Advanced Power BI (Data)

Sample manual - first two chapters

Wise Owl Training

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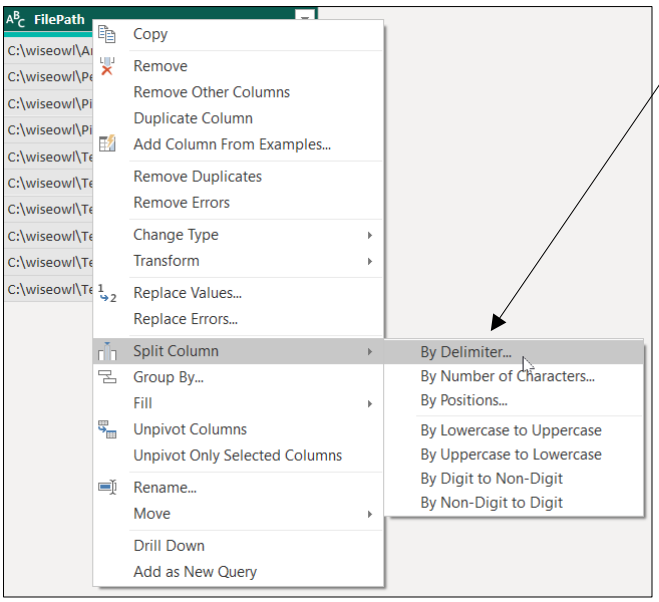
CHAPTER 1 - MANIPULATING COLUMNS

1.1 Splitting Columns

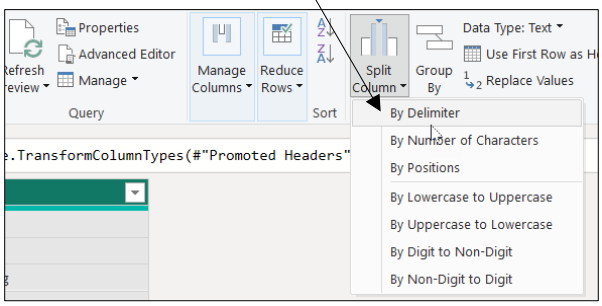
Accessing Split Column Menu

You can split columns using either the right mouse button menu or the ribbon:



Either right-click on a column that you want to split and choose one of these options …

… or select the column, then choose one of the options from the **Home** tab of the Query Editor ribbon.



The menu options are as follows:

Option	What it does
By Delimiter…	Splits a string of text when Query Editor encounters a particular character.
By Number of Characters…	Splits a string of text after a given number of characters.
By Position…	Splits a string of text at certain pre-defined character positions.
By Lowercase to Uppercase *By Uppercase to Lowercase*	Splits a string of text whenever the case changes.
By Digit to Non-Digit *By Non-Digit to Digit*	Splits a string of text whenever it changes from numbers to letters or from letters to numbers.

All of these options are shown – in this order – in the following pages, along with a couple of other column splitting methods as a bonus!

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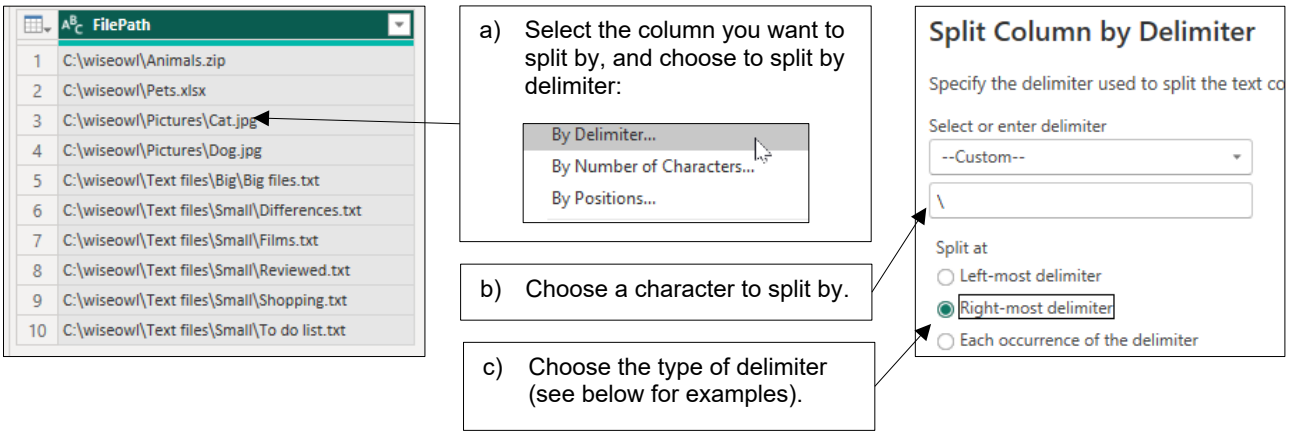
Splitting by Delimiter

For the example below, you might want to extract the file name or file path, so you'd probably split at the last `\` character:



Here are the first couple of rows you'd get for each of the 3 **Split at** options above:

Option	Results	Notes
Left-most delimiter	FilePath.1 / FilePath.2 1 C: wiseowl\Animals.zip 2 C: wiseowl\Pets.xlsx 3 C: wiseowl\Pictures\Cat.jpg	Split by the first backslash
Right-most delimiter	FilePath.1 / FilePath.2 1 C:\wiseowl Animals.zip 2 C:\wiseowl Pets.xlsx 3 C:\wiseowl\Pictures Cat.jpg	Split by the last backslash
Each occurrence of the delimiter	FilePath.1 / FilePath.2 / FilePath.3 / FilePath.4 / FilePath.5 1 C: wiseowl Animals.zip null null 2 C: wiseowl Pets.xlsx null null 3 C: wiseowl Pictures Cat.jpg null 4 C: wiseowl Pictures Dog.jpg null 5 C: wiseowl Text files Big Big files.txt	Split by every backslash

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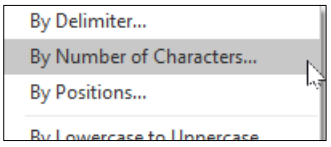
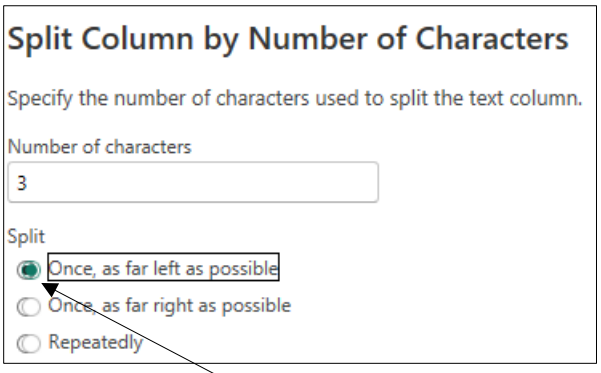
Splitting by Number of Characters

If you know how many characters you want to extract, you can use this method:

	Product Code	Sales
1	MPB-4242	24.49703694
2	HQC-0233	44.9529665
3	ZND-9682	91.64723297
4	PGL-4142	30.60766405

a) Select the column that you want to split, and choose to split it by the number of characters:





b) Choose to take the first N characters, the last N characters or a series of N-character chunks. To get the first 3 letters in this case we would choose the first option (**Once, as far left as possible**).

Product Code.1	Product Code.2
MPB	-4242
HQC	-233
ZND	-9682

c) For this example Query Editor would create these two columns, which you could then rename.

For the above example, you could instead split the product code by a delimiter (in this case, the - character) to get the letters and numbers separately.

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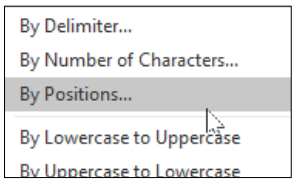
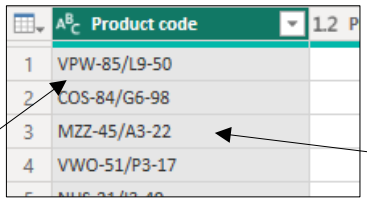
Splitting by Positions

Use this method to extract a substring of text:

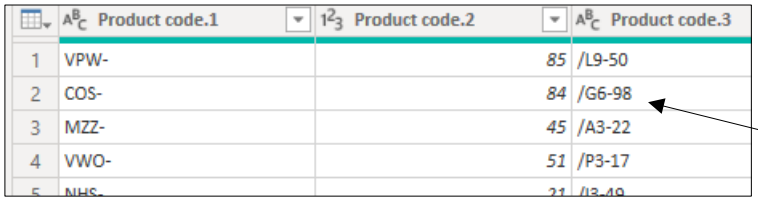
a) Choose this option to split this column by positions:





	Product code	1.2 P
1	VPW-85/L9-50	
2	COS-84/G6-98	
3	MZZ-45/A3-22	
4	VWO-51/P3-17	

b) To extract the two-digit number after the first dash from each product code you could use this transform:



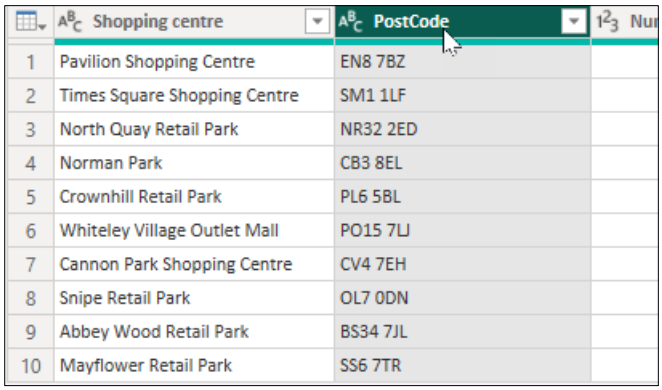
	Product code.1	Product code.2	Product code.3
1	VPW-	85	/L9-50
2	COS-	84	/G6-98
3	MZZ-	45	/A3-22
4	VWO-	51	/P3-17

c) This would give these 3 columns (everything from character 0 to 3, 4 to 5 and 6 onwards).

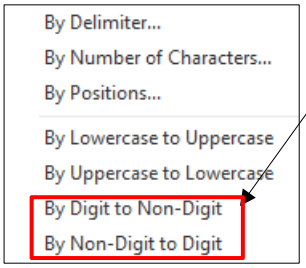
*As with most things in Power BI, characters are numbered from 0, not 1. To omit the first column you could just put **4, 6**, to start extracting characters at position 4.*

Splitting by Change in Case or Character Type

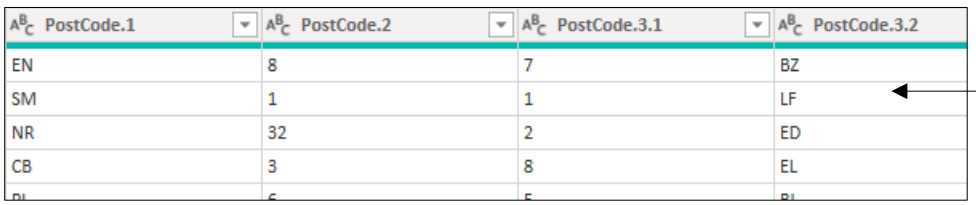
Codes are often divided into a predictable combination of letters and numbers (or of upper and lower case characters). Here's how to split up some well-behaved UK postcodes:



	Shopping centre	PostCode	Nu
1	Pavilion Shopping Centre	EN8 7BZ	
2	Times Square Shopping Centre	SM1 1LF	
3	North Quay Retail Park	NR32 2ED	
4	Norman Park	CB3 8EL	
5	Crownhill Retail Park	PL6 5BL	
6	Whiteley Village Outlet Mall	PO15 7LJ	
7	Cannon Park Shopping Centre	CV4 7EH	
8	Snipe Retail Park	OL7 0DN	
9	Abbey Wood Retail Park	BS34 7JL	
10	Mayflower Retail Park	SS6 7TR	



By repeated application of these two transforms, for example …



PostCode.1	PostCode.2	PostCode.3.1	PostCode.3.2
EN	8	7	BZ
SM	1	1	LF
NR	32	2	ED
CB	3	8	EL

… you could split each postcode into the letter(s) and number(s) before the space and the letter(s) and number(s) after it.

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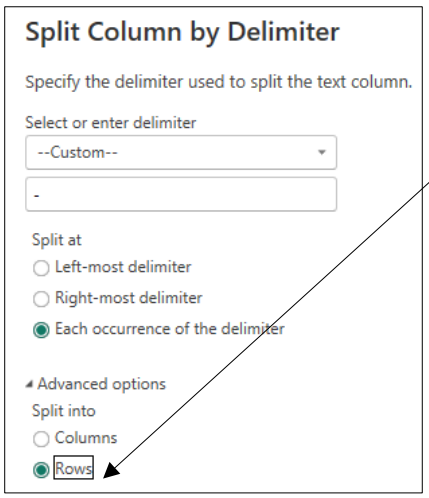
Splitting into Rows

Sometimes you may want to create one row for each constituent part of a string of text (although it's hard to think of an example!):



If you expand the advanced options when splitting a column by delimiter and choose to generate extra rows, not columns for this example …

	Product Code	Sales
1	MPB-4242	24.49703694
2	HQC-0233	44.9529665
3	ZND-9682	91.64723297
4	PGL-4142	30.60766405

… you'll get multiple rows for each original one (notice that the values of the other fields - **Sales** in this case - will be duplicated for each of these rows, making the data hard to interpret in most cases).

	Product Code	Sales
1	MPB	24.49703694
2	4242	24.49703694
3	HQC	44.9529665
4	0233	44.9529665
5	ZND	91.64723297
6	9682	91.64723297
7	PGL	30.60766405
8	4142	30.60766405

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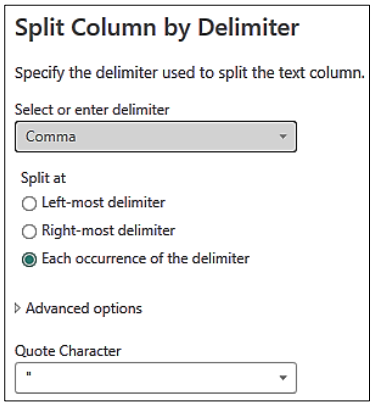
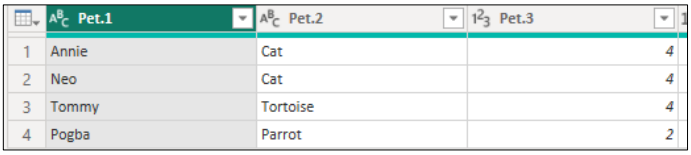
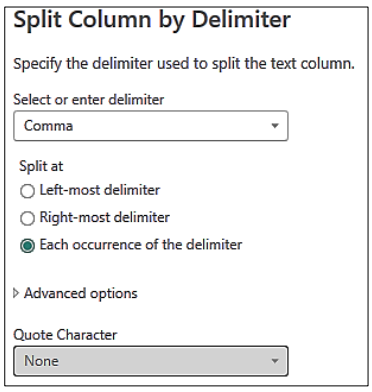
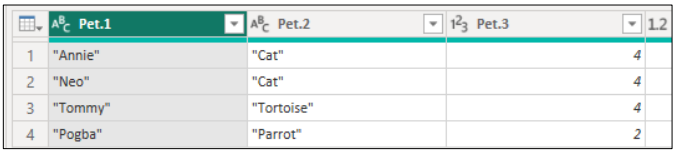
Retaining Quotation Marks

When splitting text, Power Query will automatically remove any quotation marks, but you can turn this option off as shown below.

The examples below use this as an example source query.

	Pet
1	"Annie","Cat",4,8.3
2	"Neo","Cat",4,8.5
3	"Tommy","Tortoise",4,6.2
4	"Pogba","Parrot",2,7.1

Here are the two options:

Option	Dialog box	Results for our example
Remove quote marks		
Keep quote marks		

Pet.1	Pet.2	Pet.3
1 Annie	Cat	4
2 Neo	Cat	4
3 Tommy	Tortoise	4
4 Pogba	Parrot	2

Pet.1	Pet.2	Pet.3
1 "Annie"	"Cat"	4
2 "Neo"	"Cat"	4
3 "Tommy"	"Tortoise"	4
4 "Pogba"	"Parrot"	2

There doesn't seem to be any option for automatically removing single quotation marks.

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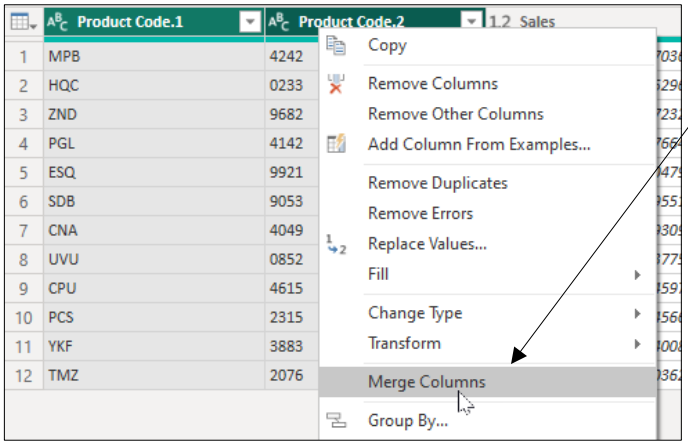
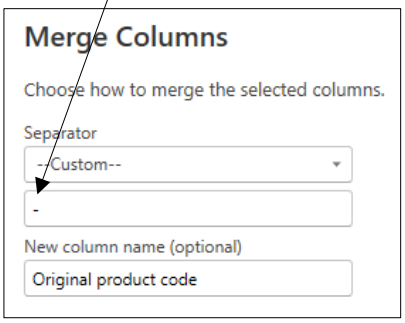
1.2 Merging Columns

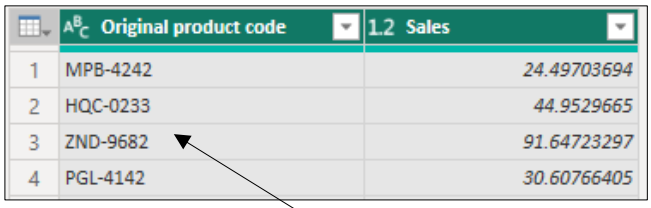
The opposite of splitting columns is *merging* them. Here's an example:



a) Suppose you want to join the parts of the product code that we split earlier in this chapter back together again! To do this, first select the columns that you want to join together, then right-click on them and choose **Merge Columns**.

b) Choose the glue you want to use to join the values together for each row (here we've gone for a dash).





	Original product code	1.2 Sales
1	MPB-4242	24.49703694
2	HQC-0233	44.9529665
3	ZND-9682	91.64723297
4	PGL-4142	30.60766405

c) Power Query has combined the columns together into a single column.

You're not limited to just two columns: you can merge as many columns as you like into a single one.

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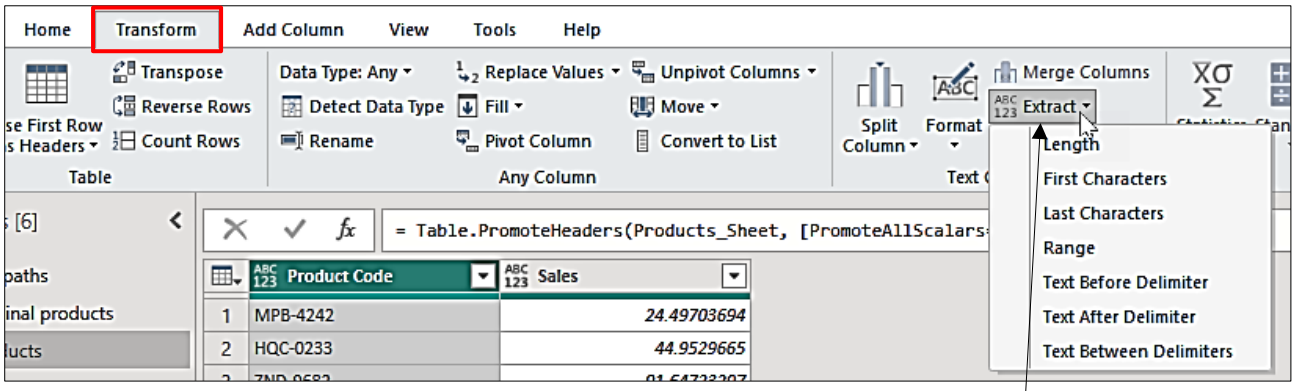
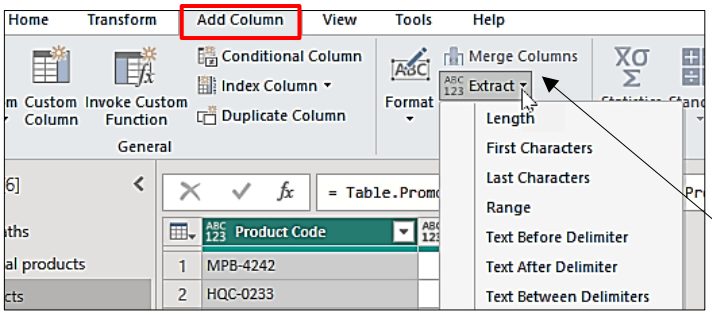
1.3 Extracting Data

Replacing or Adding Columns

There are two versions of the **Extract** tool – be careful to choose the right one for your task:



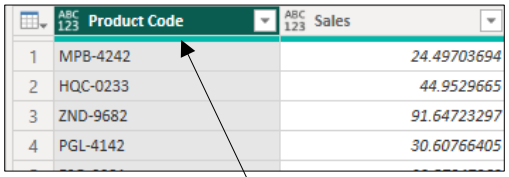
If you choose this version on the **Transform** tab of the ribbon you will replace a column …



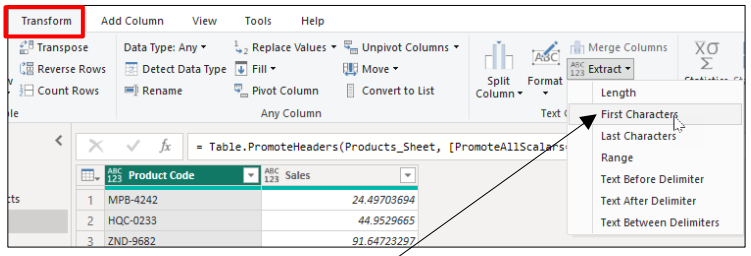
… whereas if you choose this version on the **Add Column** tab of the ribbon you will keep your existing column and add a new one to it.

An Example

The example below would extract the first 3 characters from a product code:

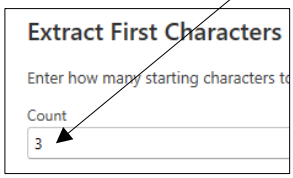


a) Select the column (or columns) from which you want to extract data.

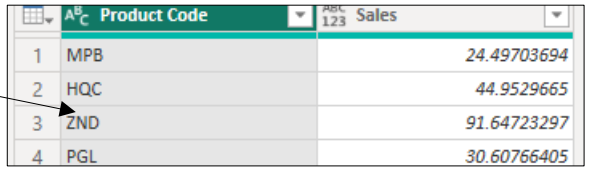


b) Here we're choosing to get the first N characters, replacing the current column.

c) Specify how many characters you want to extract (here we've gone for the first 3).



d) Power Query will replace your column with the first 3 letters for each product code.



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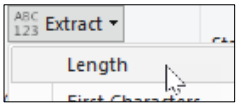
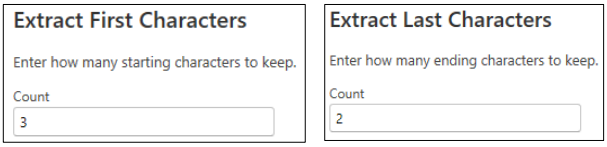
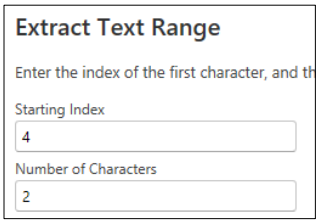
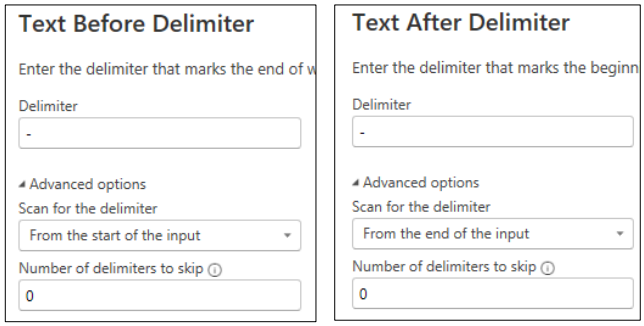
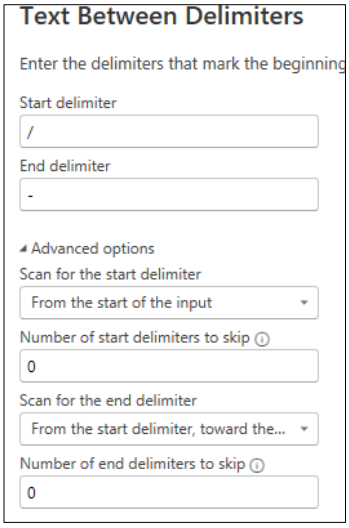
The Possible Options

Here's what the options would give for a field containing the product code **VPW-85/L9-50**:

Option	Choices	Results	Notes
Length		12	This is a quick way to find how many characters there are for each value in a column.
First Characters *Last Characters*		VPW 50	The (in this case) 3 left-most characters. The (in this case) 2 right-most characters.
Range		85	The 2 characters starting at position number 4 (remember that characters are numbered from 0, not 1).
Text Before Delimiter *Text After Delimiter*		VPW 50	Notice that you can start scanning for a delimiter from the left or right with these options, and also choose not to take the first delimiter you find.
Text Between Delimiters		L9	This powerful option allows you to pick out text between any two (possibly different) characters. You can even do things like pick out the text between the second dash and fourth backslash from the end.

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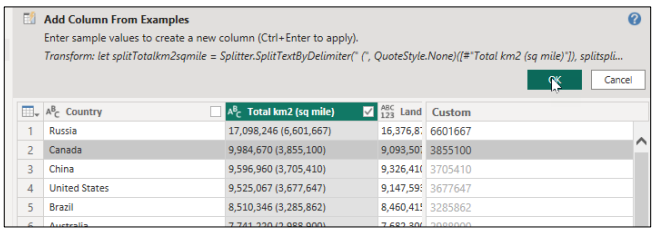
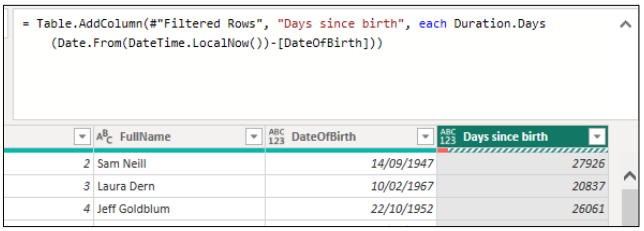
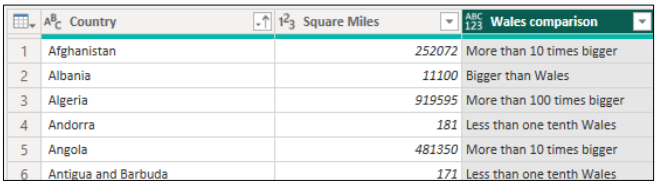
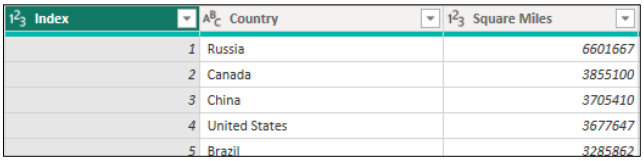
CHAPTER 2 - CREATING COLUMNS

2.1 Ways to Create New Columns

There are a variety of ways of creating columns in Power Query, including the following (covered in this chapter):

Method	What it does	Example
Column from Examples	Use AI to guess what formula you want to apply to all rows of a table based on one or two sample training values.	
Built-up Columns	Use built-in Power Query transforms in sequence to produce complicated effects (you can then delete any intermediate columns created).	
Custom Columns	Return the value - for each row of a table - of an expression using the M Power Query Formula language.	
Conditional Columns	Use rules to divide rows up into a finite number of discrete categories.	
Indexing Columns	Apply numbering to the rows in a table.	

Columns that you create in Power Query will take up more space in your model (since all of the row values have to be pre-calculated when you load your data), but will run more quickly thereafter (since Power BI doesn't need to calculate DAX columns on the fly). In practice you're unlikely to notice the difference!

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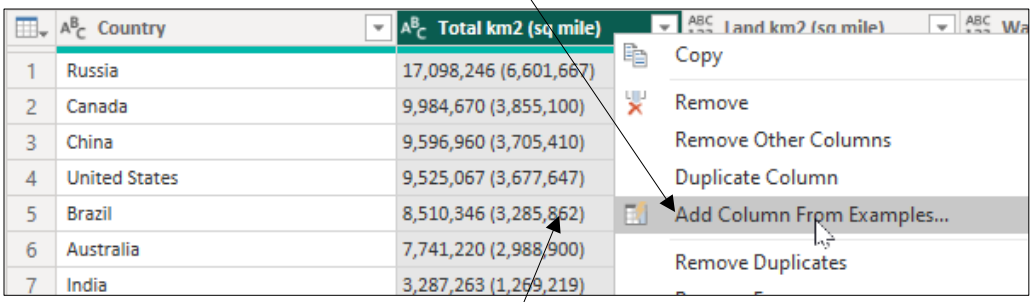
2.2 Columns from Examples

Power BI has got an excellent feature called *Columns from Examples*, which allows you to create formulae by typing in a few results. To create a column like this follow the numbered steps below.

Step 1 – Start the Feature

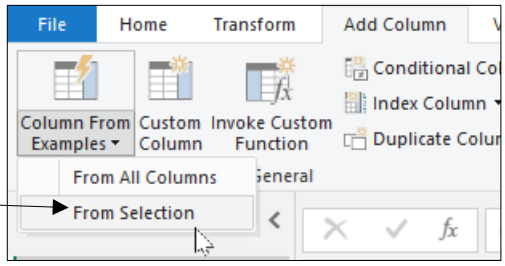
Begin by selecting the column or columns which contain the raw data from which Power Query can deduce the formula you want to apply, then right-click and choose this menu option:

For this example we want to show the total area of each country (the list comes from Wikipedia) in square miles. So for Russia this should give **6601667**, the figure in brackets.



Start by selecting the column or columns upon which Power Query should base its formula, then right-click and choose to add a column by showing some examples.

Note that you can also do this from the ribbon:



You can do the same thing by clicking on the drop-down next to the **Column From Examples** button on the **Add Column** tab of the Power Query ribbon.

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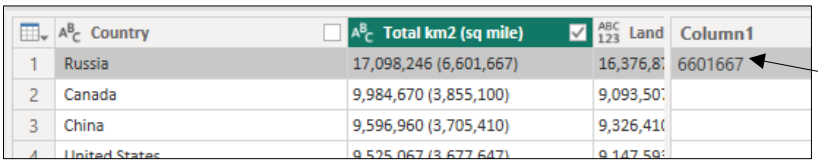
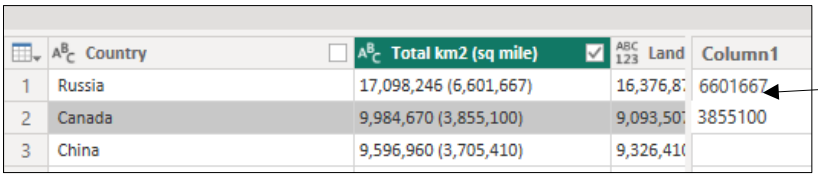
Step 2 – Show some Examples

You can now train the Power BI column formula generation algorithm:



	Country	Total km2 (sq mile)	Land	Column1
1	Russia	17,098,246 (6,601,667)	16,376,8	6601667
2	Canada	9,984,670 (3,855,100)	9,093,50	
3	China	9,596,960 (3,705,410)	9,326,41	
4	United States	9,525,067 (3,677,647)	9,147,59	

a) Type in the value you would expect a Query Editor formula to return for your first row of data, then press Ctrl + Enter.



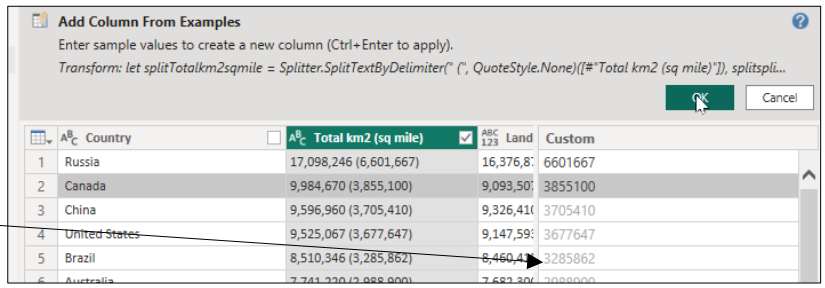
	Country	Total km2 (sq mile)	Land	Column1
1	Russia	17,098,246 (6,601,667)	16,376,8	6601667
2	Canada	9,984,670 (3,855,100)	9,093,50	3855100
3	China	9,596,960 (3,705,410)	9,326,41	

b) If you don't get any results for the first value, try a second (and even a third) until Power BI gets what you're trying to do, pressing press Ctrl + Enter each time.

Step 3 – Confirm the Formula

If you're happy with what Power BI has created, select OK; otherwise, choose Cancel:

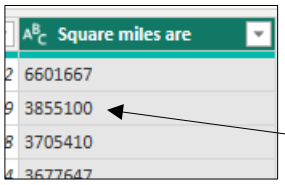
Incredibly, Power BI seems to have worked out exactly what you want to do.



	Country	Total km2 (sq mile)	Land	Custom
1	Russia	17,098,246 (6,601,667)	16,376,8	6601667
2	Canada	9,984,670 (3,855,100)	9,093,50	3855100
3	China	9,596,960 (3,705,410)	9,326,41	3705410
4	United States	9,525,067 (3,677,647)	9,147,59	3677647
5	Brazil	8,510,346 (3,285,862)	8,460,4	3285862
6	Australia	7,741,220 (2,988,900)	7,683,30	2988900

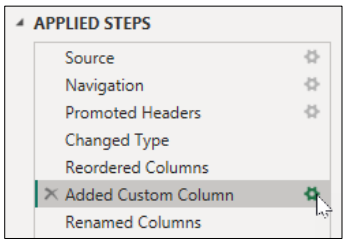
Step 4 – Review your Formula

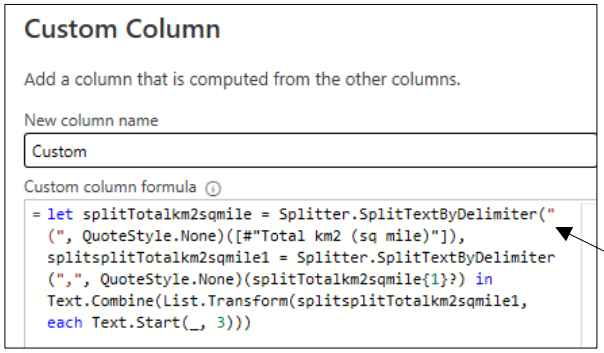
You can now have a look at the M formula created for your new column:



	Square miles are
2	6601667
9	3855100
8	3705410
4	3677647

a) Here we've renamed the column too. You can view the details of the transform step by clicking on the gear icon next to it:





b) This would show this formula, which is explained overleaf!)

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Step 5 – Understanding your Formula

The big disadvantage of creating columns by example is that you may find it hard to understand (and amend) the resulting formula.

```
= let splitTotalkm2sqmile = Splitter.SplitTextByDelimiter("
  (", QuoteStyle.None)([#"Total km2 (sq mile)"]),
  splitsplitTotalkm2sqmile1 = Splitter.SplitTextByDelimiter
  (",", QuoteStyle.None)(splitTotalkm2sqmile{1}?) in
  Text.Combine(List.Transform(splitsplitTotalkm2sqmile1,
  each Text.Start(_, 3)))
```

For our example, here's our formula.

Here's a rough breakdown of what this does:

Stage	What it does	Returns for row 1
Before any formulae applied		**17,098,246 (6,601,667)**
`let splitTotalkm2sqmile = Splitter.SplitTextByDelimiter(" (", QuoteStyle.None)([#"Total km2 (sq mile)"])`	Creates a variable with a long unwieldy name (**splitTotalkm2sqmile**) to take the column called **Total km2 (sq mile)** and split it at the first `(` character. This will return a list of items.	A list containing two items: **17,098,246 (** and **6,601,667)**.
`splitsplitTotalkm2sqmile1 = Splitter.SplitTextByDelimiter(",", QuoteStyle.None)(splitTotalkm2sqmile{1}?)`	Takes the second element returned in this list of items (list elements are numbered from 0, so [1] means the second element), which is the bit after the `(` character, and splits this by the `,` character.	A list containing the items **6**, **601** and **667)**.
`let … in Text.Combine(List.Transform(splitsplitTotalkm2sqmile1, each Text.Start(_, 3)))`	Takes this list of numbers, and for each one picks out the first 3 characters. Combines this list of miniature strings of text into a single string.	**6601667**

The above shows two things: that the M language won't be that intuitive to learn, and that (like all Microsoft wizards) the formulae created for columns by example are not always written in the simplest way!

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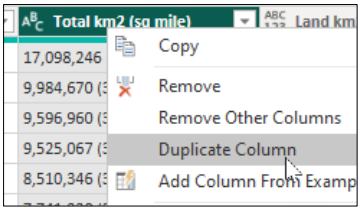
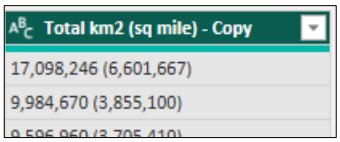
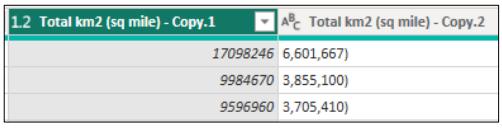
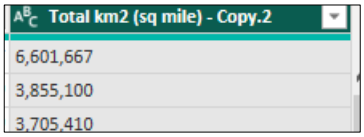
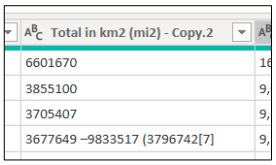
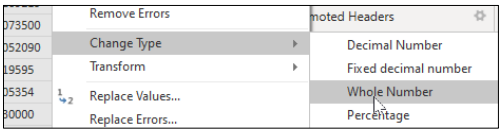
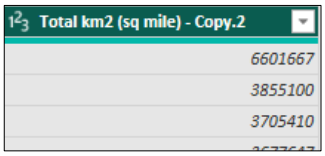
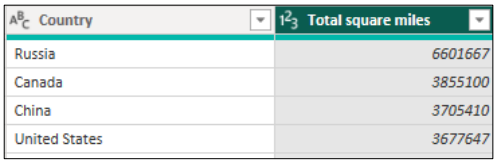
2.3 Built-up Columns

An alternative to using columns by example is to create a new column one bit at a time. For our example (getting each country's total land area in square miles) this could be as follows:

Transform	How	Result
Duplicate column	Right-click on the total land area column and choose **Duplicate Column** to take a copy of it, so we don't lose the original. 	
Split by bracket	Right-click on this duplicated column and choose **Split Column** > **By Delimiter…**, then choose a (as your delimiter.	
Remove the end bracket	Right-click on the second column generated and choose **Replace Values…**, then replace every) with nothing.	
Remove the commas	Repeat the above step, replacing each , with nothing.	
Change the value to a number	Right-click on the column and choose to change the type to a number: 	
Tidy up the columns	Delete any intermediate columns generated, reorder your columns and rename this one.	

The great advantage of this approach is that you can understand how you got from A to B, reproduce the stages and even modify them should you require.

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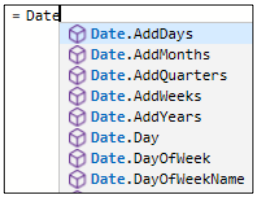
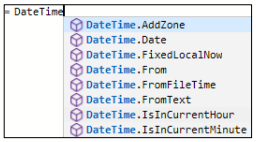
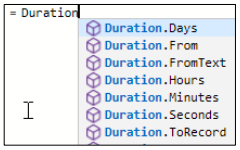
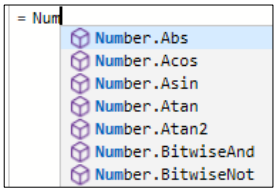
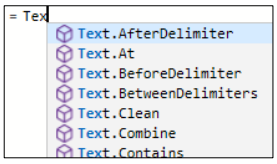
2.4 Custom Columns in M

Even if you don't know the M formula language you can sometimes guess your way round using it to create formulae for new columns based on existing ones.

M Prefixes

Here are some good prefixes to try in Intellisense:

Prefix	What it gives	Example
Date	Functions to do with dates	
DateTime	Functions to do with dates/times	
Duration	Functions giving the duration of time	

Prefix	What it gives	Example
Number	Functions giving things you can do to numbers	
Text	Functions to do with text	

Our Example – Elapsed Days

Suppose you have a table of actors, and want to find out how many days have elapsed since each was born:

DateOfBirth	Days since birth
14/09/1947	27926
10/02/1967	20837
22/10/1952	26061
29/08/1923	36708

To understand how to create this formula, ask the question a different way: you want to take the duration in days of the period between the **[DateOfBirth]** column in this table and the current local date/time, expressed as a date.

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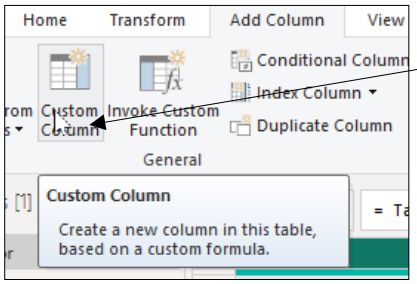
Creating a Custom Column

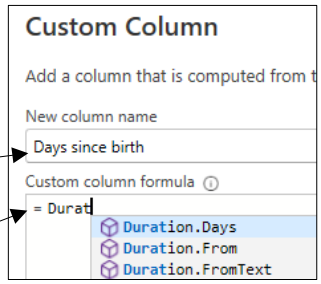
Here's how to create a column like this:

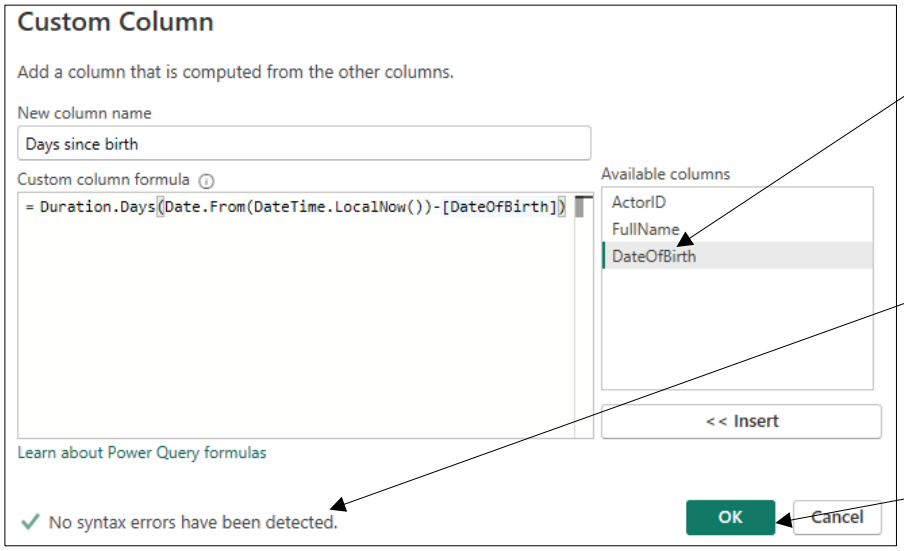


a) Click on tis icon on the **Add Column** menu to add a custom column to your query.

b) Give your new column a name.

c) Begin to create a formula.





d) Double-click on any column to insert it into your formula at any stage.

e) You won't be able to continue until you see this message confirming that your syntax is plausible.

f) When you've finished your formula, press OK to confirm it.

```
= Table.AddColumn(#"Filtered Rows", "Days since birth", each Duration.Days(Date.From(DateTime.LocalNow())-[DateOfBirth]))
```

g) Power Query will incorporate this in a new query step (in this case showing for each row in the given table the number of days between each actor's birth date and today's date).

What the above example shows is that it's not easy to guess your way round the M language. Who would have thought it would be so hard to get at today's date, for example?

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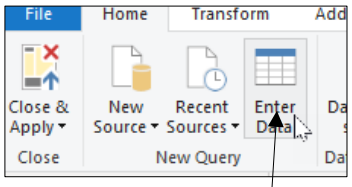
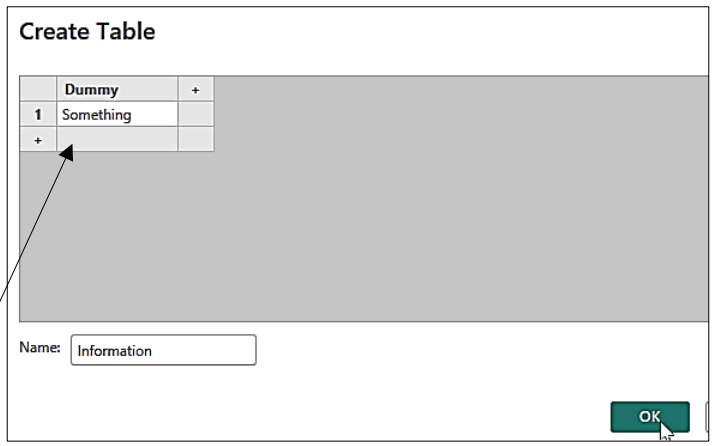
2.5 Special Case - Last Refresh Date/Time

This pages shows a way to show the last date/time when a report was refreshed:

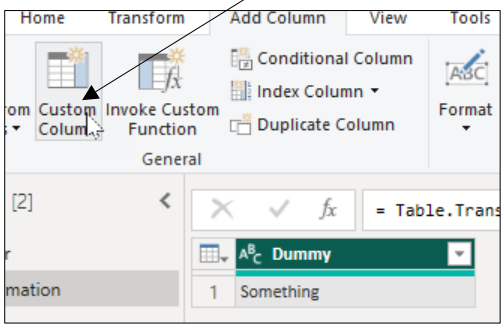


a) In Power Query, choose to create a new table by entering data for it.

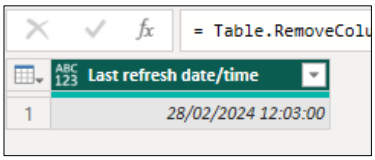
b) Make sure your table has one row in, since you want it to contain one bit of information only (it doesn't matter what this column is called, nor what it contains).

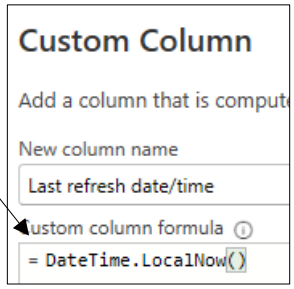


c) Choose to add a custom column from the **Add Column** tab of the ribbon.

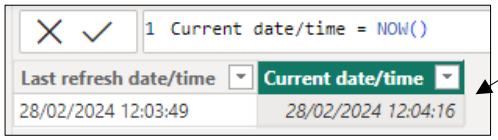


d) Create an expression giving the current date/time. You can then delete the original column to give your final table:

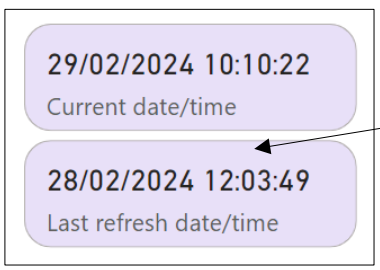




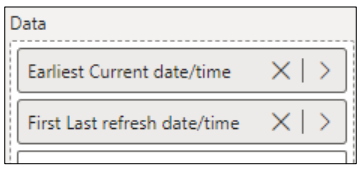
After loading your table, you could create a calculated column in it to show the current date and time, using the DAX **NOW()** function, then display both bits of information side by side:



You could add a column to your table in Power BI to show the latest date/time.



The card on the top is showing the date/time now; the one on the bottom is showing the date/time when you last refreshed your data (both shown below before we renamed them to remove the messy statistic prefix):



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2.6 Conditional Columns

You can use conditional columns to divide data up into discrete bands. In the following example we express each country's land area in units of the size of Wales (about 8,023 square miles).

In an ideal world the provider of your data would add this column into the underlying data source, to prevent you having to calculate it as you load the data.

To create a conditional column like this:

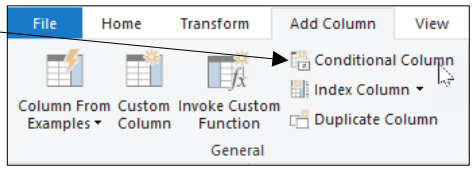
a) On the **Add Column** tab select to create a conditional column.

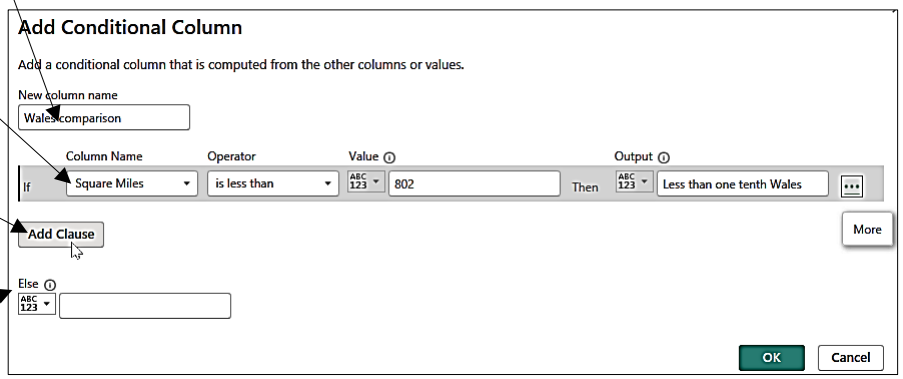
b) Give your new column a name (here we've called it **Wales comparison**).

c) Create your first condition.

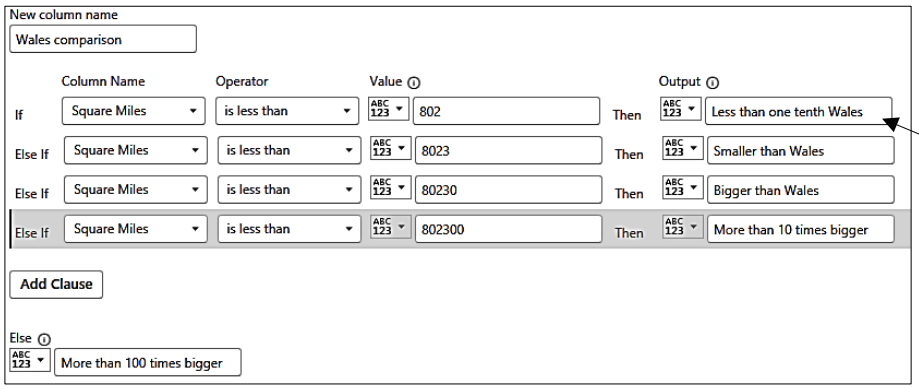
d) Click here to add other conditions.

e) Put here what should happen if all of the other conditions fail.





Continue adding conditions to get the final column:



Note that when writing numerical or date comparison conditions, you should start with the smallest/earliest number/date and work your way up (as here), or start with the biggest/latest one and work your way down.

	Country	Square Miles	Wales comparison
1	Afghanistan	252072	More than 10 times bigger
2	Albania	11100	Bigger than Wales
3	Algeria	919595	More than 100 times bigger
4	Andorra	181	Less than one tenth Wales
5	Angola	481350	More than 10 times bigger
6	Antigua and Barbuda	171	Less than one tenth Wales

The first few countries listed in alphabetical order. The UK is more than 10 times bigger than Wales, if you're interested.

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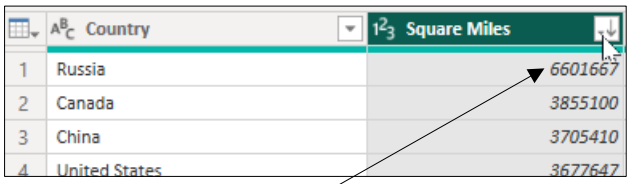
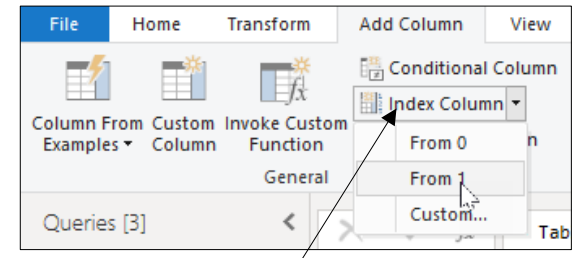
2.7 Indexing Columns

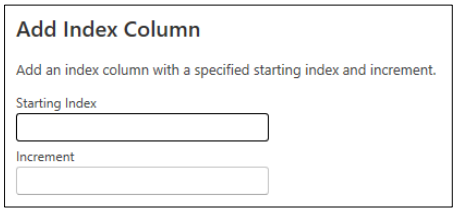
You can number rows in a table using an *index column*:

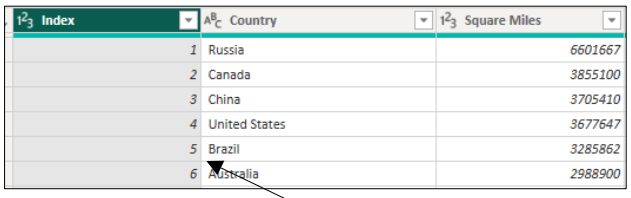


a) Sort your rows in the order in which you want them to be ordered (in this case, we'll order them by size, with the largest country first).



b) Add an index column from the **Add Column** menu, choosing to order the rows from 1, not 0. Note that you could instead choose **Custom…** to create any arithmetic series:





c) You can now use this column to show the original sort order (and to revert to it should you need to).

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