

# Spreadsheets For Teachers

Step-by-step tutorials on key areas of Excel for use by teachers

The collage features several educational spreadsheets:

- A-level Maths & Further Maths:** A table with columns for Index, Module, Exam Paper, Question, and Topic. It lists questions related to circular motion.
- Finding Prime Numbers:** A grid of numbers from 1 to 100, with prime numbers highlighted in red.
- FlightPath:** An interactive tool for projectile motion. It shows a graph of Height (metres) vs Horizontal distance (m) for a projectile launched at 95mph and 45 degrees. The range is 184m and the peak height is 46m.
- Probability Simulation:** A table for simulating probabilities. It includes a 'Number of trials' field (set to 200) and a table of events with probabilities and numbers.
- SUVAT - the calculator:** A calculator for SUVAT equations. It has input fields for Displacement (S), Initial Velocity (u), Final Velocity (v), Acceleration (a), and Time (t). It also shows calculated values like 17.895 m/s.
- Binomial Expansion:** A spreadsheet showing the expansion of  $(1+x)^n$  and a graph of the resulting function.
- Complex Numbers:** A spreadsheet for calculating the modulus and argument of a complex number, with a corresponding complex plane graph.
- Deal or No Deal:** A game interface with a 'Deal or No Deal' title, a list of bank amounts (£1, £5, £10, £20, £50, £100, £200, £500), and a 'Click below to eliminate the next box' button.
- Distance to the Horizon Calculator:** A calculator for determining the distance to the horizon based on height and planet location. It shows a height of 20m and a distance of 15.97km for Earth.

Note: the above images all link to spreadsheets I have created, available for free online. More examples can be found at [TheChalkface ICT Resources](http://TheChalkfaceICTResources.com).

This booklet is aimed at teachers already familiar with the basics of Excel who want to explore a little further the potential of this powerful piece of software.

As a teacher, you rely upon a unique blend of creativity and organisation. *From data analysis and planning to custom-built learning tools and games, spreadsheets can enrich your teaching practice both in and out of the classroom.*

Booklet and spreadsheets written by a practising UK secondary maths teacher.

Many more resources freely available online:



	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1															
2															
3															
4															
5															

# Spreadsheets For Teachers

## *Preface*

As a teacher of mathematics, I am constantly looking for new ways to explain, demonstrate or illustrate new concepts to students.

In addition to our role in the classroom, the job requires us to organise data, track progress, analyse results, budget, timetable and so on.

These different elements of the job can each be improved by the use of technology.

Like any tool, Excel is only one possible approach, but it has proven extremely helpful to me, and I hope you can benefit from some of the tips and tricks I have gradually accumulated.



The aim of this guide is to encourage more teachers to investigate and discover what Excel can do for them, hopefully give some insight into the potential spreadsheets have and some of the more useful features you may not have come across yet.

I will focus in this guide on a few key ideas, but bear in mind this only just scratches the surface of what is possible with spreadsheets. If you're wondering if you can do something particular using Excel, a quick search on a forum like [www.ozgrid.com](http://www.ozgrid.com) will almost certainly reveal that you can, and probably show you how to begin.

Finally, I hope you will be inspired to invest some of your valuable time into creating a classroom resource of your own, developing a custom electronic mark book or making something entirely different with this incredibly adaptable and versatile tool. I would love to hear from you if you have any questions or comments (either about the booklet or about your creations in Excel). Similarly, if you identify any errors or problems with this booklet I would greatly appreciate your feedback!

You are reading the trial version of the booklet. For information on purchasing the full 40-page booklet, go to [www.thechalkface.net/spreadsheetsforteachers](http://www.thechalkface.net/spreadsheetsforteachers).

Anthony

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## *Data tables and charts*

The first impression you probably ever had of Excel was a glorified table. You can enter numbers, or other data, into the boxes ('cells'), and organise them. But you may not be aware of just how much Excel can help you with the sorting and interpreting of that data. Even entering the data is quick and easy:

### *Copying and pasting data*

#### Shortcuts

To select data, click and drag the range of cells you want, or select a cell then use 'Shift' and the arrow keys to select a range. If you use 'Ctrl+↓', the cursor will jump to the lowest non-empty cell in the range, so using 'Ctrl+Shift+↓' will select everything down to the lowest non-empty cell.

To move or copy data, you can make use of the following keyboard shortcuts:

Cut:	Ctrl+X
Copy:	Ctrl+C
Paste:	Ctrl+V or Enter

When you cut or copy data in Excel, a flashing dotted border will surround the cells you have selected. While this is still flashing, the data can be pasted, but if you press 'Esc' or start typing somewhere, the flashing border will disappear and you have to select it again if you want to copy it.

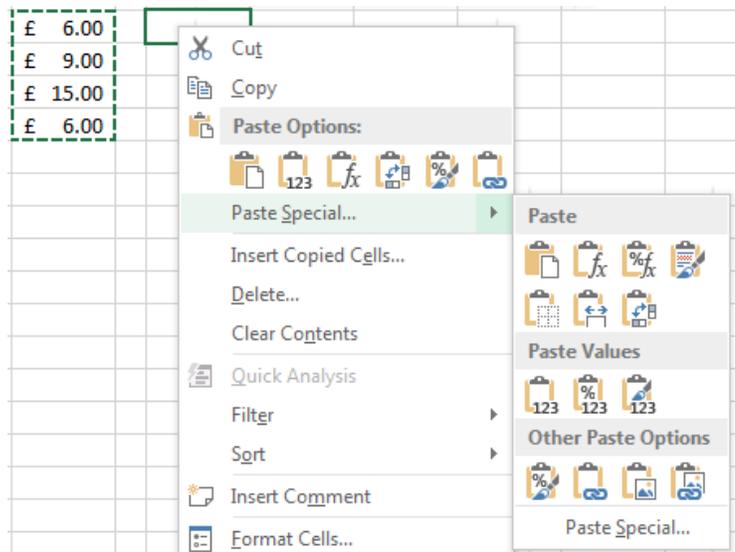
If you use 'Enter' instead of 'Ctrl+V' to paste data, the flashing border will disappear once you've pasted, but if you use 'Ctrl+V' it will remain until you press 'Esc' or start typing, meaning you can paste the same thing multiple times.

If you want to copy one cell and paste it into many cells (for example, you have a formula you want to apply to the end of each row), highlight all the cells you want to paste it into, then press 'Enter' or 'Ctrl+V'.

## Paste Special

Often the data we see on the screen is not simply numbers. It may be formatted to look like currency or a date, and it may be the result of a formula. When you copy and paste data like this, it may look the way you want, or it may not.

Right-click > Paste Special



Choose 'Paste Values' to copy just the numbers you see (losing the formulas), or 'Paste Formats' to copy the format settings (such as colour or currency format) without changing the values in the cells you're pasting onto. Choose 'Transpose' to copy columns to rows or vice versa.

## Text to Columns

The Copy and Paste features allow you to copy data from outside Excel, such as tables from a word document or a webpage. However, the data doesn't always show up the way you want.

Select the data, then in the 'Data' tab at the top, choose 'Text to Columns' and select 'Delimited' to instruct Excel where to split each cell (eg, at spaces or commas).

Original data:	Pasted into Excel	Text to Columns
<i>China: 19%</i>	<i>China: 19%</i>	<i>China:</i> 19%
<i>India: 17.5%</i>	<i>India: 17.5%</i>	<i>India:</i> 17.50%
<i>US: 4.43%</i>	<i>US: 4.43%</i>	<i>US:</i> 4.43%
<i>Indonesia: 3.50%</i>	<i>Indonesia: 3.50%</i>	<i>Indonesia:</i> 3.50%

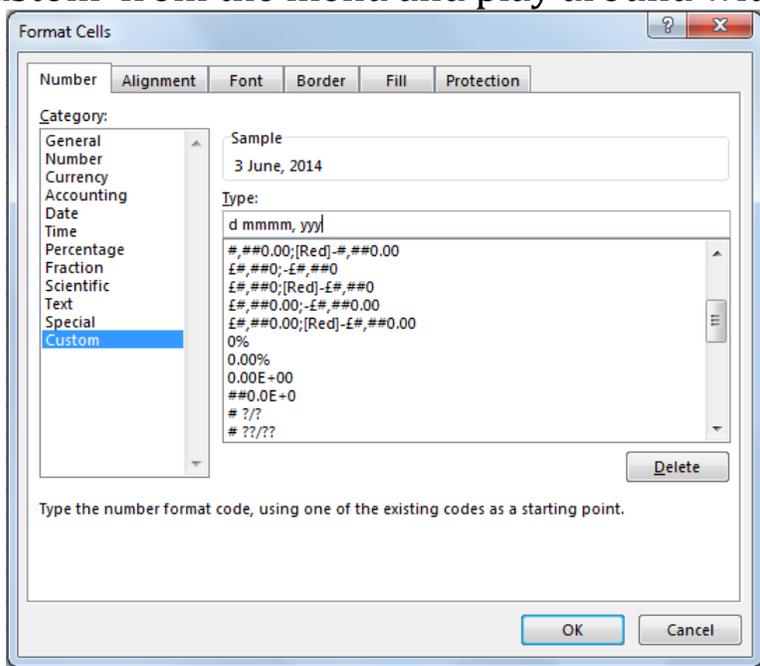
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## Custom formats

For a specific format that isn't in the standard list, or to modify a format slightly, choose 'Custom' from the menu and play around with the details:



## Changing formats with a function

Since the format of a cell is separate to its value, it is sometimes necessary to encode a format into a function. For instance, a cell that displays a percentage rounded to the nearest whole percent, when incorporated into a text function, may show an awkward decimal instead.

*Before*

43%	43%
Result: 0.428571428571429	= "Result: "&E2

*After*

43%	43%
Result: 43%	= "Result: "&TEXT(E2, "0%")

Custom formats can be incorporated into a TEXT function in just the same way:

03/02/1996	
54	
March 28	=TEXT(G5+G6, "mmm d")

If you don't know the way to write the format you want, select a cell with the required format and look at Custom under Format Cells. Then just copy the code into your TEXT function.

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## Text functions

### &

It may not look like much, but when I discovered the & operator it revolutionised the slickness of my spreadsheets. It is an operation, like + or ×, but specifically for text – if you want to put two things next to each other in a cell (text, function results, numbers, etc) simply put & in between them.

Smith	John	=C6&" "&B6	Smith	John	John Smith
-------	------	------------	-------	------	------------

This function gives the value from the second cell (C6), followed by a space, followed by the value in the first cell (B6). Note that, as in the IF example, the text string, even though it is just a space, is surrounded by speech marks.

### =FIND(find\_text,within\_text,[start\_num])

The FIND function identifies specific text within a cell:

01131.8853:197	=find(":",F3)	01131.8853:197	11
00003219.3619:616		00003219.3619:616	
002648.2289:761		002648.2289:761	
00005670.4719:735		00005670.4719:735	
002884.3471:810		002884.3471:810	
0008543.9898:175		0008543.9898:175	

You tell it what to look for, and which cell to look for it in, and it returns the position (the number of characters along) if the text can be found.

This can be used alongside the ISERROR and IF functions if all you are interested is whether a specific text string occurs in the cell:

Results	Fail?				
pass pass pass pass pass pass pass	=IF(ISERROR(FIND("fail",P3)),"PASS","resit")				
pass pass pass pass pass pass pass	PASS				
fail pass pass fail pass pass pass	resit				

### *Tell me more...*

Text functions add a huge level of functionality to Excel. Use LEFT, MID or RIGHT to extract words or parts of words from cells with text in them. Use LEN to determine the length of a text string, SUBSTITUTE to swap one text string for another, and TRIM or PROPER to deal with extra spaces or wrong capitalization. For a detailed example of how to combine these to 'fix' the format of text, see the appendix, where I explain and provide a complete formula for converting 'Smith, John' to 'John Smith'.

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## Mathematical functions

**=SQRT(number)** and **=GCD(number1,[number2],...)**

The basic operations are relatively intuitive: + and − are the same, and × and ÷ become \* and /. You can use ^ to represent a power (eg  $7^2$  is written =7^2), and by using brackets you can find cube roots, etc: =7^(1/3).

A few common functions have their own notation, like SQRT (square root), and some less obvious ones include GCD (greatest common divisor - that's 'highest common factor' to us Brits) and LCM (lowest common multiple).

**=EXP(number)** and **=LOG(number,[base])**

To find  $e^x$ , use the EXP function, and to reverse it you can use the natural logarithm LN, or, more generally, the LOG function. If you don't specify a base, the default is 10. Since INT(LOG(.))+1 gives the number of digits, this can be used to construct a function which rounds to a given number of significant figures (in this case, 2):

365780.1	370000		
3.235541	3.2		
410629.4	=ROUND(G11,2-(INT(LOG(G11))+1))		

**=SIN(number)** and **=ASIN(number)**

Note that ASIN is otherwise known as  $\sin^{-1}$ . It should be noted that these functions take radians as the standard unit of angles, and while you could use the PI function (just type PI() into your formula) to convert, Excel also includes the radians to degrees conversion function DEGREES, and - to convert from degrees to radians - the function RADIANS. For instance, an Excel calculator for solving sine rule problems might look like this:

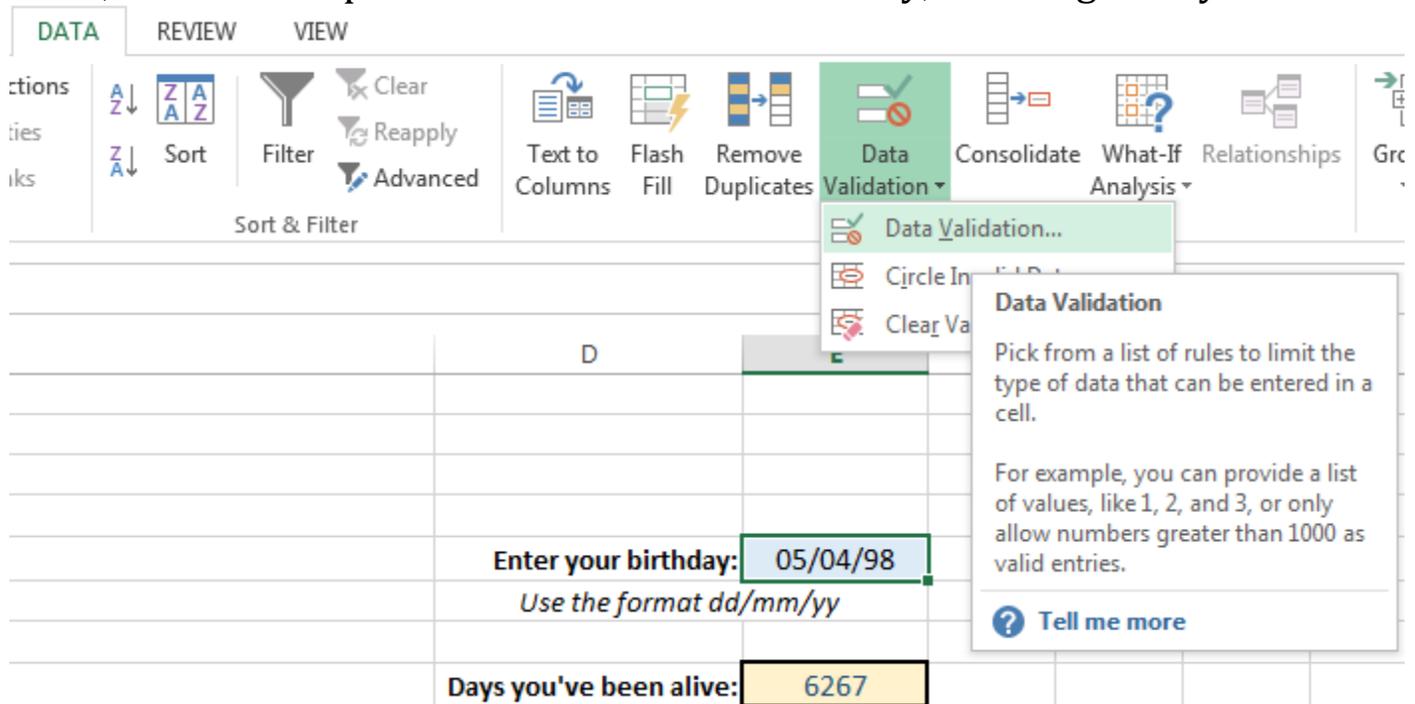
	A	B	C	D	E	F
1						
2		a	4 cm			
3		A	35 degrees			
4		b	6 cm			
5		B	=DEGREES(ASIN(C4*SIN(RADIANS(C3))/C2))			

The other two common trig functions are also included, in addition to the hyperbolic functions SINH, COSH and TANH, with their inverses (ASINH, etc).

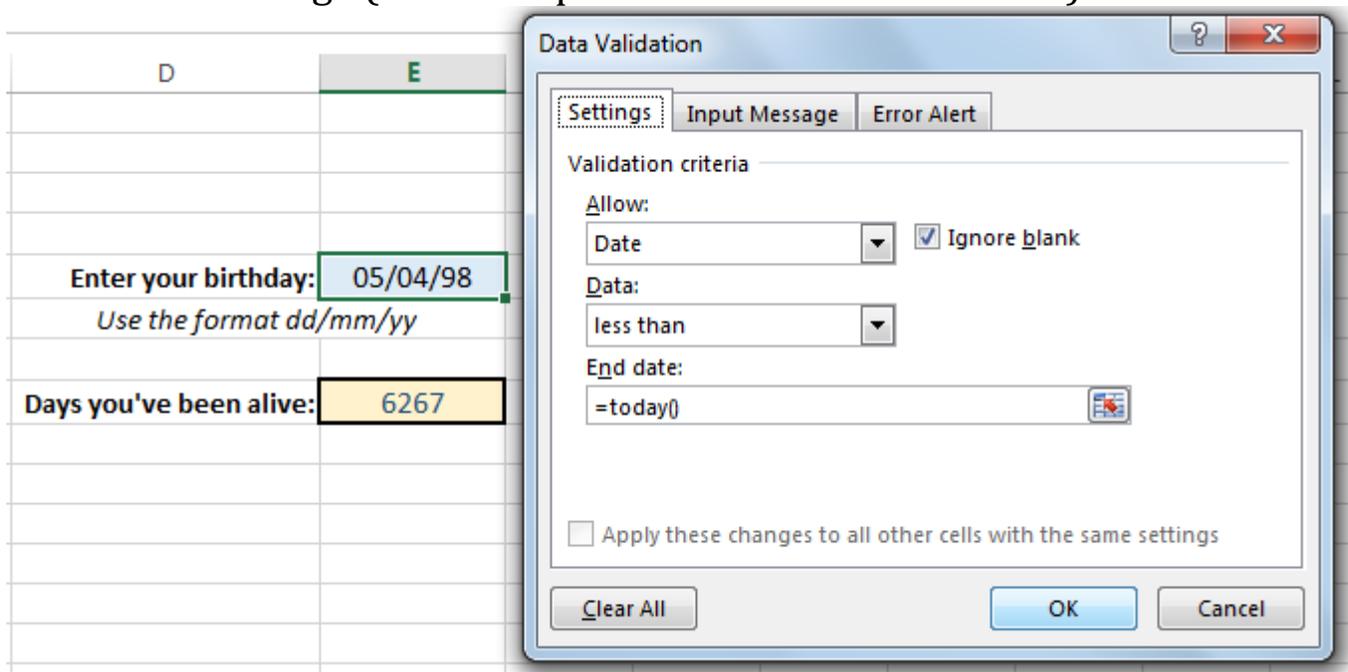
## Data Validation

### Limiting input values to certain numbers

Ensuring user input is suitable for the calculations being done can save a lot of hassle, and makes spreadsheets run more smoothly, avoiding messy errors.



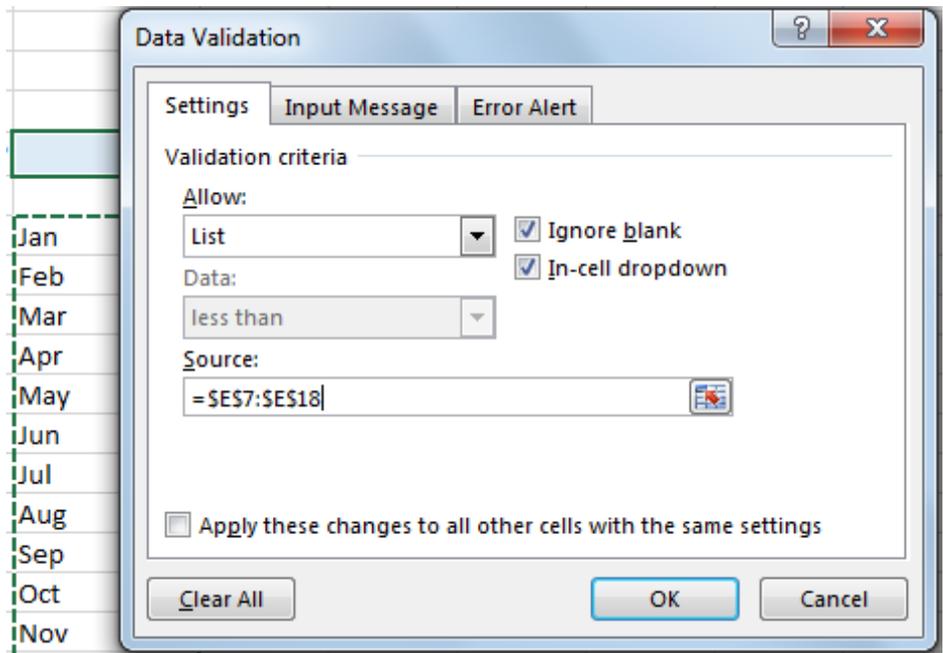
You can specify the format, a valid range of values, an input message (optional) and an error message (to show up if incorrect data is entered).



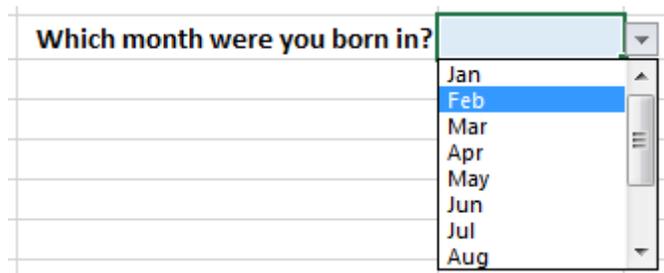
The error alert can be tailored to either not allow the wrong data to be entered, or simply to warn the user, so they can override it if necessary.

## Limiting using a drop-down menu

To limit input and provide choices for the user as a drop-down menu, choose 'List' from the options menu:

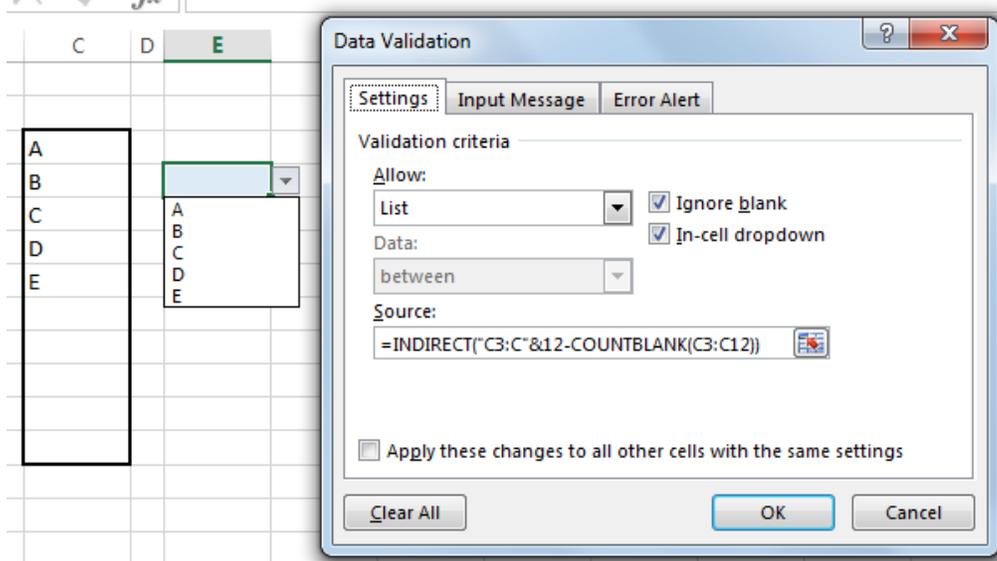


The source can be listed somewhere in your worksheet, so it is easily changeable if need be later. The result is a neat drop-down menu.



## Using INDIRECT for varying length lists

There is a neat trick for taking into account a list that may need updating:



The INDIRECT formula converts text to a cell or range reference, so when "C3:C" is combined with the row number of the last cell with contents, it becomes C3:C8 in this case, and will update if the list grows.

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## Conclusion: Evaluating your progress

The topics covered here are a good starting point from which to build.

Click below to download an interactive checklist of the contents of this booklet (made in Excel, of course) if you want to keep track of your progress:

Topic	Area	Skill	Level
Data tables & charts	Copying and pasting data	Shortcuts	Very confident
Topic progress: 22%		Paste Special	Reasonably confident
		Text to Columns	Still clueless
	Lookup functions	Generating a LOOKUP	Getting there
		Using MATCH for exact matches	Select one...
	Graphs and charts	Generate a basic chart	Select one...
		Editing text and axes	Very confident
	Sorting data	Using Data Sort	Reasonably confident
			Getting there
			Still clueless

You may notice that the spreadsheet above uses conditional formatting (cells are filled different colours according to their contents) and data validation (only values from the drop-down list are allowed). To investigate further, you will have to unprotect the sheet (there's no password) and poke around. The messy calculations are hidden, but using tools in the 'Formulas' tab like 'Trace Precedents' and 'Trace Dependents' will help you track what's going on:

Topic	Area	Skill	Level
Data tables & charts	Copying and pasting data	Shortcuts	Select one...
Topic progress: 0%		Paste Special	Select one...
	Lookup functions	Generating a LOOKUP	Select one...

And if you're curious about what a macro does on a spreadsheet, press "Alt+F11" to open the VBA editing window and have a read for yourself:

```

excel_topic_list (1).xls - Module1 (Code)
(General) | resetlevels

Sub resetlevels ()
    If MsgBox("Are you sure? This will delete") = vbYes Then
    Else
        Application.ScreenUpdating = False
        Range("D10").Select
        ActiveCell.FormulaR1C1 = "Select one..."
        Range("D10").Select
        Selection.Copy
        Range(Selection, Selection.End(xlDown)).Select
        Selection.PasteSpecial Paste:=xlPasteValues, _
            Operation:=xlPaste, Transpose:=False, _
            Merge:=False, Transpose:=False
        Range("D10").Select
    End If
End Sub
    
```

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### Postscript

Excel is one choice among many great pieces of software, and due to its versatility can do a lot of things, but it won't always be the best choice.

I use **GeoGebra** for constructing geometrical shapes or drawing graphs of mathematical functions. It is freely available to download or use online at [www.geogebra.org](http://www.geogebra.org) and my [Intro to GeoGebra](#) booklet will give you the basics.

I use **Python** increasingly for more sophisticated calculations or to write more complicated programs than is easily doable with VBA. Try an online version and learn to code at [www.codecademy.com](http://www.codecademy.com). Finally, if you have any questions or comments, I would love to hear from you: [anthony@thechalkface.net](mailto:anthony@thechalkface.net)