is a continuous range of cells in a row or column. The number of cells must be the same in each array, as in this example of a formula:

$=\text{SUMPRODUCT(B2:B11,C2:C11)}$

When applied to the following simple spreadsheet the result of the formula is 770:

	A	B	C
1		Value A	Value B
2	Item1	1	2
3	Item2	2	4
4	Item3	3	6
5	Item4	4	8
6	Item5	5	10
7	Item6	6	12
8	Item7	7	14
9	Item8	8	16
10	Item9	9	18
11	Item10	10	20

What SUMPRODUCT has done is this: $(1*2)+(2*4)+(3*6)+ \dots + (10*20) = 770$

The same result is achieved by this version of the formula, in which an asterisk replaces the comma:
`=SUMPRODUCT(B2:B11*C2:C11)`

It follows that the sign replacing the comma separating the arrays determines the mathematical operation that SUMPRODUCT engages between the pairs of values in the two arrays.

Thus this SUMPRODUCT returns the result 165:

$$\text{SUMPRODUCT}(B2:B11+C2:C11) \equiv (1+2)+(2+4)+(3+6)+ \dots + (10+20)$$

And this one returns the result 5:

$$\text{SUMPRODUCT}(B2:B11/C2:C11) \equiv (1\div 2)+(2\div 4)+(3\div 6)+ \dots + (10\div 20)$$

The examples above are based on arrays arranged in columns. SUMPRODUCT works equally well with arrays of values arranged in rows, as in this example:

$$\text{=SUMPRODUCT}(A19:F19*A20:F20)$$

Exercise: Use the SUMPRODUCT function in worksheet S5 (cells N3:P13) and apply the different options as explained under SUMPRODUCT to see the different uses of the function.

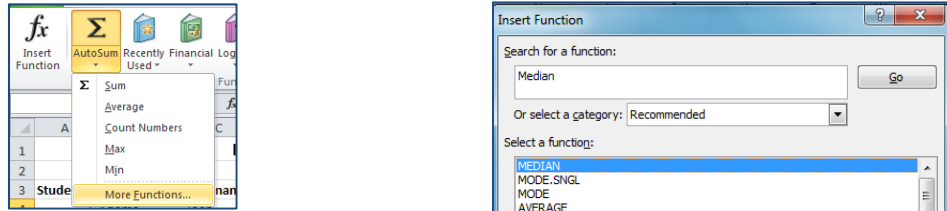
Average Function

The Average Function returns the average (arithmetic mean) of the arguments. For example, if the range A1:A20 contains numbers, the formula `=AVERAGE(A1:A20)` returns the average of those numbers. The Average Function can be found under Auto Sum in the Function Library group on the Formulas tab.

Exercise: Use the Average function and work out the students' average on worksheet S5 and place the answer in the Average column.

Median Function

The Median Function can be found under Auto Sum > More Functions on the Insert Function dialog window on the Function Library group on the Formulas tab.



Exercise: Use the Median function and work out the students median on worksheet S5 and place the answer in the Median column.

Date function

Because there are so many different date formats, and because these formats may be confused with numbered part codes or other strings that contain slash marks or hyphens, dates and times often need to be converted and reformatted. (See the DATE functions)

Use Go to Special Constants to find errors in dates:

If you have a column which contains Dates and you want to check that there are no cells which contain Text you can use the Go To dialogue box. (Home tab > Find & Select > Go To Special.... > Constants and select the constant that you want to find in your column. In this example you only select the Text box, de-select the other boxes, and press OK. This will highlight the cells that contain text and you can begin to format these cells.

*Useful functions:

=TODAY()

The TODAY() function will return the serial number of the current date every time you open the workbook/worksheet. The serial number is the date-time code used for date and time calculations. [Although this function takes no arguments, you must remember to include the empty parentheses.]

=NOW()

The NOW() function will return the serial number of the current date and time every time you open the workbook/worksheet. This function also takes no arguments. The result of the function is a serial date and time value that includes an integer (the date) and a decimal value (the time). Excel does not update the value of the NOW continuously. If the value of a cell that

contains the NOW function is not current, you can update the value by recalculating the worksheet. (You recalculate the worksheet by making a new entry or by pressing F9.) Excel also updates the NOW function whenever you open or print the worksheet.

Useful functions

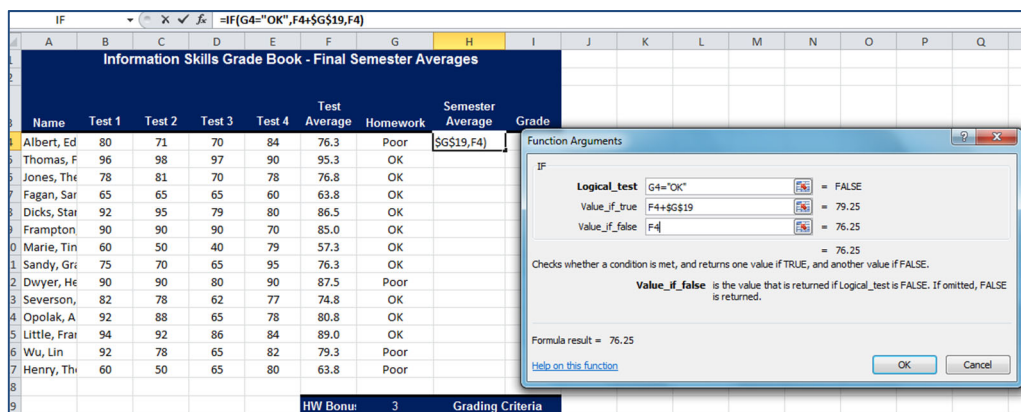
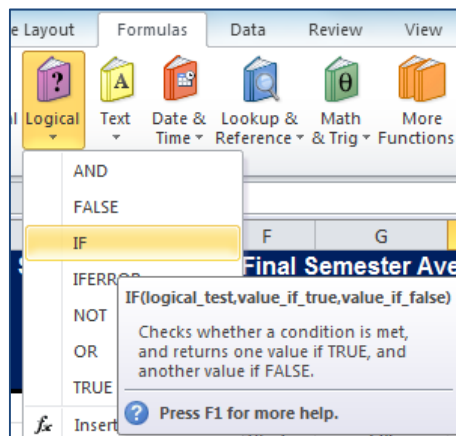
BEFORE	FORMULA	AFTER
123456789	=REPLACE(A3,6,0,"-")	12345-6789
BEFORE	FORMULA	AFTER
123-456	=+SUBSTITUTE(A4,"-","/")	123/456

Exercise: Use the =SUBSTITUTE() function to correct the date on sheet S8 to show 2017/04/06.

Remove the previous function and use the =TODAY() function in sheet S8 for column H.

IF Function

The IF function checks to see if a condition you specify is true, or false. If true, one thing happens; if false, something else happens. The IF function can be found under Logical in the Functions Library group on the Formulas tab



H4		fx		=IF(G4="OK",F4+\$G\$19,F4)				
	A	B	C	D	E	F	G	H
1	Information Skills Grade Book - Final Semester Averages							
2								
3	Name	Test 1	Test 2	Test 3	Test 4	Test Average	Homework	Semester Average
4	Albert, Ed	80	71	70	84	76.3	Poor	76
5	Thomas, F	96	98	97	90	95.3	OK	98

Exercise: Use the IF Function to determine whom of the students completed their homework to a satisfactory level (OK) and if they did, add the 3-points bonus from the HW Bonus table to the student's test average and insert the new marks in the Semester Average column on worksheet S7.

ROUND

Returns a number rounded to a specified number of decimal places.

The function ROUND has the following syntax: =ROUND(number, num_digits).

fx	=ROUND(IF(G4="OK",F4+\$G\$19,F4),0)
----	-------------------------------------

Exercise: Use the ROUND function to round of the marks in the Semester Average column on worksheet S7 in the Exercise Workbook.

Changing the case of text (UPPER, LOWER & PROPER)

Sometimes text comes in a mixed bag, especially when the case of text is concerned. Using one or more of the three Case functions, you can convert text to lowercase letters, such as e-mail addresses, uppercase letters, such as product codes, or proper case, such as names or book titles.

Unlike Microsoft Word, Microsoft Excel does not have a Change Case button for changing capitalization. You can use the UPPER, LOWER, or PROPER functions to automatically change the case of existing text to uppercase, lowercase, or proper case.

=UPPER: Makes all the letters uppercase

=LOWER: Makes all the letters lowercase

=PROPER: Makes first letter in each word uppercase

=PROPER(CONCATENATE(S8!B2," ",S8!C2))

fx =PROPER(CONCATENATE('S7!C2," ",S7!B2))		
B	C	
Full Name	User ID	D
Mark Comuntzis		

Exercise: Use the PROPER function together with the CONCATENATE function to combine the First name with the Last name from worksheet S8 into one cell in column C on worksheet S9 (in the Full name column), but this time only the first letters must be capitalised.

Removing spaces and nonprinting characters from text (TRIM)

Sometimes text values contain leading, trailing, or multiple embedded space characters (Unicode character set values 32 and 160), or nonprinting characters (Unicode character set values 0 to 31, 127, 129, 141, 143, 144, and 157). These characters can sometimes cause unexpected results when you sort, filter, or search. For example, in the external data source, users may make typographical errors by inadvertently adding extra space characters, or imported text data from external sources may contain nonprinting characters that are embedded in the text. Because these characters are not easily noticed, the unexpected results may be difficult to understand. To remove these unwanted characters, you can use a combination of the TRIM, CLEAN, and SUBSTITUTE functions.

Remove spaces and nonprinting characters from text

=TRIM: function removes spaces from text except for single spaces between words.

=CLEAN: function removes all nonprintable characters from text.

=TRIM(PROPER()): Removes extra spaces and capitalizes each word of text

Read more about SUBSTITUTE here: <https://support.office.com/en-us/article/Remove-spaces-and-nonprinting-characters-from-text-023f3a08-3d56-49e4-bf0c-fe5303222c9d>

Exercise: Use the =TRIM(): function to remove extra spaces on sheet S3 in column C.

Fixing numbers and number signs

There are two main issues with numbers that may require you to clean the data: the number was inadvertently imported as text, and the negative sign needs to be changed to the standard for your organization.

(Convert numbers stored as text to numbers; change numbers into currency or accounting, convert a value to text, round numbers to specific decimals .. see formatting)

=**TEXT**: Converts number or text to new format

=**VALUE(TRIM(CLEAN()))**: Converts text to number and removes non-printable characters

Exercise: Use FIND and REPLACE to find numbers saved as text and change the format to number on sheet S3 column E.

Merging and splitting columns

A common task after importing data from an external data source is to either merge two or more columns into one, or split one column into two or more columns. For example, you may want to split a column that contains a full name into a first and last name. Or, you may want to split a column that contains an address field into separate street, city, region, and postal code columns. The reverse may also be true. You may want to merge a First and Last Name column into a Full Name column, or combine separate address columns into one column. Additional common values that may require merging into one column or splitting into multiple columns include product codes, file paths, and Internet Protocol (IP) addresses.

Useful functions:

CONCATENATE

The CONCATENATE function combines multiple text strings in a single text string.

=CONCATENATE(S8!B2," ",S8!C2)

fx		=CONCATENATE('S7!C2," ",S7!B2)	
B		C	
Full Name		User ID	
MARK COMUNTZIS			

Exercise: Use the CONCATENATE function to combine the First name with the Last name from worksheet S8 into one cell in column B on worksheet S9 (the Full name column). There must be a space between the name and the surname.

LEFT

The LEFT function returns the first character(s) in a text based string on the specified number of characters.

=LEFT('S8'!C2,1)

	C	D	E
me	Full Name	Initial	Initial & S
zis	MARK COMUNTZIS	M	M Comuntzis
sa	ALEXANDRA FILOSA	A	A Filosa
	MARY BINGA	M	M Binga
II	SUSAN DONNELL	S	S Donnell
ol	ELIZABETH CAROL	E	E Carol
	ERICA DECKER	E	E Decker

RIGHT

RIGHT returns the last character or characters in a text string, based on the specific number of characters you specify.

=RIGHT(S8!G2,4)

	E	F
	Location	Extension
Q		2146

Exercise: Use the RIGHT function to remove the Extension from the Office Location and Extension column on worksheet S8 and place only the extension on worksheet S9 in the Extension column.

MID

MID returns a specific number of characters from a text string, starting at the position you specify, based on the number of characters you specify.

Syntax

MID(text, start_num, num_chars)

- **Text** Required. The text string containing the characters you want to extract.
- **Start_num** Required. The position of the first character you want to extract in text. The first character in text has start_num 1, and so on.
- **Num_chars** Required. Specifies the number of characters you want MID to return from text.

	L	M
Code	Column1	Description
	Beurs: Map (Regsgeleerdheid)	H672 5373 Beurs: Map (Regsgeleerdheid)

CONCATENATE

=CONCATENATE(LEFT(S8!C2,1),” ”,PROPER(S8!B2))

fx =CONCATENATE(LEFT('S7!C2,1),” ”,PROPER('S7!B2))		
B	C	D
Full Name	User ID	Department
M Comuntzis		

Exercise: Use the LEFT function together with the CONCATENATE function to combine the initial with the Last name from worksheet S8 into one cell in column D on worksheet S9 (Initial & Surname column)

FIND

The Find function searches for the specified text and returns the position of the text in another text string.

Office Location and Extension
HQ-01 2146

=LEFT(S8!G2,FIND("-",S8!G2)-1)

fx		=LEFT('S7!G2,FIND("-",S7!G2)-1)	
	E		F
ent	Location		Extension
	HQ		

Exercise: Use the FIND function to remove the Location from the Office Location and Extension column on worksheet S8 and place only the location on worksheet S9 in the Location column (Column G).

[More examples: <https://support.office.com/en-us/article/Split-text-into-different-columns-with-functions-49ec57f9-3d5a-44b2-82da-50dded6e4a68>]

Reconciling table data by joining or matching

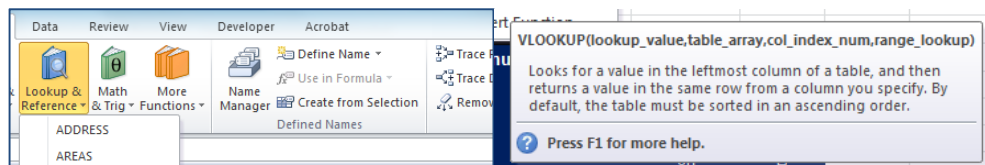
Occasionally, database administrators use Office Excel to find and correct matching errors when two or more tables are joined. This might involve reconciling two tables from different worksheets, for example, to see all records in both tables or to compare tables and find rows that do not match.

Useful functions:

VLOOKUP

The VLOOKUP function is used to find specific information that has been stored in a table of data. The VLOOKUP function searches for a value in the leftmost column of a table, and then returns a value in the same row from a column that you specify in the table.

The VLOOKUP function is under Lookup & Reference in the Functions Library group on the Formulas tab.



VLOOKUP X ✓ fx =VLOOKUP(H4,\$H\$20:\$I\$24,2,TRUE)

Test Average	Homework	Semester Average	Grade
76.3	Poor	76	2,TRUE)
95.3	OK	98	
76.8	OK	80	
63.8	OK	67	
86.5	OK	90	
85.0	OK	88	
57.3	OK	60	
76.3	OK	79	
87.5	Poor	88	
74.8	OK	78	
80.8	OK	84	
89.0	OK	92	
79.3	Poor	79	
63.8	Poor	64	

HW Bonus	Grading Criteria
3	0 F
	60 D
	70 C
	80 B
	90 A

Function Arguments

VLOOKUP

Lookup_value: H4 = 76.25

Table_array: \$H\$20:\$I\$24 = {0,"F";60,"D";70,"C";80,"B";90,"A"}

Col_index_num: 2 = 2

Range_lookup: TRUE = TRUE

Formula result = C

Help on this function

OK Cancel

I4 X ✓ fx =VLOOKUP(H4,\$H\$20:\$I\$24,2,TRUE)

Test Average	Homework	Semester Average	Grade
76.3	Poor	76	C
95.3	OK	98	A

Exercise: Use the VLOOKUP Function to complete the letter grade for the Semester Average of the students with the help of the HW Bonus table and insert the grades in the Grade column of worksheet S7. (FIRST complete the IF Function on page 31)

INDEX() & MATCH

VLOOKUP is not the only lookup formula available in Excel, and its numerous limitations might prevent you from getting the desired result in many situations. On the other hand, Excel's INDEX MATCH is more flexible and has certain features that make it superior to VLOOKUP in many respects.

The INDEX function's syntax and usage

The Excel INDEX function returns a value in an array based on the row and column numbers you specify. The syntax of the INDEX function is straightforward:

```
INDEX(array, row_num, [column_num])
```

Here is a very simple explanation of each parameter:

- **array** - this is a range of cells that you want to return a value from.
- **row_num** - the row number in array from which you want to return a value. If omitted, the column_num is required.
- **column_num** - the column number in array from which you want to return a value. If omitted, row_num is required.

If both row_num and column_num parameters are used, the INDEX function returns the value in the cell at the intersection of the specified row and column.

And here is the simplest example of the INDEX formula:

```
=INDEX(A1:C10,2,3)
```

The formula searches in cells A1 through C10 and returns a value of the cell in the 2nd row and the 3rd column, i.e. cell C2.

When working with real data you would hardly ever know which row and column you want, that is why you need the help of the MATCH function.

The MATCH function's syntax and usage

The Excel MATCH function searches for a lookup value in a range of cells, and returns the relative position of that value in the range.

For example, if the range B1:B3 contains the values "New-York", "Paris", "London", then the formula =MATCH("London",B1:B3,0) returns the number 3, because "London" is the third entry in the range.

The syntax of the MATCH function is as follows:


```
MATCH(lookup_value, lookup_array, [match_type])
```

- **lookup_value** - this is the number or text you are looking for. This can be a value, a cell reference or logical value.
- **lookup_array** -a range of cells being searched.
- **match_type** - this parameter tells the MATCH function whether you want to return an exact match or the nearest match:
 - 1 or omitted - finds the largest value that is less than or equal to the lookup value. The values in the lookup array must be sorted in ascending order, i.e. from smallest to largest.
 - 0 - finds the first value that is exactly equal to the lookup value. In the INDEX / MATCH combination, you almost always need the exact match, so the third argument of your MATCH function is "0".
 - -1 - finds the smallest value that is greater than or equal to lookup_value. The values in the lookup array must be sorted in descending order, i.e. from largest to smallest.

How to use INDEX MATCH function in Excel

Now that you know the basics of these two functions, I believe it has already started making sense how Excel's MATCH and INDEX work together.

The MATCH function determines the relative position of the lookup value in the specified range of cells. From there, the INDEX function takes that number, or numbers, and returns a value in the corresponding cell.

```
=INDEX (column to return a value from, (MATCH (lookup value, column to lookup against, 0))
```

Example:

	G	H
	Product Name	Unit Price
1	Raclette Courdavault	\$55.00
1	Original Frankfurter grüne Soße	\$13.00
1	Grandma's Boysenberry Spread	\$25.00
1	Rössle Sauerkraut	\$45.60
1	Escargots de Bourgogne	\$13.25
1	Flötensost	\$21.50
1	Rössle Sauerkraut	\$45.60
1	Chartreuse verte	\$18.00
1	Spegesild	\$12.00
1	Veggie-spread	\$43.90
1	Aniseed Syrup	\$10.00
1	Lakkalikööri	\$18.00
1	Queso Cabrales	\$21.00
1	Konbu	\$6.00
1	Teatime Chocolate Biscuits	\$9.20
1	Mozzarella di Giovanni	\$34.80
1	Tofu	\$23.25
1	Singaporean Hokkien Fried Mee	\$14.00
1	Camembert Pierrot	\$34.00
1	Gudbrandsdalsost	\$28.80
1	Outback Lager	\$12.00
1	Mascarpone Fabioli	\$32.00
1	Chang	\$19.00
1	Singaporean Hokkien Fried Mee	\$14.00
1	Ipoh Coffee	\$46.00
1	Chocolade	\$12.75
1	Queso Cabrales	\$21.00
1	Boston Crab Meat	\$18.40
1	Ravioli Angelo	\$19.50

Find the Unit price of a Product; say Tofu or Chocolade, using the following Index Match formula:

```
=INDEX(Table3[Unit Price],MATCH("Chocolade",Table3[Product Name],0))
```

Analyse what each component of this formula actually does:

- The MATCH function searches for the lookup value "Chocolade" in column G, more precisely cells \$G\$2:\$G\$2156 (Table3[UnitPrice]), and returns the number 26, because "Chocolade" is twenty-six in the list.
- The INDEX functions takes "26" in the second parameter (row_num), which indicates which row you want to return a value from, and turns into a simple =INDEX(\$H\$2:\$H\$2156,0). Translated into plain English, the formula reads: search in cells H2 through H2156 and return a value of the cell in row 26.

Here is the result you get in Excel:

=INDEX(Table3[Unit Price],MATCH("Chocolade",Table3[Product Name],0))						
Order ID	Order Date	Shipped Date	Product Name	Unit Price	Quantity	Extended Price
10835	15-Jan-2011	21-Jan-2011	Raclette Courdavault	\$55.00	15	\$825.00
10835	15-Jan-2011	21-Jan-2011	Original Frankfurter grüne Soße	\$13.00	2	\$26.00
			Chocolade			12.75
			Tofu			23.25

=INDEX(Table3[Unit Price],MATCH(L2,Table3[Product Name],0))						
Order ID	Order Date	Shipped Date	Product Name	Unit Price	Quantity	Extended Price
10835	15-Jan-2011	21-Jan-2011	Raclette Courdavault	\$55.00	15	\$825.00
10835	15-Jan-2011	21-Jan-2011	Original Frankfurter grüne Soße	\$13.00	2	\$26.00
10952	16-Mar-2011	24-Mar-2011	Grandma's Boysenberry Spread	\$25.00	16	\$400.00
10952	16-Mar-2011	24-Mar-2011	Rössle Sauerkraut	\$45.60	2	\$91.20
11011	09-Apr-2011	13-Apr-2011	Escargots de Bourgogne	\$13.25	40	\$530.00
11011	09-Apr-2011	13-Apr-2011	Flotemysost	\$21.50	20	\$430.00
10643	25-Aug-2011	02-Sep-2011	Rössle Sauerkraut	\$45.60	15	\$684.00
10643	25-Aug-2011	02-Sep-2011	Chartreuse verte	\$18.00	21	\$378.00
10643	25-Aug-2011	02-Sep-2011	Spegesild	\$12.00	2	\$24.00
10692	03-Oct-2011	13-Oct-2011	Vegie-spread	\$43.90	20	\$878.00
10702	13-Oct-2011	21-Oct-2011	Aniseed Syrup	\$10.00	6	\$60.00
10702	13-Oct-2011	21-Oct-2011	Lakkalikööri	\$18.00	15	\$270.00
10926	04-Mar-2011	11-Mar-2011	Queso Cabrales	\$21.00	2	\$42.00
10926	04-Mar-2011	11-Mar-2011	Konbu	\$6.00	10	\$60.00
10926	04-Mar-2011	11-Mar-2011	Teatime Chocolate Biscuits	\$9.20	7	\$64.40
10926	04-Mar-2011	11-Mar-2011	Mozzarella di Giovanni	\$34.80	10	\$348.00
10625	08-Aug-2011	14-Aug-2011	Tofu	\$23.25	3	\$69.75
10625	08-Aug-2011	14-Aug-2011	Singaporean Holdings Fried Mee	\$14.00	5	\$70.00

Why Excel's INDEX MATCH is better than VLOOKUP

When deciding which formula to use for vertical lookups, the majority of Excel gurus agree that INDEX / MATCH is far better than VLOOKUP. However, many Excel users still resort to utilizing VLOOKUP because it's a simpler function. This happens because very few people fully understand all the benefits of switching from Vlookup to Index Match, and without such understanding no one is willing to invest their time to learn a more complex formula.

4 top benefits of using MATCH INDEX in Excel

1. **Right to left lookup.** Excel VLOOKUP cannot look to its left, meaning that your lookup value should always reside in the left-most column of the lookup range. With INDEX MATCH, your lookup column can be on the right side of your table as well.
2. **Insert or delete columns safely.** VLOOKUP formulas get broken or return incorrect results when a new column is deleted from or added to a lookup table. With VLOOKUP, any inserted or deleted column changes the results returned by your formulas because the VLOOKUP function's syntax requires specifying the entire table array and a certain number indicating which column you want to pull the data from.

For example, if you have a table A1:C10 and want to return a value from column B, you will put "2" in the third parameter (col_index_num) of a VLOOKUP formula, say =VLOOKUP("lookup value", A1:C10, 2). If at a later point, you insert a new column between A and B, you will have to change "2" to "3" in your formula, otherwise it would return a value from the newly inserted column.

With INDEX MATCH, you can delete or insert new columns in your lookup table without distorting the results since you specify directly the column containing the value you want to get. And this is a really great benefit, especially when working with large

datasets, since you are able to insert and remove columns without worrying about updating every associated vlookup formula.

3. **No limit for a lookup value's size.** When using the VLOOKUP function, remember that the total length of your lookup criteria should not exceed 255 characters, otherwise you will end up having the #VALUE! error. So, if your dataset contains long strings, INDEX MATCH is the only working solution.

Suppose, you are using the following VLOOKUP formula that searches through cells B5 to D10 for the value in cell A2:

=VLOOKUP(A2,B5:D10,3,FALSE)

The formula won't work if the lookup value in cell A2 exceeds 255 symbols. Instead, you shall use the analogous INDEX / MATCH function:

=INDEX(D5:D10, MATCH(TRUE, INDEX(B5:B10=A2, 0), 0))

4. **Higher processing speed.** If you are working with relatively small tables, the difference in Excel's performance will most likely be unnoticeable, especially in recent versions. But if you use large worksheets with thousands of rows and thousands of lookup formulas, Excel will work much faster if you use MATCH INDEX rather than VLOOKUP. Generally, the use of Index / Match formulas increases Excel's performance by 13% compared to equivalent Vlookup formulas.

[Cheasheva, S. 2017: INDEX & MATCH functions in Excel – a better alternative to VLOOKUP]

Exercise:

Find the Unit price of a Product; say Tofu or Chocolate, using the following Index Match formula on S15 in the workbook

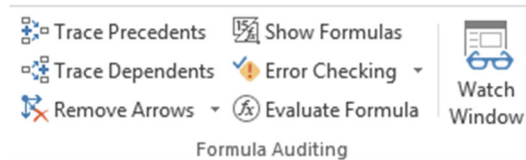
Use the Index and Match formula to complete the letter grade for the Semester Average of the students with the help of the HW Bonus table and insert the grades in the Grade column of worksheet S7. (First remove the VLOOKUP function)

[Support.Office: Top ten ways to clean your data]

Formula Auditing

Excel offers some very effective formula-auditing tools for tracking down a cell that's causing errors by tracing the relationships between the formulas in the cells of your worksheet.

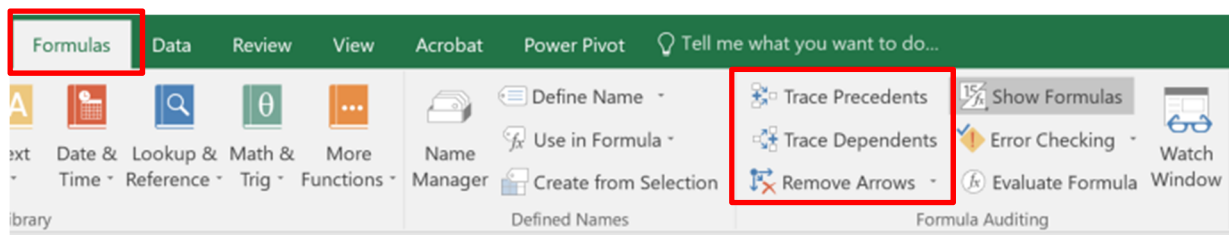
Formula Auditing is on the Formulas tab



Trace Precedents:

When you click this button, Excel draws arrows to the cells (the so-called direct precedents) that are referred to in the formula inside the selected cell. When you click this button again, Excel adds “tracer” arrows that show the cells (the so-called indirect precedents) that are referred to in the formulas in the direct precedents.

Open the Formulas tab > Formula Auditing group



D	E	F
ation	Area	
783600	2057	
5296486	10577	
3414350	7836	
3976457	49576	
2281054	45333	
5751947	115379	
5130632	113909	

Trace Dependents

When you click this button, Excel draws arrows from the selected cell to the cells (the so-called direct dependents) that use, or depend on, the results of the formula in the selected cell. When you click this button again, Excel adds tracer arrows identifying the cells (the so-called indirect dependents) that refer to formulas found in the direct dependents.

Remove Arrows: Clicking this button removes all the arrows drawn, no matter what button or pull-down command you used to put them there.

Show Formulas

To display all formulas in their cells in the worksheet instead of their calculated values

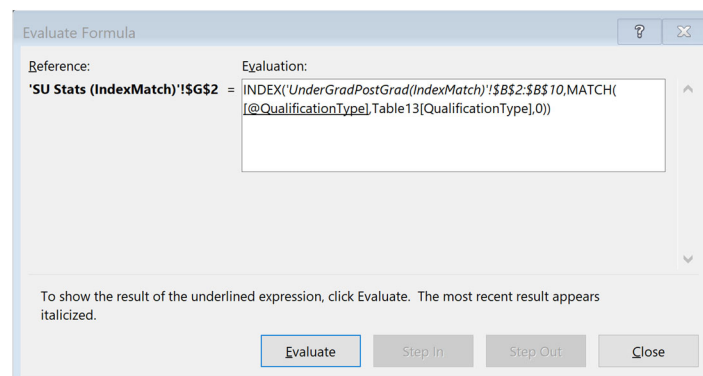
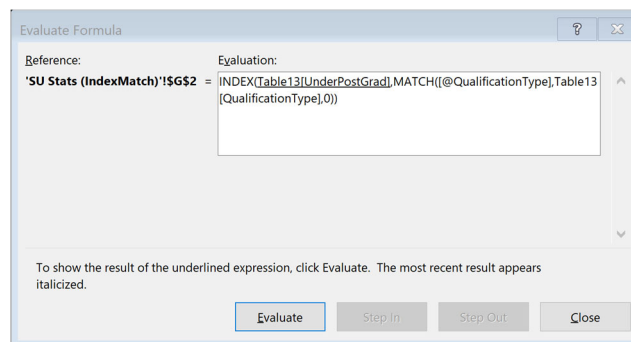
	D	E
	Population	Area
	783600	2057
	5296486	10577
	8414350	7836
	18976457	49576
	12281054	45333
	=SUBTOTAL(9,D2:D6)	=SUBTOTAL(9,E2:E6)
	5138632	113888

Error Checking

When you click this button or click the Error Checking option on its drop-down menu, Excel displays the Error Checking dialog box, which describes the nature of the error in the current cell, gives you help on it, and enables you to trace its precedents.

Evaluate Formula

Clicking this button opens the Evaluate Formula dialog box, where you can have Excel evaluate each part of the formula in the current cell. The Evaluate Formula feature can be quite useful in formulas that nest many functions within them.



Watch Window

Clicking this button opens the Watch Window dialog box, which displays the workbook, sheet, cell location, range name, current value, and formula in any cells that you add to the watch list. To add a cell to the watch list, click the cell in the worksheet, click the Add Watch button in the Watch Window dialog box, and then click Add in the Add Watch dialog box that appears.

Charts

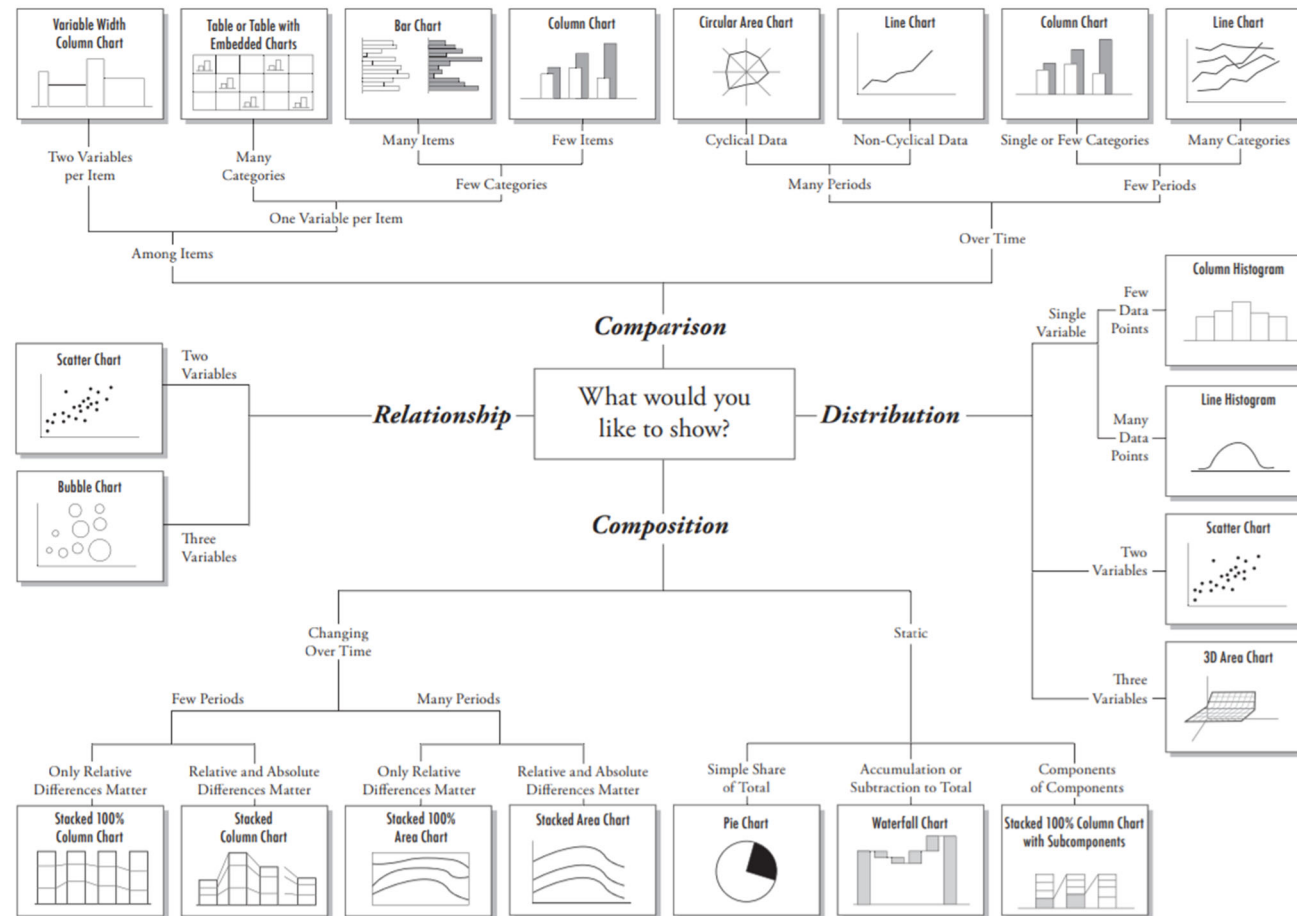
Chart Type	Explanation
Column Charts	Column charts are used to compare values across categories
Line Charts	Line charts are used to display trends over time
Pie Charts	Pie charts are used to display contribution of each value to a total.
Bar Charts	Bar charts are used for comparing multiple values
Area Charts	Area charts are used to emphasize differences between several sets of data over a period of time
XY Scatter Charts	Scatter charts are used to compare pairs of values
Stock Chart	Data that is arranged in columns or rows in a specific order on a worksheet can be plotted in a stock chart. As the name implies, stock charts can show fluctuations in stock prices. However, this chart can also show fluctuations in other data, like daily rainfall or annual temperatures. Make sure you organize your data in the right order to create a stock chart.
Surface Chart	Data that is arranged in columns or rows on a worksheet can be plotted in a surface chart. This chart is useful when you want to find optimum combinations between two sets of data. As in a topographic map, colours and patterns indicate areas that are in the same range of values. You can create a surface chart when both categories and data series are numeric values.
Radar Chart	Data that is arranged in columns or rows on a worksheet can be plotted in a radar chart. Radar charts compare the aggregate values of several data series.
Waterfall Chart	A waterfall chart shows a running total of your financial data as values are added or subtracted. It's useful for understanding how an initial value is affected by a series of positive and negative values. The columns are colour coded so you can quickly tell positive from negative numbers.
Histogram Chart	Data plotted in a histogram chart shows the frequencies within a distribution. Each column of the chart is called a bin, which can be changed to further analyse your data.
Pareto Chart	Using the Pareto chart, you can automatically sort the frequency of the most prevalent issues (the bar graph) and then show the additive contributions of each issue as you move along the horizontal axis (the line graph).
Funnel Chart	Funnel charts show values across multiple stages in a process.
Box & Whisker	A box and whisker chart shows distribution of data into quartiles, highlighting the mean and outliers. The boxes may have lines extending vertically called "whiskers".

Chart Type	Explanation
	These lines indicate variability outside the upper and lower quartiles, and any point outside those lines or whiskers is considered an outlier. Use this chart type when there are multiple data sets which relate to each other in some way.
Treemap	The treemap chart provides a hierarchical view of your data and an easy way to compare different levels of categorization. The treemap chart displays categories by colour and proximity and can easily show lots of data which would be difficult with other chart types. The treemap chart can be plotted when empty (blank) cells exist within the hierarchal structure and treemap charts are good for comparing proportions within the hierarchy.
Sunburst	The sunburst chart is ideal for displaying hierarchical data and can be plotted when empty (blank) cells exist within the hierarchal structure. Each level of the hierarchy is represented by one ring or circle with the innermost circle as the top of the hierarchy. A sunburst chart without any hierarchical data (one level of categories), looks similar to a doughnut chart. However, a sunburst chart with multiple levels of categories shows how the outer rings relate to the inner rings. The sunburst chart is most effective at showing how one ring is broken into its contributing pieces.
Combo Chart	Data that is arranged in columns and rows can be plotted in a combo chart. Combo charts combine two or more chart types to make the data easy to understand, especially when the data is widely varied. Shown with a secondary axis, this chart is even easier to read. In this example, we used a column chart to show the number of homes sold between January and June and then used a line chart to make it easier for readers to quickly identify the average sales price by month.

[Support.Office: Available charts in Office]

Chart suggestions by Dr Andrew Abela (2016)

Chart Suggestions—A Thought-Starter



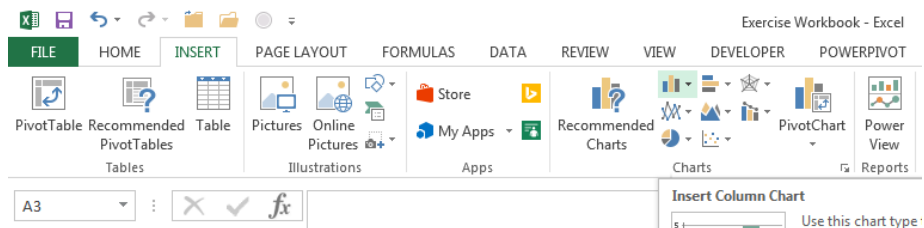
www.ExtremePresentation.com
© 2009 A. Abela — a.v.abela@gmail.com

[<https://extremepresentation.typepad.com/files/choosing-a-good-chart-09.pdf>]]

Create a Chart

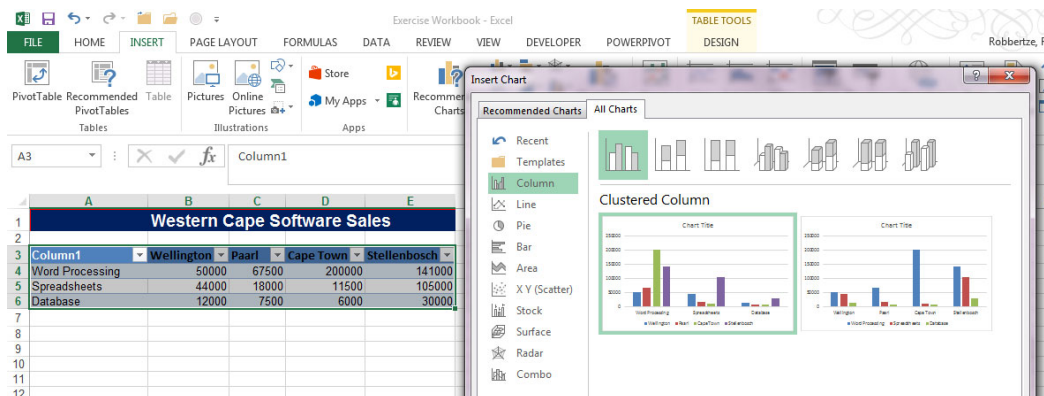
Select the desired data

Click on the desired chart gallery on the Insert tab in the Charts group



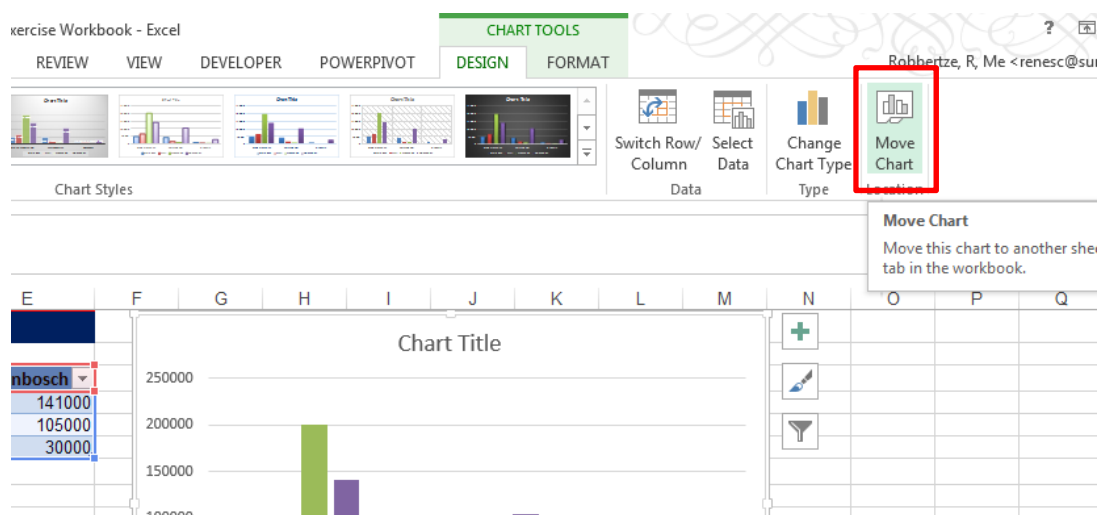
Creating a Self-Expanding Chart

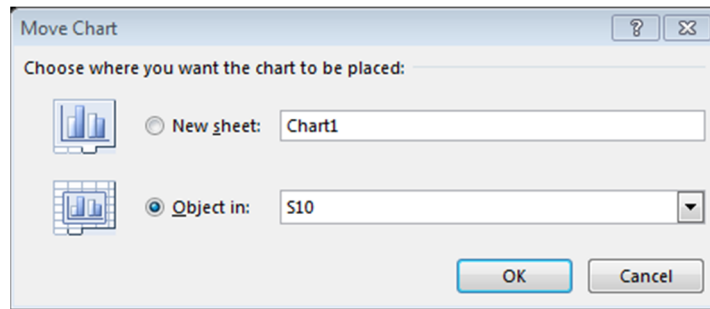
A chart will expand automatically when you add new data to a worksheet if the data that you use is in a table.



Move Chart to a new sheet

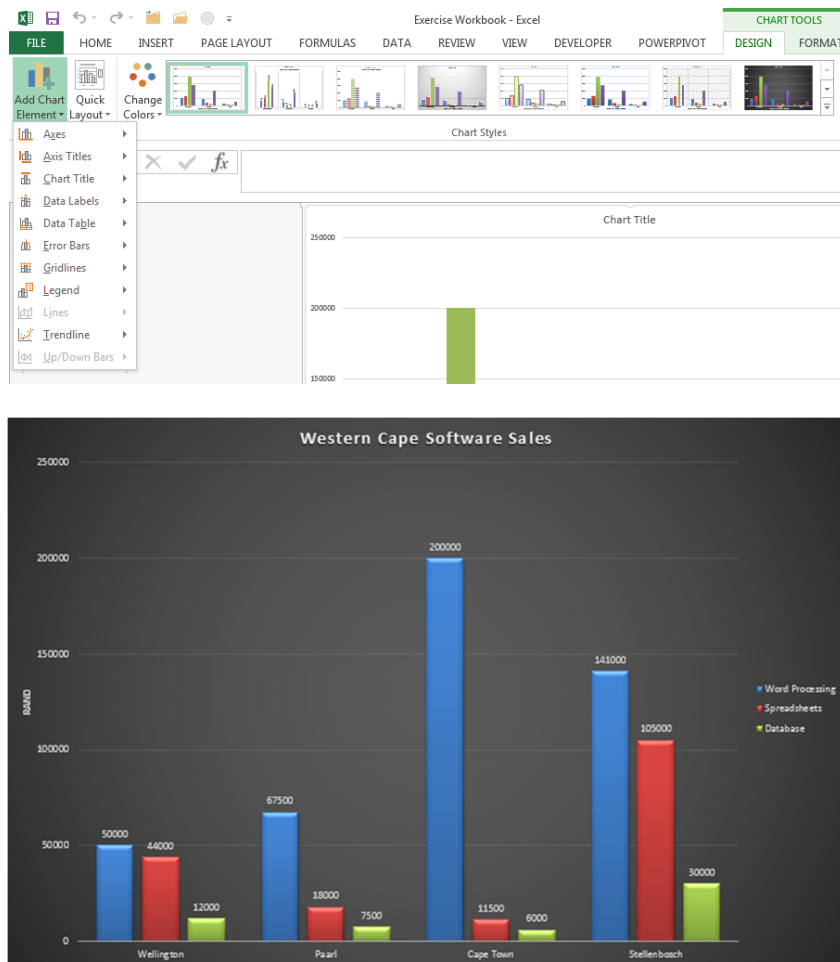
Select the chart and click on Move Chart in the Locations group on the Design tab





Exercise: Move the chart on sheet S11 to a new worksheet and call it Software Sales.

Select a style and add chart elements for the chart



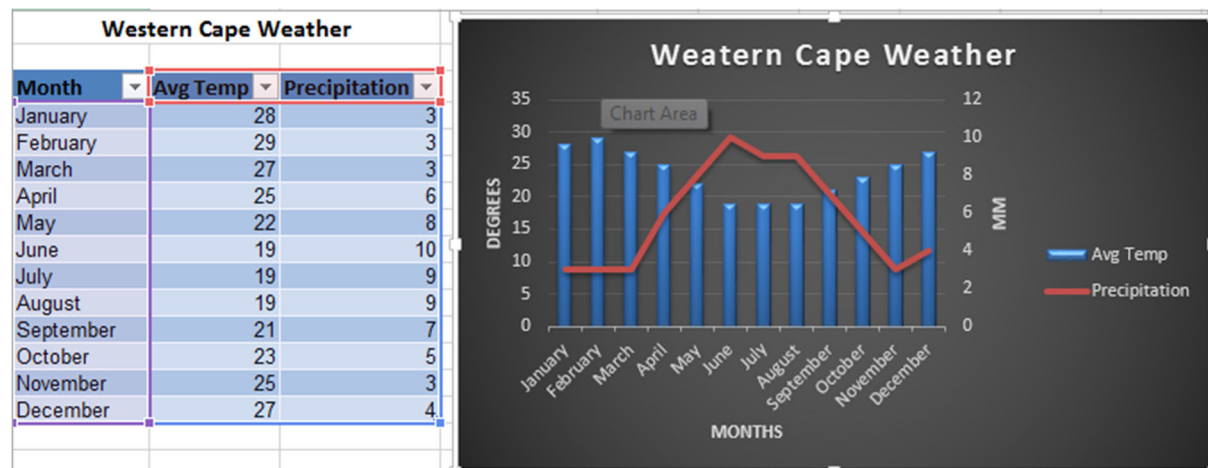
Exercise: Select a style and add chart elements.

Creating Combination Charts

Typically, a chart uses a single style: a column chart, a line chart, or a pie chart, for example. If your chart has more than one data series, you might want to display multiple styles within the same chart — a combination chart.

Below is a chart that's a good candidate for a combination chart. The chart shows average temperature and precipitation, by month. But there's a problem. The two ranges of data vary in magnitude, so the precipitation columns are barely visible in the chart.

The following figure shows the chart after it has been converted it to a combination chart. In this chart, the precipitation values are depicted with a line, and it uses a second vertical axis on the right. Most would agree that this chart is a vast improvement over the original.



This combination chart displays two data series that vary in magnitude.

Exercise: Use the table information on worksheet S12.

Follow these steps:

Insert a columns chart

Click on the Precipitation series

Choose Chart Tools > Design > Type > Change Chart Type.

In the Change Chart Type dialog box, select Combo chart

Then select line chart next to precipitation and Secondary Axis

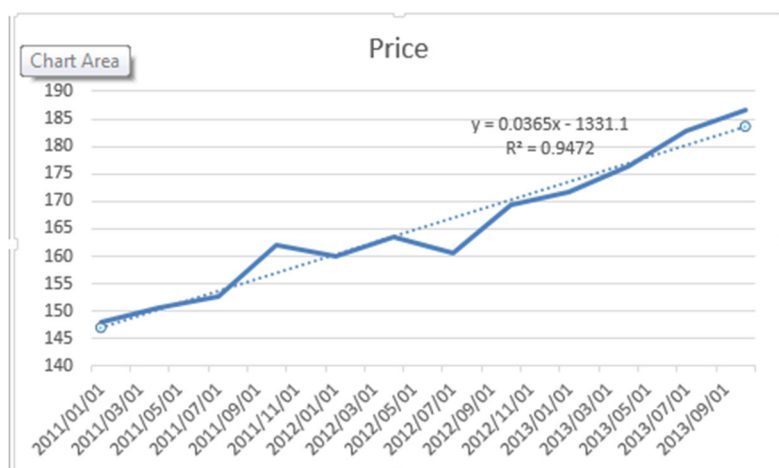
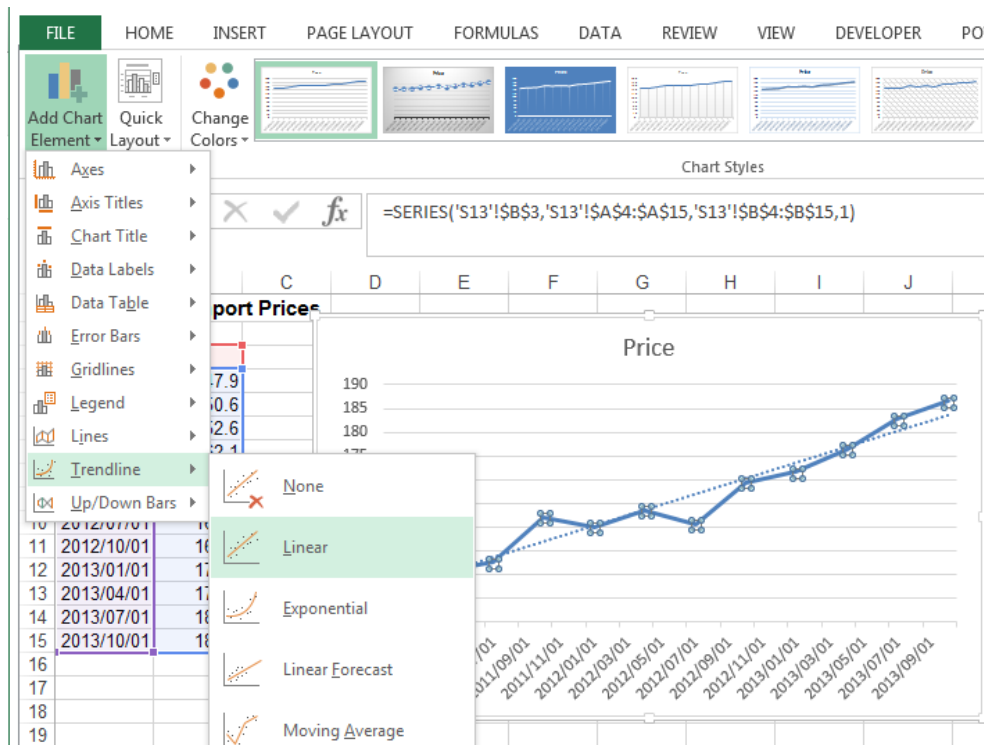
Adding Moving Averages and other Trendlines

A Trend line is a graphical representation of trends in a data series that allows you to make informed decisions. It can be a moving average, a linear-regression line, or a line generated by one of various kinds of nonlinear, curve-fitting methods.

Add a trendline to a series in an area: Open worksheet S14 and insert a chart (select line chart for the example), then click on Trendline under **Add Chart Element** in the Chart Layout group on the Design tab on the Chart Tools tab. Select the Trendline of your choice (Linear for the

example). Double click on the Trendline to open the Format Data Series dialog window. On the dialog window you can select the Equation and the R-squared.

In statistics, the coefficient of determination (R^2) indicates how well data points fit a statistical model – sometimes simply a line or curve. It is a statistic used in the context of statistical models whose main purpose is either the prediction of future outcomes or the testing of hypotheses, on the basis of other related information. An R^2 of 1 indicates that the regression line perfectly fits the data.



Exercise: Use the information on worksheet S14 to create a line chart, then add a linear trendline that shows the R-squared and the equation on the chart.

Pivot tables

A PivotTable report is an interactive worksheet table that you can use to summarize and analyse large amount of worksheet data quickly. It displays the selected worksheet data in a matrix format with specialized functionality that enables you to see new data relationships; summarize, group, and format selected portions of the data; pivot the data between columns and rows; and create concise customised output.

Steps to consider when creating a pivot chart

1. You can build a pivot table in about one minute

Many people have the idea that building a pivot table is complicated and time-consuming, but it is simply not true. Compared to the time it would take you to build an equivalent report manually, pivot tables are incredibly fast. If you have well-organized source data, you can create a pivot table less than a minute. Here is how:

- Select any cell in the source data
- On the Insert tab of the ribbon, click the PivotTable button
- In the Create PivotTable dialog box, check the data and click OK
- Drag a "label" field into the Row Labels area (e.g. customer)
- Drag a numeric field into the Values area (e.g. sales)

2. Perfect your source data

To minimize problems down the road, always use good quality source data, organized in a tabular layout. "Perfect" source data will have no blank rows or columns, and no subtotals. Each column will have a unique name (on one row only), every field will have a value in every row, and columns will not hold repeated groups of data (i.e. month names, location names, region names, etc.).

3. Count the data first

When you first create a pivot table, use it to generate a simple count first to make sure the pivot table is processing the data as you expect. To do this, simply add any text field as a Value field. You will see a very small pivot table that displays the total record count, that is, the total number of rows in your data. If this number makes sense to you, you are good to go. If the number does

not make sense to you, it is possible the pivot table is not reading the data correctly or that the data has not been defined correctly.

4. Plan before you build

Although it is a lot of fun dragging fields around a pivot table, and watching Excel churn out yet another unusual representation of the data, you can find yourself going down a lot of unproductive rabbit holes very easily. An hour later, it is not so fun anymore. Before you start building, jot down what you are trying to measure or understand, and sketch out a few simple reports on a notepad. These simple notes will help guide you through the huge number of choices you have at your disposal. Keep things simple, and focus on the questions you need to answer.

5. Use a table for your data to create a "dynamic range"

If you use an Excel Table for the source data of your pivot table, you get a very nice benefit: your data range becomes "dynamic". A dynamic range will automatically expand and shrink the table as you add or remove data, so will not have to worry that the pivot table is missing the latest data. When you use a Table for your pivot table, the pivot table will always be in sync with your data.

To use a Table for your pivot table:

- Select any cell in the data use the keyboard shortcut Ctrl-T to create a Table
- Click the Summarize with PivotTable button (TableTools > Design)
- Build your pivot table normally
- Profit: data you add to your Table will automatically appear in your Pivot table on refresh

6. Use a pivot table to count things

By default, a Pivot Table will count any text field. This can be a handy feature in a lot of general business situations. For example, suppose you have a list of employees and want to get a count by department? To get a breakdown by department, follow these steps:

- Create a pivot table normally
- Add the Department as a Row Label
- Add the employee Name field as a Value

- The pivot table will display a count of employee by Department

7. Show totals as a percentage

In many pivot tables, you will want to show a percentage rather than a count. For example, perhaps you want to show a breakdown of sales by product. But, rather than show the total sales for each product, you want to show sales as a percentage of the total sales. Assuming you have a field called Sales in your data, just follow these steps:

- Add Product to the pivot table as a Row Label
- Add Sales to the pivot table as a Value
- Right-click the Sales field, and set "Show Values As" to "% of Grand Total"

8. Use a pivot table to build a list of unique values

Because pivot tables summarize data, they can be used to find unique values in a field. This is a good way to quickly see all the values that appear in a field and also find typos, and other inconsistencies. For example, suppose you have sales data and you want to see a list of every product that was sold. To create a product list:

- Create a pivot table normally
- Add the Product as a Row Label
- Add any other text field (category, customer, etc) as a Value
- The pivot table will show a list of all products that appear in the sales data

9. Create a self-contained pivot table

When you have created a pivot table from data in the same worksheet, you can remove the data if you like and the pivot table will continue to operate normally. This is because a pivot table has a pivot cache that contains an exact duplicate of the data used to create the pivot table.

- Refresh the pivot table to ensure cache is up to date (PivotTable Tools > Refresh)
- Delete the worksheet that contains the data
- Use your pivot table normally

10. Group a pivot table manually

Although pivot tables automatically group data in many ways, you can also group items manually into your own custom groups. For example, assume you have a pivot table that shows

a breakdown of employees by department. Suppose you want to further group the Engineering, Fulfilment, and Support departments into Group 1, and Sales and Marketing into Group 2. Group 1 and Group 2 do not appear in the data, they are your own custom groups. To group the pivot table into the ad hoc groups, Group 1 and Group 2:

- Control-click to select each item in the first group
- Right-click one of the items and choose Group from the menu
- Excel creates a new group, "Group1"
- Select Marketing and Sales in column B, and group as above
- Excel creates another group, "Group2"

11. Group numeric data into ranges

One of the most interesting and powerful features that every pivot table has is the ability to group numeric data into ranges or buckets. For example, assume you have a list of voting results that includes voter age, and you want to summarize the results by age group:

- Create your pivot table normally
- Add Age as a Row Label, Vote as a Column Label, and Name as a Value
- Right-click any value in the Age field and choose Group
- Enter 10 as the interval in the "By:" input area
- When you click OK, you'll see the voting data grouped by age into 10-year buckets

12. Rename fields for better readability

When you add fields to a pivot table, the pivot table will display the name that appears in the source data. Value field names will appear with "Sum of " or "Count of" when they are added to a pivot table. For example, you'll see Sum of Sales, Count of Region, and so on. However, you can simply overwrite this name with your own. Just select the cell that contains the field you want to rename and type a new name.

13. Add a space to field names when Excel complains

When you try to rename fields, you might run into a problem if you try to use exactly the same field name that appears in the data. For example, suppose you have a field called Sales in your

source data. As a value field, it appears as Sum of Sales, but (sensibly) you want it to say Sales. However, when you try to use Sales, Excel complains that the field already exists, and throws a "PivotTable field name already exists" error message.

14. Add a field more than once to a pivot table

There are many situations when it makes sense to add the same field to a pivot table more than once. It may seem odd, but you can indeed add the same field to a pivot table more than once. For example, suppose you have a pivot table that shows a count of employees by department. The count works fine, but you also want to show the count as a percentage of total employees. In this case, the simplest solution is to add the same field twice as a Value field:

- Add a text field to the Value area (e.g. First name, Name, etc.)
- By default, you'll get a count for text fields
- Add the same field again to the Value area
- Right-click the second instance, and change Show Values As to "% of Grand Total"
- Rename both fields as you wish

15. Automatically format all value fields

Any time you add a numeric field as a Value in a pivot table, you should set the number format directly on the field. You may be tempted to format the values you see in the pivot table directly, but this is not a good idea, because it is not reliable as the pivot table changes. Setting the format directly on the field will ensure that the field is displayed using the format you want, no matter how big or small the pivot table becomes.

For example, assume a pivot table that shows a breakdown of sales by Region. When you first add the Sales field to the pivot table, it will be displayed in General number format, since it's a numeric field. To apply the Accounting number format to the field itself:

- Right-click on the Sales field and select Value Field Settings from the menu
- Click the Number Format button in the Value field settings dialog that appears
- Set the format to Accounting and click OK to exit

16. Drill down to see (or extract) the data behind any total

Whenever you see a total displayed in a pivot table, you can easily see and extract the data that makes up the total by "drilling down". For example, assume you are looking at a pivot table that shows employee count by department. You can see that there are 50 employees in the Engineering department, but you want to see the actual names. To see the 50 people that make up this number, double-click directly on the number 50 and Excel will add a new sheet to your workbook that contains the exact data used to calculate 50 engineers. You can use this same approach to see and extract data behind totals wherever you see them in a pivot table.

17. Clone your pivot tables when you need another view

Once you have one pivot table set up, you might want to see a different view of the same data. You could of course just rearrange your existing pivot table to create the new view. But if you're building a report that you plan to use and update on an on-going basis, the easiest thing to do is clone an existing pivot table, so that both views of the data are always available.

There are two easy ways to clone a pivot table. The first way involved duplicating the worksheet that holds the pivot table. If you have a pivot table set up in worksheet with a title, etc., you can just right click the worksheet tab to copy the worksheet into the same workbook. Another way to clone a pivot table is to copy the pivot table, and paste it somewhere else. Using these approaches, you can make as many copies as you like.

When you clone a pivot table this way, both pivot tables share the same pivot cache. This means that when you refresh any one of the clones (or the original) all of the related pivot tables will be refreshed.

18. Unclone a pivot table to refresh independently

After you have cloned a pivot table, you might run into a situation where you really do not want the clone to be linked to the same pivot cache as the original. A common example is after you have grouped a date field in one pivot table, refresh, and discover that you have also accidentally grouped the same date field in another pivot table that you did not intend to change. When pivot tables share the same pivot cache, they also share field grouping as well.

Here is one way to unclone a pivot table, that is, unlink it from the pivot cache it shares with other pivot tables in the same worksheet:

- Cut the entire pivot table to the clipboard
- Paste the pivot table into a brand new workbook

- Refresh the pivot table
- Copy it again to the clipboard
- Paste it back into the original workbook
- Discard the temporary workbook

Your pivot table will now use its own pivot cache and will not refresh with the other pivot table(s) in the workbook, or share the same field grouping.

19. Get rid of useless headings

The default layout for new pivot tables is the Compact layout. This layout will display "Row Labels" and "Column Labels" as headings in the pivot table. These are not the most intuitive headings, especially for people that do not often use pivot tables. An easy way to get rid of these odd headings is to switch the pivot table layout from Compact to Outline or Tabular layout. This will cause the pivot table to display the actual field names as headings in the pivot table, which is much more sensible. To get rid of these labels altogether, look for a button called Field Headers on the Analyse tab of the Pivot Table Tools ribbon. Clicking this button will disable headings completely.

20. Add a little white space around your pivot tables

This is just a simple design tip. All good designers know that a pleasing design requires a little white space. White space just means empty space set aside to give the layout breathing room. After you create a pivot table, insert an extra column to the left and an extra row or two at the top. This will give your pivot table some breathing room and create a better-looking layout. In most cases, I also recommend that you turn off gridlines on the worksheet. The pivot table itself will present a strong visual grid, so the gridlines outside the pivot table are unnecessary, and will simply create visual noise.

21. Get rid of row and column grand totals

By default, pivot tables show totals for both rows and columns, but you can easily disable one or both of these totals if you do not want them. On the Pivot Table tab of the ribbon, just click the Totals button and choose the options you want.

22. Format empty cells

If you have a pivot table that has a lot of blank cells, you can control the character that is displayed in each blank cell. By default, empty cells will display nothing at all. To set your

own character, right-click inside the pivot table and select Pivot Table options. Then make sure that "Empty cells as:" is checked, and enter the character you want to see. Keep in mind that this setting respects the applied number format. For example, if you are using the accounting number format for a numeric value field, and enter a zero, you'll see a hyphen "-" displayed in the pivot table, since that's how zero values are displayed with the Accounting format.

23. Turn off AutoFit when necessary

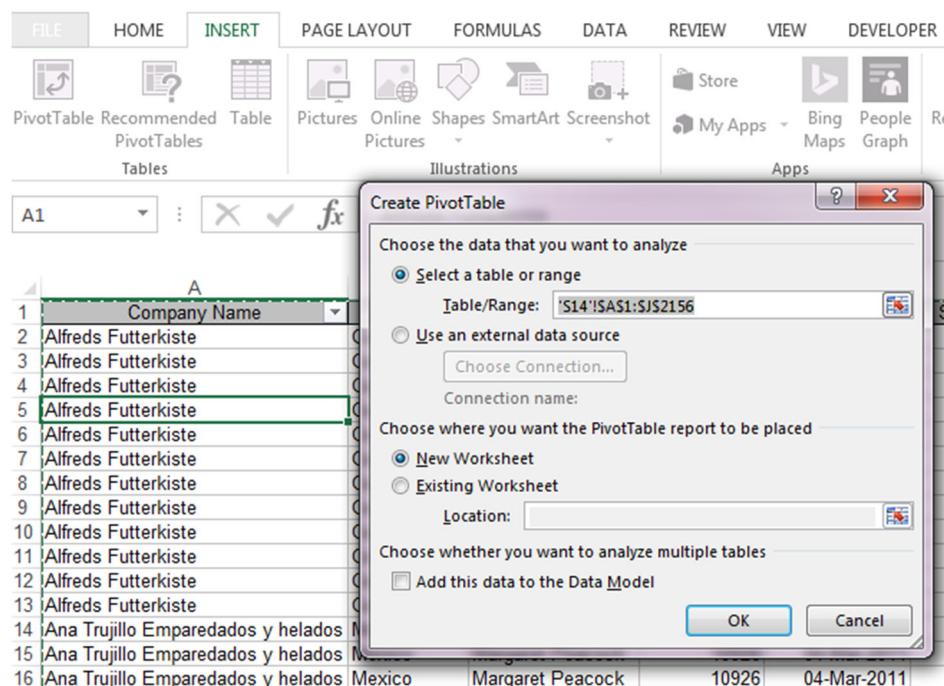
By default, when you refresh a pivot table, the columns that contain data are adjusted automatically to best fit the data. Normally, this is a good thing, but it can drive you crazy if you have other things on worksheet along with the pivot table, or if you have carefully adjusted the column widths manually and do not want them changed. To disable this feature, right-click inside the pivot table and choose PivotTable Options. In the first tab of the options (or the layout tab on a Mac), uncheck "AutoFit Column Widths on Update".

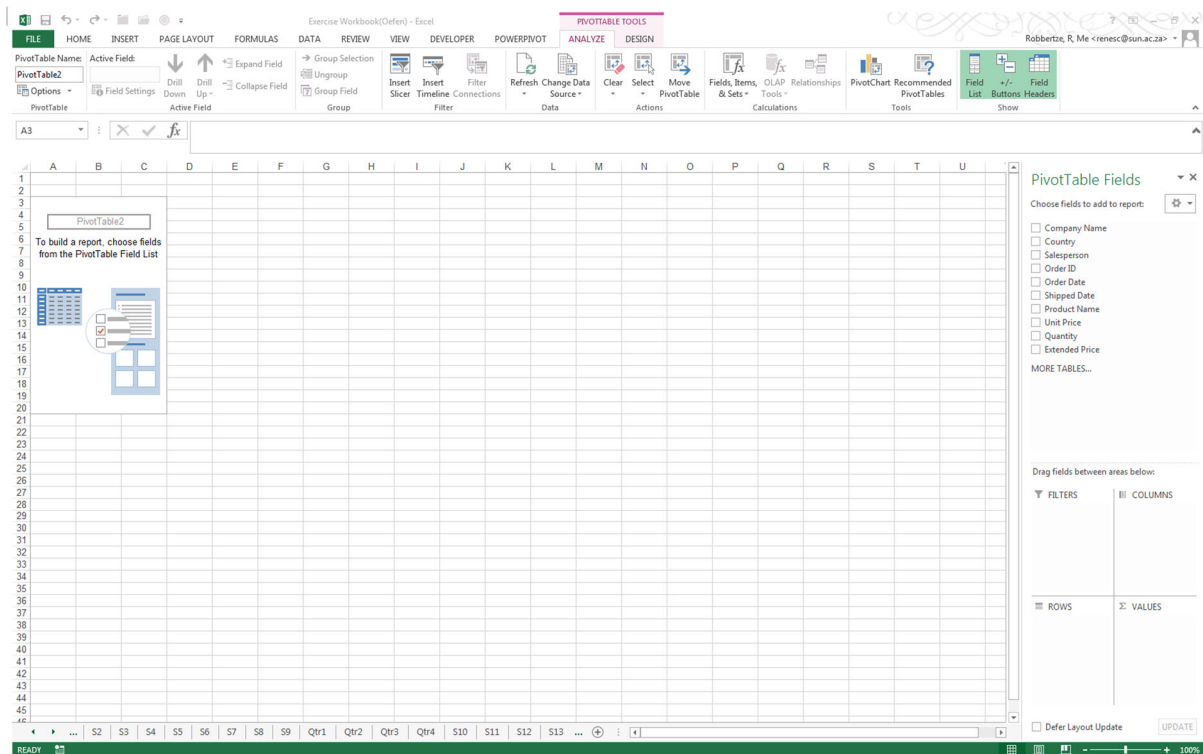
[Bruns, D. 2014. 23 things you should know about Excel pivot tables]

Pivot Table Report

How to create a PivotTable Report

Select a cell in the data range you want to use as the source data in the worksheet. > Click on PivotTable in the Tables group on the Insert tab.> Specify the data range in the Create PivotTable dialog box, choose a new sheet and click OK.





The PivotTable Filed List Pane

The PivotTable Filed List pane is displayed when you select a PivotTable report. The pane includes drop zones, wherein you drag and drop fields in order to reorient and rearrange data and calculated values in multiple formats quickly. It also includes the Report Filter drop zone for fields that need to be eliminated from PivotTable reports. You can make informed decisions more efficiently by manipulating the PivotTable report results interactively.

Choose the fields to add to the PivotTable report

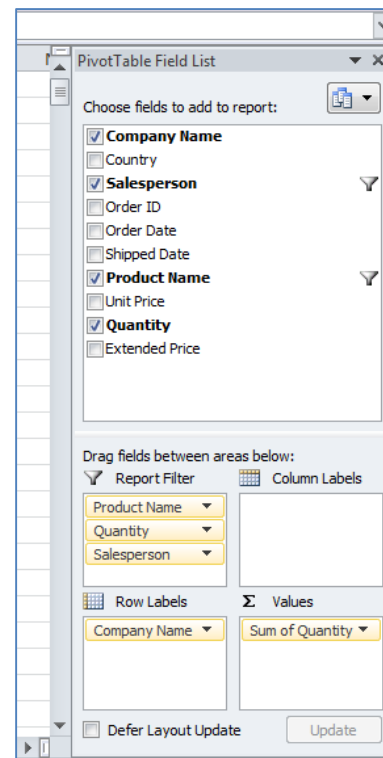
Check or uncheck the check boxes to select fields for the PivotTable report.

To use a field in a separate are of the report, from the Choose fields to add to report list box, drag the desired fields to the Report Filter, Column Labels, Row Labels, or Values drop zone.

If desired, check Defer Layout Update if you want to use the Update button to manually updates the PivotTable report.

To move a field to different area, drag the field, or click the field's drop-down arrow, and make the appropriate selection.

	A	B
1	Product Name	Camembert Pierrot
2	Quantity	(All)
3	Salesperson	Margaret Peacock
4		
5	Row Labels	Sum of Quantity
6	Furia Bacalhau e Frutos do Mar	20
7	Great Lakes Food Market	15
8	Lehmanns Marktstand	20
9	Queen Cozinha	15
10	QUICK-Stop	55
11	Rattlesnake Canyon Grocery	21
12	Richter Supermarkt	60
13	Romero y tomillo	10
14	Save-a-lot Markets	45
15	Suprêmes délices	40
16	Tradição Hipermercados	30
17	Grand Total	331
18		
19		



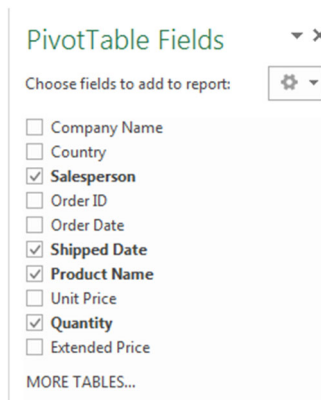
Exercise: Create a PivotTable:

Scenario: A Shipping workbook contains a large amount of information about the products that were shipped by ABC Ltd in the past several months. Your manager has requested a report to review the total quantity of products that Anne sold in January, sorted by company name. Since you are confident that your manager might have a similar request for information on other salespersons as well, you decide to create a PivotTable report to easily extract information without consistently having to rearrange data by sorting and re-creating formulas.

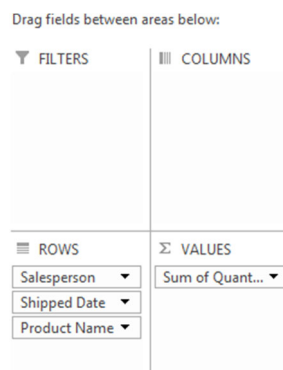
Step 1: Create a PivotTable report of sales by each salesperson and shipped date.

- Open worksheet S15 in the Exercise Workbook
- Select PivotTable on the Insert tab in the Tables group
- In the Create PivotTable dialog box, in the Choose the data that you want to analyse section, verify that Select a table or range is selected and in the Table/Range text box, Invoices!\$A1:\$j\$2156 is displayed. In the Choose where you want the PivotTable report to be placed section, verify that New Worksheet is selected and click OK to create the PivotTable.

- In the PivotTable Field List pane, in the Choose fields to add to the report list box, check Salesperson, Shipped Date, Product Name, and Quantity to show these items on the PivotTable report.



- Observe that Excel automatically determines the most appropriate field from what has been checked in the list to place in the Values list box.

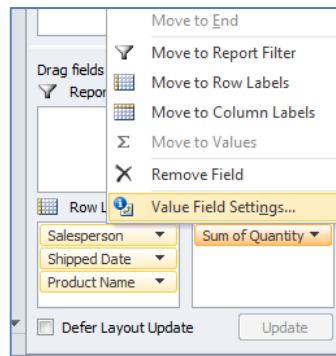


- In the PivotTable, observe that the products are displayed in the ascending order of the shipped date.

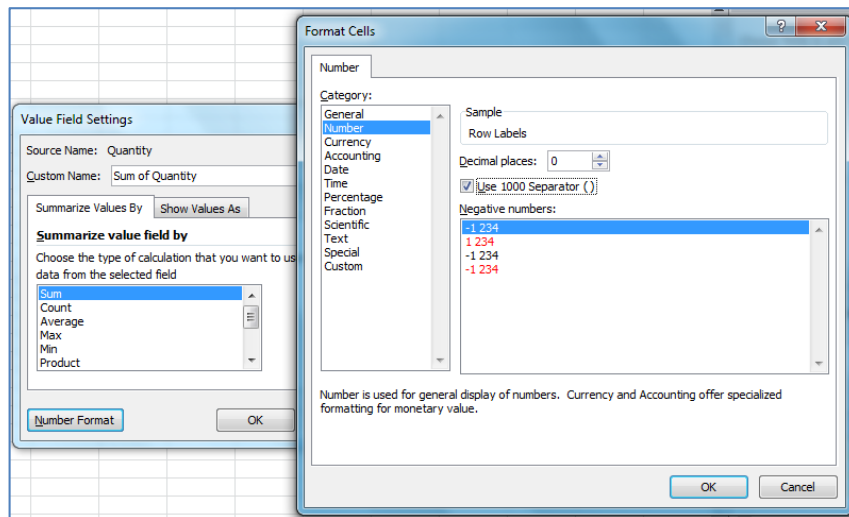
Row Labels	Sum of Quantity
Andrew Fuller	6055
01-Jan-2011	50
Gudbrandsdalsost	50
05-Jan-2011	12
Mozzarella di Giovanni	10
Tarte au sucre	2
07-Jan-2011	17
Konbu	7
NuNuCa Nuß-Nougat-Creme	5
Outback Lager	5
08-Jan-2011	100
Gumbär Gummibärchen	30
Maxilaku	30
Singaporean Hokkien Fried Mee	40
09-Jan-2011	240
Côte de Blaye	10
Gnocchi di nonna Alice	20

Step 2: Change the label in the PivotTable report to “Total Quantity Sold” by using the Values Field Settings dialog box.

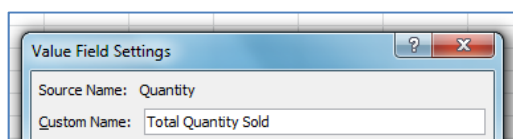
- In the PivotTable Field List pane, in the Drag fields between areas below section, in the Values list box, click SUM of Quantity Drop-down arrow and select Value Field Settings.



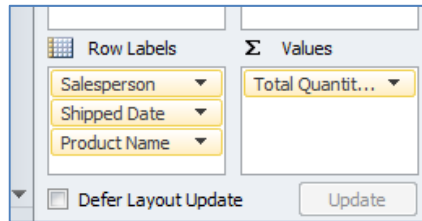
- In the Value Field Settings dialog box, on the Summarize Values By tab, in the Summarize value field by list box, verify that Sum is selected by default and click Number Format.
- In the Format Cells dialog box, in the Category list box, select Number.
- In the right pane, in the Decimal places spin box, enter 0.
- Check the Use 1000 Separator (,) check box to separate the value with a comma and click OK.



- In the Value Field Settings dialog box, in the Custom Name text box, replace the default text with Total Quantity Sold and click OK.

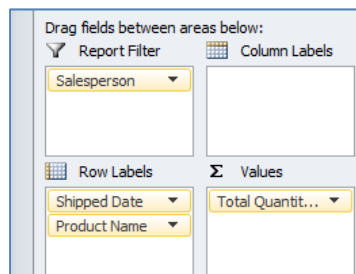


- In the PivotTable Field List pane, in the Drag fields between areas below section, verify that the Values list box displays the new label as Total Quantity Sold.

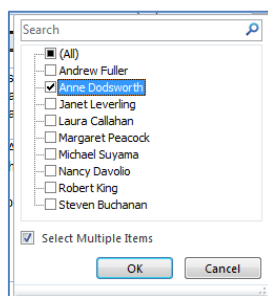


Step 3: Create a filter to group the PivotTable by Salesperson and then display products that Anne Dodsworth sold.

- In the PivotTable Field List pane, from the Rows Labels list box, drag the Salesperson field to the Report Filter list box.



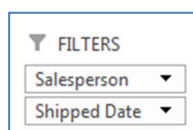
- On the worksheet, from the Salesperson filter drop-down list, select Anne Dodsworth and click OK.



PivotTable		Active Field	Group	Sort
A3		fx	Row Labels	
1	Salesperson	Anne Dodsworth		
2				
3	Row Labels	Total Quantity Sold		
4	05-Jan-2011	65		
5	Guaraná Fantástica	20		
6	Konbu	20		

Step 4: Display products that Anne sold that were shipped in the month of January.

- From the Row Labels list box, drag the Shipped Date field to the Report Filter list box and place it below Salesperson.

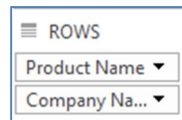


- In the worksheet, in the Shipped Date filter drop-down list, check Select Multiple Items.
- In the Shipped Date Items list check 01-Jan-2011 through 31-Jan-2011 and click OK.

- Observe that the PivotReport displays the total quantity of each product sold by Anne for the period 01-Jan-2011 to 31-Jan-2011.

Step 5: In the PivotTable report, display the names of the companies to which the products were being shipped.

- From the Choose fields to add to report list box, drag Company Name to the row Labels list box and place it below Product Name.



- Observe that the PivotTable now shows the total quantity of products sold by Anne grouped by the company name.

A		B
Salesperson	Anne Dodsworth	Y
Shipped Date	(Multiple Items)	Y
Row Labels	Total Quantity Sold	
Aniseed Syrup	49	
Königlich Essen	49	
Boston Crab Meat	25	
Berglunds snabbköp	25	

- Close the PivotTable List pane to make more space visible on the worksheet.

Step 6: Display the subtotals in a separate row at the bottom of each group and format the PivotTable report.

- On the PivotTable Tools Design contextual tab, in the Layout group, from the Sub-Totals drop-down list, select Show all Subtotals at Bottom of Group.

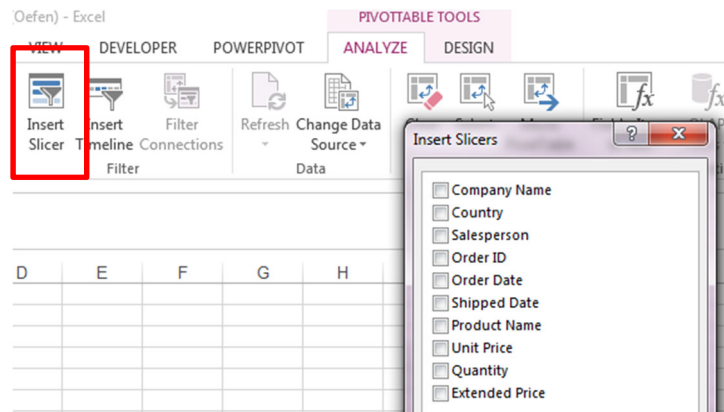
Row Labels	Total Quantity Sold
Aniseed Syrup	
Königlich Essen	49
Aniseed Syrup Total	49
Boston Crab Meat	
Berglunds snabbköp	25
Boston Crab Meat Total	25
Camembert Pierrot	
Island Trading	21
Camembert Pierrot Total	21

Filter Data Using Slicers

A slicer is a filtering tool that allows users to include only the required elements in the PivotTables and Pivot Charts. It allows users to add and remove elements from the table display so that the data can be compared and evaluated from different perspectives. Users can choose more than one Slicer for a PivotTable, if required.

The Insert Slicers dialog box allows you to select the fields for slicing PivotTable data.

This dialog box is on the PivotTables Tools Analyze tab in the Filter group



2	Product Name	(All)	
3	Salesperson	(All)	
4			
5	Row Labels	Sum of Quantity	
6	Frankenversand	121	
7	Grand Total	121	
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			

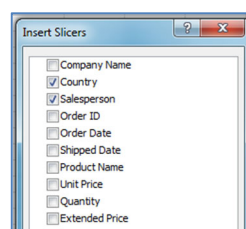
Country	Order Date
Germany	2010/12/16
Portugal	2010/12/22
Argentina	2010/12/23
Austria	2010/12/25
Belgium	2010/12/26
Brazil	2010/12/27
Canada	2011/01/06
Denmark	2011/01/07

Exercise: Filtering PivotTable Data using slicers

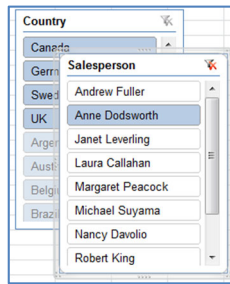
Scenario: Your manager has asked you to create a report for a presentation showing the sales information of each salesperson. He wants you to display the data for each salesperson grouped by country. Though you entered the data in a PivotTable format, you want to further filter it so as to keep the presentation as simple as possible. To make the presentation simple, you decide to apply Slicers to the PivotTable so that you can switch between different salespersons.

Step 1: Define Slicers for your table.

- On the PivotTable Tools Analyze tab, in the Filter group click on Insert Slicer.
- In the Insert Slicers dialog box, check the Country and Salesperson check boxes and click OK.



- Observe that two Slicer windows are placed on the worksheet.



- Reposition the Slicer windows to view the entire PivotTable.

Step 2: View the information related to individual salespersons in a country.

- In the Country Slicer window, select Brazil to display the information specific to the country.
- Observe that there is no sales data available for the salesperson Anne in Brazil for the month of January, indicating that she has not sold anything in Brazil in January.
- In the Salesperson Slicer window, select Janet to display the information specific to the salesperson.
- Observe that the sales data for the salesperson Janet in Brazil is displayed in the PivotTable report.

PivotCharts

A PivotChart is an interactive chart that graphically represents the data in a PivotTable report. When you create a PivotChart report, a PivotTable report associated with the chart is also created. A chart contains standard chart elements, although you can make changes to it by changing its type or layout.

A PivotChart is tied to its PivotTables report's contents and functionality, not to worksheet sells.

Exercise: Create a PivotChart:

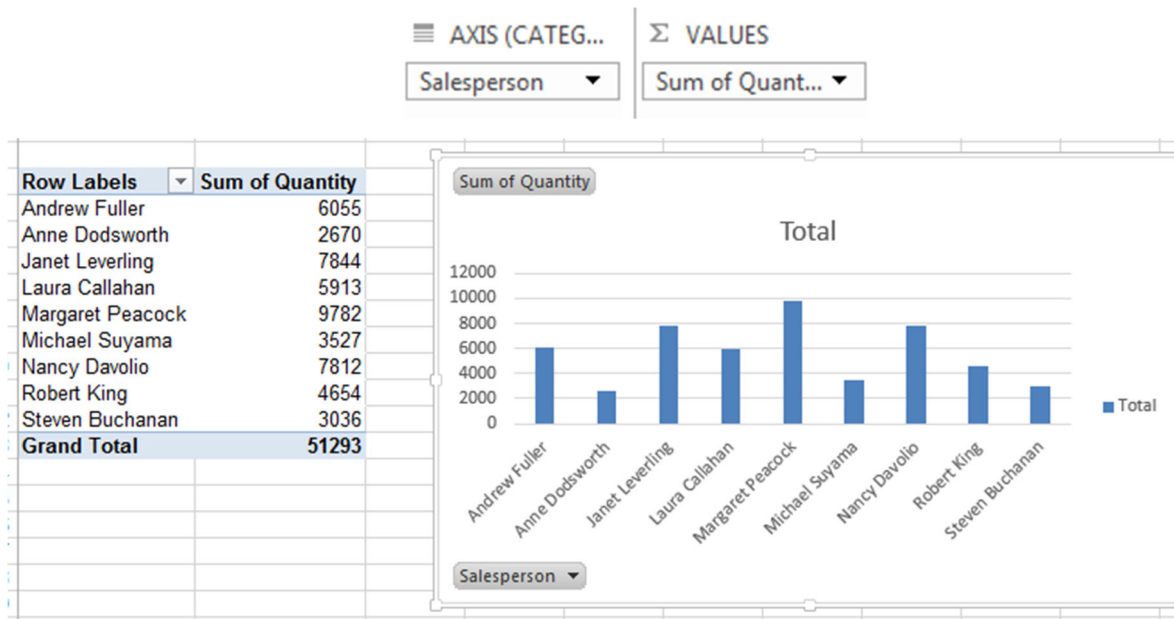
Scenario: The sales manager at ABC Ltd has asked you to create a column chart based on the data on the PivotCharts worksheet to show the sales people how they have been doing with their sales for different products in different countries. Instead of creating multiple column charts, you decide to present the data in a simple format using a PivotChart that can filter the details of sales by country and product.

Step 1: Create a PivotChart

- Open worksheet S15
- On the Insert tab, in the Charts group, from the PivotChart drop-down list, select PivotChart & PivotTable.



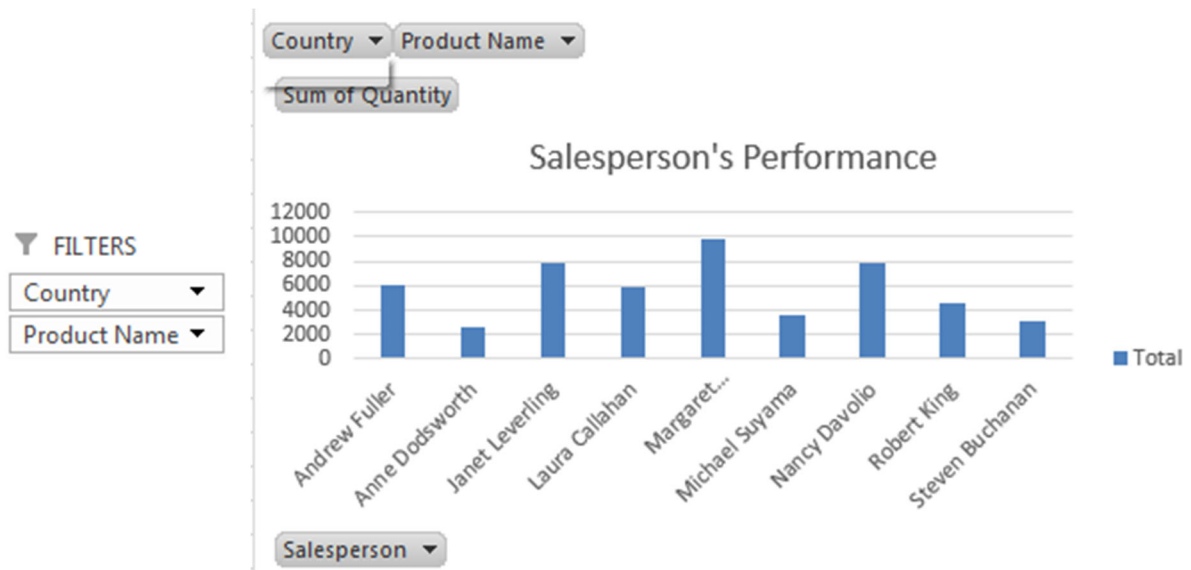
- In the Create PivotTable with PivotChart dialog box, in the Choose the data that you want to analyse section, verify that Select a table or range is selected and in the Table/Range text box, Invoices!\$A\$1:\$J\$2156 is displayed. In the Choose where you want the PivotTable and PivotChart to be placed, verify that New Worksheet is selected and click OK to create the PivotTable.
- In the PivotTable Field List pane, in the Choose fields to add to the report list box, check the Salesperson and Quantity check boxes to display them in the Axis Fields (Categories) and Values list box respectively.



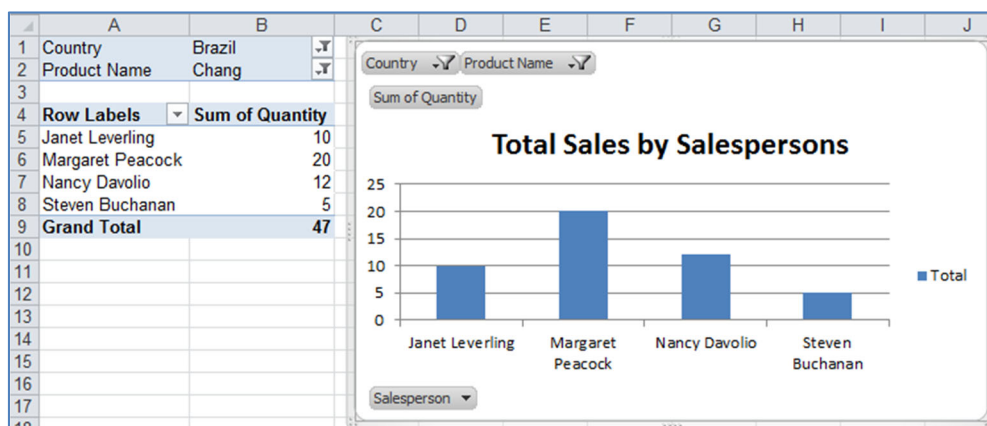
Step 2: Change the chart title to Salesperson's Performance

Step 3: Create a PivotChart report filter to filter the report by country and then by product, to display the total quantity for products sold by each salesperson in a country.

- In the PivotTable Fields List pane, from the Choose fields to add to the report list box, drag the Country field to the Report Filter list box.
- Drag the Product Name field to the Report Filter list box below the Country field.



- On the PivotChart, from the Country drop-down list, select Germany and click OK.
- On the PivotChart from the Product Name drop-down list, select Aniseed Syrup and click OK.
- Verify that both the PivotTable and PivotChart now display the Sum of Quantity for the product Aniseed Syrup in Germany for different salespersons.
- On the PivotChart from the Country drop-down list, select Brazil, and click OK.
- Observe that there were no sales for the product Aniseed Syrup in Brazil.
- On the PivotChart from the Product Name drop-down list, select Chang and click OK.
- Verify that the PivotChart now displays the Sum of Quantity for the product Chang in Brazil for different salespersons.



Step 4: Format the PivotChart

- On the PivotChart Tool Design contextual tab, in the Type group, click Change Chart Type.

- In the Change Chart Type dialog box, in the right pane, in the column section, in the first row, select 3-D Clustered Column and click OK.



- In the Chart Styles group, click the More button.
- In the displayed gallery, select a style of your choice.

Power Pivot for Excel

Microsoft Power Pivot for Excel is an add-in that you can use to perform powerful data analysis in Microsoft Excel and bringing self-service business intelligence to your desktop. Using Power Pivot for Excel to give your data meaning. By using Power Pivot for Excel, you can transform enormous quantities of data with incredible speed into meaningful information to get the answers you need in seconds.

- Take advantage of familiar Excel tools and features
- Process massive amounts of data in seconds.
- Import millions of rows of data from multiple data sources.
- Load even the largest data sets from virtually any source including databases, data feeds, Reporting Services, and text files
- Use powerful new analytical capabilities, such as Data Analysis Expressions (DAX)
- You can download the full version of PowerPivot software for free. There is no cost, now or in the future.
- PowerPivot becomes part of Excel and provides powerful, new data analysis capabilities.

With Power Pivot for Excel, you can import millions of rows of data from multiple data sources into a single Excel workbook, create relationships between heterogeneous data, create

calculated columns and measures using formulas, build PivotTables and PivotCharts, and then further analyse the data so that you can make timely business decisions.

[Power Pivot Add-in. Microsoft Online: <https://support.office.com/en-us/article/Power-Pivot-Add-in-a9c2c6e2-cc49-4976-a7d7-40896795d045>]

So what is this software and why is it free?

The software is called "PowerPivot" and is available from Microsoft as a free add-in to Excel. Microsoft is making PowerPivot available for free to the hundreds of thousands of Excel users because it is counting on a small percentage of them buying additional Microsoft server products to publish PowerPivot data models.

PowerPivot is an innovative adaptation of "Business Intelligence" software used by big companies to analyse data. Microsoft's plan is to "bring Business Intelligence to the masses" and PowerPivot is their first step in the plan. Eventually Microsoft can make millions from expanded use of its Business Intelligence software. In the meantime you can take advantage of free PowerPivot software.

Almost every organization is drowning in data. Businesses need to analyse marketing data, service data and budget data. Schools need to analyse student performance data. Governmental agencies need to analyse demographic data. The list goes on and on.

Most organizations have limited IT resources so they are spending hours and hours of time crunching data in Excel. There is never enough time to fully analyse the data.

By using PowerPivot you can analyse data in ways that go way beyond "regular Excel". You can get more done in less time.

PC World Magazine says it this way:

“As the name implies, PowerPivot is a PivotTable on steroids. With PowerPivot, you can pull into Excel large amounts of data from multiple database tables, databases or other sources of data, and sort and filter them almost instantly. Data can be reorganized around one column or compared against columns from another data source. You can divide the data by time, geographic origin or some other parameter. Since it runs Microsoft's business intelligence software on the back end, it can do much of what a full-fledged BI application can do.”

Gartner says:

“Microsoft Excel has been widely used for data aggregation and lightweight analysis, but limitations have precluded its use as a high-end ad hoc analysis tool, including limits to the data size it can handle and the number of rows it offers, its slow calculations, its lack of understanding of dimensional models and its lack of centralized spreadsheet management and control. PowerPivot begins to address this limitation extending interactive analysis capabilities to Excel "power users.””

How the data is stored

The data that you work on in Excel and in the Power Pivot window is stored in an analytical database inside the Excel workbook, and a powerful local engine loads, queries, and updates the data in that database. Because the data is in Excel, it is immediately available to PivotTables, PivotCharts, Power View, and other features in Excel that you use to aggregate and interact with data. All data presentation and interactivity are provided by Excel; and the data and Excel presentation objects are contained within the same workbook file. Power Pivot supports files up to 2GB in size and enables you to work with up to 4GB of data in memory.

Steps you use to prepare the dashboard

Step 1: Think about the data you want to measure.

This is the most important step in the process. Whatever you want to improve, start by measuring it. An easy to maintain dashboard will help to focus everyone’s attention on improvement.

After deciding what to measure you need to find the data. This might require meeting with a technical resource. In this example you got the data from six interconnected database tables and two Excel worksheets.

Step 2: Connect Excel to the data

PowerPivot has all you need to connect to databases, Excel, Access, text files or sources of data from the web. Once connected PowerPivot stores a copy of the data in Excel. Millions of rows of data can be effectively stored by PowerPivot using a new technology that compresses the data.

When you are ready to update the data you just click on the PowerPivot “Refresh” button and an updated copy of the data is copied into the PowerPivot database.

Step 3: Prepare Excel charts to show the measure

You can make Excel pivot tables and pivot charts from the data in the PowerPivot database. Add one pivot table to a worksheet. If you need a pivot chart add the chart to the same worksheet. These worksheets will be hidden in the final dashboard. Use them to get your data and measures right.

Step 4: Copy the charts to a single worksheet and add slicers

Copy charts from the pivot table worksheet to your dashboard sheet. Arrange the charts on the dashboard. Then add “Slicers” which are groups of buttons used to filter the data in your charts. Each slicer can be attached to multiple pivot tables. When you click on a year in the slicer on the dashboard then each of the pivot tables attached to that slicer will show data only for that year. In this way slicer buttons on the dashboard worksheet control what data is shown on the dashboard charts.

Excel 2010 has three new features that are all part of the new Excel PowerPivot Self-Service BI capability.

1. Excel PowerPivot allows you to create a simple database within Excel.
2. Excel PowerPivot pivot table and charts allows you to quickly prepare the charts. Unlike the lightweight pivot tables in Excel 2003, these pivot tables can combine data from different tables and come with new formulas that are essential for serious analysis.

At first glance PowerPivot pivot tables and pivot charts are similar to the pivot table and charts that have been in Excel since 1993. But the new PowerPivot pivot table and pivot charts have two very significant differences:

- a. They can combine data from multiple tables. (The old pivot tables required you to get all the data in one table.)
- b. The new Data Analysis Expression (DAX) formula language that makes it easy to do calculations within the pivot table and line up comparative measures like “Prior Year To Date”.

3. Excel Slicers provide a way of selecting data so that multiple charts can be shown together and controlled by one set of buttons.

[Dashboards, PowerPivot, Slicers, and DAX: Things you can do with Excel 2010

<http://www.pivotaldashboard.com/Pages/PowerPivotExample.aspx>]

Create relationships in Diagram View in Power Pivot

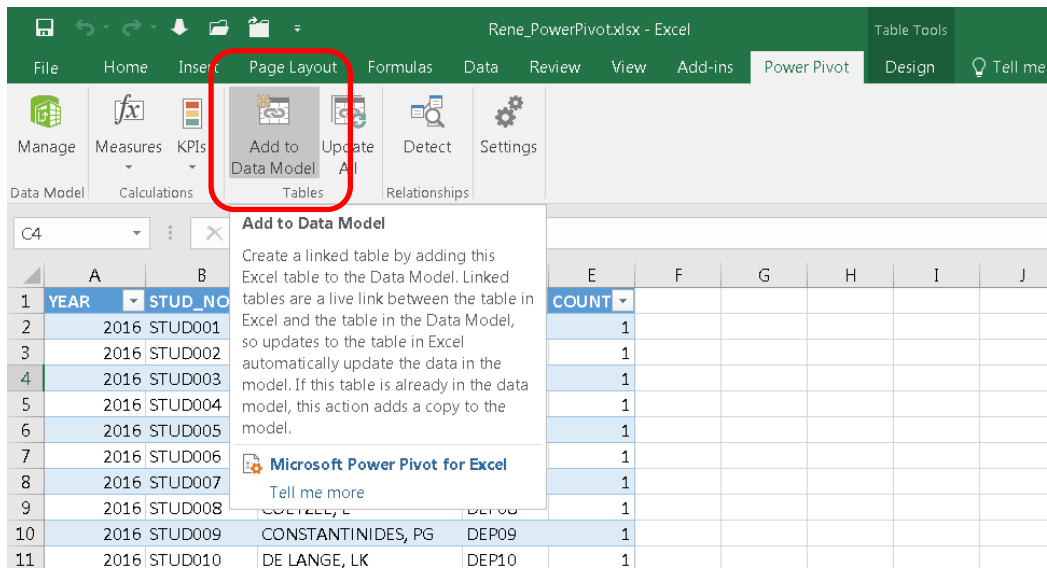
Working with multiple tables makes data more interesting and relevant to the PivotTables and reports that use that data. When you work with your data using the Power Pivot add-in, you can use Diagram View to create and manage the connections among the tables you imported.

Creating table relationships requires that each table has a column that contains matching values. For example, if you are relating Customers and Orders, each Order record would need to have a Customer Code or ID that resolves to a single customer.

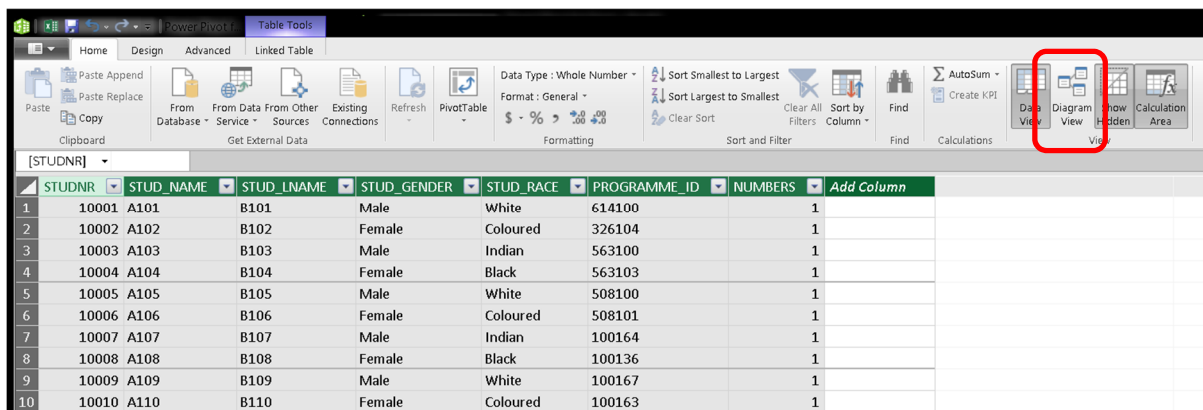
1. In the Power Pivot window, click **Diagram View**. The Data View spreadsheet layout changes to a visual diagram layout, and the tables are automatically organized, based on their relationships.
2. Right-click a table diagram, and then click **Create Relationship**. The Create Relationship dialog box opens.
3. If the table is from a relational database, a column is preselected. If no column is preselected, choose one from the table that contains the data that will be used to correlate the rows in each table.
4. For **Related Lookup Table**, select a table that has at least one column of data that is related to the table you just selected for Table.
5. For **Column**, select the column that contains the data that is related to **Related Lookup Column**.
6. Click **Create**.

Exercise: Create a very basic PowerPivot chart
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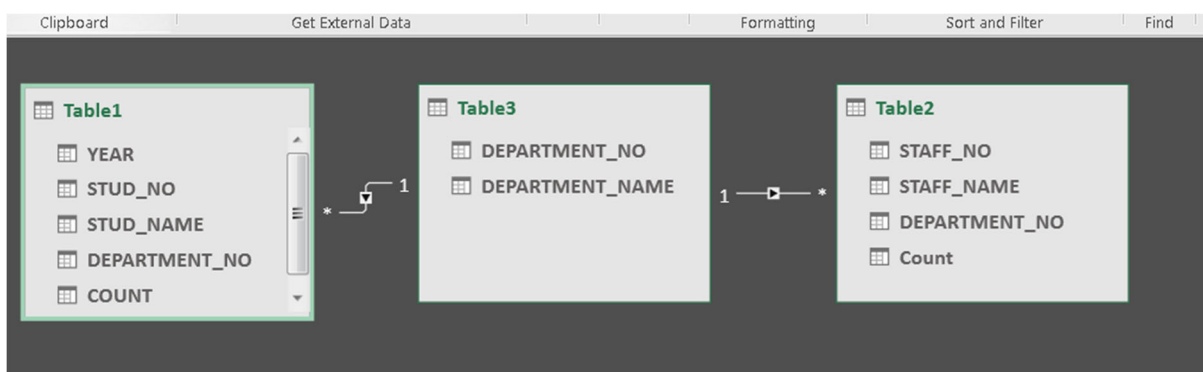
- | |
|--|
| <ol style="list-style-type: none">1. Open PowerPivot example workbook.2. Open the Insert tab and Insert the data on sheets1-3 in tables.3. Open the PowerPivot tab, click on every table and Add to Data Model |
|--|



4. Click on Diagram view in the Views tab



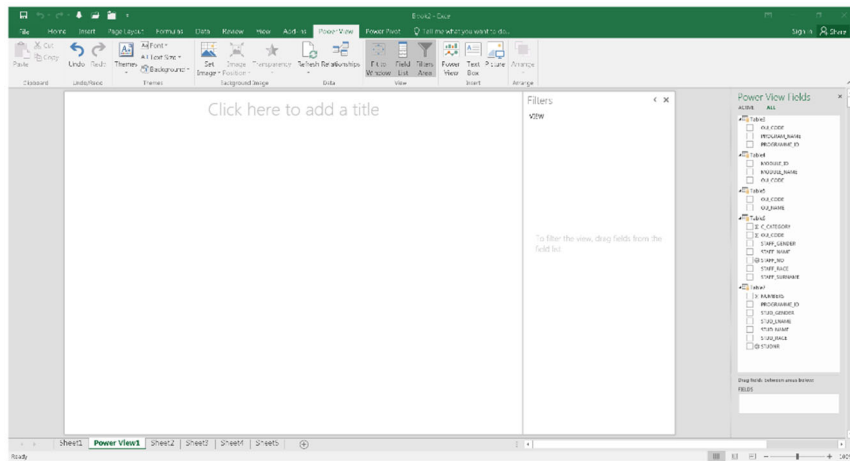
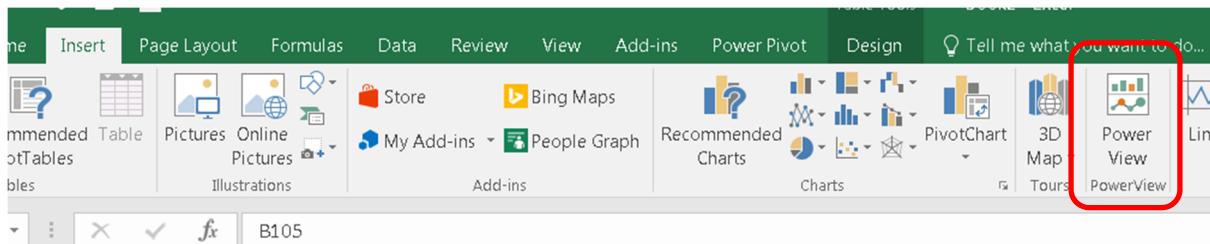
5. Arrange your tables and draw the relationships between the tables



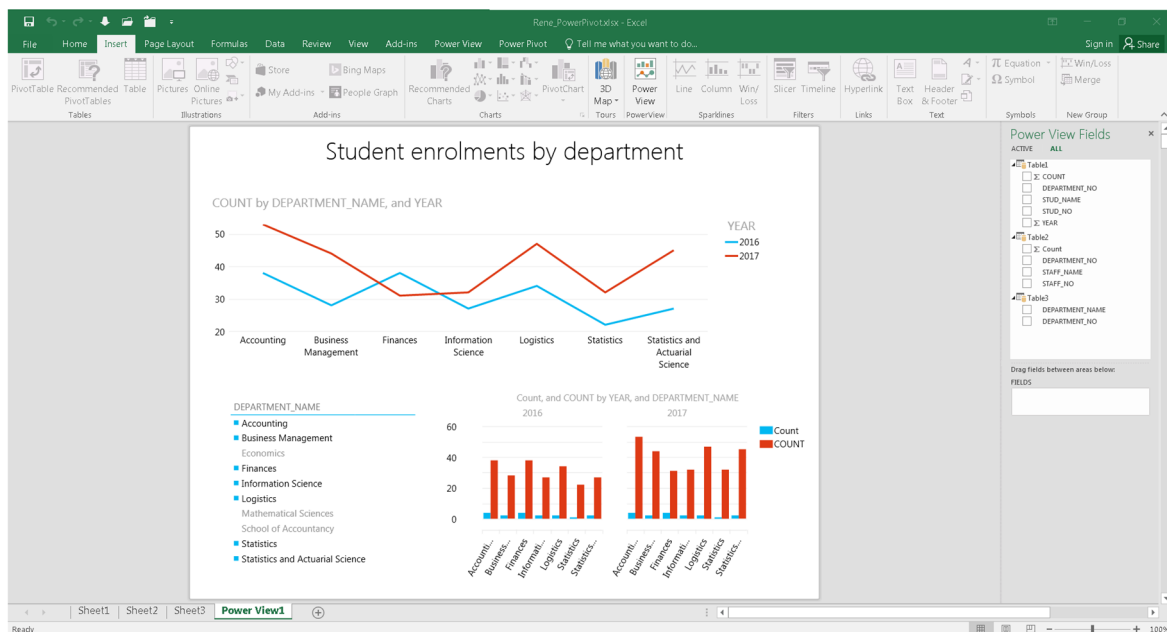
6. Open the Insert tab and click on PowerView in the PowerView group

*PowerView is an add in. Open the File tab > Options > Customise Ribbon > Under Choose commands, select All commands > Click on the + next to Insert on the Main Tabs group and

click on New Group at the bottom of the list > find PowerView under All tabs and move over to the Main tabs list. Click on OK.



7. Make your selections and draw a few tables.



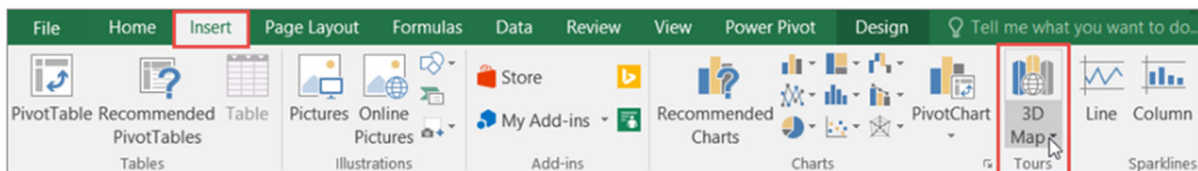
3DMaps

Microsoft 3D Maps for Excel is a three-dimensional (3-D) data visualization tool that lets you look at information in new ways. 3D Maps lets you discover insights you might not see in traditional two-dimensional (2-D) tables and charts.

With 3D Maps, you can plot geographic and temporal data on a 3-D globe or custom map, show it over time, and create visual tours you can share with other people. You will want to use 3D Maps to:

- Map data: Plot more than a million rows of data visually on Bing maps in 3-D format from an Excel table or Data Model in Excel.
- Discover insights: Gain new understandings by viewing your data in geographic space and seeing time-stamped data change over time.
- Share stories: Capture screenshots and build cinematic, guided video tours you can share broadly, engaging audiences like never before. Or export tours to video and share them that way as well.

You will find the 3D Map button in the Tours group, on the Insert tab of the Excel ribbon, as shown in this picture.



Create a Power Map

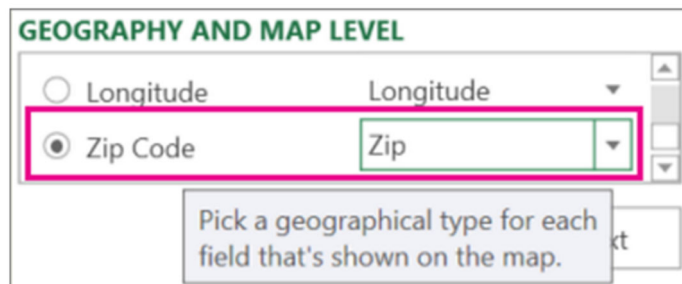
When you have Excel data that has geographic properties in table format or in a Data Model—for example, rows and columns that have names of cities, states, counties, zip codes, countries/regions, or longitudes and latitudes—you are ready to get started. Here is how:

1. In Excel, open a workbook that has the table or Data Model data you want to explore in Power Map.
2. Click any cell in the table.
3. Click Insert > Map. Clicking Map for the first time automatically enables Power Map.

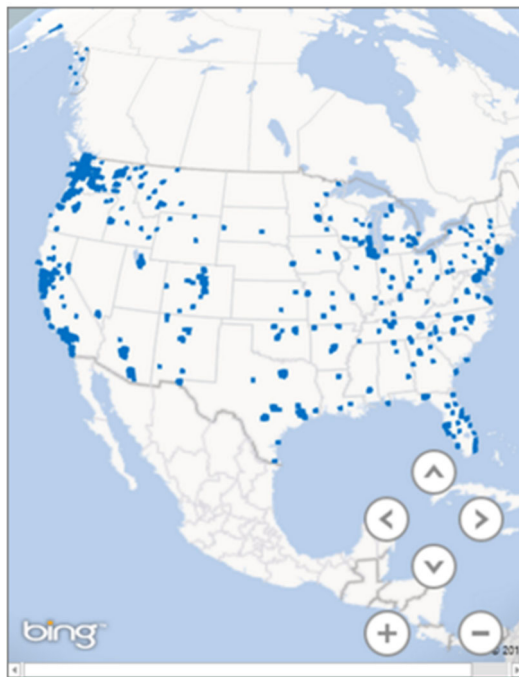
Power Map uses Bing to geocode your data based on its geographic properties. After a few seconds, the globe will appear next to the first screen of the Layer Pane.

4. 1. In the Layer Pane, verify that fields are mapped correctly and click the drop-down arrow of any incorrectly mapped fields to match them to the right geographic properties.

For example, make sure that Zip Code is recognized as Zip in the drop-down box.



5. When Power Map plots the data, dots appear on the globe.



6. Click Next to start aggregating and further visualizing your data on the map.

[Microsoft Office: https://support.office.com/en-us/article/Get-started-with-Power-Map-88a28df6-8258-40aa-b5cc-577873fb0f4a?ui=en-US&rs=en-US&ad=US#_exploring_sample_datasets]

Explore your data in a Power Map tour

[3D Maps_Chicago_narcotics.xlsx]

Microsoft Power Map tour can show a time-based relationship between geographic locations and their associated data—such as population numbers, temperature highs or lows, or flight arrival delays.

When you start Power Map from a workbook that does not already contain a tour, a new tour with a single scene is automatically created. Tours and scenes are the basic way to save the Power Map visualizations of your data.

You can create as many tours as you want in a workbook. You switch between tours and create new tours by using the Launch Power Map box. This example has three tours that show world population by continent.

Create a tour

- Select any cell in the Excel table or range of cells that has your data. Be sure to do this before you create the tour; it makes it easier for you to hook up the data to the new tour.
- Click Insert > Map > Open Power Map.

The Power Map window appears, showing your new tour.



Create a tour

- Select any cell in the Excel table or range of cells that has your data. Be sure to do this before you create the tour; it makes it easier for you to hook up the data to the new tour.

- Click Insert > Map > Open Power Map.

The Power Map window appears, showing your new tour.

Add another tour to your workbook

- Select any cell in the Excel table or range of cells that has your data. Be sure to do this before you create the tour; it makes it easier for you to hook up the data to the new tour2. Click Insert > Map > Open Power Map.

The Launch Power Map box appears

- Click New Tour.

The new tour appears in the Power Map window. If another tour was already open, Power Map closes it.

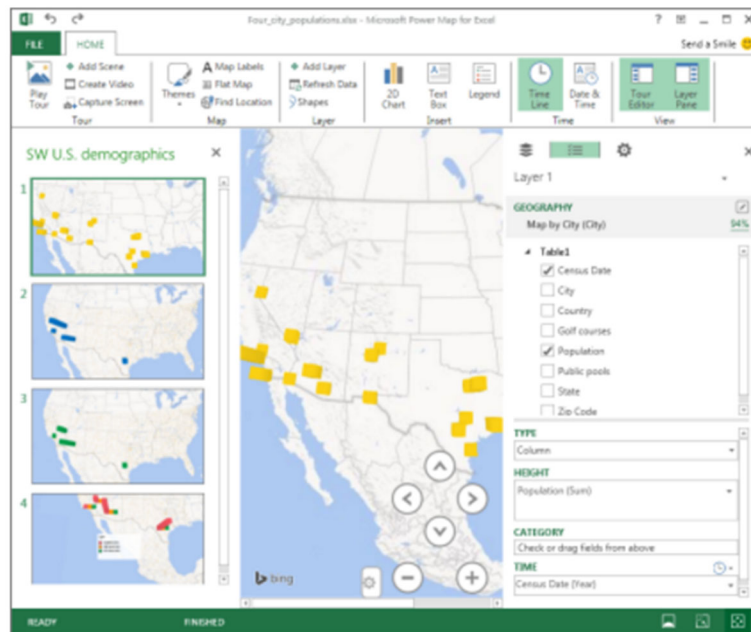
Save your tours

There's no Save button in Power Map; all tours and scenes are preserved in the state in which you close the window. When you save your workbook, any Power Map tours and scenes are saved with it.

All changes you make to a scene in Power Map while editing are saved automatically, but any changes you make to a scene in tour playback mode—such as resizing, removing a legend, or removing a timeline—aren't saved. All tours open in edit mode by default, and all the scenes in a tour are shown in the Tour Editor pane.

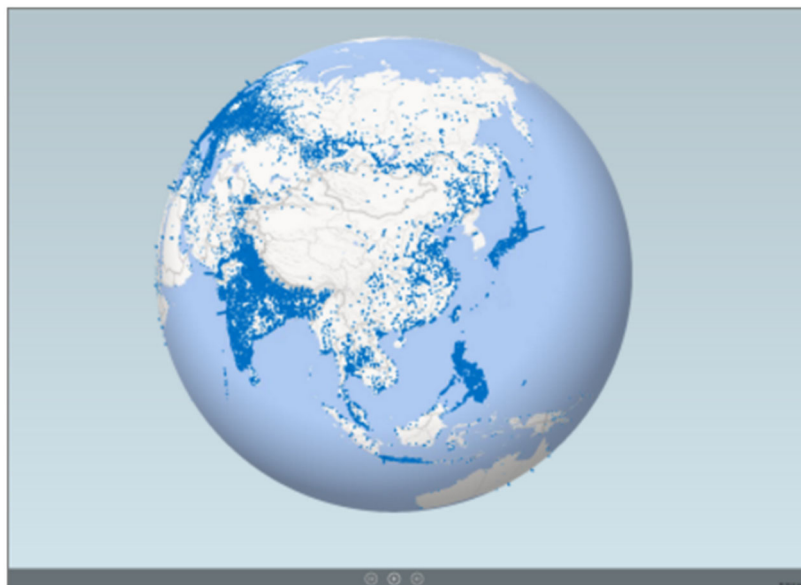
Add a scene to a tour

A tour can have a single scene, or multiple scenes that play sequentially to show different views of your data, such as highlighting a section of a map, or showing other data related to the geographic locations. For example, the first scene in your tour could show population growth for cities over time, followed by a scene showing the number of public swimming pools in those cities over the same time period, followed by more scenes that show other information about those cities. This example shows a four-scene tour for a selection of cities in the U.S. Southwest region.



Play a tour

Power Map always plays a tour in full-screen mode. Playback buttons are available at the bottom of the screen.



- Open the tour from the Launch Power Map box.
- In the Power Map window, on the Home tab, click Play Tour.

You can pause, play, move to the previous or next scene, or go back to edit mode. When you pause the tour, you can explore the 3-D environment and interact with it. Any changes you make in play mode are not saved as part of the scene. Once you resume playback or go back to edit mode, the changes you made in play mode are lost.

Delete a tour

- In the workbook, click Insert > Map > Open Power Map.
- Right-click the tour, and click Delete.

Copy a tour

In the Launch Power Map box, right-click a tour and click Duplicate. This creates a new tour that you can fine tune, while leaving the original tour untouched.

[Microsoft Office: <https://support.office.com/en-us/article/Explore-your-data-in-a-Power-Map-tour-6c5606cf-1e97-43d9-8bb3-c1903987f000>]

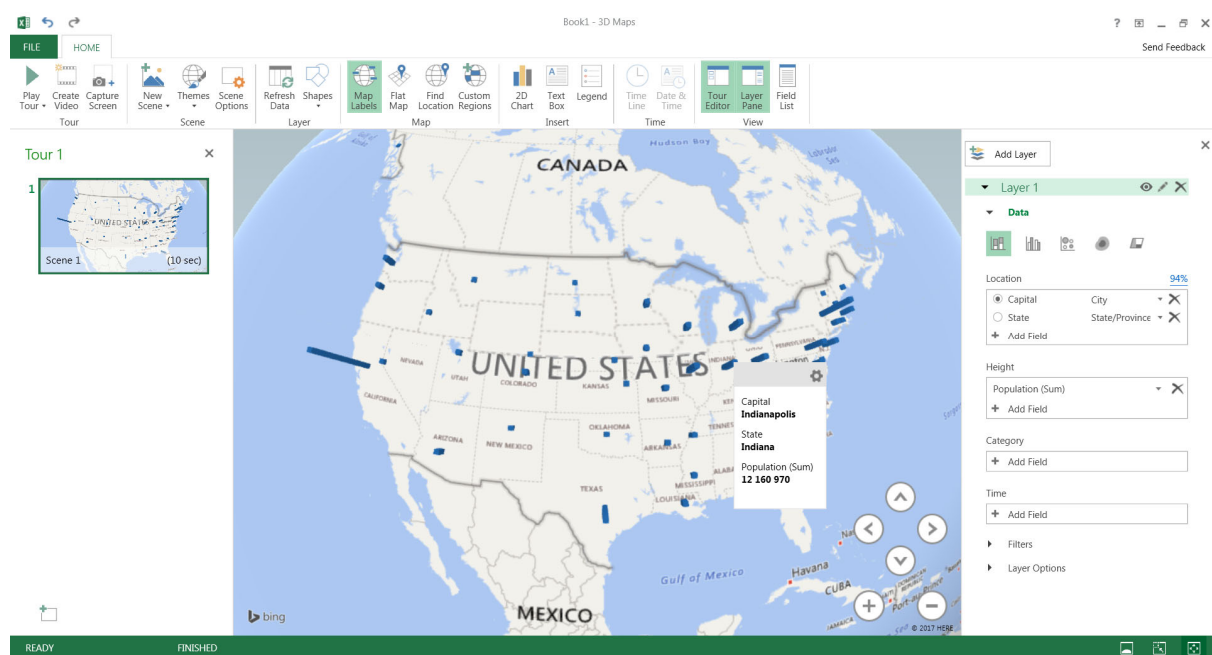
Exercise:

Open S2 and use 3D Maps on the Insert tab to show the population.

Suggestions: Drag population to height and add region to filter.

Add Map Labels.

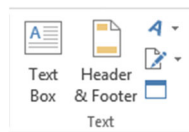
More examples (S16 & S17)



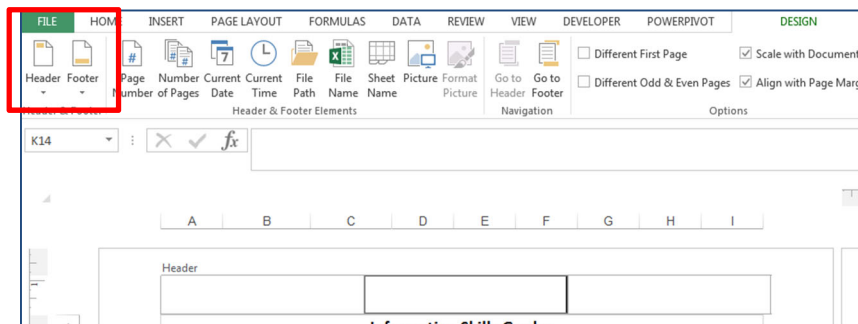
Printing Excel Workbooks

Headers and Footers

A header or footer is a data block that compromises text and graphics displayed at the top or bottom of a printed page. Excel headers and footers contain 3 placeholders at the left, centre and right edges of the page. You can include information in any of the 3 placeholders in the header or the footer. Each placeholder can contain text or graphics that will remain the same for all the pages or text that changes like page numbers. The Header & Footer function is in the Text Group on the Insert tab.



The Header & Footer Tools tab becomes available and on the Design tab in the Header & Footer Elements group you have a variety of elements to choose from



Exercise: Insert a header and page numbers for worksheet S5.

Page Margins

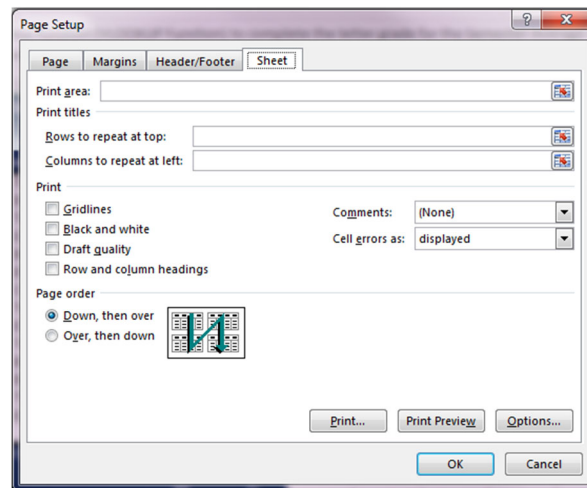
A page margin is a boundary line that determines the amount of space between the worksheet data and the edge of the paper. Excel allows you to select from a list of predefined margins or specify custom margins.



Exercise: Change the Page Layout of worksheet S7 to Landscape and set the Page Margins to Normal

Print Titles Command

Print Titles can be used to repeat the row(s) and column(s) titles on each page of a worksheet. You can set print Titles by using the Print Titles section on the Sheet tab in the Page Setup dialog box:



Page Breaks

Page breaks are lines that split content across pages for print purposes.

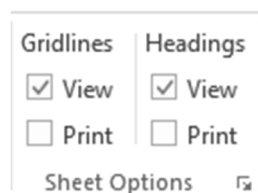
You can insert a Page break by clicking on Breaks in the Page Setup group on the Page Layout tab.

Exercise: Add a page break on S2 after row 40 and repeat the first row by using the Print Titles Command and preview your selection.

Gridlines

Gridlines are thin lines that divide a worksheet into rows and columns. Printing gridlines enables you to read and reference information presented on a printed worksheet easily.

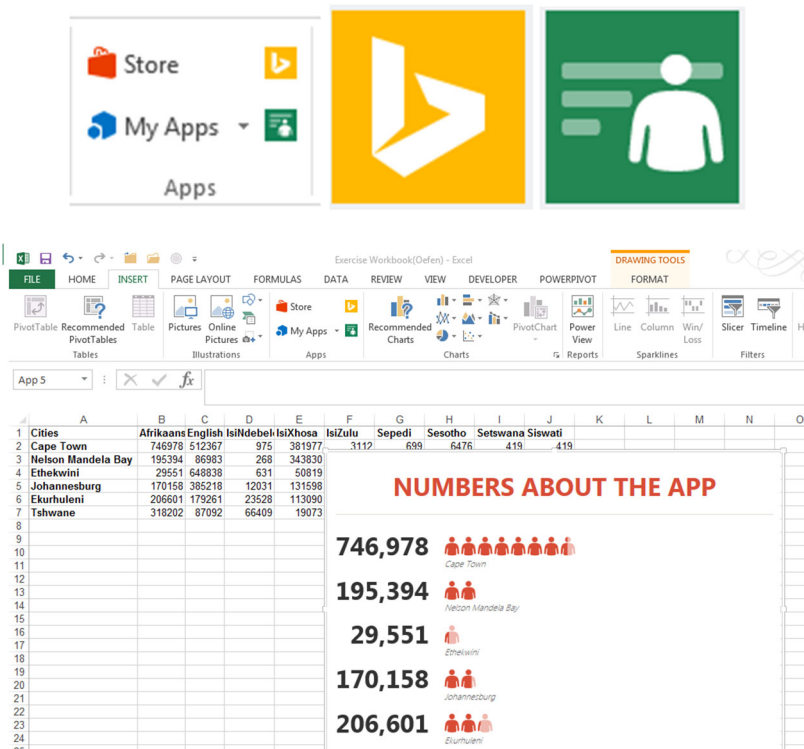
Gridlines are in the Sheet Options group on the Page Layout tab.



Apps

Apps for Office can help you personalize your documents or speed up the way you access information on the web. For example, with an app you could look up items on Wikipedia or turn cold data into add cool pictures by using the People Graph without having to leave Excel.

Apps can be added in the Apps group on the Insert tab.



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