

# Sum Product

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*Mary eta lambda this month* – and then created a semantic model using Fabric and Copilot to blow its entire savings in the bank! Or something like that. It's a huge month for Microsoft releases as we say goodbye to 2023, with three new Excel functions, eta lambda capability, Fabric and Copilot all coming into play! Learn more on all these topics in our mammoth newsletter this month.

It's been a big month for SumProduct too – our team continues to grow – and we are delighted to announce a key new member to the posse, **Loretta Ross**, who has become our Head of Sales and Product Strategy. This role has been vacant for sometime: finding the right person has been an immense challenge for us and we think she will do a fabulous job for us. You can meet her in this month's newsletter below.

This month we look at another common request in recent months – data validation lists. And then there are the regulars: Beat the Boredom Challenge, plus more tips on Charts & Dashboards, our still reasonably new Excel for Mac article, plus Visual Basics, Power Pivot Principles, Power Query Pointers, Power BI Updates and Excel Updates. We also take the **P** in our A to Z of Keyboard Shortcuts and we even **MDETERM** what to put in this month's A to Z of Excel functions.

As always, happy reading and remember: stay safe, stay happy, stay healthy.

*Liam Bastick*, Managing Director, SumProduct



## Please Welcome Our New Head of Sales and Product Strategy, Loretta Ross



How can we kick off this month's newsletter without welcoming our newest member of the SumProduct family, **Loretta Ross**, Head of Sales and Product Strategy.

Loretta brings a wealth of experience to SumProduct having worked at CPA Australia for the past 10 years, where she was responsible for a large and diverse portfolio of commercial learning products and services. In this time, she established and grew the CPA Australia in-house learning

and consultancy business into a global powerhouse, featuring a broad range of offerings that were often tailored to customers' specific needs and provided quantifiable return on investments.

Before CPA Australia, Loretta spent 12 years in the financial services industry partnering with financial advisors to upskill on a wide range of technical, technological and transferrable skills to keep pace with an ever-changing and dynamic business environment.



Loretta has a passion for connecting with people from all parts of the world, discovering their problems, often complex in nature, and finding the best solutions to help them learn, unlearn and re-learn new skills to reach their potential. There is no problem too big or small to solve, only the opportunity to be more productive and in turn, enable organisations and its people to focus on value-adding and strategic business priorities.

She is looking forward to working with the SumProduct team to innovate and develop the online learning and in-person training offerings and provide value through commercial partnerships with the global finance and accounting community. The number one goal is to build mutually

rewarding partnerships with a wide range of organisations to help them reach their goals.

If you work in an organisation that could benefit from learning new skills in the world of Microsoft Excel, Power BI and more, or know of anyone who does, don't hesitate to get in touch with Loretta on [loretta.ross@sumproduct.com](mailto:loretta.ross@sumproduct.com). She will be more than happy to arrange a call to discuss your needs.

Welcome Loretta!

## GROUPBY, PIVOTBY, PERCENTOF, Eta Lambdas et al

In addition to the Excel Updates mentioned later in this newsletter, Microsoft has announced three new functions and “eta reduced lambda” functions (known as “eta lambdas”) into the Excel family in the past couple of weeks. They make automating data analysis really simple – as long as you have access to all of these functions! They are rolling out on the beta channel for Excel for Windows and Excel for Mac as we write.

### eta Lambdas

These “eta reduced lambda” functions may sound scary, but they make the world of dynamic arrays more accessible to the inexperienced. They help make the other three functions simpler to use. Dynamic array calculations using basic aggregation functions often require syntax such as

**LAMBDA(x, SUM(x))**

**LAMBDA(y, AVERAGE(y))**

*etc.*

However, given **x** and **y** (*above*) are merely dummy variables, an “eta lambda” function simply replaces the need for this structure with the so-easy-anyone-can-understand-it syntax of

**SUM**

**AVERAGE**

*etc.*

Even I can do it. For example, consider the following formula in cell **G17** below:

	C	D	E	F	G	H	I	J	K	L	M	N
9												
10												
11												
12												
13												
14												
15												
16												
17												
18												

	Q1	Q2	Q3	Q4
North	8	8	3	10
South	9	4	9	9
East	8	4	5	8
West	1	10	2	6
<b>Total</b>	<b>26</b>	<b>26</b>	<b>19</b>	<b>33</b>

=BYCOL(G13:J16,LAMBDA(x,SUM(x)))

**=BYCOL(G13:J16,LAMBDA(x,SUM(x)))**

This sums the range **G13:J16** by column using that **LAMBDA(x, SUM(x))** trick. But there is no need for this anymore, viz.

	F	G	H	I	J	K	L	M
19								
20								
21								
22								
23								
24								
25								

	Q1	Q2	Q3	Q4
North	8	8	3	10
South	9	4	9	9
East	8	4	5	8
West	1	10	2	6
<b>Total</b>	<b>26</b>	<b>26</b>	<b>19</b>	<b>33</b>

=BYCOL(G21:J24,SUM)

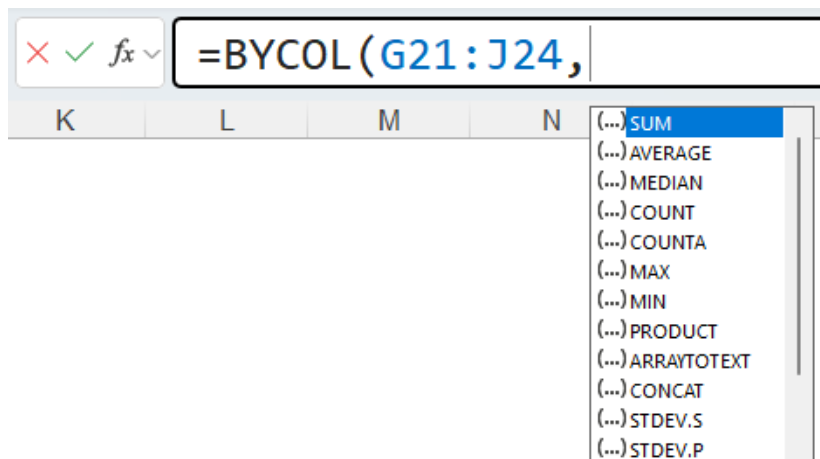
**=BYCOL(G21:J24,SUM)**

That's much simpler!

Presently, the following built-in functions are available to Excel users lucky enough to get all these functions and functionalities:

- **ARRAYTOTEXT**
- **AVERAGE**
- **CONCAT**
- **COUNT**
- **COUNTA**
- **MAX**
- **MEDIAN**
- **MIN**
- **MODE.SNGL**
- **PERCENTOF**
- **PRODUCT**
- **STDEV.P**
- **STDEV.S**
- **SUM**
- **VAR.P**
- **VAR.S**

These will pop up when they may be used, but they don't appear in alphabetical order. It's more a ranking of what Microsoft perceives to be the most common aggregation operations:



### GROUPBY

The new **GROUPBY** function allows you to create a summary of your data formulaically. It supports grouping along one axis and aggregating the associated values. For instance, if you had a table of sales data, you might generate a summary of sales by year, or by salesperson, or by category, or by...

In essence, it allows you to group, aggregate, sort and filter data based upon the fields you specify.

The syntax of the **GROUPBY** function is given by:

**GROUPBY(row\_fields, values, function, [field\_headers], [total\_depth], [sort\_order], [filter\_array])**

It has the following arguments:

- **row\_fields**: this is required, and represents a column-oriented array or range that contains the values which are used to group rows and generate row headers. The array or range may contain multiple columns. If so, the output will have multiple row group levels
- **values**: this is also required, and denotes a column-oriented array or range of the data to aggregate. The array or range may contain multiple columns. If so, the output will have multiple aggregations
- **function**: also required, this is an explicit or eta reduced lambda (e.g. **SUM**, **PERCENTOF**, **AVERAGE**, **COUNT**) that is used to aggregate **values**. A vector of lambdas may be provided. If so, the output will have multiple aggregations. The orientation of the vector will determine whether they are laid out row- or column-wise
- **field\_headers**: this and the remaining arguments are all optional. This represents a number that specifies whether the **row\_fields** and **values** have headers and whether field headers should be returned in the results. The possible values are:
  - **Missing**: Automatic
  - **0**: No
  - **1**: Yes and don't show
  - **2**: No but generate
  - **3**: Yes and show

It should be noted that "Automatic" assumes the data contains headers based upon the **values** argument. If the first value is text and the second value is a number, then the data is assumed to have headers. Fields headers are shown if there are multiple row or column group levels

- **total\_depth**: this optional argument determines whether the row headers should contain totals. The possible values are:
  - **Missing**: Automatic, with grand totals and, where possible, subtotals
  - **0**: No Totals
  - **1**: Grand Totals
  - **2**: Grand and Subtotals
  - **-1**: Grand Totals at Top
  - **-2**: Grand and Subtotals at Top

It should be noted that for subtotals, fields must have at least two [2] columns. Numbers greater than two [2] are supported provided there are sufficient columns

- **sort\_order**: again optional, this argument denotes a number indicating how rows should be sorted. Numbers correspond with the columns in **row\_fields** followed by the columns in **values**. If the number is negative, the rows are sorted in descending / reverse order. A vector of numbers may be provided when sorting based upon only **row\_fields**
- **filter\_array**: the final optional argument, this represents a column-oriented one-dimensional array of Boolean values [1, 0] that indicate whether the corresponding row of data should be considered. It should be noted that the length of the array must match the length of **row\_fields**.

To show how **GROUPBY** works, we took inspiration from Microsoft's data table:

## Example Data

Table Used for Formulae

Year	Category	Item	Sales	Rating
2020	Components	Wheels	4,000	10%
2022	Components	Pedals	3,200	50%
2020	Components	Brakes	3,300	45%
2020	Clothing	Jerseys	1,100	10%
2020	Components	Saddles	500	85%
2020	Clothing	Jerseys	1,500	30%
2021	Accessories	Bike Racks	2,600	85%
2020	Bikes	Touring Bikes	1,100	30%
2022	Clothing	Tights	800	65%
2021	Clothing	Bib-Shorts	1,000	45%
2021	Accessories	Helmets	2,700	45%
2020	Clothing	Gloves	800	20%
2022	Clothing	Vests	1,100	30%
2021	Components	Brakes	1,100	100%
2022	Components	Handlebars	3,200	25%
2022	Accessories	Locks	400	55%
2021	Accessories	Tyres and Tubes	500	70%
2020	Components	Pedals	1,000	45%
2021	Accessories	Helmets	3,600	60%
2020	Bikes	Touring Bikes	200	55%
2021	Clothing	Gloves	4,000	100%
2020	Accessories	Locks	1,500	75%
2022	Bikes	Road Bikes	600	75%
2022	Clothing	Gloves	900	65%
2022	Components	Chains	100	10%
2022	Components	Chains	1,600	45%
2021	Bikes	Touring Bikes	2,400	70%

I have converted this data table into an Excel Table by selecting all the data and using **Insert -> Table (CTRL + T)** and calling the resultant Table **tbl**. Look, it's late as I write this and I have no imagination, OK!?

I can summarise my Table very simply using the formula

**=GROUPBY(tbl[Category],tbl[Sales],SUM)**

Description	Amount
Accessories	485,500
Bikes	495,800
Clothing	509,700
Components	493,200
<b>Total</b>	<b>1,984,200</b>

**=GROUPBY(tbl[Category],tbl[Sales],SUM)**

How easy is that!? Essentially, I am summing the sales (using the eta lambda **SUM**) by the **Category** field.

If you want to aggregate by more than one **row\_field**, as stated above, this is possible. One way is to use **HSTACK**:

**=GROUPBY(HSTACK(tbl[Year],tbl[Category]),tbl[Sales],SUM)**

Year	Category	Sales
2020	Accessories	193,500
2020	Bikes	144,300
2020	Clothing	182,900
2020	Components	175,600
2021	Accessories	145,400
2021	Bikes	161,800
2021	Clothing	173,600
2021	Components	142,400
2022	Accessories	146,600
2022	Bikes	189,700
2022	Clothing	153,200
2022	Components	175,200
<b>Total</b>		<b>1,984,200</b>

*=GROUPBY(HSTACK(tbl[Year],tbl[Category]),tbl[Sales],SUM)*

This simply combines the **Year** and **Category** fields in the **tbl** Table, and then sums **Sales** across them. However, I think I prefer the **CHOOSECOLS** approach:

**=GROUPBY(CHOOSECOLS(tbl,1,2),tbl[Sales],SUM)**

Year	Category	Sales
2020	Accessories	193,500
2020	Bikes	144,300
2020	Clothing	182,900
2020	Components	175,600
2021	Accessories	145,400
2021	Bikes	161,800
2021	Clothing	173,600
2021	Components	142,400
2022	Accessories	146,600
2022	Bikes	189,700
2022	Clothing	153,200
2022	Components	175,200
<b>Total</b>		<b>1,984,200</b>

*=GROUPBY(CHOOSECOLS(tbl,1,2),tbl[Sales],SUM)*

Here, the idea is that I shall **SUM Sales** by columns 1 (**Year**) and 2 (**Category**) of the **tbl** Table. This might not seem as clear as the **HSTACK** alternative at first glance as you have to refer to the Table to identify what the columns are. However, stick with me. Let me make the formula more complex:

**=GROUPBY(CHOOSECOLS(tbl,MATCH(F\$12,tbl[#Headers],0),  
MATCH(G\$12,tbl[#Headers],0)),tbl[Sales],SUM)**

Year	Category	Sales
2020	Accessories	193,500
2020	Bikes	144,300
2020	Clothing	182,900
2020	Components	175,600
2021	Accessories	145,400
2021	Bikes	161,800
2021	Clothing	173,600
2021	Components	142,400
2022	Accessories	146,600
2022	Bikes	189,700
2022	Clothing	153,200
2022	Components	175,200
<b>Total</b>		<b>1,984,200</b>

*=GROUPBY(CHOOSECOLS(tbl,MATCH(F\$12,tbl[#Headers],0),MATCH(G\$12,tbl[#Headers],0)),tbl[Sales],SUM)*

Looks horrible, yes? I have replaced the values 1 and 2 in the previous formula with

**MATCH(F\$12,tbl[#Headers],0)**

and

**MATCH(G\$12,tbl[#Headers],0)**

which return the positions in the **Headers** row of the Table **tbl**. Now, this may seem overkill but consider the following image:

Year	Category	Sales
2020	Accessories	193,500
2020	Bikes	144,300
2020	Clothing	182,900
2020	Components	175,600
2021	Accessories	145,400
2021	Bikes	161,800
2021	Clothing	173,600
2021	Components	142,400
2022	Accessories	146,600
2022	Bikes	189,700
2022	Clothing	153,200
2022	Components	175,200
<b>Total</b>		<b>1,984,200</b>

Brilliant. I have changed the background colour of the first two headers to yellow. Well no, it's a little more than that. I have used data validation dropdown lists (**ALT + D + L**) to create input headers!!

Year	Category	Sales
Year	Accessories	193,500
Category	Bikes	144,300
Item	Clothing	182,900
Sales	Components	175,600
Rating	Accessories	145,400
2021	Bikes	161,800
2021	Clothing	173,600
2021	Components	142,400
2022	Accessories	146,600
2022	Bikes	189,700
2022	Clothing	153,200
2022	Components	175,200
<b>Total</b>		<b>1,984,200</b>

Thus, if I change the selections, I have dynamic summarisations, such as

Category	Item	Sales
Accessories	Bike Racks	82,700
Accessories	Helmets	115,700
Accessories	Lights	64,900
Accessories	Locks	72,000
Accessories	Pumps	72,900
Accessories	Tyres and Tube	77,300
Bikes	Cargo Bikes	149,300
Bikes	Mountain Bikes	122,500
Bikes	Road Bikes	108,100
Bikes	Touring Bikes	115,900
Clothing	Bib-Shorts	52,300
Clothing	Caps	53,300
Clothing	Gloves	72,400
Clothing	Jerseys	79,000
Clothing	Shorts	67,000
Clothing	Socks	58,700
Clothing	Tights	64,700
Clothing	Vests	62,300
Components	Bottom Bracket	60,000
Components	Brakes	53,100
Components	Chains	65,000
Components	Handlebars	85,600
Components	Pedals	87,900
Components	Saddles	64,700
Components	Wheels	76,900
<b>Total</b>		<b>1,984,200</b>

or

Rating	Category	Sales
0.05	Accessories	20,800
0.05	Bikes	32,200
0.05	Clothing	25,800
0.05	Components	24,800
0.1	Accessories	25,800
0.1	Bikes	30,800
0.1	Clothing	28,200
0.1	Components	32,000
0.15	Accessories	32,000
0.15	Bikes	15,600
0.15	Clothing	26,500
0.15	Components	18,400
0.2	Accessories	26,600
0.2	Bikes	19,800
0.2	Clothing	17,900
0.2	Components	27,600
0.25	Accessories	22,100
0.25	Bikes	31,000
0.25	Clothing	19,500
0.25	Components	23,300
0.3	Accessories	25,000
0.3	Bikes	36,000
0.3	Clothing	24,700
0.3	Components	30,300
0.35	Accessories	26,800
0.35	Bikes	18,600
0.35	Clothing	16,200

Multiple summary statistics may be created similarly, or else you can simply connect them if the reporting fields are contiguous, e.g.

**=GROUPBY(CHOOSCOLS(tbl,1,2),tbl[[Sales]:[Rating]],AVERAGE)**

Year	Category	Sales	Rating
2020	Accessories	2,059	48%
2020	Bikes	1,659	51%
2020	Clothing	2,204	49%
2020	Components	2,116	52%
2021	Accessories	1,795	48%
2021	Bikes	1,926	49%
2021	Clothing	2,019	51%
2021	Components	2,064	54%
2022	Accessories	2,065	53%
2022	Bikes	2,062	54%
2022	Clothing	1,990	55%
2022	Components	1,947	50%
<b>Total</b>		<b>1,990</b>	<b>51%</b>

**=GROUPBY(CHOOSCOLS(tbl, 1, 2),tbl[[Sales]:[Rating]],AVERAGE)**

Here, **tbl[[Sales]:[Rating]]** may be used to specify the **values** as they are side by side.

Obviously, there are many more arguments to play with, but hopefully, you get the general idea, such as ranking the **Item** field in descending order by **Sales** using the formula

**=GROUPBY(tbl[Item],tbl[Sales],SUM,,,-2)**

Item	Sales
Cargo Bikes	149,300
Mountain Bikes	122,500
Touring Bikes	115,900
Helmets	115,700
Road Bikes	108,100
Pedals	87,900
Handlebars	85,600
Bike Racks	82,700
Jerseys	79,000
Tyres and Tubes	77,300
Wheels	76,900
Pumps	72,900
Gloves	72,400
Locks	72,000
Shorts	67,000
Chains	65,000
Lights	64,900
Tights	64,700
Saddles	64,700
Vests	62,300
Bottom Brackets	60,000
Socks	58,700
Caps	53,300
Brakes	53,100
Bib-Shorts	52,300
<b>Total</b>	<b>1,984,200</b>

`=GROUPBY(tbl[Item],tbl[Sales],SUM,,-2)`

Indeed, the outputs summarised don't have to be numerical. A more comprehensive example summarising the **Items** field might look like this:

`=GROUPBY(tbl[Category],tbl[Item],LAMBDA(x,ARRAYTOTEXT(SORT(UNIQUE(x)))))`

Accessories	Bike Racks, Helmets, Lights, Locks, Pumps, Tyres and Tubes
Bikes	Cargo Bikes, Mountain Bikes, Road Bikes, Touring Bikes
Clothing	Bib-Shorts, Caps, Gloves, Jerseys, Shorts, Socks, Tights, Vests
Components	Bottom Brackets, Brakes, Chains, Handlebars, Pedals, Saddles, Wheels
Total	Bib-Shorts, Bike Racks, Bottom Brackets, Brakes, Caps, Cargo Bikes, Chains, Gloves, Handlebars, Helmets, Jerseys, Lights, Locks, Mountain Bikes, Pedals, Pumps, Road Bikes, Saddles, Shorts, Socks, Tights, Touring Bikes, Tyres and Tubes, Vests, Wheels

`=GROUPBY(tbl[Category],tbl[Item],LAMBDA(x,ARRAYTOTEXT(SORT(UNIQUE(x)))))`

## PIVOTBY

The **PIVOTBY** function allows you to create a summary of your data via a formula too, akin to a formulaic PivotTable. It supports grouping along two axes and aggregating the associated values. For instance, if you had a table of sales data, you might generate a summary of sales by state and year.

It should be noted that **PIVOTBY** is a function that returns an array of values that can spill to the grid. Furthermore, at this stage, not all features of a PivotTable appear to be replicable by this function.

The syntax of the **PIVOTBY** function is:

**PIVOTBY**(row\_fields, col\_fields, values, function, [field\_headers], [row\_total\_depth], [row\_sort\_order], [col\_total\_depth], [col\_sort\_order], [filter\_array])

It has the following arguments:

- **row\_fields**: this is required, and represents a column-oriented array or range that contains the values which are used to group rows and generate row headers. The array or range may contain multiple columns. If so, the output will have multiple row group levels
- **col\_fields**: also required, and represents a column-oriented array or range that contains the values which are used to group columns and generate column headers. The array or range may contain multiple columns. If so, the output will have multiple column group levels
- **values**: this is also required, and denotes a column-oriented array or range of the data to aggregate. The array or range may contain multiple columns. If so, the output will have multiple aggregations
- **function**: also required, this is an explicit or eta reduced lambda (e.g. **SUM**, **PERCENTOF**, **AVERAGE**, **COUNT**) that is used to aggregate values. A vector of lambdas may be provided. If so, the output will have multiple aggregations. The orientation of the vector will determine whether they are laid out row- or column-wise



- **field\_headers:** this and the remaining arguments are all optional. This represents a number that specifies whether the **row\_fields**, **col\_fields** and **values** have headers and whether field headers should be returned in the results. The possible values are:
  - **Missing:** Automatic
  - **0:** No
  - **1:** Yes and don't show
  - **2:** No but generate
  - **3:** Yes and show

It should be noted that "Automatic" assumes the data contains headers based upon the **values** argument. If the first value is text and the second value is a number, then the data is assumed to have headers. Fields headers are shown if there are multiple row or column group levels

- **row\_total\_depth:** this optional argument determines whether the row headers should contain totals. The possible values are:
  - **Missing:** Automatic, with grand totals and, where possible, subtotals
  - **0:** No Totals
  - **1:** Grand Totals
  - **2:** Grand and Subtotals
  - **-1:** Grand Totals at Top
  - **-2:** Grand and Subtotals at Top

It should be noted that for subtotals, **row\_fields** must have at least two [2] columns. Numbers greater than two [2] are supported provided **row\_field** has sufficient columns

- **row\_sort\_order:** again optional, this argument denotes a number indicating how rows should be sorted. Numbers correspond with the columns in **row\_fields** followed by the columns in **values**. If the number is negative, the rows are sorted in descending / reverse order. A vector of numbers may be provided when sorting based upon only **row\_fields**
- **col\_total\_depth:** this optional argument determines whether the column headers should contain totals. The possible values are:
  - **Missing:** Automatic, with grand totals and, where possible, subtotals
  - **0:** No Totals
  - **1:** Grand Totals
  - **2:** Grand and Subtotals
  - **-1:** Grand Totals at Top
  - **-2:** Grand and Subtotals at Top

It should be noted that for subtotals, **col\_fields** must have at least two [2] columns. Numbers greater than two [2] are supported provided **col\_field** has sufficient columns

- **col\_sort\_order:** again optional, this argument denotes a number indicating how they should be sorted. Numbers correspond with the columns in **col\_fields** followed by the columns in **values**. If the number is negative, these are sorted in descending / reverse order. A vector of numbers may be provided when sorting based upon only **col\_fields**
- **filter\_array:** the final optional argument, this represents a column-oriented one-dimensional array of Boolean values [1, 0] that indicate whether the corresponding row of data should be considered. It should be noted that the length of the array must match the length of **row\_fields** and **col\_fields**.

Similar in many ways to **GROUPBY**, **PIVOTBY** is fairly straightforward to use:

**=PIVOTBY(tbl[Category],tbl[Year],tbl[Sales],AVERAGE)**

	2020	2021	2022	Total
Accessories	2,059	1,795	2,065	1,974
Bikes	1,659	1,926	2,062	1,885
Clothing	2,204	2,019	1,990	2,072
Components	2,116	2,064	1,947	2,038
Total	2,007	1,948	2,014	1,990

**=PIVOTBY(tbl[Category],tbl[Year],tbl[Sales],AVERAGE)**

You can get more imaginative and sort in descending order by the **AVERAGE** of **Rating**, viz.

**=PIVOTBY(tbl[Item],tbl[Year],tbl[Rating],AVERAGE,,-2)**

	2020	2021	2022	Total
Brakes	46%	61%	65%	59%
Locks	50%	58%	71%	56%
Pumps	70%	41%	56%	56%
Shorts	52%	52%	64%	55%
Vests	54%	51%	60%	55%
Touring Bikes	54%	51%	59%	55%
Pedals	58%	57%	50%	54%
Bib-Shorts	43%	48%	69%	54%
Gloves	49%	64%	52%	53%
Road Bikes	46%	54%	58%	53%
Cargo Bikes	56%	51%	51%	53%
Saddles	63%	43%	47%	52%
Tights	56%	53%	46%	51%
Handlebars	53%	52%	47%	51%
Caps	60%	39%	51%	51%
Chains	52%	49%	51%	51%
Socks	50%	45%	56%	50%
Wheels	41%	67%	45%	50%
Tyres and Tubes	46%	54%	46%	50%
Lights	47%	46%	49%	47%
Mountain Bikes	48%	42%	48%	46%
Bottom Brackets	48%	42%	45%	46%
Helmets	47%	43%	47%	45%
Bike Racks	31%	51%	54%	44%
Jerseys	27%	53%	45%	44%
Total	50%	50%	53%	51%

=PIVOTBY(tbl[Item],tbl[Year],tbl[Rating],AVERAGE,,-2)

**PERCENTOF**

This final function can be used in conjunction with **GROUPBY** and **PIVOTBY**, or else on its own. This is used to return the percentage that a subset makes up of a given dataset. It is logically equivalent to

$$\text{SUM(subset) / SUM(everything)}$$

It sums the values in the subset of the dataset and divides it by the sum of all the values. It has the following syntax:

$$=\text{PERCENTOF}(\text{data\_subset}, \text{data\_all})$$

The arguments are as follows:

- **data\_subset**: this is required, and represents the values that are in the data subset
- **data\_all**: this too is required, and denotes the values that make up the entire set.

You can use it, for example, with **GROUPBY**:

$$=\text{GROUPBY}(\text{tbl}[\text{Category}],\text{tbl}[\text{Sales}],\text{PERCENTOF})$$

Description	Percentage
Accessories	24.47%
Bikes	24.99%
Clothing	25.69%
Components	24.86%
<b>Total</b>	<b>100.00%</b>

=GROUPBY(tbl[Category],tbl[Sales],PERCENTOF)

Alternatively, it may be used on its own:

$$=\text{PERCENTOF}(\text{G13:G14},\text{G13:G16})$$

	E	F	G	H	I	J	K	L
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								

Category	Sales
Accessories	24.47%
Bikes	24.99%
Clothing	25.69%
Components	24.86%
<b>Total</b>	<b>100.00%</b>

Accessories and Bikes	49.46%
-----------------------	--------

=PERCENTOF(G13:G14,G13:G16)

### Word to the Wise

Do remember these functions have just come out. At the time of writing, they are rolling out to users enrolled in the beta channel for Windows Excel and Mac Excel. Don't be upset if you don't get them straight away – they are coming!

It is possible the syntax for these functions might change (this happened with **RANDARRAY** for instance), so do be careful. There may be bugs too. Indeed, I have noted the following so far:

- there is nothing to prohibit creating a named range with the same name as an eta lambda, e.g. **SUM**. This can cause the formula to produce an **#VALUE!** error. To distinguish between an eta lambda and a range name with the same moniker, use **\_xleta**. as a prefix which might update automatically, e.g.

**=GROUPBY(tbl[Category], tbl[Sales], \_xleta.SUM)**

- it has been noted already within the Excel community that titles do not always seem to fully appear:

**=GROUPBY(F12:G20,H12:H20,SUM,3,0)**

	E	F	G	H	I	J	K	L
11								
12								
13		Division	Product	Cost		Division	Product	
14		A	Alfred	100		A	Alfred	100
15		A	Beater	200		A	Beater	200
16		A	Gammon	300		A	Gammon	300
17		B	Goodrem	400		B	Echo Echo	500
18		B	Echo Echo	500		B	Goodrem	400
19		C	Charleston	600		C	Charleston	600
20		C	GTI	700		C	GTI	700
21		C	Motel	800		C	Motel	800
22								
23								

**=GROUPBY(F12:G20,H12:H20,SUM,3,0)**

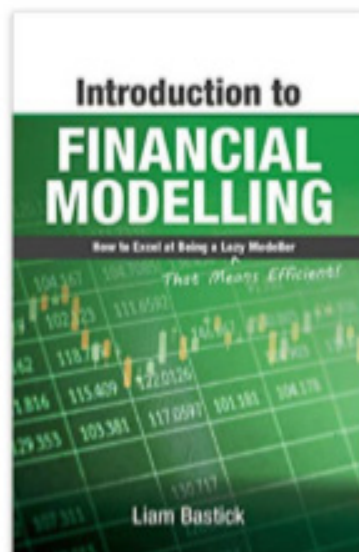
These functions are still fledgling, and hopefully such issues shall be rectified soon.

Don't let these minor gremlins (and others you may find) deter you!

## ChatGPT Training – Coming in 2024!

We are pleased to announce a new training course is coming to our portfolio in the New Year – ChatGPT – with a focus on those working in finance, accounting and banking (but available to all). Its aim will to show you how to embrace chatbot technology to aid productivity and not be in fear of your job!!


As a taster, SumProduct analyst **Myles Kuah** decided to have a play and create a “specialised” GPT where he uploaded our very own Financial Modelling book:



In effect, he created a "Financial Modelbot" that digested all of Liam Bastick's thoughts on Financial Modelling so that the AI's brains may be picked. So he had a try:

 You

Explain best practice in financial modelling

 Financial Modelbot

Best practice in financial modeling, according to the knowledge source, involves adhering to principles that ensure your model is CRaFTed well. Here's how you can ensure your financial model is a veritable work of art:

1. **Consistency** - Your model should be the epitome of predictability. Uniform formulas across ranges, consistent formatting, and a steady flow of information make for a model that's as reliable as your favorite old sweater. Users should be able to navigate your masterpiece with the ease of a hot knife through butter.
2. **Robustness** - Like a trusty old truck, your model should be robust, free from error, and mathematically sound. It should handle data without throwing a tantrum or spouting error messages like "#REF!" or "#DIV/0!" - which are the equivalent of model road rage.
3. **Flexibility** - A top-notch model is as flexible as an Olympic gymnast. It should bend to accommodate various assumptions and scenarios without snapping. This means considering what inputs might change and preparing your model to handle these variations with the elegance of a swan on a lake.
4. **Transparency** - Your model should be as clear as a pristine mountain spring. If someone can follow it on a piece of paper without squinting at the Formula Bar in confusion, you've hit the transparency jackpot. Keep inputs, calculations, and outputs as distinct as the colors in a Mondrian painting.

Remember, these aren't just best practices; they're the gospel according to the church of financial modeling. Preach CRaFT, and your model will not only be a thing of beauty but also a beacon of clarity and reliability in the often murky waters of financial analysis.




 Message Financial Modelbot...



It's a shame it's not "Best Practice" (*i.e.* a proper noun to denote a concept to aspire to, rather than something that may always be achieved), but it's not a bad draft. I like the flowery wittering: I'm loving "model road rage"!

But Myles didn't stop there. Oh no, we have trained him well! He enquired about tax...

 Financial Modelbot

Liam's Law of Tax, found within the creased pages of our financial modeling tomes, carries the kind of wry humor that tax discussions desperately need. It states:

"Often in tax legislation, rules may be ambiguous. If this occurs, calculate the tax to be paid under the different possibilities. Whichever is the worst for you is the one that was meant."

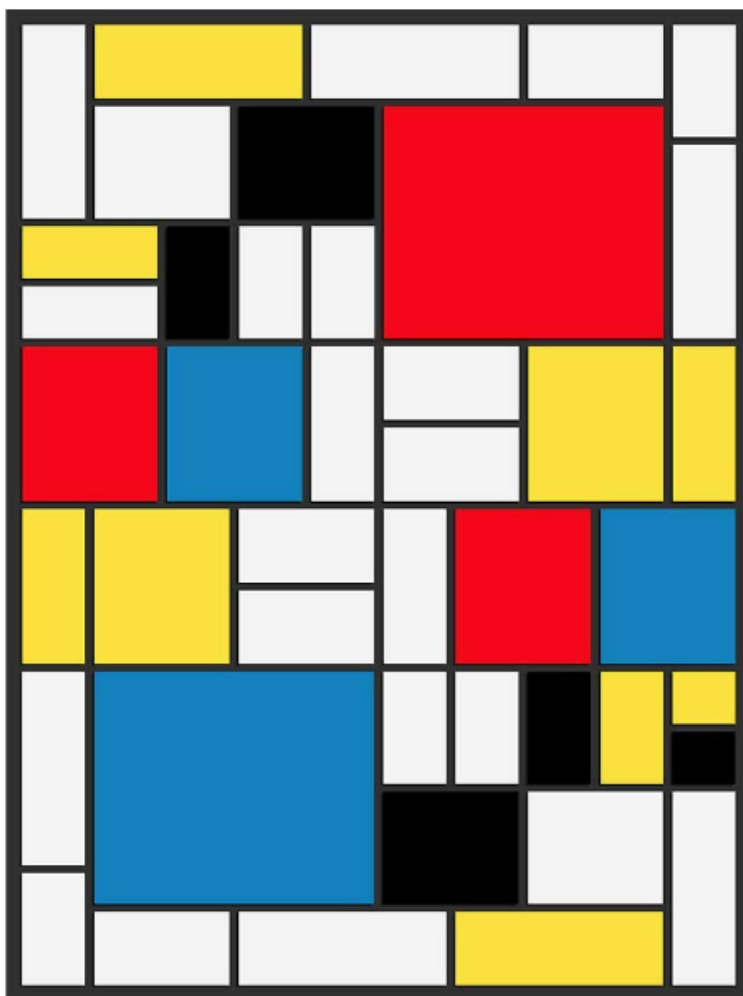
It's a droll reminder that when dealing with the labyrinthine corridors of tax laws, one should prepare for the possibility that the most onerous interpretation might just be the one the tax authorities favor. I have yet to find an exception to this rule and remember:

"All rules have exceptions except this one."

It's like Murphy's Law had a rendezvous with your tax return – and as with Murphy's Law, it's best not to think about that too much. After all, when it comes to taxes, it's often the case that expenses are disallowed but sometimes revenue is non-assessable. In the grand theatre of financial forecasting and modeling, this law serves as a whimsical yet cautionary note to prepare for the strictest tax scenario, especially when ambiguity reigns supreme.

Right, I'm off to paint hot knives through swans for a Mondrian painting (once I have found out what one is)...



If you wish to find out more about ChatGPT training (or any of our training for that matter) and how it can revolutionise your workload, drop us a line at [training@sumproduct.com](mailto:training@sumproduct.com).

No swans were hurt during the making of this article. Unfortunately, we can't say the same for the butter.

## Australian Institute of Training and Development (AITD) Beaten Finalist



Well, we didn't win – but we were shortlisted for the second year running! The Australian Institute of Training and Development (AITD) Excellence Awards recognise outstanding achievement in organisational learning and development. We mentioned recently that SumProduct was recognised as a contributor to a project which achieved finalist status in the AITD 2023 Awards. Alas, for the second year running, we made the shortlist, but we had to settle for another bridesmaid's dress (I always think they look nicer than the dresses I wear anyway...). We'll have to hope for third time lucky!

Projects entered in the AITD Excellence Awards were assessed against specific award criteria including business needs, strategic alignment, design, delivery and measurable impact by an independent judging panel. Entrants had to provide evidence to demonstrate a high achievement against these criteria to be awarded finalist status. Therefore, jokes aside, we were delighted to have been nominated once again. It's great to be recognised for the work both our team and our client performed. In any case, the gang had fun up on the Gold Coast!



*Pictured: Tim Heng and our new Head of Sales and Product Strategy, Loretta Ross. Why do they both have better teeth than me? We'll let you figure out who is who...*

If you would like to find out how our standard or customised training programs can benefit you and your team, drop us a line at [training@sumproduct.com](mailto:training@sumproduct.com).

## Fabric and Copilot in Power BI

You will see later in this month's newsletter that there are a significant number of updates for Power BI this month. We mention the updates again there, but summarise them here.

These updates include the General Availability of Microsoft Fabric and the public Preview of Copilot in Microsoft Fabric, including the experience for Power BI. With the launch of these next-generation analytics tools, you can empower your data teams to more easily scale to meet the demand of the business.

Microsoft Fabric is reshaping how teams work with data by bringing everyone together on a single end-to-end analytics platform. Data

analysts can work side-by-side with data engineers, data warehousing professionals, data scientists, and business users, all working in the same software as a service (SaaS) experience and from the same unified data lake, OneLake, to uncover insights.

Microsoft also believes Copilot in Fabric has the potential to dramatically change the way organisations work with data. Seasoned business intelligence professionals can use Copilot to scale and create stunning reports faster. Less skilled users can use Copilot to explore their data, create reports, and answer their questions without burdening their data teams.

### **General Availability of Microsoft Fabric**

Microsoft Fabric is now out there. It is an end-to-end data platform that can reshape how everyone accesses, manages and acts on data and insights by connecting every data source and analytics service together.

There are four [4] ways Microsoft Fabric may assist the current analytics market:

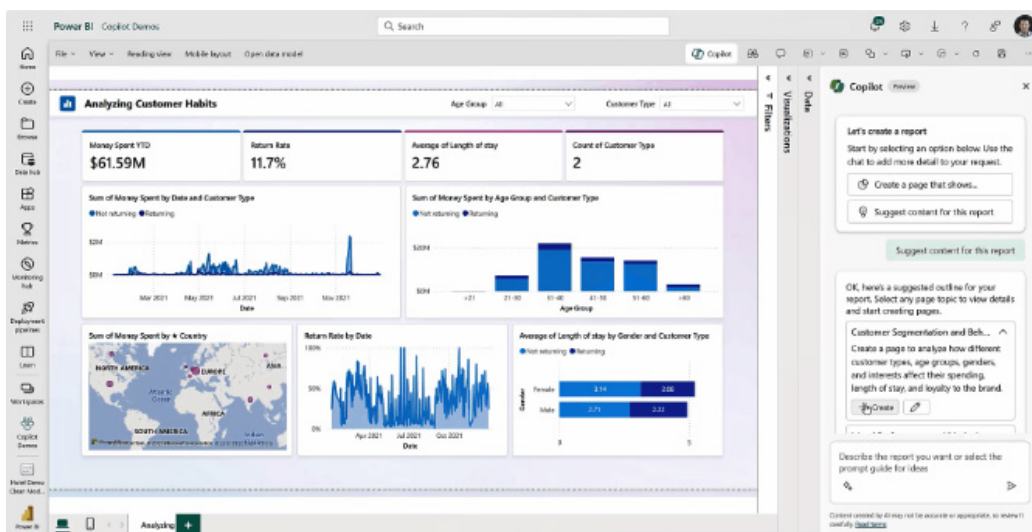
1. **Fabric is a complete analytics platform.** By bringing together seven [7] role-specific workloads, Data Factory, Data Engineering, Data Warehouse, Data Science, Real-Time Analytics, Data Activator and Power BI, into a single, unified experience and architecture, Fabric can help to reduce the typical cost and effort of integrating services and streamline your data estate. This unified architecture also simplifies both governance with built-in features that span every workload and billing with a single pool of capacity and storage that can be used for every workload

- Fabric is lake-centric and open.** You can easily connect all your data across clouds, accounts and domains to Fabric's unified, multi cloud data lake, OneLake, to create a single source of truth for your data. OneLake is automatically wired into every Fabric workload and with OneLake's open data format, you only need to load the data into the lake once to use it across every Fabric workload and engine, minimising data duplication and sprawl
- Fabric empowers business users.** It can ensure business users in your organisation have access to the data and insights needed to make data-driven decisions. With Power BI natively built into Fabric, anyone can quickly go from data sitting in a lake to bespoke Power BI visuals embedded in a Microsoft 365 app
- Fabric is AI-powered.** It has infused AI to help data professionals get more done, more quickly. With Copilot in Fabric, you can use natural language to create dataflows and pipelines, write SQL statements, build reports or even develop machine learning models.

### Announcing the public Preview of Copilot in Microsoft Fabric

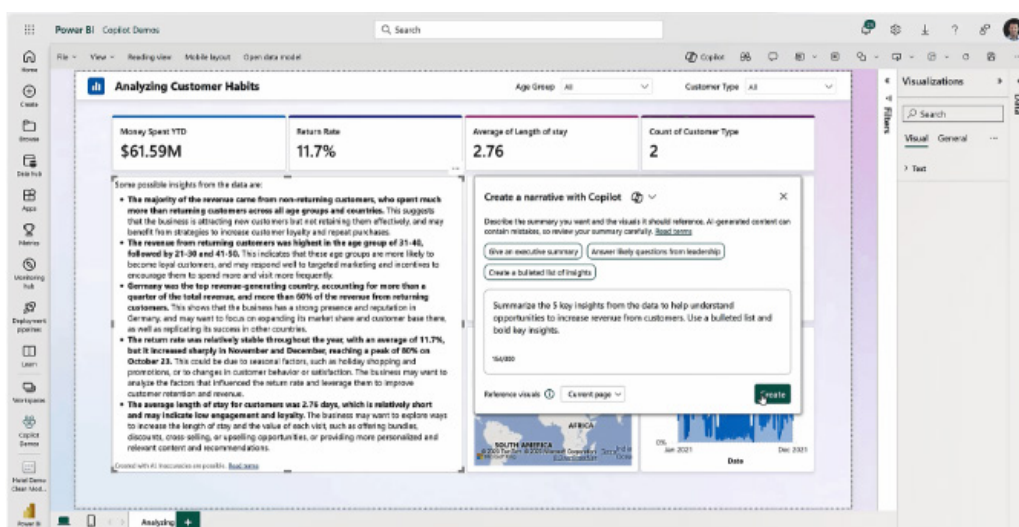
There is also the announcement of the public Preview of Copilot in Microsoft Fabric, including the experience for Power BI, which helps users quickly get started by helping them create reports in the Power BI web experience. Based upon a high-level prompt, Copilot for Power BI in Fabric creates an entire report page for you by identifying the tables,

fields, measures and charts that would help you get started. You can then customise the page using. Copilot can also help you understand your semantic model and even suggest topics for your report pages. It's a fast and easy way to get started with a report, especially if you're less familiar with report creation in Power BI.



In addition to report creation, Copilot's ability to summarise data has been brought to the 'Smart Narrative' visual, now rebranded as the 'Narrative with Copilot' visual. This visual summarises the data and

insights on the page, across your report or even for your own template if you need to define a specific summary. This visual is available in the Power BI service and in Power BI Desktop.



Lastly, in Power BI Desktop, Copilot can help model authors improve their models and save time. The first capability is being released now, and helps authors generate synonyms for their fields, measures and tables using Copilot. But this is just the start. Future Power BI Desktop updates will bring even more new Copilot experiences, including the report creation experience from the Service, a Data Analysis Expressions (DAX) writing experience, and more.

The Preview of Copilot in Microsoft Fabric will be rolling out in stages with the goal that all customers with Power BI Premium capacity (P1 or higher) or Fabric capacity (F64 or higher) will have access to the Copilot preview by the end of March 2024. You don't need to sign up to join the Preview, it will automatically become available to you as a new setting in the Fabric administrator (admin) portal when it is rolled out to your tenant. When charging begins for the Copilot in Fabric experiences, you can simply count Copilot usage against your existing Fabric or Power BI Premium capacity.

### **Power BI semantic model support for Direct Lake on Synapse Data Warehouse**

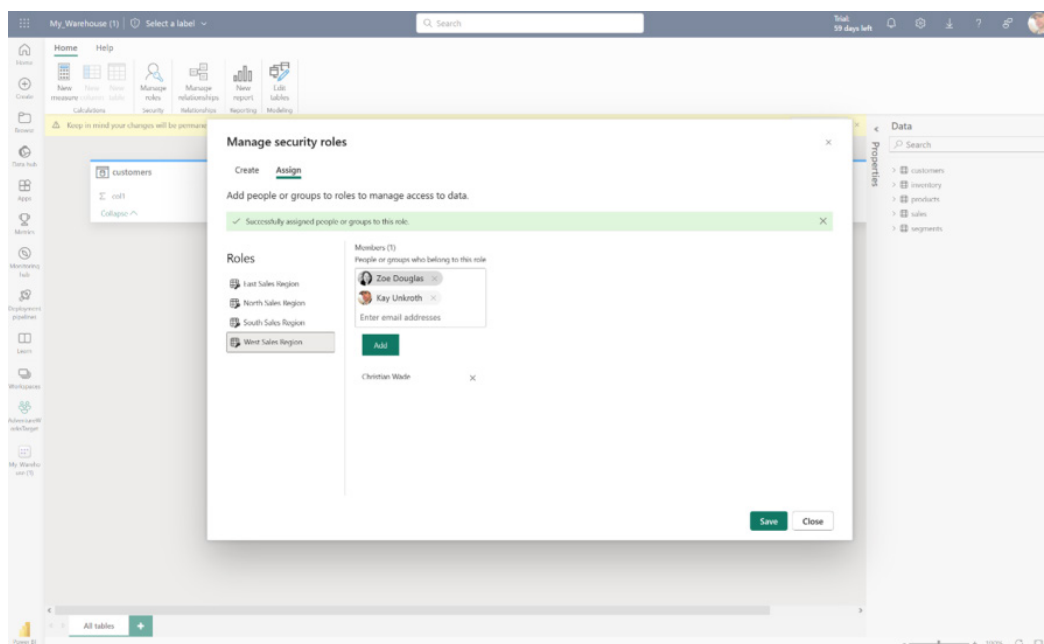
The Power BI semantic models can now leverage Direct Lake mode in conjunction with Synapse Data Warehouses in Microsoft Fabric. Until now, Direct Lake mode was limited to semantic models on Fabric lakehouses, whilst warehouses were queried only in DirectQuery mode. Now, Microsoft has expanded Direct Lake mode to support warehouses

in Fabric as well. Direct Lake mode is a groundbreaking data access technology for semantic models based on loading Delta-Parquet files directly from OneLake without having to import or duplicate the data. Direct Lake combines the advantages of import and DirectQuery modes to deliver quick query performance without any data movement.

### **Announcing public Preview of stored credentials for Direct Lake semantic model Row Level Security (RLS) and Object Level Security (OLS)**

This latest set of updates also sees the public Preview of Row Level Security (RLS) and Object Level Security (OLS) and stored credentials for Direct Lake semantic models. RLS and OLS is a Power BI feature that enables you to define row-level and object-level access rules in a semantic model, so different users can see different subsets of the data based on their roles and permissions.

Stored credentials help reduce configuration complexity and are strongly recommended when using RLS and OLS with Direct Lake semantic models. The following screenshot shows how you can add users to RLS roles in a Direct Lake model using the web modelling experience.



The web modelling security roles dialog will be fully deployed in the coming days or weeks.

### **Instantly integrate your import-mode semantic models into OneLake**

There is also the public Preview of Microsoft OneLake integration for import models. With the flick of a switch, you can enable OneLake integration and automatically write data imported into your semantic models to delta tables in OneLake and enjoy the benefits of Fabric without any migration effort. The data is instantly and concurrently accessible

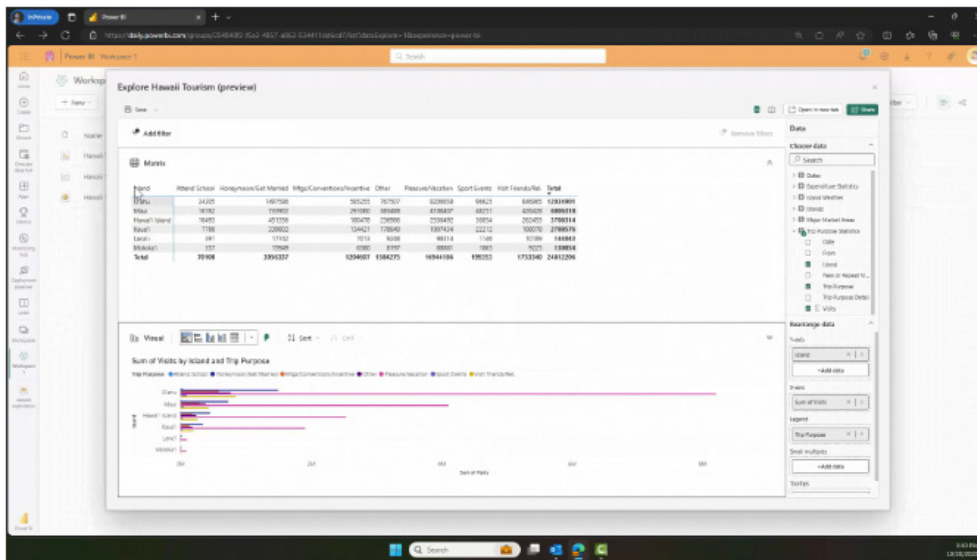
through these delta tables. Data scientists, database administrators, app developers, data engineers, citizen developers and any other type of data consumer now have direct access to the same data that drives your business intelligence.

### **Quickly answer your data questions with Explore**

Another public Preview feature called Explore has been announced that will enable anyone to quickly explore a semantic model. Similar to exporting and building a PivotTable in Excel, you can open the Explore experience and create a matrix or visual view for your data. Analysts

could use Explore to learn about a new semantic model before building a report for example or a business user could answer a specific question they have about the data without building an entire report.



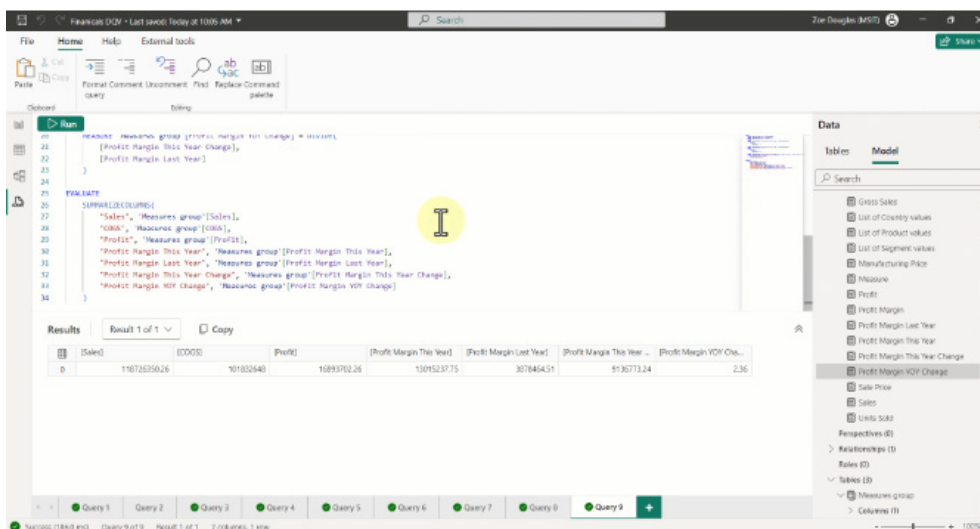


### Announcing the public Preview of Data Analysis Expressions Query view

DAX queries help you quickly explore and analyse your semantic model. The new DAX query view in Power BI Desktop lets you utilise the powerful DAX query language to discover, analyse and see the data in your semantic model. Like the Explore feature (above), model authors can quickly validate data and measures in their semantic model without having to build a visual or use an additional tool. Changes made to measures can be seamlessly updated directly back to the semantic model. This capability along with several existing features like auto formatting, integration with the Report View's Performance Analyzer,

quick measures and measure-reference expansion all mean DAX query authoring in Power BI have just become much more productive for data professionals and advanced data analysts.

Microsoft has stated that they plan to continue adding functionality to the 'DAX Query view', including Copilot integration, support for live connect reports and adding it to the Power BI Service. You may get started by turning on this public Preview feature in **Power BI Desktop Options -> Preview features**.



### Announcing the General Availability of semantic model scale-out, now with Direct Lake compatibility

The semantic model scale-out is now Generally Available. With scale-out, Power BI automatically scales out read-only replicas to ensure there are no performance slowdowns when many users are using the system at the same time, enabling large-scale production solutions to support high user concurrency. Automatic scale-out now works for Direct Lake semantic models too. Additionally, import-mode semantic models will benefit from refresh isolation, ensuring business users are unaffected by resource-intensive refresh operation, and continue to enjoy quick queries for interactive analysis.

Semantic-model scale-out is the last of the key features to make Microsoft Fabric and Power BI a superset of Microsoft Azure Analysis Services. Scale-out in Fabric is even superior to Analysis Services since scale-out takes place based on live user demand and adjusts automatically to changes in usage patterns. Analysis Services on the other hand requires detailed analysis to determine peak usage times, create automation scripts and monitor to ensure optimum set up. Additionally, cost in Analysis Services increases linearly per replica, unlike Fabric's usage-based billing model.

## New Microsoft Fabric licensing options

In June 2023, Microsoft announced pay-as-you-go prices for Fabric that allow you to dynamically scale up or scale down and pause capacity as needed. There is now “reservation pricing” for Fabric that will allow you to pre-commit Fabric Capacity Units in one-year increments, helping you save up to 40% over the pay-as-you-go prices (excluding Power BI Premium capacity SKUs). Microsoft has also announced OneLake business continuity and disaster recovery (BCDR) and cache storage

prices, expanding on their already announced OneLake storage pricing. You may check out all these pricing options on the [Microsoft Fabric pricing page](#).

With these announcements, current Power BI Premium per capacity customers have an additional pricing option to experience everything Fabric has to offer.

## Getting started with Power BI and Microsoft Fabric

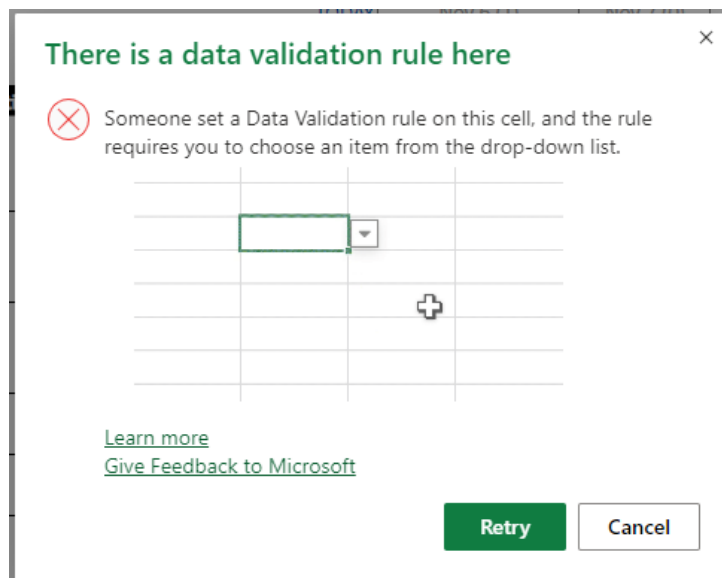
If you are an existing Power BI Premium per capacity customer, you can already access Microsoft Fabric by simply turning on Fabric in your admin portal.

If you don't already have Power BI Premium capacity, you can try out everything Fabric has to offer by signing up for the free trial — no credit

card information is required. To start your free trial, sign up for a free account (Power BI customers can use their existing account), and once signed in, select Start Trial within the account manager tool in the Fabric app. Each trial user will receive a 64 CU trial capacity — your billing unit — to use against any workload during your 60-day free trial.

## Celebrating Data Validation Lists

We have seen feedback for Excel for the web that when typing invalid data an animated dialog appears. Cool!

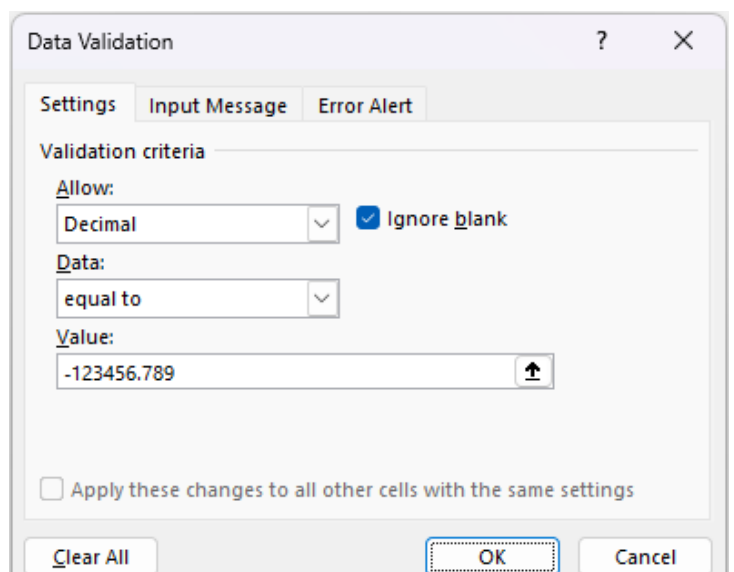


These dialogs are definitely getting fancier. But more than that, it got us thinking. It triggered an old memory.

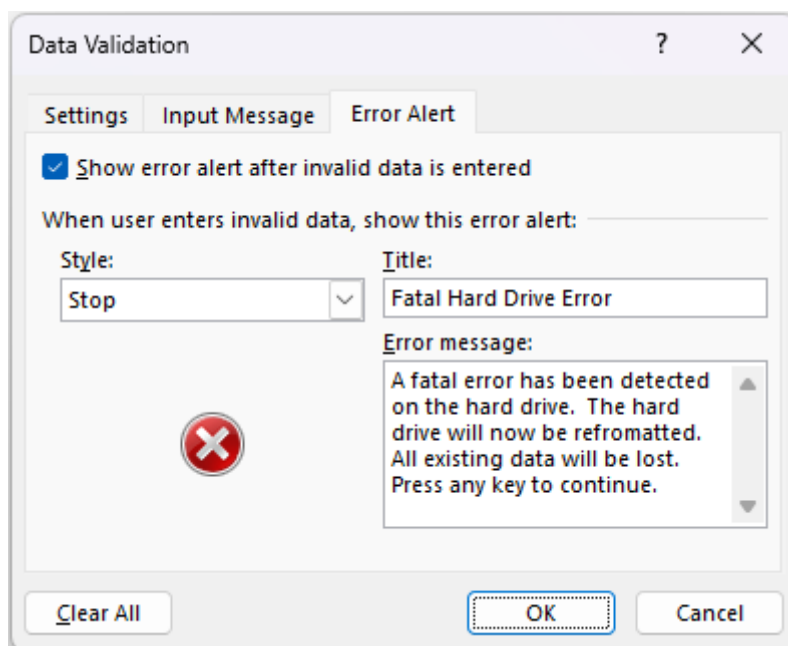
We have some twisted individuals reading these newsletters! By far and away the most popular 'trick' (in all sense of the word!) was this monster first divulged way back in our very first newsletter.

Data Validation is a useful way to control what end users can type into a worksheet cell (see [www.sumproduct.com/thought/data-validation](http://www.sumproduct.com/thought/data-validation)). You can use this functionality to play a trick. Please use this at your own risk: if you get fired, you will get no sympathy here.

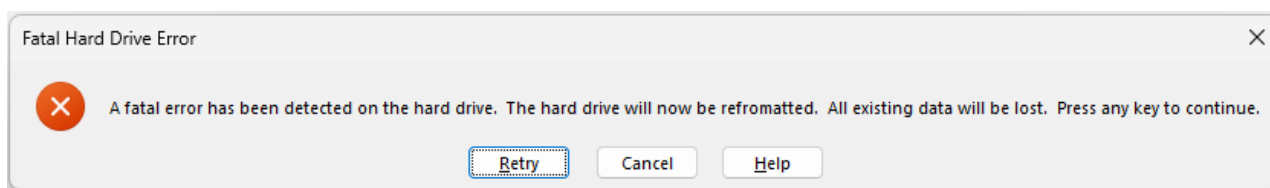
If someone is unfortunate to leave a spreadsheet unprotected, simply highlight the whole worksheet and then activate Data Validation (**ALT + D + L**). In the 'Settings' tab, select settings similar to the following (the aim is to pick a number the user won't use):



Then, select the 'Error Alert' tab:



Now, de-select the range and wait for your victim to use the worksheet. As soon as they type an invalid entry, they will be greeted with the following error alert:



Who says spreadsheets can't be fun..?

## Beat the Boredom Challenge

*With many of us currently "working from home" / quarantined, there are only so Zoom / Teams calls and virtual parties you can make before you reach your (data) limit. Perhaps they should measure data allowance in blood pressure millimetres of mercury (mmHg). To try and keep our*

*readers engaged, we will continue to reproduce some of our popular **Final Friday Fix** challenges from yesteryear in this and upcoming newsletters. One suggested solution may be found later in this newsletter. Here's this month's...*

How do you create a series of dropdown boxes so that they feed off each other? For example, given data validation with a car make (manufacturer, in layman's terms), how can that populate the next data validation to list the models associated with only that make, then the variants associated with that model and year of manufacture, and so on?

each list you want to use. For example, we have three Toyota vehicles in our list, so you would set up a named range called "Toyota", so when you enter in that value in the "make" cell, the data validation will point to =INDIRECT("Toyota"), which gives you the list of three models that we have in our data set.

Now, this is not a difficult question – Google will generally provide an answer involving the **INDIRECT** function and creating a named range for

However, this results in two primary problems:

- doing this will result in a LOT of named ranges. Taking this approach will create one named range for each possible make, plus one named range for each model within each make, and another named range for each possible year within that model – this leading on to the second issue...
- if you have repeated items such as the year of manufacture, there is no way to distinguish between a 2018 Corolla and a 2018 Fiesta. Therefore, you will need to have a combination of named ranges such as 2018Corolla, 2017Corolla, 2016Corolla, so you can pick out the relevant variants specific to each year. For the record, in Australia, there were 19 different variants of the Ford Focus manufactured in 2017. Yuck (that's a comment on the number of combinations, not the car models, but having said that...).

This all seems a bit messy. So here is our challenge for this month: can you come up with a way of creating a cascading set of data validated cells that refer back to the value selected in the previous cell, without creating a mess of named ranges in the process?

Make	Ford
Model	Focus
Year	2018
Variant	Trend Manual
	Trend Auto
	Trend Manual
	Trend 5 Yr Auto
	Trend 5 Yr Manual
	Titanium Sedan Auto
	Titanium 5 Yr Sedan Auto
	Trend Sedan Auto
	Trend 5 Yr Sedan Auto

We've compiled a [list of cars](#) for a list of cars for you to use as a dataset if you wish – two different makes (Toyota and Ford), with five different models across the makes (Yaris, Corolla, Camry, Fiesta and Focus), across three different years, and no less than 161 unique variants across the combination of years and models. We wish to stress that this is

an incredibly small dataset when compared to the actual number of different manufacturers and models and variants available in the world, so it should be clear that having a solution that is scalable is going to be critical. If we doubled the number of makes, models and years, we don't want a solution that will require us to do a heap of work to upgrade.

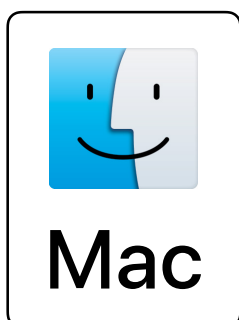
Make	Model	Year	Variant
Toyota	Yaris	2018	Ascent Auto
Toyota	Yaris	2018	Ascent Manual
Toyota	Yaris	2018	SX Auto
Toyota	Yaris	2018	SX Manual
Toyota	Yaris	2018	ZR Auto
Toyota	Yaris	2017	Ascent Auto
Toyota	Yaris	2017	Ascent Manual
Toyota	Yaris	2017	SX Auto
Toyota	Yaris	2017	SX Manual
Toyota	Yaris	2017	ZR Auto
Toyota	Yaris	2017	YRS Auto
Toyota	Yaris	2017	YRS Manual
Toyota	Yaris	2017	YRX Auto

Sounds easy? Try it. One solution *just might* be found later in this newsletter – but no reading ahead!

## Excel for Mac

With Steve Kraynak joining the team, we thought we would exploit his knowledge and recant all about Microsoft Excel for Mac. Each month, we'll cover a different topic to help you understand how Excel for Mac is different

than Excel for Windows. This month, we'll touch on some fundamentals to help you get going and be productive using Excel for Mac.

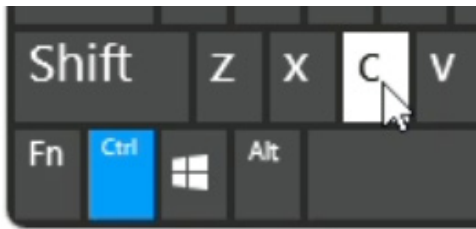


The Mac operating system is intuitive and easy to use, but if you're familiar with Windows, and switching to Mac, or just starting to use Excel on the Mac, then there are some important things to know so you can make the most of it.

### Keyboard Shortcuts

First things first, let's talk about keyboard shortcuts. The good news is that most of the keyboard shortcuts work similarly on Mac as they do on Windows. Also, since Mac has both a **CTRL** key and a **COMMAND (CMD)** key, in most cases, Excel can use either one as the modifier key for the action you need.

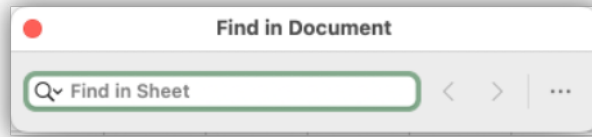
For example, to copy, you can press either **CTRL + C** or **CMD + C**. They both work the same!



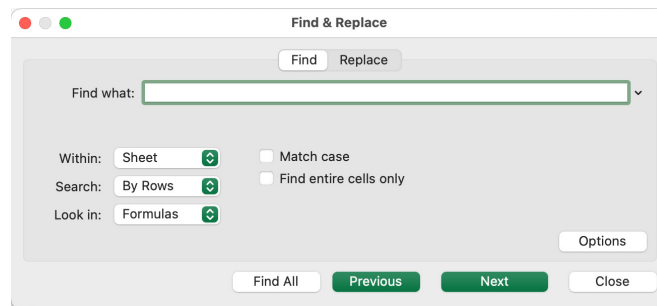
There are a few key combinations that are different and there are good reasons for that. The Mac has some of its own keyboard shortcuts that work in all applications, and Excel doesn't override those.

Here are some instances where **CTRL** and **CMD** don't work the same:

1. **CMD + F** opens the 'Find in Document' dialog:

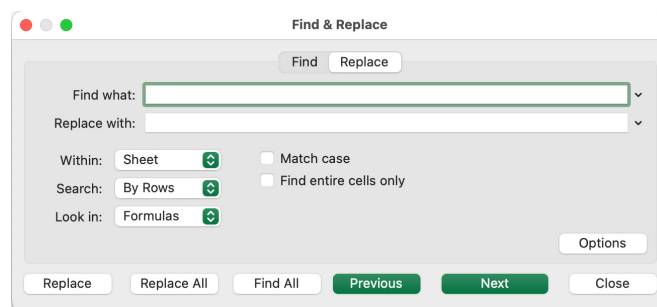


2. **CTRL + F** opens Excel's 'Find & Replace' dialog ('Find' tab):



3. **CMD + H** will hide the current window. This works in all apps on Mac

4. **CTRL + H** opens Excel's Find & Replace dialog ('Replace' tab):



5. **CMD + U** applies underline formatting

6. **CTRL + U** edits the active cell and position the insertion point at the end of the line

7. **CTRL + SPACE** – this conflicts with a default keyboard shortcut on Mac which switches the keyboard input. To allow this shortcut to select the entire column in Excel, go to your **Mac preferences -> Keyboard -> Keyboard Shortcuts -> Input Sources** and disable it there

8. **CMD + SPACE** opens the Spotlight search on Mac.

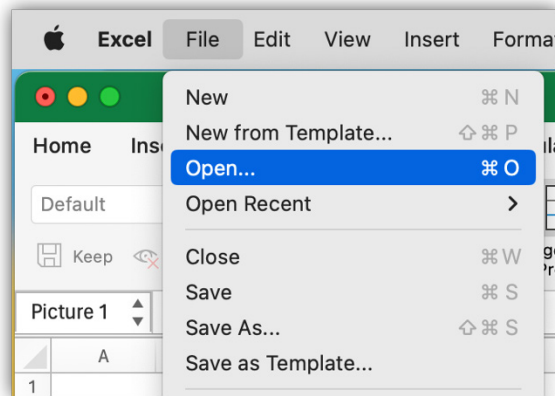
### Switching Between Workbooks or Applications (Apps)

Many people get frustrated or confused when they switch from Windows to Mac, because they're accustomed to switching between open documents / apps by pressing **ALT + TAB**. On Mac, there are two [2] shortcuts to know so you can easily switch between windows:

1. **CMD + `** (the button above **TAB**) which switches between open documents in an app
2. **CMD + TAB** which switches between applications.

## Mac Still Has a Menu!

Unlike Windows, there is still a menu on Mac, so you can use your mouse or press **CTRL + F2** and use arrow keys to open the menus. Then, you may get to many actions and features if you prefer that to the Ribbon or keyboard shortcuts.



## What's Missing

Unfortunately, the **ALT** key tips are not available in Excel for Mac, but you can voice your support for this feature in Microsoft's community. Please go vote for it at [ALT key Ribbon access](#).

## More Information

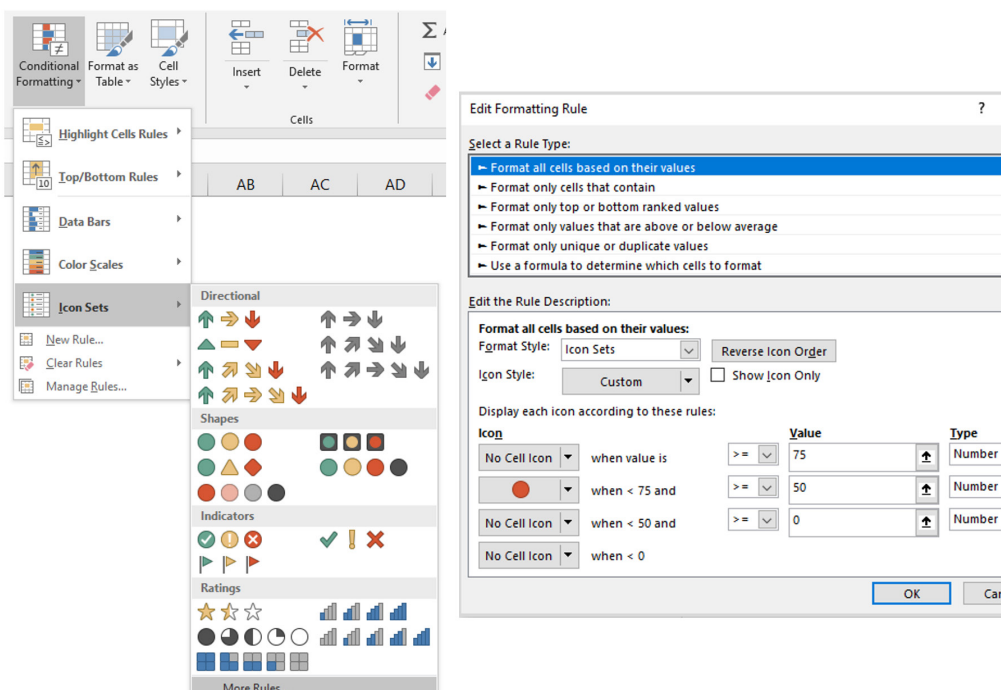
If you have any trouble or need more detailed information, Microsoft's full list of keyboard shortcuts may have the answer. See this article: [Keyboard shortcuts in Excel](#).

We'll continue next month...

# Charts and Dashboards

*It's time to chart our progress with an introductory series into the world of creating charts and dashboards in Excel. This month, we consider the pre-work for Symbol Charts in dashboards.*

Adding symbols into tables or charts can be a great visual aid to the numbers and a helpful way to quickly communicate where end user focus is needed. Symbols can be added to data using Conditional Formatting. On the Home tab, click 'Conditional Formatting', then choose which type of symbol you would like to use and set your customised rules, if you wish to, in 'More Rules'.



For example, we have a data set of internal supplier ratings. We want to focus on whether to exclude suppliers with an under-75 average score. Therefore, we put a red dot next to any cell matching this condition. If we add a sparkline here, there will be an additional clue when we evaluate

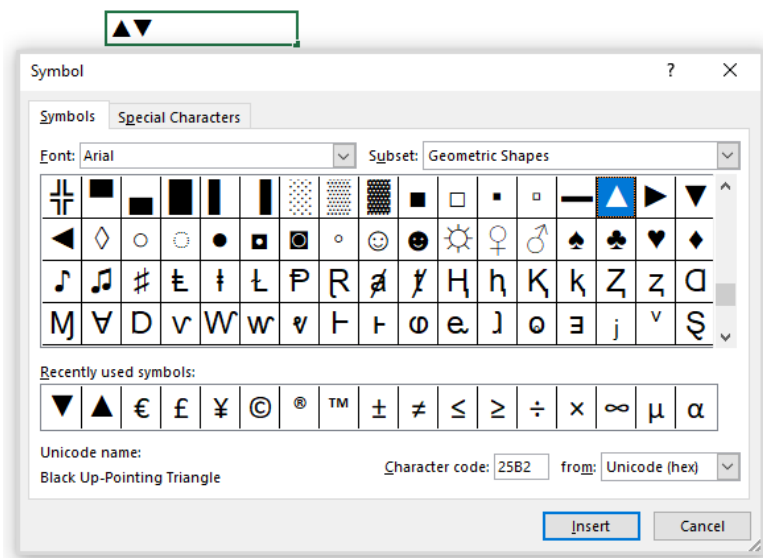
the criteria. For instance, Supplier 10 has an average score under 75. However, the sparkline shows that the rating exhibits an upward trend, which should be taken into consideration before exclusion.

Supplier code	Period 1	Period 2	Period 3	Period 4	Period 5	Period 6	Sparkline	Average
1	74	73	65	88	56	99		75.83
2	89	58	94	66	53	94		75.67
3	77	69	54	93	58	71		70.33
4	70	62	99	74	66	75		74.33
5	95	84	92	66	65	83		80.83
6	60	70	96	50	67	84		71.17
7	91	66	56	78	84	54		71.50
8	58	87	84	89	94	92		84.00
9	100	73	59	83	84	71		78.33
10	53	78	77	77	61	87		72.17

Frequently, we need to include an icon indicator. As an illustration, imagine we have sales data as below and we need to produce a chart which can show the 2018 data with simple icons depicting the changes over the year:

Year	2018	2019	vs 2018 (%)
<b>BizSupplies</b>	\$ 76,813	\$ 77,034	0.29%
<b>Dynamic Attire</b>	\$ 65,608	\$ 65,449	-0.24%
<b>Harmonic Sonics</b>	\$ 68,089	\$ 69,948	2.73%
<b>Plumb'n'Stuff</b>	\$ 76,792	\$ 77,321	0.69%

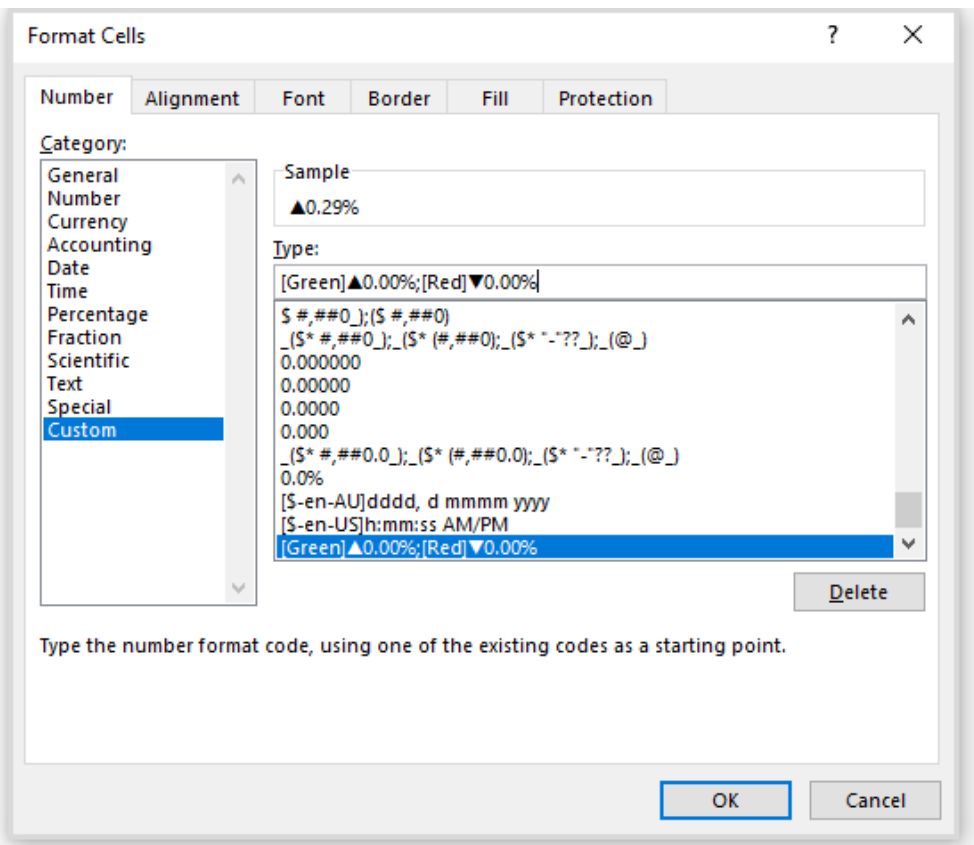
To do this, first, we have to format the cells to indicate the increase / decrease (demonstrated by the **vs 2018 (%)** column). In a blank cell, we may need to insert the up / down arrow symbol by going to the Insert tab and clicking 'Symbol'. For quick navigation, in the Font box, you may also choose Arial.



Then, we can use these symbols in the cell formatting. Select the cells we need to format (**vs 2018 (%)** column), and in the 'Format Cells' dialog, and choose Custom (the last item on the list), where we type:

[Green]▲0.00%;[Red]▼0.00%

In English, this means a positive number will be green and a negative number will be red (both formatted as percentages to two decimal places), together with the associated icons.



After cell formatting, the data table will now display as follows:

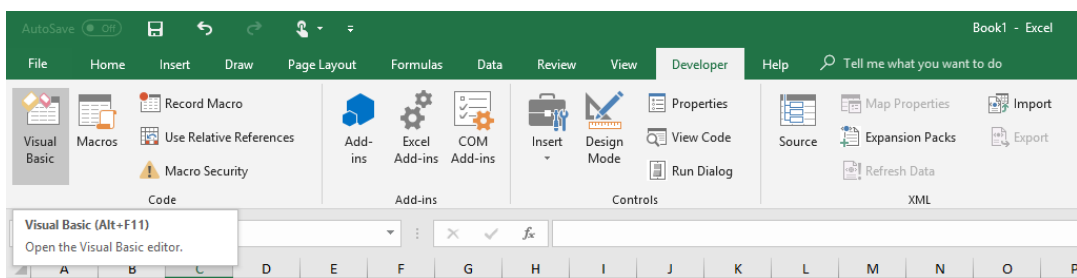
Year	2018	2019	vs 2018 (%)
<b>BizSupplies</b>	\$ 76,813	\$ 77,034	▲0.29%
<b>Dynamic Attire</b>	\$ 65,608	\$ 65,449	▼0.24%
<b>Harmonic Sonics</b>	\$ 68,089	\$ 69,948	▲2.73%
<b>Plumb'n'Stuff</b>	\$ 76,792	\$ 77,321	▲0.69%

It's better to create a chart that illustrates this data with the assigned symbol, but that's for next month...

## Visual Basics

We thought we'd run an elementary series going through the rudiments of Visual Basic for Applications (VBA) as a springboard for newer users. This month we look at the VBA Editor.

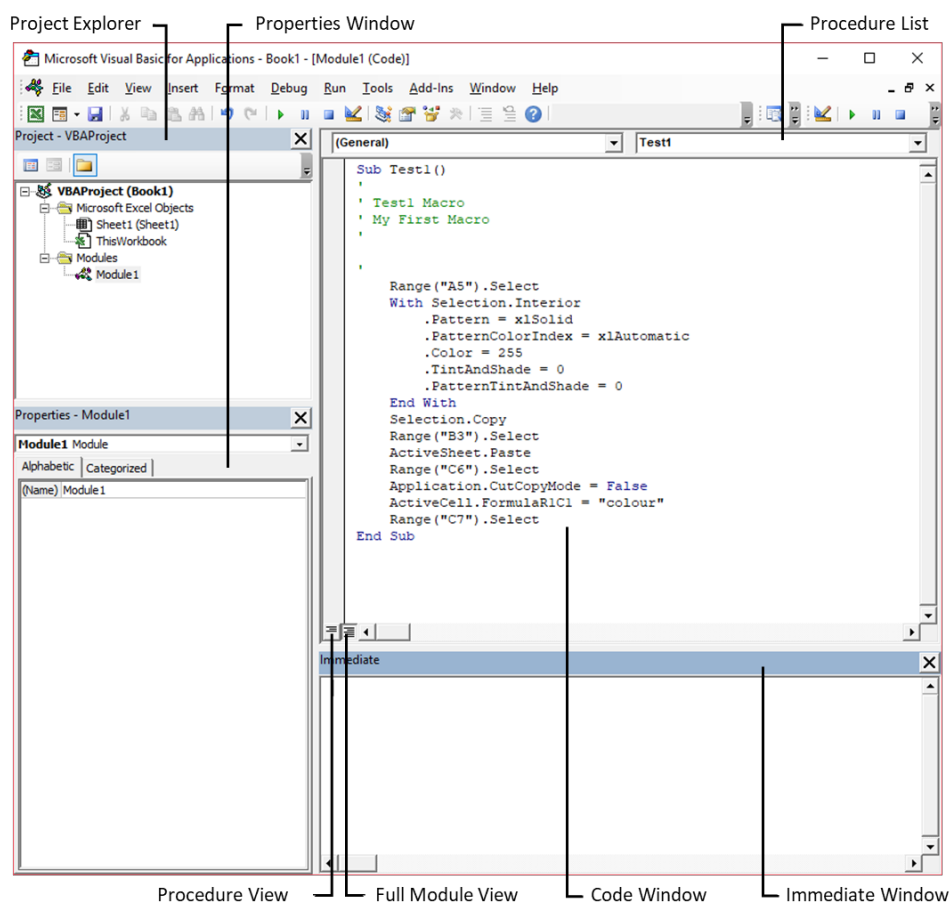
Using the 'View Macros' option is one way to get to the VBA Editor. However, it is also accessible from Excel via the 'Developer' tab in the Ribbon. Under the 'Code' category on the 'Developer' tab, clicking on the 'Visual Basic' button will take us directly into the VBA Editor:





Alternatively, **ALT + F11** is the keyboard shortcut to enter the Microsoft Visual Basic for Applications editor (known as the “VBA Editor”).

Let’s review the Visual Basic Editor and familiarise ourselves with the different components:



Many of these terms are self-explanatory but let me go through some of them:

- the **Code Window** is where procedures appear, *i.e.* macros that have been recorded and stored are also displayed here. The code window is also where we can write code for our macros
- the **Procedure List** is visible at the top-right of the Code Window. From this list, navigation to any procedure in the active module is quick and easy. Also notice the view options at the bottom of the screen. When we have several macros in a module, it can be helpful to view them one at a time
- **Full Module View** allows us to switch between viewing the ‘Full Module view’ and single procedure view with just a click of a button
- the **Immediate Window** is used to debug and evaluate expressions, execute statements, print variable values *etc.* It allows us to enter expressions to be evaluated or executed by the development language during debugging
- **Project Explorer** is where we see the list of all VBA projects that are currently open or loaded. All open documents, as well as open or loaded document templates, appear here, regardless of whether they contain macros or not. They can be easily collapsed or expanded to view the modules and objects that it contains
- for modules, the **Properties Window** is generally used only to edit the module name. Module naming rules are the same as macro naming rules – no spaces or special characters and the name must begin with a letter. However, for some object types (such as UserForms), the Properties Window becomes extremely important because it's populated with many settings that we can edit directly in that window, like the height and width of a UserForm or the value to display on a form control.

Continued next month.

## Power Pivot Principles

We continue our series on the Excel COM add-in, Power Pivot. This month, we review the **NOT** function.

Sometimes we must create custom columns that return with either TRUE or FALSE values. We may also have to create custom columns that have inverse values to another logical column. For example, if we create a custom column with TRUE or FALSE values, we would create another column with the inverse TRUE or FALSE value for each row.

To kick start this example, we are going to revisit the custom columns we created for the [Conditional Custom Columns Using IF, OR and '||'](#) article.

We will use the following Table:

	A	B	C	D	E
1					
2		Category 1	Category 2	Category 3	Customer Name
3		Y	Y	0	Harry
4		Y	N	1	Joe
5		N	Y	1	Kat
6		N	N	1	Nicole
7		Y	Y	2	Monia
8		N	Y	0	Jeff
9		N	Y	0	Petra
10		N	N	1	Lenny
11		Y	Y	2	Gavin
12					

After importing the Table into our data model we are going to create a simple custom column that returns with TRUE when Category 1 is 'Y' or Category 2 is 'N' (you can read more about using the '||' delimiter [here](#)):

**=IF([Category 1]="Y" || [Category 2]="N",TRUE,FALSE)**

[Included] X ✓ fx =IF([Category 1]="Y"    [Category 2]="N",TRUE,FALSE)					
	Category 1	Category 2	Category 3	Customer Name	Included
1	Y	Y	0	Harry	TRUE
2	Y	N	1	Joe	TRUE
3	N	Y	1	Kat	FALSE
4	N	N	1	Nicole	TRUE
5	Y	Y	2	Monia	TRUE
6	N	Y	0	Jeff	FALSE
7	N	Y	0	Petra	FALSE
8	N	N	1	Lenny	TRUE
9	Y	N	2	Gavin	TRUE

If we need to create a column with the inverse TRUE or FALSE values, we can use the IF function:

**=IF(Table1[Included]=TRUE,FALSE,TRUE)**

[Using IF] fx =IF(Table1[Included]=TRUE,FALSE,TRUE)						
	Category 1	Category 2	Category 3	Customer Name	Included	Using IF
1	Y	Y	0	Harry	TRUE	FALSE
2	Y	N	1	Joe	TRUE	FALSE
3	N	Y	1	Kat	FALSE	TRUE
4	N	N	1	Nicole	TRUE	FALSE
5	Y	Y	2	Monia	TRUE	FALSE
6	N	Y	0	Jeff	FALSE	TRUE
7	N	Y	0	Petra	FALSE	TRUE
8	N	N	1	Lenny	TRUE	FALSE
9	Y	N	2	Gavin	TRUE	FALSE

We can also use the **NOT** function.

The **NOT** function uses the following syntax:

**=NOT([Calculated Column])**

With that in mind, we can create the following calculated column:

**=NOT(Table1[Included])**

	[NOT]	fx =NOT(Table1[Included])					
	Category 1	Category 2	Category 3	Customer Name	Included	Using IF	NOT
1	Y	Y		0 Harry	TRUE	FALSE	FALSE
2	Y	N		1 Joe	TRUE	FALSE	FALSE
3	N	Y		1 Kat	FALSE	TRUE	TRUE
4	N	N		1 Nicole	TRUE	FALSE	FALSE
5	Y	Y		2 Monia	TRUE	FALSE	FALSE
6	N	Y		0 Jeff	FALSE	TRUE	TRUE
7	N	Y		0 Petra	FALSE	TRUE	TRUE
8	N	N		1 Lenny	TRUE	FALSE	FALSE
9	Y	N		2 Gavin	TRUE	FALSE	FALSE

Rather simple, yes?

One important point to note is that the **NOT** function requires the **[Calculated Column]** input to have TRUE or FALSE values. Text values will not be accepted by the **NOT** function, even if they literally say 'TRUE' or 'FALSE'.

	[Included]	fx =IF([Category 1]="Y"    [Category 2]="N","TRUE","FALSE")					
	Category 1	Category 2	Category 3	Customer Name	Included	Using IF	NOT
1	Y	Y		0 Harry	TRUE	#ERROR	#ERROR
2	Y	N		1 Joe	TRUE	#ERROR	#ERROR
3	N	Y		1 Kat	FALSE	#ERROR	#ERROR
4	N	N		1 Nicole	TRUE	#ERROR	#ERROR
5	Y	Y		2 Monia	TRUE	#ERROR	#ERROR
6	N	Y		0 Jeff	FALSE	#ERROR	#ERROR
7	N	Y		0 Petra	FALSE	#ERROR	#ERROR
8	N	N		1 Lenny	TRUE	#ERROR	#ERROR
9	Y	N		2 Gavin	TRUE	#ERROR	#ERROR

That's it for this month; more next time.

## Power Query Pointers

Each month we'll reproduce one of our articles on Power Query (Excel 2010 and 2013) / Get & Transform (Office 365, Excel 2016 and 2019) from [www.sumproduct.com/blog](http://www.sumproduct.com/blog). If you wish to read more in the meantime, simply check out our Blog section each Wednesday. This month, we take a final look at an example where we need to translate numbers to letters in multiple columns, this time using the **M** function **List.ReplaceMatchingItems()** and matching those items using values from another table.

(Yet again) we have the exam results for some children who were lucky(!) enough to take their exams when the system was in the middle of changing from letters to numbers. It's confusing, not least because nine [9] is the new top grade, whereas intuitively we might expect one [1] to be the highest. We want to replace the numbers with letters so that I can see everything in the same format. We've completed the

task in the last newsletter articles. In the first, we did this by using **List.ReplaceMatchingItems()**, and last time out, this was performed by merging our table of results with a table of numeric to letter equivalents. This time, we will be using a combined approach which is designed to be more robust.

Name	Biology	Chemistry	Computer Science	English Language	English Literature	French	History	Mathematics	Physics	Spanish	Number Grade	Equivalent
1 Abby	B	C	A	8	9 A	B		7 B	A			
2 Brian	C	C	A	7	6 B	B		6 C	C		10	A*
3 Claire	A	A*	B	5	6 A	A		7 B	B		9	A*
4 Dave	E	E	E	2	2 E	E		3 E	E		6	A/B
5 Ewan	B	C	B	7	8 A	C		8 C	C		7	A/B
6 Frank	C	E	B	6	5 C	B		7 C	C		6	B/C
7 Georgia	A*	A	A	9	8 B	A*		8 B	A*		5	B/C
8 Harry	B	C	A	7	6 B	C		7 B	A		4	C
9 Ian	C	C	D	6	6 A	B		6 C	B		3	D/E
10 Jack	A	B	B	6	7 C	A		6 A	A		2	E/F
11 Kylie	C	A	C	5	5 B	D		6 B	B		1	F/G
12 Liam	A*	A*	A*	10	10 A*	A*		10 A*	A*			
13 Marie	C	B	A	7	8 B	A		8 B	D			
14 Nick	B	C	D	6	8 C	A		5 E	B			
15 Olivia	A*	A*	A*	9	9 A*	A*		9 A*	A*			
16 Paula	E	D	C	4	5 A	B		3 B	B			
17 Quentin	C	D	C	5	4 B	D		2 C	B			
18 Rose	A	C	B	8	9 C	A		8 B	A			

Since the last blog, Liam has been awarded 10 in all the numeric grades (*but of course – shame it’s out of 100!*) This will have an impact on how we create the list of numeric grades, as we show later. *[That’s a shame – this appears to be Kathryn’s last article – Ed.]*

We’ll begin by creating a query ‘From Table’ in the ‘Get & Transform’ section of the ‘Data’ tab.

Name	Biology	Chemistry	Computer Science	English Language	English Literature	French	History	Mathematics	Physics	Spanish
1 Abby	B	C	A	8		9 A	B		7 B	A
2 Brian	C	C	A	7		6 B	B		6 C	C
3 Claire	A	A*	B	5		6 A	A		7 B	B
4 Dave	E	E	E	2		2 E	E		3 E	E
5 Ewan	B	C	B	7		8 A	C		8 C	C
6 Frank	C	E	B	6		5 C	B		7 C	C
7 Georgia	A*	A	A	9		8 B	A*		8 B	A*
8 Harry	B	C	A	7		6 B	C		7 B	A
9 Ian	C	C	D	6		6 A	B		6 C	B
10 Jack	A	B	B	6		7 C	A		6 A	A
11 Kylie	C	A	C	5		5 B	D		6 B	B
12 Liam	A*	A*	A*	10		10 A*	A*		10 A*	A*
13 Marie	C	B	A	7		8 B	A		8 B	D
14 Nick	B	C	D	6		8 C	A		5 E	B
15 Olivia	A*	A*	A*	9		9 A*	A*		9 A*	A*
16 Paula	E	D	C	4		5 A	B		3 B	B
17 Quentin	C	D	C	5		4 B	D		2 C	B
18 Rose	A	C	B	8		9 C	A		8 B	A

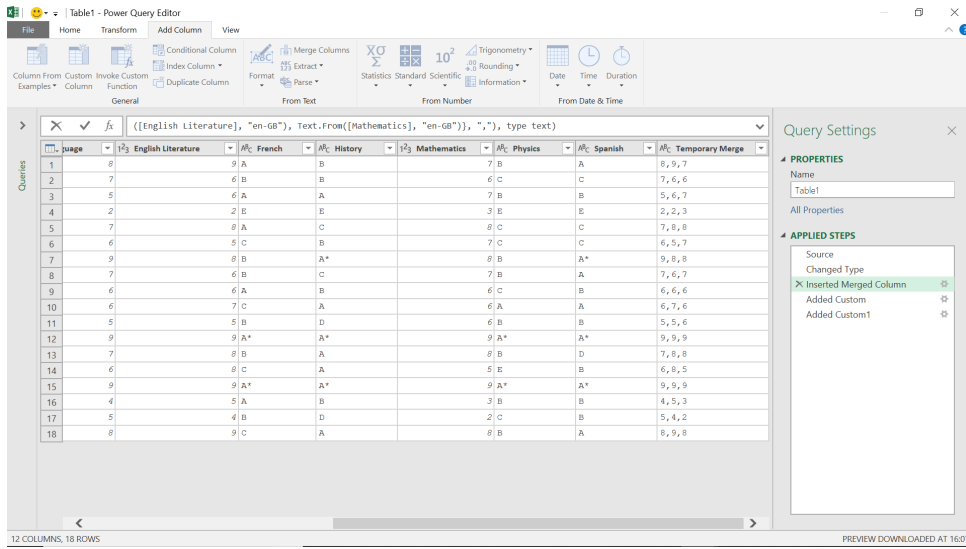
We want to translate all the values at the same time in all numeric columns, creating new columns. One way to do this is to use **List()** M functionality. Let’s begin by merging the columns we need to translate, namely **English Language**, **English Literature** and **Mathematics**. This

would work equally well if we were to merge all the columns and if we had less stable data, *i.e.* other subjects were soon to move to numeric grades, then this approach would be better. There are also ways to allow for a variable number of columns, but we will save this for another time.

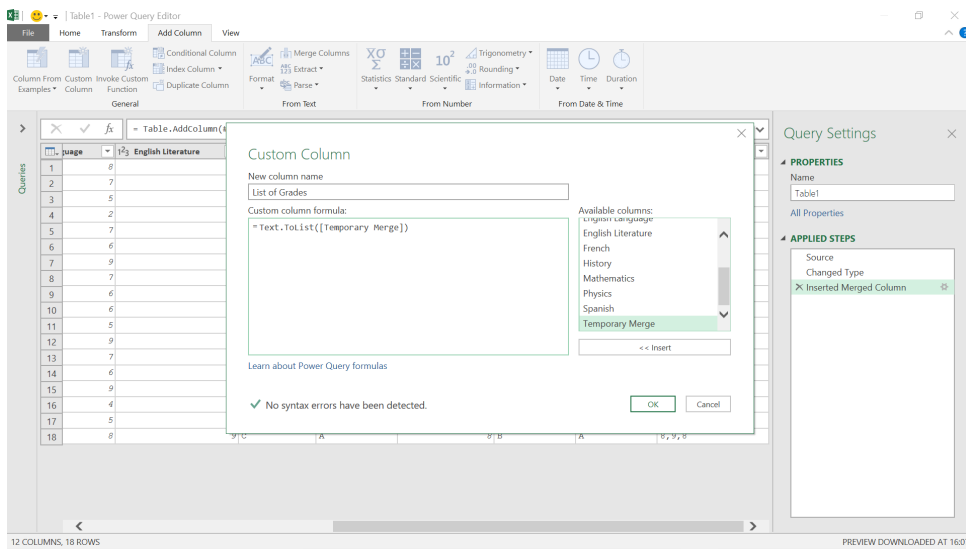
Merge Columns dialog box:

- Separator: Comma
- New column name (optional): Temporary Merge

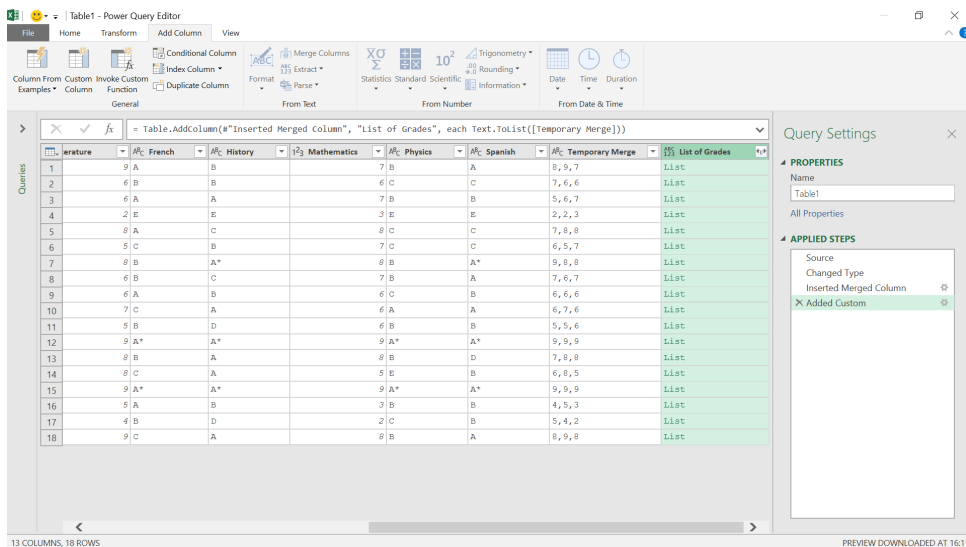
Let's decide to use a comma delimiter to help us convert our data back later.



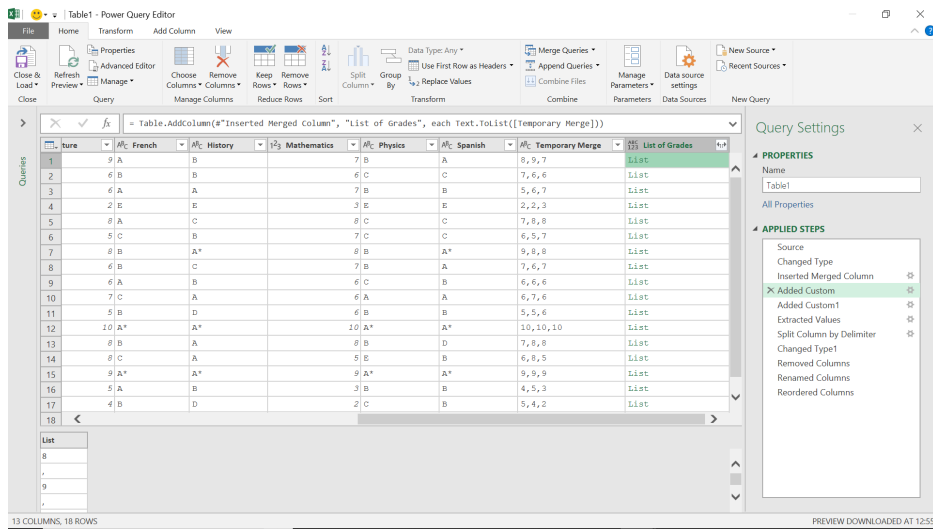
Now this is where we used **Text.ToList** to convert our column to lists previously. However, as we'll show below, there is a problem with this.



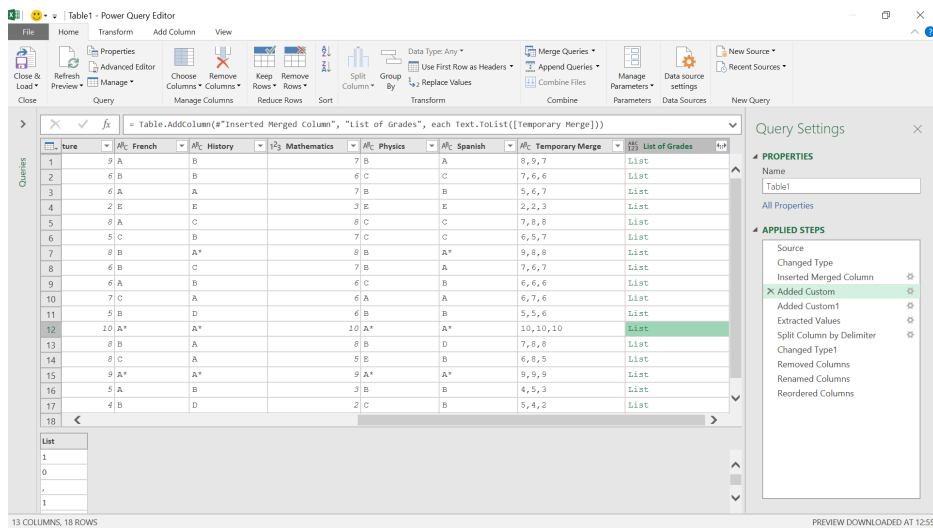
This gives us a column of lists that we may manipulate.



However, if we look at how the list is constructed,



we can see that each character has been given a separate list entry. If instead we look at Liam’s list of grades,

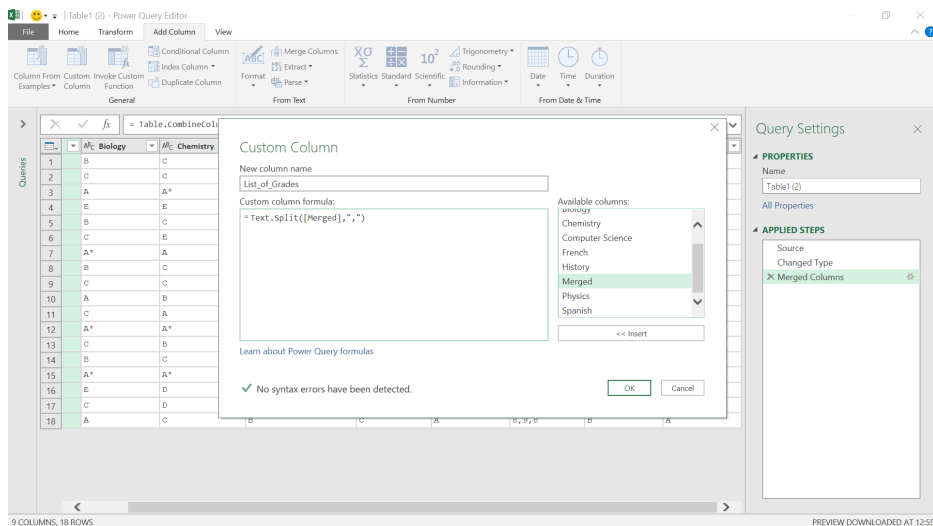


this shows that any translation would replace the one [1] not the 10, so that’s not what we want. There is another function that works better in these circumstances:

**Text.Split(string as text, separator as text) as list**

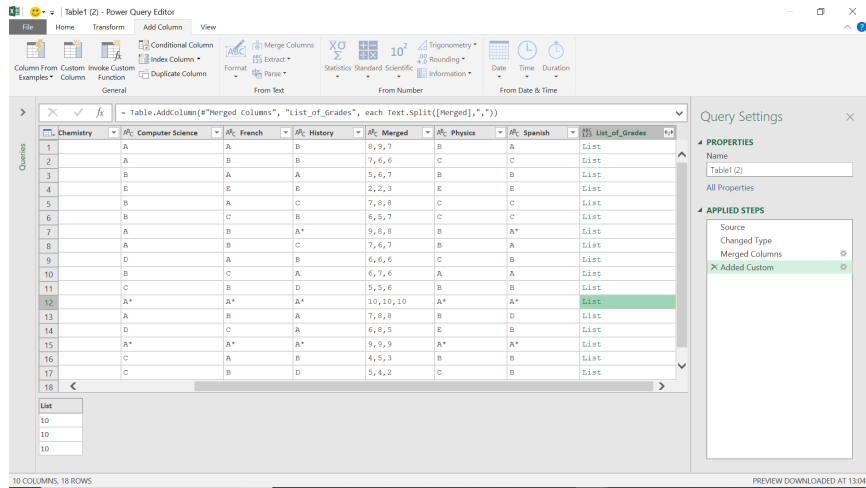
This returns a list containing parts of a string that are delimited by a separator text value.

Therefore, we add a new custom column:

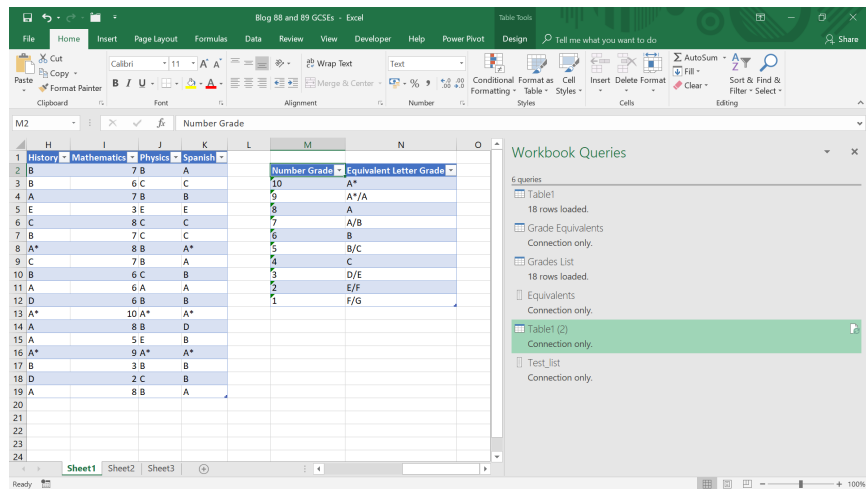


The M formula used is:

**= Text.Split([Merged],",")**



We have a list of each of the grades this time, so we are ready to move to the next step. Instead of specifying what to replace in a manual list, we're going to convert our grade equivalents table into a list that we may use.

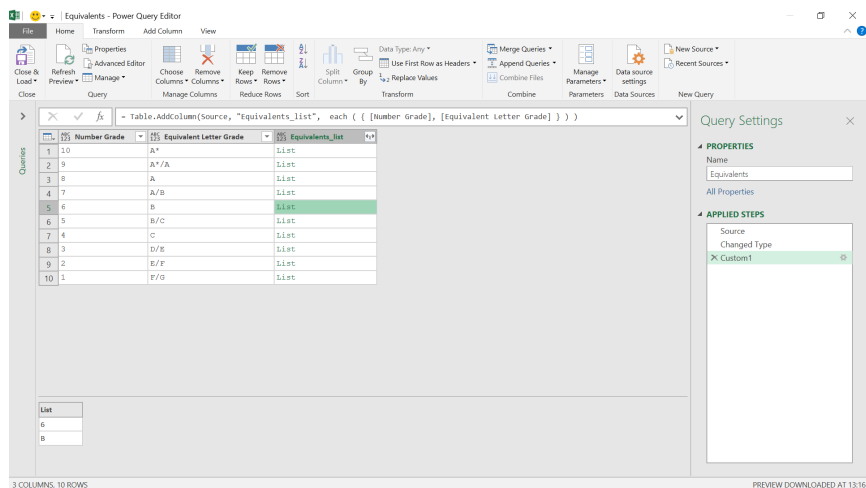


We found when we were carrying out this task it was easiest if we made sure that the columns in our Excel table were set to 'Text'. Having created a query from the grade equivalents table, we need to create a column that stores each pair of rows as a list. To do this, we use the **Table.AddColumn()** function:

**Table.AddColumn(table as table, newColumnName as text, columnGenerator as function, optional columnType as nullable type) as table**

This adds a column named **newColumnName** to a **table**.

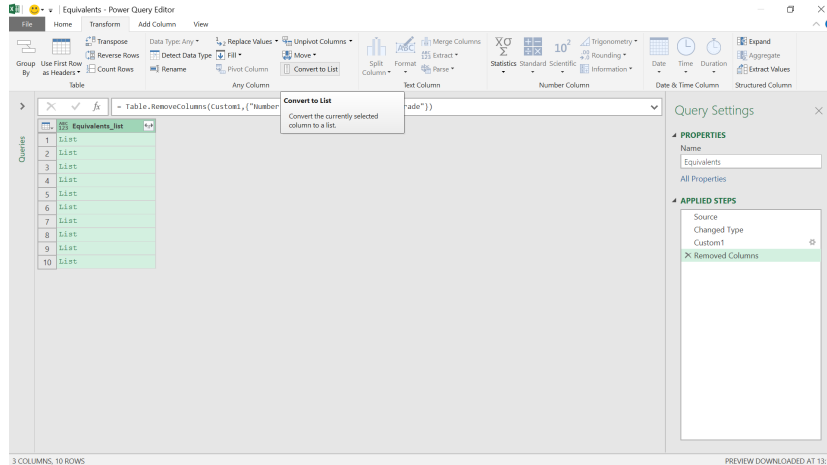
If we add the new column by defining a list, then we may create a column of lists:



The formula we have used is

**= Table.AddColumn(Source, "Equivalents\_list", each ( { [Number Grade], [Equivalent Letter Grade] } ))**

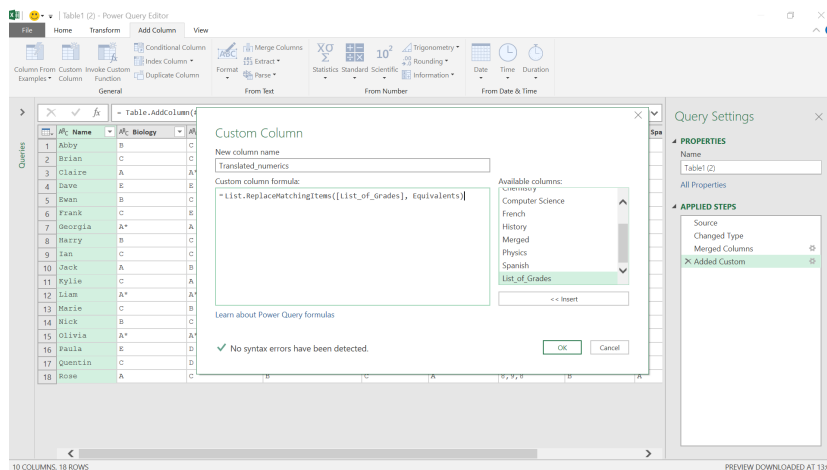
This creates a list of pairs of number grades and their equivalent letter grade. We delete the other columns to only leave **Equivalents\_list**:



We convert the remaining column to a list so that we now have a list of lists called 'Equivalents'. We save this as 'Connection Only'. We can now go back to our first query and use a **List()** function to transform our data. The one we are going to use is

**List.ReplaceMatchingItems(list as list, replacements as any, optional equationCriteria as any) as list**

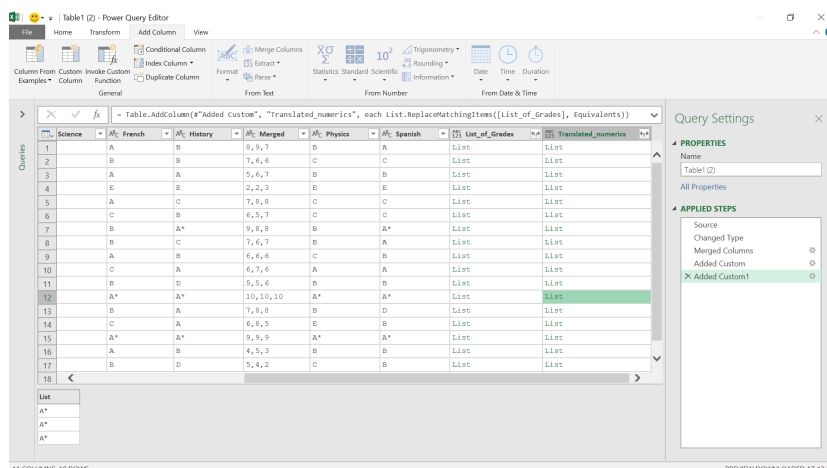
This replaces occurrences of existing values in the **list** with new values using the provided **equationCriteria**. Old and new values are provided by the **replacements** parameters.



The **M** functionality we have used is

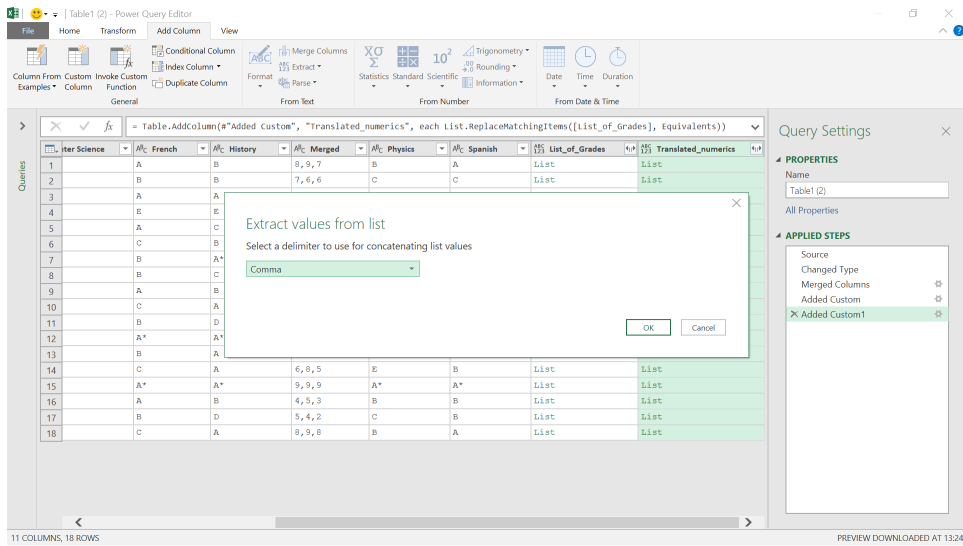
**= List.ReplaceMatchingItems([List\_of\_Grades], Equivalents)**

This replaces any entries in my merged column that are in the first item in the list in 'Equivalents' with the second item in the list. Therefore, any numerical grades should be translated to the corresponding letter grade.

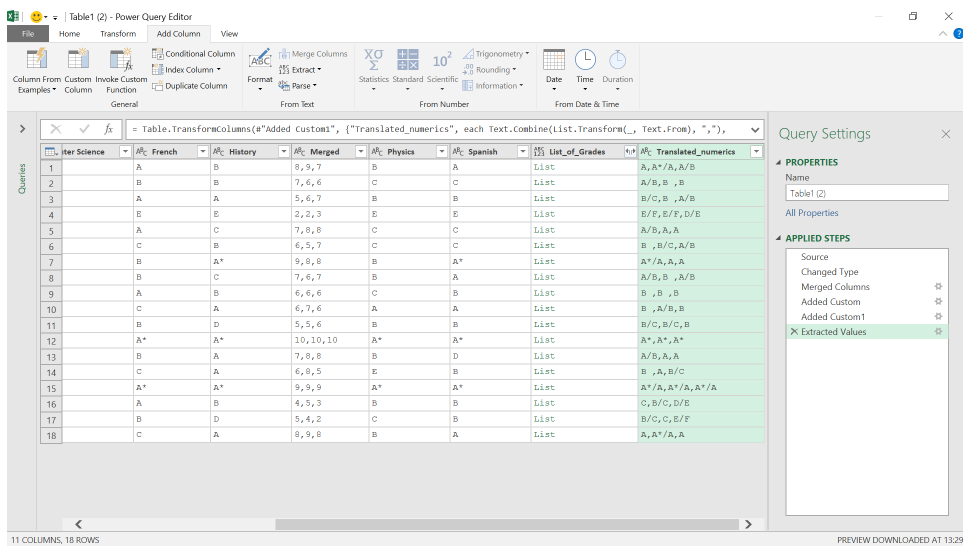




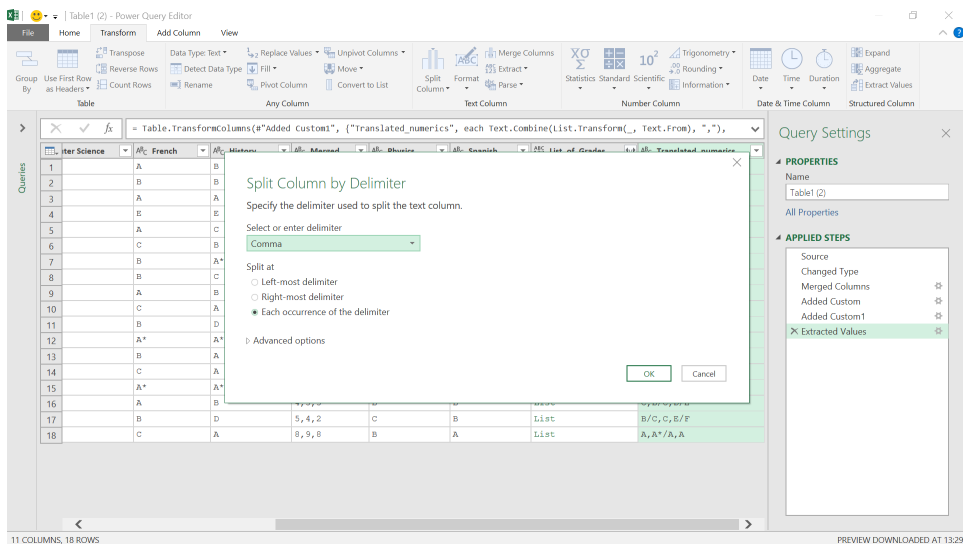
Judging by the new list of Liam's grades, it's looking promising! Now we will extract the list:



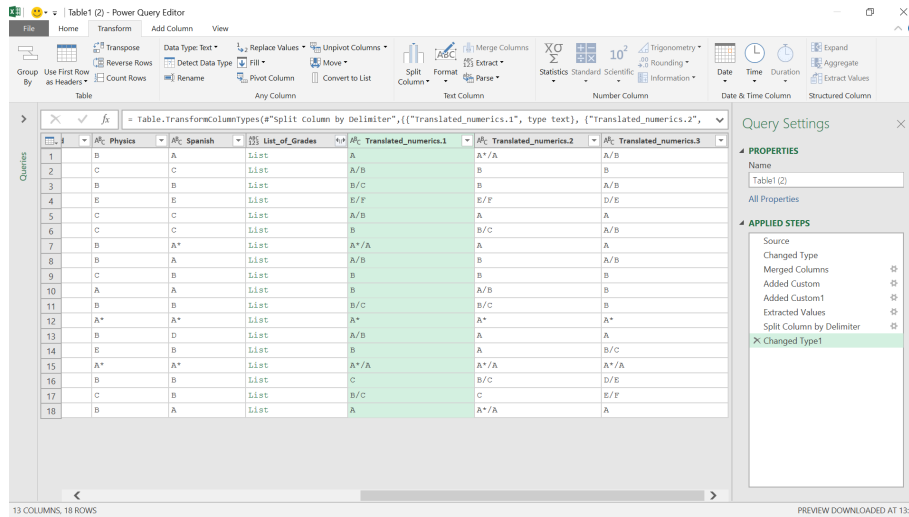
We'll choose to use a comma delimiter here, as **Text.Split** has not included the comma delimiter we used earlier.



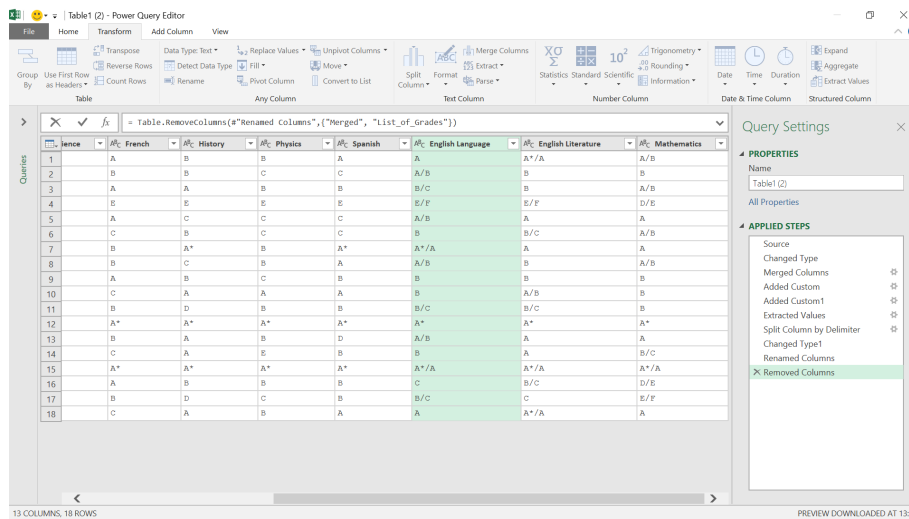
On the 'Transform' tab, we can choose to split the column.



We click 'OK' to create three new columns:



We can now remove the other list and the temporary column we used to merge the grades. We'll also rename our new columns.



We can now see what the letter grade is for English and Maths. Yay!

More anon.

## Power BI Updates

Aside from all the above on Fabric and Copilot in Power BI, there is the usual volume of updates this month, including 'DAX Query view', semantic model scale-out and Advanced Filtering for Paginated Reports.

The full list is as follows:

### Reporting

- Button slicer in Preview
- Reference labels in Preview
- Enhance your Q&A visual with suggested synonyms from Copilot in Preview
- On-object Interaction updates:
  - Always open in new pane' setting
  - Resizing the data flyout
  - Table's 'Add' button returns
  - New On-object default coming soon

- Azure Maps visual now aggregates multiple data points at the same location
- Narrative visual with Copilot in Preview

### Modelling

- Datasets renamed to semantic models
- **DAX** query view to write and run **DAX** queries on your model in Preview
- Edit your data model in the Power BI Service – updates:
  - Mark as a date table
  - Rename and delete tables and columns

### Data connectivity

- Azure Resource Graph (new connector)
- Profisee (connector update)
- Bloomberg Enterprise Data and Analytics (connector update)
- Dremio (connector update)
- Celonis (connector update)

### Service

- Explore in Preview
- Copilot for Power BI in Microsoft Fabric in Preview
- OneLake integration for Import-mode semantic models in Preview
- RLS / OLS security and stored credentials for Direct Lake semantic models in Preview
- Sharable cloud connections for semantic models now Generally Available

- Semantic model scale-out now Generally Available
- Show visuals as tables in Preview
- Advanced Filtering for paginated reports

### Visualisations

- New visuals in AppSource
- Zebra BI Tables 6.6: introducing text columns
- Funnel Chart by Powerviz
- Create interactive timelines with full control

### Other

- Enhanced accessibility in paginated reports authored in Report Builder
- Skill up on Fabric with the Microsoft Learn Cloud Skills Challenge
- Dynamic dataset binding for paginated reports.

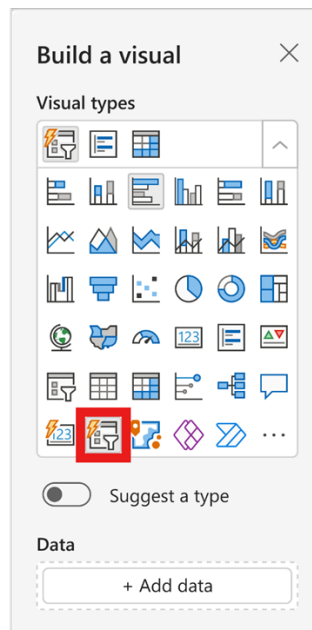
Let's look at each in turn.

### Button slicer in Preview

This update introduces the Button slicer, an oft-requested tool for slicing data. Apparently, this is just the first step in a five-stage journey that will replace the old tile slicer with a better, more flexible alternative.

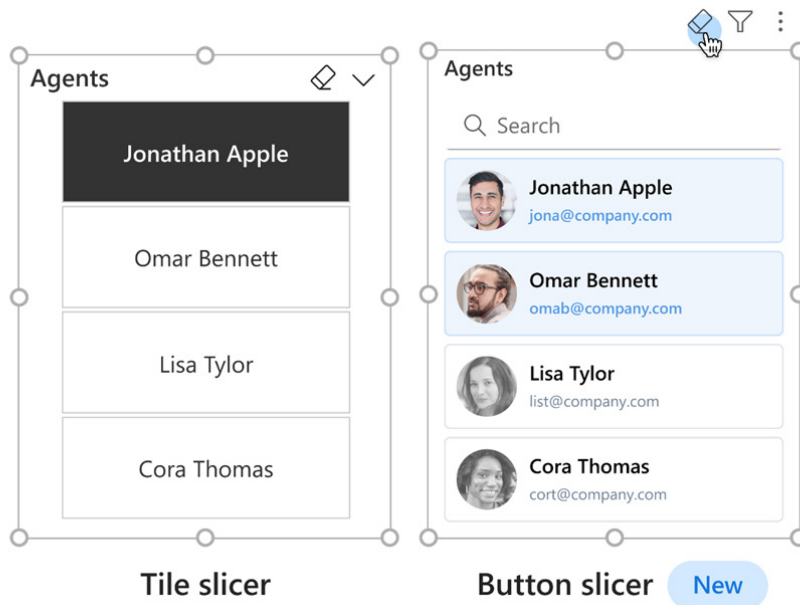


### New slicer icon



There are quite a few upgrades and enhancements in the new Button slicer:

- you may now customise the shape and appearance of your design with more control to modify the corner radius
- with an adjustable grid layout, you may now divide your design into rows and columns, and even use pixels to customise card spacing
- when grid layouts have more buttons than rows and columns, use overflow styles, and choose Pagination or Continuous scrolling with vertical or horizontal direction
- just like the new card visual, the Button slicer simplifies alignment and format properties, and the Label feature will spotlight crucial information from within your buttons
- image control allows you to infuse buttons with images such as URL images
- interactive states make designs more engaging with options including on hover and on press
- there are new formatting settings to make the slicer more versatile
- 'Single select' has been updated with a 'Force Selection' toggle and a new 'Select All' option
- the new multi-select feature allows greater flexibility
- a new ToolTips experience is available for the new Button slicer, as it now supports both default and report page ToolTips.



With this Preview update, the new Button slicer feature has been toggled **ON** by default and is found in one of three places:

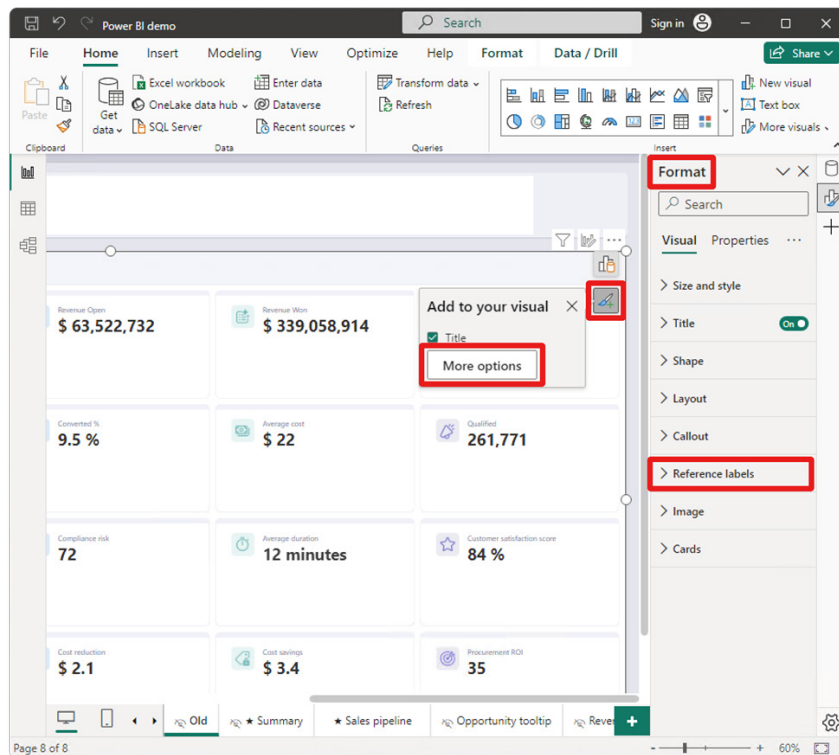
1. the Visual gallery on the Ribbon
2. by selecting 'Build a visual' after right-clicking on the canvas, and then choosing the new slicer
3. by selecting new slicer from the on-object dialog.

You may also toggle this feature Preview on or off by looking under **Options -> Preview features -> New button slicer**.

As mentioned earlier, this is only the first stage on the new slicer roadmap...

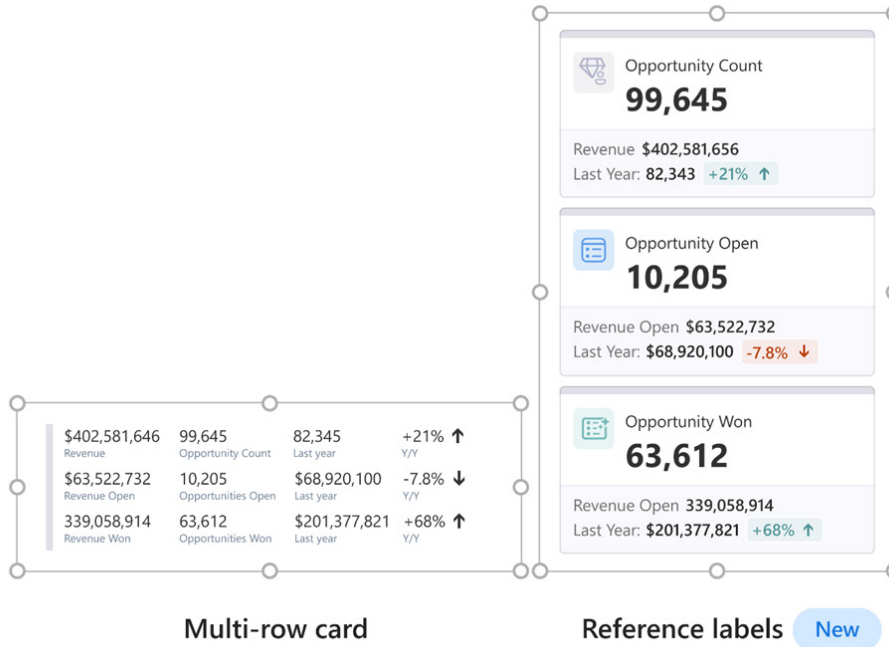
### Reference labels in Preview

Reference labels is a versatile tool employed for adding custom labels to new cards, providing relevant information, comparisons, key metrics, benchmarks, goals and more. This represents the second step in Microsoft's five-stage new card visual journey.



With Reference labels, end users will have access to the following features:

- not only can you Reference labels to your card visual, but you even add multiple data fields to your Reference labels
- with three main components, namely Title, Value and Detail, you may also choose custom content using a different data field or measure and apply various styles to both Title and Value
- extra context is available for the Detail component, showing data from a single data field well, but is also customisable with styles and colours
- with an active Divider, Reference labels have their own area where you can modify the divider line and use colour to differentiate callout and Reference labels
- Reference labels may have a horizontal or vertical layout and can have custom spacing and padding too.



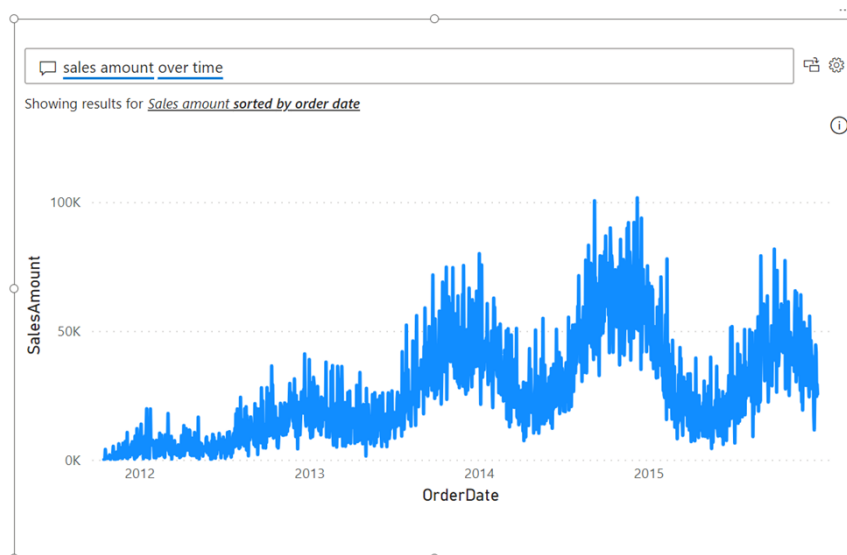
With this Preview update, the new 'Reference labels' feature has been toggled ON by default for convenience and is found in one of three ways:

1. from the Visual gallery on the Ribbon
2. by selecting 'Build a visual' after right-clicking on the canvas, and then choosing the new slicer
3. by selecting new slicer from the on-object dialog.

You may also toggle this feature preview on or off by looking under **Options -> Preview features -> Reference labels**.

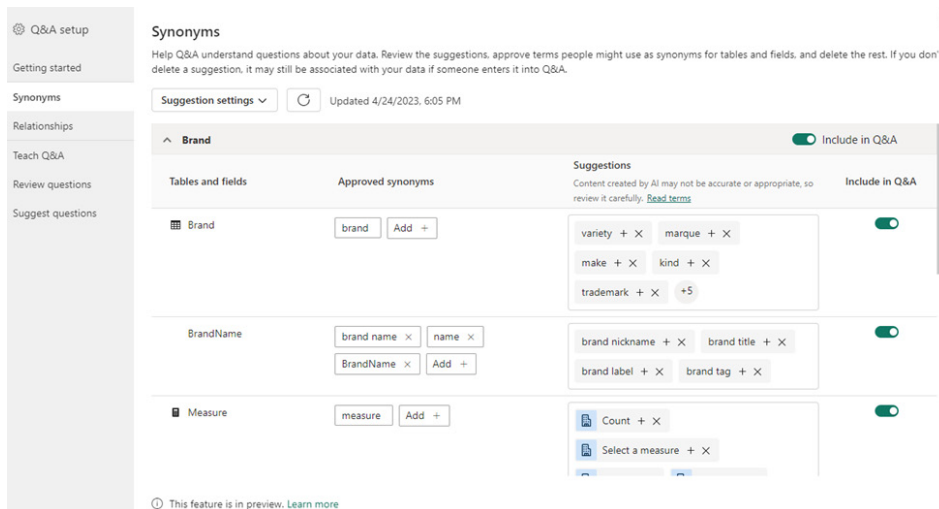
**Enhance your Q&A visual with suggested synonyms from Copilot in Preview**

The Q&A visual allows you to ask questions about your data and get answers in the form of visual. It provides any report viewer with an intuitive means to explore their data without requiring deeper knowledge of the model or report authoring. I know; I have relied upon it for years!



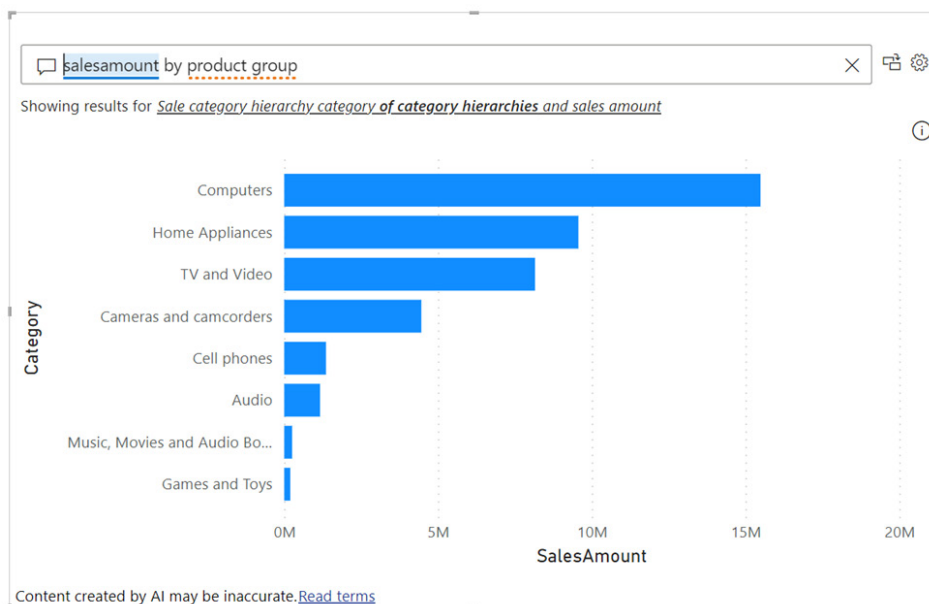
Presently, the Q&A visual doesn't rely upon generative AI to function. The Q&A engine processes your natural language input all inside Power BI algorithmically using a variety of linguistic principles, associating words and phrases you use with data in your model. This makes it good at answering precise questions about your data, but it may not be able to associate everything you input with data in the model.

To help authors ensure that the Q&A visual provides consistent and accurate answers based upon the unique language their report consumers actually use, Microsoft has introduced Q&A setup tools with an emphasis on providing Q&A with synonyms for column and table names in the model. This way, authors may explicitly define different ways people might refer to their data, and users will always receive the correct answers when they ask similar questions in the future.



Power BI recognises two types of synonyms: **approved synonyms** and **suggestions**:

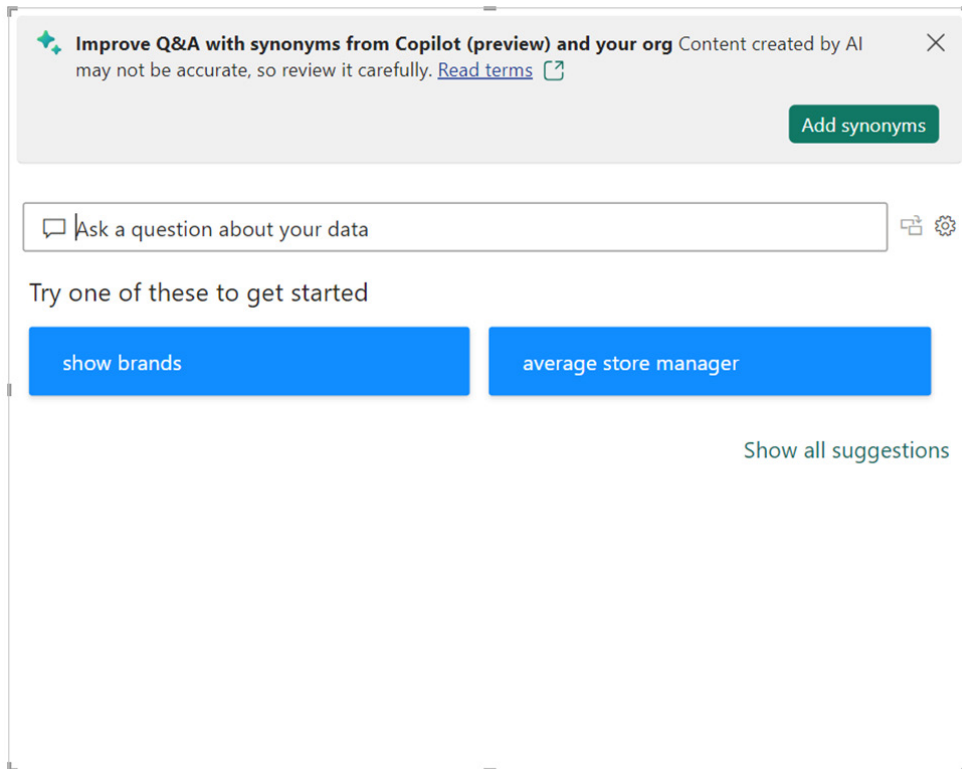
- **Approved synonyms** either come directly from the names of fields themselves or are explicitly added by the author. When you use an approved synonym in your Q&A input, it will be treated just as though you used the name of the field and the association will be presented with high confidence, signified by a solid blue underline
- **Suggested terms** are words Power BI thinks are likely to refer to their corresponding name. They come from a variety of sources – synonyms from the Office thesaurus show up by default, but you can also connect to your organisation's collection of approved terms and add those to your suggestions as well. Suggestions will still be used by Q&A, but with lower priority than approved synonyms, and the lower confidence will be signalled in the results with a dotted orange underline. In the Q&A setup menu, suggestions may be added to the approved synonyms list or removed entirely.



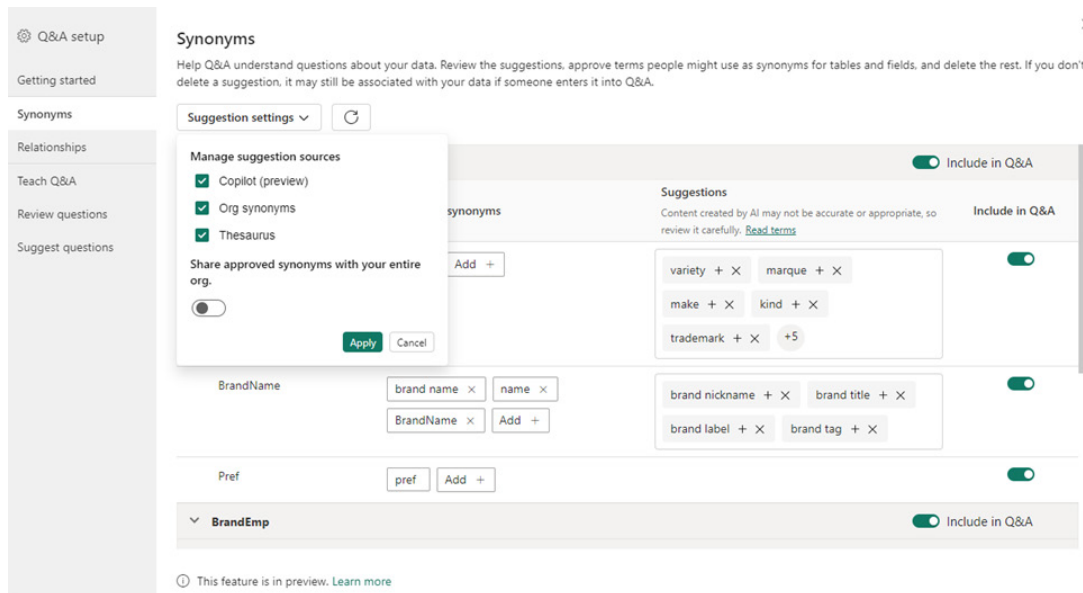
Managing synonyms is therefore an important part of improving the quality of the Q&A experience. However, coming up with synonyms for every data entity in your model can be mentally laborious and physically time-consuming. Copilot for Power BI streamlines this process by generating some for you.

If you have Copilot enabled, there are a few ways for you to get suggestions from Copilot. However, before you being you will have to enable the feature in Power BI Desktop in **File -> Options -> Preview features -> Improve Q&A with Copilot**.

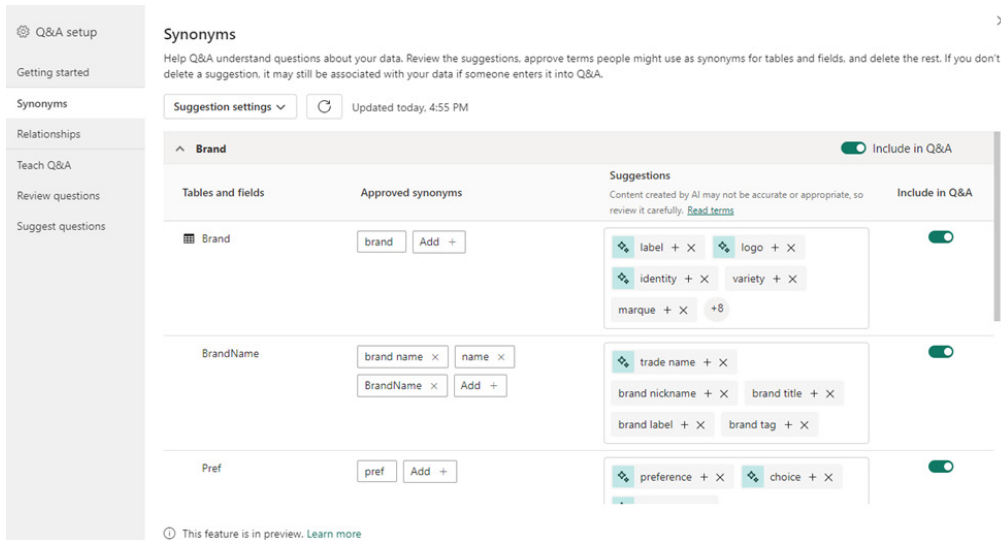
Then, you might be prompted to add synonyms with Copilot via a banner that shows up the first time you make a Q&A visual or open the Q&A setup menu:



You'll also be able to get Copilot suggested synonyms via the Q&A setup menu. You can turn on Copilot as a source in the suggestion settings menu in the Synonyms tab, then click 'apply to get synonyms'. Alternatively, if Copilot is already enabled as a source, you can click the Refresh button next to the suggestion settings dropdown.



After you have entered / received these suggestions, you might be prompted to review them. You'll find the new synonyms in the suggestions column in the synonyms page of the Q&A setup menu:



Copilot-suggested synonyms will function just like any other suggested synonyms. This means that they may be used by Q&A as a fallback when trying to determine what data fields a natural language input may refer to. You should carefully review them in the Suggestions column of the Q&A visual, remove the synonyms which are inaccurate and approve the ones which best fit the data.

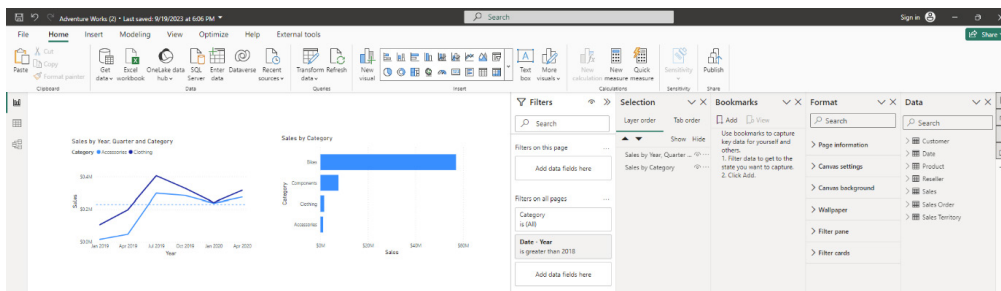
Please keep in mind that as Microsoft scales out Copilot, you might run into throttling, which may cause Copilot to return incomplete results if you send too many requests in a short period of time. If that happens, you should wait a while and try again. Copilot may also not return results for terms for which it cannot generate synonyms or when its results are deemed inappropriate by Microsoft's content filter. That fxxing sxxxs.

### On-object Interaction updates

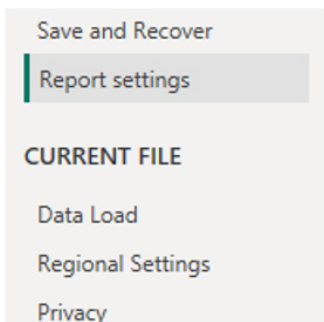
#### 'ALWAYS OPEN IN NEW PANE' SETTING

This month's updates introduce the ability to configure your pane switcher to stack panes instead of swap them. If you preferred the behaviour from before, where panes opened side-by-side by default, you can now configure this setting by checking the new option for 'always open in new pane' from either the Options menu or the View tab on the Ribbon.

To achieve the stacked behaviour of panes as before:



Turn on the new option within the Options menu:

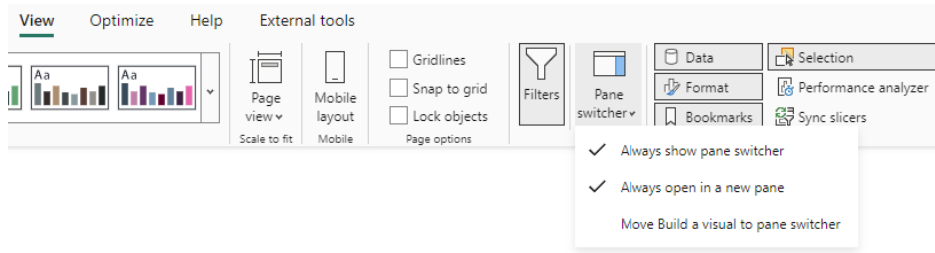


#### Pane switcher

- Always show the pane switcher
- Always show the Build a visual menu in the pane switcher
- Always open a new pane

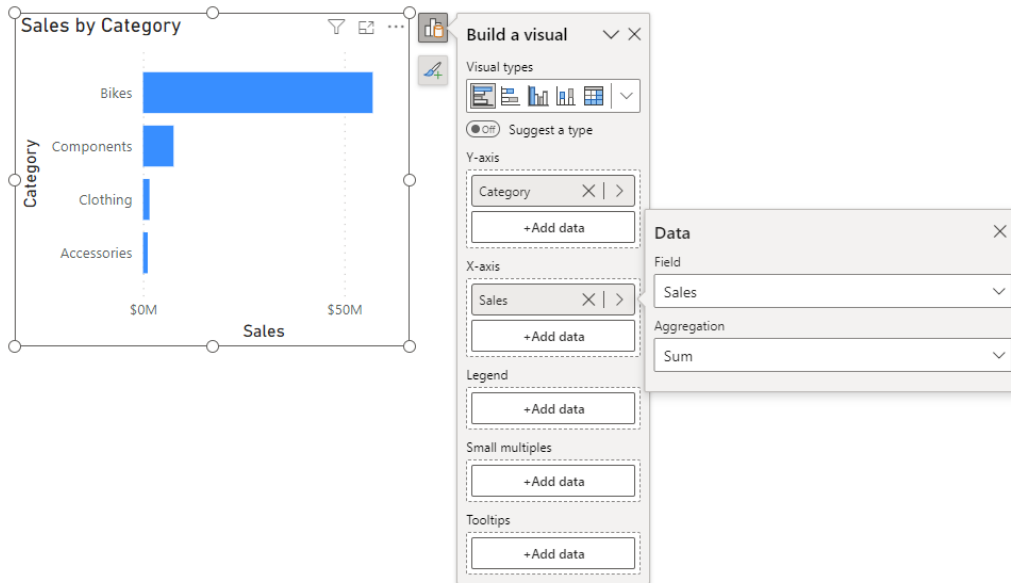


Or else select the new option from the View tab on the Ribbon:



**RESIZING THE DATA FLYOUT**

The ability to resize the data flyout (second flyout) from the Build button when working with long field names has also been added this month.

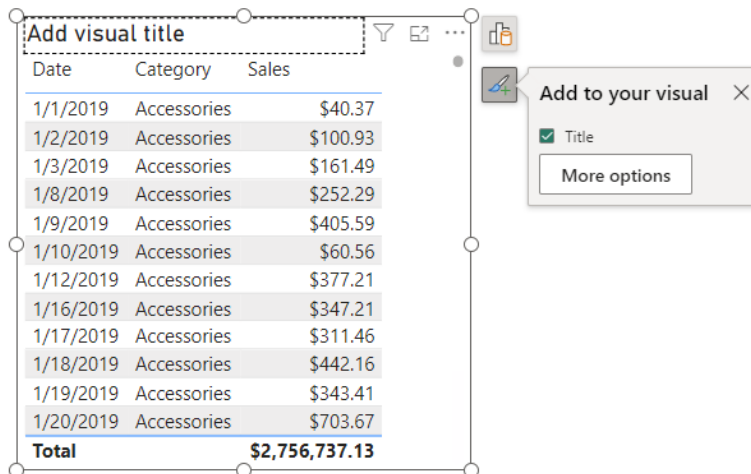


Microsoft has noted that there may be cases where the resize handles appears to the left of the data flyout if there is not enough space to expand on the right side. They state that this bug is known, and that they are working on a fix. As a workaround in these cases, you can move the visual to left temporarily on the canvas to resize the data flyout.

**TABLE'S 'ADD' BUTTON RETURNS**

The Table visual has the add button again. Originally, Microsoft had to remove the Add button from the Table visual type as currently the only chart element to add from this menu was the title that does not have a default value. This added confusion to the experience because simply turning on the title did not appear to have changed anything in the visual

and users had to go to the Format pane to type in their visual title. In the most recent update, Microsoft shipped placeholder text which allowed Power BI to bring back the Add button for Tables. Now, when turning on title, a placeholder will appear to type directly onto the visual.



## NEW ON-OBJECT DEFAULT SETUP COMING SOON

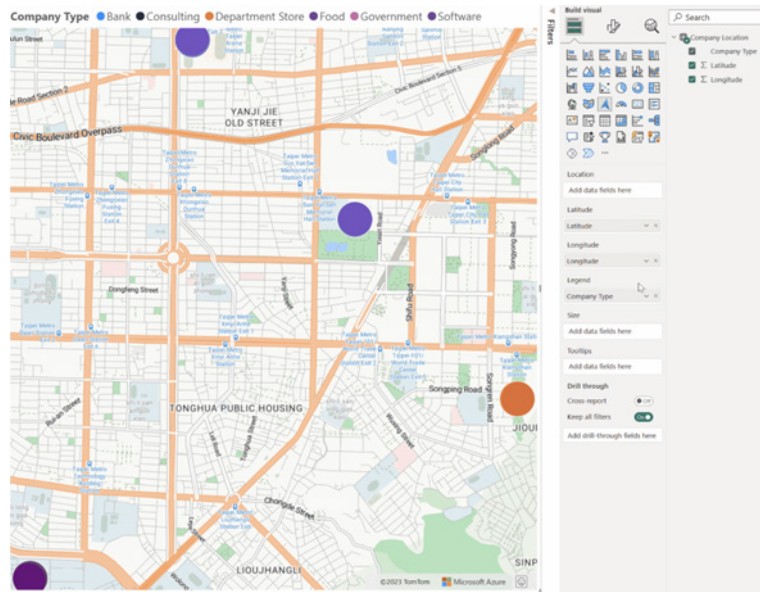
With this month's addition of the new 'always open in new pane' setting, the next update Microsoft be able to introduce is a new default setup that feels closer to the previous "classic" look. With this new default, you will be able to preset the following options with just one click:

- move the 'build a visual' menu to the pane switcher by default
- show both build and data panes expanded by default
- Format pane in the pane switcher by default
- 'Always open in new pane set to on, thereby stacking panes by default
- collapse panes to the pane switcher instead of close 'X' by default.

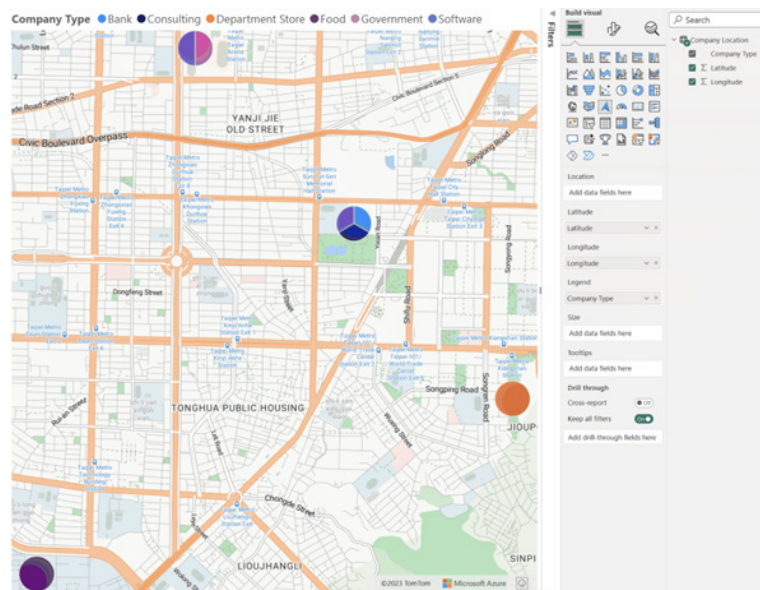
## Azure Maps visual now aggregates multiple data points at the same location

Previously, when you had multiple data points with the same latitude and longitude field values, those points would be plotted separately, leaving them drawn one over the other at the same location. This could lead to some unclear data visualisations. For example, grouping the points

by category using a legend field might leave just one category visible per location due to the overlap. This behaviour was also different from visualising those points using location names, which would aggregate the points together.



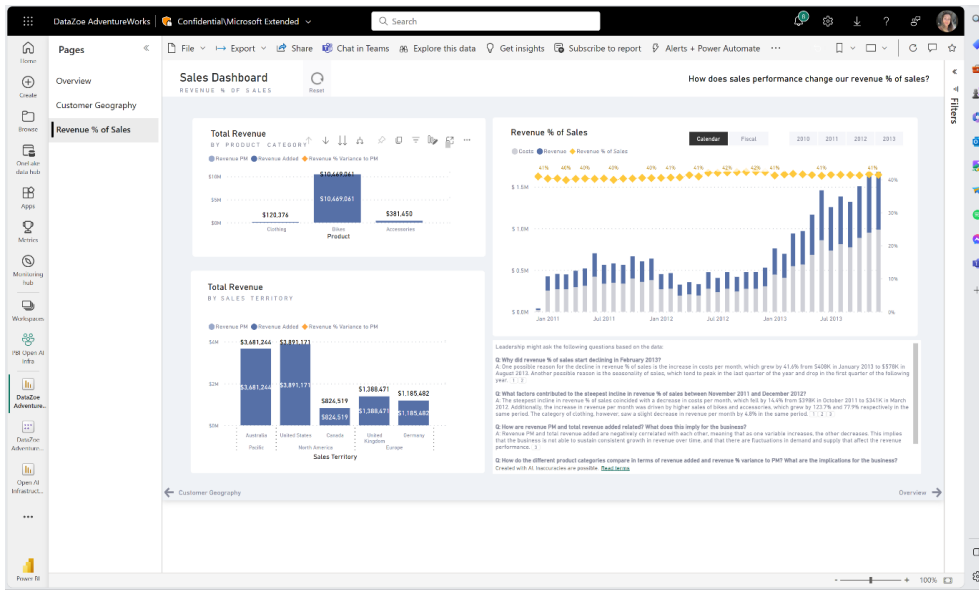
With this release, Azure Maps now aggregates points with the same latitude and longitude values in the same way that it does with location names, allowing you to see them as one bubble. These aggregated points can then be filtered or grouped as you would normally.



**Narrative visual with Copilot in Preview**

Copilot’s unique ability to summarise data has now been exploited to the rebranded ‘Narrative with Copilot’ visual – formerly ‘Smart Narratives’. This visual allows you to use Copilot to summarise data across your report or even specific pages or visuals you choose. Power

BI offers suggested prompts to get authors started, such as “Give me an executive summary”, “Answer likely questions from leadership” and “created a bulleted list of insights”. Users can also type in their own custom prompts and questions that return summaries about their data.



How does sales performance change...

### Create a narrative with Copilot 🔗 ✓ ✕

Describe the summary you want and the visuals it should reference. AI-generated content can contain mistakes, so review your summary carefully. [Read terms](#)

Give an executive summary

Answer likely questions from leadership

Create a bulleted list of insights

Tell me what's happening with bikes in this [report](#)

50/300

Reference visuals i

19 visuals ▼

Create

## Create a narrative with Copilot ✕

Describe the summary you want and the visuals it should reference. AI-generated content can contain mistakes, so review your summary carefully. [Read terms](#)

Give an executive summary

Answer likely questions from leadership

Create a bulleted list of insights

Tell me what's happening with bikes in this [report](#)

50/300




















Reference visuals 

- The report shows the performance of bikes with accessories and clothing. The report highlights the following insights:
- Bikes generated the highest revenue in 2013. This is equivalent to 9% of total revenue.
  - Bikes also had the highest revenue margin than accessories.
  - Bikes showed a consistent growth pattern, with the highest growth in June.
  - Bikes were most popular in the UK territory, with a revenue of \$1.01M.
  - Bikes had a seasonal pattern, with revenue peaking in the summer months.

Created with AI. Inaccuracies are possible.

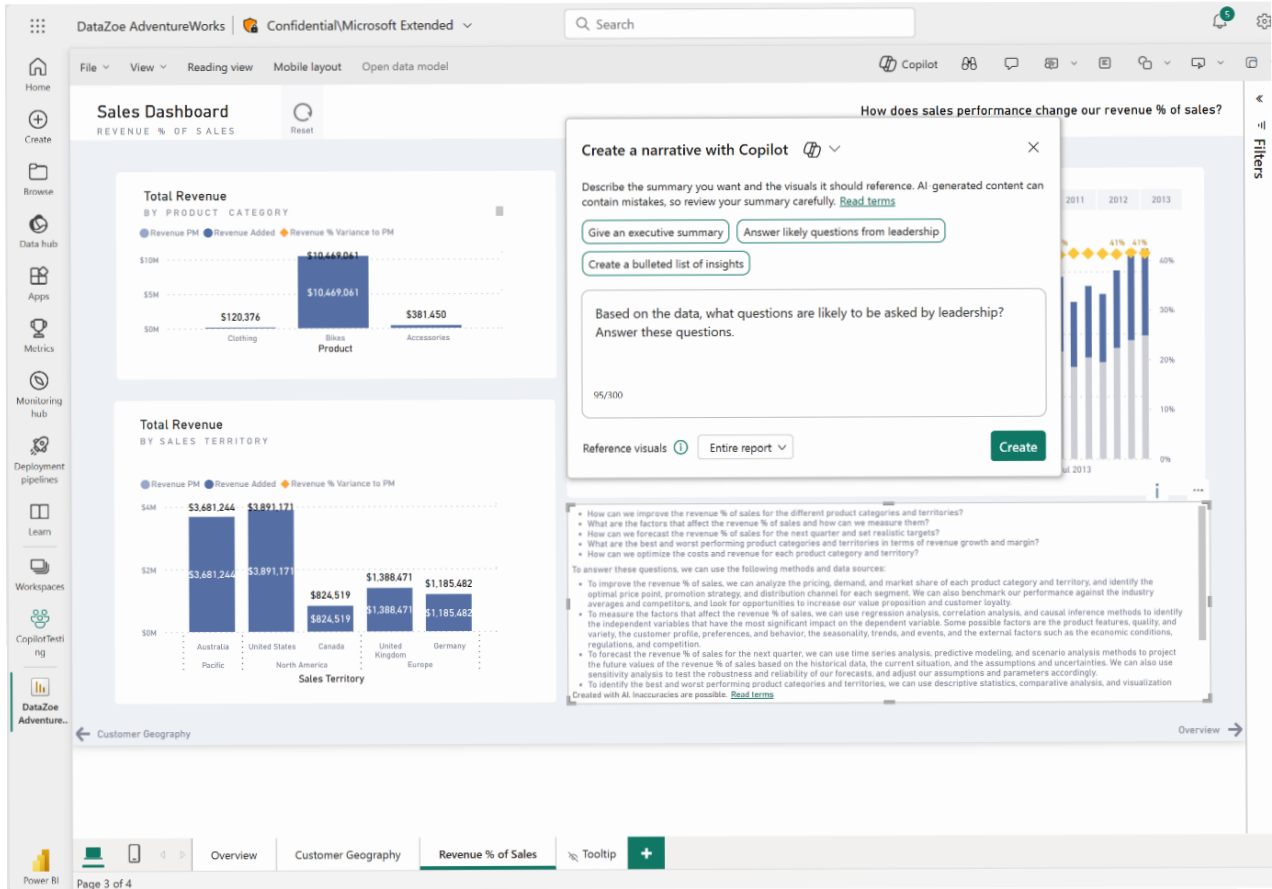
Tooltip



- Select all
- Overview
  -  \$ and # by Commute
  -  \$ and # by Country
  -  \$ and # by Month
  -  Card
  -  Card
  -  Card
  -  Card
  -  Card
  -  = by Month and Category
- Customer Geography
  -  Customers
  -  UK
  -  USA
  -  Canada
  -  Germany
  -  Australia
  -  Selected Measure \$, Selected Measure # a...
- Revenue % of Sales (Current)
  -  Costs, Revenue and Revenue % of Sales b...
  -  How did product revenue do compared t...
  -  How did sales territories do compared to ...
- Tooltip

Users have the ability to choose whether they want to summarise over the entire report, select pages or even specific visuals across their report, giving them flexibility in what their summary looks like. Users will also see references for each portion of the summary that align to visuals on the various pages on the report, from which the summary lines were generated, making it easy to validate the summary's accuracy and tie it back to the data.

The summary can be updated as the data is sliced and diced, so end users may interact with it, without editing the prompts themselves. This narrative visual with Copilot makes it faster to communicate insights about the data that matters to you. The visual is available in the Service and in Power BI Desktop.

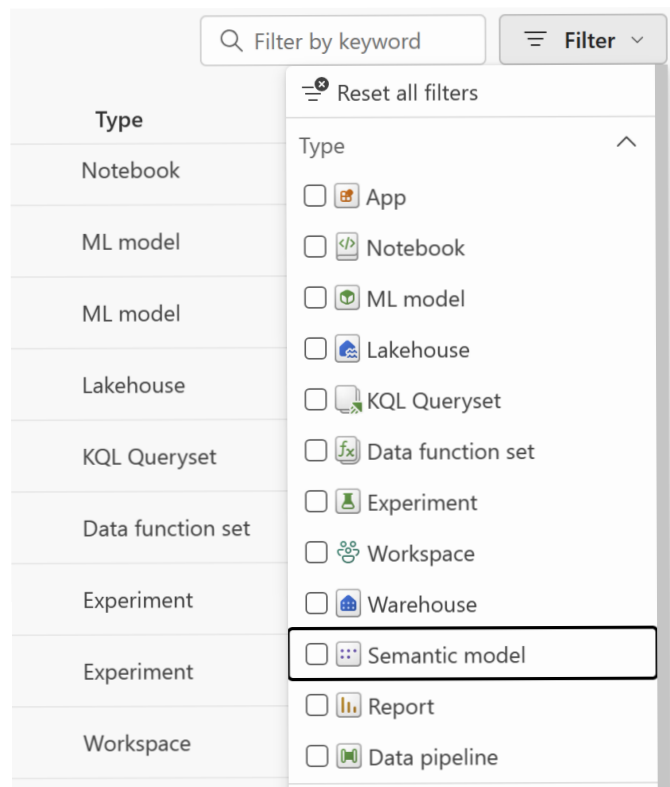


### Datasets renamed to semantic models

Datasets are being renamed "semantic models" in Power BI and Fabric. This might seem like a semantic point [*groan – Ed.*] but it is necessary for disambiguation from other Fabric items and will make the product clearer and more usable. You will see this change in the most prominent user interface (UI) elements and Microsoft has stated that the documentation is presently being updated.

Application Programming Interfaces (APIs) are not currently affected

as Microsoft will progressively roll out further changes. The timing of this change is driven by the upcoming General Availability of Fabric and aligns with the rename for Machine Learning (ML) models. It reflects the immense progress that Power BI datasets have made in becoming an enterprise-grade semantic modelling technology. The semantic model name will help drive awareness of the new powerful capabilities provided.



***DAX query view to write and run DAX queries on your model in Preview***



The ‘**DAX** Query view’ is a fourth view in Power BI Desktop which allows you to utilise the powerful **DAX** query language using **EVALUATE** to discover, analyse and see the data in your semantic model. Similar to the Explore feature in Power BI Service (*see below*), model authors may quickly validate data and measures in their semantic model without

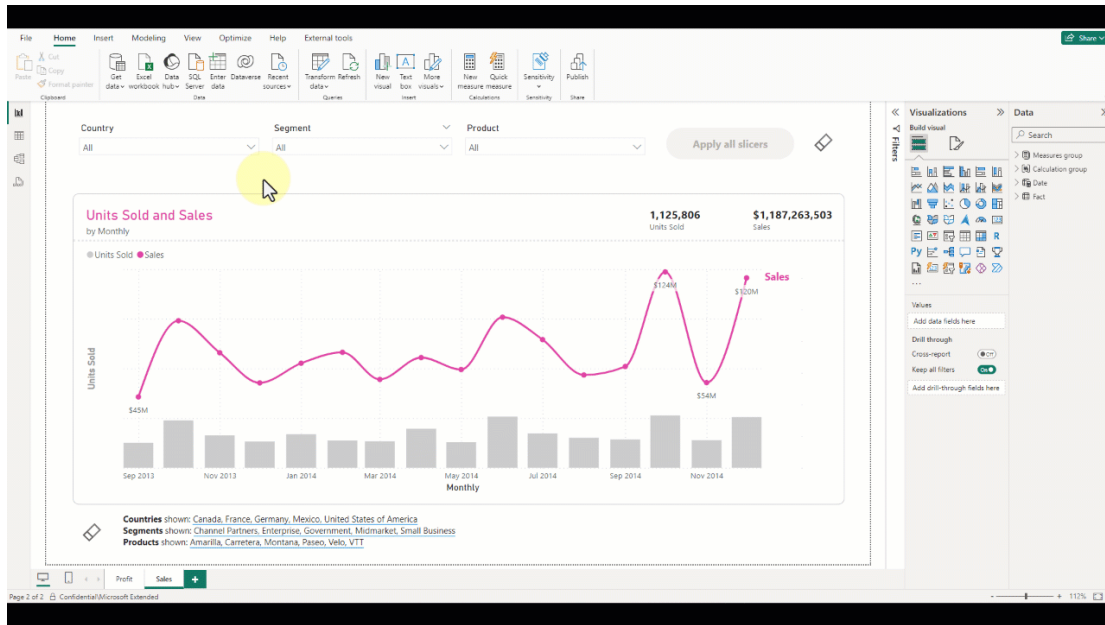
having to build a visual, publish or use an additional tool. Changes made to measures may be updated back to the semantic model. **DAX** queries are different from **DAX** expressions used to create model items such as measures, calculated columns and calculated tables, and are more like SQL queries returning data in a table.

This powerful way to interact with your data model is now available in the new ‘**DAX** query view’:

- Quick queries can generate **DAX** queries for you in the Data pane context menu of tables, columns or measures, giving you a head start by generating a **DAX** query to preview data or show summary statistics. You may use **DAX** queries to help you understand the data without creating visuals and for DirectQuery you no longer must go back to Power Query to see some sample data
- Quick queries may be used to obtain the **DAX** expression of all, some or a specific measure in a generated **DAX** query. It provides the **DEFINE** block with the measure’s **DAX** expression and an **EVALUATE** block to see the measure’s output. You may then add to the **DAX** query with any additional group by columns

- 'Update the model options' will be available to you with any **DAX** query updates to measures in DAX query's **DEFINE** block
- measures that reference other measures can now be seen on the same screen and updated together. You may preview the output of your changes and then also update the model when read
- Report view's 'Performance Analyzer' already lets you copy the visual **DAX** query. Now, you no longer need to take that **DAX** query and use another tool to view and run it: simply run it in '**DAX** query view' instead
- all these features are now in a bigger **DAX** query editor similar to VS Code, including more keyboard shortcuts and the ability to improve readability by formatting any **DAX** query.

Microsoft plans to continue to add functionality to the '**DAX** query view': they have previously shown a visual demonstration with a '**DAX** query view Copilot', which will be coming soon. You may get started today by turning on this public Preview feature in **Options -> Preview features**.



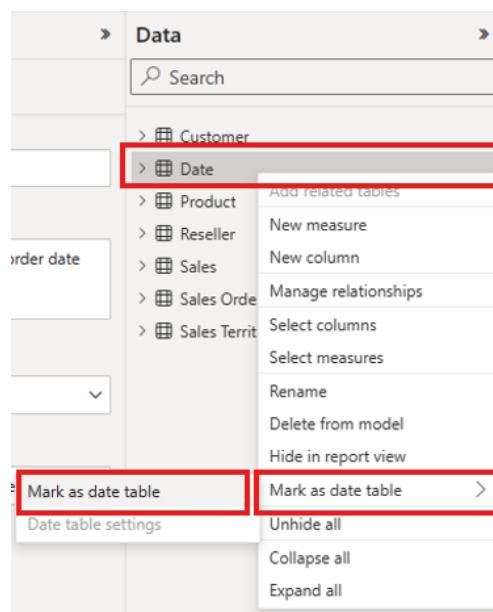
### Edit your data model in the Power BI Service – updates

The new data model editing in the Service feature was released to preview in April. Since then, Microsoft has been busy. Below are the improvements in this month's set of updates:

#### MARK AS A DATE TABLE

Within the Service, you can now mark a table in your data model as a date table. Marking a date table in your model allows you to use this table for various date-related elements including visuals, tables, quick

measures and more, with full Time Intelligence support. To set a date table in the Service, right-click on the desired table and choose '**Mark as date table => Mark as date table**' in the menu that appears.



Next, specify the date column by selecting it from the dropdown menu within the 'Mark as date table' dialog. Power BI will then perform validations on the selected column and its data to ensure it adheres to the 'date' data type and contains only unique values.

### Mark as a date table ×

To enable the creation of date-related visuals, tables and quick measures using this table's date data, mark it as a date table.

Keep in mind any built-in date tables that are already associated with this table will be removed. Visuals or DAX expressions referring to them may break. [Learn more](#)

**Mark as a date table**

On

**Choose a date column**

Date ▼

Validated successfully

## RENAME AND DELETE TABLES AND COLUMNS

Within the Service the following functionality is now supported:

- Renaming and deleting any table
- Renaming and deleting any column.

### ***Azure Resource Graph (new connector)***

You may now empower your data insights with the Power BI data connector for Azure Resource Graph. Now, you can transform your Azure Resource Graph queries into visualisations within Power BI.

### ***Profisee (connector update)***

Profisee's Power BI Connector Version 3.0 exposes new information around data quality, enhancing analytics on data quality improvements for data managed in Profisee with detailed information regarding validation issues flagged within their data. Additionally, the data types have been

refined streamlining the experience for users using the Profisee Connector to load data from Profisee to Microsoft Fabric using Data Factory Gen 2 Data Flows.

### ***Bloomberg Enterprise Data and Analytics (connector update)***

This version of the Bloomberg Data and Analytics connector for Power BI includes changes to support underlying infrastructure updates and back-end performance enhancements. All user-facing features remain unchanged.

### ***Dremio (connector update)***

The Dremio connectors have been updated to support additional optional values and parameters.

### ***Celonis (connector update)***

The Celonis EMS connector has been updated with minor changes.

### ***Explore in Preview***

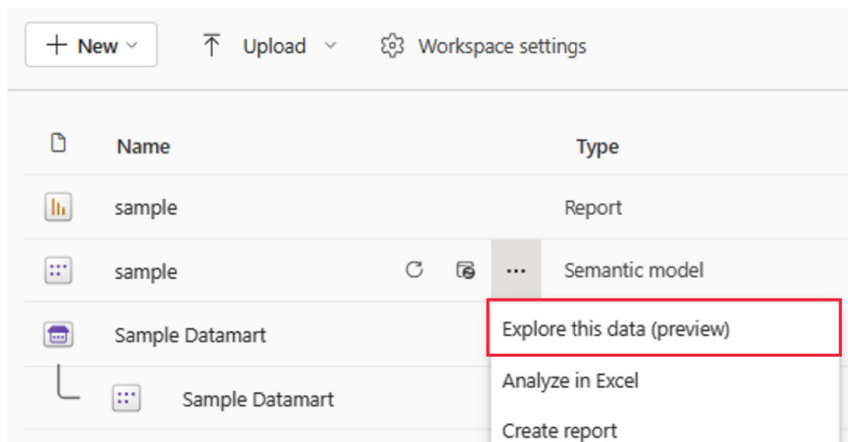




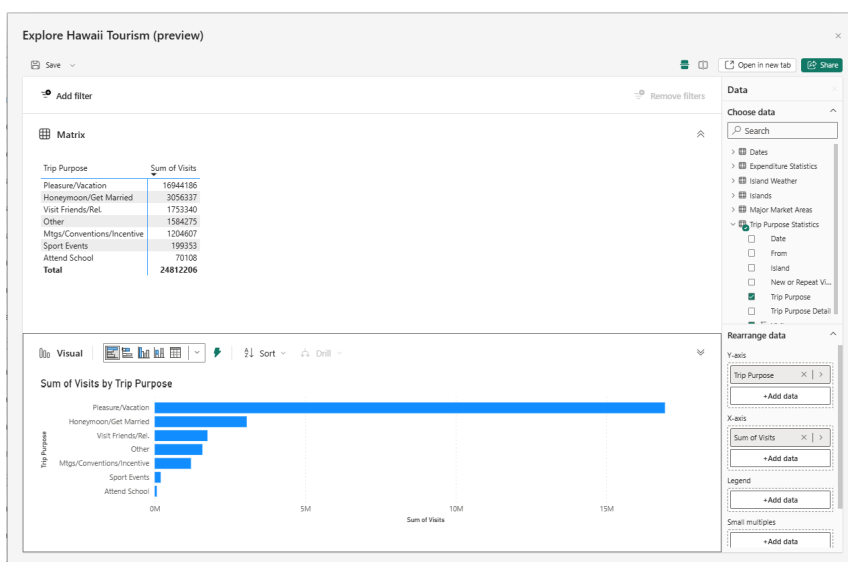
Within Power BI, many times you need to perform *ad hoc* exploration of your data. This could be as an analyst who just been provided with access to a new dataset or data source and wants to spend time learning about the data before building a report off it. Alternatively, you may be a business user who needs to answer a specific question using the data to include in a PowerPoint presentation, but the report you are using doesn't answer the exact question you have. Creating a new report from scratch in these cases is a large hurdle, just to get a quick answer or screenshot for a deck.

This is where the public Preview of the new Explore feature comes in, where users have a lightweight and focused experience to explore their data. Similar to exporting and building a PivotTable in Excel, now, directly within Power BI users may quickly launch Explore to begin creating a matrix / visual pair to get the answers they need without all the distractions and extra complexity of reports.

Simply find a dataset or report you'd like to explore:



Begin building your matrix / visual pair to get to the answers you need:



And, if you'd like to return to your work save it as an exploration:

The screenshot shows the 'Save this exploration' dialog box. It has a close button (X) in the top right corner. The dialog contains the following fields and options:

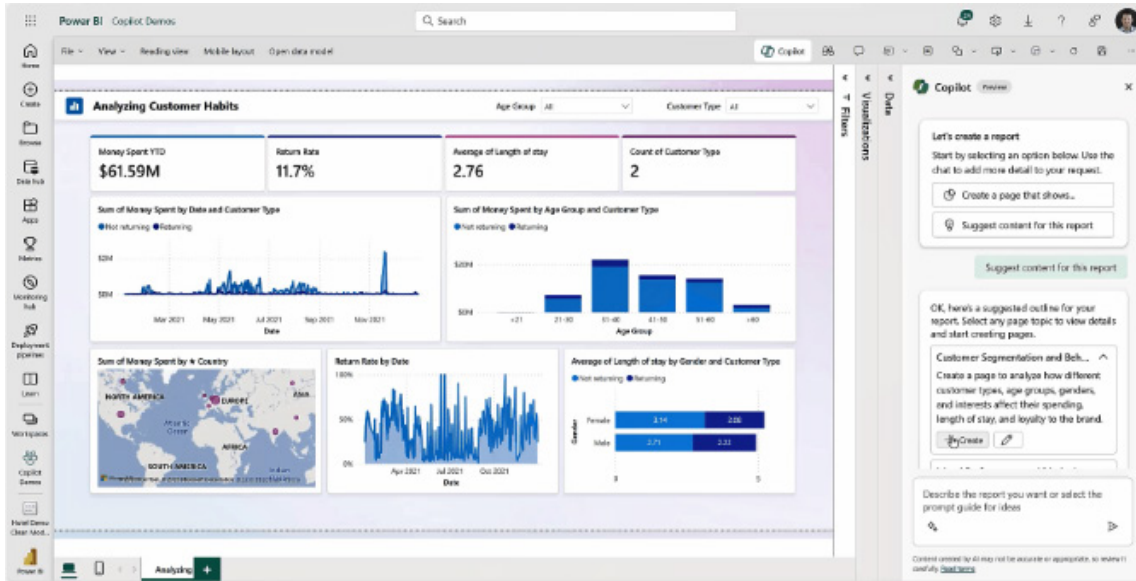
- Enter a name for your exploration\***: A text input field containing 'sample exploration'.
- Save it to a workspace**: A dropdown menu showing 'My workspace'.
- Sensitivity\***: A dropdown menu showing 'General'.
- At the bottom, there are two buttons: 'Save' (in a green box) and 'Cancel'.

Easy!

## Copilot for Power BI in Microsoft Fabric in Preview

And so to the public Preview of Copilot in Microsoft Fabric, including the experience for Power BI which helps you quickly get started by helping you to create reports in the Power BI web experience. This update has also added Copilot's ability to summarise data to the 'Smart Narrative' visual, now rebranded as the 'Narrative with Copilot' visual (see above).

The visual is available in the Power BI Service and in Power BI Desktop. Lastly in Desktop, the Power BI team has added the ability to generate synonyms for their fields, measures and tables using Copilot. To use Copilot, you'll need access to a workspace that has a P1 or higher or an F64 or higher capacity.



## OneLake integration for Import-mode semantic models in Preview

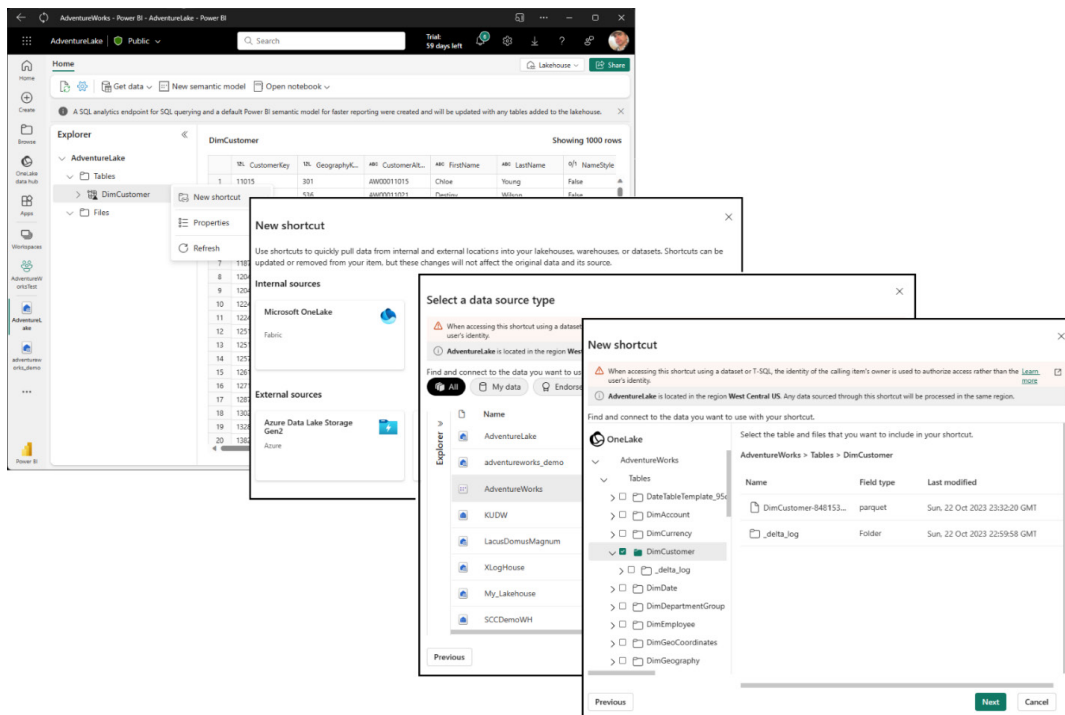
This month also witnesses the public Preview of Microsoft OneLake integration for import models. With the click of a mouse button, you can enable OneLake integration and automatically write data imported into your semantic models to delta tables in OneLake, as depicted in the following diagram:



The data is instantaneously and concurrently accessible through these delta tables. Data scientists, DBAs, app developers, data engineers, citizen developers and any other type of data consumer can now get seamless access to the same data that drives your business intelligence and financial reports. You can include these delta tables in your Lakehouses and Synapse Data Warehouses via shortcuts so that your users can use T-SQL, Python, Scala, PySpark, Spark SQL, R and no-code / low-code solutions to query the data.

OneLake integration can even help you if you don't plan to query the data. Perhaps you only want to export the data to backup files. Thanks to OneLake integration, this is very straightforward now. Ensure that your import-mode semantic model is hosted in a workspace on a Premium or Fabric capacity and that the large dataset storage format is enabled. Then, enable OneLake integration and perform a manual or scheduled data refresh operation. That's it! The semantic model writes the imported data to the delta tables as part of the refresh operation. Exporting import-mode tables has never been easier. The delta tables are kept up to date without requiring any ETL pipelines copying data.





That's it. Now you can use Direct Lake mode to read delta tables directly from OneLake and write delta tables thanks to OneLake integration. Fabric is assisting how customers may build their BI solutions for faster performance at big-data scale while at the same time reducing Total Cost

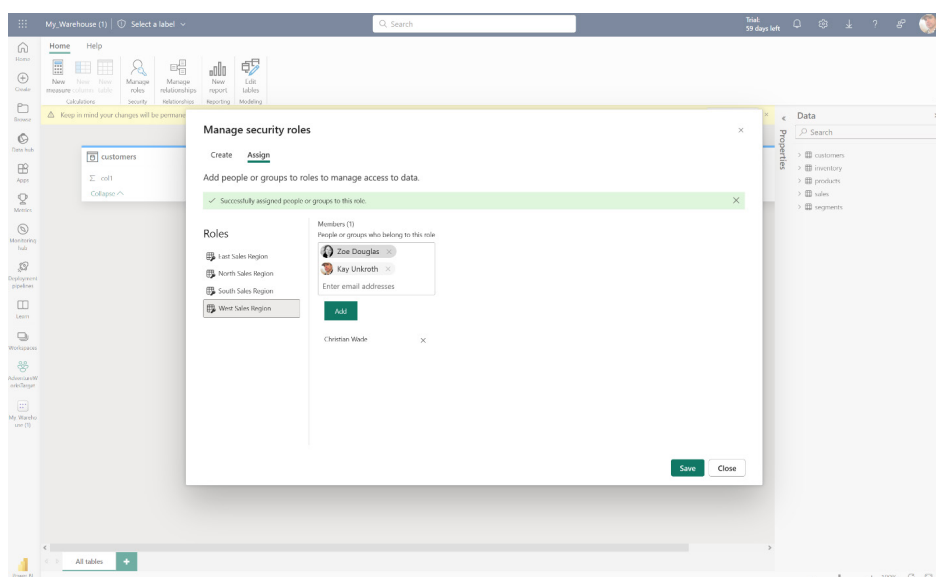
of Ownership (TCO) and infrastructure complexity. For example, you no longer need an entire portfolio of homegrown ETL solutions to get data volumes of any size in and out of semantic models.

### ***RLS / OLS security and stored credentials for Direct Lake semantic models in Preview***

It keeps going this month, doesn't it? Up next is the public Preview of the Row Level Security / Object Level Security (RLS / OLS) and stored credentials for Direct Lake semantic models. RLS / OLS is a Power BI feature that enables you to define row-level and object-level access rules in a semantic model, so that different users can see different subsets of the data based on their roles and permissions. Stored credentials help

reduce configuration complexity and are strongly recommended when using RLS / OLS with Direct Lake semantic models.

The following screenshot shows how you can add users to RLS roles in a Direct Lake model by using the Web modelling experience. The web modelling security roles dialog will be fully deployed in the coming days or weeks.



There is (almost) nothing special for RLS / OLS in Direct Lake models. You can define roles and assign users as for any other semantic model type. However, do keep in mind that by default Direct Lake models use single sign-on (SSO) authentication to the underlying data source. Using RLS / OLS in conjunction with SSO can be challenging because

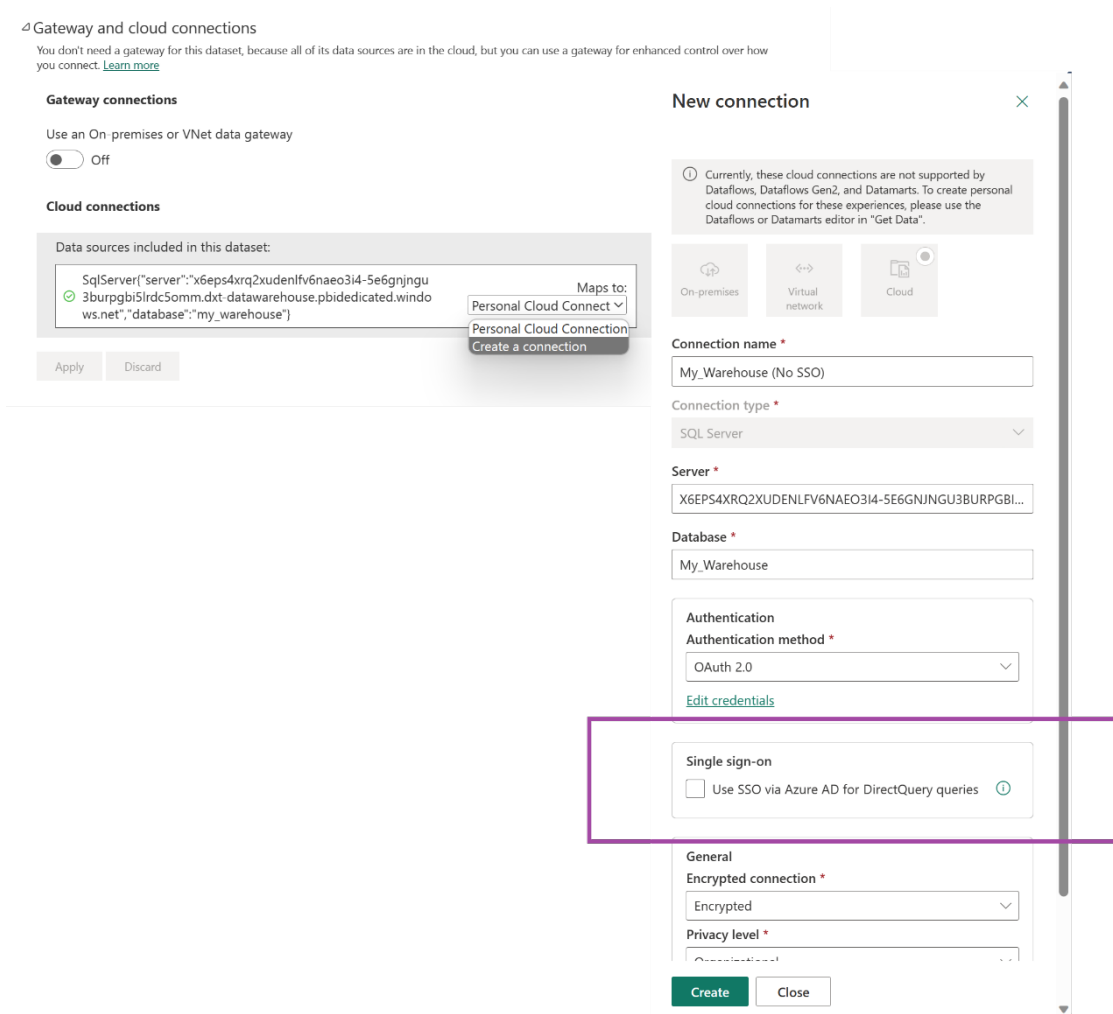
it involves multiple authorisation layers — RLS / OLS in the semantic model and user authorisation at the data source. For example, if you wanted to authorise a new user, you would have to add that new user to appropriate RLS roles and ensure that the user has access permissions to the underlying delta tables in the lakehouse or data warehouse.

Managing user authorisation at multiple layers adds complexity and friction. That's why Power BI has introduced support for stored credentials with Direct Lake semantic models. Your semantic models can now access the delta tables at the source with a single, fixed identity on behalf of the users instead of delegating the actual user identities via SSO. When adding new users to an RLS role, you are effectively

authorising them to use the fixed identity. Because this approach avoids SSO-related complexity and friction, it is strongly recommended that you switch to a fixed identity whenever you add RLS / OLS to a Direct Lake model. Switching to a fixed identity is as easy as binding the Direct Lake model to a Shareable Cloud Connection (SCC) that has SSO disabled.

Here are the steps to configure a Direct Lake model with a fixed identity:

- display the settings of the Direct Lake model and expand the Gateway and cloud connections section. Note that your Direct Lake model has a SQL Server data source pointing to a lakehouse or data warehouse in Fabric
- under Maps to, open the listbox, and click on Create a connection. This will pull you to the connections management page with the new connection form opened and prepopulated with the data source information
- select 'OAuth 2.0' or 'Service Principal' as the authentication method and provide the credentials of the fixed identity you want to use
- make sure you disable the checkbox labelled 'Use SSO via Azure AD for DirectQuery queries', as in the below screenshot
- configure any other parameters as needed and then click Create. This pulls you back to the Direct Lake model settings page. Verify that the data source is now associated with the non-SSO cloud connection.



The ability to set up stored credentials is available right now. The RLS editor for Direct Lake datasets in the web modelling experience is being deployed and will be visible in the coming days or weeks.

## Sharable cloud connections for semantic models now Generally Available

Along with the General Availability (GA) of shareable cloud connections (SCC), SCC support for semantic models and paginated reports has been announced as GA as well. Now, you may use this modern connection type in conjunction with your production semantic models and paginated reports to access cloud data sources and centralize cloud connection management.

In enterprise organisations, centralising cloud connection management in addition to data gateway management can help to lower the overhead of maintaining data connections and credentials. SCCs let you securely

share access to cloud data sources through an access-control list. The credentials are protected and cannot be retrieved from the SCCs, but Power BI users with at least 'Use permissions' may connect their semantic models and paginated reports to the cloud data sources through these SCCs. You can also create multiple connections to the same data source, which is particularly useful if you want to use different connection settings, such as different credentials, privacy settings or single-sign-on settings for different semantic models, paginated reports and other artifacts.

## Semantic model scale-out now Generally Available

The semantic model scale-out is now generally available (GA). Large-scale production solutions will benefit from high user concurrency, as Power BI automatically scales out read-only replicas to ensure performance doesn't slow down when lots of users are using the system at the same time. Of course, automatic scale out works for Direct Lake semantic

models. Additionally, Import-mode semantic models will benefit from refresh isolation, ensuring business users are unaffected by resource-intensive refresh operations and continue to enjoy enable smart, quick queries for interactive analysis.

Here's a quick summary of the benefits semantic model scale-out can provide to your reports, dashboards and other BI solutions:

- **increased query throughput:** Power BI can automatically scale read-only replicas when query volume increases and fluctuates
- **refresh isolation:** refresh and write operations on the read-write replica do not impact the query performance on read-only replicas
- **more flexibility for advanced data refresh scenarios:** as a side-benefit of refresh isolation, you can now perform advanced refresh operations on the read-write replica without impacting the read-only replicas. Simply disable automatic replica synchronisation, then refresh, refresh, refresh until the read-write replica is fully updated, and then synchronise the read-replicas manually.

Semantic-model scale-out is the last of the key features to make Microsoft Fabric and Power BI a superset of Azure Analysis Services (AAS) and is superior in Fabric compared to its equivalent in AAS. Unlike AAS, scale out takes place based on live user demand, and adjusts automatically to

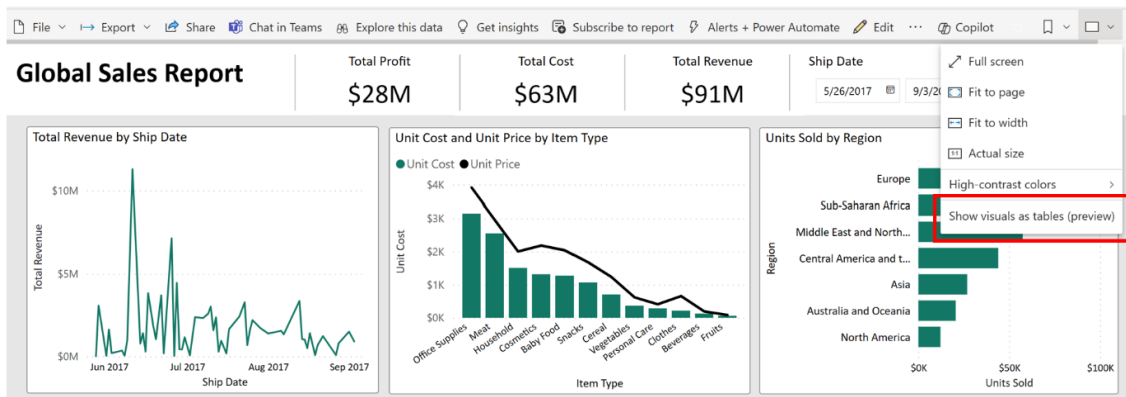
changes in usage patterns. AAS, on the other hand, requires detailed analysis to determine peak usage times, creation of automation scripts and ongoing monitoring to ensure optimum set up. Additionally, cost in AAS increases linearly per replica, unlike Fabric that is usage based.

## Show visuals as Tables in Preview

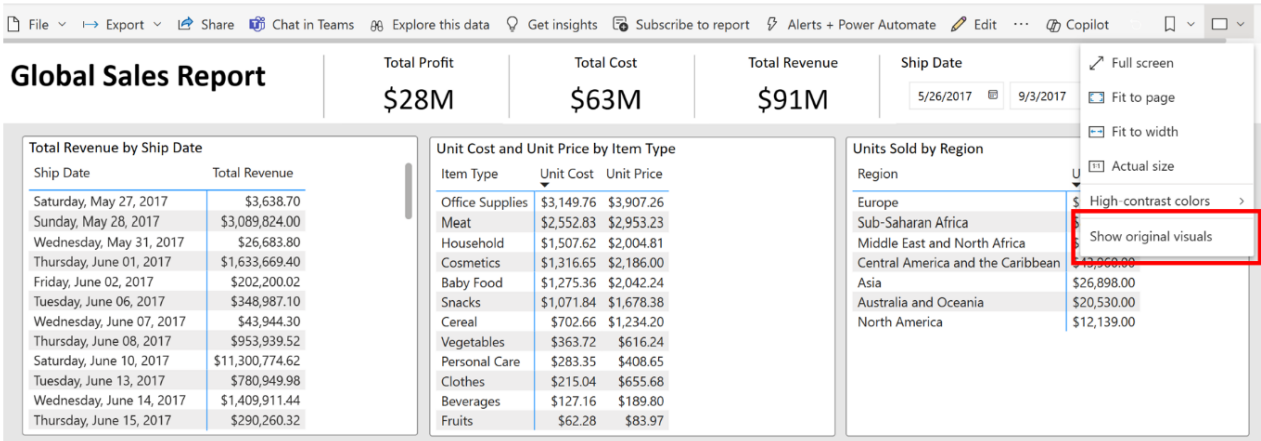
Leveraging Power BI's previous accessibility improvements to Table and Matrix visualisations, the Power BI team is now introducing a new view mode called 'Show visuals as tables', which displays report visuals in a tabular format with a single action. Some users may prefer to consume data in a text-based or tabular format depending on their different learning styles and usage of assistive technologies. This provides a supplemental format for visuals that allows users to display the data in the way that best meets their needs.

This new view mode is similar to how 'Show as a table' displays underlying data for individual visuals today. 'Show visuals as tables' will display the underlying data for visuals for all pages in the current report, with the added functionality of interaction and cross-filtering capabilities.

To activate this view mode, navigate to the view dropdown menu and select 'Show visuals as tables':



To revert, select 'Show original visuals':



Alternatively, you may simply use the keyboard shortcut **CTRL + SHIFT + F11** to toggle between the two views.

### Advanced Filtering for paginated reports

You can now use 'Advanced Filtering' whilst authoring paginated reports on the Service. This allows you to define conditions such as contains or does not contain, is not equal or is equal, or else to a specific value.

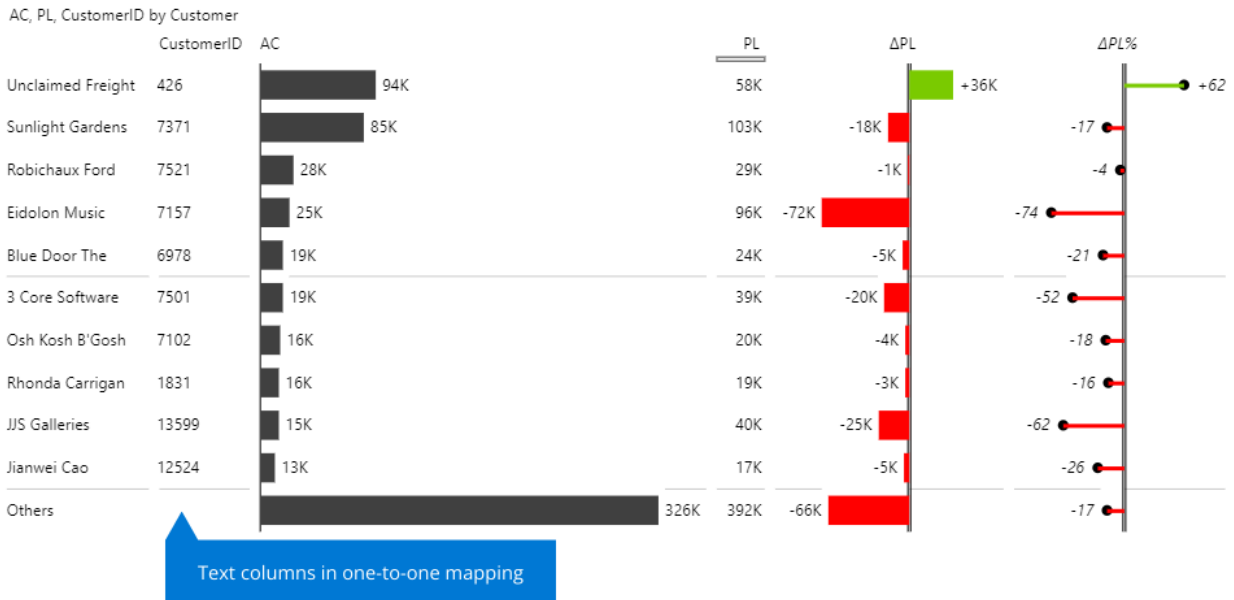
### New visuals in AppSource

There is just the one to report this month:

- Apex Gantt chart.

### Zebra BI Tables 6.6: introducing text columns

With Zebra BI Tables 6.6, you can add multiple text columns inside the table. Using this feature, you can bridge the gap in data visualization by having relevant information side by side in the table / matrix custom visual for Power BI:

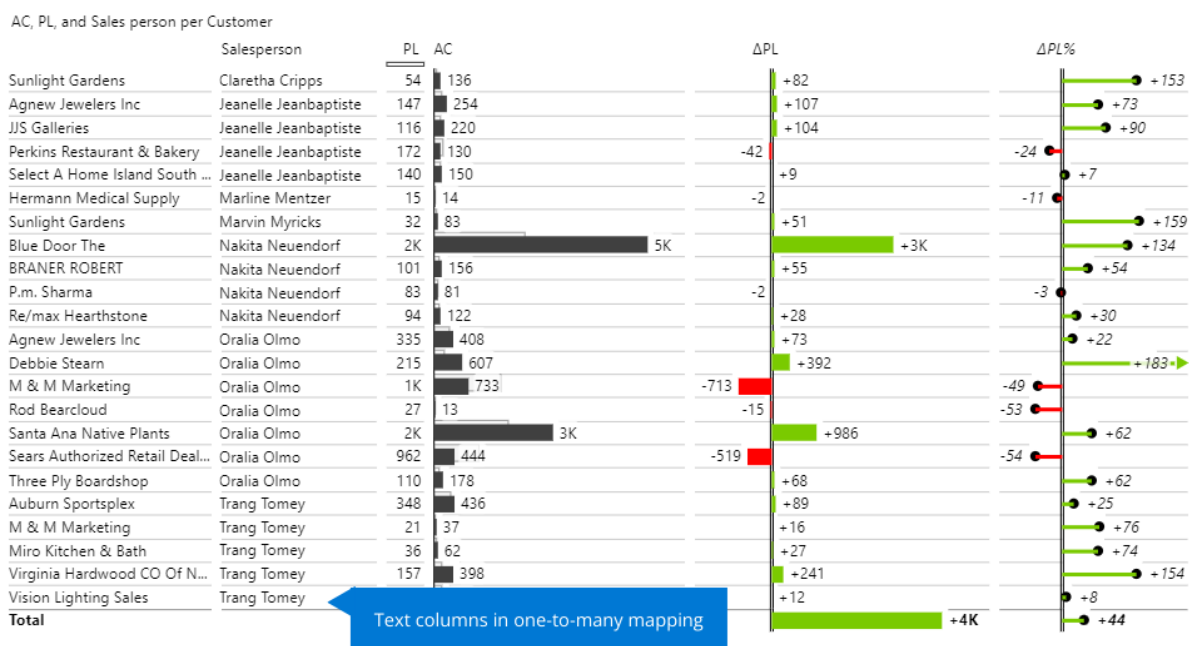


With this feature, you can now display multiple text columns in a tabular way, which leads to a better understanding of the data when displaying more attributes of the same Category. Additionally, there is no need to apply any complex **DAX** functions. Simply add additional text columns into the 'Values' placeholder.

Some popular use cases include:

- in **one-to-one mapping**, you usually need to add additional information next to the descriptive column to ensure data accuracy, consistency and ease of reference:
  - Product ID: Product name
  - Product ID: SKU: Shipping / Order ID
  - Job ID: Job title
- The new feature also works in cases with **one-to-many mapping**, e.g.
  - Customer: Sales representatives because the same person can represent multiple customers.

You can also add multiple text columns when presenting data in a hierarchical table or using cross-tables for quarterly performance.



### Funnel Chart by Powerviz

The Funnel Chart by Powerviz is their take on the Funnel chart. It has four [4] chart types in one visual, including a Pyramid chart. The Power BI-certified visual is useful for tracking progress through different stages. It may also group data with legends for detailed insights.

Key features include:

- **Funnel settings:** multiple display types are available, including vertical and horizontal orientation
- **Data colours:** offers seven [7] schemes and 30+ colour palettes
- **Labels:** select from multiple display styles with a custom label option included
- **Conversion rate:** in a single click, measure the percentage of top and bottom stages to identify bottlenecks
- **Fill patterns:** highlight stages with custom or pre-filled patterns
- **Conditional formatting:** create rules based upon measure or category rules.

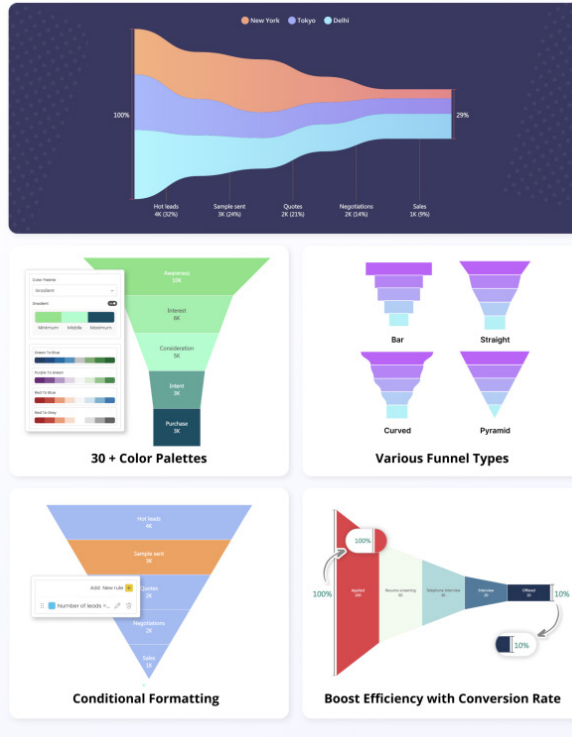
Many other features included are ranking, annotation, grid view, show condition and accessibility support.

Business use cases include:

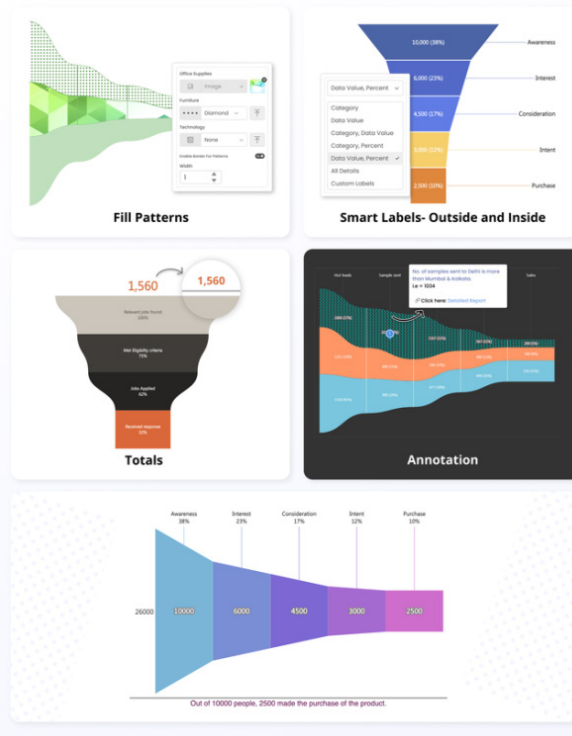
- **Sales funnel analysis:** track sales stages
- **Marketing campaigns:** assess lead generation and conversion rates
- **User onboarding:** monitor steps to product adoption.
- **Website traffic:** visualise visitor drop-offs.



**INTRODUCING AN ADVANCED FUNNEL CHART BY POWERVIZ**  
WITH HORIZONTAL/VERTICAL ORIENTATION, VARIOUS FUNNEL TYPES, CONVERSION RATE & MORE.



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**Create interactive timelines with full control**

Drill Down Timeline PRO allows you to create timelines with a date / time hierarchy. You may click directly on the chart to drill down to examine specific periods in detail. You can combine multiple series and choose between multiple chart types (line, column and area).

Main features include:

- on-chart interactions: click on chart to drill down to months, days, hours or milliseconds
- customise up to 25 series
- **DAX** measure support
- apply conditional formatting
- use series defaults and value labels defaults to customise multiple series
- static and dynamic thresholds: set up to four [4] thresholds to demonstrate targets
- full customisation: colours, gradients, backgrounds, fonts and more
- touch device friendly: explore data on any device (not sure that includes remote controls, microwaves and Rubik's cubes...).

Popular use cases include:

- **Banking and Finance:** stock exchange indices, capital ratios, transaction volumes
- **Sales and Marketing:** web traffic, audience reach, sales revenue
- **Information Technologies:** network traffic, response times, syslog and error trends
- **Manufacturing:** quality metrics, uptime and downtime, production output and cost.



#### **Enhanced accessibility in paginated reports authored in Report Builder**

The **StructureTypeOverwrite** property has been added to the .rdl model. You can use it to improve accessibility for paginated reports in Microsoft Report Builder and Power BI Report Builder. You can then publish these reports to the Power BI Service.

## Skill up on Fabric with the Microsoft Learn Cloud Skills Challenge

Microsoft has announced the **Microsoft Ignite: Microsoft Fabric Challenge** as part of the Microsoft Learn Cloud Skills Challenge. You can skill up for in-demand tech scenarios and enter to win a VIP pass to the next Microsoft Ignite. The challenge is on until Monday 15 January 2024.

In this challenge, you will learn how to connect to data, ingest it with Data Factory and notebooks, store it in the lakehouse or data warehouse, and

create Power BI reports to turn your data into competitive advantage.

The challenge will help you prepare for the **Microsoft Certified: Fabric Analytics Engineer Associate** certification and new Microsoft Applied Skills credentials covering the lakehouse and data warehouse scenarios, which are coming in the next few months.

## Dynamic dataset binding for paginated reports

You can now use dynamic binding to maintain a single template of an RDL report that can be connected to multiple datasets across workspaces, instead of copying and maintaining hundreds of report duplicates. You don't need to create copies of the same report with a different dataset. You can bind datasets dynamically to a paginated report or a paginated report visual.

More next month!

## New Features for Excel

This month sees several new features rolling out across Excel for the web, Windows and Mac. The Automate Work button, Formula Authoring Enhancements and 'Queries and Connection' pane are now available in Excel for the web. Furthermore, web connector enhancements

and 'Optimized Narrator Screen Announcements' have started rolling out to users of Excel for Windows. Finally, checkboxes in cells and the ability to control your data conversions come to Insider users [on Excel for Windows].

You can check out the full list here:

### Excel for the web

- 'Automate Work' button
- Formula authoring enhancements
- 'Queries and Connections' Pane

### Excel for Windows

- Checkboxes in cells (Insiders)
- Control data conversions
- Web connector enhancements
- Optimising Screen Narrator Announcements

### Excel for Mac

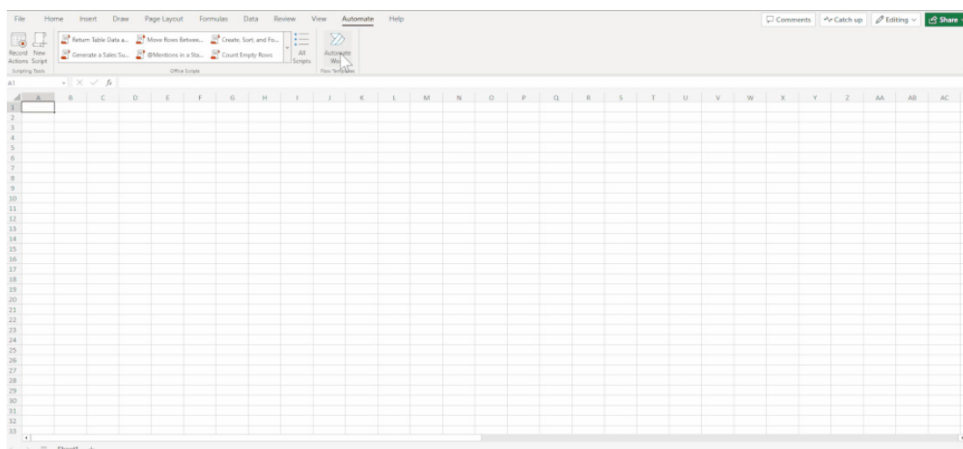
- Control data conversions.

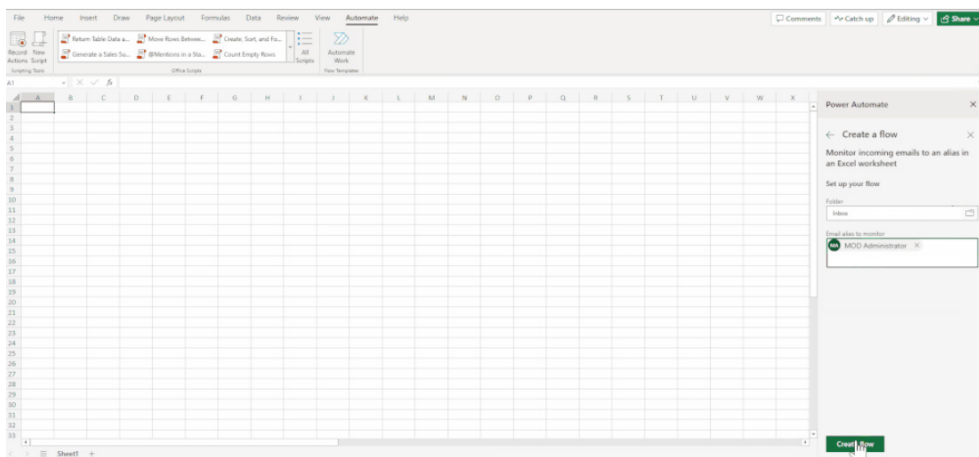
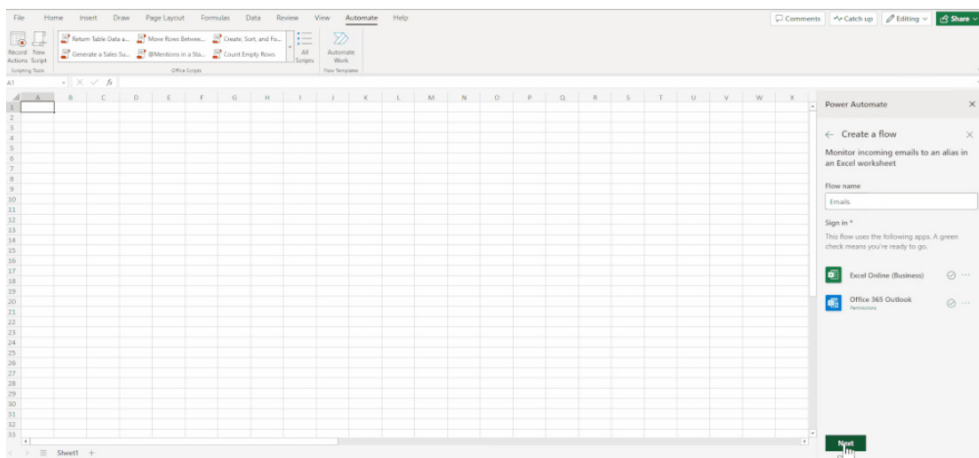
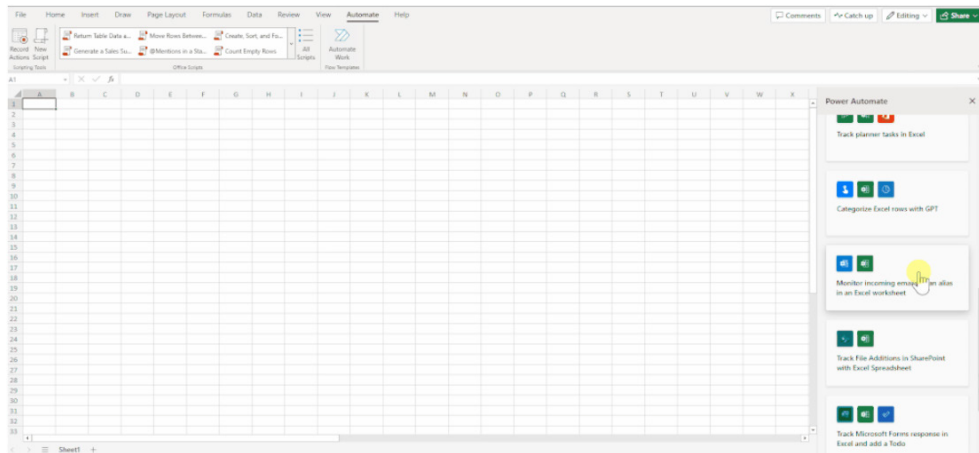
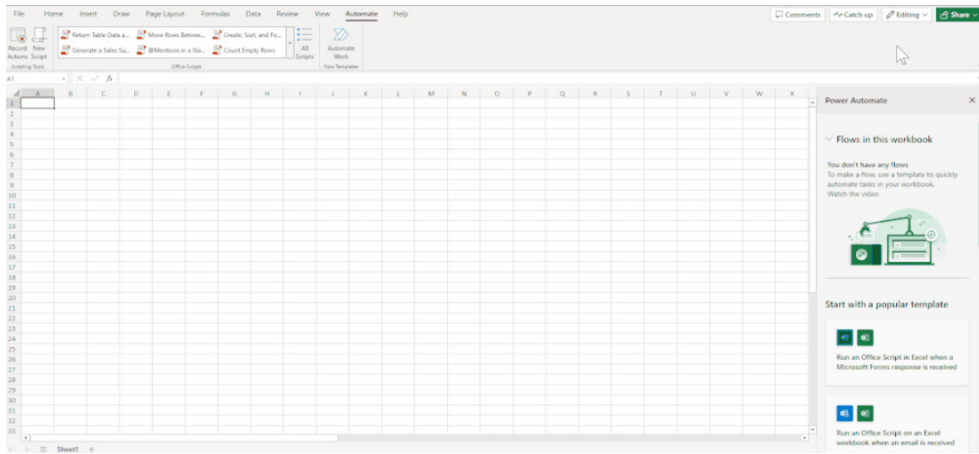
Let's get started.

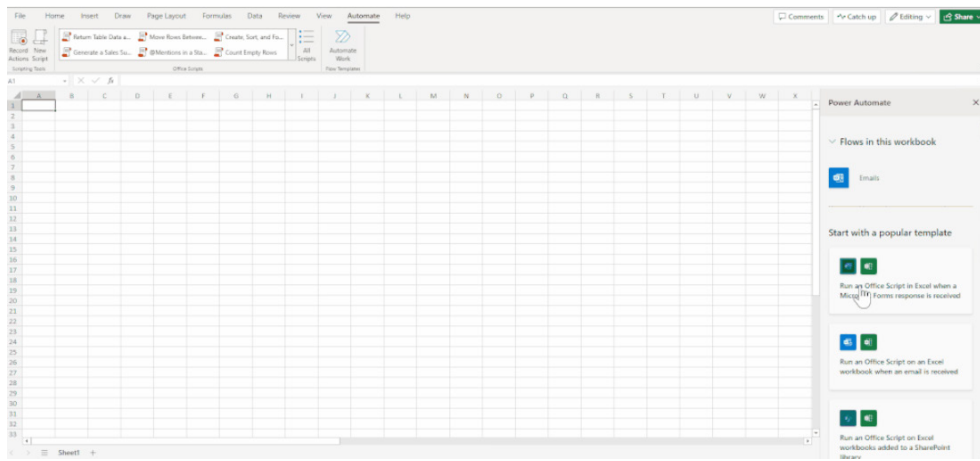
### 'Automate Work' button

There is a new 'Automate Work' button in Excel for the web (if only real life were like this), powered by Power Automate, making it easier to automate tasks and run processes efficiently from anywhere. The new 'Automate Work' button replaces the 'Automate a Task' button, extending Power Automate's capabilities to Excel for the web by providing access to pre-built templates and allowing users to build workflows quickly and easily.

For example, you can automatically capture customer feedback from emails and store it in an Excel for the web worksheet using the 'Monitor incoming emails to an alias in an Excel worksheet' template. With this template, businesses can keep track of customer feedback in one centralised location, making it easy to respond to customer needs and improve customer satisfaction.







The new 'Automate Work' button is currently available in Excel for the web for users that have a commercial or EDU license that gives access to the Microsoft 365 office desktop apps (e.g. Office 365 E3 and E5 licenses) only.

It should be noted that if you do not have the Automate tab in Excel for the web, your administrator may have disabled the feature.

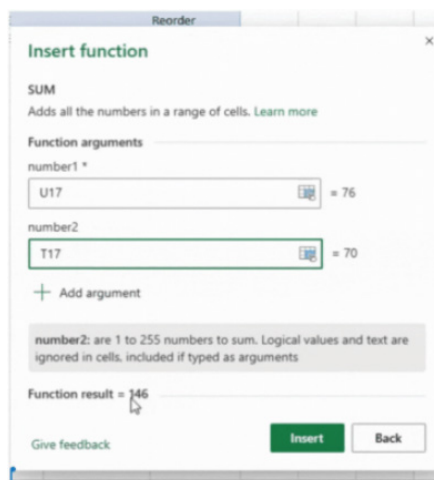
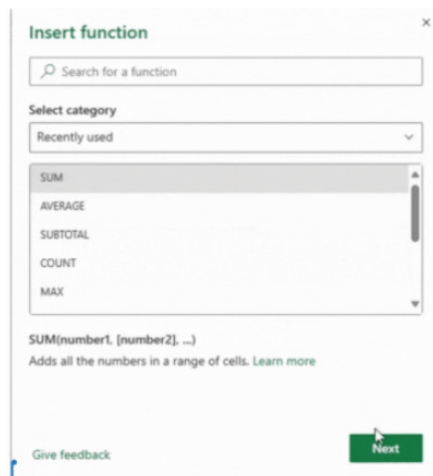
### Formula authoring enhancements

There is a new set of capabilities in Excel for the web that help make creating and correcting formulae easier, enabling you to work on your spreadsheets more effectively and confidently. They are detailed below.

#### 1. INSERT FUNCTION DIALOG

The 'Insert Function' dialog simplifies the process of building complex formulae, as it provides a user-friendly interface to help you select the right function and its arguments. Now, you may quickly look up a function or browse through categories to find what you need. Each

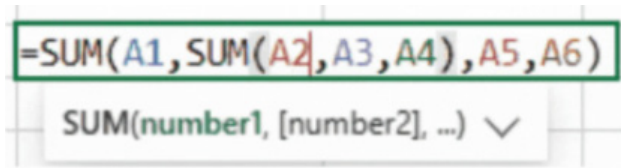
function comes with a description and expected arguments, and you get a preview of each argument's value and the complete formula. You may access the dialog from the Formulas tab and then click the 'Insert Function' button or otherwise by clicking the **fx** button on the Formula bar.



## 2. PARENTHESES COUPLING

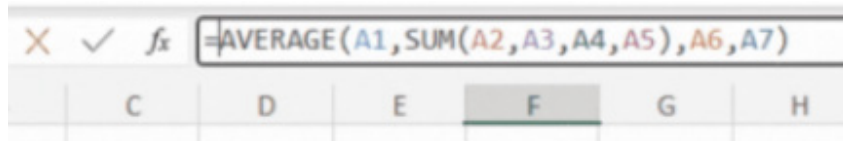
Parentheses Coupling enhances the readability of long or complex formulae by visually highlighting the corresponding pair of parentheses based upon your cursor's position. When you position your cursor within a set of parentheses, Parentheses Coupling intelligently highlights

the corresponding closing parenthesis. This visual indicator simplifies the identification of paired parentheses allowing you to concentrate on the specific section of the formula you are currently editing.



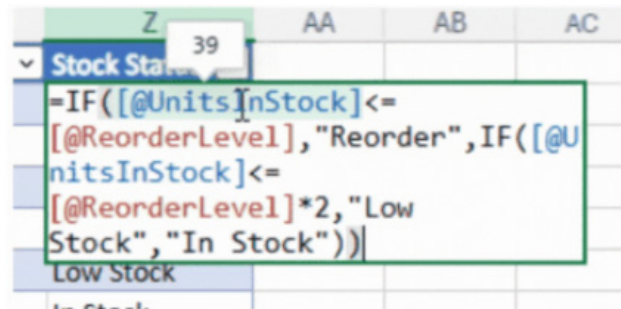
## 3. MONOSPACED FONT

Monospaced font introduces a fixed-width font experience in Formula Edit (F2) mode, improving the formula creation, editing and reading experience. This should enhance formula readability and complements features like parentheses coupling and value preview.



## 4. VALUE PREVIEW

Value Preview simplifies the evaluation and troubleshooting of formulae by providing real-time displays of the value associated with any part of a formula when you hover your mouse pointer over the section or select it. This feature is currently rolling out to Windows users.

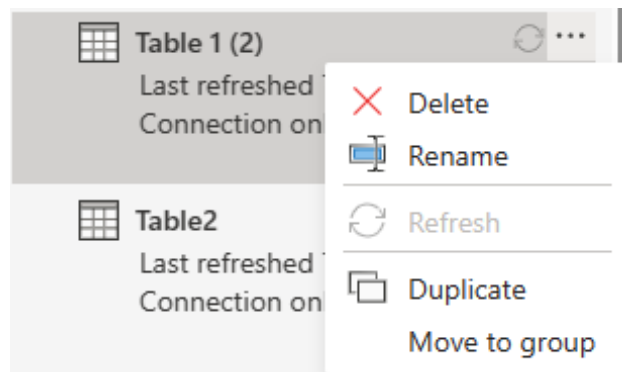


## 'Queries and Connections' Pane

By using the 'Queries and Connections' pane, you can:

- delete a query
- rename a query
- duplicate a query
- drag and drop a query into a folder or change its order.

To open it, go to **Data -> Queries & Connections**. This feature is already supported for Windows users.

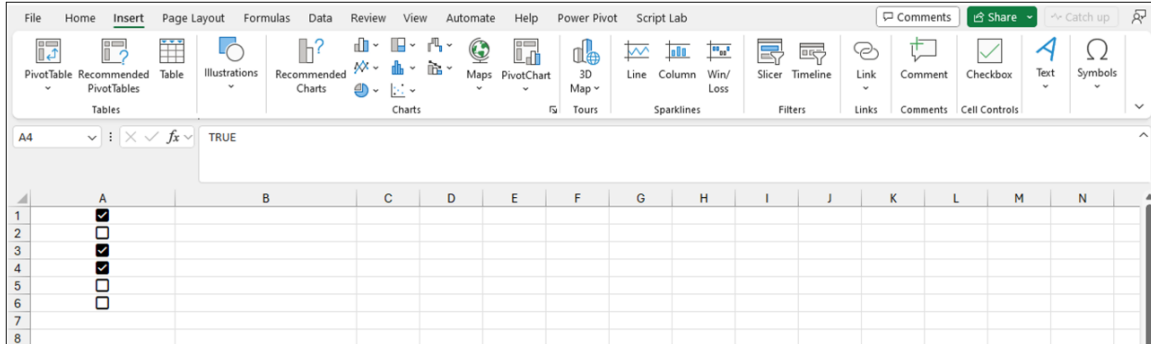


## Checkboxes in cells (Insiders)

Microsoft has stated that checkboxes in cells is a top end user feature request for simplifying data entry and reducing user errors. Therefore, the Excel team is adding a new Ribbon group called 'Cell Controls' to Excel for Windows. The checkbox is the first control being added, but we are assured more is on the way.

It works as follows:

- Open an existing Excel workbook or create one
- On the Insert tab, select Checkbox in the 'Cell Controls' group.



You should note that checkboxes appear in the selected cells. Also, it may be seen that blank cells are automatically set to FALSE and any existing values and formulae in the cells remain the same. Do remember checkbox formatting only works with Boolean values and blank cells. Any other cell values, e.g. numbers and text, will be ignored.

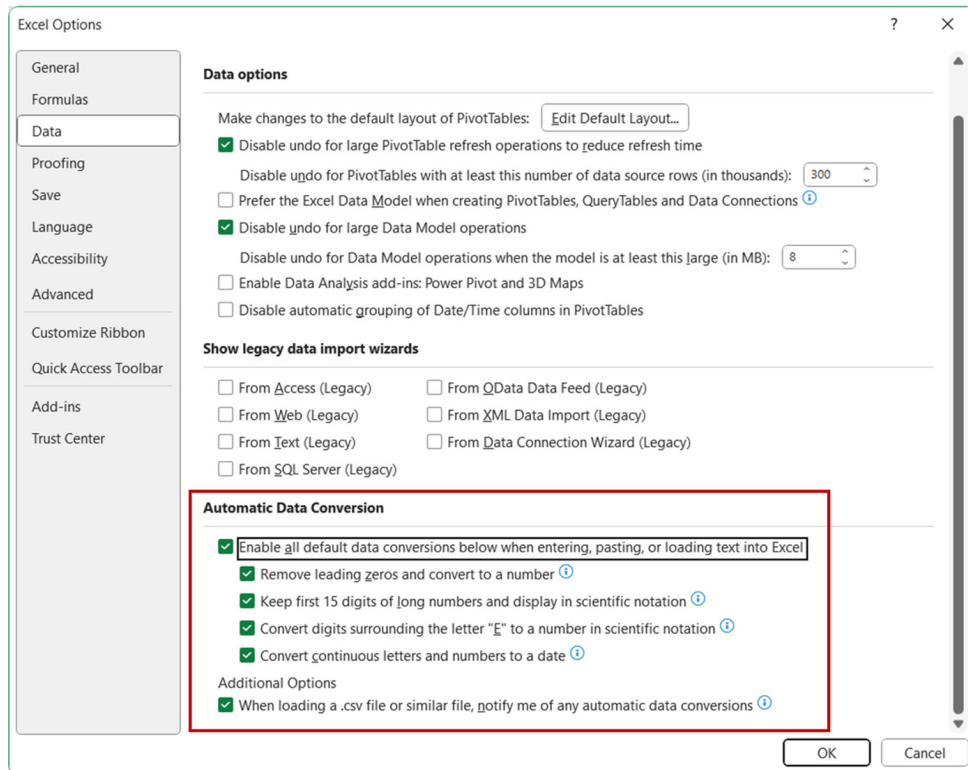
If the active cell has a checkbox, you can toggle the values of all selected checkboxes by pressing the space bar.

One other thing: you can't directly remove checkbox formatting in a cell. To do so, you'll need to select **Home -> Clear -> Clear Formats**.

This feature is available to Beta Channel users running Version 2310 (Build 196924.2000) or later.

## Control data conversions

This new functionality allows you to change Excel's default behaviour and disable specific types of automatic data conversions as needed. This way, you won't need to worry about your data being converted to a format that you didn't want and weren't expecting. This feature is currently rolling out to Windows and Mac users.



You can enable or disable the following options:

- remove leading zeros from numerical text and convert to a number
- truncate numerical data to 15 digits of precision and convert to a number that may be displayed in scientific notation, if needed
- convert numerical data surrounding the letter “E” to a number displayed in scientific notation
- convert a continuous string of letters and numbers to a date.

When you select the ‘When loading a .csv file or similar file, notify me of any automatic number conversions’ check box, Excel displays a warning message when it detects that at least one of the optional automatic data conversions is enabled and about to occur when opening a .csv or .txt file. The message gives the ability to open the file once without converting the data.

The feature does not support disabling these conversions during macro execution.

This feature is available to all users running:

- Windows: Version 2309 (Build 16808.10000) or later
- Mac: Version 16.77 (Build 23091003) or later.

### **Web connector enhancements**

The web connector for Excel (alternatively known as ‘Get Data From Web’) is a tool that allows you to connect to websites and import data into your Excel workbook. The Web connector leverages the abilities of Power Query in Excel to import data. You may also refresh your data connection to get the latest updates from the selected websites.

Presently, this new Web connector will only be available in Excel for Windows. Microsoft has plans to support Excel for Web and Excel for Mac in the future.

So what are the new features and enhancements?

- **Suggested Tables:** provides auto-detection of suggested tables, so you can easily structure your data
- **Add Table Using Examples:** allows you to provide examples of what you want your data to look like and select from AI-generated table structures based on the examples provided.

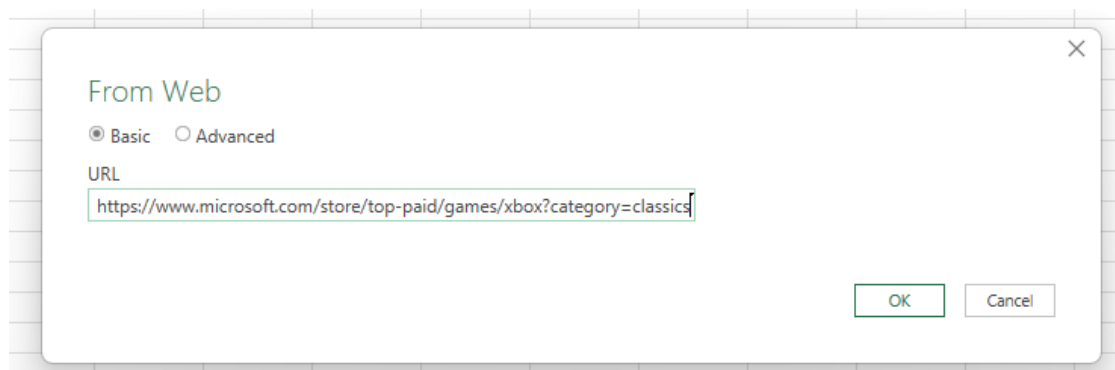
The new Web connector in Excel is available as part of an Office 365 subscription.

Here are some examples of using the new features. In general, to use the Web connector for Excel, follow these steps:

1. Open Excel and create a new workbook or open an existing one
2. Go to the Data tab and click on From Web
3. Enter the Web page URL from which you'd like to extract data

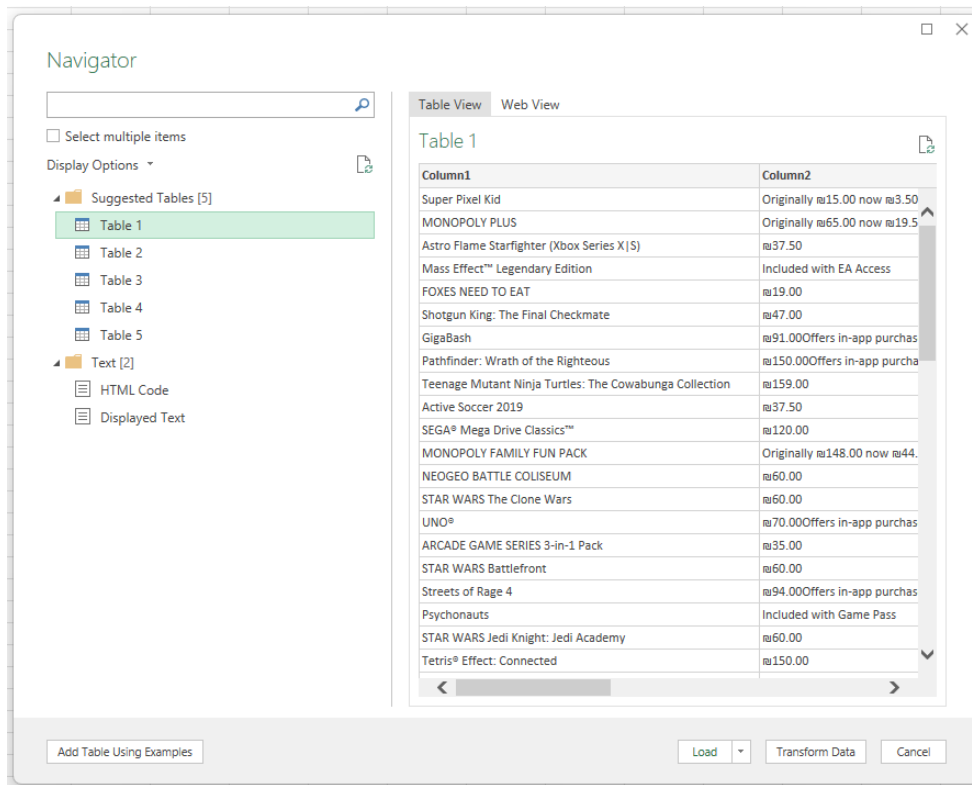
Here, we'll use the Microsoft Store Web page, and show how this connector works. If you want to follow along, you can use the Microsoft Store URL that we use in this article:

<https://www.microsoft.com/store/top-paid/games/xbox?category=classics>

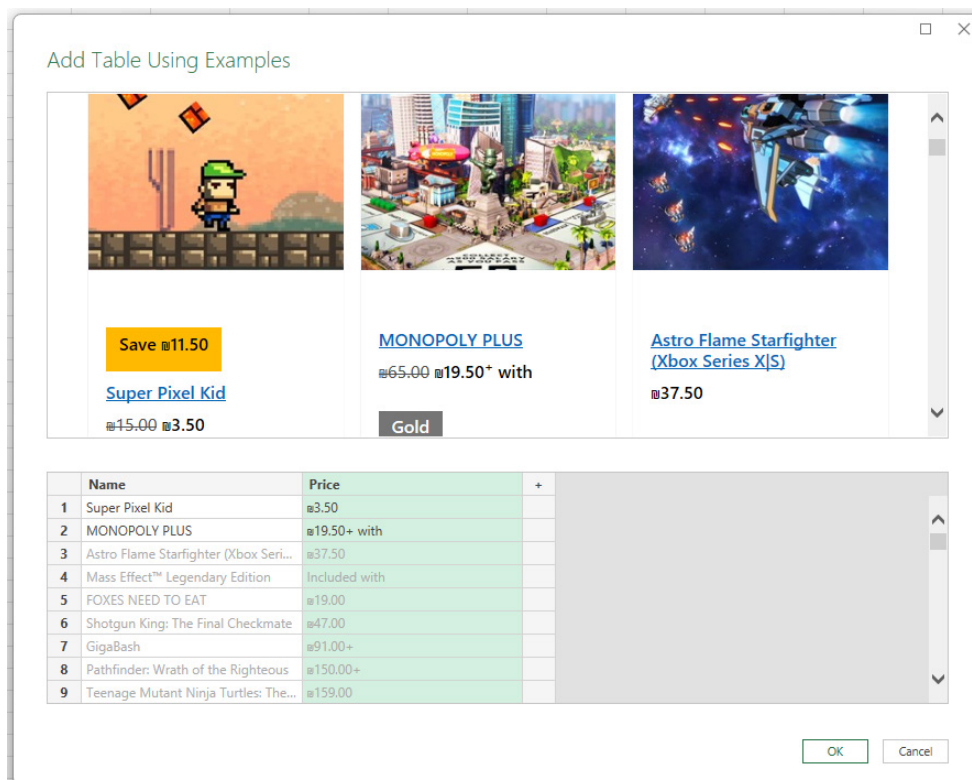


4. When you select OK, you're taken to the Navigator dialog box where you can see Suggested Tables, which are autodetected tables from the Web page. In the case shown in the image below, five [5] tables were found

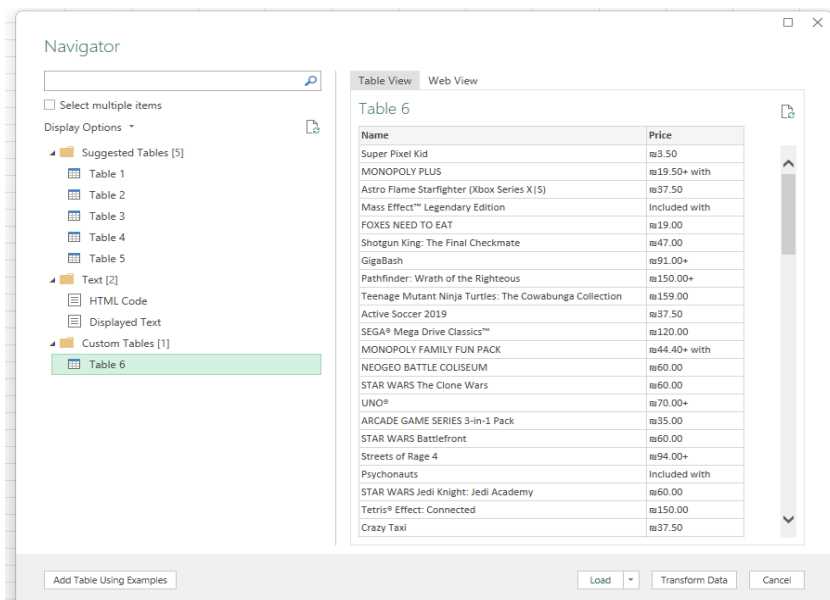




- Alternatively, you can use the new 'Add Table Using Examples' feature, which presents an interactive window, where you can preview the content of the Web page. Simply enter sample values of the data you want to extract
- In this example, you'll extract the **Name** and **Price** for each game on the page. You can do that by specifying a couple of examples from the page for each column. As you enter examples, Power Query extracts data that fits the pattern of example entries using smart data extraction algorithms.



- Once you're happy with the data extracted from the Web page, select OK to add the data to the list, and select the custom table that was created:



- You can use Transform Data to shape your data with the Power Query Editor or Load to load the data to the Excel grid.

### Optimising Screen Narrator Announcements

Microsoft has announced a new and improved Narrator screen reader announcements in Excel for Windows. Announcements are now more concise, customisable via keyboard shortcuts, and give more context about your spreadsheet. These are new with the latest Windows.

A screen reader is assistive technology for people who prefer to hear content versus see it (or cannot see it). For example, someone who is blind or who has low vision might use a screen reader to use their computer, read emails or navigate their Excel spreadsheet.

The Windows operating system comes with a screen reader pre-installed, called Narrator. You can turn on Narrator on any Windows device by pressing **CTRL + WINDOWS + ENTER**.

The Windows team has added a new experimental capability where app teams may optimise screen reader announcements based upon their scenarios, indicating what information is most relevant to them at any given time. Here are some highlights:

- more succinct reading when navigating in the grid and selecting cells, both within tables and in spreadsheets that do not use tables
- explicit announcements if a cell is blank
- succinct, explicit announcements when cells contain non-text or unclear information like conditional formatting, data validation and formulae
- better handling of merged cells
- more information about collaborators on cells that someone else has selected or is editing
- customisable order of announcements for grid cells (e.g. “A1 blank” vs “blank A1”).

Before the update, Narrator used to say “A1, selected, editable, column 2 row 2, item, test, cell” when you navigated to cell A1 with data called test. Now it simply says “test, A1”. This saves time for people who use screen readers and makes skimming a workbook to find the right information more efficient.

The updated version of the grid with all the new features is fast becoming too complicated to show clearly here. Nonetheless, you can find the interactive links at [aka.ms/ExcelFeaturesFlyer](https://aka.ms/ExcelFeaturesFlyer).

Excel Features Availability

Feature	Insider		Production				Web
	Windows <small>Find the latest Excel version for this platform</small>	Mac <small>Find the latest Excel version for this platform</small>	Windows/CC <small>Find the latest Excel version for this platform</small>	Windows/MCC <small>Find the latest Excel version for this platform</small>	Windows/SA <small>Find the latest Excel version for this platform</small>	Mac <small>Find the latest Excel version for this platform</small>	
<a href="#">Block XL1 Add-ins</a>	Version 2302 (Build 16130.20128) or later						
PivotTables: Manual Sort of Rows & Columns			Already Supported	Already Supported	Already Supported	Already Supported	February 2023
<a href="#">Automatic Recalculation Optimisation</a>	Version 2308 (Build 15928.10000) or later	Version 16.64 (Build 22081401) or later					
<a href="#">Import Data from SQL Server Database</a>		Version 16.68 (Build 22109001) or later					
<a href="#">Import Data from Additional Sources</a>						Version 16.69 (Build 23010900) or later	
<a href="#">Power Query Editor</a>						Version 16.69 (Build 23010900) or later	
<a href="#">IMAGE function</a>			Version 2211 (Build 15831.20190) or later	Version 2211 (Build 15831.20152) or later		Version 16.87 (Build 22102900) or later	December 2022
<a href="#">Check Formulas with Values, Preview Tooltips</a>	Version 2302 (Build 16116.20000) or later	Version 16.70 (Build 230116) or later					
<a href="#">Office Scripts</a>	Version 2112 (Build 15922.20000) or later	Version 16.68 (Build 22101001) or later					
<a href="#">Automate Tasks with Power Automate Task</a>			Version 2302 (Build 16703.10000) or later			Version 16.66 (Build 22092500) or later	
<a href="#">PivotTable Show Details to K10</a>							January 2023
<a href="#">Excel Live in Teams</a>							December 2022
<a href="#">Formula Suggestions</a>							December 2022*
<a href="#">Formulas by Example</a>							December 2022*
<a href="#">Suggested Links</a>							December 2022
<a href="#">Add search bar in queries pane</a>							December 2022

\*Starting to roll out

## Excel Features Availability

Page 2 of 4

Feature	Insider		Production				Web
	Windows <a href="#">Find the latest Excel version for this platform</a>	Mac <a href="#">Find the latest Excel version for this platform</a>	Windows/CC <a href="#">Find the latest Excel version for this platform</a>	Windows/MEC <a href="#">Find the latest Excel version for this platform</a>	Windows/SA <a href="#">Find the latest Excel version for this platform</a>	Mac <a href="#">Find the latest Excel version for this platform</a>	
Add keyboard shortcut to open PQ editor			Version 2211 (Build 14728.20188) or later				
Create nested PQ data types	Version 2211 (Build 15928.10000) or later						
Add Get Data From Dynamic Arrays	Version 2205 (Build 14024.20051) or later						
Data from picture			Version 2210 (Build 15723) or later	Version 2210 (Build 15726.20482) or later		Version 16.88 or later	December 2022
Chart Data Falls							November 2022
Show Changes			Version 2208 (Build 15763.10000) or later			Version 16.66 (Build 22092500) or later	Already Supported
New Paste Options	Version 2210 (Build 15726.20000) or later						
Quickly Find the Command you need			Version 2208 (Build 15921.20010) or later				October 2022
New MAX Functions	Version 2208 (Build 15504.10000) or later						
Navigation Pane			Version 2208 (Build 15829.10000) or later				
Smooth Scrolling			Version 2205 (Build 15221.20092) or later	Version 2208 (Build 15601.20230)	Version 2208 (Build 15601.20454) or later	Already Supported	Already Supported
Check Performance							September 2022
Share Section of Excel Workbook							September 2022
Dynamic Array Support in Charts	Version 2209 (Build 15617.10000) or later			Version 2210 (Build 15726.20482) or later			September 2022
Modern Comments			Version 2208 (Build 15427.20000) or later				
Manage Your Storage Accounts from Mac		Version 16.64 (Build 22082100) or later					

Features Flyer: [aka.ms/ExcelFeaturesFlyer](https://aka.ms/ExcelFeaturesFlyer)

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## Excel Features Availability

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Feature	Insider		Production				Web
	Windows <a href="#">Find the latest Excel version for this platform</a>	Mac <a href="#">Find the latest Excel version for this platform</a>	Windows/CC <a href="#">Find the latest Excel version for this platform</a>	Windows/MEC <a href="#">Find the latest Excel version for this platform</a>	Windows/SA <a href="#">Find the latest Excel version for this platform</a>	Mac <a href="#">Find the latest Excel version for this platform</a>	
New Excel functions			Version 2208 (Build 15427.20194) or later	Version 2208 (Build 15601.20230) or later		Version 16.64 (Build 22084801) or later	August 2022
Faster Query Group operations							August 2022
Improvements to the connected Power BI experience	Version 2208 (Build 15603.20028) or later						August 2022
Add and edit rich text formatting			Already Supported	Already Supported	Already Supported	Already Supported	August 2022
Sort by color or icon from auto filter menu			Already Supported	Already Supported	Already Supported	Already Supported	August 2022
Edit files with legacy data connections			Already Supported	Already Supported	Already Supported	Already Supported	August 2022
Edit files with legacy Shared Workbook feature			Already Supported	Already Supported	Already Supported	Already Supported	August 2022
Delete chart elements							August 2022
Multiline formula bar							August 2022
Search within PivotTable Field List			Already Supported	Already Supported	Already Supported	Already Supported	July 2022
Set automatic data connections	Version 2207 (Build 15427.20000) or later						
Natural Language Query improvements			Version 2208 (Build 15320.20230) or later	Version 2205 (Build 15221.20156) or later		Version 16.63 (Build 22070801) or later	
Resize Conditional Formatting dialog box		Version 16.64 (Build 22070800) or later					
Sheet protection			Already Supported	Already Supported	Already Supported	Already Supported	June 2022

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Semi-select for links creation			Already Supported	Already Supported	Already Supported	Already Supported	June 2022
Add "PivotTable Connections to Slicer settings pane"			Already Supported	Already Supported	Already Supported		June 2022
Import from local text, CSV, and XLSX files						Version 16.57 (22011100) or later	
Provide automatic alt-text suggestions on charts and PivotCharts			Version 2205 (Build 15221.20288) or later	Version 2204 (Build 15128.20280) or later		Version 16.62 (22061100) or later	
Power Query refresh for selected data sources			Already Supported	Already Supported	Already Supported	Already Supported	May 2022
Changing source file for workbook links			Already Supported	Already Supported	Already Supported	Already Supported	May 2022
Improved Recommended PivotTable experience	Version 2204 (Build 15128.10000) or later						
Faster recalc on resource constrained devices		Version 16.62 (Build 22050804) or later	Version 2204 (Build 15128.20248) or later	Version 2204 (Build 15128.20280) or later			
Faster AutoFilter				Version 2204 (Build 15128.20248) or later	Version 2208 (Build 15601.20454) or later	Version 16.63 (22030700) or later	
Dataflow connector				Version 2203 (Build 15028.20248) or later			
Dataverse connector			Version 2204 (Build 15128.20178) or later				
Improved Find dialog and Find All						Version 16.60 (220410) or later	
LAMBDA Helper Functions			Version 2202 (Build 14915.20120) or later	Version 2202 (Build 14915.20274) or later	Version 2208 (Build 15601.20454) or later	Version 16.54 (Build 211211) or later	Already Supported

Features Flyer: [aka.ms/ExcelFeaturesFlyer](https://aka.ms/ExcelFeaturesFlyer)

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More next month, we're sure.

## The A to Z of Excel Functions: MDETERM



In mathematics, especially in areas such as linear algebra, matrices may be used to solve simultaneous equations. For the record, a matrix is not just a movie it's a rectangular arrangement of  $mn$  elements, in the dimensions of  $m$  rows by  $n$  columns, e.g. a matrix **A** (say) may be represented as

$$A = \begin{bmatrix} a_{11} & a_{12} & \dots & a_{1n} \\ a_{21} & a_{22} & \dots & a_{2n} \\ \dots & \dots & \dots & \dots \\ a_{n1} & a_{n2} & \dots & a_{nn} \end{bmatrix}_{m \times n}$$

It is often written in compact form as

$$A = [a_{ij}]_{m \times n}, 1 \leq i < m, 1 \leq j < n$$

Should the matrix be square (i.e.  $m = n$ ), then we may calculate a scalar value, known as the **determinant** which can be used to calculate matrix inverses, solve systems of linear equations and assist with calculus (unless it's really stuck on your teeth). For a square matrix **A**, this determinant is denoted by

$$\det \mathbf{A} \text{ or } |\mathbf{A}|$$

For example, with a 3 x 3 matrix, the determinant may be represented as

$$A = \begin{vmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{vmatrix}$$

Some texts state that if the determinant is zero, the matrix inverse does not exist, but this is not strictly correct, as there may be another multiplicative identity for such a matrix – but that's way beyond what we wish to talk about here!

To calculate it, the idea is as follows. For a 2 x 2 matrix,

$$|A| = \begin{vmatrix} a & b \\ c & d \end{vmatrix} = ad - bc$$

For a 3 x 3 matrix, the calculation extends:

$$|A| = \begin{vmatrix} a & b & c \\ d & e & f \\ g & h & i \end{vmatrix} = a \begin{vmatrix} e & f \\ h & i \end{vmatrix} - b \begin{vmatrix} d & f \\ g & i \end{vmatrix} + c \begin{vmatrix} d & e \\ g & h \end{vmatrix}$$

$$= aei + bfg + cdh - ceg - bdi - afh$$

In this situation, each determinant of the three  $2 \times 2$  matrices is called a **minor** of the matrix **A**. This procedure can be extended to give a recursive definition for the determinant of an  $n \times n$  matrix, known as a **Laplace expansion**. It sounds a bit like my waistline.

The Excel function **MDETERM** returns the matrix determinant of an array. It has the following syntax:

**MDETERM(array)**

where:

- **array** is required, and represents a numerical **array** with an equal number of rows and columns.

It should be noted that:

- **array** may be given as:
  - a cell range, e.g. **A1:C3**
  - an **array** constant, such as **{1,2,3;4,5,6;7,8,9}**
  - a name to either of these
- **MDETERM** returns the **#VALUE!** error when:
  - any cells in array are empty or contain text
  - **array** does not have an equal number of rows and columns
- the matrix determinant is a number derived from the values in the **array**. For a three-row, three-column array, **A1:C3**, the determinant is defined as:

**MDETERM(A1:C3)** equals

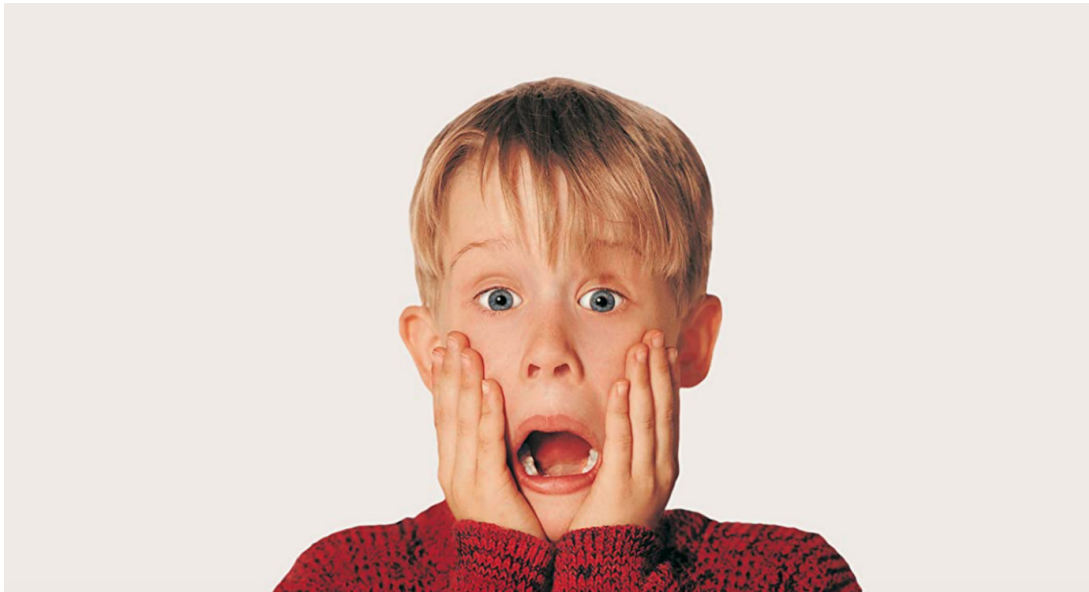
$$A1 * (B2 * C3 - B3 * C2) + A2 * (B3 * C1 - B1 * C3) + A3 * (B1 * C2 - B2 * C1)$$

- matrix determinants are generally used for solving systems of mathematical equations that involve several variables
- **MDETERM** is calculated with an accuracy of approximately 16 digits, which may lead to a small numeric error when the calculation is not complete. For example, the determinant of a singular matrix may differ from zero by 1E-16.

As an example:

	A	B	C	D	E	F	G	H
1	Data							
2	1	3	8	5				
3	1	3	6	1				
4	1	1	1	0				
5	7	3	10	2				
6								
7								
8						<b>=MDETERM(A2:D5)</b>	Determinant of highlighted matrix	<b>88</b>
9						<b>=MDETERM({3,6,1;1,1,0;3,10,2})</b>	Determinant of the matrix as an array constant	<b>1</b>
10						<b>=MDETERM({3,6,1,1})</b>	Determinant of the matrix as an array constant	<b>-3</b>
11						<b>=MDETERM({1,3,8,5;1,3,6,1})</b>	Returns an error, as the array constant does not have an equal number of rows and columns	<b>#VALUE!</b>
12								

## The A to Z of Excel Functions: MDURATION



Not to be confused with **PDURATION**, this function returns the modified Macauley duration for a security with an assumed par value of \$100.

Whereas the modified duration measures the price sensitivity of a bond when there is a change in the yield to maturity, the (modified) Macauley duration calculates the weighted average time before a bondholder would receive the security's cash flows. It is frequently used by portfolio managers who wish to adopt what is known as an immunisation strategy (nothing to do with COVID-19).

The Macauley duration is calculated by multiplying the time period by the periodic coupon payment and dividing the resulting value by 1 plus the periodic yield raised to the time to maturity. Next, the value is calculated for each period and added together. Then, the resulting value is added to the total number of periods multiplied by the par value, divided by one [1], plus the periodic yield raised to the total number of periods. This is then divided by the current bond price.

$$\text{Macauley Duration} = \frac{\left( \sum_{t=1}^n \frac{t \cdot C}{(1+y)^t} + \frac{n \cdot M}{(1+y)^n} \right)}{\text{Current bond price}}$$

**where:**

$C$  = periodic coupon payment

$y$  = periodic yield

$M$  = the bond's maturity value

$n$  = duration of bond in periods

As stated above, the **MDURATION** function returns this modified Macauley duration for a security with an assumed par value of \$100. It employs the following syntax to operate:

**MDURATION(settlement, maturity, coupon, yield, frequency, [basis])**

The **MDURATION** function has the following arguments:

- **settlement:** this is required and represents the security's settlement date. The security settlement date is the date after the issue date when the security is traded to the buyer
- **maturity:** this is also required, and is the security's maturity date, *i.e.* when the security expires
- **coupon:** again required, this is the security's annual **coupon** rate
- **yield:** another required argument, this is the security's annual **yield**
- **frequency:** another mandatory field, this is the number of coupon payments per year. For annual payments, **frequency** is 1; for semiannual, **frequency** is 2; for quarterly, **frequency** is 4. These are the only options (*see below*)
- **basis:** the type of day count basis to use. This is optional. There are five options:

Basis	Day count basis
0 or omitted	US (NASD) 30 / 360
1	Actual / actual
2	Actual / 360
3	Actual / 365
4	European 30 / 360

It should be further noted that:

- Microsoft Excel stores dates as sequential serial numbers so they can be used in calculations. By default, January 1, 1900 is serial number 1, and January 1, 2008 is serial number 39448 because it is 39,448 days after January 1, 1900
- dates should be entered using the **DATE** function, or as results of other formulae or functions. For example, use **=DATE(2020,2,29)** for the 29<sup>th</sup> of February 2020. Problems may occur if dates are entered as text
- the settlement date is the date a buyer purchases a coupon, such as a bond. The maturity date is the date when a coupon expires. For example, suppose a 30-year bond is issued on January 1, 2008, and is purchased by a buyer six months later. The issue date would be January 1, 2008, the settlement date would be July 1, 2008, and the maturity date would be January 1, 2038, 30 years after the January 1, 2008, issue date
- the arguments **settlement**, **maturity**, **frequency** and **basis** are truncated to integers
- if **settlement** or **maturity** is not a valid date, **MDURATION** returns the **#VALUE!** error value
- if **yield** is less than zero [0], **MDURATION** returns the **#NUM!** error value
- if **frequency** is any number other than 1, 2, or 4, **MDURATION** returns the **#NUM!** error value
- if **basis** < 0 or if **basis** > 4, **MDURATION** returns the **#NUM!** error value
- if **settlement** ≥ **maturity**, **MDURATION** returns the **#NUM!** error value
- Excel calculates **MDURATION** as follows:

$$\text{MDURATION} = \frac{\text{DURATION}}{1 + \left( \frac{\text{Market yield}}{\text{Coupon payments per year}} \right)}$$

Please see our example below:

	A	B	C
1	Data	Description	
2	01-01-22	Settlement date	
3	01-Jan-24	Maturity date	
4	8%	% Coupon	
5	9%	% Yield	
6	2	Frequency is semi-annual	
7	1	Actual / actual basis	
8			
9			
10	Formula	Description	Result
11	<b>=MDURATION(A2,A3,A4,A5,A6,A7)</b>	The modified duration, for the bond with the terms specified in A2:A7	<b>1.805</b>

## The A to Z of Excel Functions: MEDIAN



In statistics and probability theory, the median is the value separating the higher half from the lower half of a data sample, population or probability distribution. For a dataset, it may be thought of as "the middle" value. The basic feature of the median in describing data compared to the mean (often simply described as the "average") is that it is not skewed by a small proportion of extremely large or small values, and therefore provides a better representation of a "typical" value. Median income, for example, may be a better way to suggest what a "typical" income

is, because income distribution can be very skewed. The median is of central importance in robust statistics, as it is the most resistant statistic, having a breakdown point of 50%: so long as no more than half the data are contaminated, the median is not an arbitrarily large or small result.

The **MEDIAN** function measures what is known as "central tendency", which is the location of the centre of a group of numbers in a statistical distribution. There are three common measures of central tendency:

The **MEDIAN** function measures what is known as "central tendency", which is the location of the centre of a group of numbers in a statistical distribution. There are three common measures of central tendency:

- **Average:** the arithmetic mean, calculated by adding a group of numbers and then dividing by the count of those numbers. For example, the average of 2, 3, 3, 5, 7, and 10 is 30 divided by 6, which is 5
- **Median:** the middle number of a group of numbers; that is, half the numbers have values that are greater than the median, and half the numbers have values that are less than the median. For example, the median of 2, 3, 3, 5, 7, and 10 is 4. If the number of values in the selection is an even number, the median is defined as the midpoint between the two central numbers
- **Mode:** the most frequently occurring number in a group of numbers. For example, the mode of 2, 3, 3, 5, 7, and 10 is 3.

For a symmetrical distribution of a group of numbers, these three measures of central tendency are all the same. For a skewed distribution of a group of numbers, they can be different.

The **MEDIAN** function employs the following syntax to operate:

**MEDIAN(number1, [number2], ...)**

The **MEDIAN** function has the following arguments:

- **number1:** this is required. The first number, cell reference, or range for which you want the median
- **number2, ...:** this is optional. Additional numbers, cell references or ranges for which you want the median, up to a maximum of 255 in total.



It should be further noted that:

- if there is an even number of numbers in the set, then **MEDIAN** calculates the average of the two numbers in the middle
- arguments may either be numbers or names, ranges or cell references that contain numbers
- logical values and text representations of numbers that you type directly into the list of arguments are counted
- if a range or cell reference argument contains text, logical values, or empty cells, those values are ignored; however, cells with the value zero are included
- arguments that are error values or text that cannot be translated into numbers cause errors.

You should bear in mind that when you calculate the median of cell values, there is a difference between empty cells and those containing the value zero. If you have cleared the 'Show a zero in cells that have a zero value' check box in the Excel Options dialog box in Excel, you may not realise zeros are being included in calculating the average. To locate

the 'Show a zero in cells that have a zero value' check box, go to **File -> Options -> Advanced** and look under 'Display options for this worksheet'.

Please see our final example below:

	A	B	C
1	Values	Average	Formula
2	1	1.00	=MEDIAN(A\$2:A2)
3	2	1.50	=MEDIAN(A\$2:A3)
4	3	2.00	=MEDIAN(A\$2:A4)
5	4	2.50	=MEDIAN(A\$2:A5)
6	0	2.00	=MEDIAN(A\$2:A6)
7		2.00	=MEDIAN(A\$2:A7)
8	{Text}	2.00	=MEDIAN(A\$2:A8)
9			
10			<i>A7 is a blank cell.</i>

More Excel Functions next month.

## Beat the Boredom Suggested Solution

Earlier in this month's newsletter, we posed a challenging question: given a large table of data, how can we create a set of data validated cells that would automatically update when you select a particular item in the previous cell?

Make	Ford
Model	Focus
Year	2018
Variant	Trend Manual
	Trend Auto
	Trend Manual
	Trend 5 Yr Auto
	Trend 5 Yr Manual
	Titanium Sedan Auto
	Titanium 5 Yr Sedan Auto
	Trend Sedan Auto
	Trend 5 Yr Sedan Auto

We gave you several restrictions:

- the solution needed to be scalable. Creating named ranges for each new type of make and model of vehicle was not acceptable, as it requires additional work should the data update and change
- the solution needed to deal with the awkward situation that different models of cars would all be made in the same year, so you couldn't just create a '2018' named range.

The solution we have isn't trivial, by any means. It comes in two parts:

1. transforming the dataset into a more useable format for our purposes; *and then*
2. building the data validation framework.

### 1. Transforming the Dataset

The first task is to convert the dataset into something more useable. Essentially, we need to establish a relationship between Make and Model, in a logical way. This is actually surprisingly difficult. It's easy to use a Group By command in Power Query to get to here:

	A <sup>B</sup> C Make	A <sup>B</sup> C Model
1	Toyota	Yaris
2	Toyota	Corolla
3	Toyota	Camry
4	Ford	Fiesta
5	Ford	Focus

... but it's quite difficult to establish it in two rows or two columns like the following:

Make	Column1	Column2	Column3
Toyota	Yaris	Corolla	Camry
Ford	Fiesta	Focus	

To do this, we further grouped the previous values into Tables, as follows:

	A <sup>B</sup> C Make	Table
1	Toyota	Table
2	Ford	Table

Make	Model
Toyota	Yaris
Toyota	Corolla
Toyota	Camry

Then, we created a custom function that would transpose the table and keep only the models in the result:

	A <sup>B</sup> C Make	Table	ABC <sub>123</sub> TransposeTable
1	Toyota	Table	Table
2	Ford	Table	Table

Column1	Column2	Column3
Yaris	Corolla	Camry

Removing the Table column and expanding the **TransposeTable** column then gives us our final result.

	ABC 123 Make	ABC 123 Column1	ABC 123 Column2	ABC 123 Column3	ABC 123 Column4
1	Toyota	Yaris	Corolla	Camry	null
2	Ford	Fiesta	Focus	null	null

We then just needed to repeat these steps to create relationship tables between Model and Year, and Model, Year and Variant.

Make	Column1	Column2	Column3	Column4
Toyota	Yaris	Corolla	Camry	
Ford	Fiesta	Focus		

Model	Column1	Column2	Column3	Column4
Yaris	2018	2017	2016	
Corolla	2018	2017	2016	
Camry	2018	2017	2016	
Fiesta	2018	2017	2016	
Focus	2018	2017	2016	

Model	Year	ModelYear	Column1	Column2
Yaris	2018	Yaris2018	Ascent Auto	Ascent Manual
Yaris	2017	Yaris2017	Ascent Auto	Ascent Manual
Yaris	2016	Yaris2016	Ascent Auto	Ascent Manual
Corolla	2018	Corolla2018	Ascent Auto	Ascent Manual
Corolla	2017	Corolla2017	Ascent Auto	Ascent Manual
Corolla	2016	Corolla2016	Ascent Auto	Ascent Manual
Camry	2018	Camry2018	Ascent	Ascent (Hybrid)
Camry	2017	Camry2017	Altise	Altise Hybrid
Camry	2016	Camry2016	Altise	Altise Hybrid
Fiesta	2018	Fiesta2018	Ambiente Auto	Ambiente Manual
Fiesta	2017	Fiesta2017	Ambiente Auto	Ambiente Manual
Fiesta	2016	Fiesta2016	Ambiente Auto	Ambiente Manual
Focus	2018	Focus2018	RS Manual	RS 5 Yr Manual
Focus	2017	Focus2017	RS Manual	RS Limited Edition Manual
Focus	2016	Focus2016	RS Manual	Sport Auto

## 2. Building the Data Validation Framework

Once those tables are in place, we essentially need a tool that would look up the first value (the Make of a car) and use that to find the corresponding models associated with that make. To do this, we created a simple table to find the right values.

Make	Ford
1	Fiesta
2	Focus
3	0
4	0
5	0
6	0
7	0
8	0
9	0
10	0

To populate this table, we're using a simple **INDEX(MATCH)** (or **XLOOKUP** for those that have it) to look for the **Make** in the first column of our Make / Model table, then specifying the column we want to pull in based on the index number in the list. Therefore, the formula looks like this:

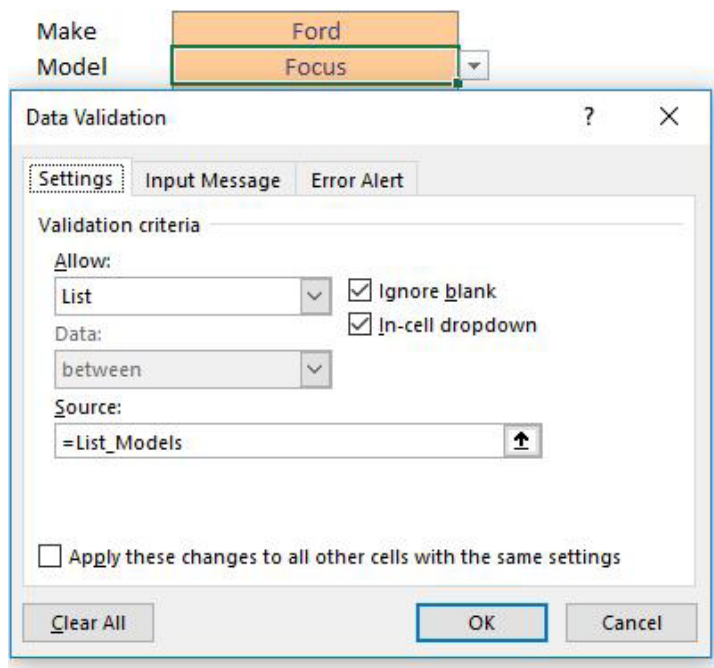
**=INDEX(MakeModel, MATCH(\$H\$2,MakeModel[Make],0),G22+1)**

where **G22** is the cell in the left-hand column of the above picture.

This tells us what models are linked to an input make. To turn this into a data validation list without the unused cells, we can create a Named Range called **List\_Models**, that refers to the cells:

**=OFFSET(Sheet1!\$H\$22,0,0,COUNTIF(Sheet1!\$H\$22:\$H\$31,"<>0"),1)**

**H22** is the first item (currently Fiesta) in a worksheet we have imaginatively called **Sheet1**. Starting from there, it picks up a range that is **X** rows tall, being the number of non-zero values in the list (in this case, only two[2]). We can then go into our input cell and set our data validation to point to the **List\_Models** named range:



All we need to do is repeat this process for each different parameter that we have! One Power Query output and one of these validation tables for every field after the first one. Then, we have one named range for each of those fields.

### Summary

This is a bit more convoluted than what you'll find on Google, but it's a far more flexible and scalable way to build multiple data validation lists that require very little (if any) additional rework once the file has been set up.

Until next month.

## Upcoming SumProduct Training Courses - COVID-19 update

Due to the COVID-19 pandemic that is currently spreading around the globe, we are suspending our in-person courses until further notice. However, to accommodate the new working-from-home dynamic, we are switching our public and in-house courses to an online delivery stream, presented via Microsoft Teams, with a live presenter running through the same course material, downloadable workbooks to complete the hands-on exercises during the training session, and a recording of the sessions for

your use within 1 month for you to refer back to in the event of technical difficulties. To assist with the pacing and flow of the course, we will also have a moderator who will help answer questions during the course.

If you're still not sure how this will work, please contact us at [training@sumproduct.com](mailto:training@sumproduct.com) and we'll be happy to walk you through the process.

Location	Course	Date	Date	Duration	Duration
Online (Australia)	Excel Tips and Tricks	5 Dec 2023	09:00-17:00 AEDT	(-1 day) 22:00-17:00 GMT	1 Day
Online (Australia)	Financial Modelling	6 - 7 Dec 2023	09:00-17:00 AEDT	(-1 day) 22:00-17:00 GMT	2 Days

## Key Strokes

Each newsletter, we'd like to introduce you to useful keystrokes you may or may not be aware of. We've started going through the alphabet actions. It's time to take the **P** this month...

Keystroke	What it does
<u>P</u> age Down	Page down
ALT + <u>P</u> age Down	Page right
CTRL + <u>P</u> age Down	Next sheet
SHIFT + <u>P</u> age Down	Extend selection page down
ALT + SHIFT + <u>P</u> age Down	Extend selection page right
CTRL + SHIFT + <u>P</u> age Down	Extend selection one sheet down
<u>P</u> age Up	Page up
ALT + <u>P</u> age Up	Page left
CTRL + <u>P</u> age Up	Previous sheet
SHIFT + <u>P</u> age Up	Extend selection page up
ALT + SHIFT + <u>P</u> age Up	Extend selection page left
CTRL + SHIFT + <u>P</u> age Up	Extend selection one sheet up

There are c.550 keyboard shortcuts in Excel. For a comprehensive list, please download our Excel file at [www.sumproduct.com/thought/keyboard-shortcuts](http://www.sumproduct.com/thought/keyboard-shortcuts). Also, check out our new daily **Excel Tip of the Day** feature on the [www.sumproduct.com](http://www.sumproduct.com) homepage.

## Our Services

We have undertaken a vast array of assignments over the years, including:

- **Business planning**
- **Building three-way integrated financial statement projections**
- **Independent expert reviews**
- **Key driver analysis**
- **Model reviews / audits for internal and external purposes**
- **M&A work**
- **Model scoping**
- **Power BI, Power Query & Power Pivot**
- **Project finance**
- **Real options analysis**
- **Refinancing / restructuring**
- **Strategic modelling**
- **Valuations**
- **Working capital management**

If you require modelling assistance of any kind, please do not hesitate to contact us at [contact@sumproduct.com](mailto:contact@sumproduct.com).

## Link to Others

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## Any Questions?

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