# Microsoft Power BI

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# Introduction

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- Microsoft Power BI is a collection of apps, software services and connectors that come together to turn unrelated data into visually impressive and interactive insights.
  - Power BI can work with simple data sources like Microsoft Excel and complicated ones like cloud-based or on-premises hybrid Data warehouses. Power BI has the capabilities to easily connect to your data sources, visualise and share and publish your findings with anyone and everyone.
  - Power BI is simple and fast enough to connect to an Excel workbook or a local database.
  - It can also be robust and enterprise-grade, ready for extensive modeling and real time analytics.
  - This means it can be used in a variety of environments from a personal report and visualisation tool to the analytics and decision engine behind group projects, divisions, or entire corporations.

# Parts of Power BI

- Power BI constitutes of a Microsoft Windows desktop application called Power BI Desktop, an online **SaaS** (Software as a Service) called Power BI Service and a mobile Power BI apps that can be accessed from Windows phones and tablets, and also available on Apple iOS and Google Android devices.
- These **three elements— Desktop, the Service, and Mobile apps** - are the backbone of the Power BI system and lets users create, share and consume the actionable insights in the most effective way.

# PARTS OF POWER-BI

## 1. POWER-BI DESKTOP

It is a Windows application that provides a rich environment for data modeling, transformation, and visualization.

Key features of Power BI Desktop include the ability to import data from various sources, create data models, design visuals, write DAX calculations, and customize report layouts .

Power BI Desktop is primarily used by data analysts and report developers to build and design reports before publishing them to the Power BI Service.

# PARTS OF POWER-BI

## 2. POWER-BI SERVICE

Power BI Service, also called as Power BI Cloud or Power BI Online.
It is a cloud-based platform where reports and dashboards created in Power BI Desktop can be published, shared, and accessed by others.
With Power BI Service, users can view and interact with reports and dashboards through a web browser or the Power BI mobile app.
It offers collaboration features, including the ability to share reports, create dashboards, set up data alerts, and collaborate with colleagues in real time.
Power BI Service also provides data refresh capabilities to ensure that reports stay up to date with the latest data.

# PARTS OF POWER-BI

## 3. POWER-BI MOBILE

Power BI Mobile is a mobile application available for iOS and Android devices. It allows users to access and interact with Power BI reports and dashboard. Users can view, filter, and drill down into data, making it convenient for decision-makers who need access to business insights while away from their computers.

The app also supports offline access, so users can access reports even without an internet connection.

# BUILDING BLOCKS OF POWER-BI

The basic building blocks in Power BI are:

- **Visualizations**

A visualization is a representation of data in a visual format. It could be a line chart, a bar graph, a color coded map or any visual way to present the data.

- **Datasets**

A dataset is a collection of data that Power BI uses to create its visualizations.

- **Reports**

A Report is a collection of visualizations that appear together on one or more pages.

- **Dashboards**

A Power BI dashboard is a collection of visuals from a single page that you can share with others.

# BENEFITS OF POWER-BI

## 1. User-Friendly Interface

Power BI features a user-friendly, drag-and-drop interface, making it easy to both technical and non-technical users.

Users can create reports and dashboards without any extensive training.

## 2. Data Integration and Transformation

Power BI can connect to a wide range of data sources, including databases, cloud services, web sources, and more. It offers robust data transformation capabilities to clean, reshape, and model data for analysis.

## 3. Advanced Data Modeling

Users can create sophisticated data models using DAX, enabling complex calculations, aggregations, and relationships. The data model supports the creation of hierarchies, measures, and calculated columns.

# BENEFITS OF POWER-BI

## 4. Interactive Visualizations

Power BI provides a huge library of customizable visualizations, including bar charts, line charts, maps, etc.
Visualizations can be filtered, cross-highlighted, and drilled down to explore data interactively.

## 5. Natural Language Queries

Users can ask questions using natural language queries, and Power BI's AI capabilities generate visualizations and insights based on the questions.

## 6. Real-Time Data

Power BI supports real-time data, allowing organizations to monitor and react to data changes in real-time.

# BENEFITS OF POWER-BI

**7. Data Sharing and Collaboration:**

Reports and dashboards created in Power BI can be shared securely with others. Collaboration features include commenting, annotation, and the ability to create and share dashboards with stakeholders.

**8. Security and Compliance:**

Power BI offers robust security and access control features, including integration with Azure Active Directory for identity management.

It complies with various industry standards and regulations, making it suitable for organizations with strict data governance requirements.

**9. Scalability:**

Power BI is highly scalable, capable of handling large datasets and serving the needs of small to large organizations.

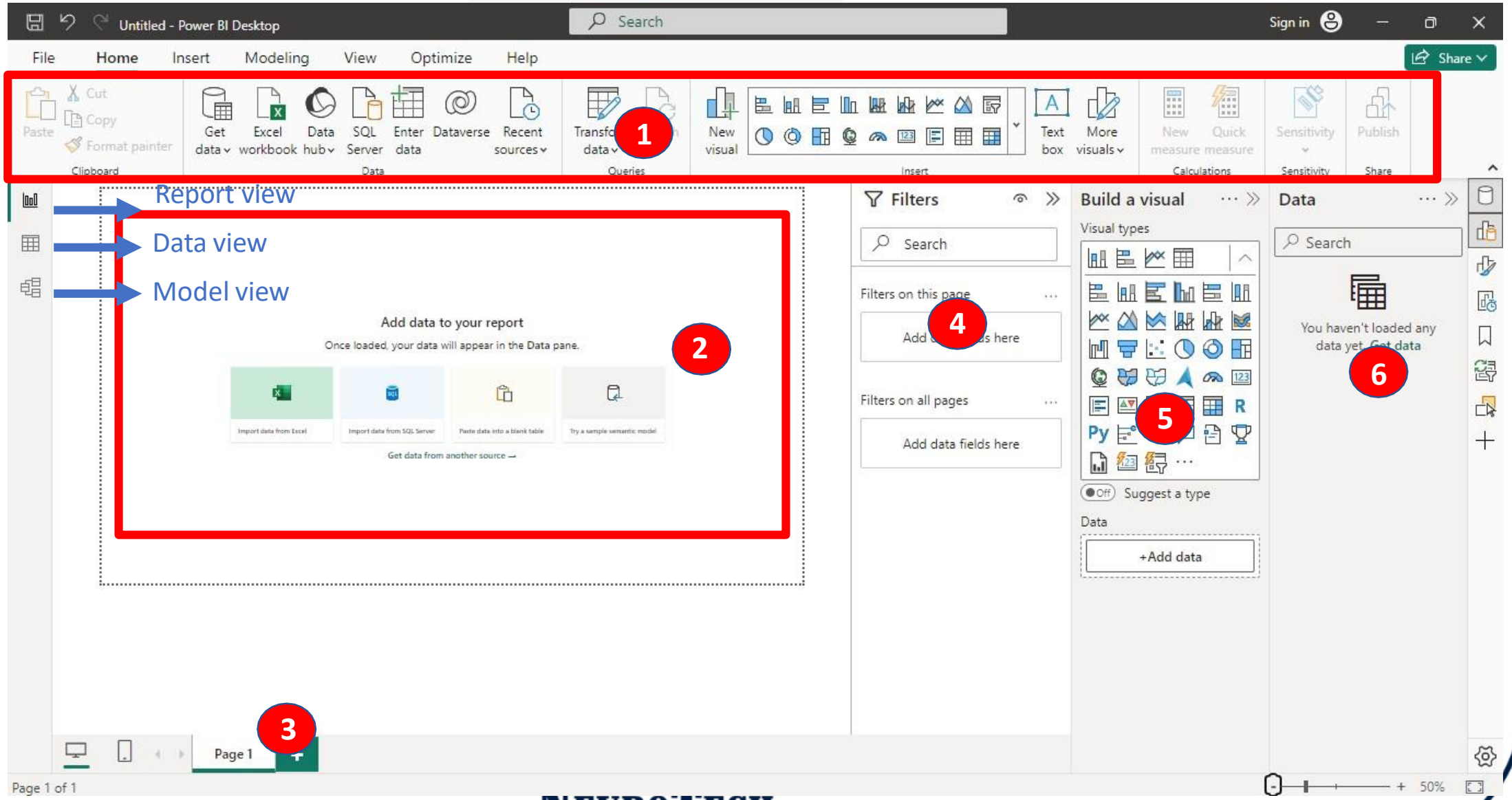
# BENEFITS OF POWER-BI

**10. Cost-Efficiency**

Power BI offers both free and paid licensing options, making it accessible to organizations of all sizes.

Power BI Pro and Premium licenses provide additional features for advanced use cases.

# POWER-BI DESKTOP VIEW

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# POWER-BI DESKTOP VIEW

**1.Ribbon** - Displays common tasks that are associated with reports and visualizations.

**2. Report view, or canvas** - Where visualizations are created and arranged. You can switch between Report, Data, and Model views by selecting the icons in the left column.

**3.Pages tab** - Located along the bottom of the page, this area is where you would select or add a report page.

**4. Filters Pane –** Where you drag fields in filters as per requirement

**5. Visualizations pane** - Where you can change visualizations, customize colors or axes, apply filters, drag fields, and more.

**6.Data pane** - Where dataset tables with respected columns, measures and calculated columns are displayed.

# Importing Data Base

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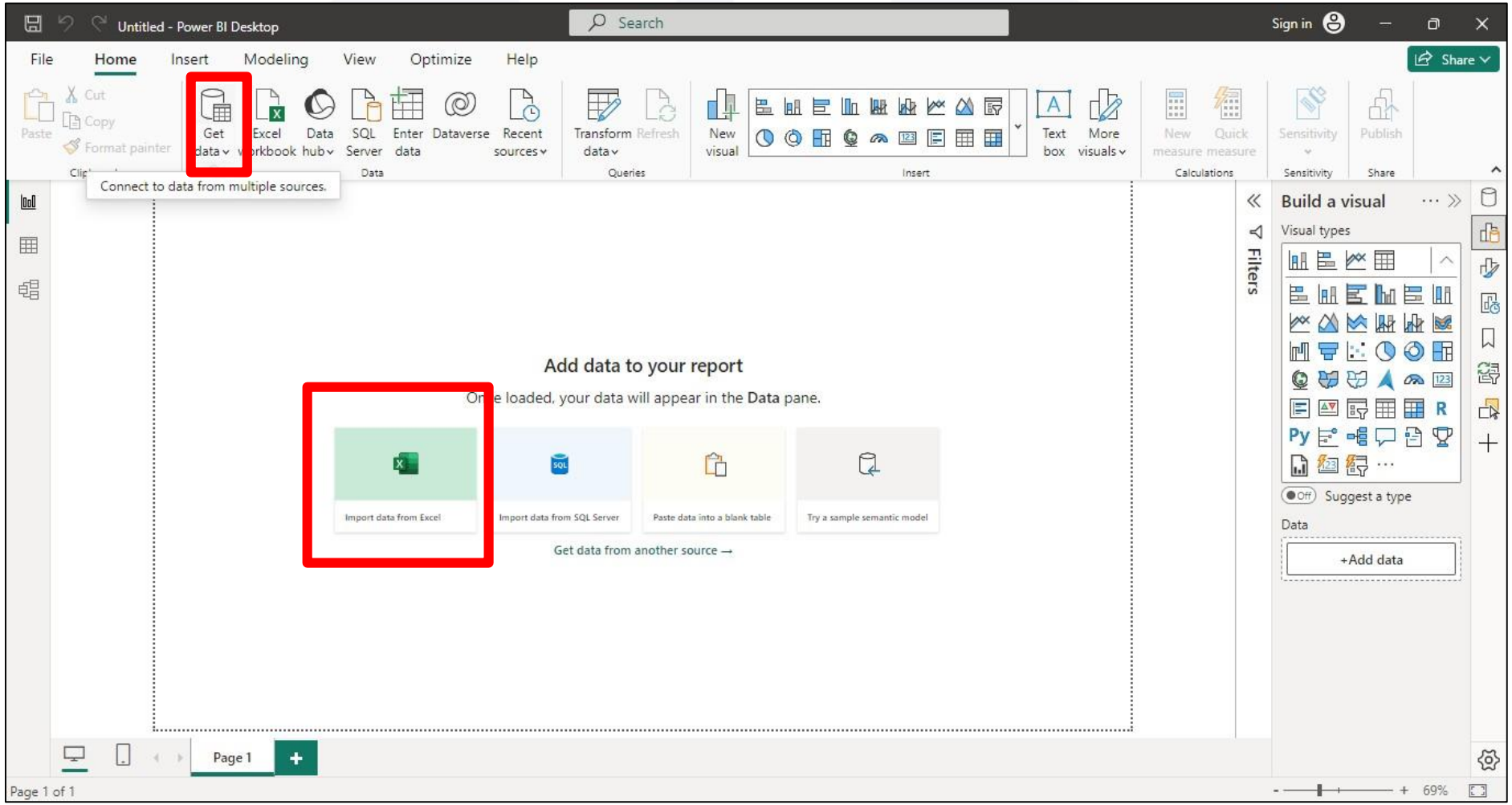
Power BI can connect to a whole range of data sources from Excel sheets and local databases to several Cloud services.
Currently, over 60 different cloud services have specific connectors to help you connect with generic sources through XML, CSV, text, and ODBC.

# IMPORTING DATA IN POWER-BI – CSV TO POWER-BI

As your first step is to import the dataset/file into Power BI, click on the “Get Data” icon on the ribbon of Home tab or on canvas “Import data from excel”.

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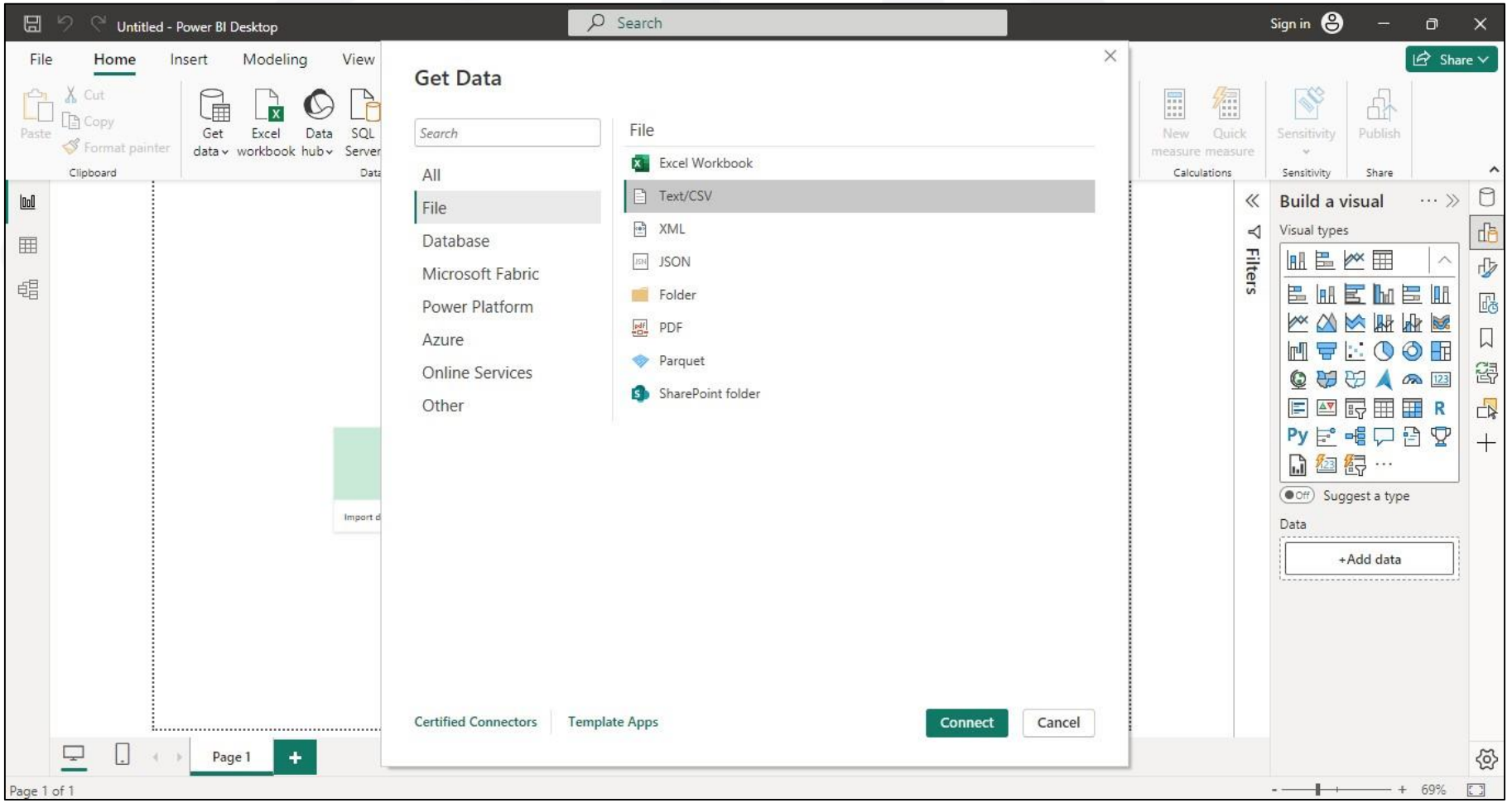
Once you select it, go ahead and select the CSV option under the file subheading. Then browse the file and select the necessary CSV file. Press on Connect to have a quick preview of the file. Once we click on Load, Power BI will successfully import the file.

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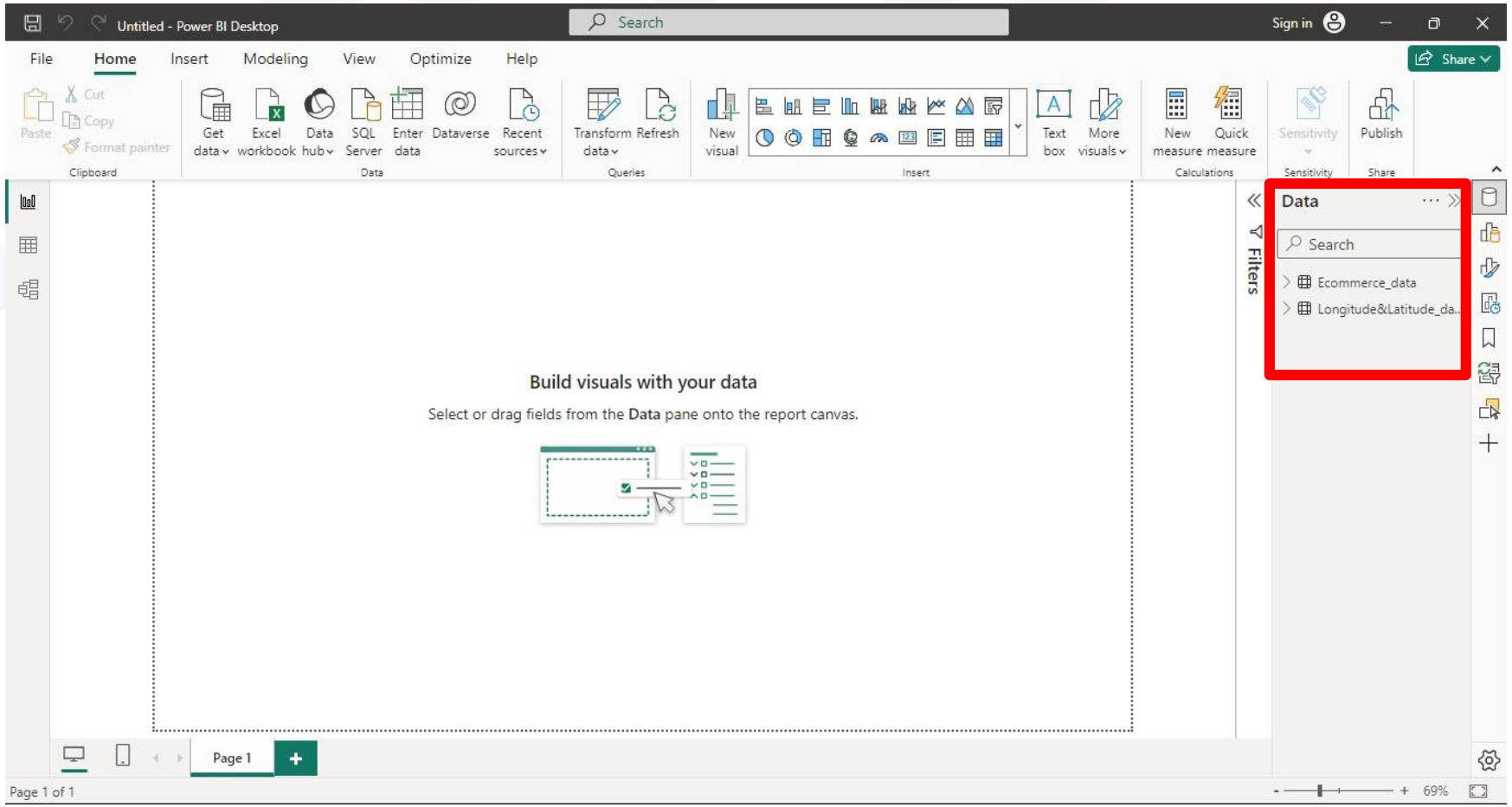
When you click on Load, file gets loaded in Power-BI

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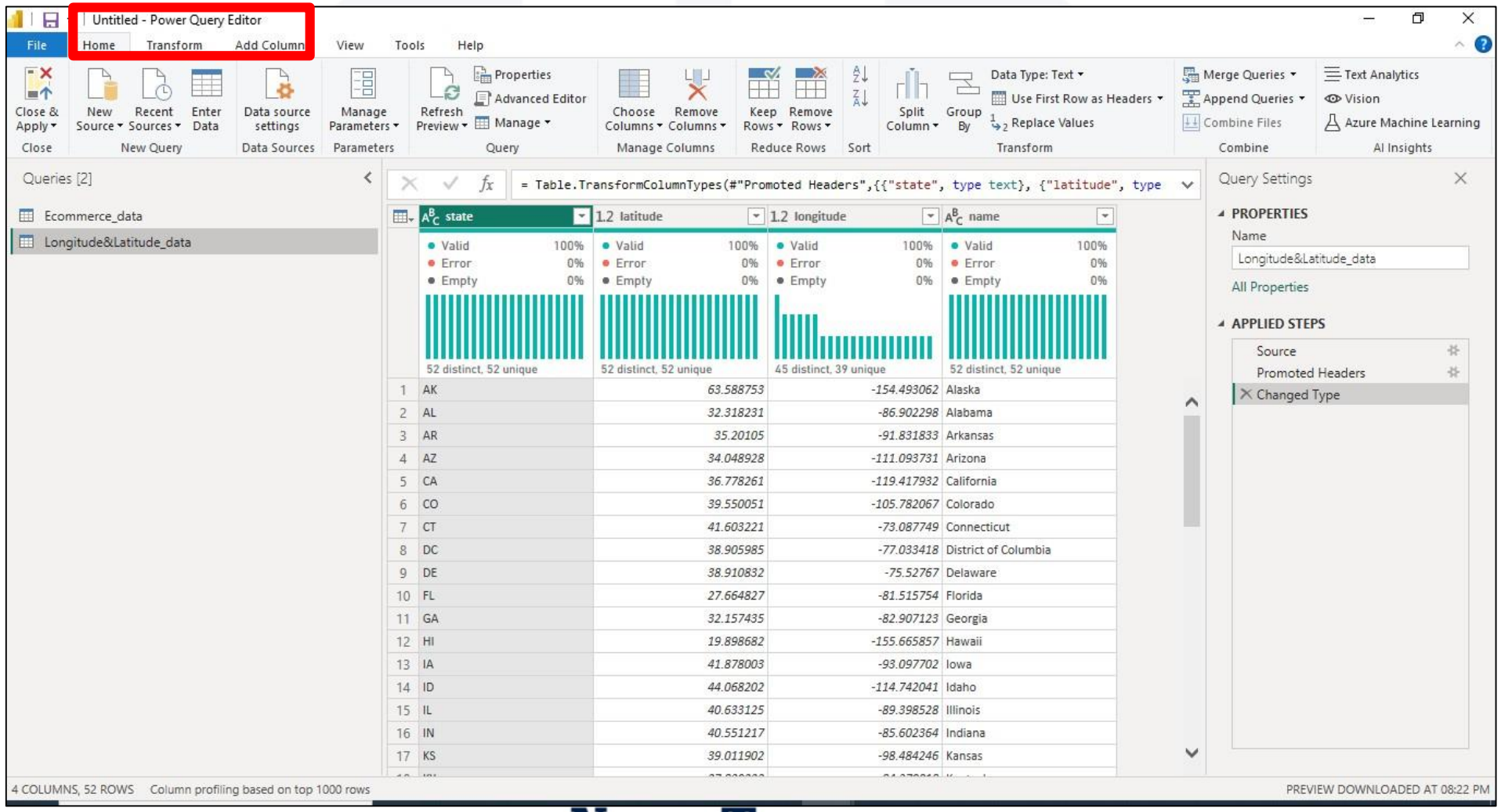
When you click on Transform Data, file gets loaded in Power Query Editor for data modelling purpose.

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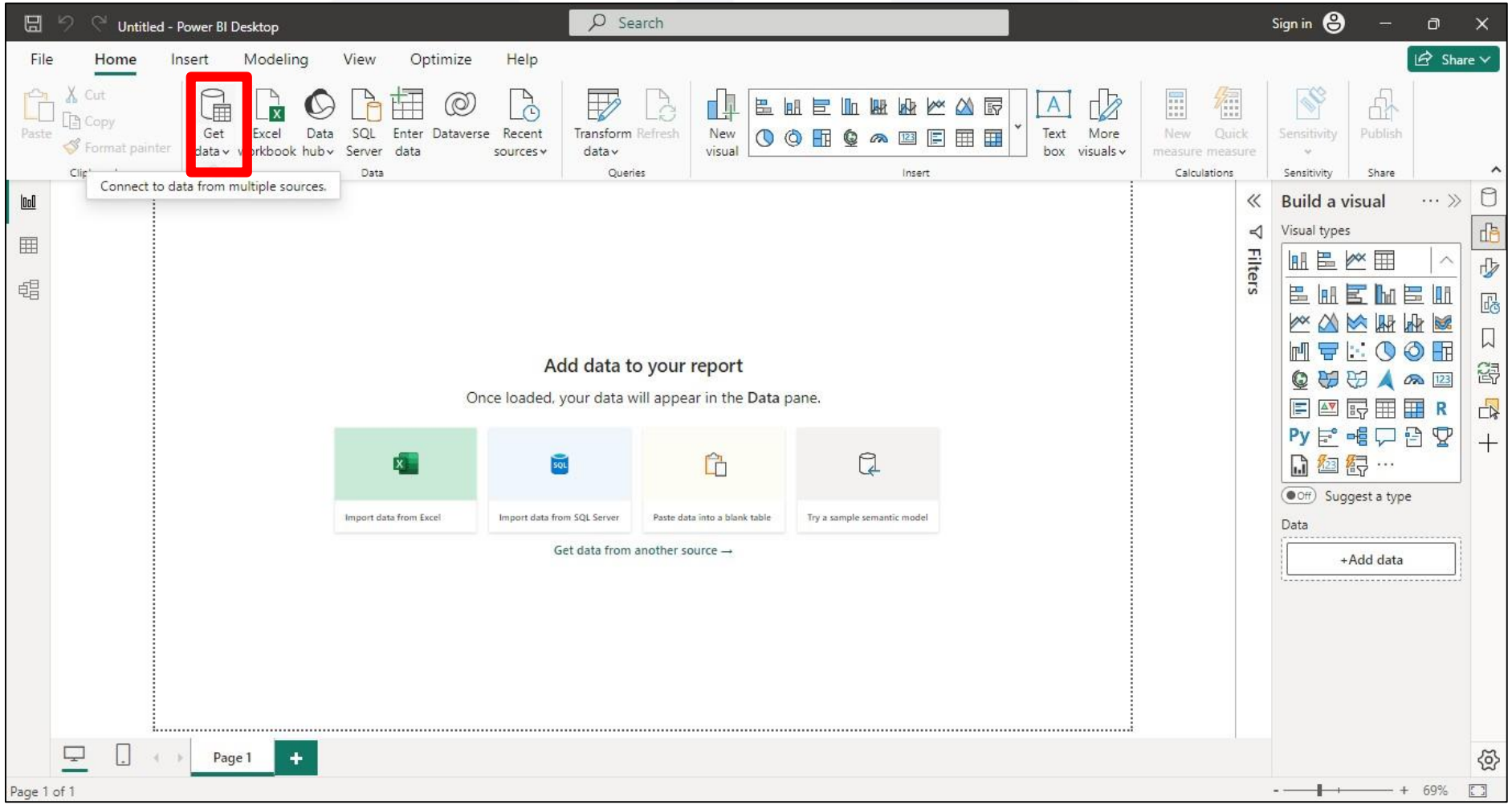
# IMPORTING DATA IN POWER-BI – MYSQL TO POWER-BI

As your first step is to import the dataset/file into Power BI, click on the “Get Data” icon on the ribbon of Home tab.

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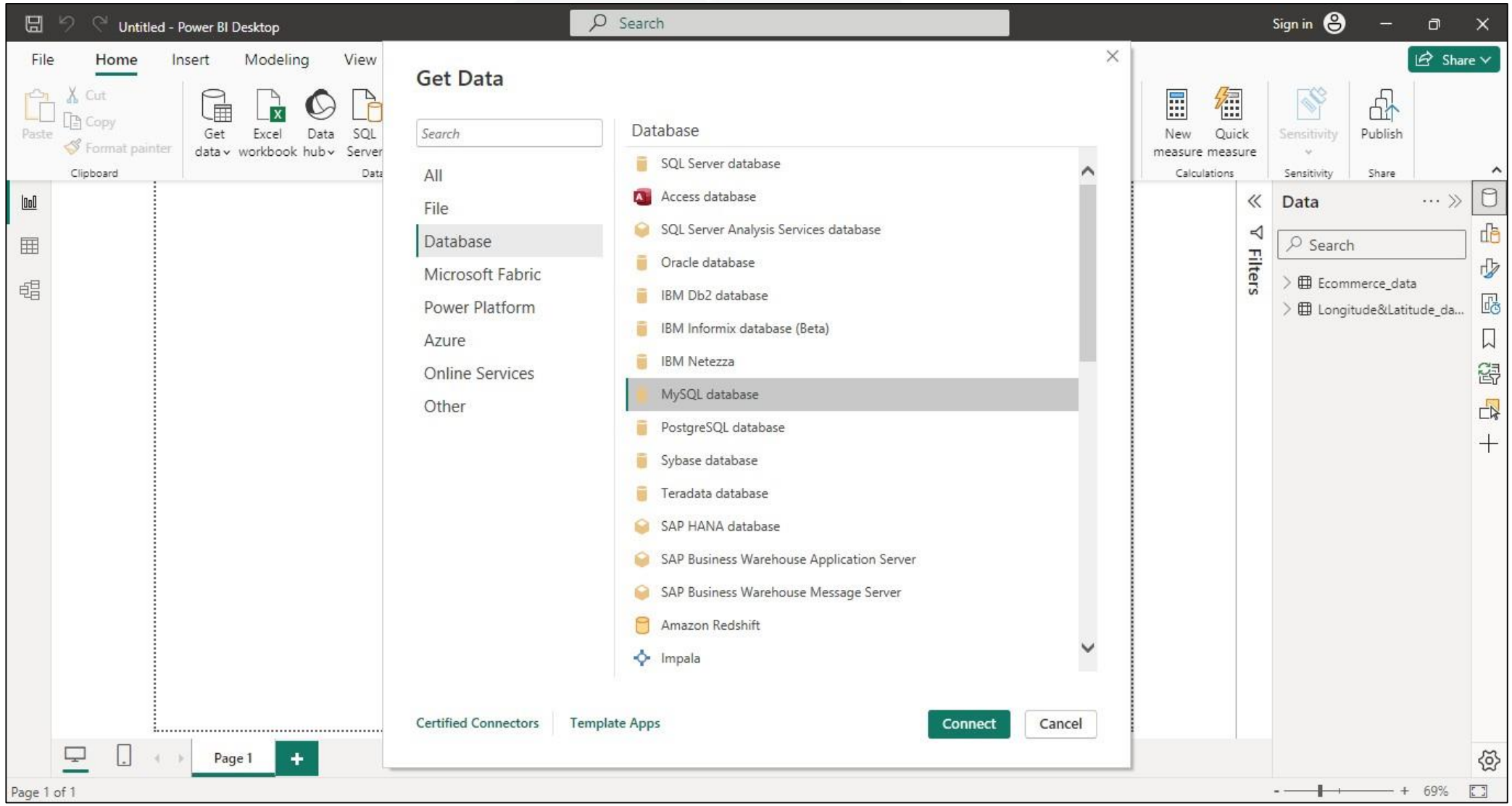
Once you select it, go ahead and select the MySQL Database option under the Database subheading. Press on Connect to connect with MySQL .

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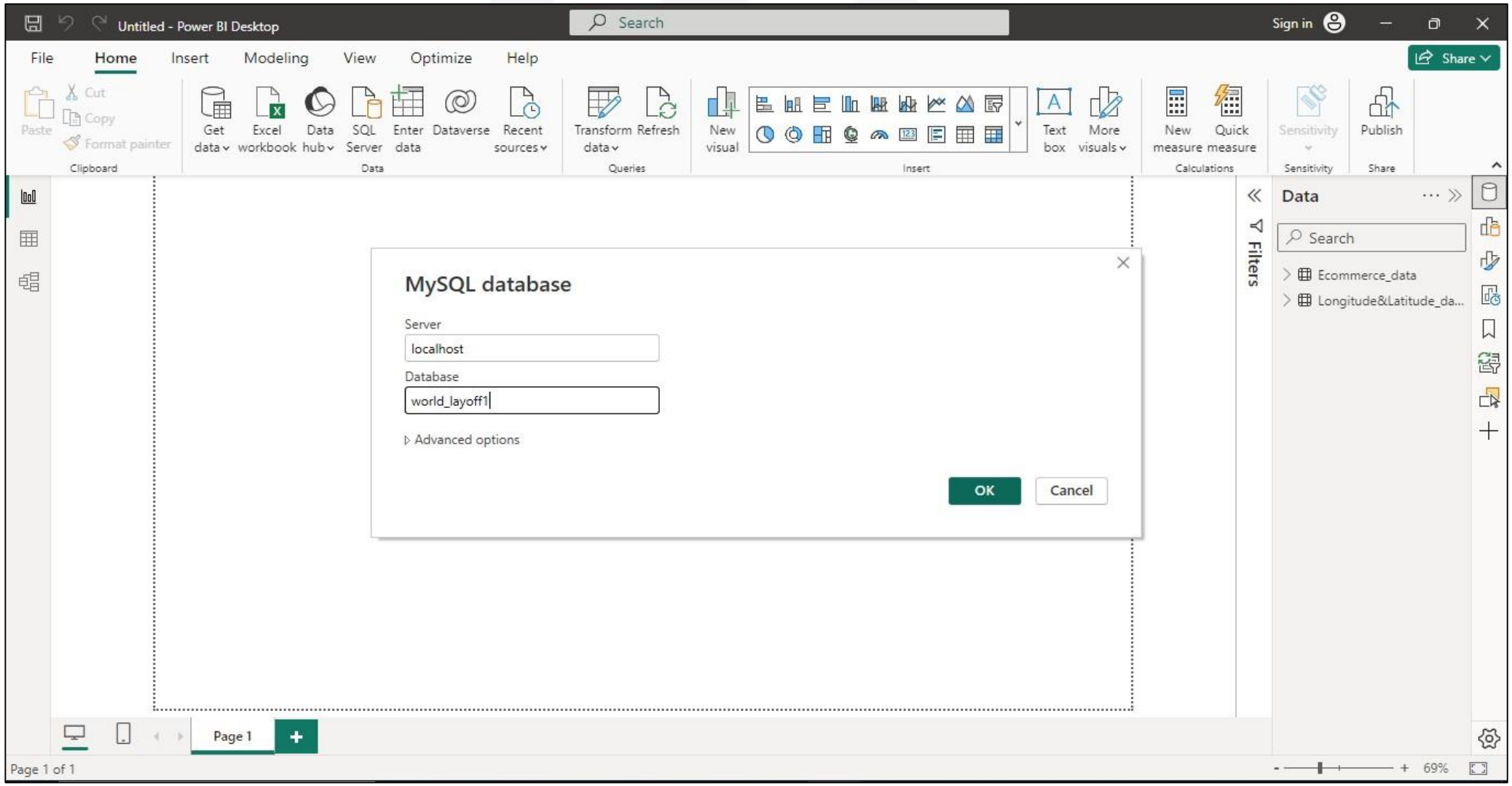
Provide database credential. As localhost and the name of database/schema and click OK

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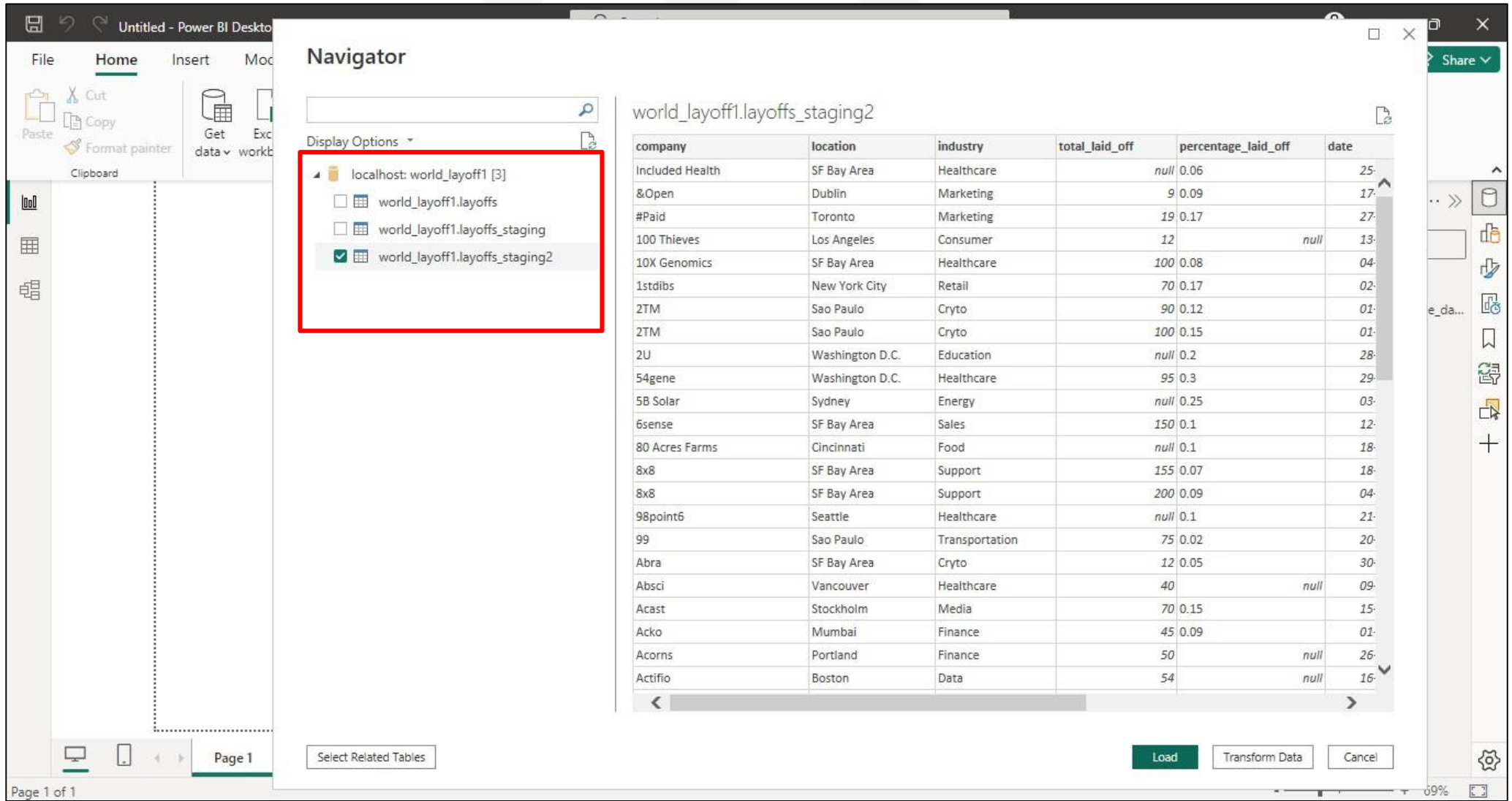
Select the necessary data from list, check its preview and click Load to load the dataset in Power-BI

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# Data Transformation in Power Query

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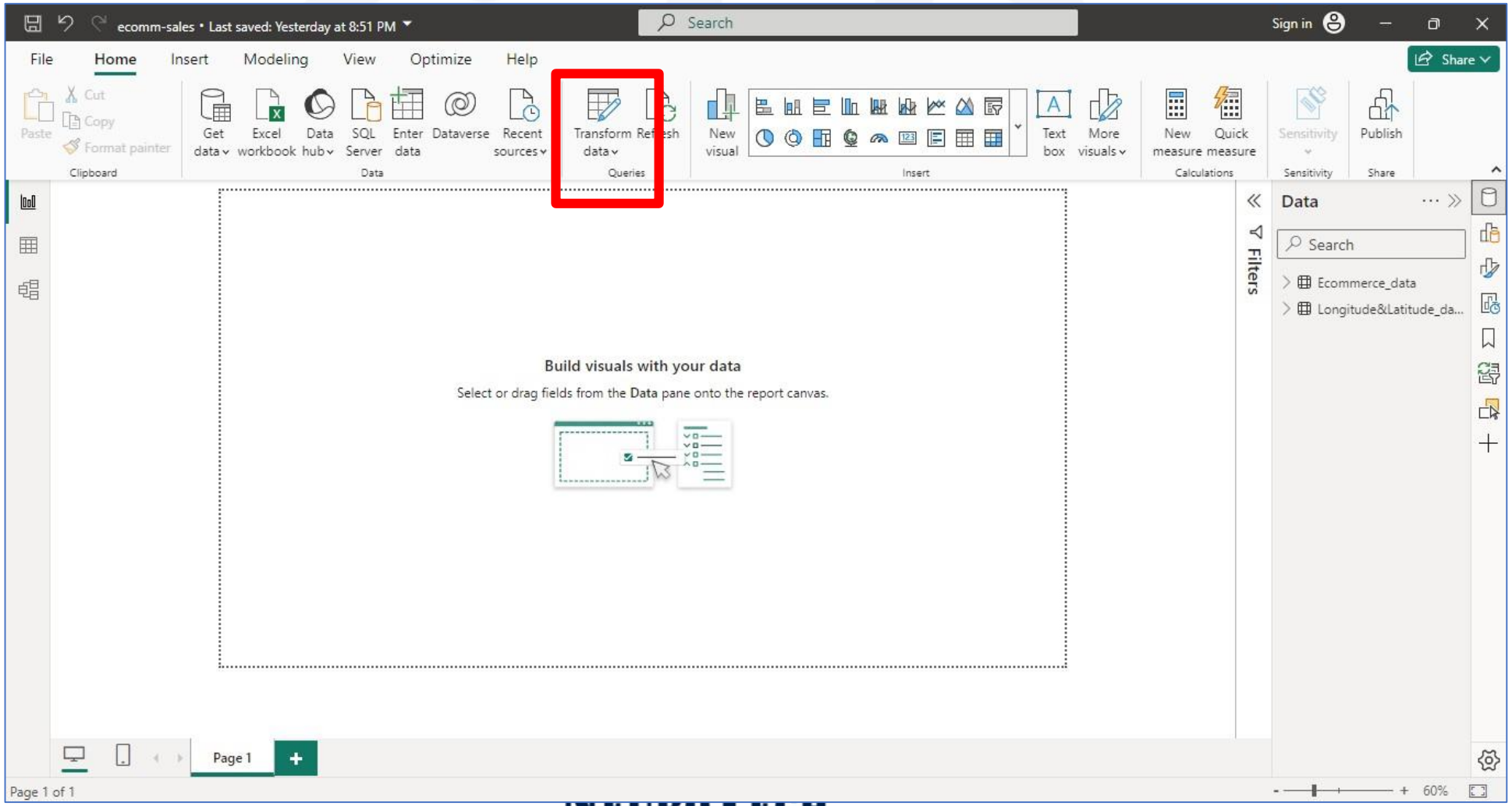
Once you've connected to your data source in Power BI, the next step is to transform the data into a format that can be easily analyzed and visualized. This process is often known as ETL (extract, transform, load).

The Power Query Editor provides a user-friendly interface that allows users to perform a series of data transformations through a set of tabs.

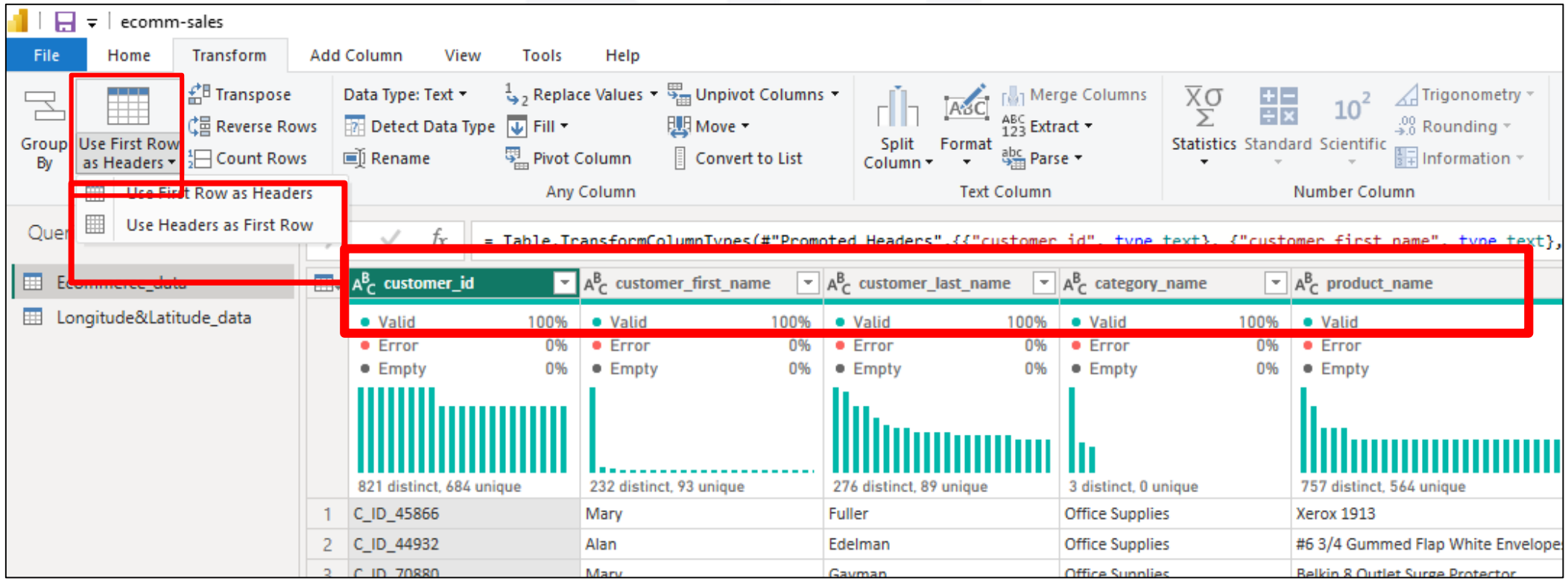
Lets go through some basic data transformation steps in Power Query Editor---

To open Power Query Editor, click on “Transform data” under Home tab.



# 1. FORMAT TABLE HEADER

Sometimes, power query include headers in data as a first row so to set that first row as header click on “Use First Row as Headers” under Transform tab.

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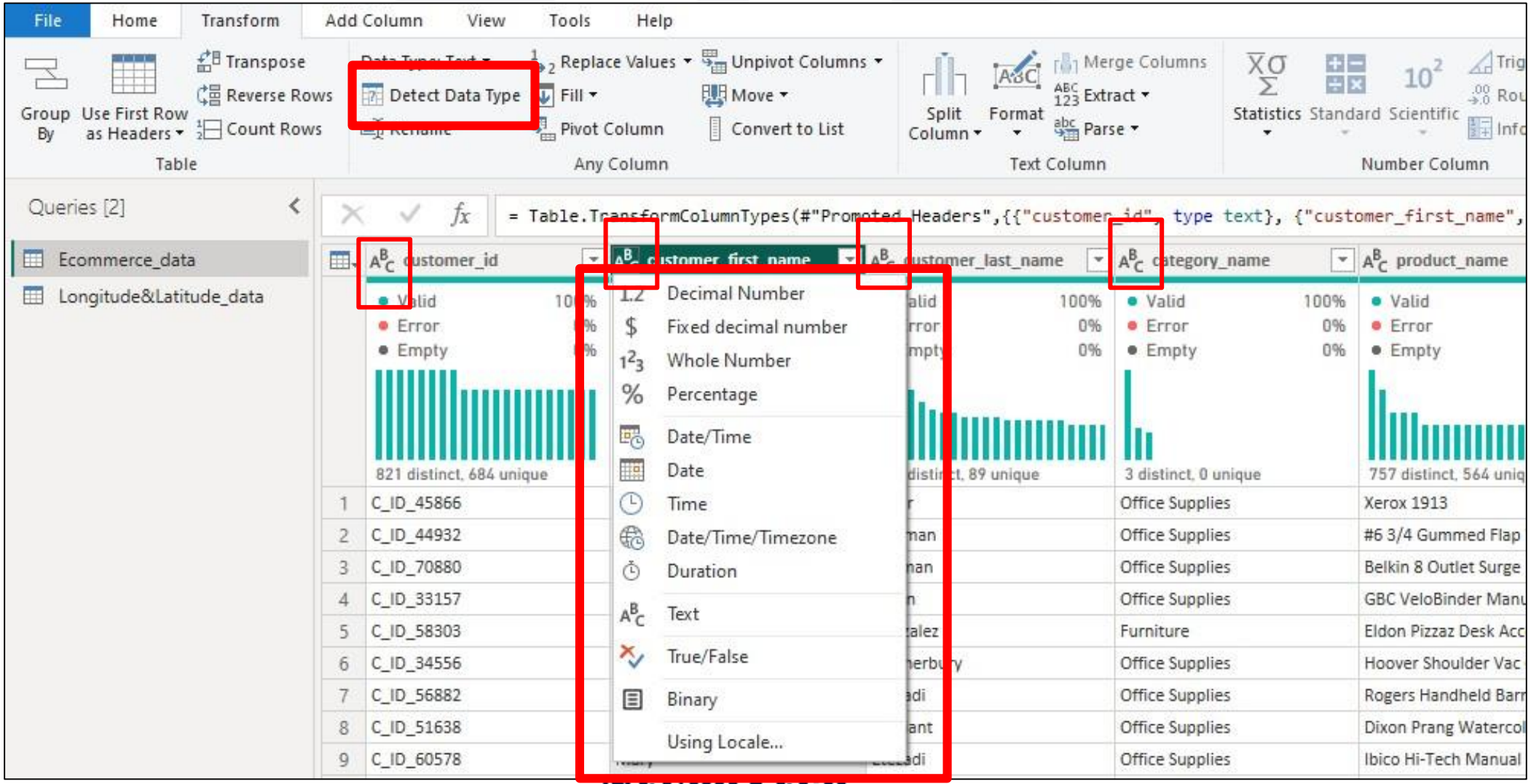
# 2. CHANGING DATA TYPE OF COLUMN

Check the data type of column shown beside column name. If found any wrong data type select particular column, click on “Detect Data Type” under Transform tab to automatically set data type OR click on data type beside column name and select respected type.

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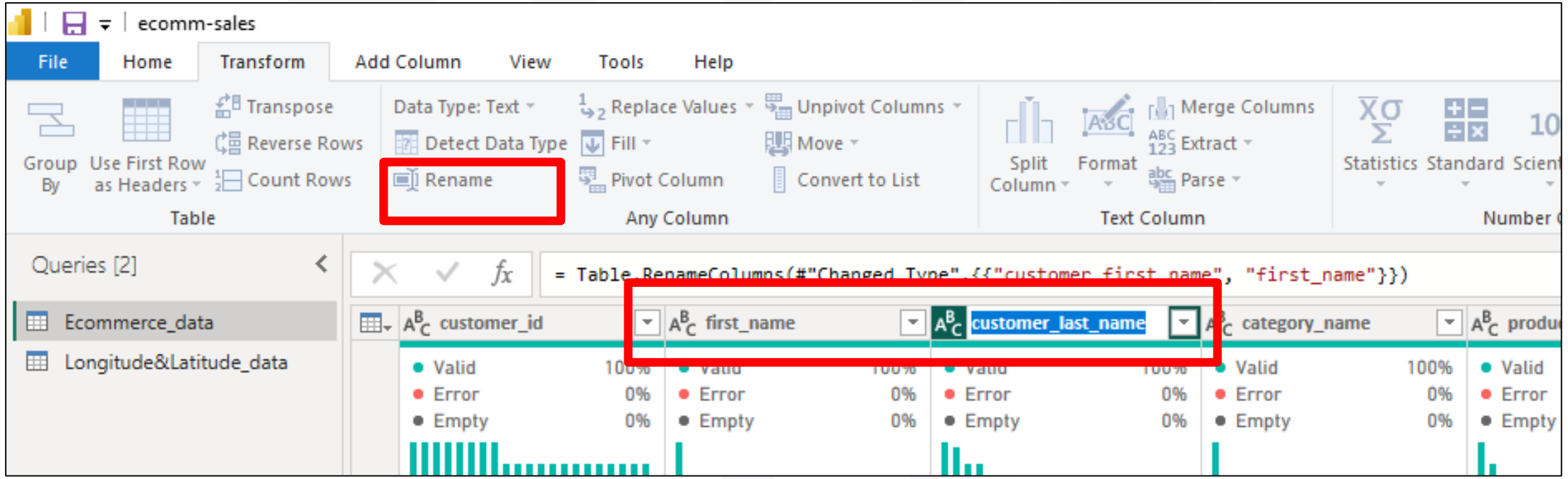
# 3. RENAMING COLUMN NAME

Columns from raw data can be difficult to read or meaningless. Renaming the columns in your query to a meaningful name will make it easier for you to understand your data.
Either double-click on column name and rename it OR simply select the column and click on “Rename” under Transform tab.

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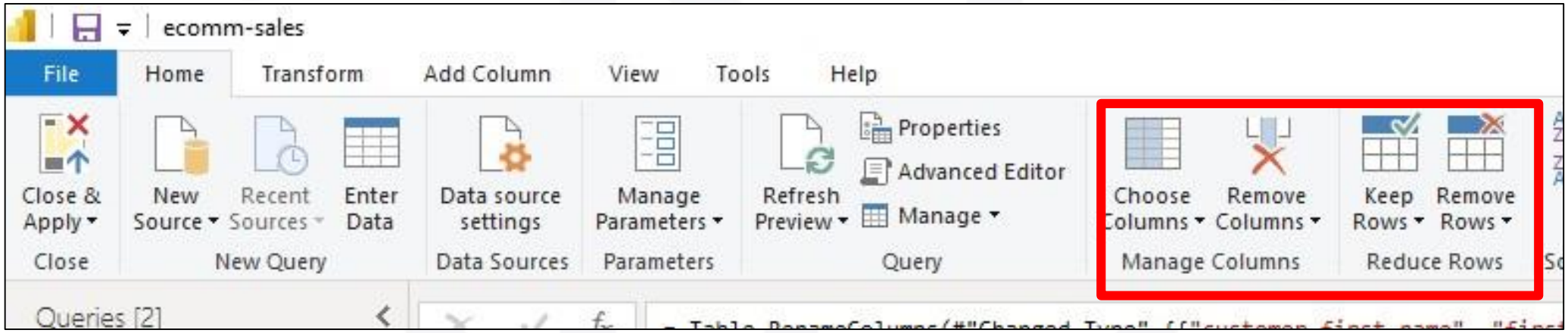
# 4. REMOVE COLUMNS/ROWS

Use this transformation to clean up your dataset by removing unnecessary or redundant columns, which can improve query and report performance.
Simply select the column OR row and click on “Remove column” or “Remove row” under Home tab.

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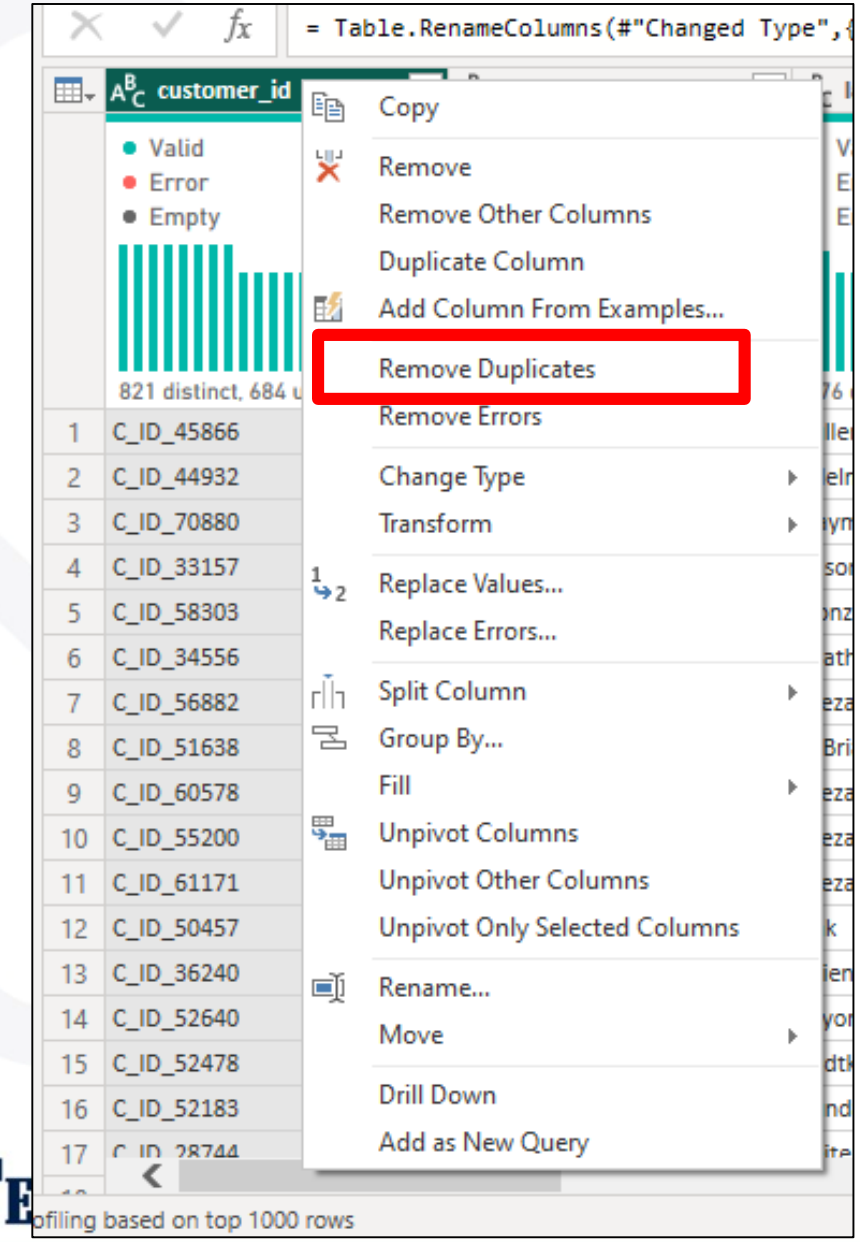
# 5. REMOVE DUPLICATES

It allows you to eliminate duplicate rows from your dataset based on the values in one or more columns. It helps you maintain data integrity by keeping only unique Records.

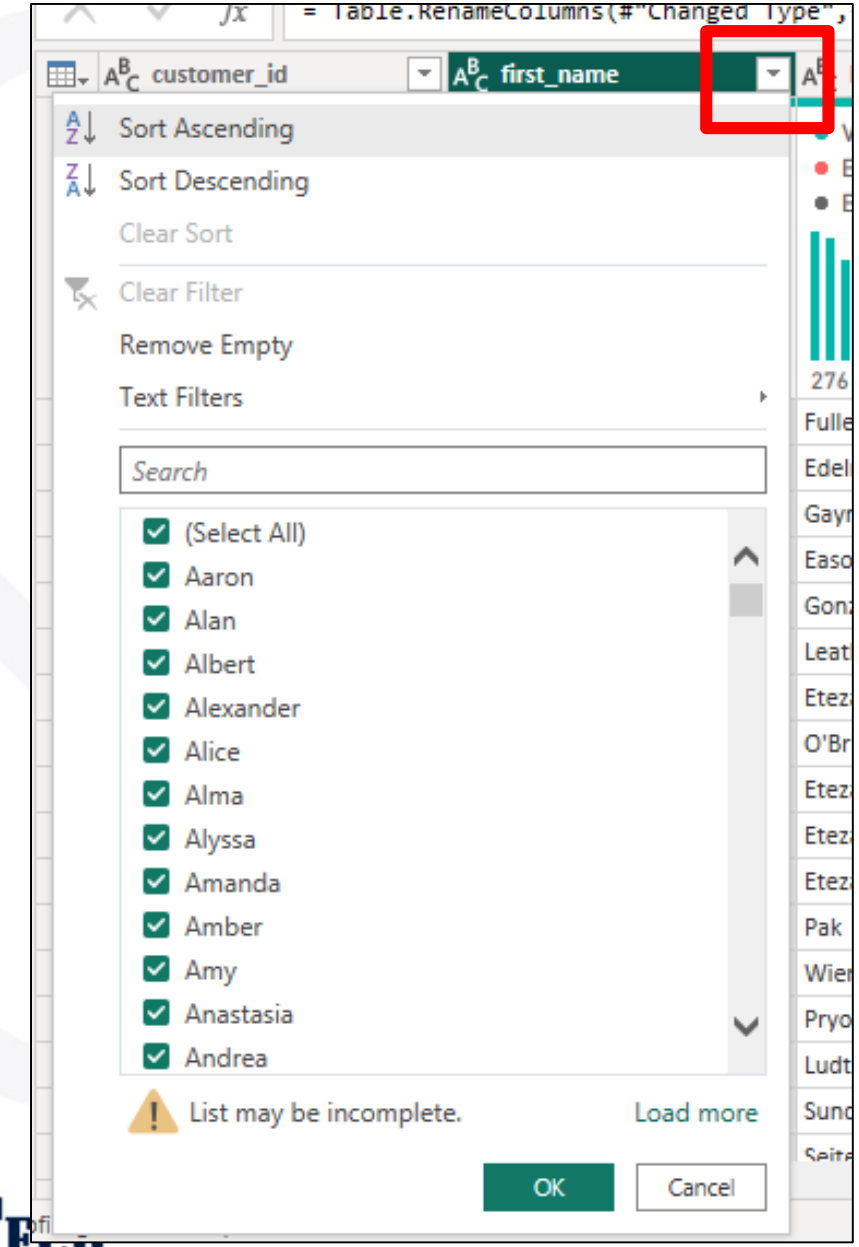
Simply right-click on the column and click on “Remove duplicates”.



# 6. FILTER ROWS

It enables you to include or exclude rows from your dataset based on specific criteria or conditions.

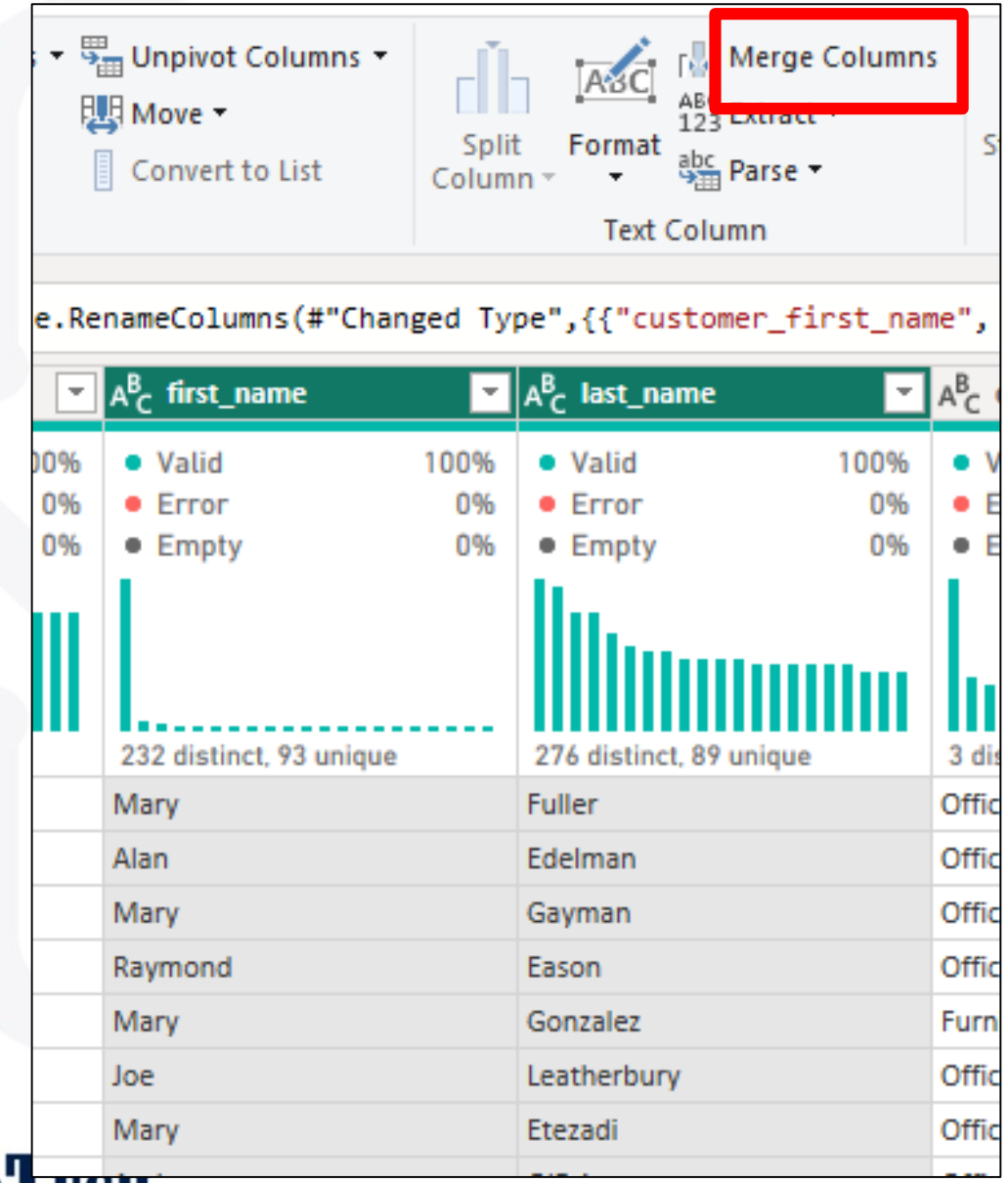
Click on the filter arrow besides column name and check the distinct values- if there are any misspell words, formats, missing values, etc



# 7. MERGE COLUMN

It lets you combine the values from multiple columns into a single new column. You can choose the delimiter or separator to use between merged values.

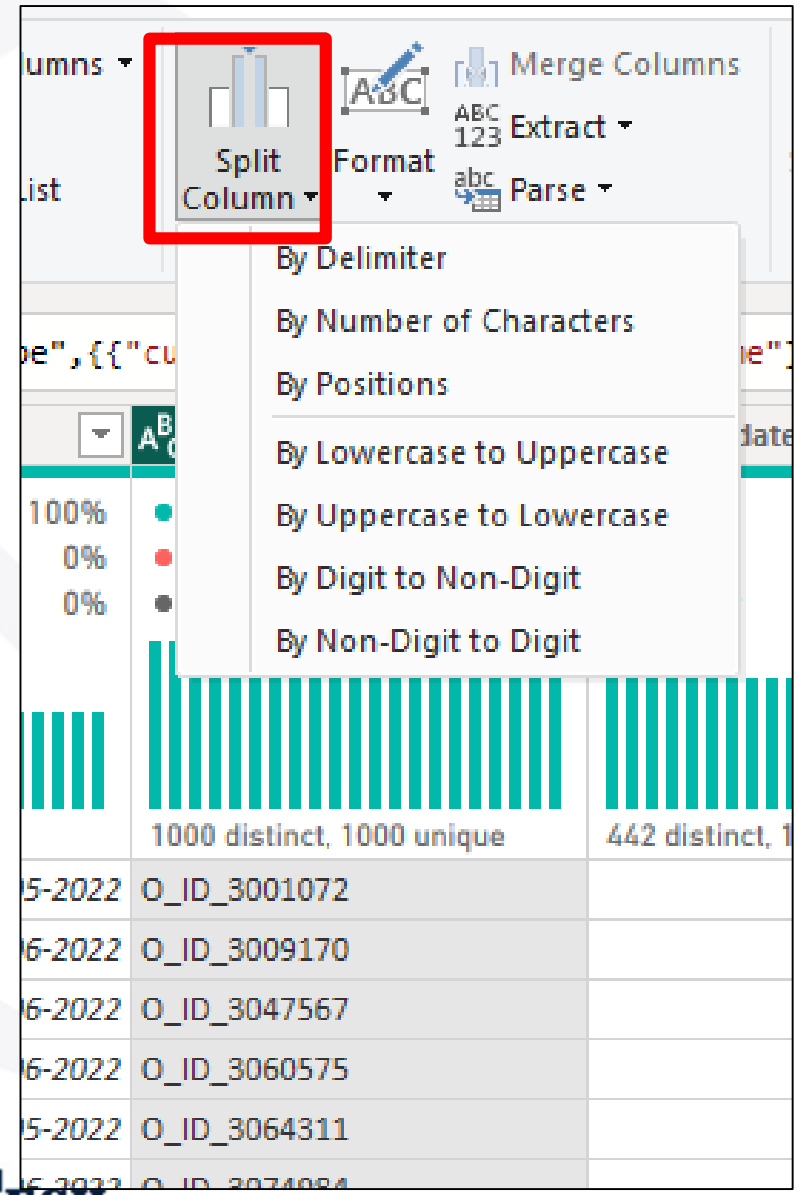
Select 2 columns that you need to concatenate and click on “Merge columns” under Transform tab.



# 8. SPLIT COLUMN

It  allows you to divide a single column into multiple columns based on a specified delimiter or pattern.

Select the column and click on “split column” and select the respective option as per selected column.

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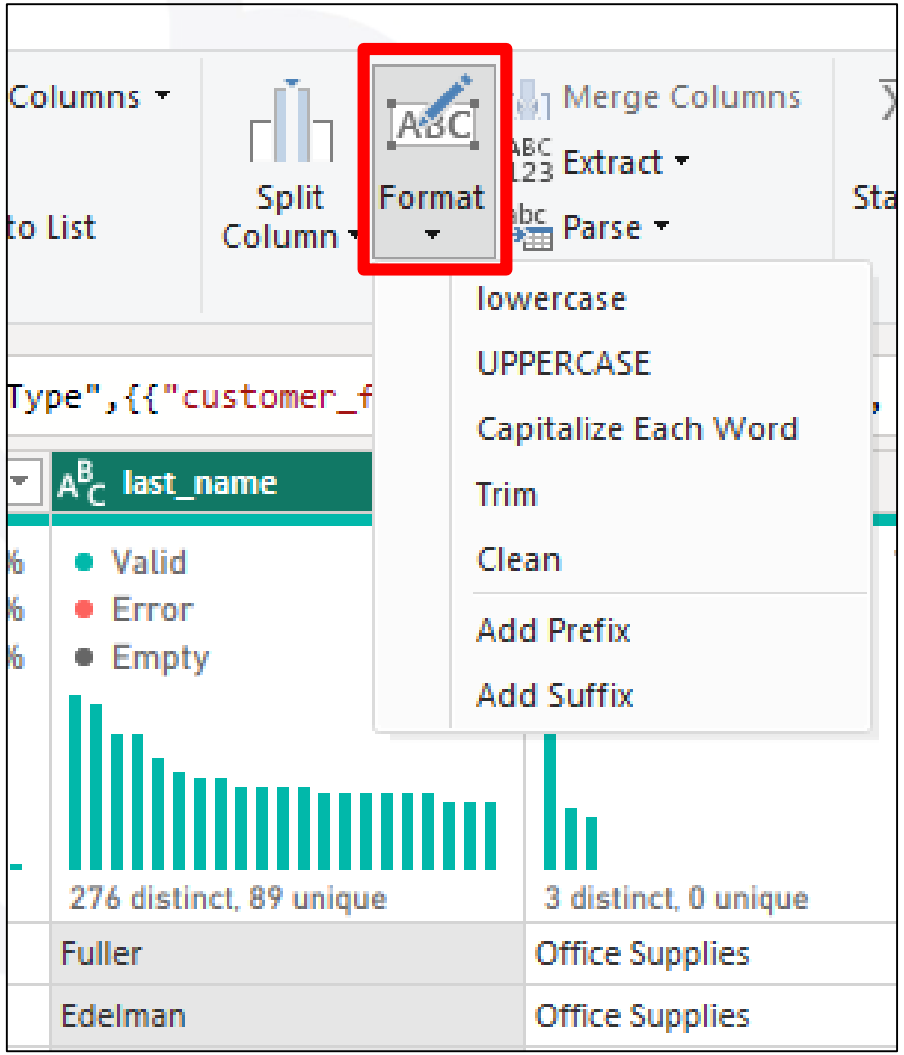
# 9. FORMAT COLUMN

It enables you to standardized the data like trim, lowercase, uppercase, etc

Select the column and click on “format” and select respected option.

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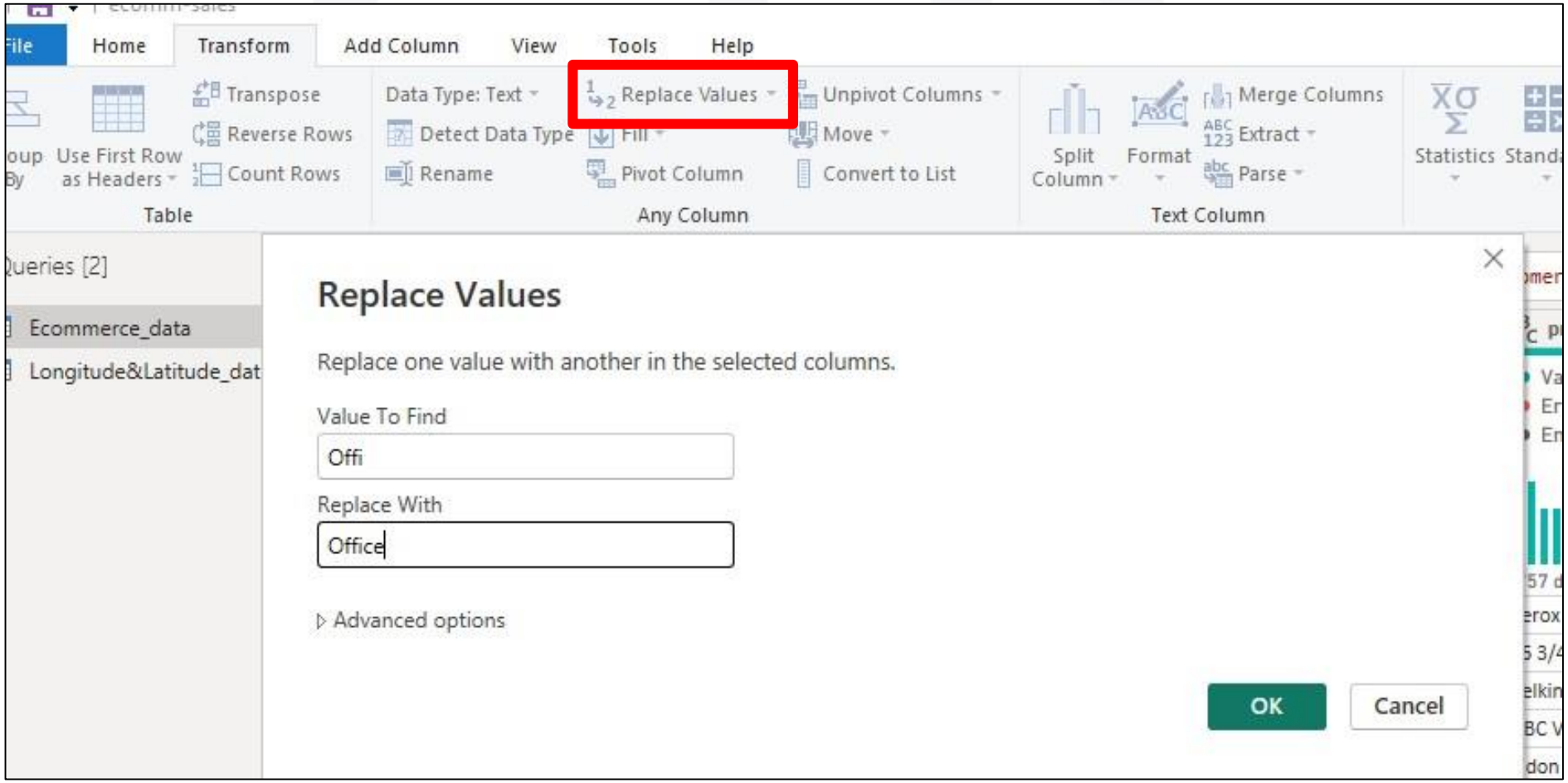
# 10. REPLACE VALUES

It enables you to format misspell words.
Click on “Replace values” under Transform tab and specify the required words.

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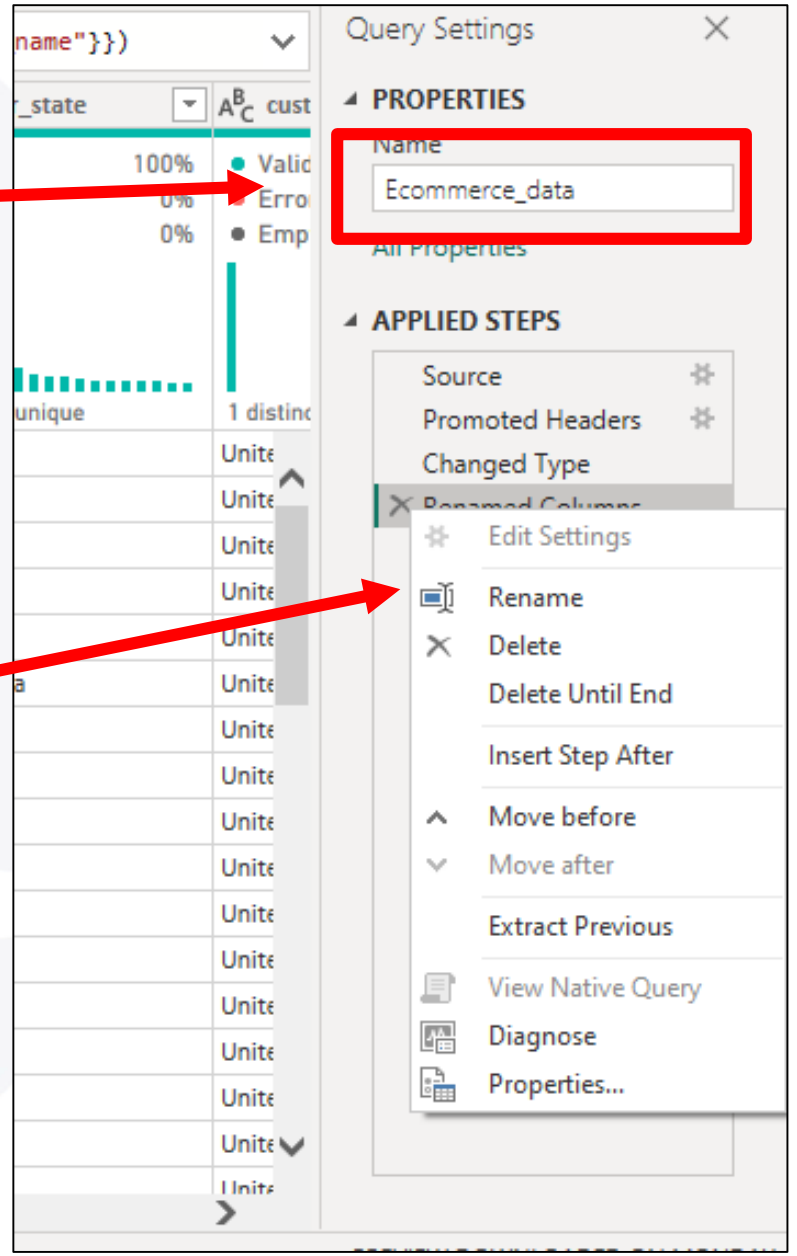
# 11. EDIT TABLE NAME AND RENAME APPLIED STEPS

You can edit your table name here.

Rename the steps that you performed while transforming the data so that when you revisit the project after days you know what steps were performed.
Right-click on particular step and select rename.

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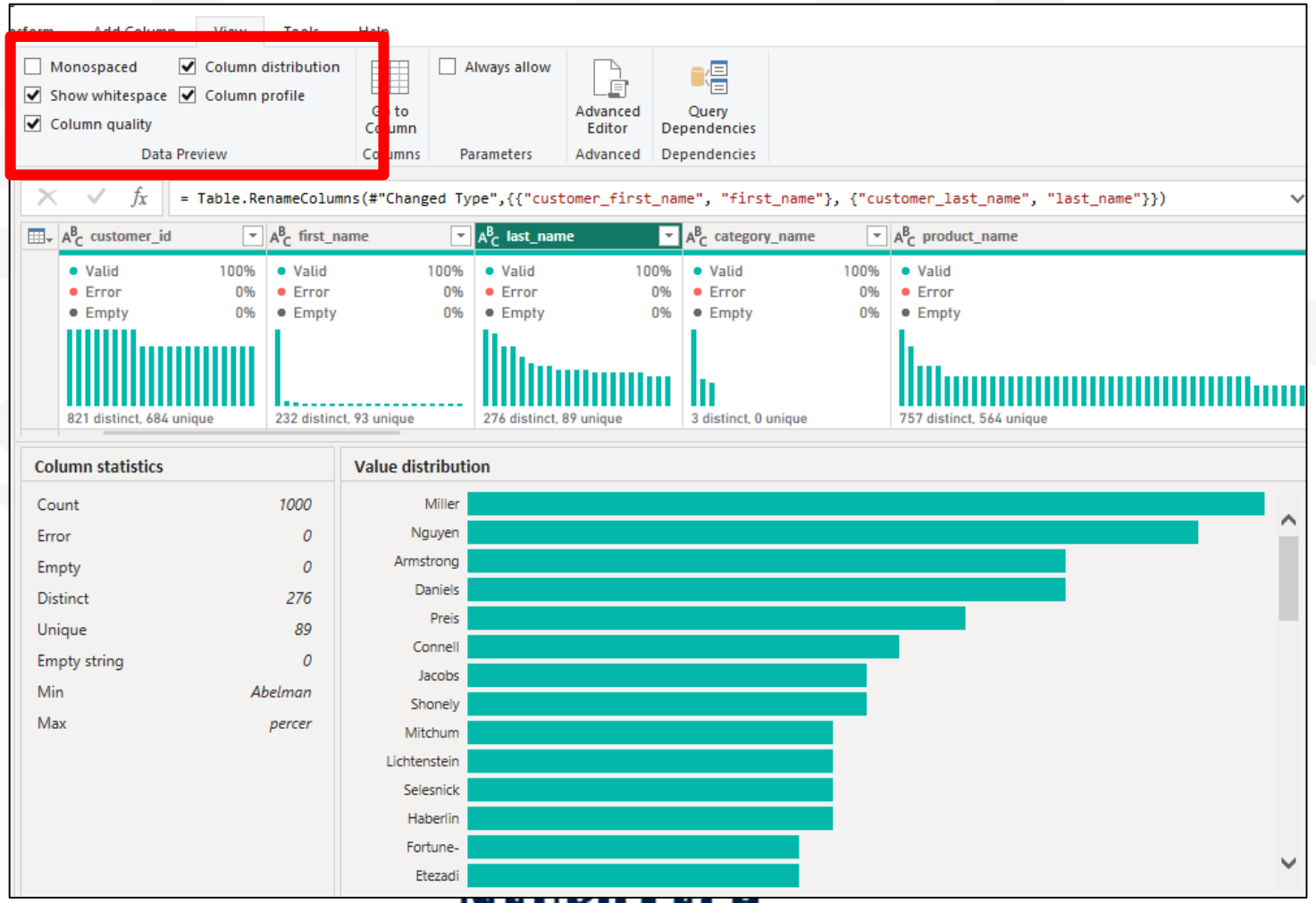
# 12. DATA PREVIEW

While working on large datasets, it is necessary to get an basic idea of the data in a seconds, for that turn ON following options under View tab – Column distribution, Column profile, Column quality.

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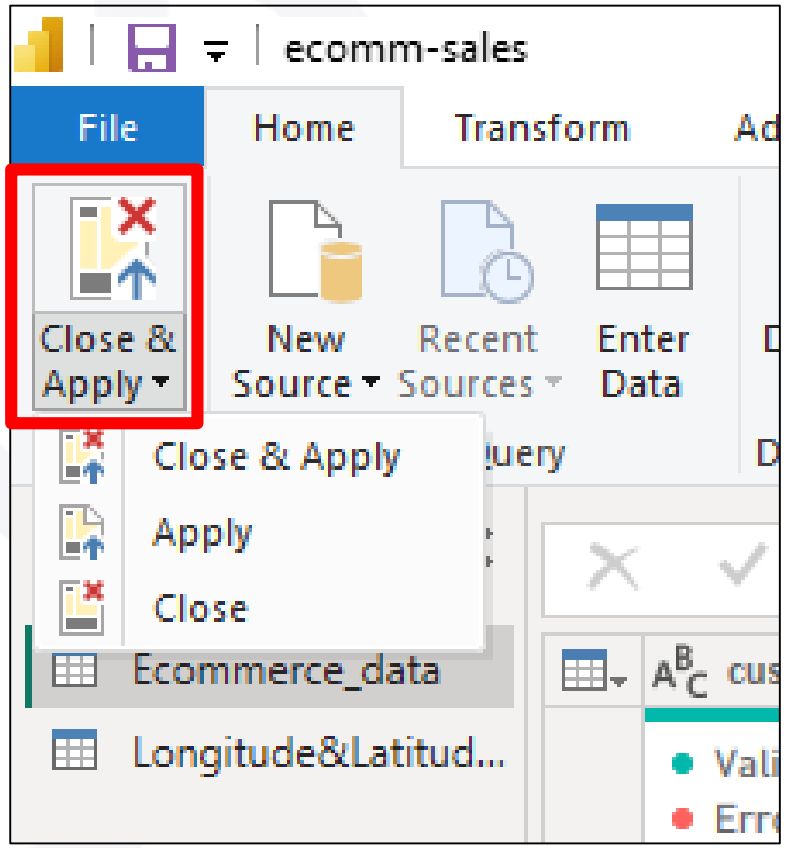
# LOADING DATA TO POWER-BI DESKTOP FROM POWER QUERY EDITOR

After transforming your data in Power Query, you can load it into Power BI Desktop to create your reports and visualizations.

Under home tab Click on “close & Apply” to save changes and close power query.

Selecting “Apply ” will just save the changes.

Selecting “close” will close the power query without saving the changes.

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# Data Modeling

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# INTRO

Data Modelling in Power-BI is fundamental process that involves creating a structures, interconnected data framework to enable efficient data analysis and reporting.

Key aspects in data modelling within Power-BI are—

1. Designing the data model
2. Establishing relationships

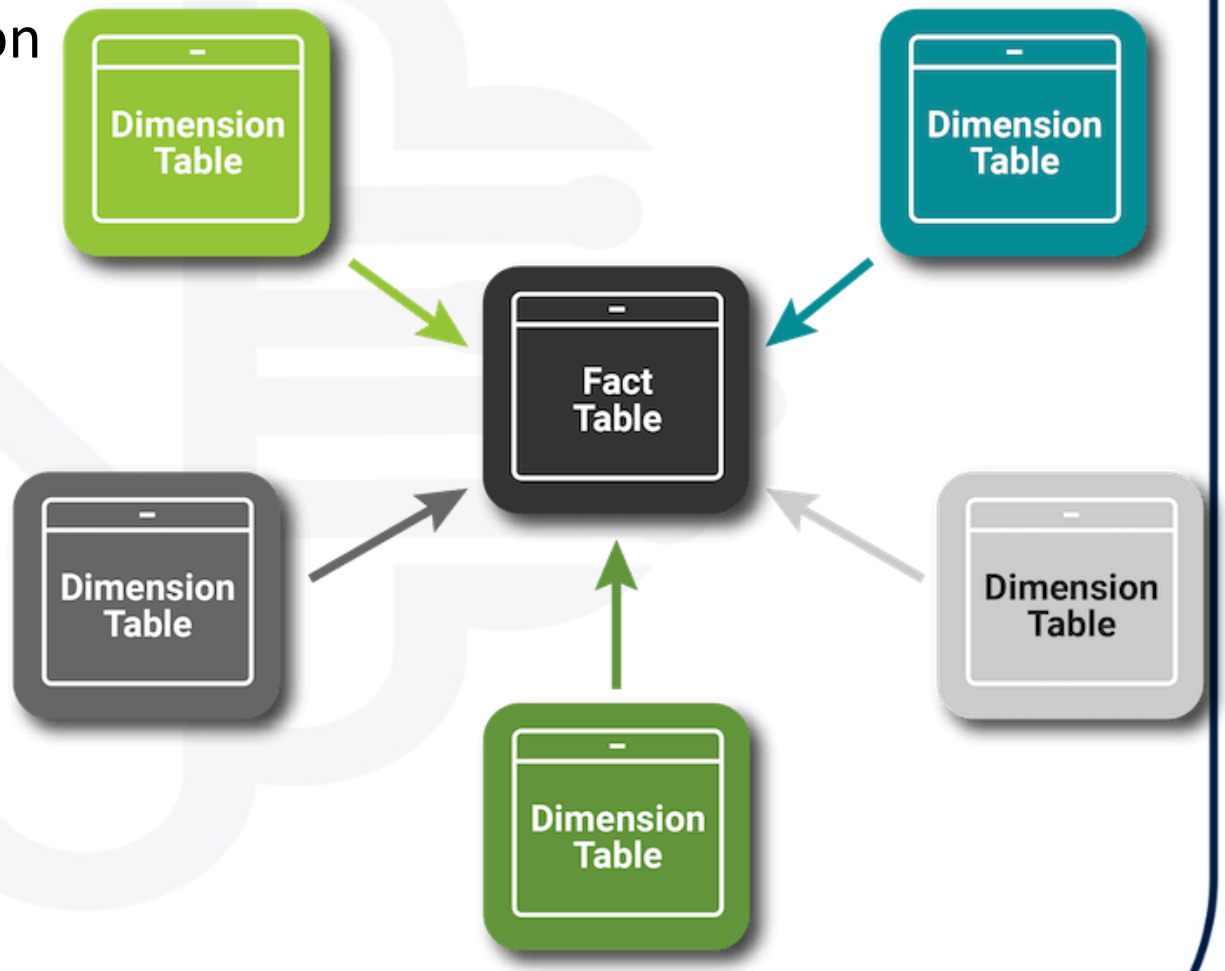
# DESIGNING THE DATA MODEL

The core of data modelling in Power-BI involves designing a schema that defines how different data tables relate to each other.
This is usually done using a star schema or snowflake schema.

There are two types of tables in any data model—

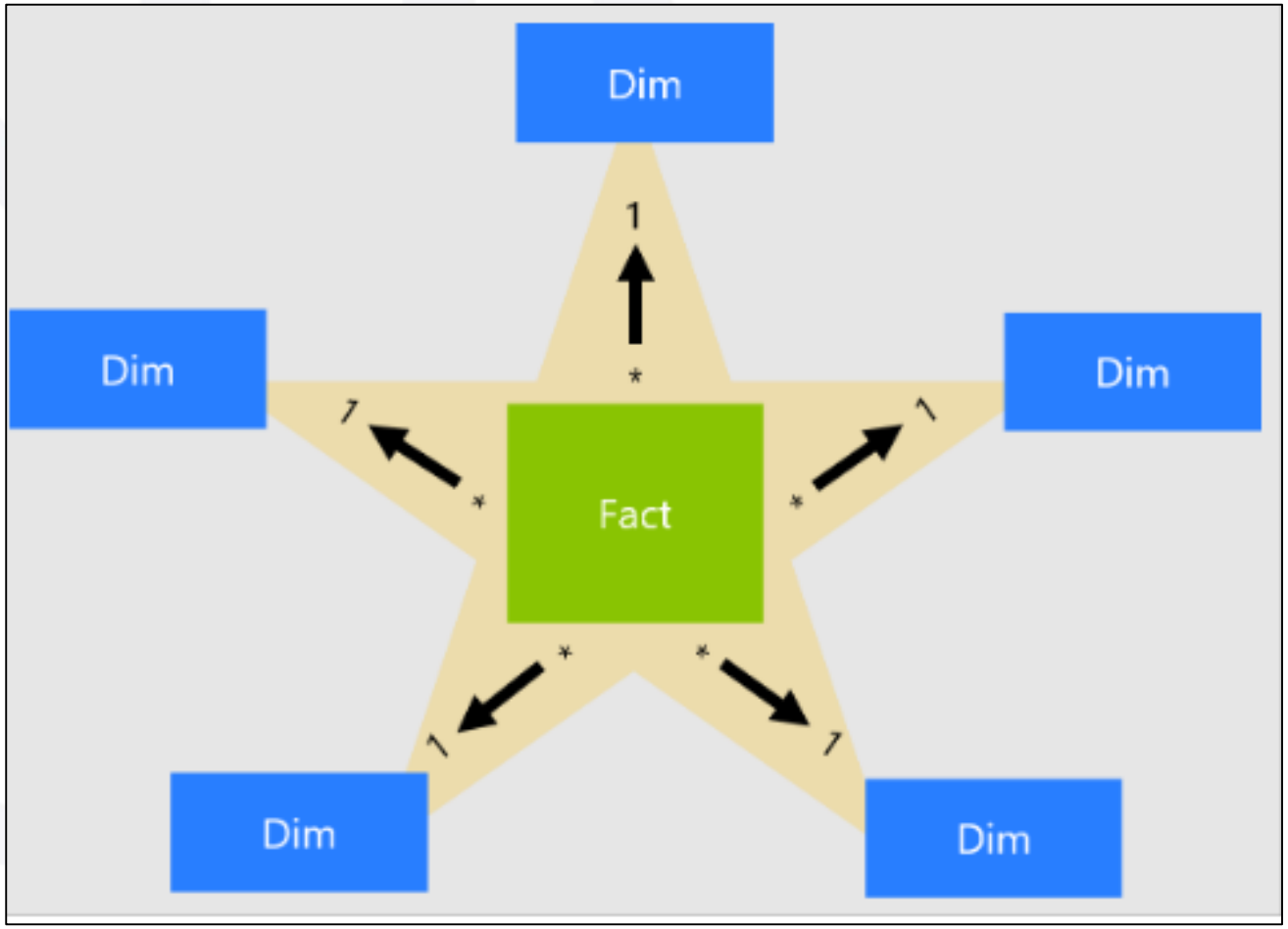
1. Slicer tables – Dimensions
    - They keep descriptive information
    - They are used for slicing and dicing
        - Slicers or filters
        - Axis/legends of chart
    - Descriptive doesn't means only text data type, also includes other data types
    - Small table in no. of rows but big in no. of columns

2. Value tables – Facts
   - Explains happening of an action
   - Keeps values (numeric, aggregable)
   - Used in values in charts and visuals
   - Small table in no. of columns and huge in no. of rows



Relationship between Fact and Dimensions tables---

- One to Many
- From dimension to fact
- Single direction
- Star schema

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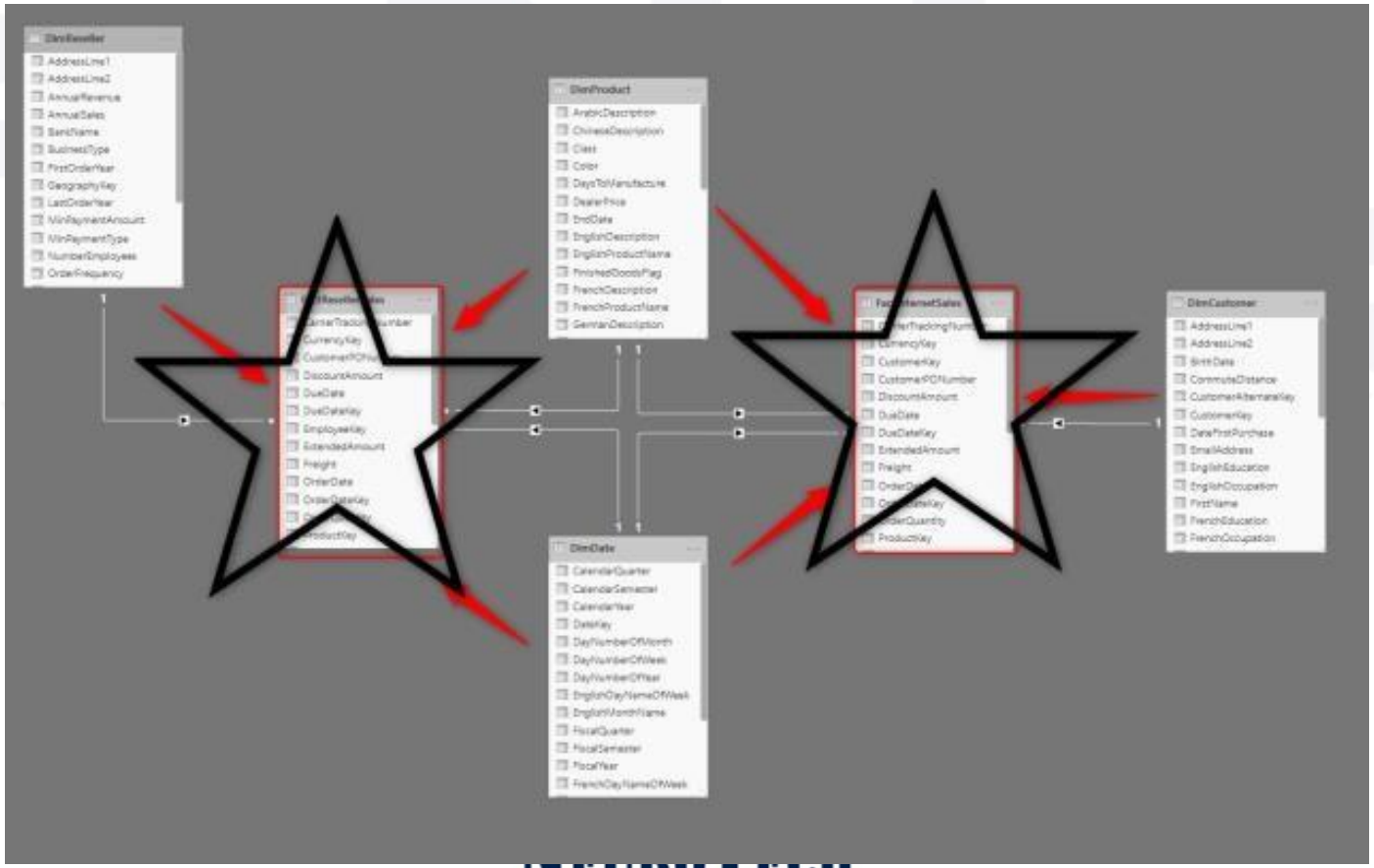
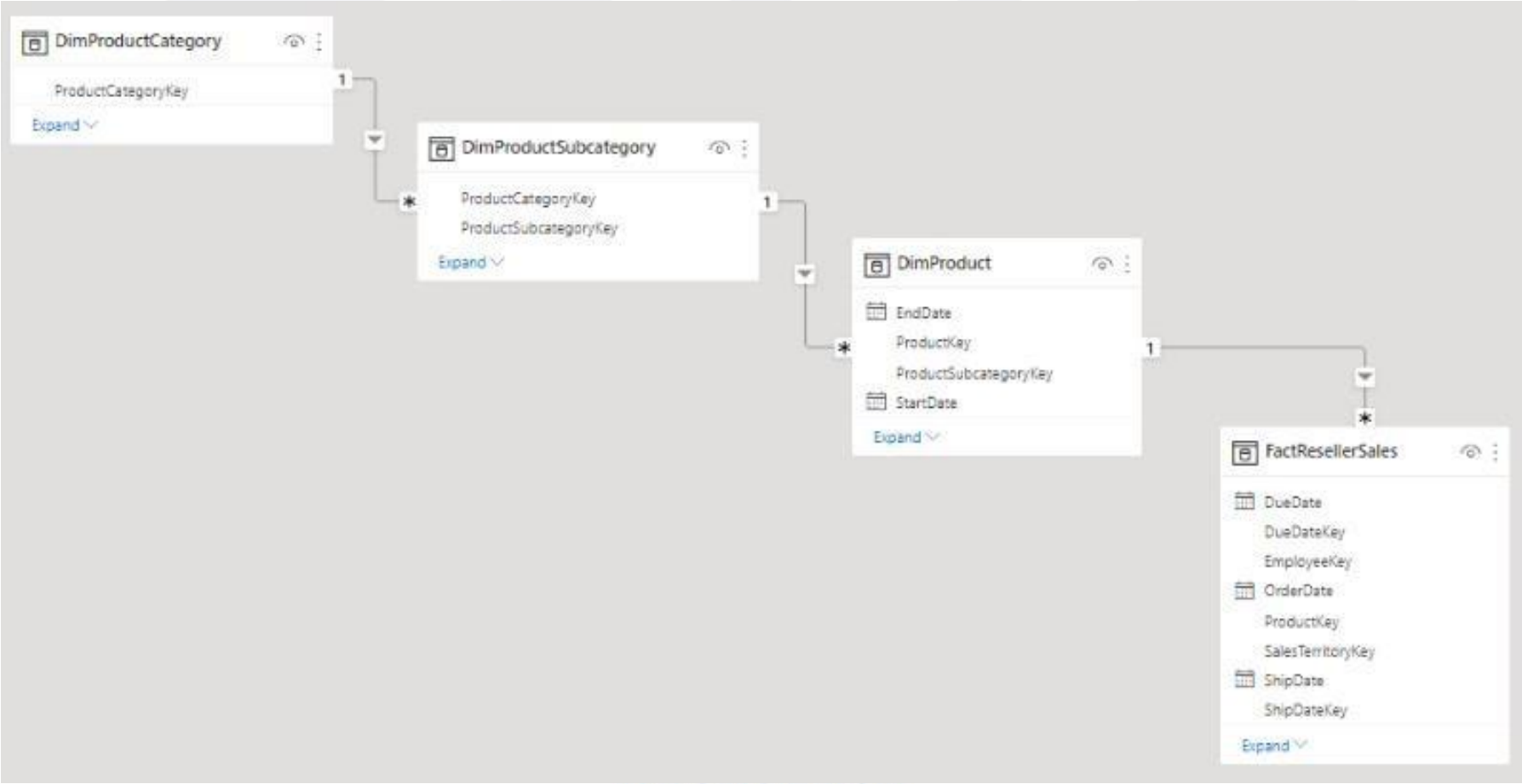
# STAR SCHEMA

- Fact table in the middle and other dim tables surrounding it.
- It can also have more than 1 fact tables surrounded by dim tables.
- It cannot have relationship between dim to dim table.



# SNOWFLAKE SCHEMA

- It is a variation of star schema
- Dim tables are normalized into multiple related tables.



## WHAT IS A GOOD DATA MODEL?

- It has star schema
- It has shared dimensions tables
- It includes fact table
- Single direction relationship
- One to many relationship

# ESTABLISHING RELATIONSHIPS

In Power-BI, relationships between tables are created to enable data to be combined across them.

This is done using—

- **Primary and foreign keys**– ensuring unique identifiers in the fact tables match the corresponding keys in dimension tables
- **Cardinality** – defining the type of relationship (one to one, one to many or many to many)
- **Cross-filter direction** – specifying the direction in which filters should flow (single or both direction)

## CARDINALITY

Each model relationship is defined by a cardinality type. There are four cardinality type options, representing the data characteristics of the "from" and "to" related columns.
The "one" side means the column contains unique values; the "many" side means the column can contain duplicate values.
There are 4 types of cardinality--
**One-to-many (and many-to-one) cardinality--** When configuring a one-to-many or many-to-one relationship, you'll choose the one that matches the order in which you related the columns.

**One-to-one cardinality** -- A one-to-one relationship means both columns contain unique values

**Many-to-many cardinality** -- A many-to-many relationship means both columns can contain duplicate values

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## CROSS FILTER DIRECTION

Each model relationship is defined with a cross filter direction. Your setting determines the direction(s) that filters will propagate. The possible cross filter options are dependent on the cardinality type.
Single cross filter direction means "single direction", and Both means "both directions".
A relationship that filters in both directions is commonly described as bi-directional

| Cardinality type | Cross filter options |
| --- | --- |
| One-to-many (or Many-to-one) | Single<br>Both |
| One-to-one | Both |
| Many-to-many | Single (Table1 to Table2)<br>Single (Table2 to Table1)<br>Both |

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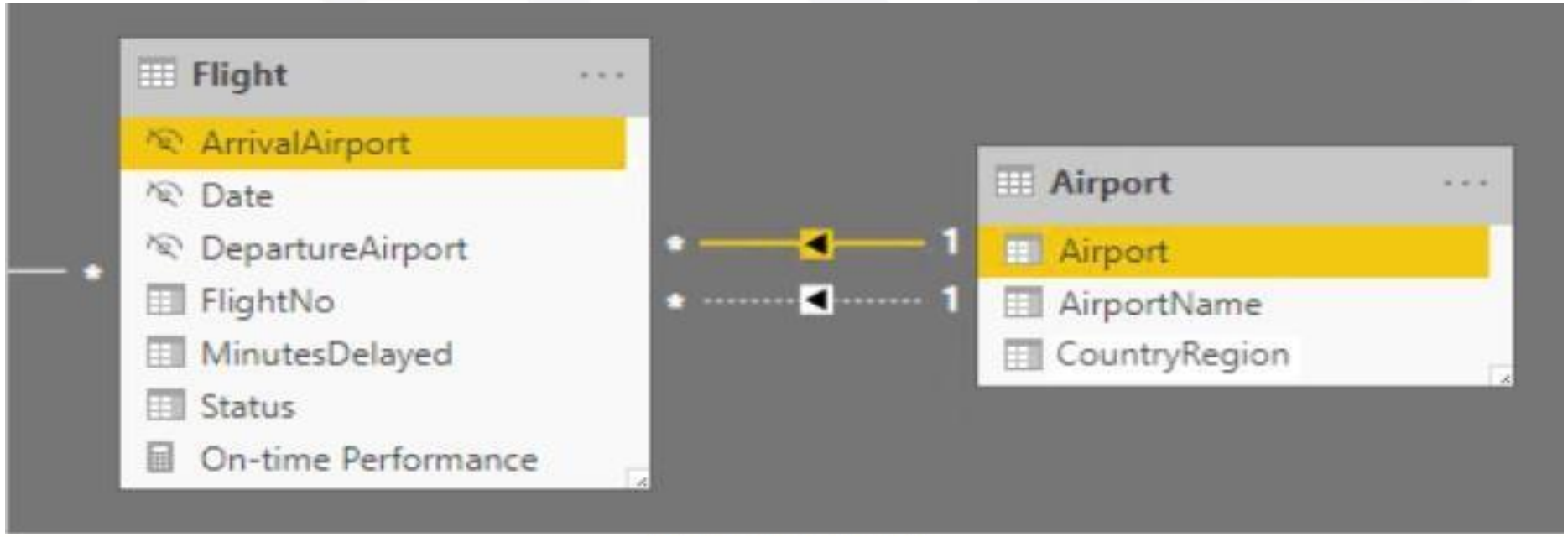
## ACTIVE AND INACTIVE RELATIONSHIPS

By default, relationship is always active.
If the tables contains more than one relationship, then first relationship is active rest all remains inactive.
Active relationship is a solid line and inactive relationship is a dotted line.
Inactive relationship doesn't play any role, it just remains there. So to make it working there are 2 methods– Define it using USERELATIONSHIP() in DAX or Role playing dimension(RPD)



**METHOD 1--** Define using USERELATIONSHIP() in DAX

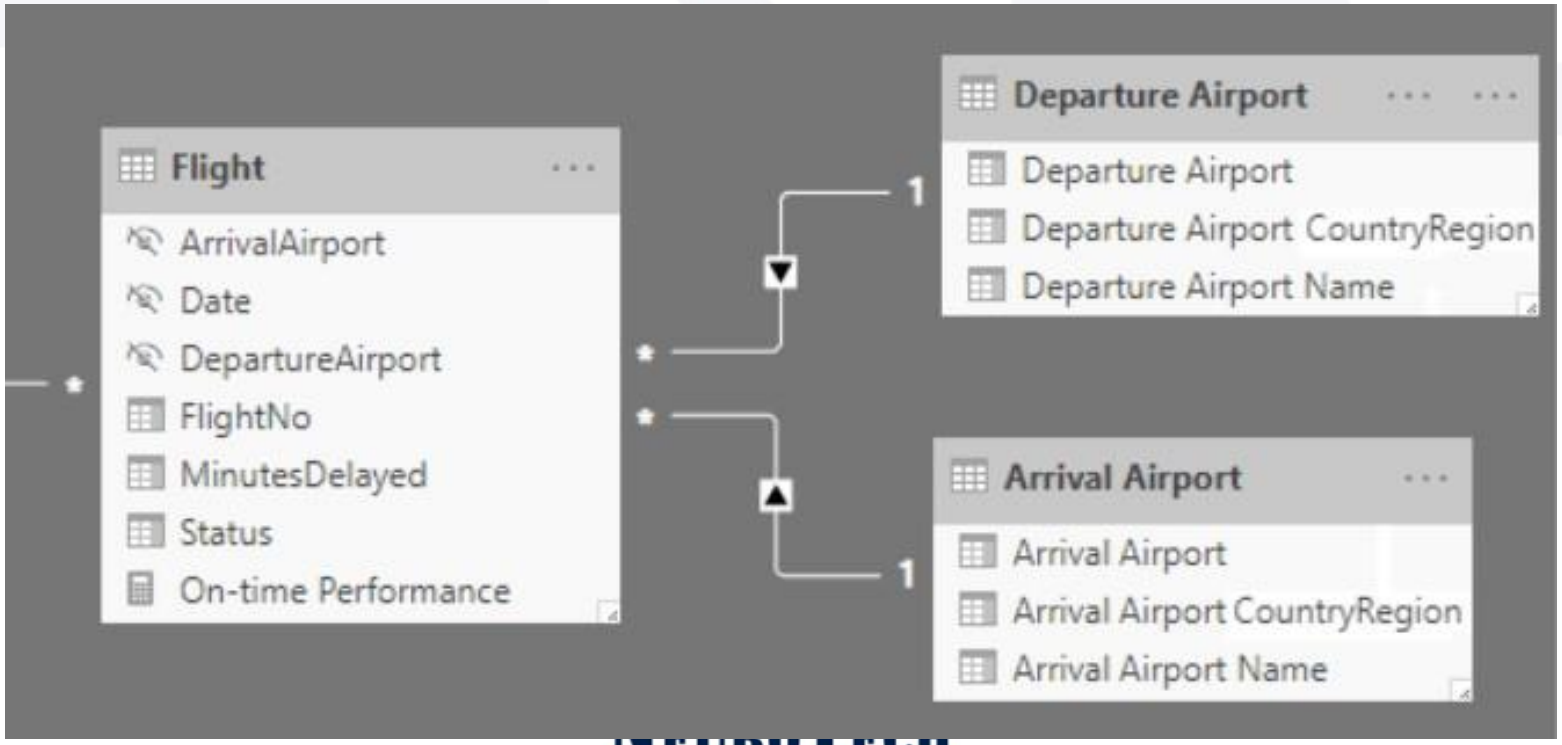
You can use the USERELATIONSHIP DAX function to activate a specific relationship for relevant model calculations.

**Syntax--**
USERELATIONSHIP(<columnName1>,<columnName2>)

In USERELATIONSHIP, the status of a relationship is not important; that is, whether the relationship is active or not does not affect the usage of the function.
Even if the relationship is inactive, it will be used and overrides any other active relationships that might be present in the model but not mentioned in the function arguments.

**METHOD 2–** Role Playing Dimensions

Duplicate table is created, and then create a active relationship between them.
Here, Airport table is duplicated and named them accordingly.



# Practical
# Implement Ecommerce Sales Data Set

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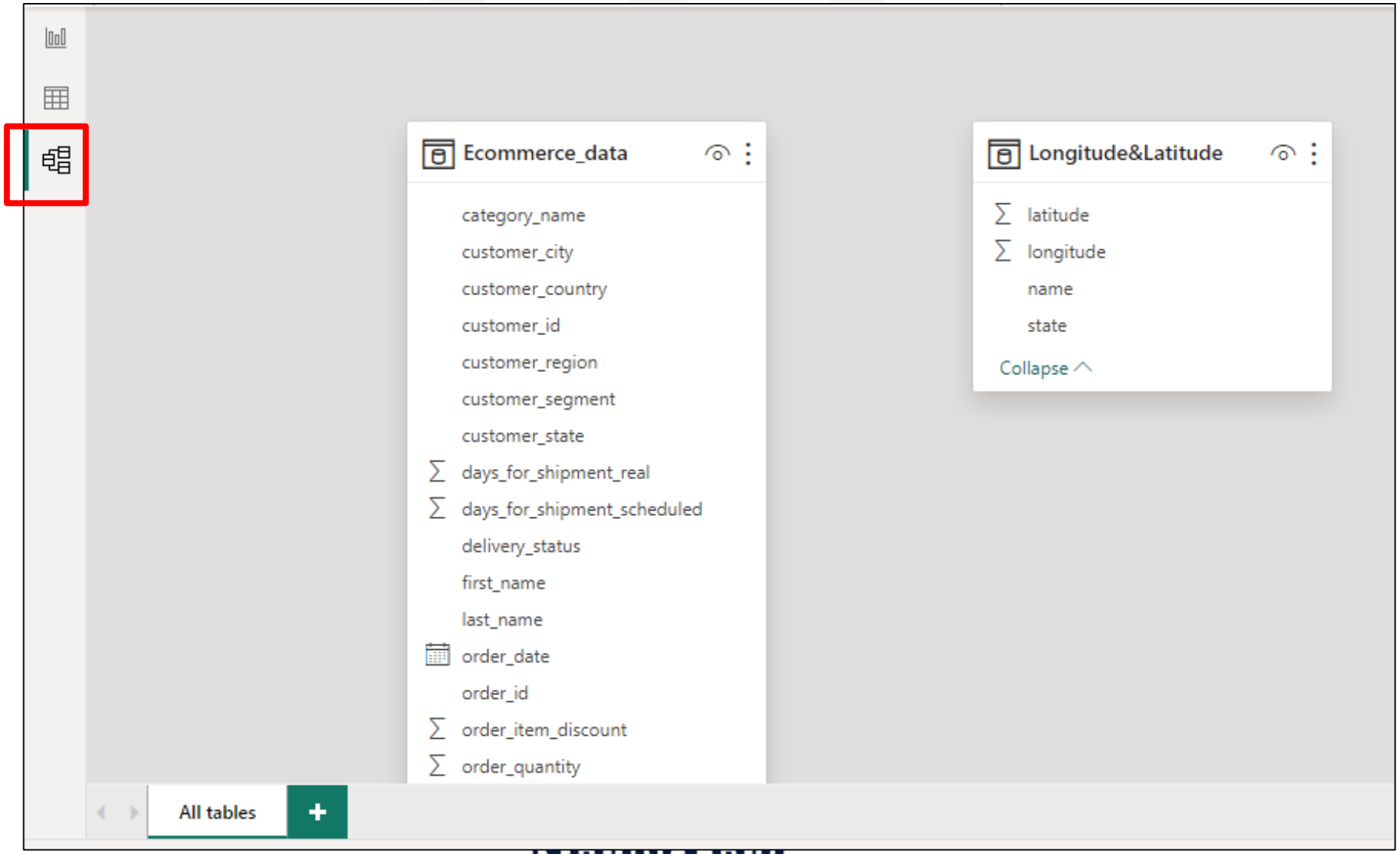
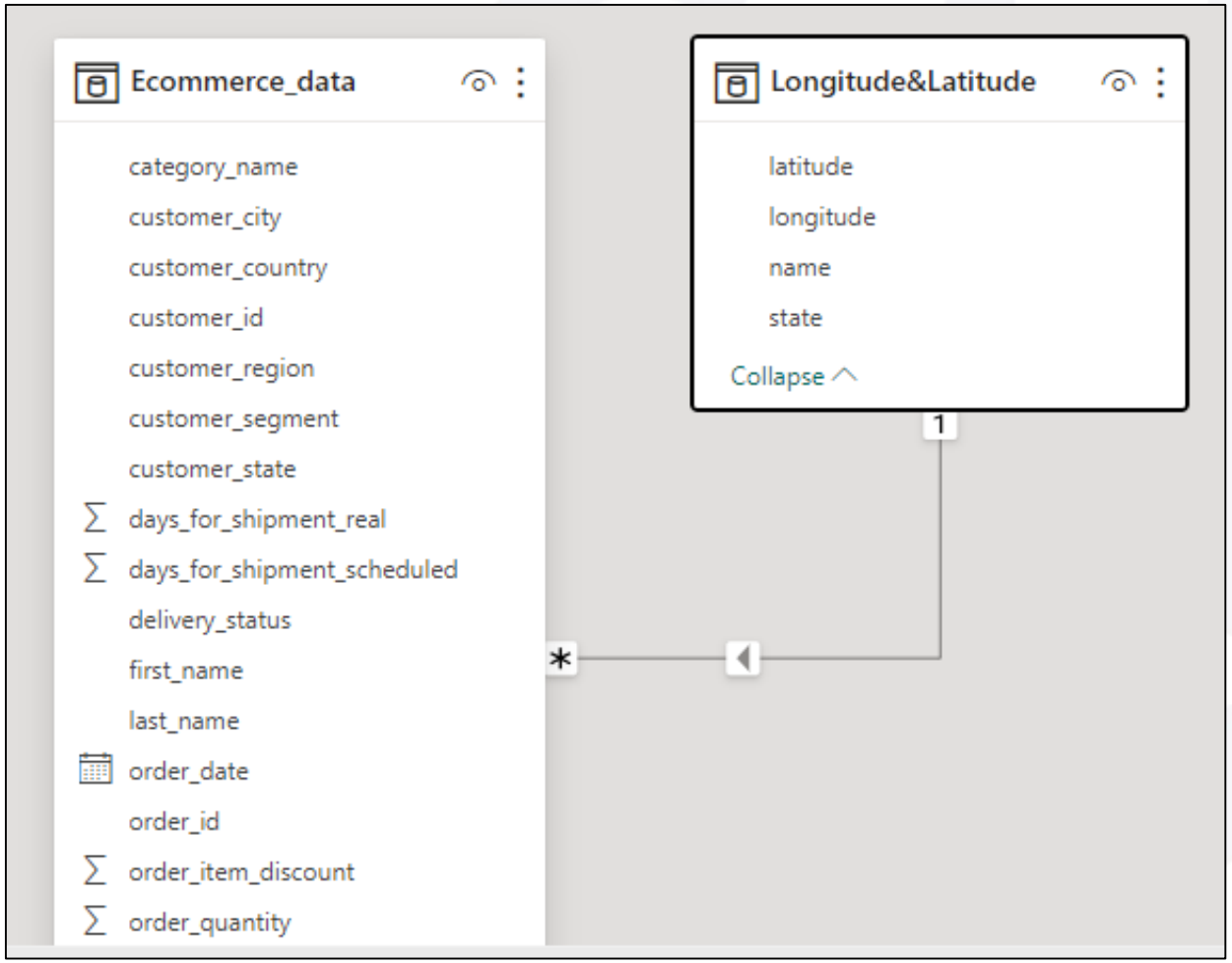
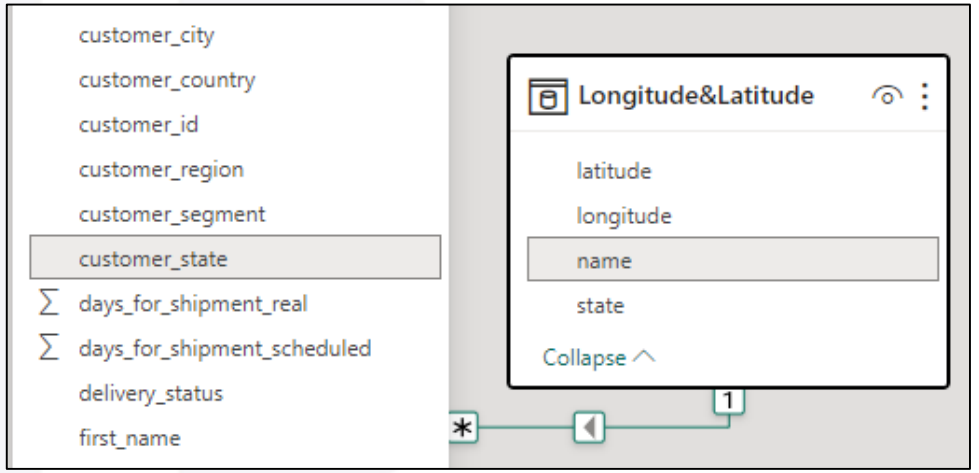
Open Model View and check if Power-BI has automatically detected relationship, if not you have to create them.



**Method 1---**

Check which columns are common in both table. Drag column from one table on the other table's respective column, it creates automatic relationship.




Hover on relationship line to see which columns are connected.

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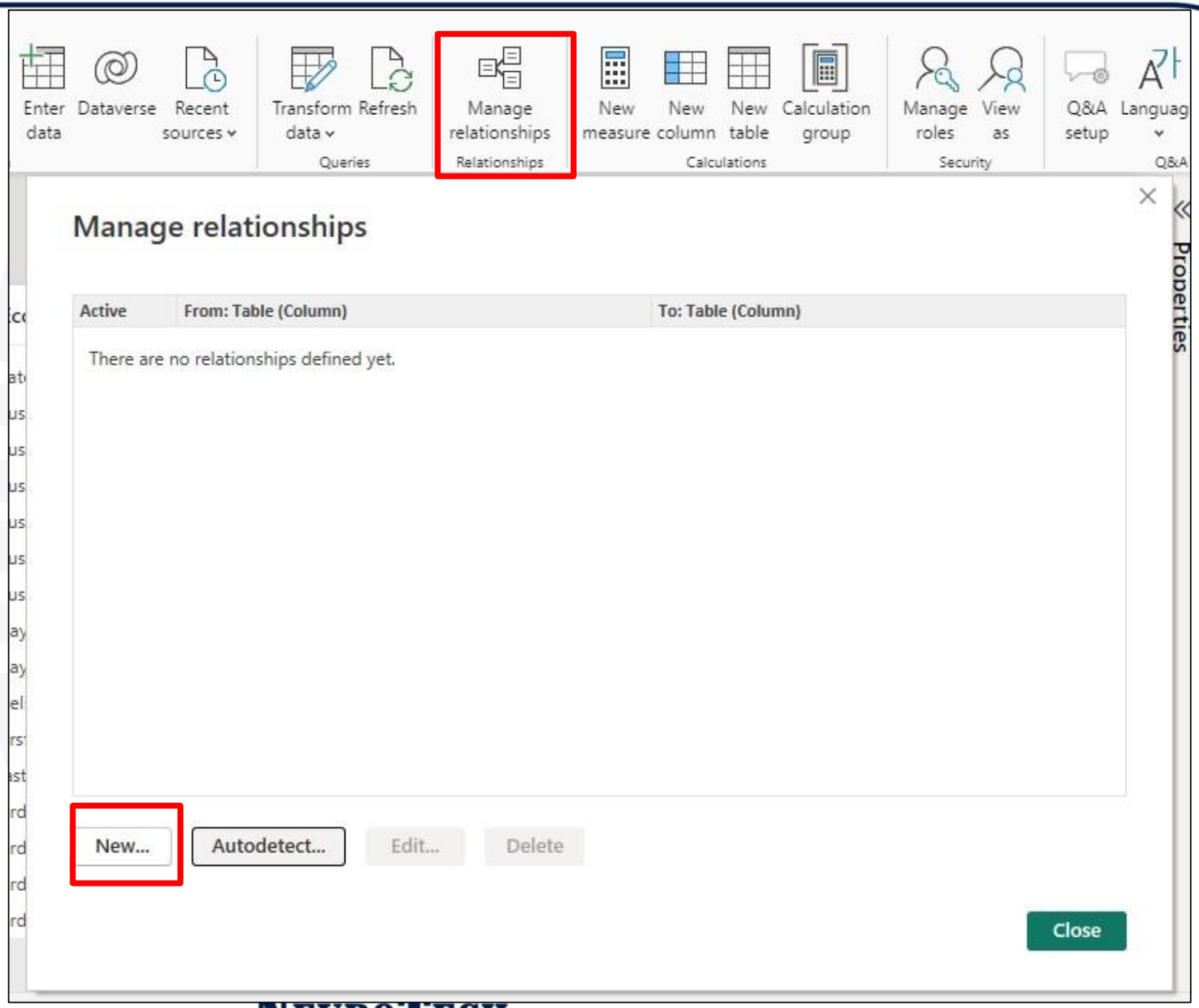
**Method 2---**

Step1--

Click on “ Manage Relationship” then “New”

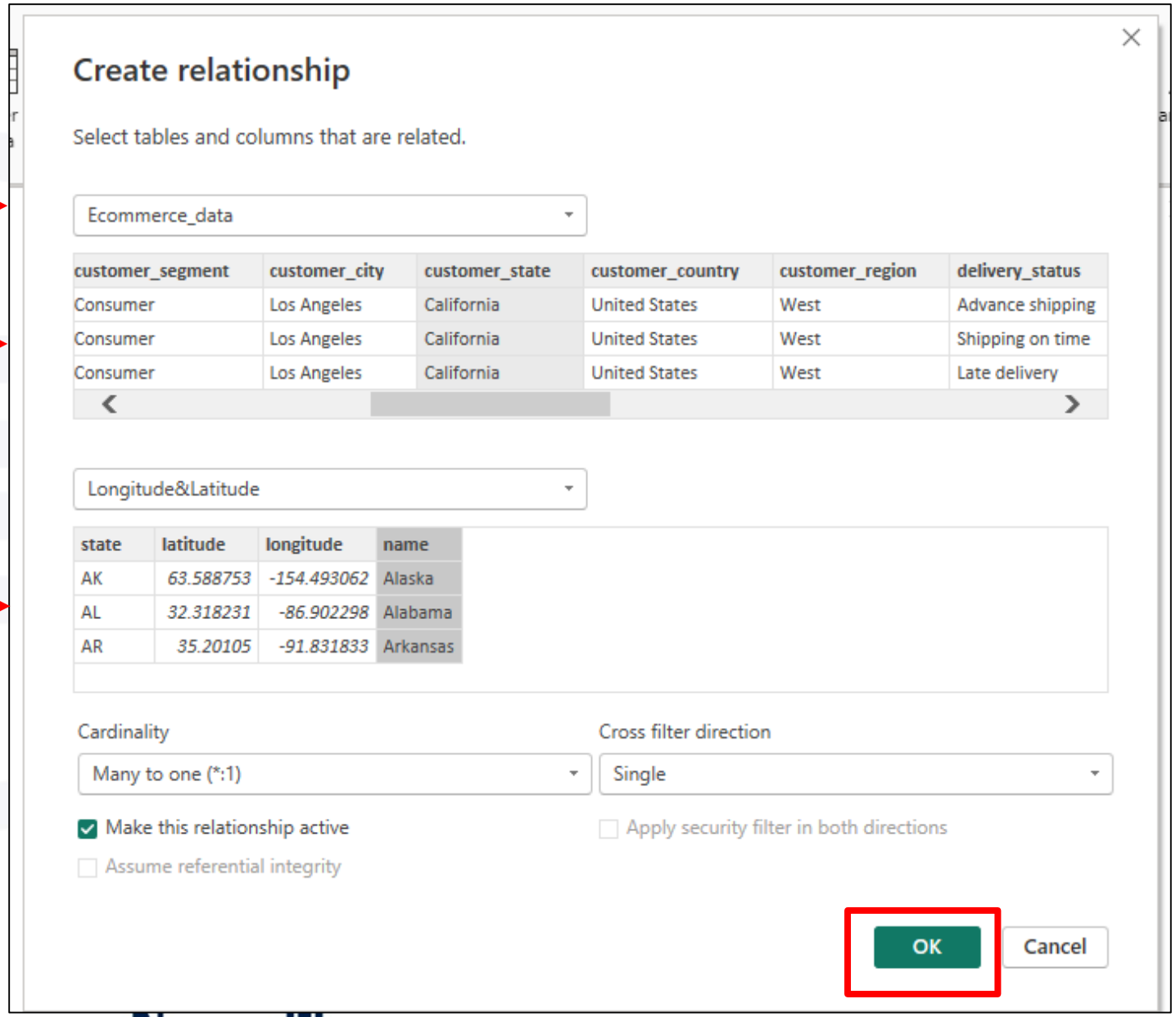


Step 2--

Select table

Select column

Select column

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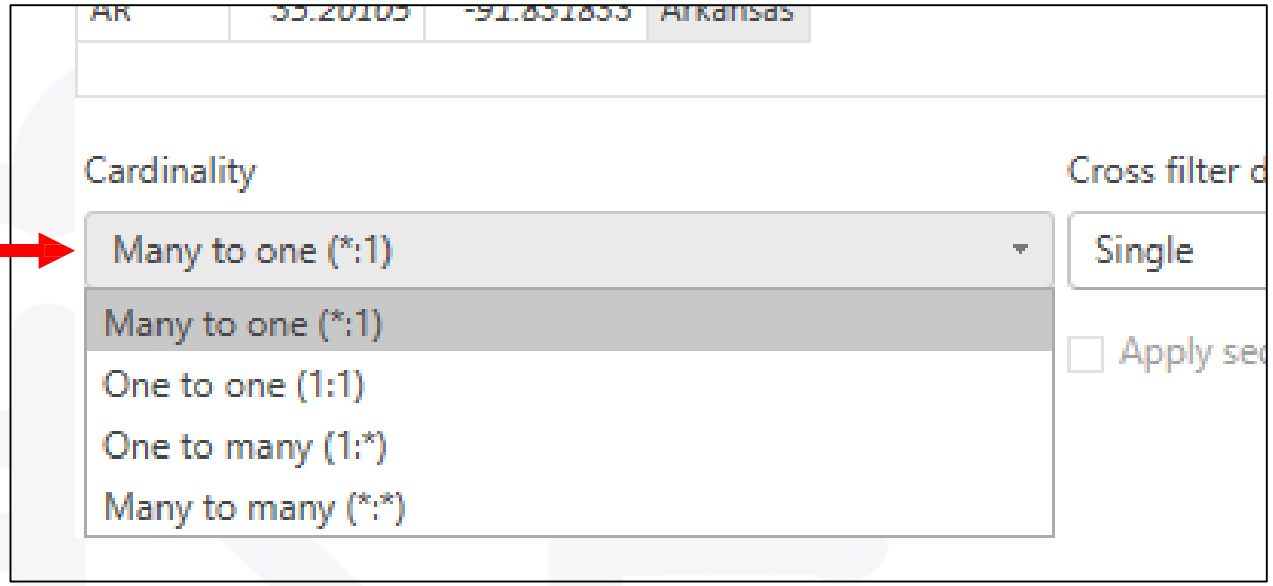
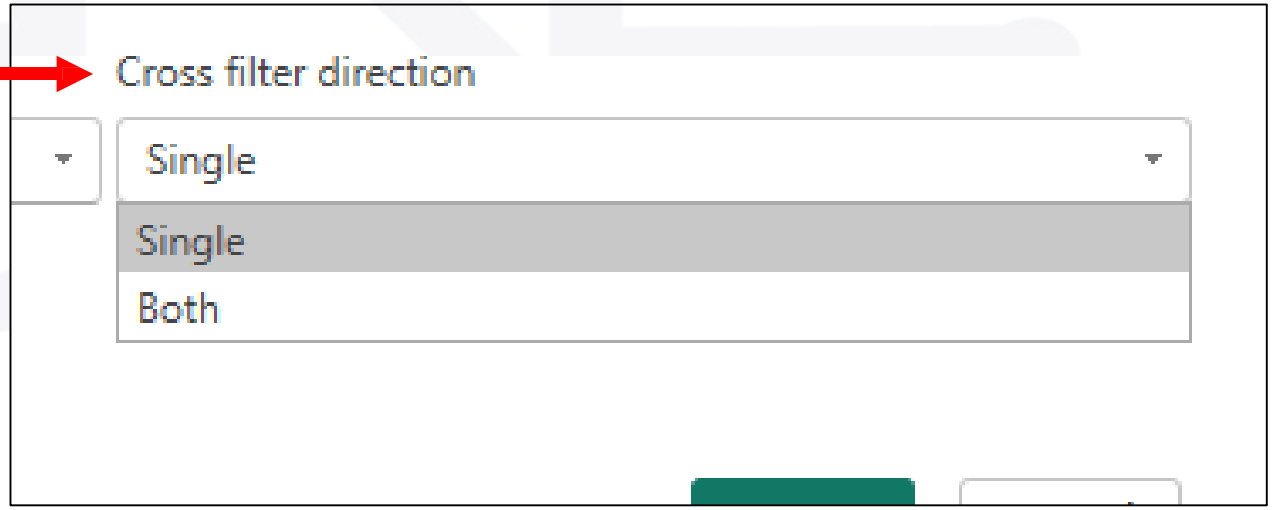
Cardinality types




Relationship direction

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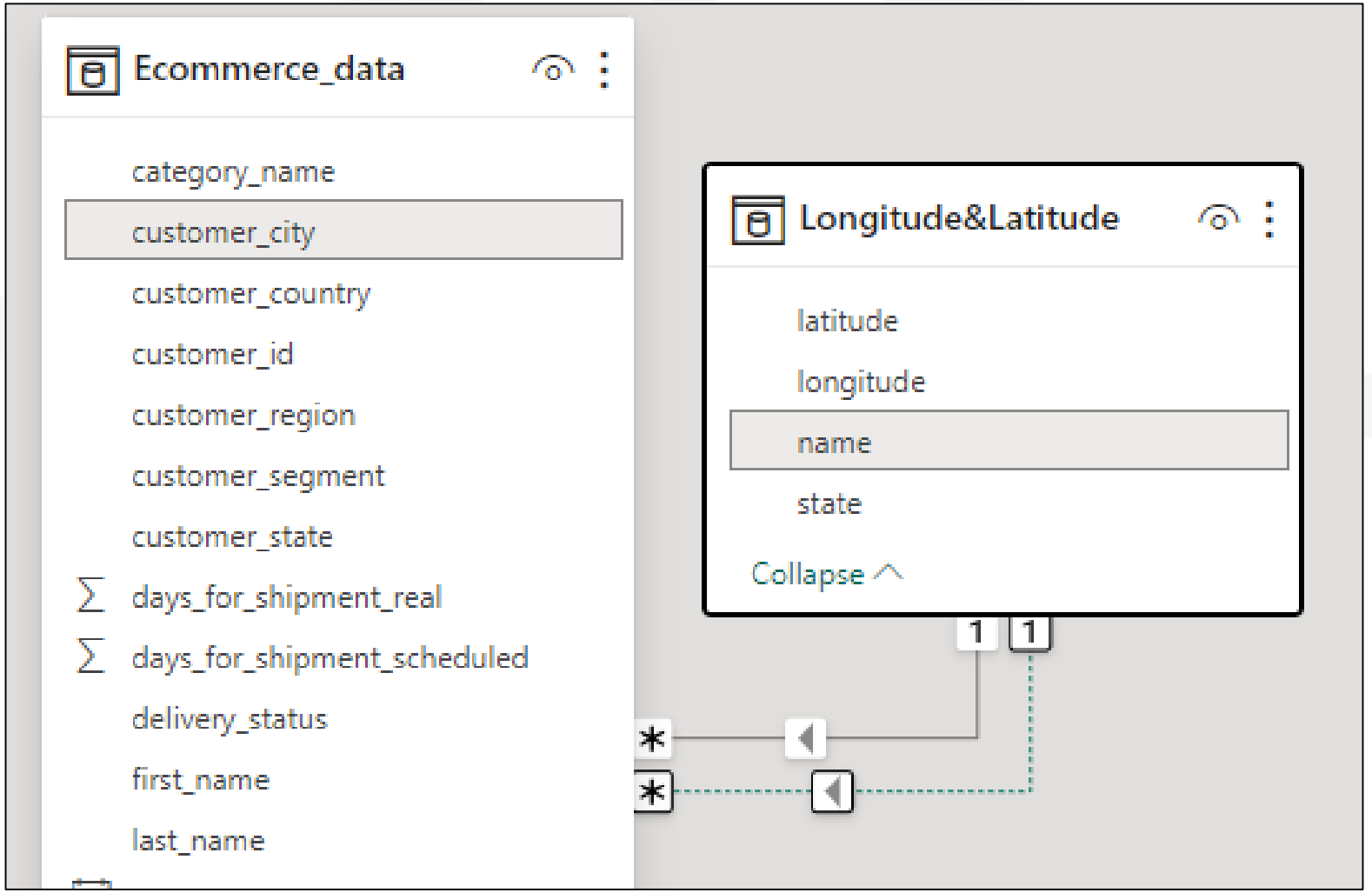
(JUST FOR DEMO)– Inactive relationship
It is identified by dotted line.

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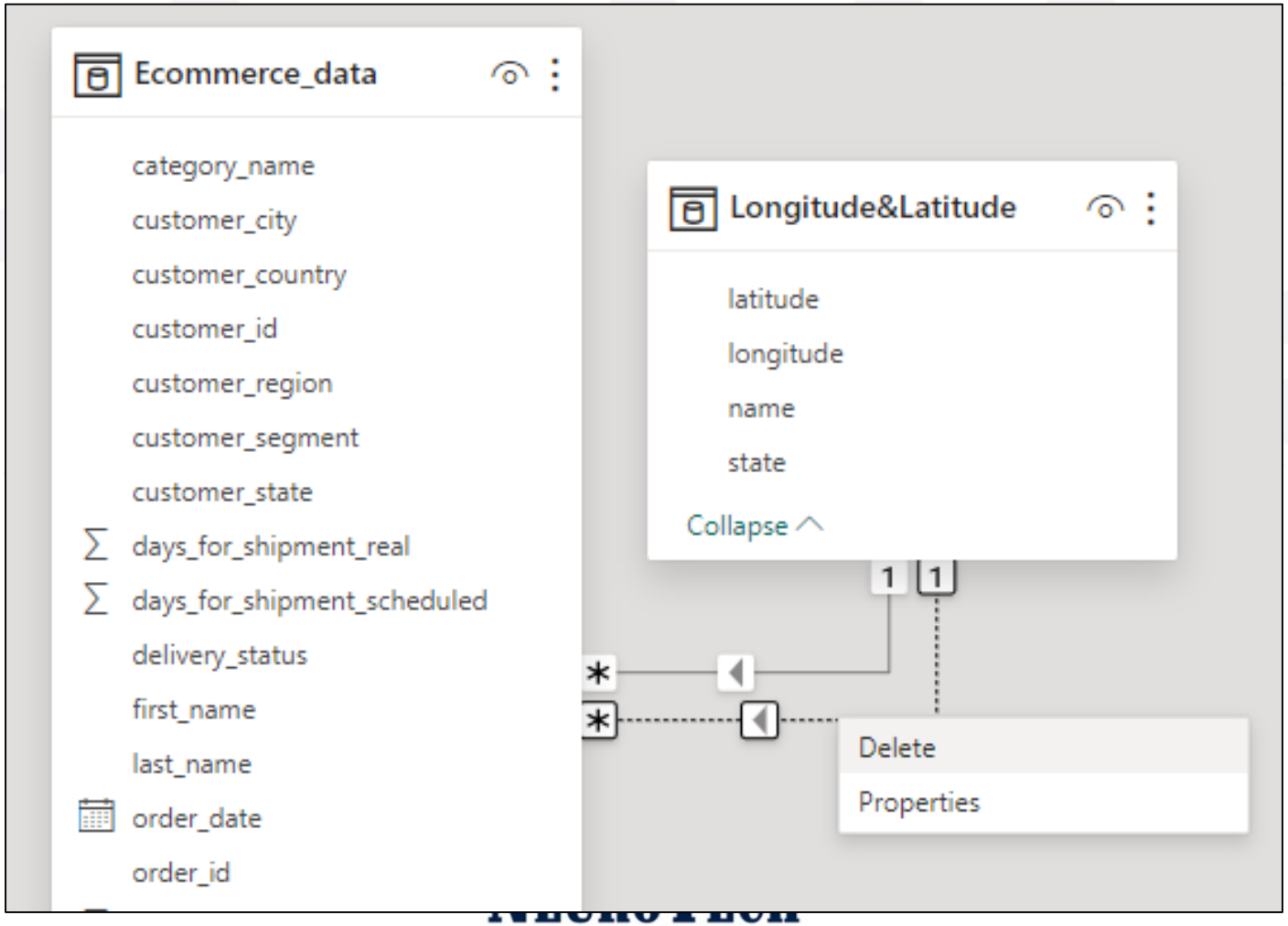
If any relationship is wrong, you can delete it or edit it.

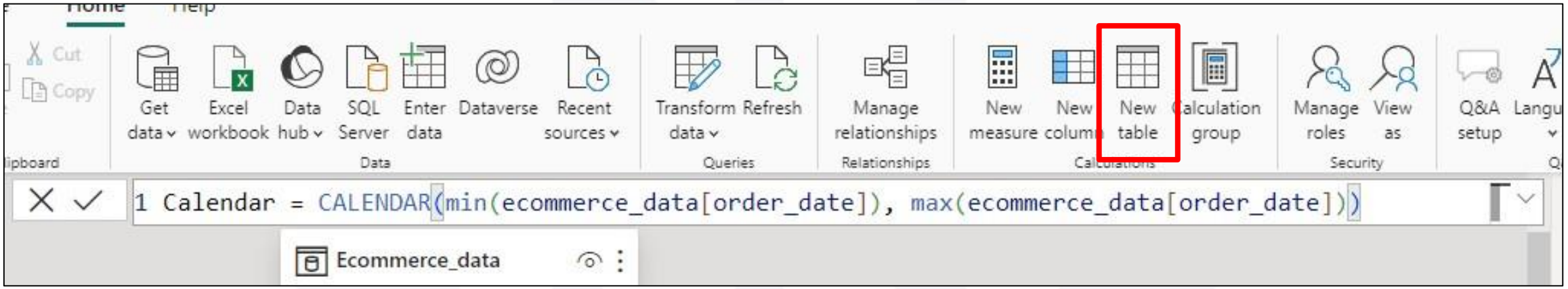
Right click on the line—

- To delete click delete
- To edit click properties



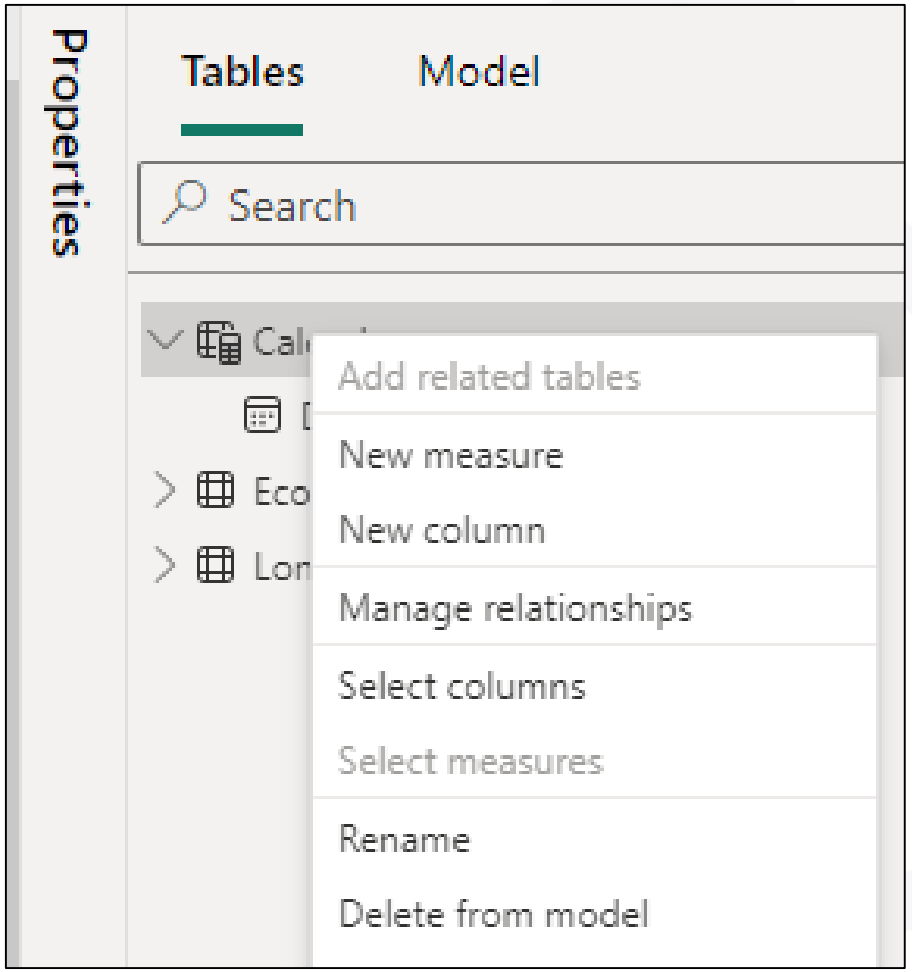
You need to create a Calendar table.

A separate date table enhances time intelligence capabilities, ensures consistency across fact tables, and enables more flexible and efficient date-based filtering and calculations.




Click on “new table”
Write DAX query for new table
Press Enter

You need to extract Year, Month, Month_Number from Date column.




Right-Click on table name select “new column” write following queries for each column

```
1 Year = year('Calendar'[Date])
```

```
1 Month = format('Calendar'[Date], "mmmm")
```

```
1 Month Number = MONTH('Calendar'[Date])
```

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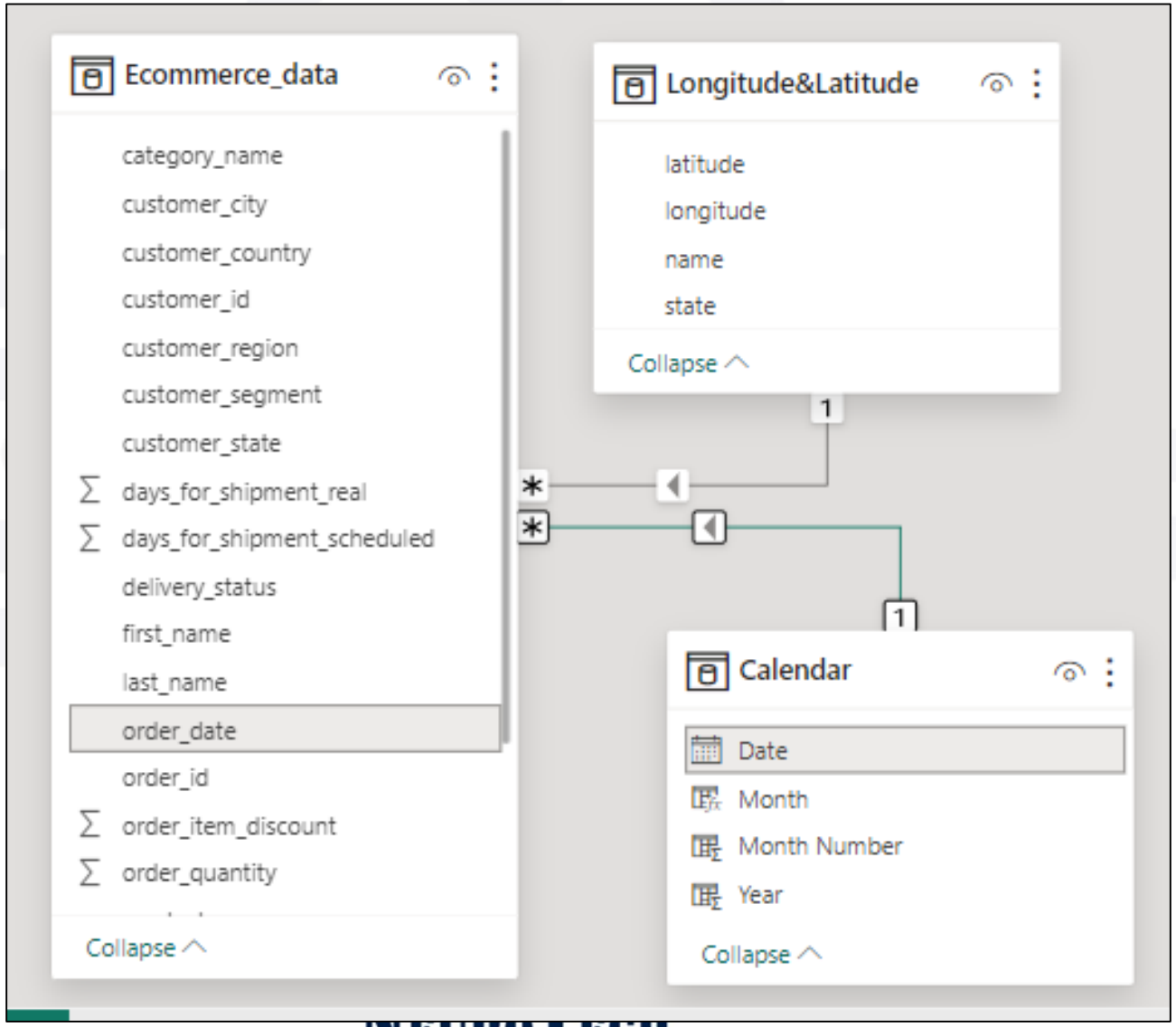
# Create relationship between date columns



# Data Analysis Expression (DAX)

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# INTRO

Data Analysis Expressions (DAX) is a formula expression language used in Analysis Services, Power BI, and Power Pivot in Excel.
DAX formulas include functions, operators, and values to perform advanced calculations and queries on data in related tables and columns in tabular data models.

DAX formulas are used in measures, calculated columns, calculated tables, and row-level security.

- **Calculated columns** are computed during data load and are stored in the data model, often used for intermediate calculations.

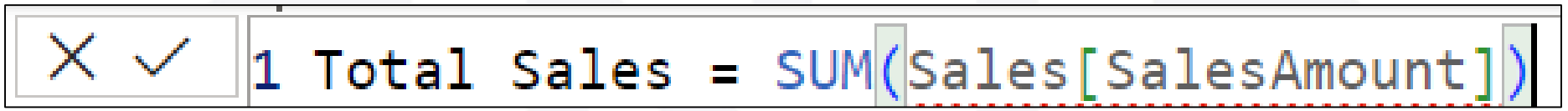
- **Measures** are dynamic calculations evaluated at query time and provide flexibility and efficiency for reporting.

- **Calculated table** is a computed object, based on a formula expression, derived from all or part of other tables in the same model. Instead of querying and loading values into your new table's columns from a data source, a DAX formula defines the table's values.

- With **row-level security**, a DAX formula must evaluate to a Boolean TRUE/FALSE condition, defining which rows can be returned by the results of a query by members of a particular role.

# SYNTAX

Syntax includes the various elements that make up a formula, or more simply, how the formula is written.
For example, here's a simple DAX formula for a measure:




The measure name, **Total Sales**.
The equals sign operator **(=),** which indicates the beginning of the formula. When calculated, it will return a result.
The DAX function **SUM**, which adds up all of the numbers in the Sales[SalesAmount] column.
Parenthesis **(),** which surround an expression that contains one or more arguments. An argument passes a value to a function.
The referenced table, **Sales**.
The referenced column, **[SalesAmount],** in the Sales table. With this argument, the SUM function knows on which column to aggregate a SUM.

# FUNCTIONS

**Functions** are predefined formulas that perform calculations by using specific values, called arguments, in a particular order or structure.
Arguments can be other functions, another formula, expression, column references, numbers, text, logical values such as TRUE or FALSE, or constants.

DAX includes the following categories of functions:-
Aggregation functions, Date and Time functions, Filter functions, Financial functions, Information functions, Logical functions, Math and trig functions, Other functions, Parent and child functions, Relationship functions, Statistical functions, Table manipulation functions, Text functions, Time intelligence functions.

Some of the common DAX functions—

- **AVERAGE--** Returns the average (arithmetic mean) of all the numbers in a column.

  syntax-- AVERAGE(<column>)

- **AVERAGEX--** Calculates the average (arithmetic mean) of a set of expressions evaluated over a table

  syntax-- AVERAGEX(<table>,<expression>)

- **DISTINCTCOUNT**- Counts the number of distinct values in a column

  syntax-- DISTINCTCOUNT(<column>)

- **SUM–** Adds all the numbers in a column
  syntax-- SUM(<column>)

- **SUMX**- Returns the sum of an expression evaluated for each row in a table
  syntax-- SUMX(<table>,<expression>)

- **CALENDAR** Returns a table with a single column named "Date" that contains a contiguous set of dates. The range of dates is from the specified start date to the specified end date, inclusive of those two dates.
  syntax-- CALENDAR(<start_date>, <end_date>)

- **DATEDIFF--** Returns the number of interval boundaries between two dates.
  syntax-- DATEDIFF(<Date1>, <Date2>, <Interval>)

- **NETWORKDAYS–** Returns the number of whole workdays between two dates (inclusive). Parameters specify which and how many days are weekend days. Weekend days and days specified as holidays are not considered as workdays.

  syntax-- NETWORKDAYS(<start_date>, <end_date>[, <weekend>, <holidays>])

- **ALL--** Returns all the rows in a table, or all the values in a column, ignoring any filters that might have been applied. This function is useful for clearing filters and creating calculations on all the rows in a table.

  syntax-- ALL( [<table> | <column>[, <column>[, <column>[,…]]]] )

- **CALCULATE--** Evaluates an expression in a modified filter context

  syntax-- CALCULATE(<expression>[, <filter1> [, <filter2> [, …]]])

- **SWITCH–** Evaluates an expression against a list of values and returns one of multiple possible result expressions. This function can be used to avoid having multiple nested IF statements.
- syntax-- SWITCH(<expression>, <value>, <result>[, <value>, <result>]…[, <else>])

- **DIVIDE-** Performs division and returns alternate result or BLANK() on division by 0.

  syntax-- DIVIDE(<numerator>, <denominator> [,<alternateresult>])

- **GENERATESERIES-** Returns a single column table containing the values of an arithmetic series, that is, a sequence of values in which each differs from the preceding by a constant quantity. The name of the column returned is Value.

  syntax-- GENERATESERIES(<startValue>, <endValue>[, <incrementValue>])

- **CONCATENATE–** Joins two text strings into one text string.
  syntax-- CONCATENATE(<text1>, <text2>)

- **DATESBETWEEN--** Returns a table that contains a column of dates that begins with a specified start date and continues until a specified end date.
  syntax-- DATESBETWEEN(<Column>, <StartDate>, <EndDate>)

- **TOTALMTD--** Evaluates the value of the expression for the month to date, in the current context.
  syntax-- TOTALMTD(<expression>,<dates>[,<filter>])

- **TOTALQTD--** Evaluates the value of the expression for the dates in the quarter to date, in the current context.
  syntax-- TOTALQTD(<expression>,<dates>[,<filter>])

- **TOTALYTD--** Evaluates the year-to-date value of the expression in the current context

  syntax-- TOTALYTD(<expression>,<dates>[,<filter>],[<year_end_date>])

- **DATESYTD-** Returns a table that contains a column of the dates for the year to date, in the current context.

  syntax-- DATESYTD(<dates> [,<year_end_date>])

- **DATESMTD-** Returns a table that contains a column of the dates for the month to date, in the current context.

  syntax-- DATESMTD(<dates>)

- **DATESQTD-** Returns a table that contains a column of the dates for the quarter to date, in the current context.

  syntax-- DATESQTD(<dates>)

# DAX OPERATORS

The DAX language uses operators to create expressions that compare values, perform arithmetic calculations, or work with strings.

There are four different types of calculation operators: -
Arithmetic operator,
Comparison operator,
Text concatenation operator, and
Logical operator.

# ARITHMETIC OPERATORS

To perform basic mathematical operations such as addition, subtraction, or multiplication; combine numbers; and produce numeric results, use the following arithmetic operators

| Arithmetic operator | Meaning | Example |
|---|---|---|
| + (plus sign) | Addition | 3+3 |
| – (minus sign) | Subtraction or sign | 3–1–1 |
| * (asterisk) | Multiplication | 3*3 |
| / (forward slash) | Division | 3/3 |
| ^ (caret) | Exponentiation | 16^4 |

# COMPARISON OPERATORS

You can compare two values with the following operators. When two values are compared by using these operators, the result is a logical value, either TRUE or FALSE

| Comparison operator | Meaning | Example |
|---|---|---|
| = | Equal to | [Region] = "USA" |
| == | Strict equal to | [Region] == "USA" |
| > | Greater than | [Sales Date] > "Jan 2009" |
| < | Less than | [Sales Date] < "Jan 1 2009" |
| >= | Greater than or equal to | [Amount] >= 20000 |
| <= | Less than or equal to | [Amount] <= 100 |
| <> | Not equal to | [Region] <> "USA" |

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TEXT CONCATENATION OPERATOR

Use the ampersand (&) to join, or concatenate, two or more text strings to produce a single piece of text.

| Text operator | Meaning | Example |
|---|---|---|
| & (ampersand) | Connects, or concatenates, two values to produce one continuous text value | [Region] & ", " & [City] |

# LOGICAL OPERATORS

Use logical operators (&&) and (||) to combine expressions to produce a single result.

| Text operator | Meaning | Examples |
|---|---|---|
| && (double ampersand) | Creates an AND condition between two expressions that each have a Boolean result. If both expressions return TRUE, the combination of the expressions also returns TRUE; otherwise the combination returns FALSE. | ([Region] = "France") && ([BikeBuyer] = "yes")) |
| \|\| (double pipe symbol) | Creates an OR condition between two logical expressions. If either expression returns TRUE, the result is TRUE; only when both expressions are FALSE is the result FALSE. | (([Region] = "France") \|\| ([BikeBuyer] = "yes")) |
| IN | Creates a logical OR condition between each row being compared to a table. Note: the table constructor syntax uses curly braces. | 'Product'[Color] IN { "Red", "Blue", "Black" } |

# ERROR HANDLING IN DAX

The **BLANK** function represents missing or undefined values in DAX calculations.

**ISBLANK** checks if a value is blank and returns TRUE if it is, otherwise FALSE.

**IFERROR** provides a way to handle errors by returning a specified value if an error occurs in a calculation

# FORMATING DAX FORMULAS

- Proper formatting improves the readability and maintainability of DAX code, making it easier to understand and debug.
- Use indentation and line breaks to separate different parts of the formula clearly.
- Add comments to explain complex logic and document your thought process.
- Consistent formatting practices help in collaborative environments and future proof your reports.

# PRACTICAL IMPLEMENTATION OF DAX ON ECOMM SALES ANALYSIS PROJECT

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AIM OF THE PROJECT—

The primary goal is to provide actionable insights into the e-commerce landscape, pinpointing areas for enhancement and growth through comprehensive analysis.

On having a look at aim of project and available dataset structure, you can decide the primary columns or measures needed during visualization process.

Here, you can create basic measures like –

( YTD= YearToDate, YOY= YearOverYear, PYTD= PreviousYTD )

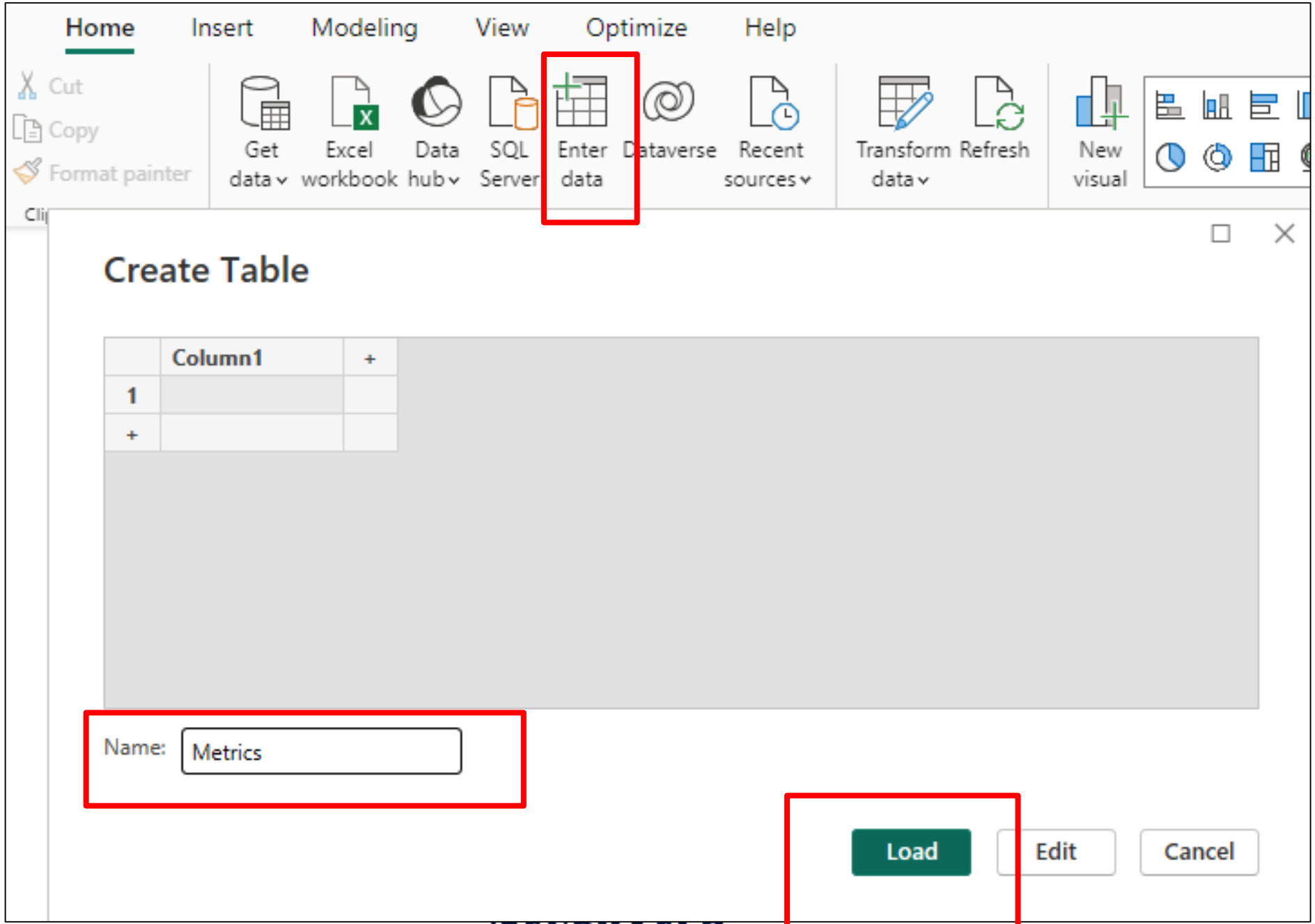
YTD sales, YTD Qty, YTD Profit, YTD Profit margin

YOY Sales, YOY Qty, YOY Profit, YOY Profit margin To get YOY, you will need--

PYTD Sales, PYTD Qty, PYTD Profit, PYTD Profit margin

First of all, create a separate table for measures, so that it won't get confusing in the dataset tables.  You can create them in existing tables itself.

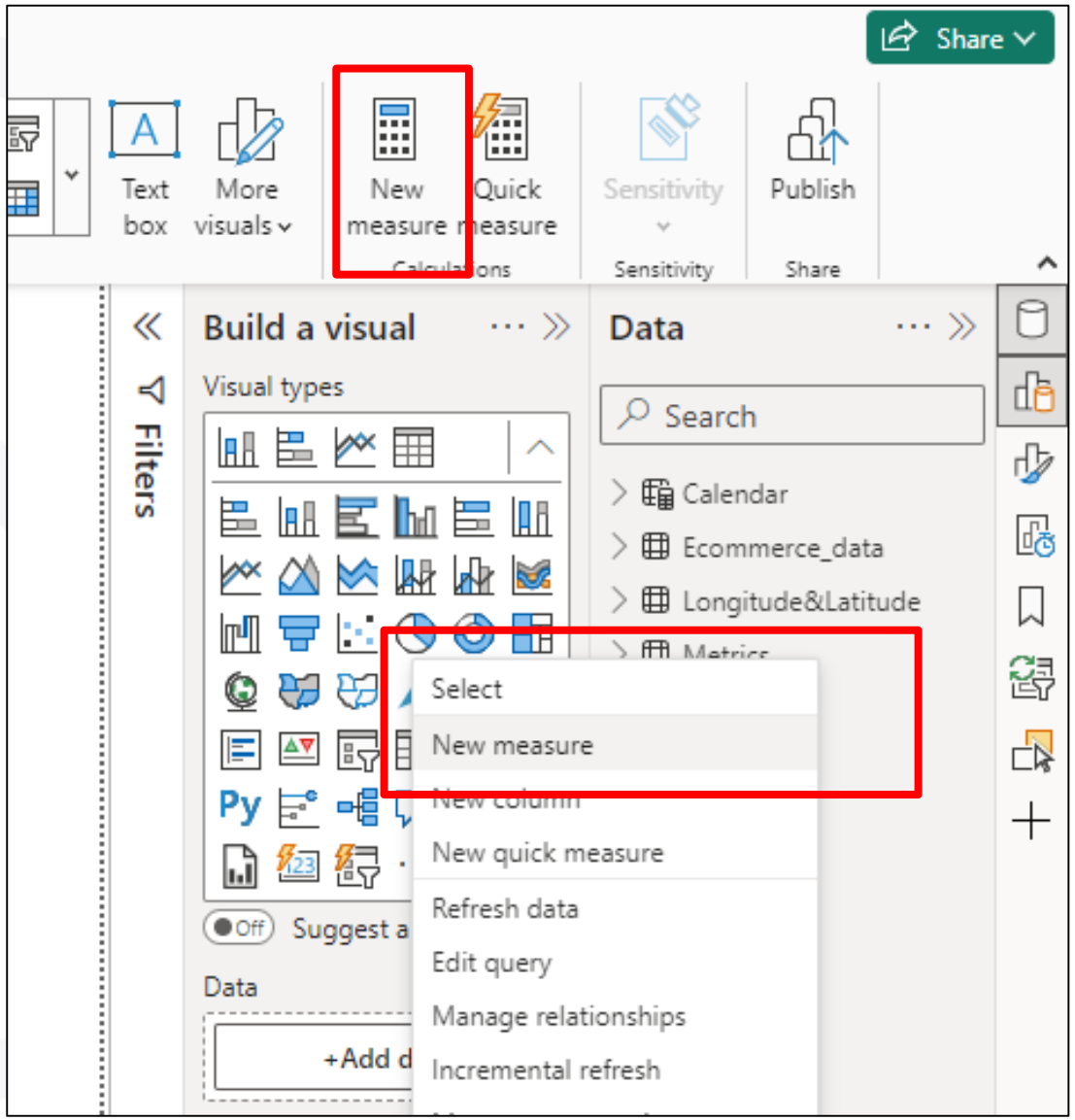
Click on "Enter Data" under Home tab.
Name the table
Click Load
On right side in DATA panel, the new table is displayed.


Home
Insert
Modeling
View
Optimize
Help
Cut
Copy
Format painter
Get data
Excel workbook
Data hub
SQL Server
Enter data
Dataverse
Recent sources
Transform data
Refresh
New visual
Create Table
Column1
1
Name:
Metrics
Load
Edit
Cancel

To create 1st measure right click on new table → create measure

OR

Click on “New Measure” under Home tab

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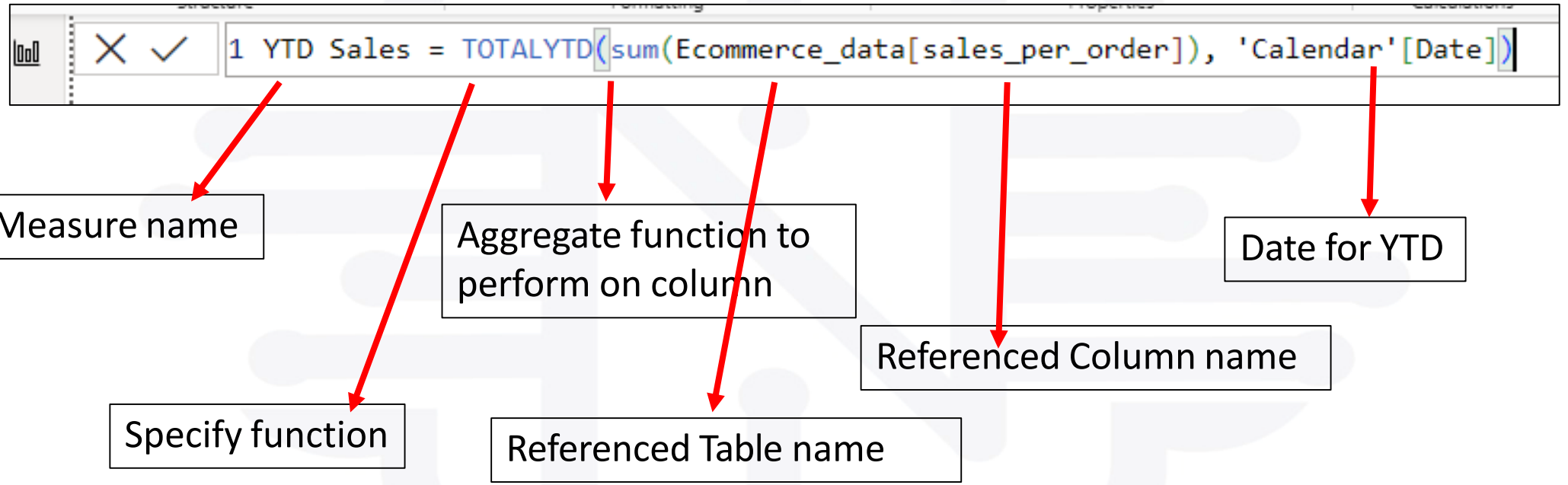
Write following query and press Enter




( First, it calculates the sum of the sales per order from the `ecmm_data` table.
Then, it takes this sum and computes the year-to-date total using the dates provided in the `Calendar[Date]` column.)

Following same process write other queries.

```
1 YTD Qty = TOTALYTD(sum(Ecommerce_data[order_quantity]), 'Calendar'[Date])
```

```
1 YTD Profit = TOTALYTD(sum(Ecommerce_data[profit_per_order]), 'Calendar'[Date])
```

```
1 Profit Margin = SUM(Ecommerce_data[profit_per_order])/SUM(Ecommerce_data[sales_per_order])
```

```
1 YTD Profit Margin = TOTALYTD([Profit Margin], 'Calendar'[Date])
```

```
1 PYTD Sales = CALCULATE(SUM(Ecommerce_data[sales_per_order]), DATESYTD(SAMEPERIODLASTYEAR
  ('Calendar'[Date])))
```

```
1 PYTD Qty = CALCULATE(SUM(Ecommerce_data[order_quantity]), DATESYTD(SAMEPERIODLASTYEAR
  ('Calendar'[Date])))
```

```
1 PYTD Profit = CALCULATE(SUM(Ecommerce_data[profit_per_order]), DATESYTD(SAMEPERIODLASTYEAR
  ('Calendar'[Date])))
```

```
1 PYTD Profit Margin = CALCULATE([Profit Margin], DATESYTD(SAMEPERIODLASTYEAR('Calendar'
  [Date])))
```

```
1 YOY Sales = ([YTD Sales] - [PYTD Sales]) / [PYTD Sales]
```

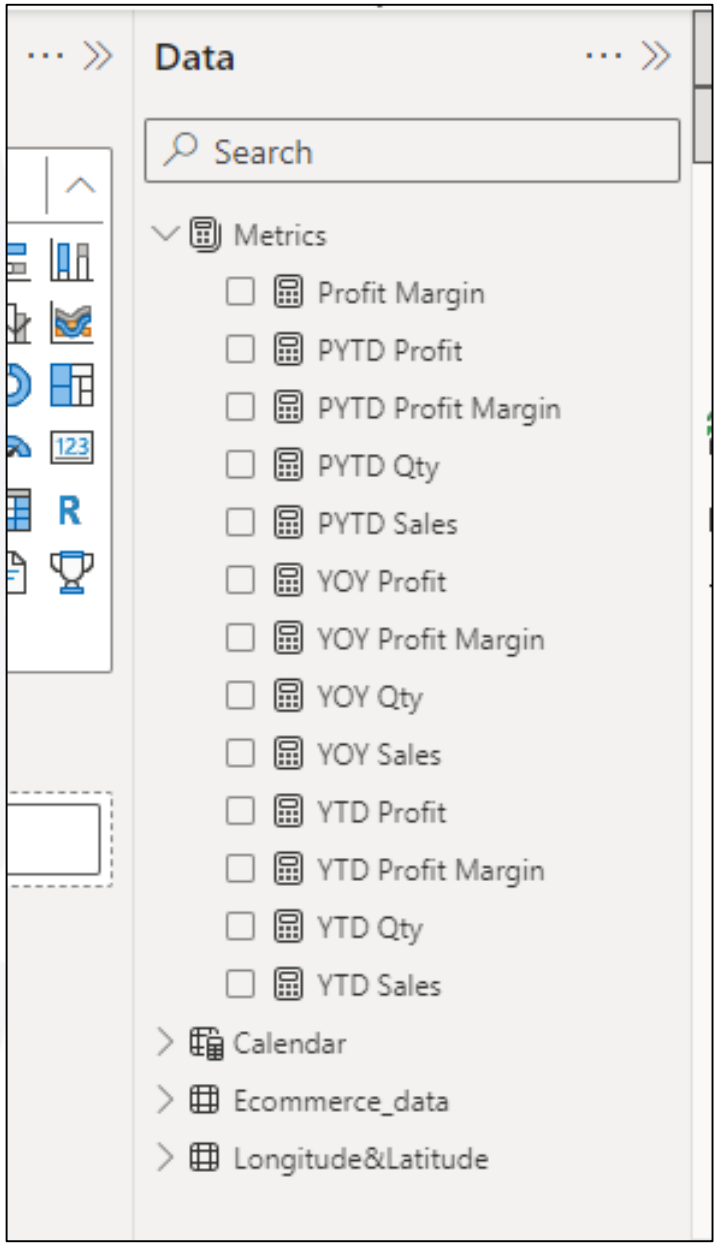
```
1 YOY Qty = ([YTD Qty] - [PYTD Qty]) / [PYTD Qty]
```

```
1 YOY Profit = ([YTD Profit] - [PYTD Profit]) / [PYTD Profit]
```

```
1 YOY Profit Margin = ([YTD Profit Margin] - [PYTD Profit Margin]) / [PYTD Profit Margin]
```

List of primary measures created.

Other measures can be created as per requirement during visualization process.

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# Visualization Part 1

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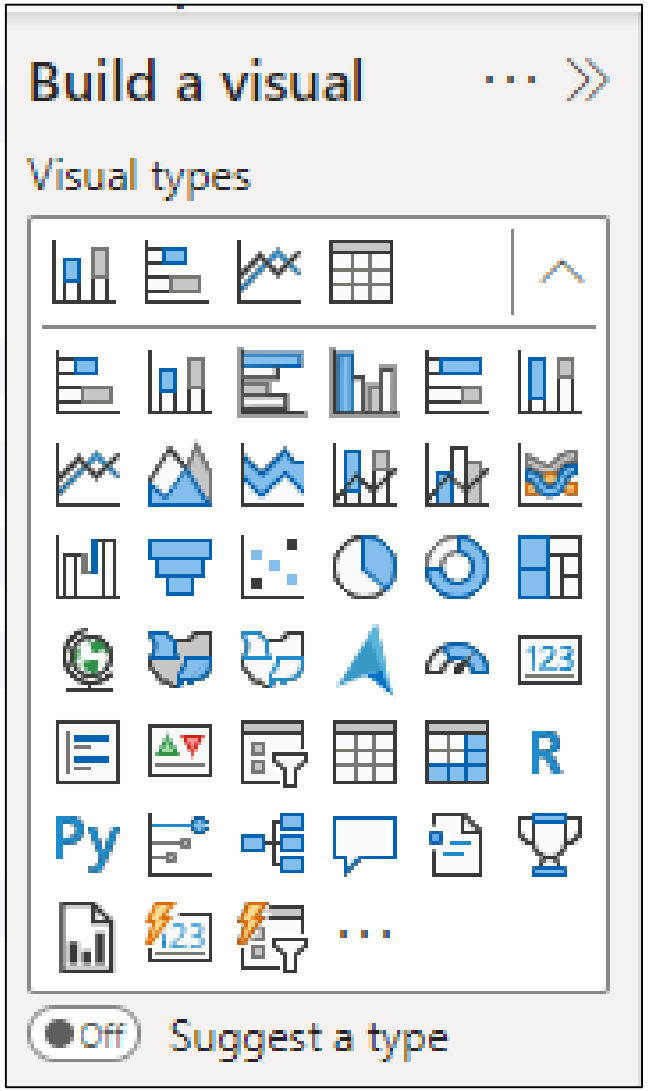
# INTRO

- Visualizations, also called visuals for short, display insights that are discovered in the data.
- Data visualization is the process of converting raw information (text, numbers, or symbols) into a graphical format.
- A Power BI report might have a single page with one visual or it might have pages full of visuals. In the Power BI service, visuals can be pinned from reports to dashboards.
- There are many different visual types available directly from the Power BI Visualizations pane.

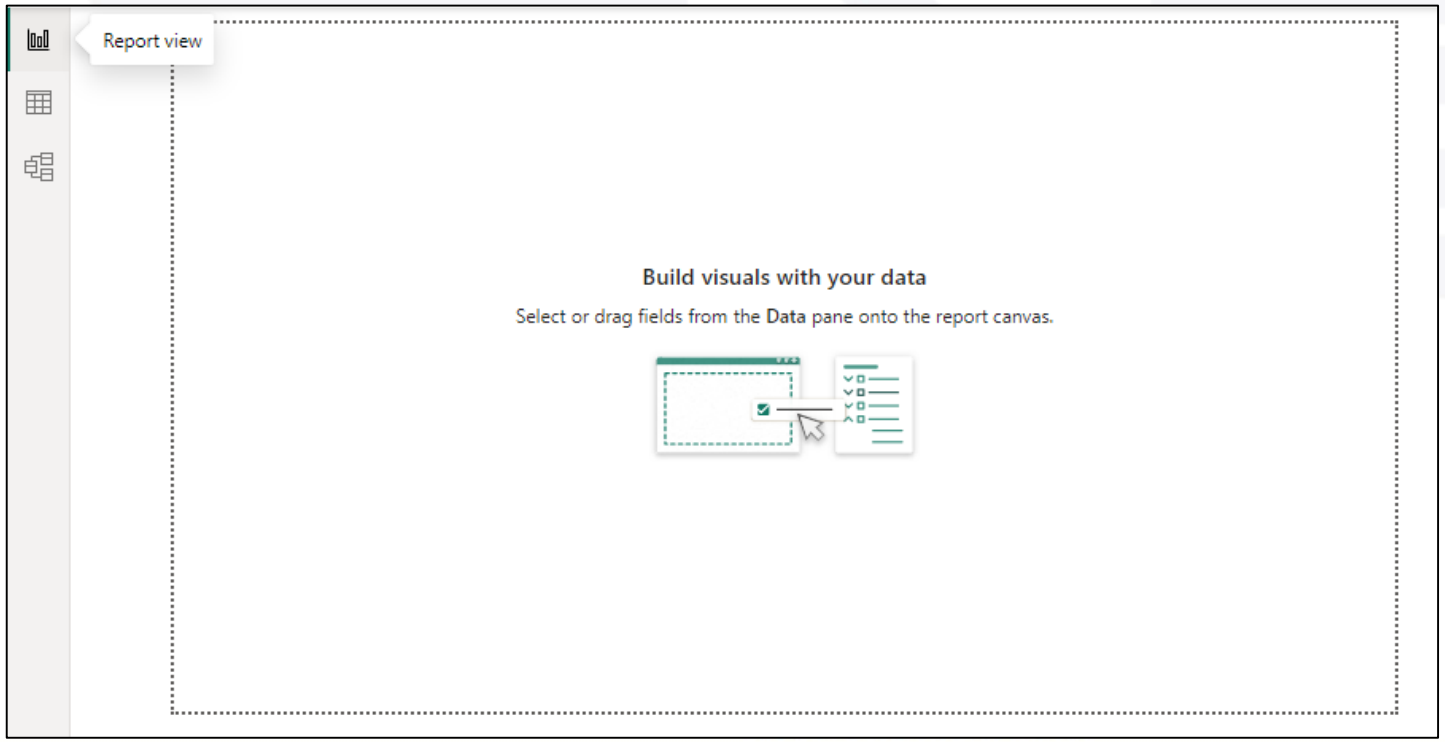


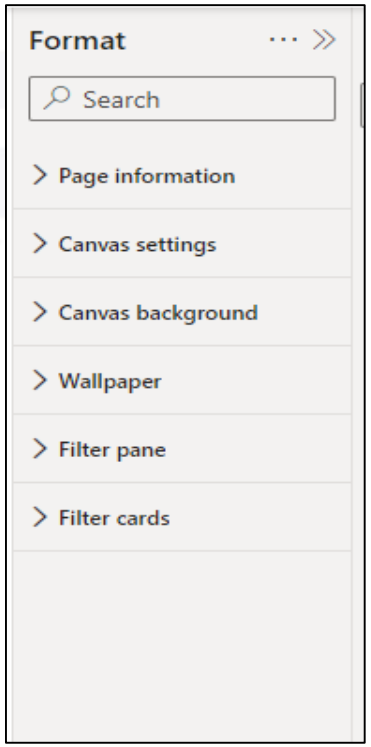
# DASHBOARD CANVAS

Open Report view from left sidebar.
Dotted square is the place called canvas to create the dashboards or reports.

Format the canvas under FORMAT pane.

- Page information– name the page and select its type
- Canvas settings– size of report or select custom and define height width
- Canvas background– space inside the dotted square
- Wallpaper – space outside dotted square

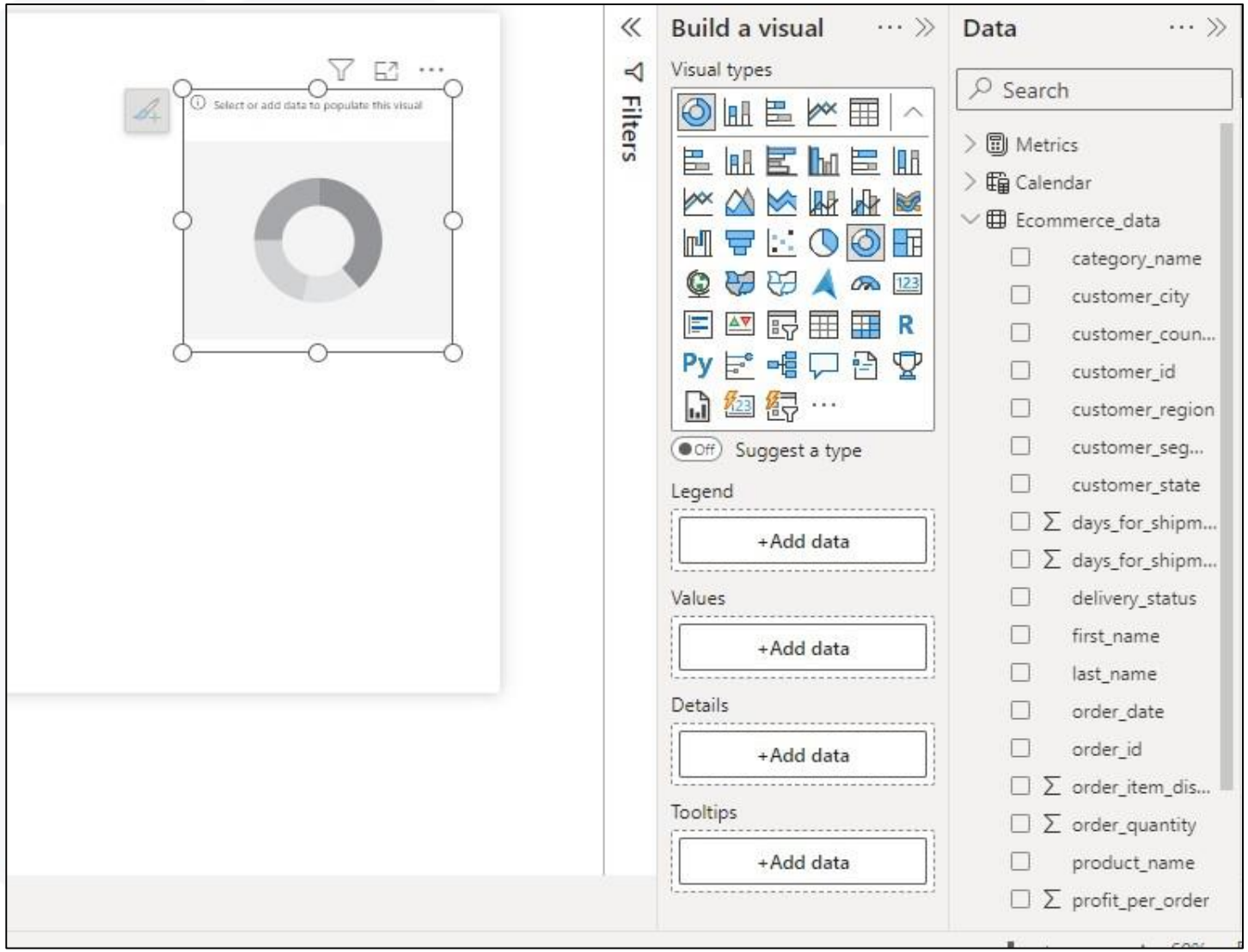


# CREATE A VISUAL

- Click on respected visual as per the required result.
- Add data fields gets activated
- Select the required columns from table, they automatically gets placed in the fields.

(Sometimes need to replaced them manually by just drag and drop)

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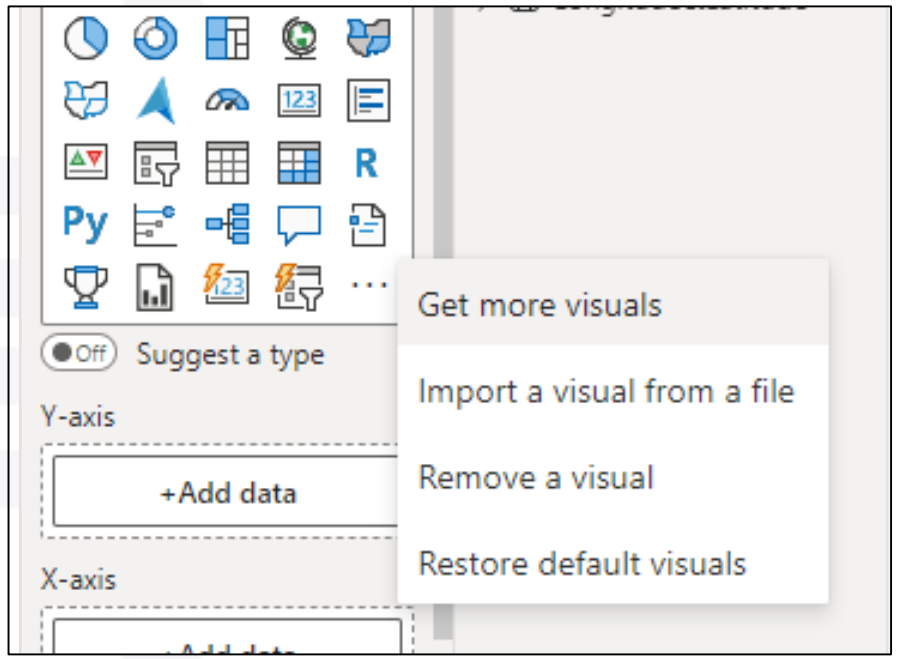
# ADD A VISUAL IN POWER-BI DESKTOP

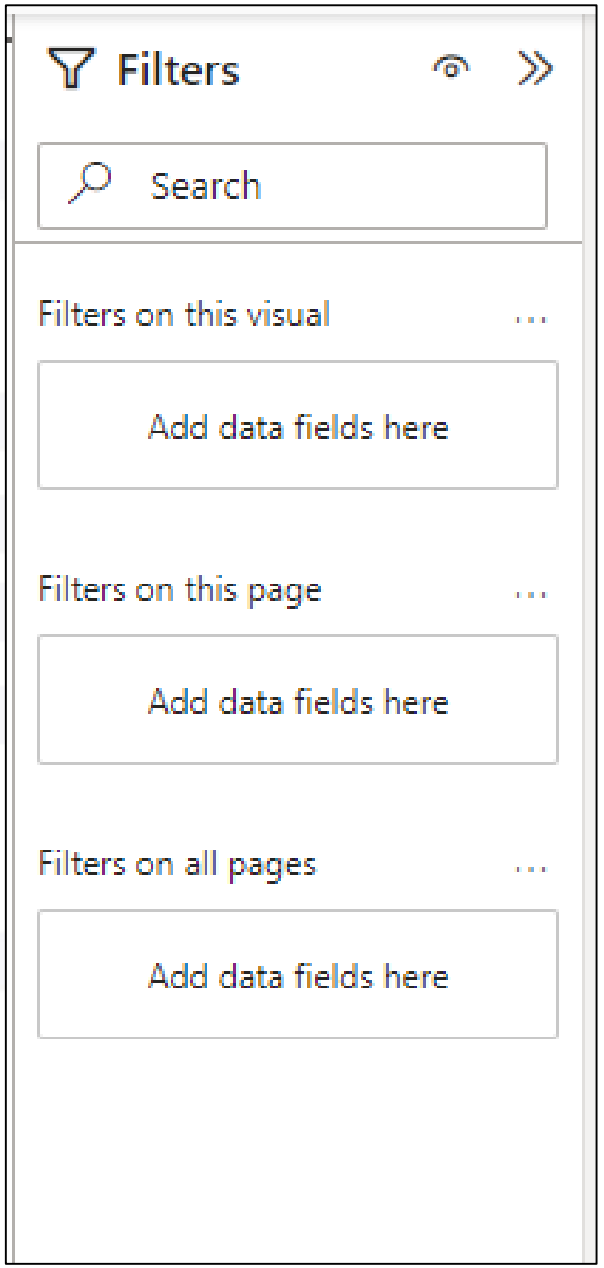
- Click on 3dots in visuals section under Visualization pane.
- Get more visuals: upload more visuals from Microsoft app-source. Once uploaded, right-click on resp. visual and pin it to visualization pane.
- Import a visual from a file : upload a visual from the file/folder from your device.
- Remove a visual : you can remove visuals.
- Restore default visuals: you can restore removed visuals.



# POWER BI DESKTOP FILTERS

- Visual Level Filter: This gets applied to only to the active visual.
- Page Level Filter: This gets applied to all the visuals in the existing page.
- Report Level Filter: This gets applied to all the visuals in all the existing pages in the report.

(select any visual to activate visual level filter)

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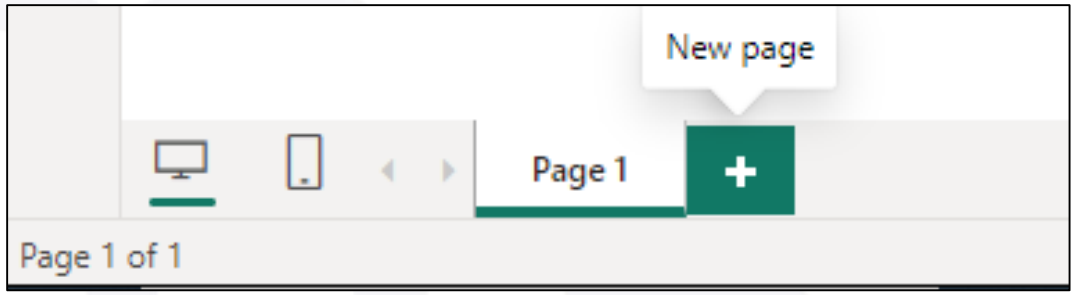
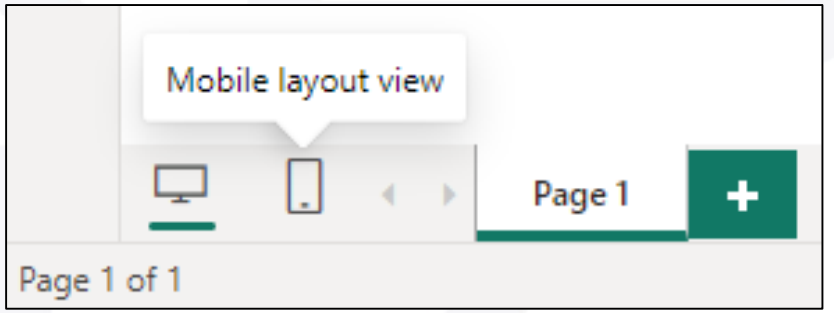
## ADD NEW PAGES TO REPORT

Click on + icon to add pages
Double click on name to rename them.




## DESIGN MOBILE VIEW

By default desktop view is on.
Click on mobile icon to view and edit mobile view of dashboard

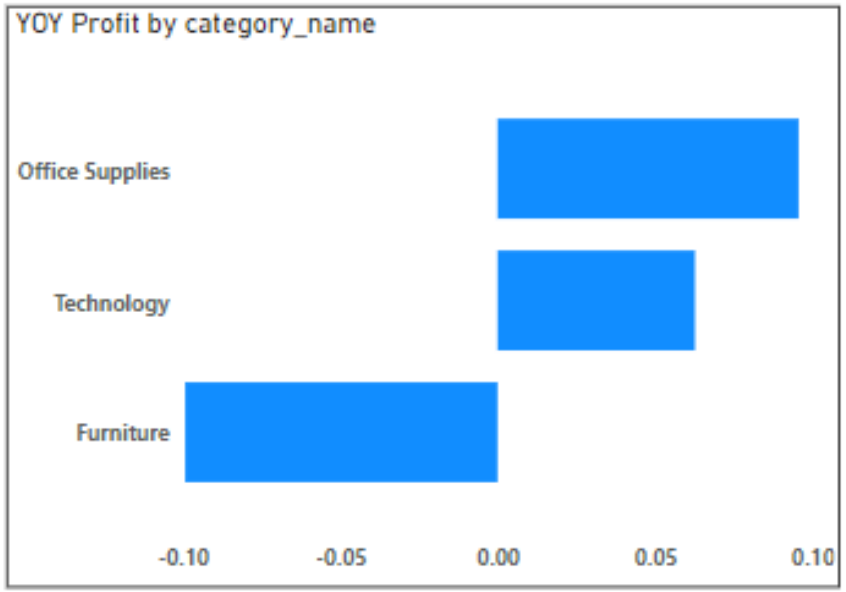


- TYPES OF VISUALS
- WHEN TO USE WHICH VISUAL
- FORMATING OPTIONS

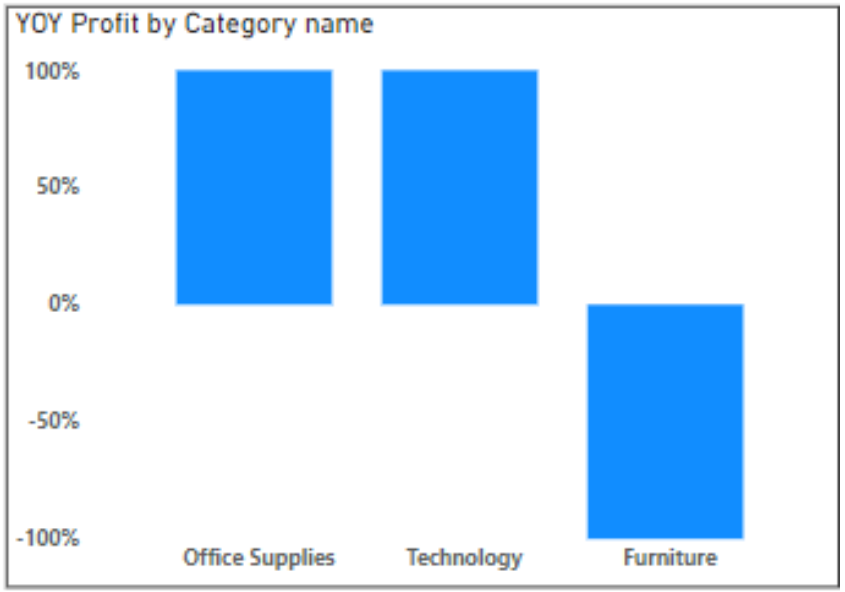
# COLUMN AND BAR CHARTS

A bar/column chart represents categorical data with rectangular bars, their heights being proportional to the values displayed.

BAR




COLUMN



Use a bar chart for the following reasons:

- compare two or more values in the same category
- compare parts of a whole
- don’t have too many groups (less than 10 works best)
- understand how multiple similar data sets relate to each other

Don’t use a bar chart for the following reasons:

- you’re visualizing only has one value associated with it
- to visualize continuous data

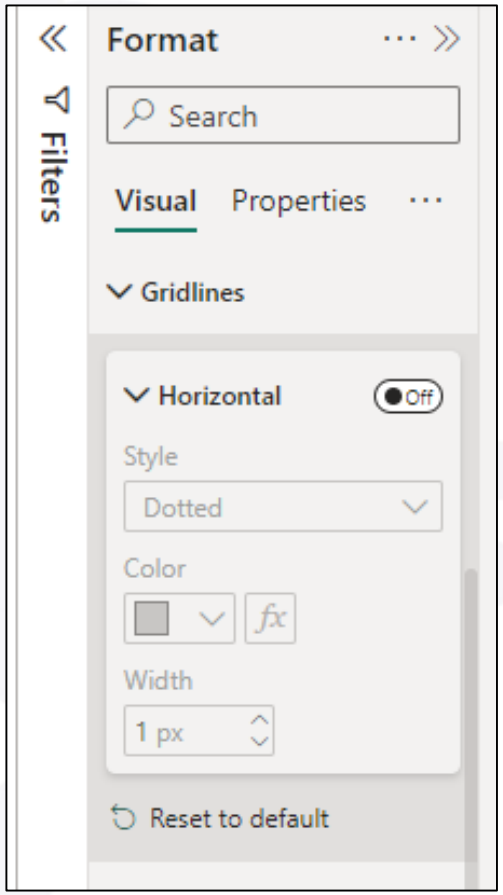
key design best practices:

- Use consistent colors and labeling throughout so that you can identify relationships more easily
- Simplify the length of the y-axis labels and don’t forget to start from 0 so you can keep your data in order

# COMMON FORMATTING OPTIONS

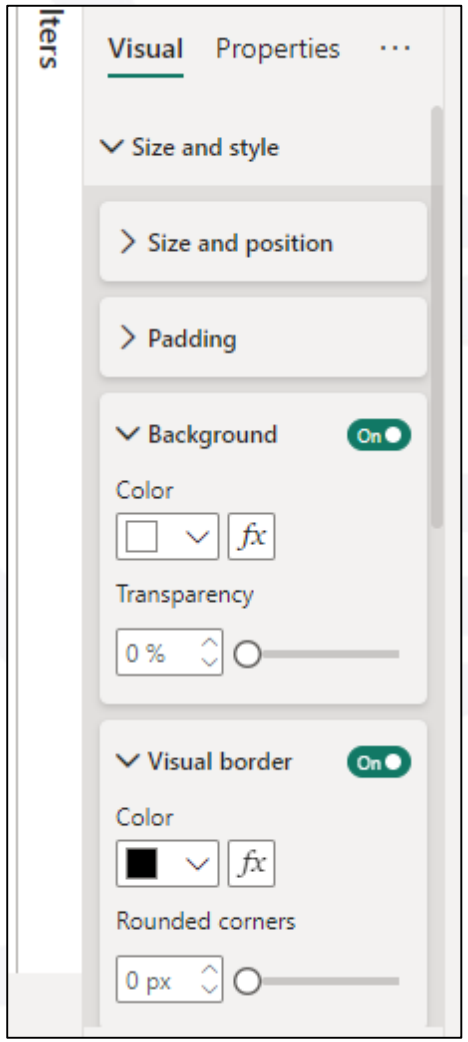
1. First remove background gridlines

Go to Format pane
→ visual
→ Gridlines
→ turn off horizontal/vertical



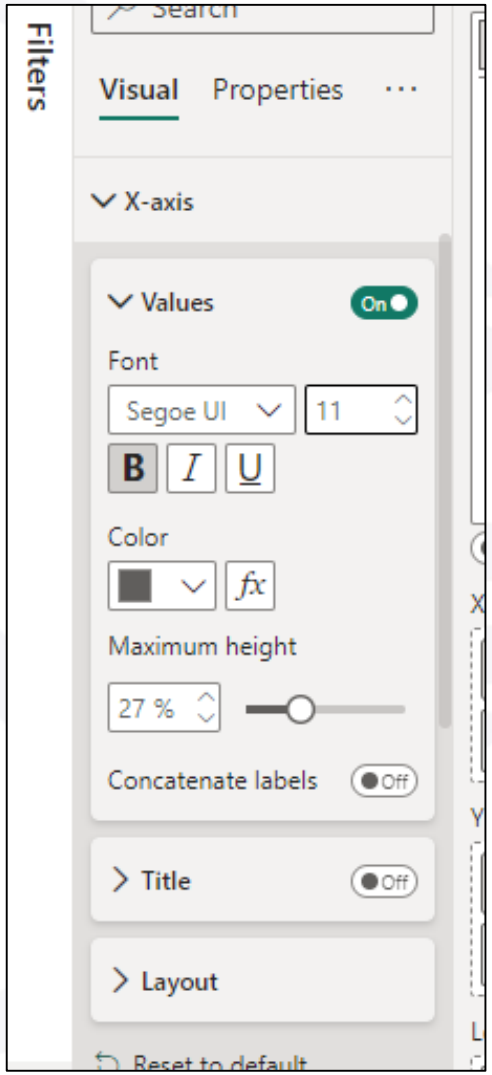
2. Apply border and background

Go to Format pane
→ visual
→ size and style
→ turn ON
→ Select your color



3. Edit X-axis and Y-axis

Go to Format pane
→ visual
→ X-axis/Y-axis
→ turn ON/OFF values and title (as per requirement)
→ Select font, size, bold, color, etc



4. Edit Title. Add subtitle, divider

Go to Format pane

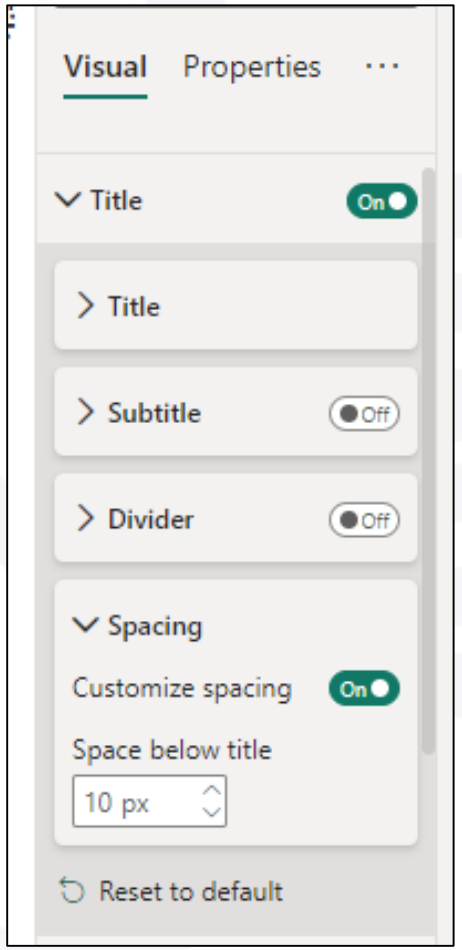
→ visual

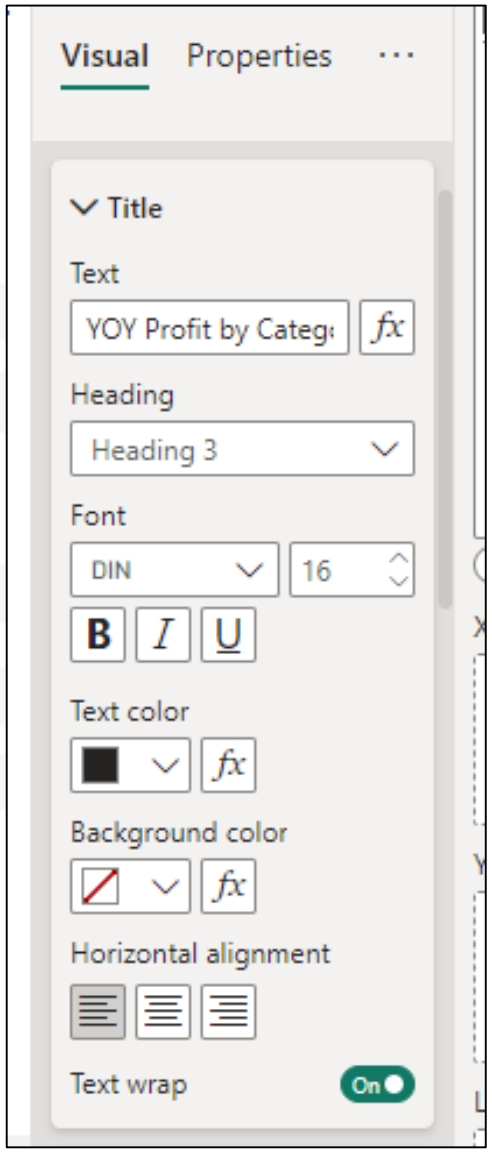
→ Title

→ turn ON/OFF title, subtitle, divider, spacing (as per requirement)

→ Edit your title

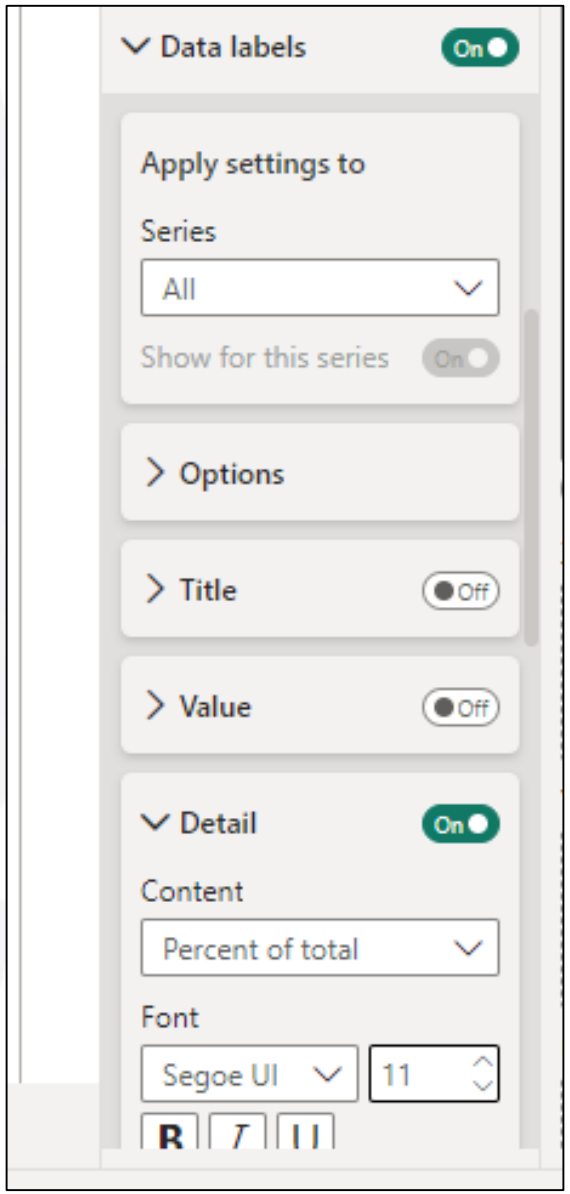
→ Select font, size, bold, color, etc



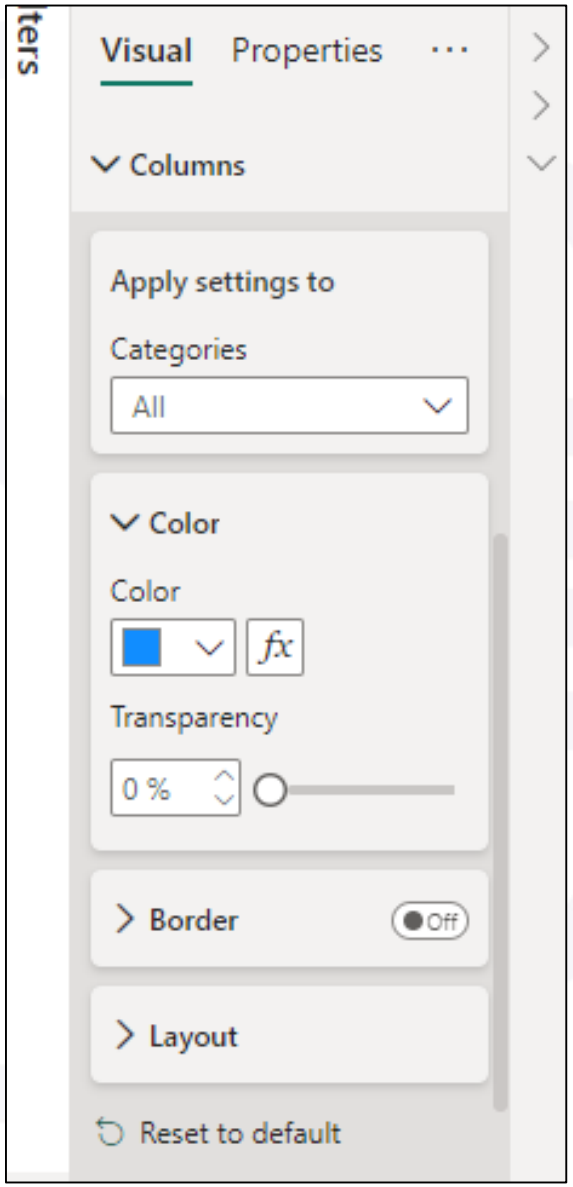
5. Data Labels (add values on the bars)

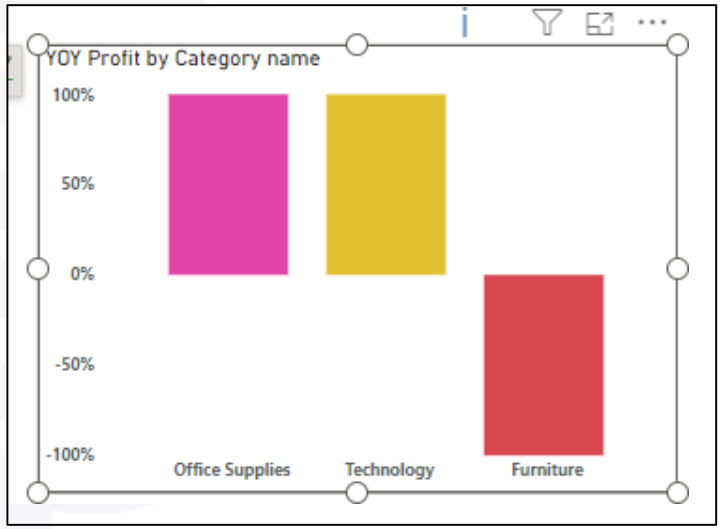
Go to Format pane
→ visual
→ Data Labels
→ turn ON/OFF Edit your title
→ Select font, size, bold, etc



6. Color each bars with different colors

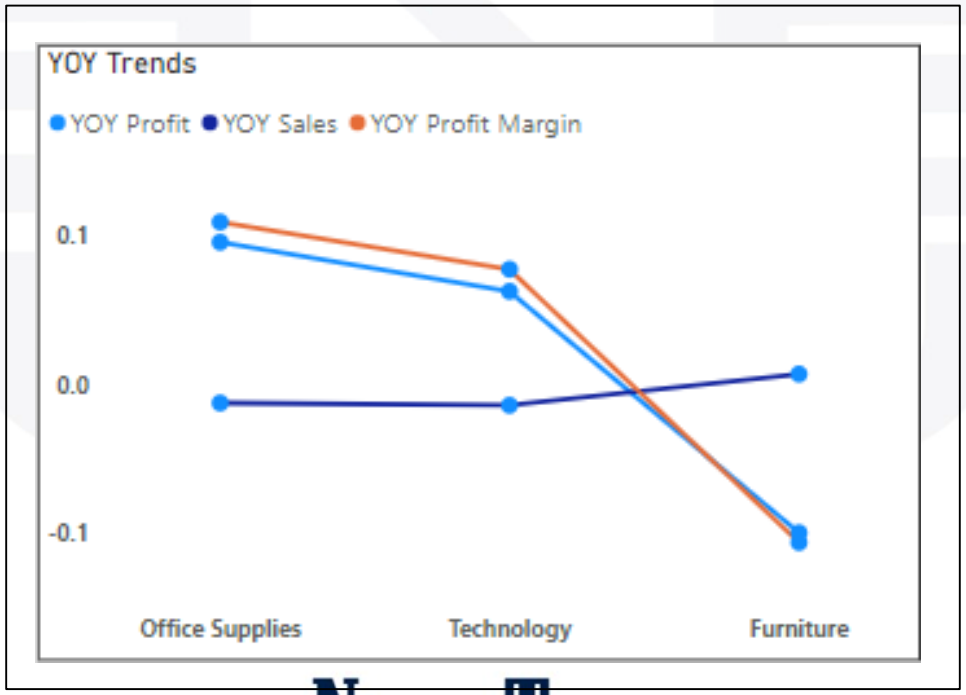
Go to Format pane
→ visual
→ Columns/ bars
→ Select bar category
→ Select color with 0 transparency
(select bars one by one to define colors, select ALL to apply one color to all the bars.)



# LINE CHART

Line charts are used to show resulting data relative to a continuous variable - most commonly time or money.
The proper use of color in this visualization is necessary because different colored lines can make it even easier for users to analyze information.

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Use a line chart for the following reasons:

- understand trends, patterns, and fluctuations in your data
- compare different yet related data sets with multiple series
- make projections beyond your data

Don’t use a line chart for the following reason:

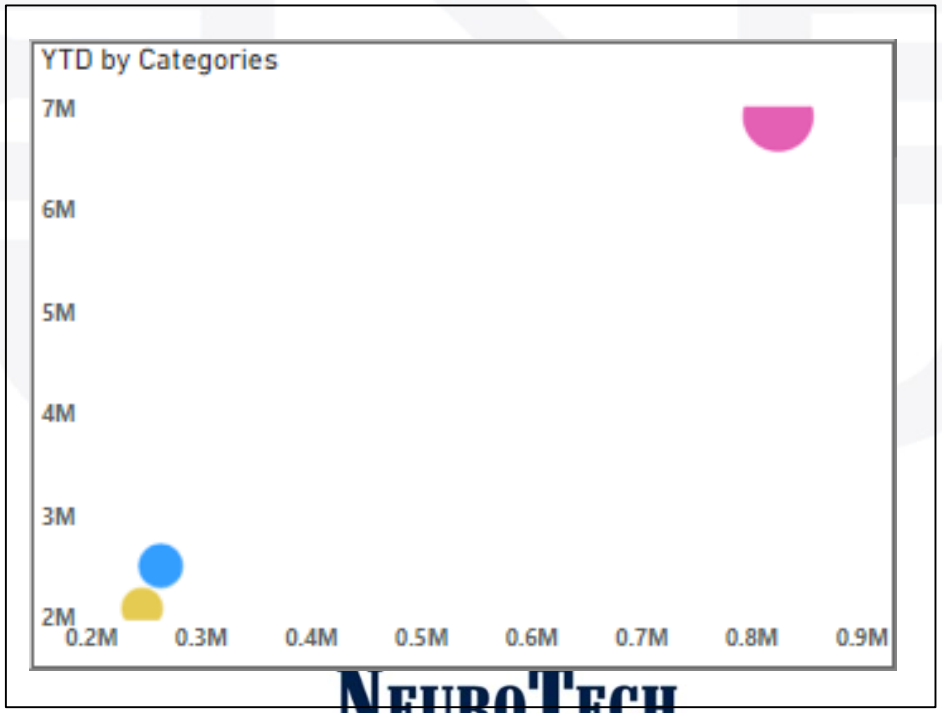
- demonstrate an in-depth view of your data

key design best practices:

- Along with using a different color for each category you’re comparing, make sure you also use solid lines to keep the line chart clear and concise
- To avoid confusion, try not to compare more than 4 categories in one line chart

# SCATTER CHART

Scatterplots are the right data visualizations to use when there are many different data points, and you want to highlight similarities in the data set.
If the data forms a band extending from lower left to upper right, there most likely a positive correlation between the two variables.
If the band runs from upper left to lower right, a negative correlation is probable. If it is hard to see a pattern, there is probably no correlation.




NEUROTECH

Use a scatterplot for the following reasons:

- show the relationship between two variables
- compact data visualization

Don’t use a scatterplot for the following reasons:

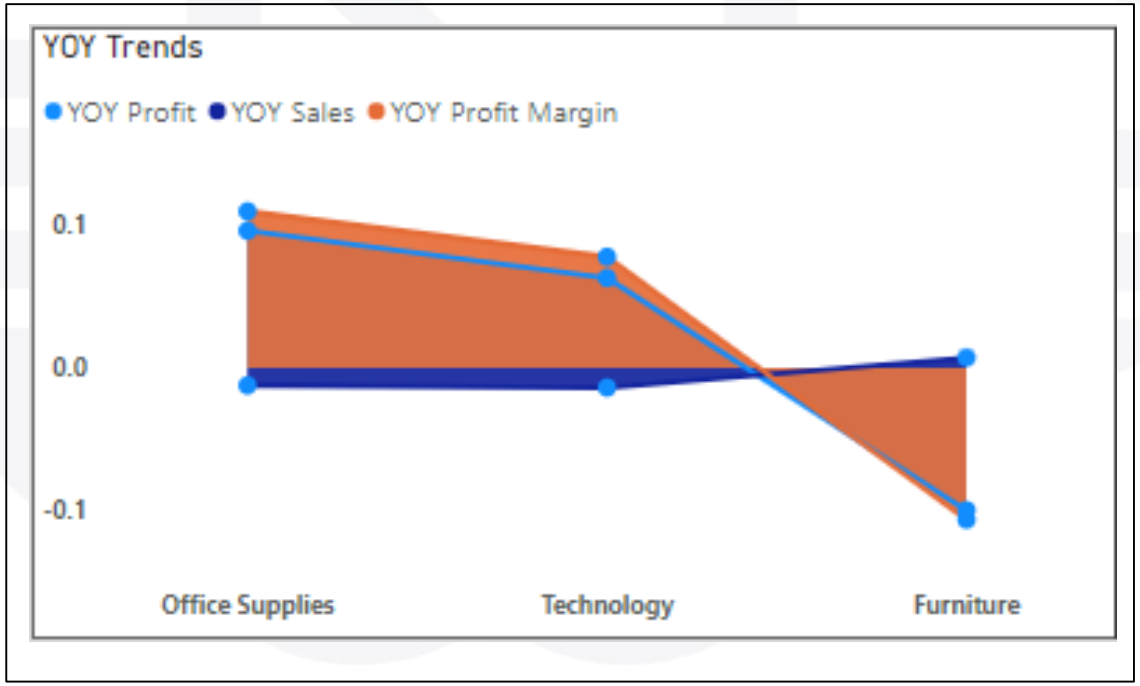
- rapidly scan information
- clear and precise data points

key design best practices:

- Although trend lines are a great way to analyze the data on a scatterplot, ensure you stick to 1 or 2 trend lines to avoid confusion
- Don’t forget to start at 0 for the y-axis

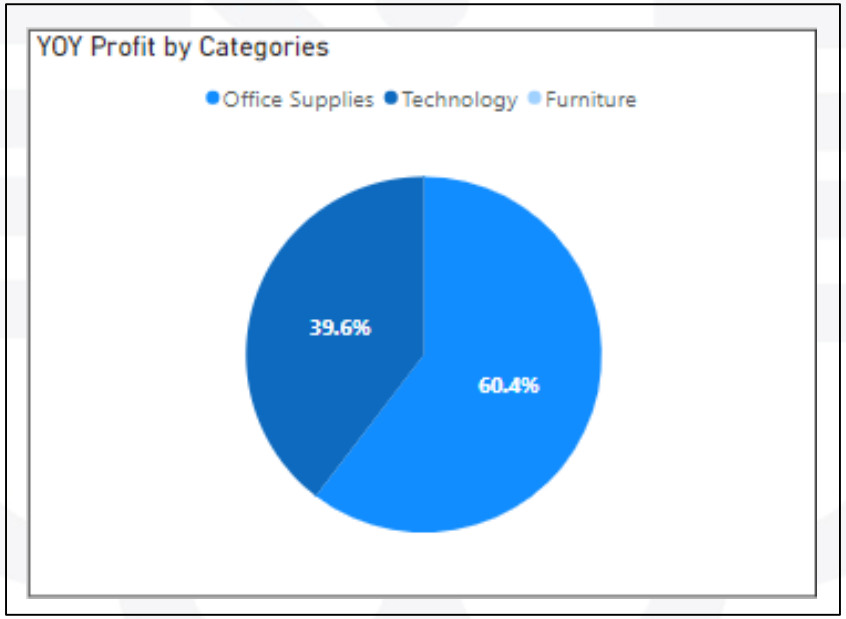
## AREA CHART

An area chart is very similar to a line graph but may do a better job of highlighting the relative differences between items.
Use an area chart when you want to see how different items stack up or contribute to the whole.



# PIE CHART

Pie charts are an interesting graph visualization. At a high-level, they're easy to read and understand because the parts-of-a-whole relationship is made very obvious



Use a pie chart for the following reasons:

- compare relative values
- compare parts of a whole
- rapidly scan metrics

Don’t use a pie chart for the following reason:

- precisely compare data

key design best practices:

- Make sure that the pie slices add up to 100%. To make this easier, add the numerical values and percentages to your pie chart
- Order the pieces of your pie according to size
- Use a pie chart if you have only up to 5 categories to compare. If you have too many categories, you won’t be able to differentiate between the slices

## TABLE

If you’re someone who wants a little bit of everything in front of you to make thorough decisions, then tables are the visualization to go with. Tables are great because you can display both data points and graphics, such as bullet charts, icons, and sparklines. This visualization type also organizes your data into columns and rows, which is great for reporting

YOY Trends

| category_name | YOY Profit | YOY Sales | YOY Profit Margin | YOY Qty |
|---|---|---|---|---|
| Office Supplies | 0.10 | -0.01 | 0.11 | -0.07 |
| Technology | 0.06 | -0.01 | 0.08 | -0.08 |
| Furniture | -0.10 | 0.01 | -0.11 | -0.09 |

Use a table for the following reasons:

- You want to display two-dimensional data sets that can be organized categorically
- You can drill down to break up large data sets with a natural drill-down path

Don’t use a table for the following reason:

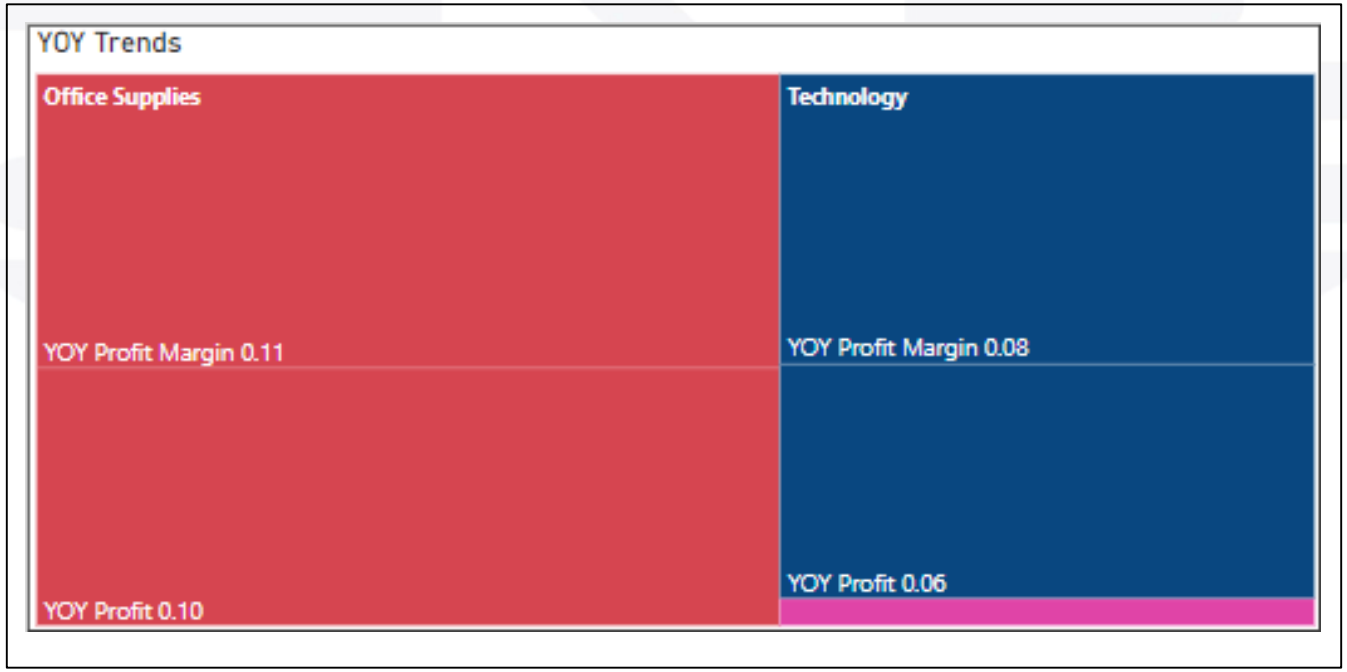
- You want to display large amounts of data

key design best practices:

- Be mindful of the order of the data. Make sure that labels, categories, and numbers come first then move on to the graphics
- Try not to have more than 10 different rows on your table to avoid clutter

# TREE MAP

A treemap is a visual tool that can be used to break down the relationships between multiple variables in your data.
They can be used strictly as a presentation vehicle to show how your products roll up into different categories, for example.
A treemap can be broken down into 2-3 different layers to show the hierarchical relationship between items.



Use a treemap for the following reasons:

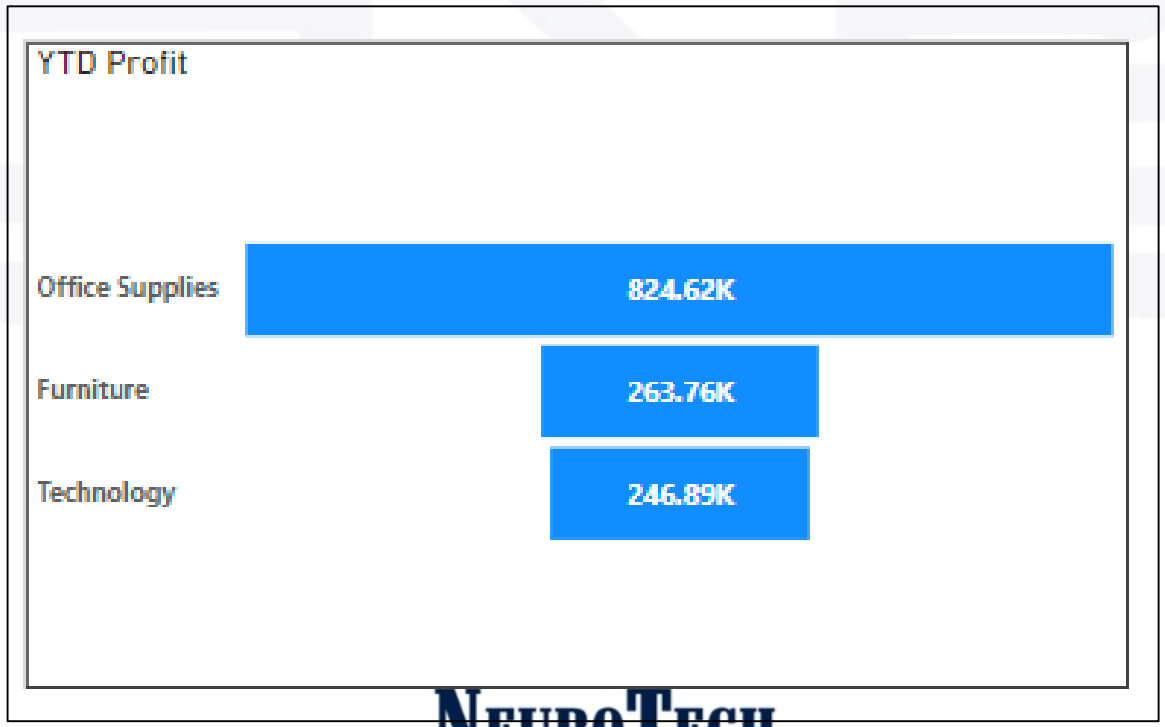
- display hierarchical data
- proportion of each category as a whole.

Don’t use a treemap for the following reason:

- there are too many categories or the data is not hierarchical

# FUNNEL

A funnel chart is your data visualization of choice if you want to display a series of steps and the completion rate for each step.
This can be used to track the sales process, a marketing funnel or the conversion rate across a series of pages or steps.

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Use a funnel chart for the following reason:

- To display a series of steps and each step's completion rate

Don't use a funnel chart for the following reason:

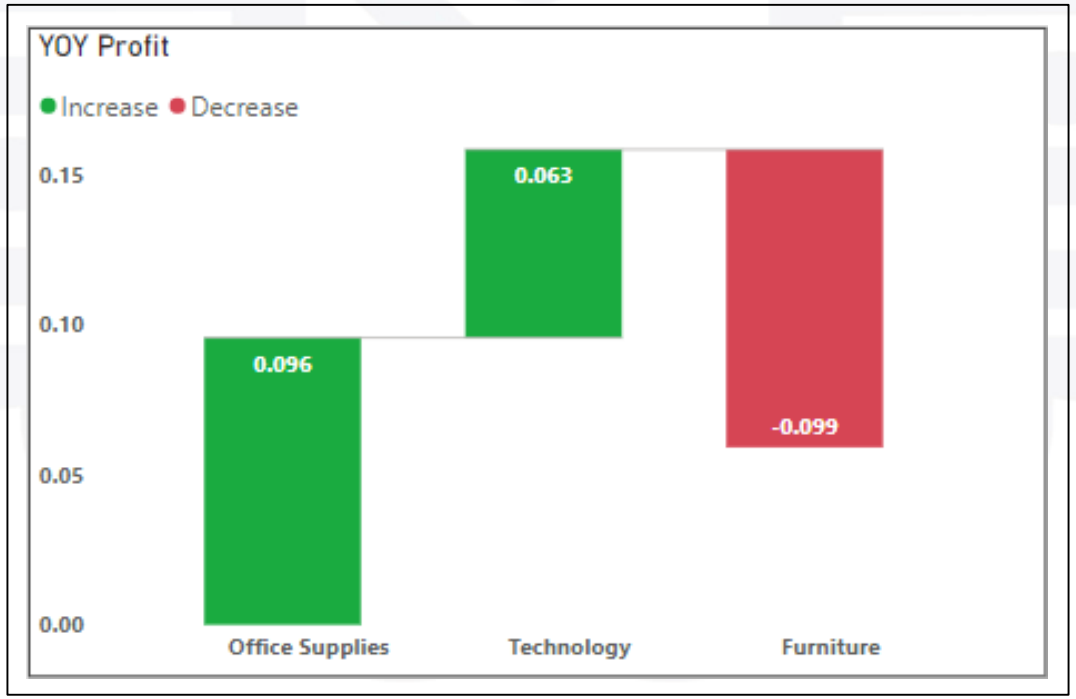
- To visualize individual, unconnected metrics

key design best practices:

- Scale the size of each section to accurately reflect the size of its data set
- Use contrasting colors or one color in gradating hues, from darkest to lightest as the size of the funnel decreases

# WATERFALL CHART

A waterfall chart is an information visualization that should be used to show how an initial value is affected by intermediate values and resulted in a final value.
The values can be either negative or positive.

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Use a waterfall chart for the following reason:

- To reveal the composition or makeup of a number

Don’t use a waterfall chart for the following reason:

- You want to focus on more than one number or metric

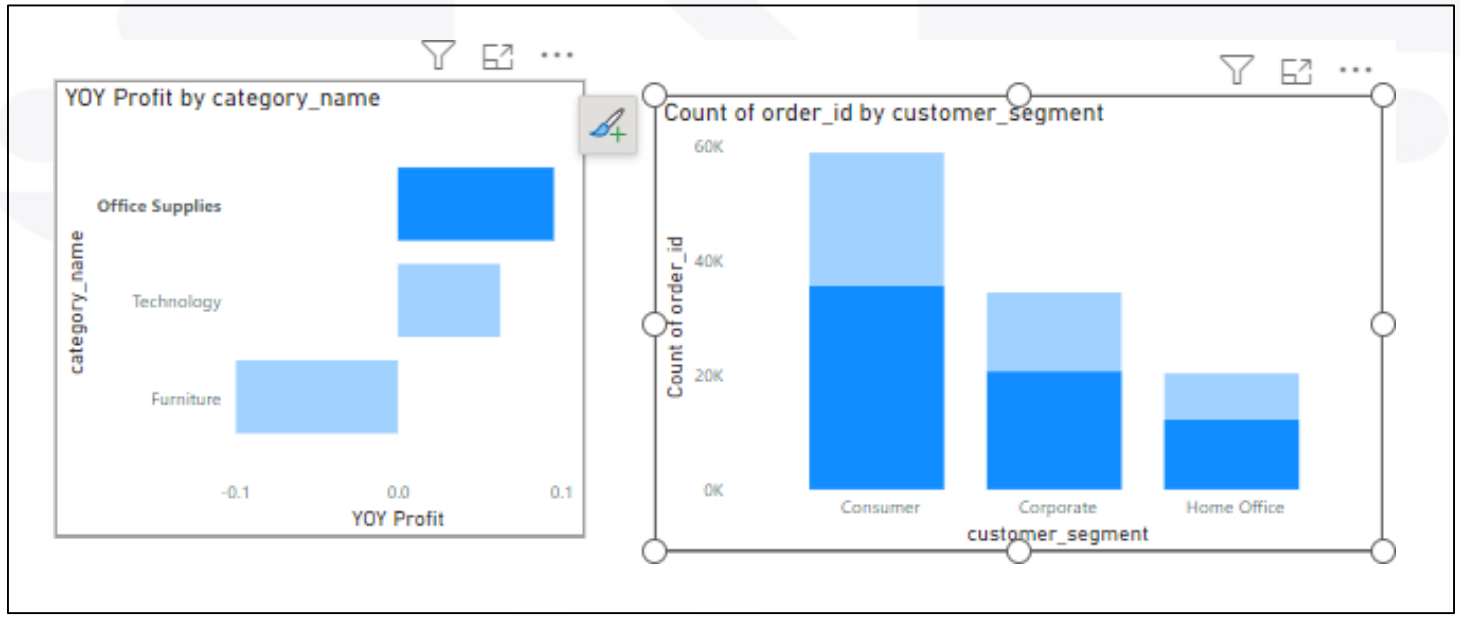
key design best practices:

- Use contrasting colors to highlight differences in data sets
- Choose warm colors to indicate increases and cool colors to indicate decreases

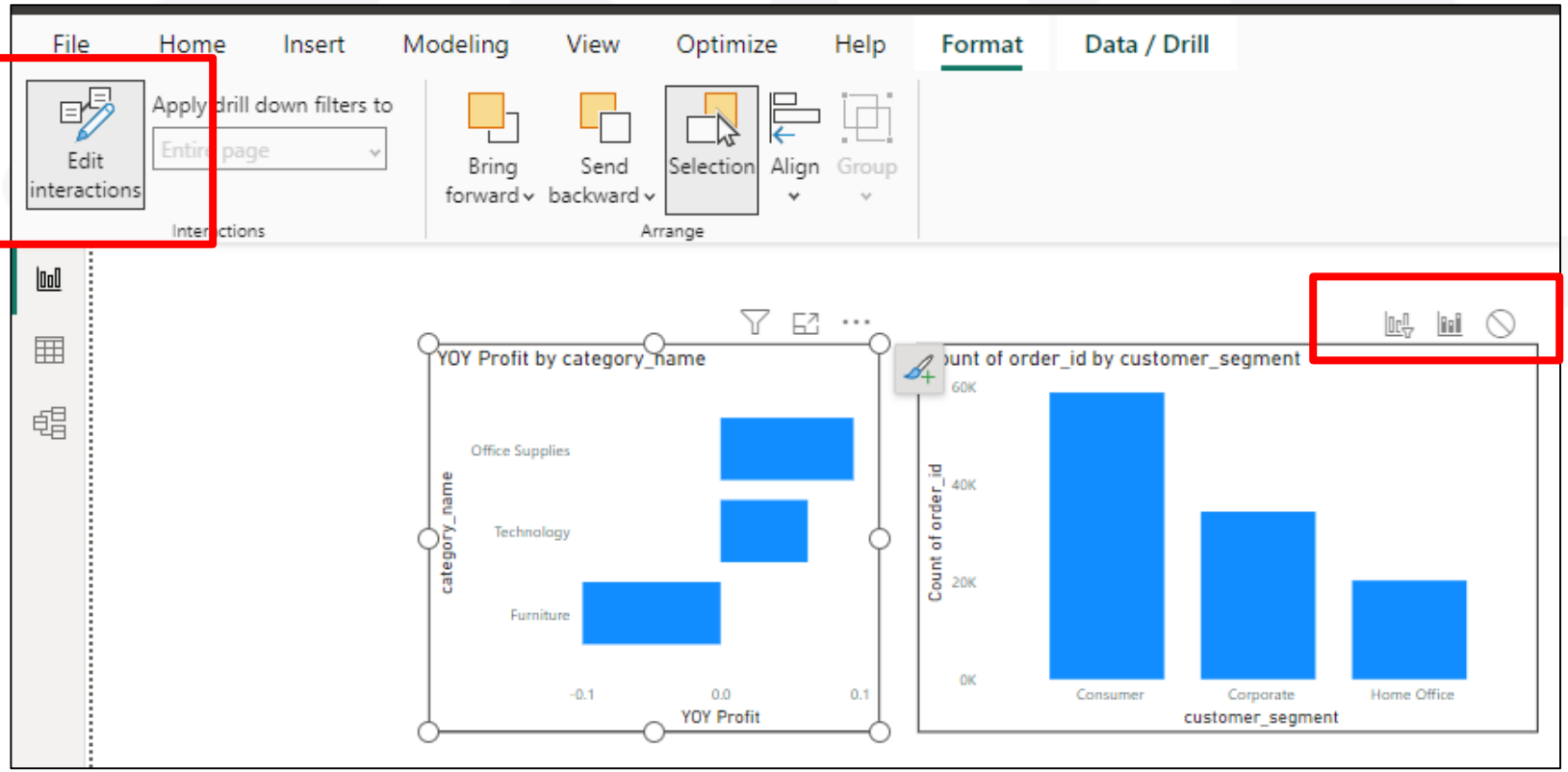
# REPORT INTERACTIONS

By default, all the visualizations are connected to each other and filtering items in one visual will impact others too.
Through “Edit interactions” we can prevent certain visualizations to get filtered.

Here, when click on “office supplier” on bar chart, other chart changes color based on selected category. If you don’t want other charts to change color, use “Edit interactions”.



Remove filter: Select chart → format → edit interaction → none → edit interaction
Apply filter(no color change): Select chart → format → edit interaction → filter → edit interaction
Original (color change): Select chart → format → edit interaction → highlight → edit interaction




3 Options
- Filter
- Highlight
- None

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# PRACTICAL IMPLEMENTATION OF ECOMM SALES ANALYSIS PROJECT

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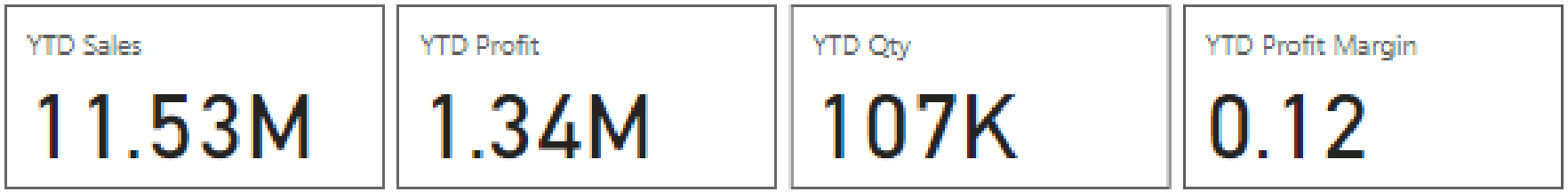
To get the overall idea of a Ecomm sales, certain important metrics needs to be displayed.
This is achieved with the help of visual called “card” or “card(new)”.

Here, card(new) visual is used, displaying below metrics-

- YTD sales
- YTD profit
- YTD Qty
- YTD profit margin

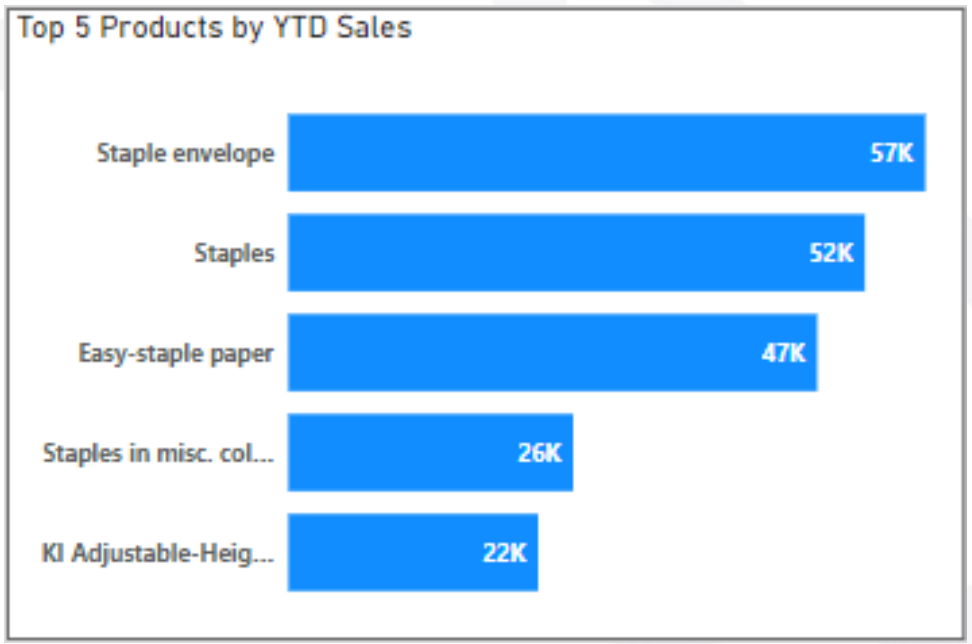


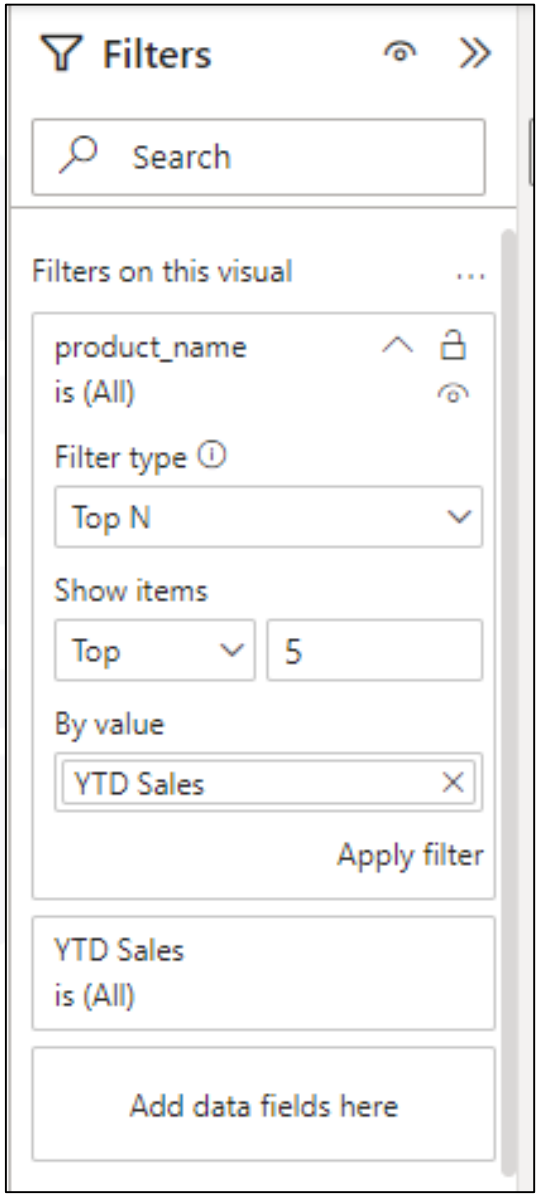

Format the font , size , etc under format pane. (this visual is still under process so it provides limited formatting options)

(You can even use “card” visual, you will need to edit each card separately or simply edit one card and do “format painter” to other cards so that all cards gets edited in one go)

To display Top 5 products by YTD sales

Use bar chart and insert fields – product name and YTD sales
In filter pane select type top N , items as top 5, by value YTD sales click apply filter

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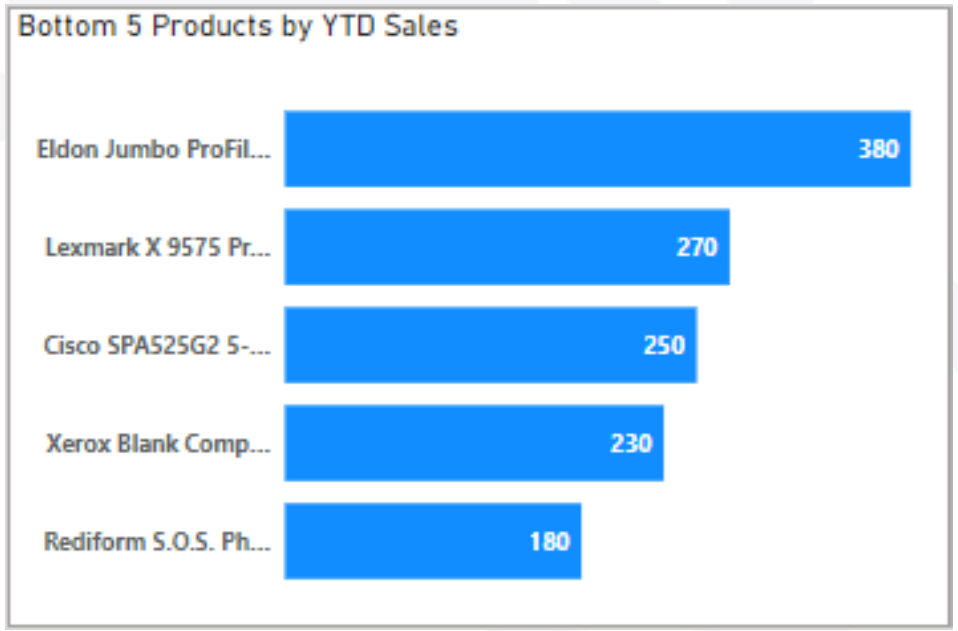
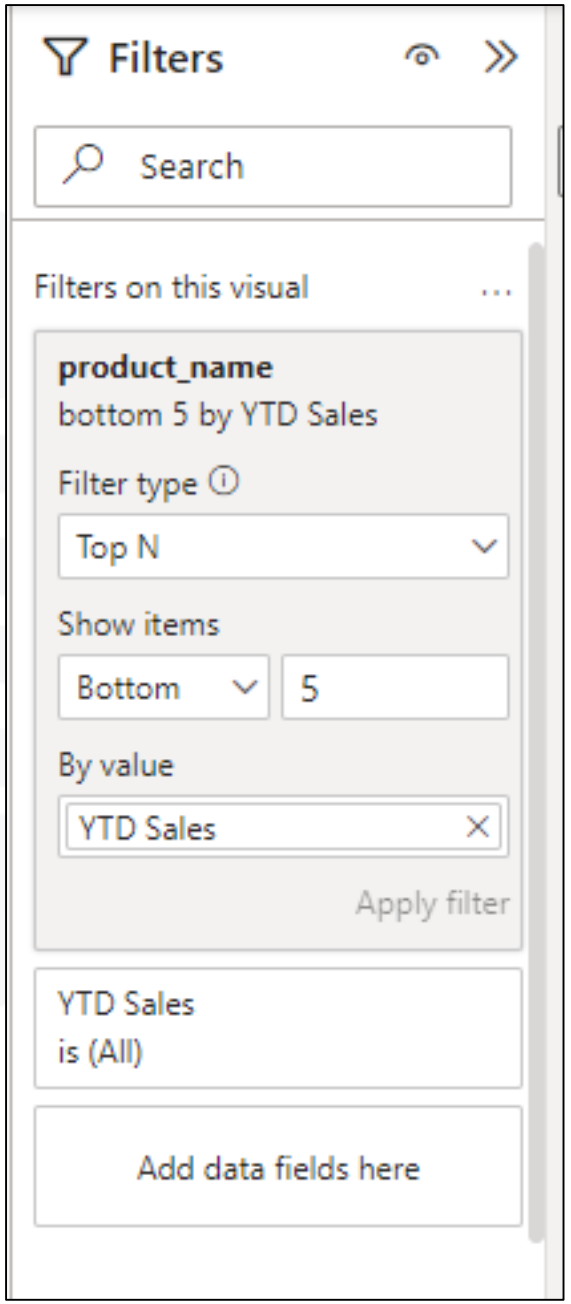
To display Bottom 5 products by YTD sales

Copy and paste Top 5 products bar chart.
In filter change items from top to bottom.
Edit chart title.

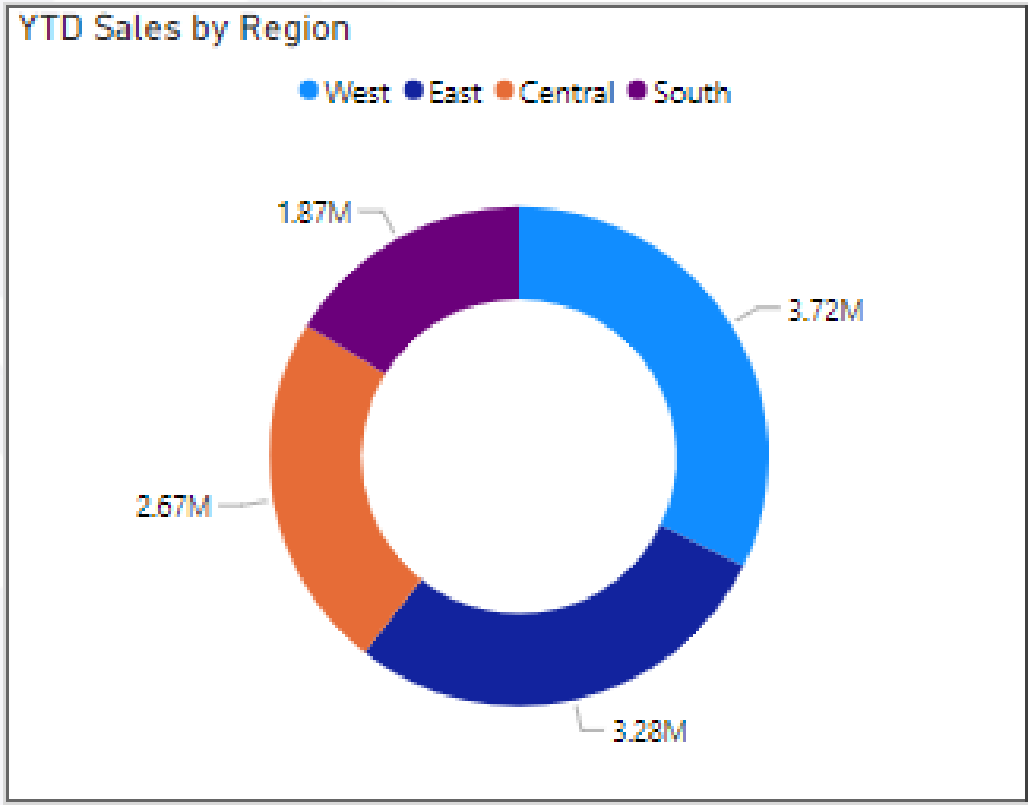



NEUROTECH

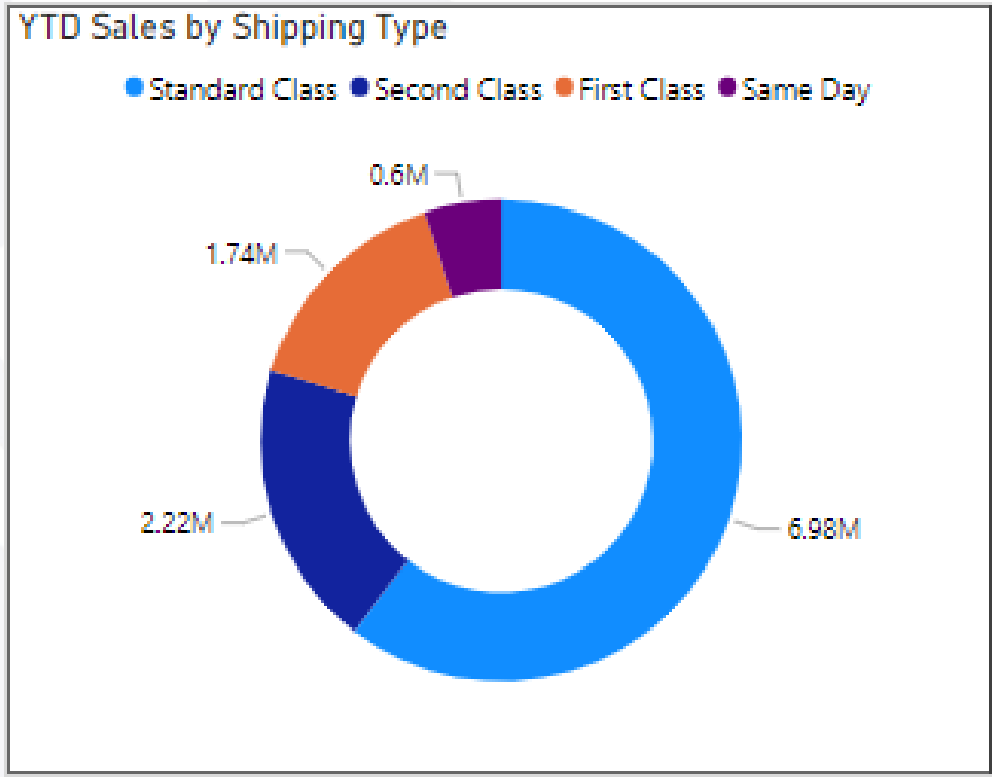
To display YTD sales by Regions

Select Donut chart
Take fields customer region and YTD sales
Edit the chart in Format pane



To display YTD sales by Shipping Type

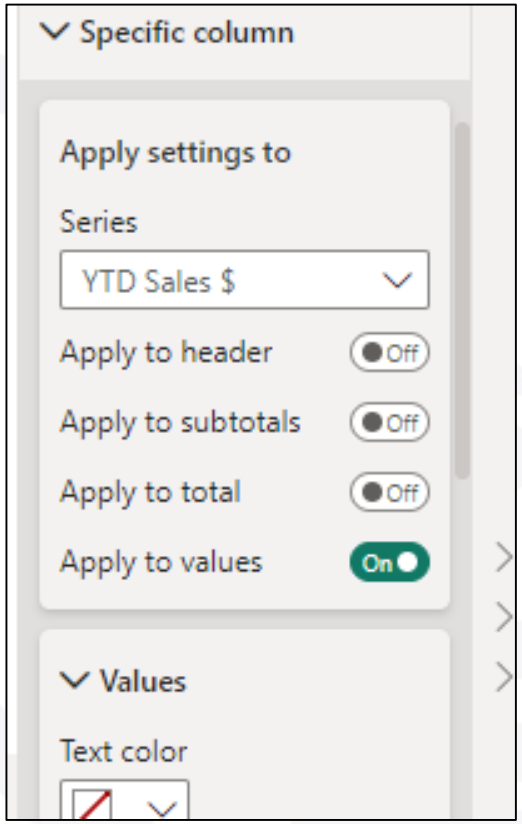
Copy paste previous donut chart.
Remove regions field and select shipping type.
Edit title

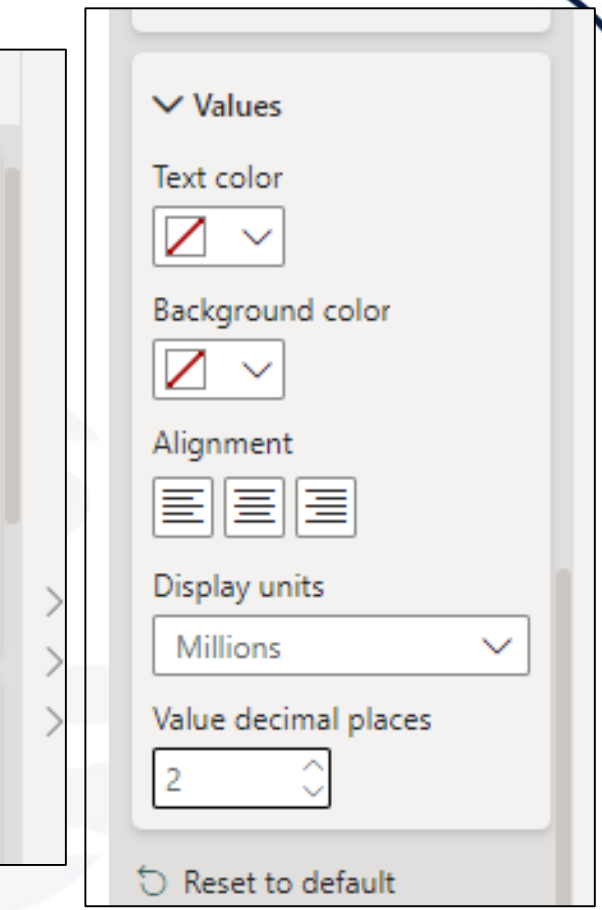


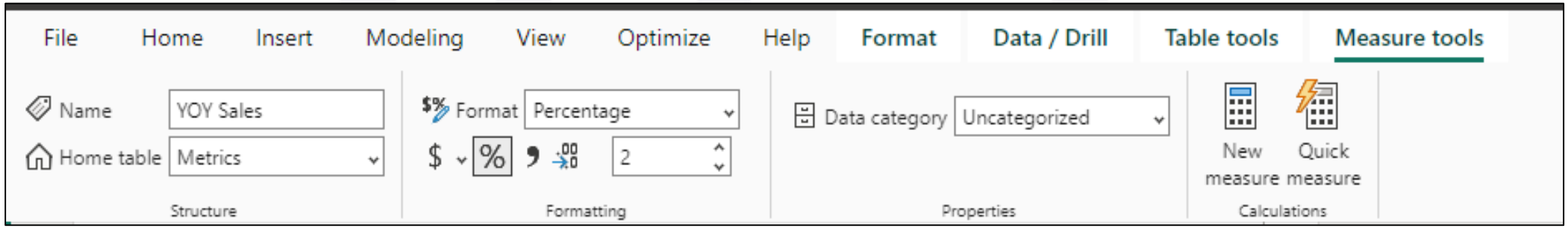
Display tabular information

•Select table visual, select fields
YTD sales, PYTD sales, YOY sales

- Edit the decimal pt. and unit in “format pane” –> specific column
- To display $ / %, click on measure name in “Data pane”, “measure tools” tab opens select the format

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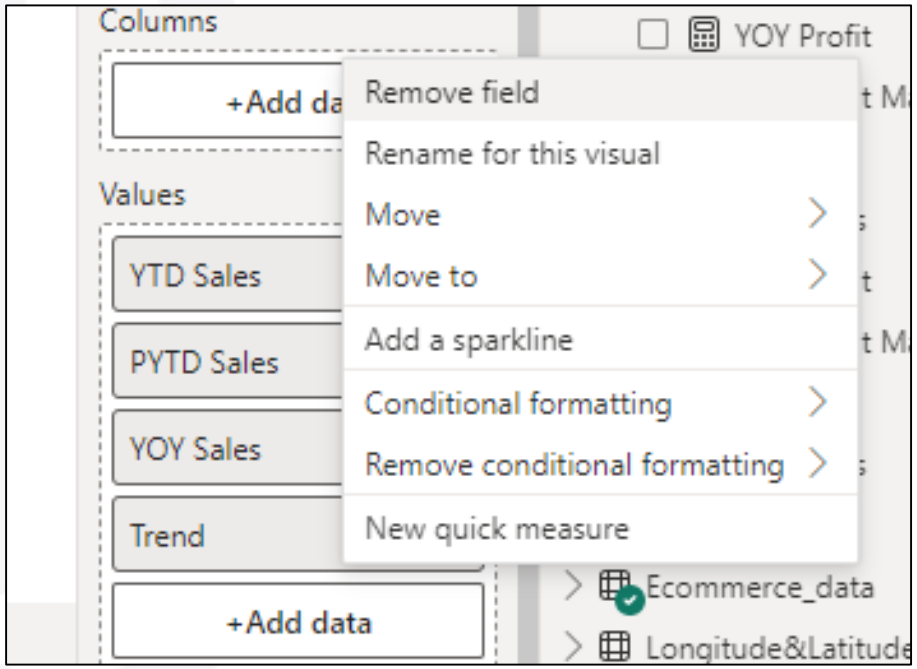
- Create 2 new measures—

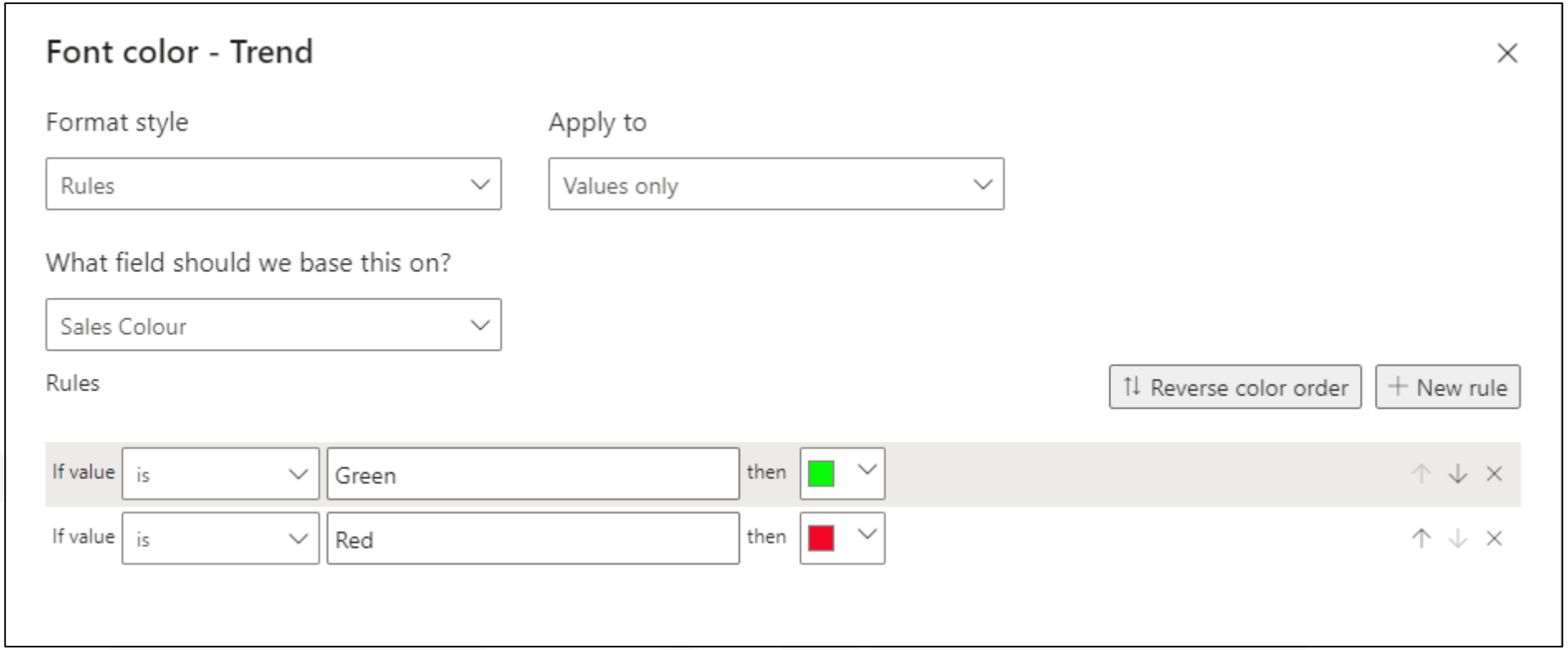
Trend = var positive_icon = UNICHAR(9650)
var negative_icon = UNICHAR(9660)
var result = IF([YOY Sales]>0, positive_icon, negative_icon)
return result

Sales Colour = IF([YOY Sales]>0, "Green", "Red")

- Drag trend measure in fields
- Right click on trend →conditional formatting → font color




NEUROTECH




| category_name | YTD Sales | PYTD Sales | YOY Sales | Trend |
|---|---|---|---|---|
| Furniture | $2.52M | $2.50M | 0.73% | ▲ |
| Office Supplies | $6.92M | $7.00M | -1.22% | ▼ |
| Technology | $2.10M | $2.13M | -1.37% | ▼ |

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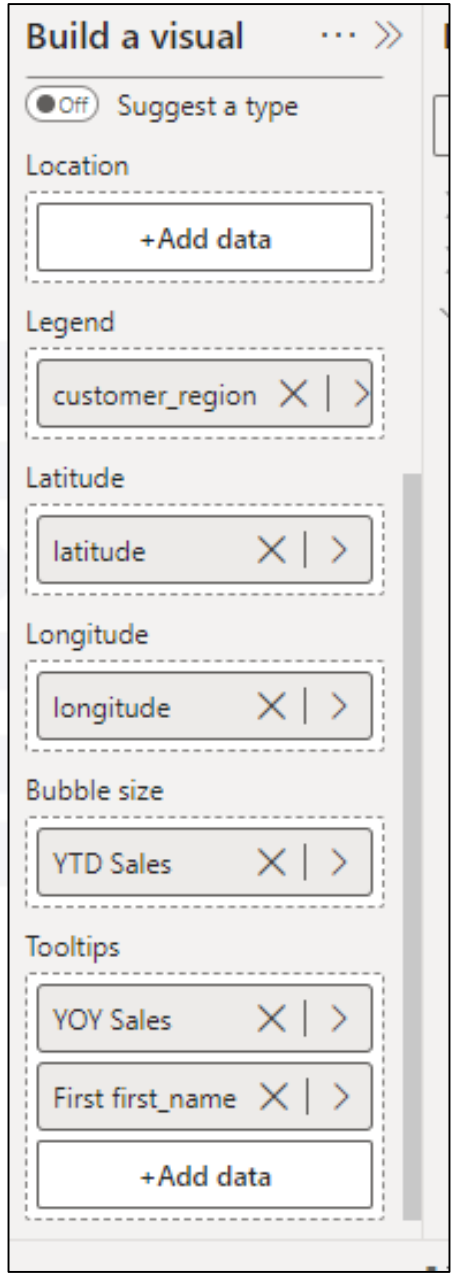
Create Map

Select Map visual
Select fields as shown
(map visual works only when network connectivity is ON)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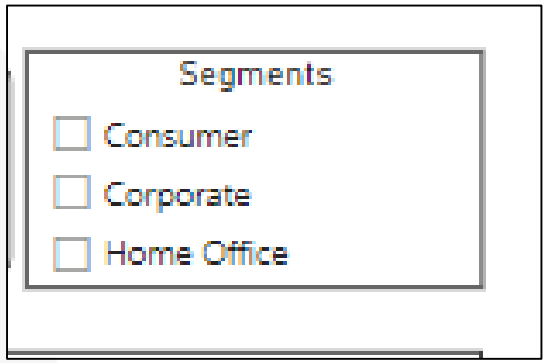
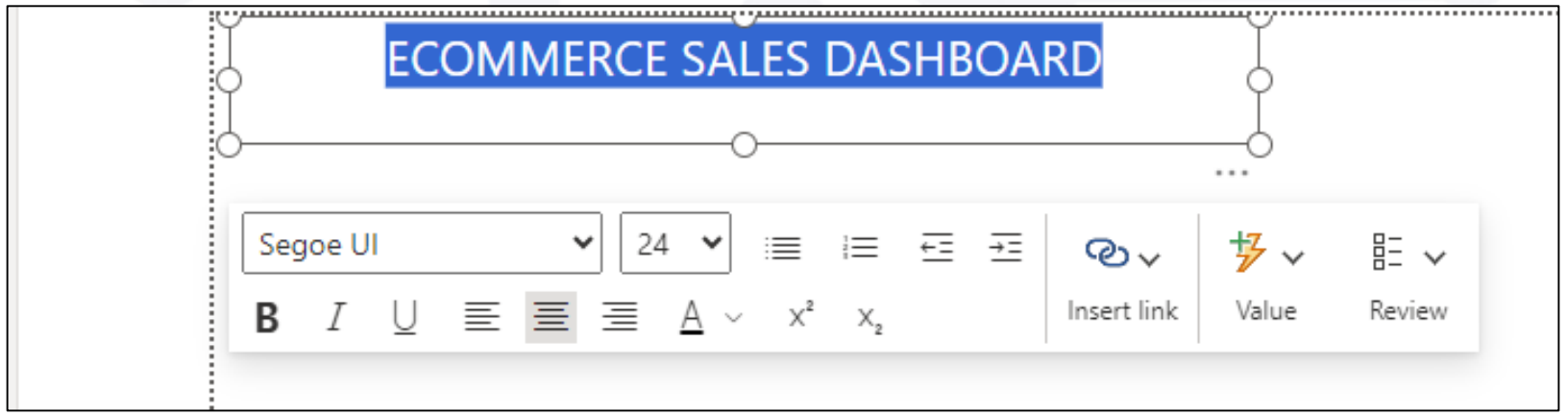
**Create Filter**

Select Slicer visual
Select fields as “customer segment”




**Add dashboard title**

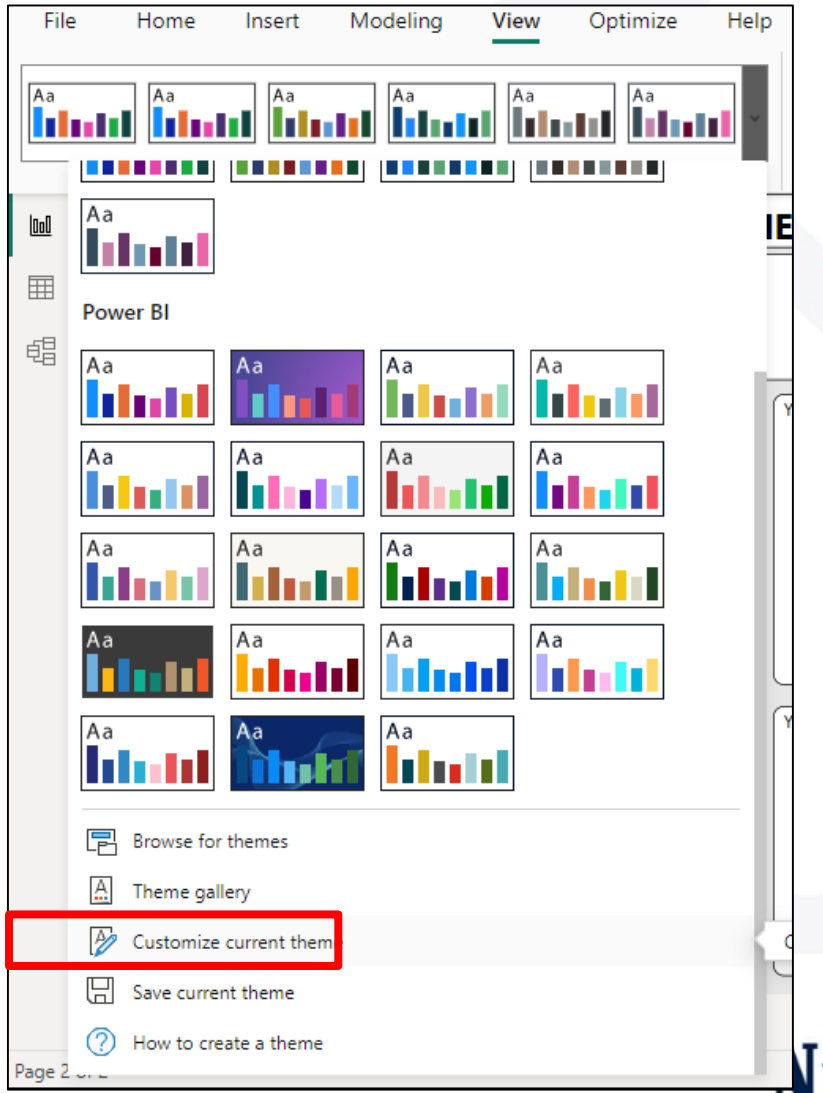
Select Text box under Home tab
Name your dashboard

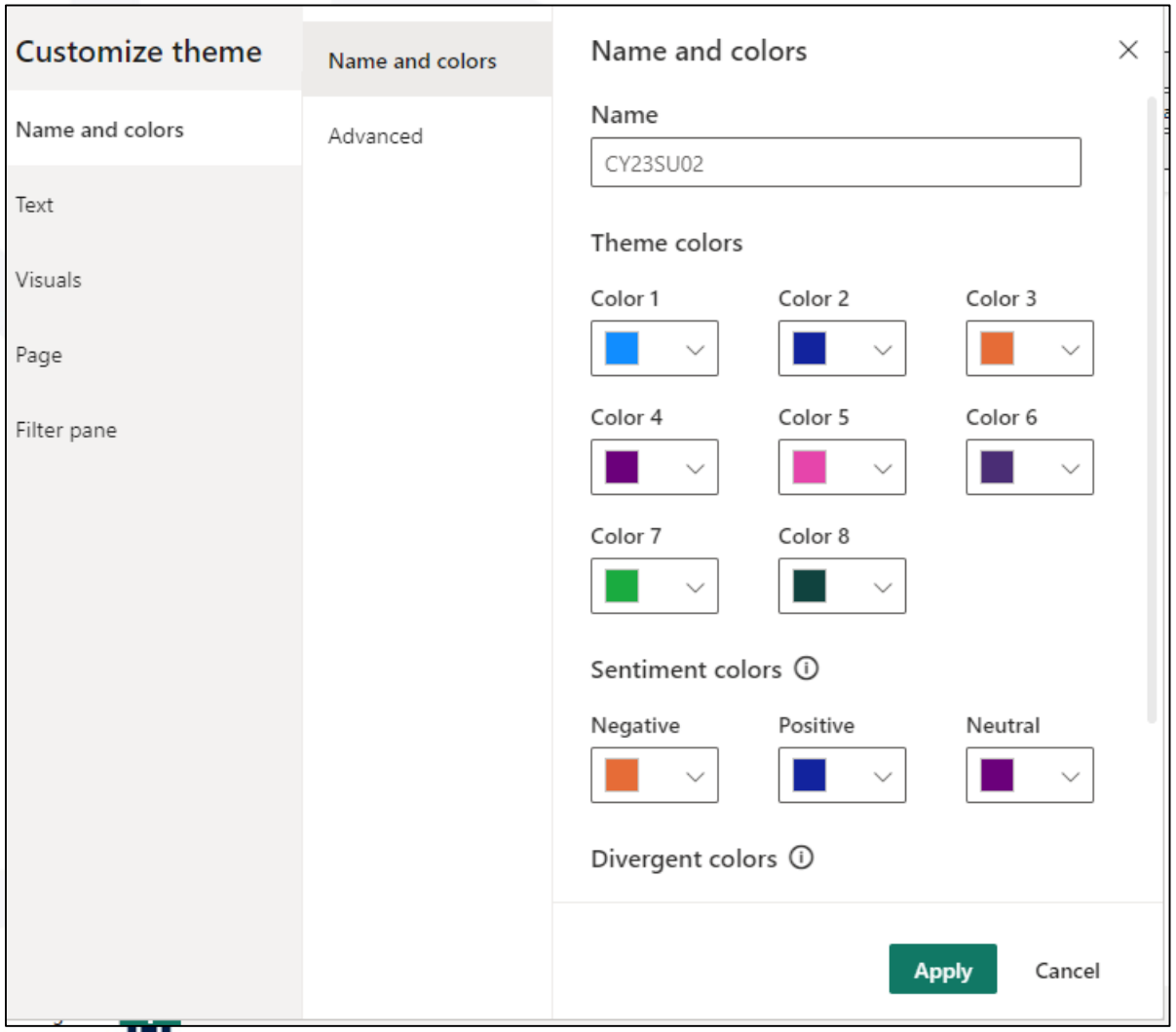


**Dashboard Theme**

Existing theme: View → select from available options

Create theme: view → customize current theme → customize as per your choice.

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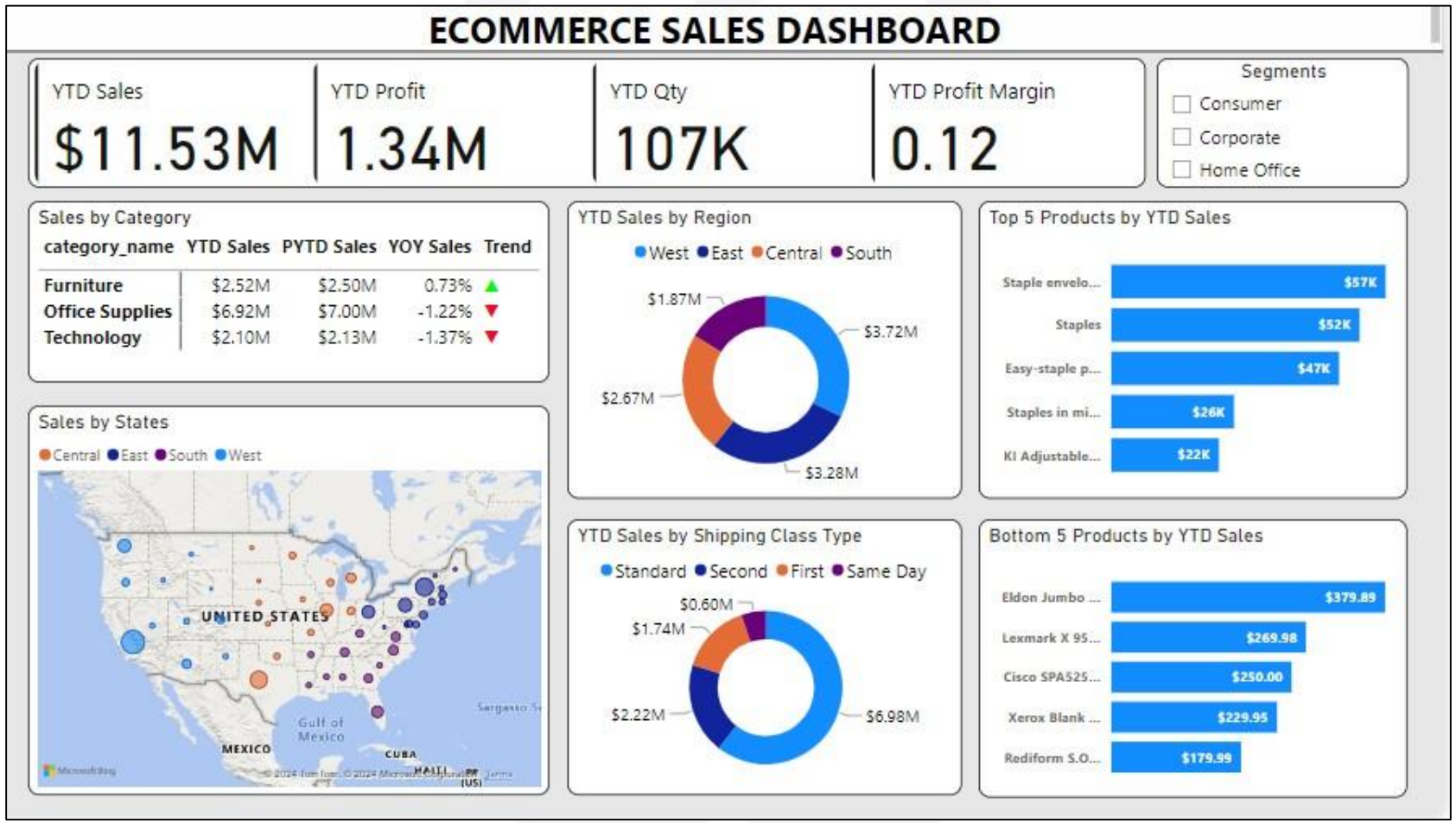
Edit all the visuals and align them properly.
Below is the final dashboard.

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# Visualization Part 2

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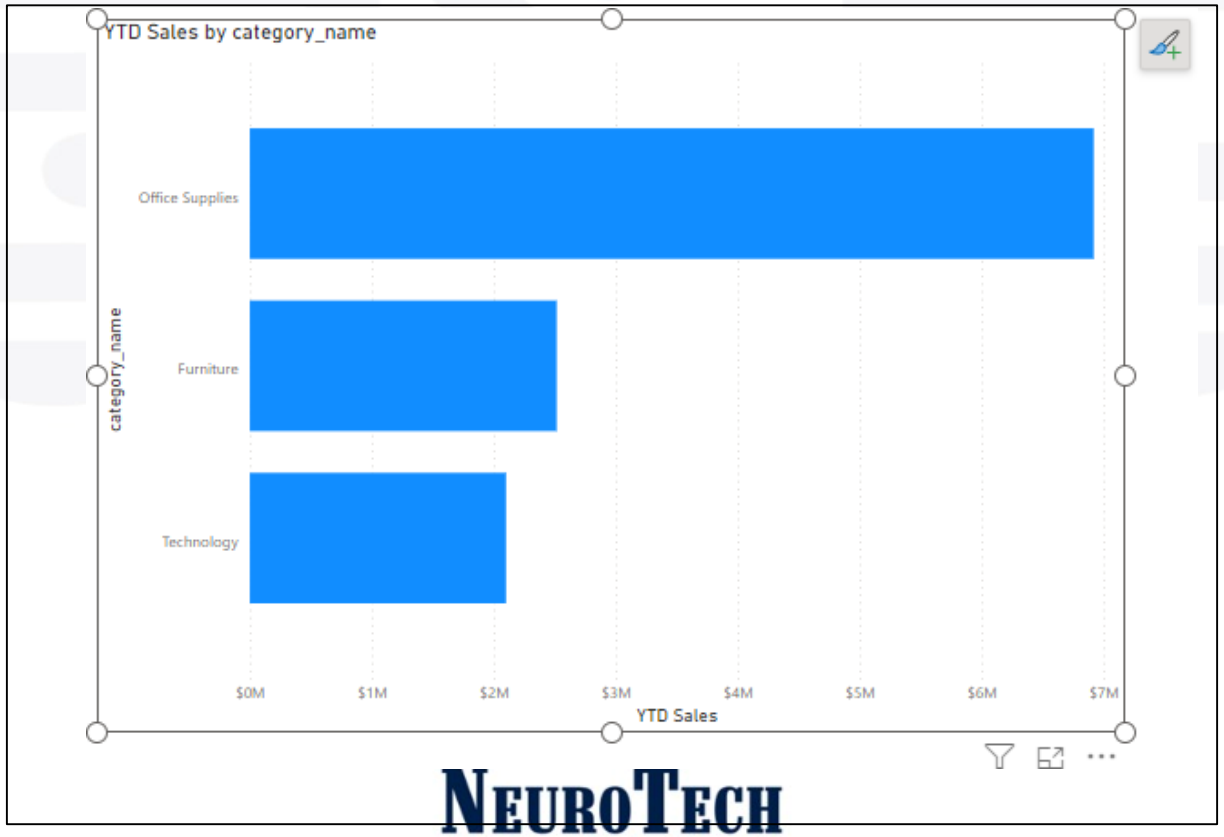
# DRILL DOWN-UP

- Drill Down means basically when you click, you go to next level.
- For e.g – bar chart shows results of years, when you click you go to next level i.e. quarter
- Drill Up means going back to the original data. i.e. quarter to years
- We will go through the below chart that has YTD sales vs category name.

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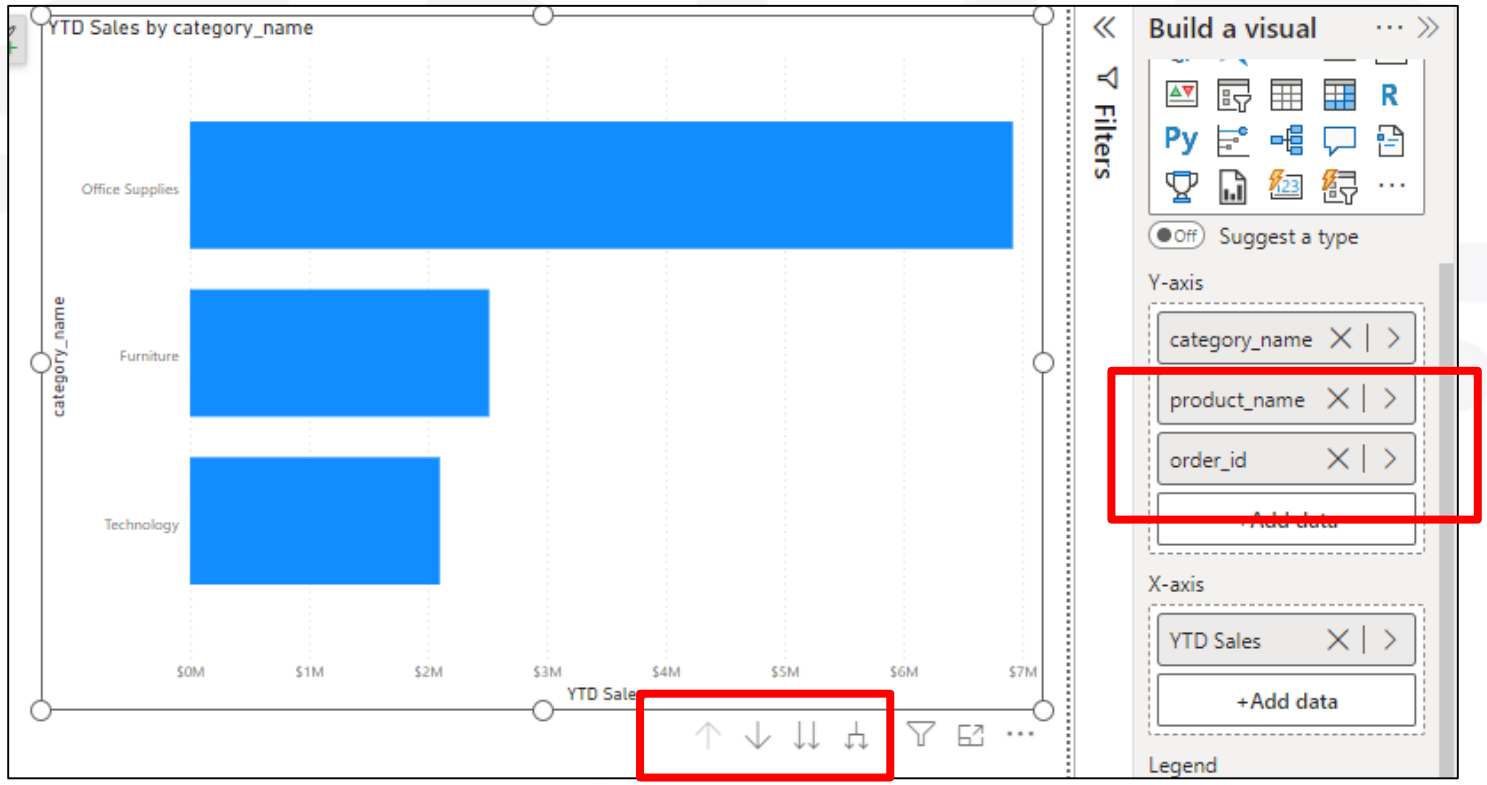
- To activate the drill down option, you need to add hierarchy fields like product name, order id.
- You can add 2 fields/ 3 fields, depends on your final result.

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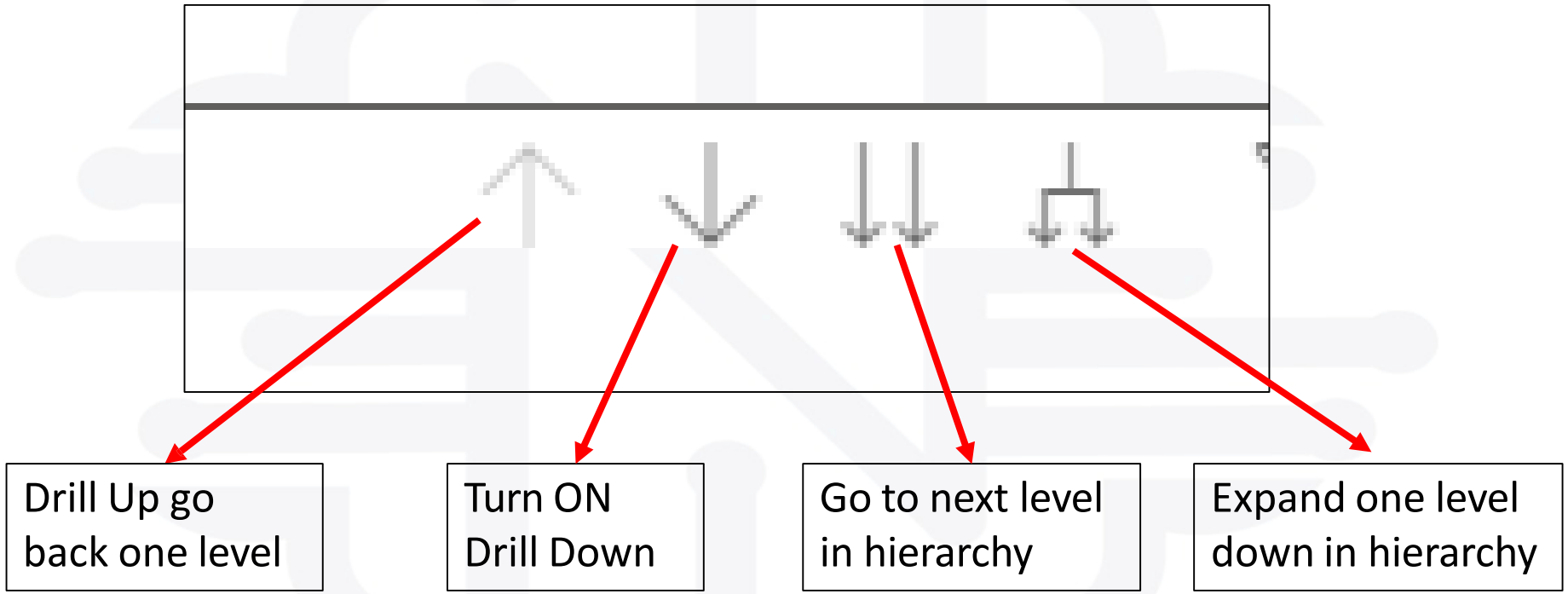
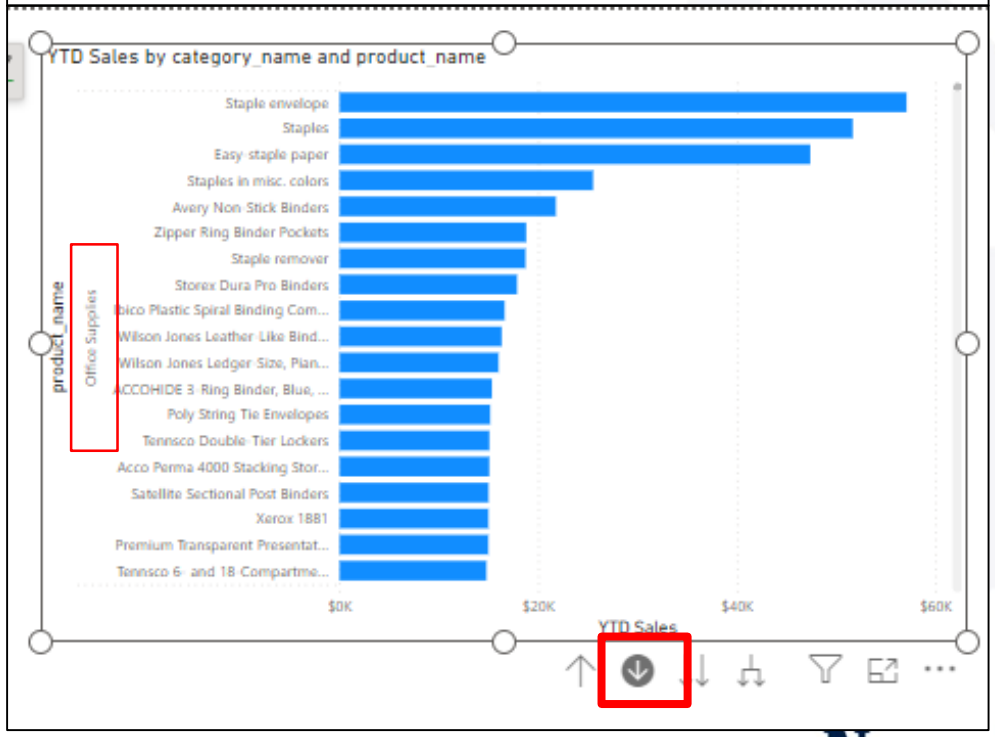
- After adding the hierarchy fields, you get 4 options activated.



- Before any drill down, first you need to **turn ON** drill down option
- **Understand the difference** in both charts having same output.

Here, I have click directly on Office Suppliers bar. You can see vertical “office supplier” category is displayed also the change in title of chart




Here, I have click on 3rd option i.e. go to next level hierarchy. Here you can not see vertical category but just “product name” also the change in title of chart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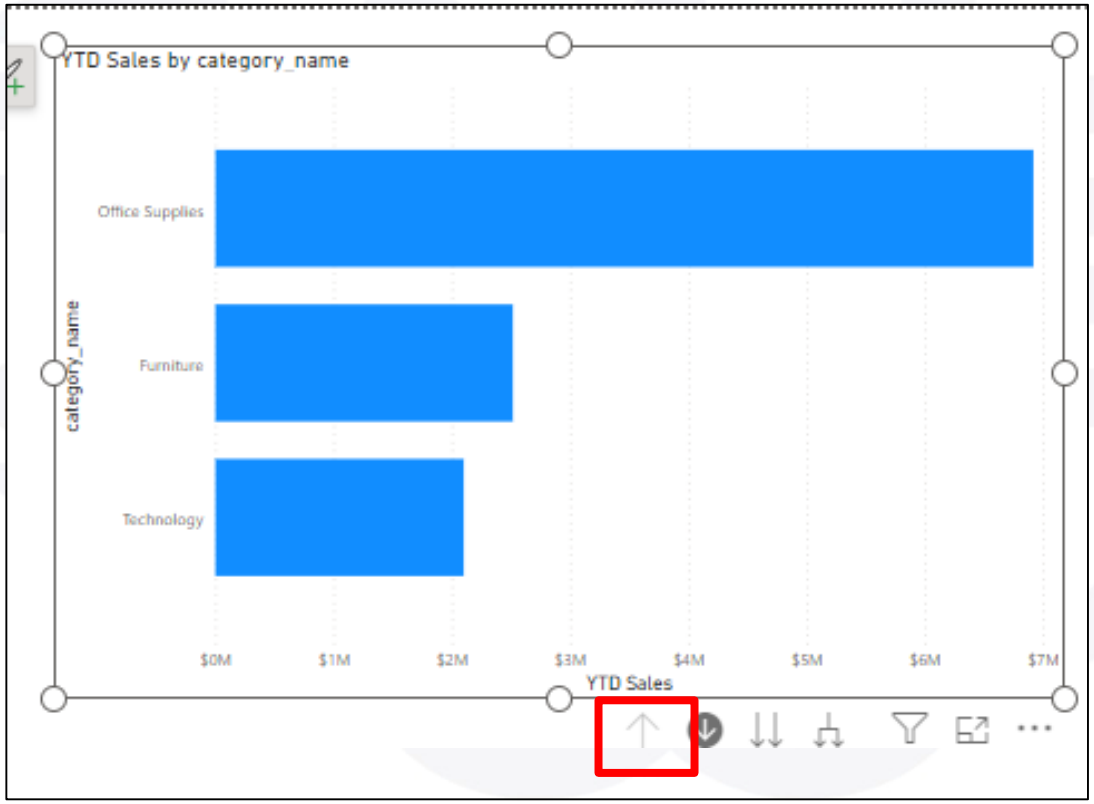
- Drill Up- back to original chart.
- It doesn’t go directly to original chart, goes by level.
- This option is one shade lighter in color.

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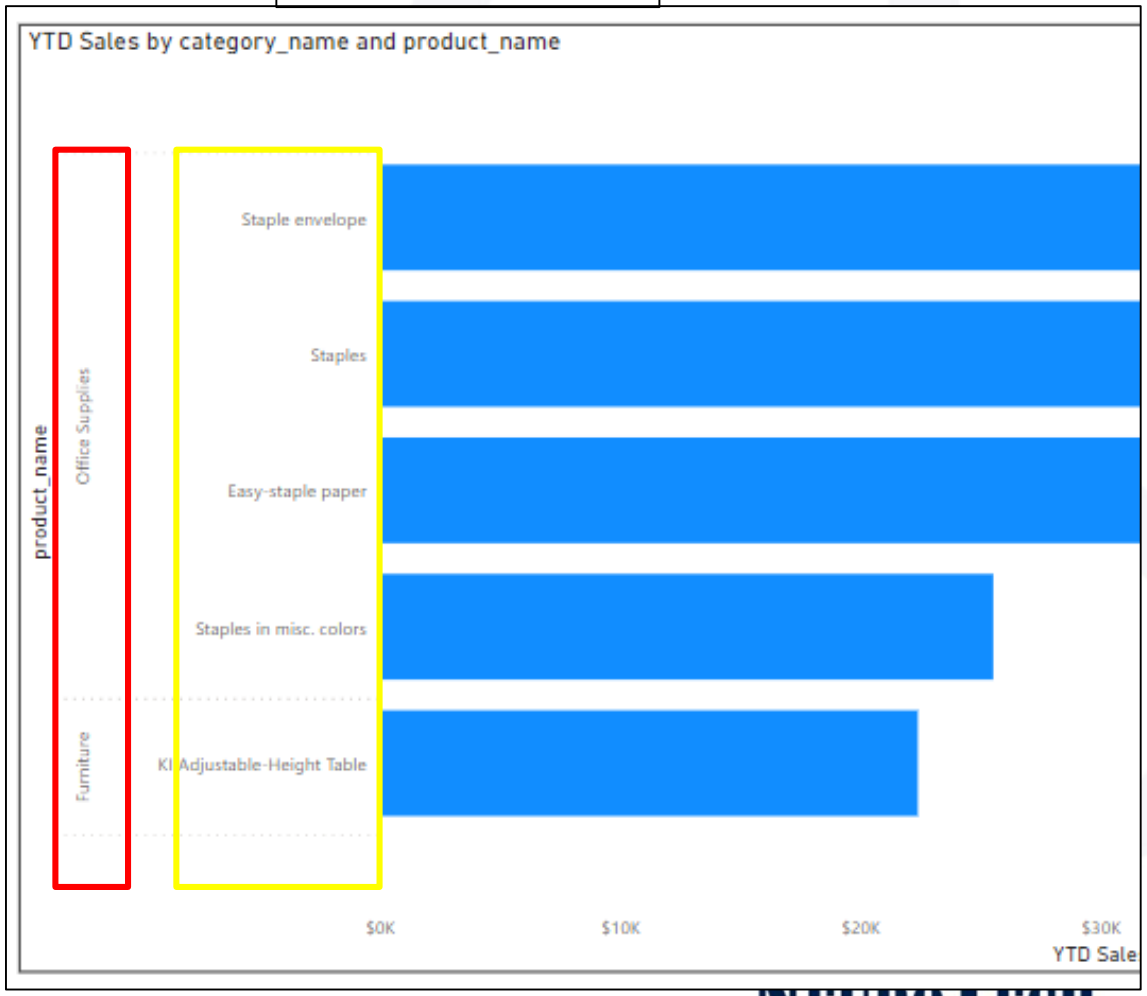
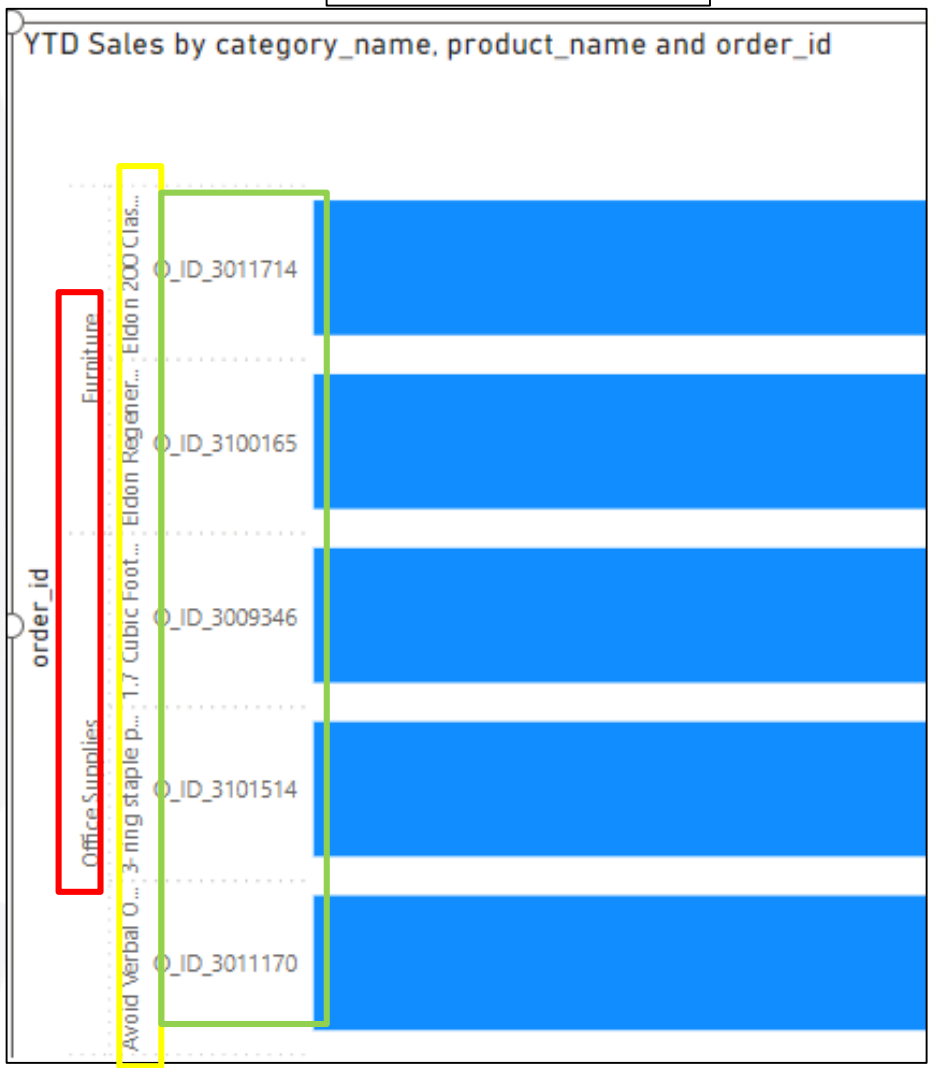
- This is how you will see when you go to 4th option expands hierarchy

One level down




Two level down

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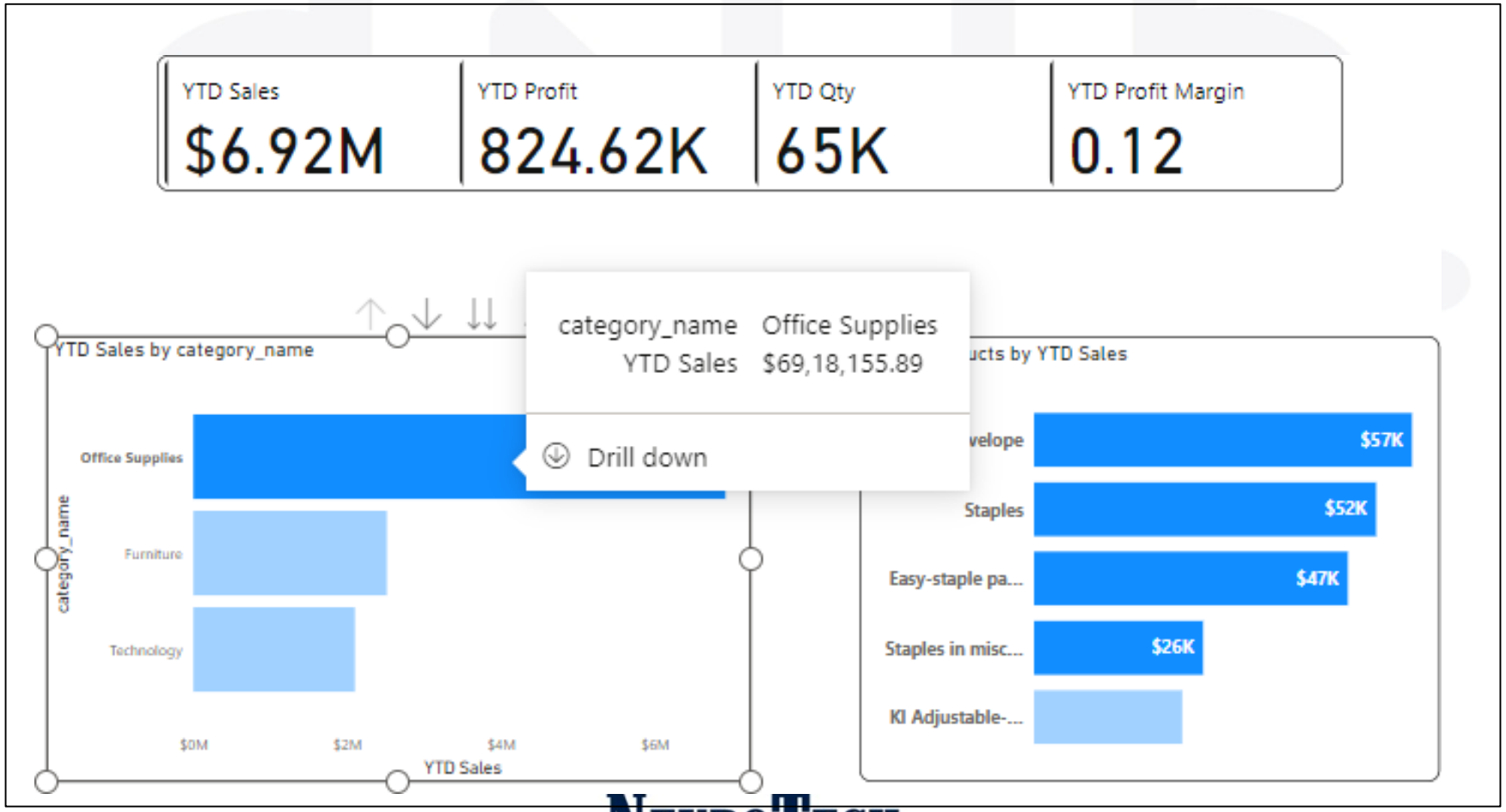
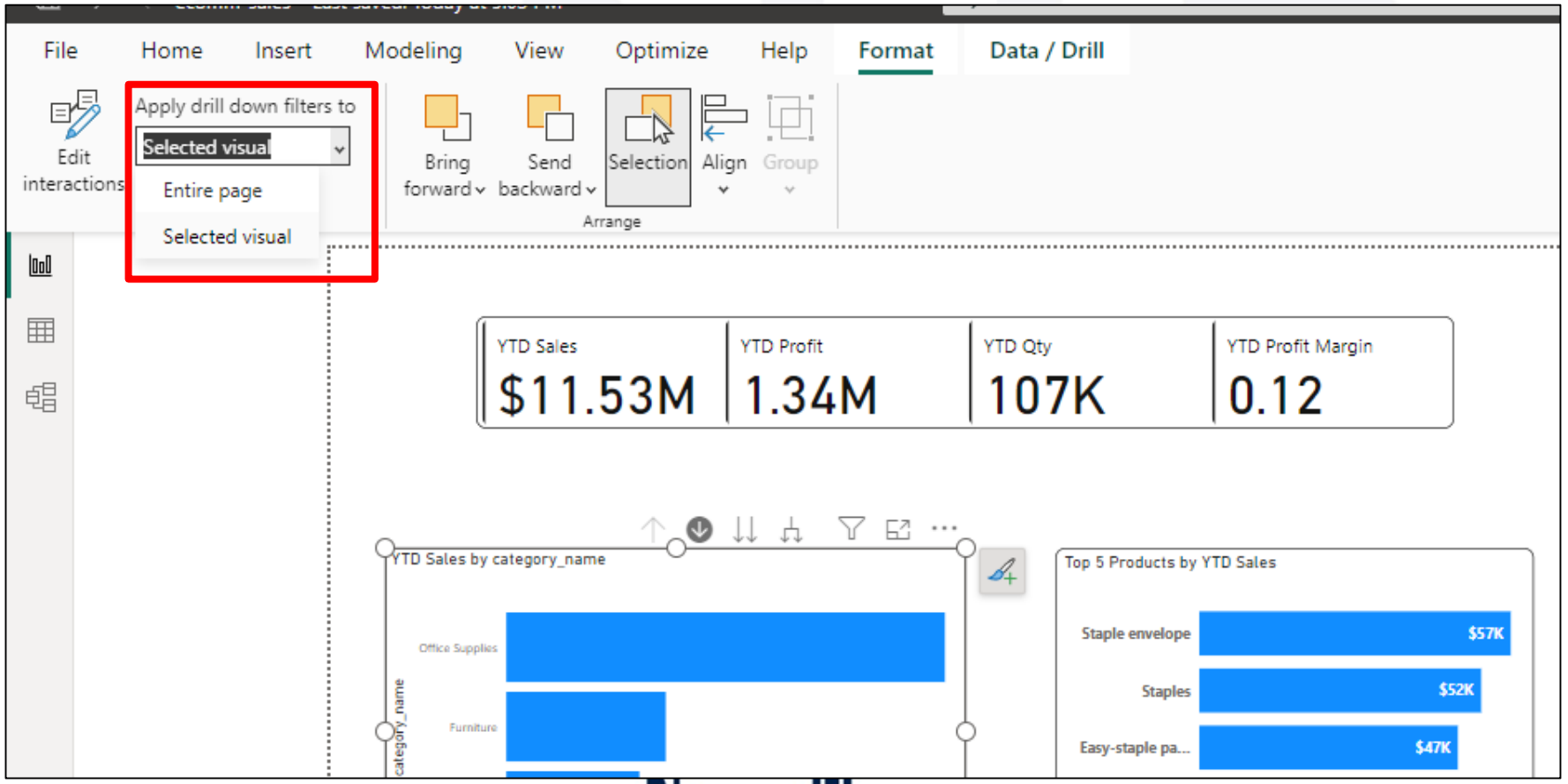
- When you click on any specific category, other charts too gets filter.
- If you don’t want other charts to get filtered, change the setting from entire page to only visual.




NEUROTECH

- Turn ON Drill Down option, go to “interaction” under “format” tab select “selected visual”.
- “selected visual” doesn’t works when Drill Down option is turn OFF, then you can use “Edit Interaction”

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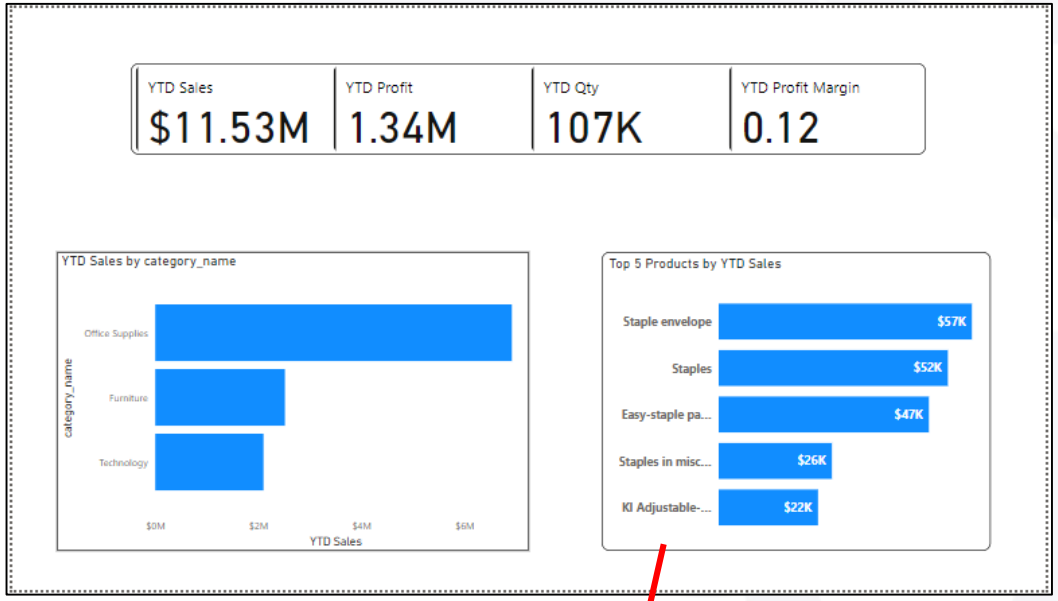
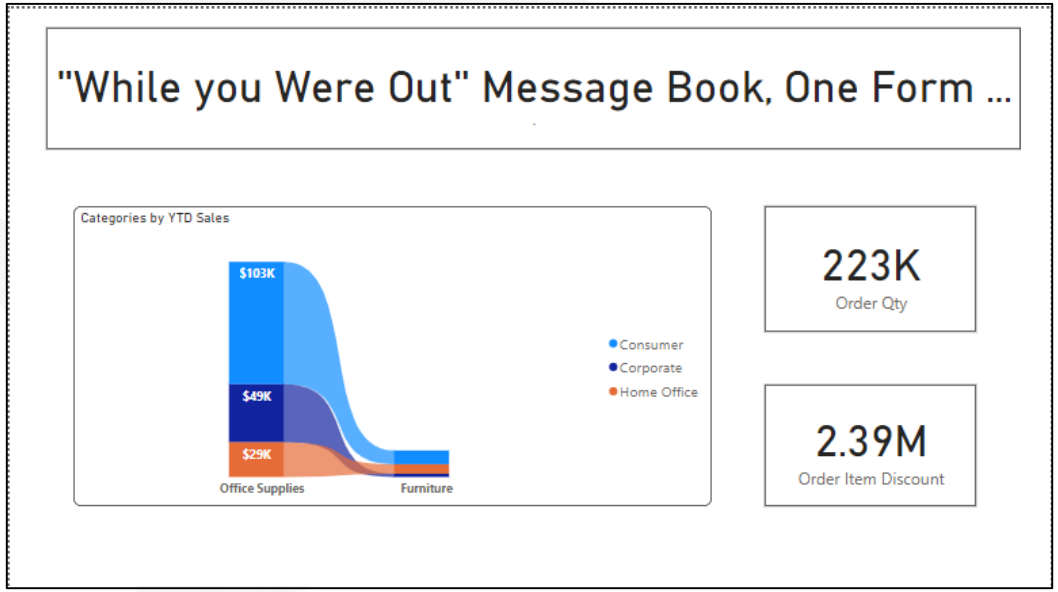
# DRILL THROUGH (Method 1)

With drillthrough in Power BI reports, you can create a destination target page in your report that focuses on a specific entity such as a supplier, customer, or manufacturer. When your report readers right-click a data point in other source report pages, they drill through to the target page to get details that are filtered to that context.




This ia main page.
We will use Top 5 products Bar chart

This is Drillthrough target page

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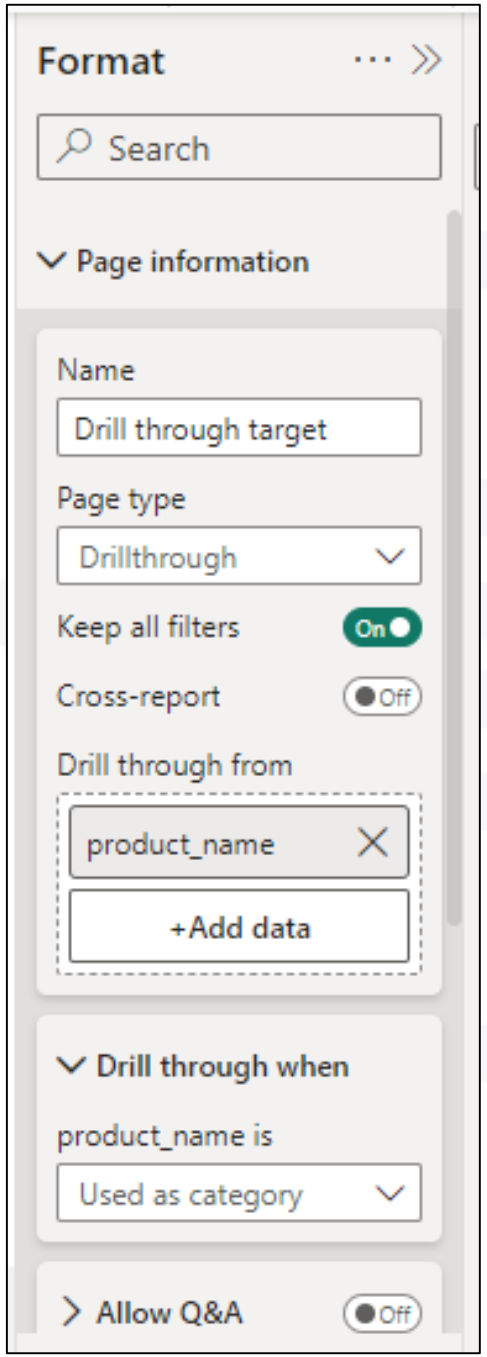
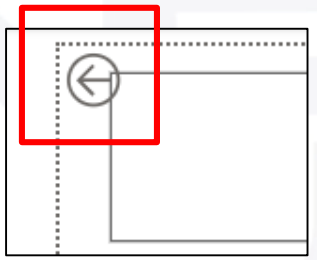



- Go to target page click on canvas → format pane → page information → page type = drillthrough → keep all filters ON → drill through from = (field through which you want more details like I want products details so I selected product name) → drill through when = used as category
- You will find a back arrow in top corner on target page



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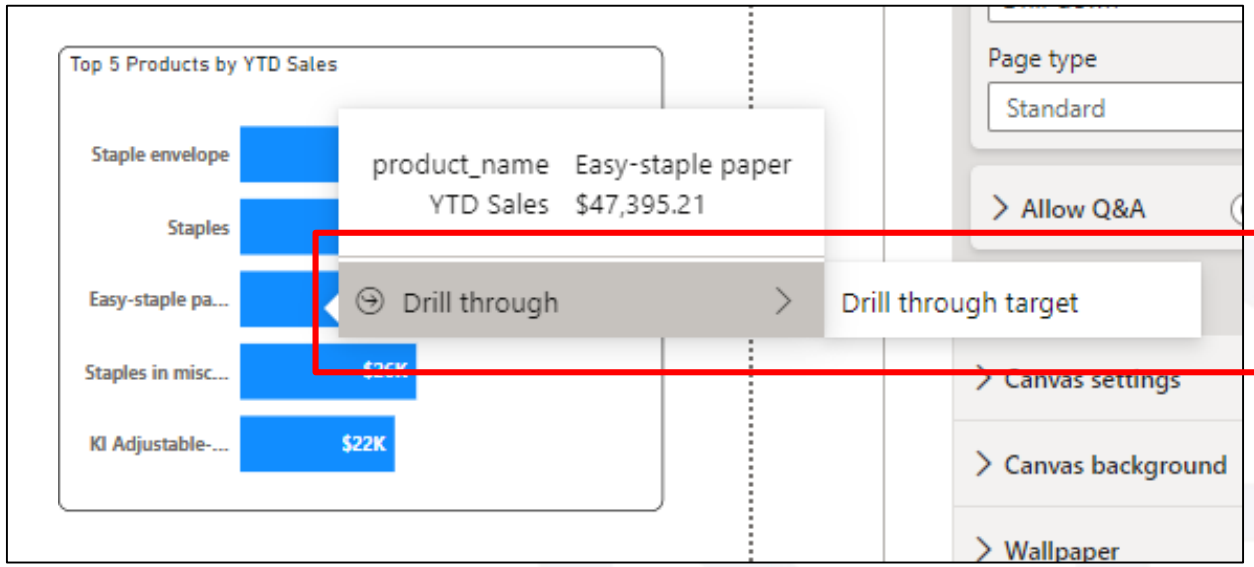
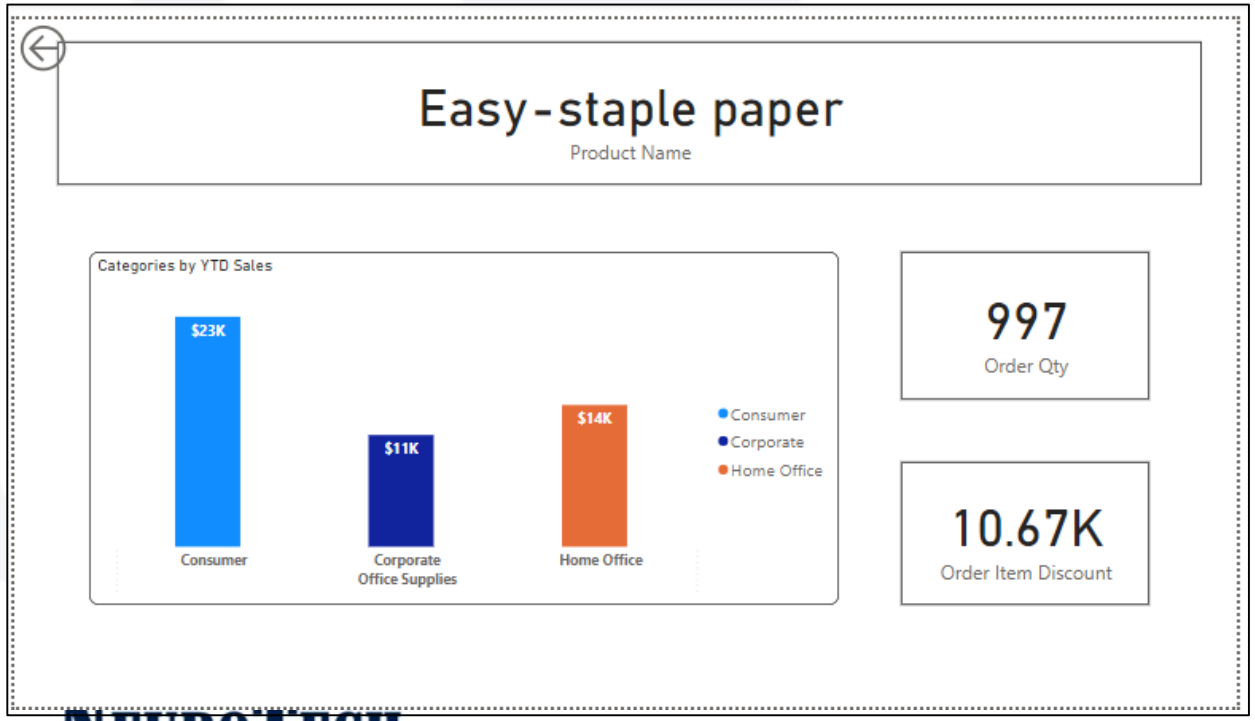

Top 5 Products by YTD Sales
Staple envelope
Staples
Easy-staple pa...
Staples in misc...
KI Adjustable-...
$22K
product_name Easy-staple paper
YTD Sales $47,395.21
Drill through
Drill through target
Page type
Standard
Allow Q&A
Canvas settings
Canvas background
Wallpaper


Easy-staple paper
Product Name
Categories by YTD Sales
$23K
$11K
$14K
Consumer
Corporate
Office Supplies
Home Office
Consumer
Corporate
Home Office
997
Order Qty
10.67K
Order Item Discount

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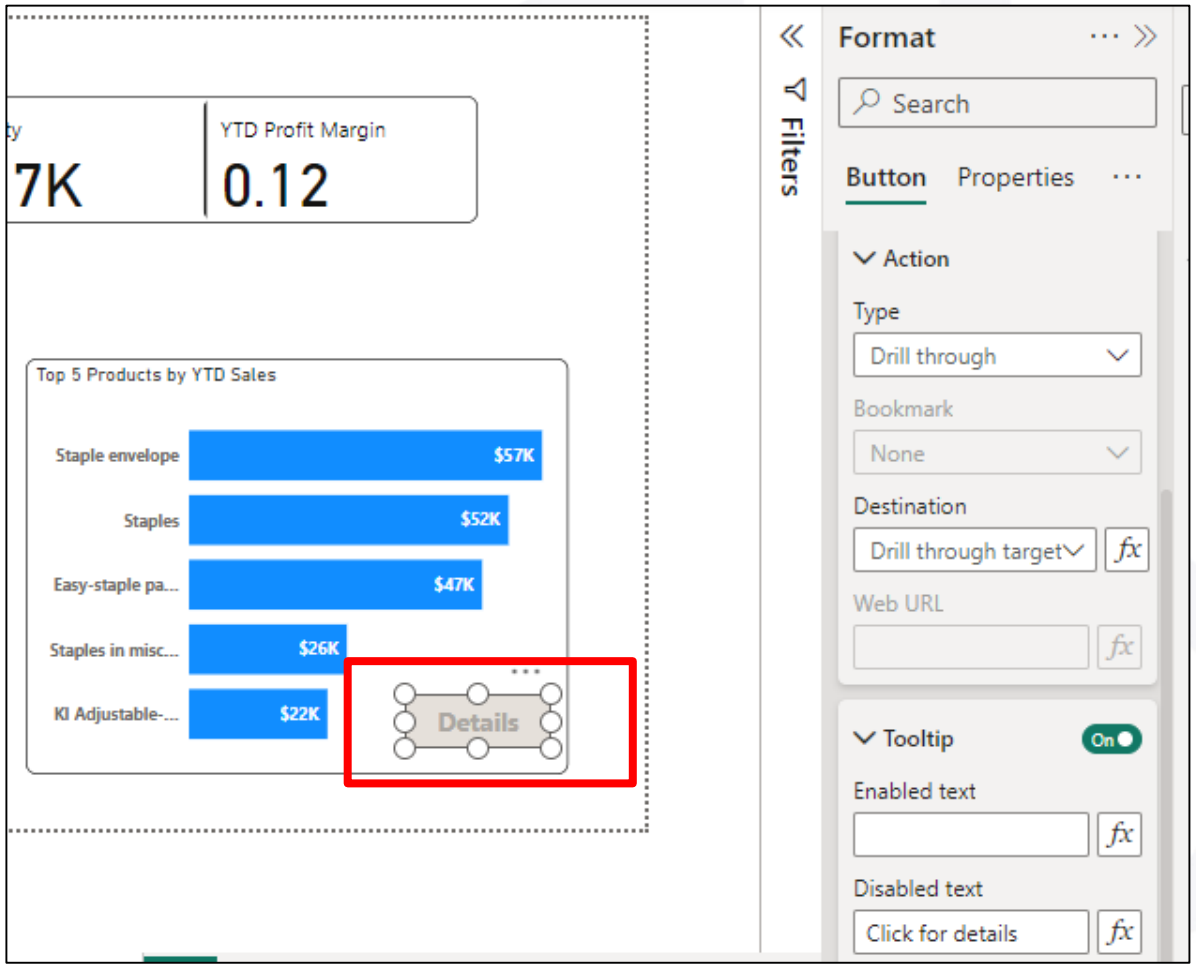
# DRILL THROUGH (Method 2)




Insert → Button → Blank
Format pane → action → type = drillthrough → destination = (select target page) → tooltip → disabled text = click for details
Button style → text → enter your text and do other formatting

Click on any product bar, button gets active, click on button , you are directed to target page.

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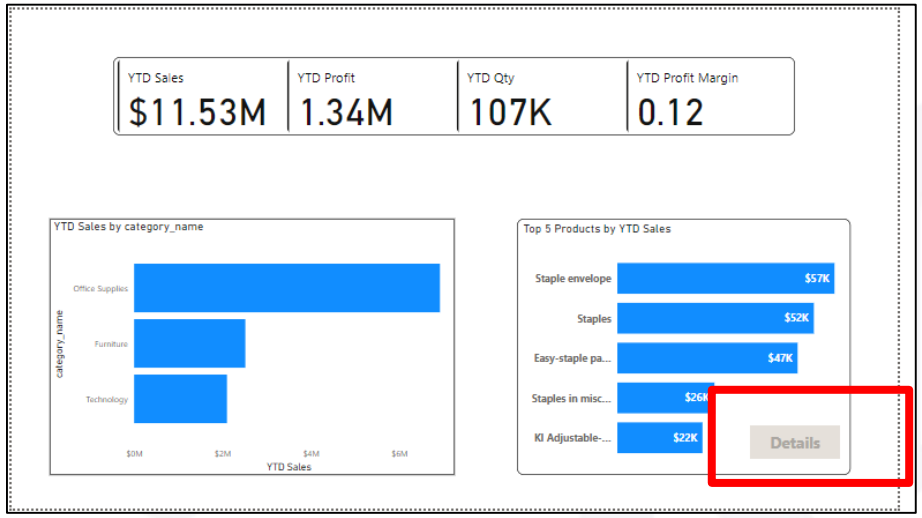
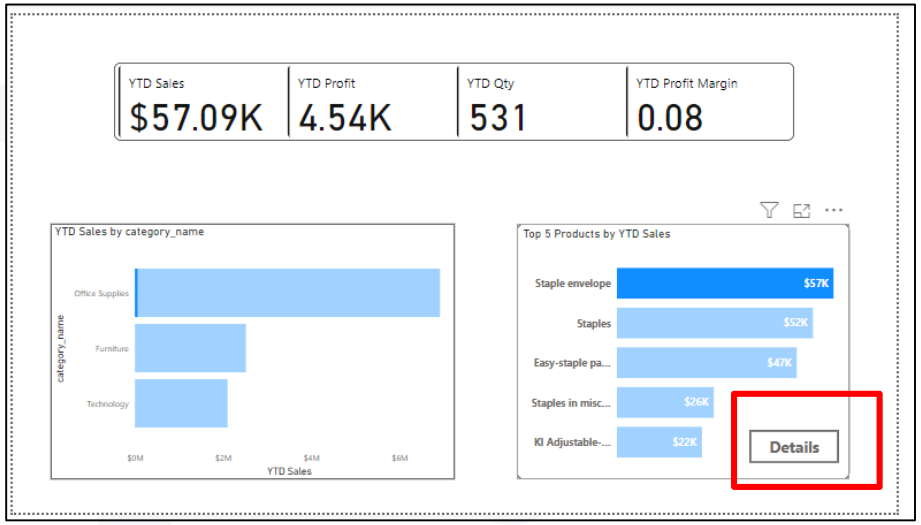
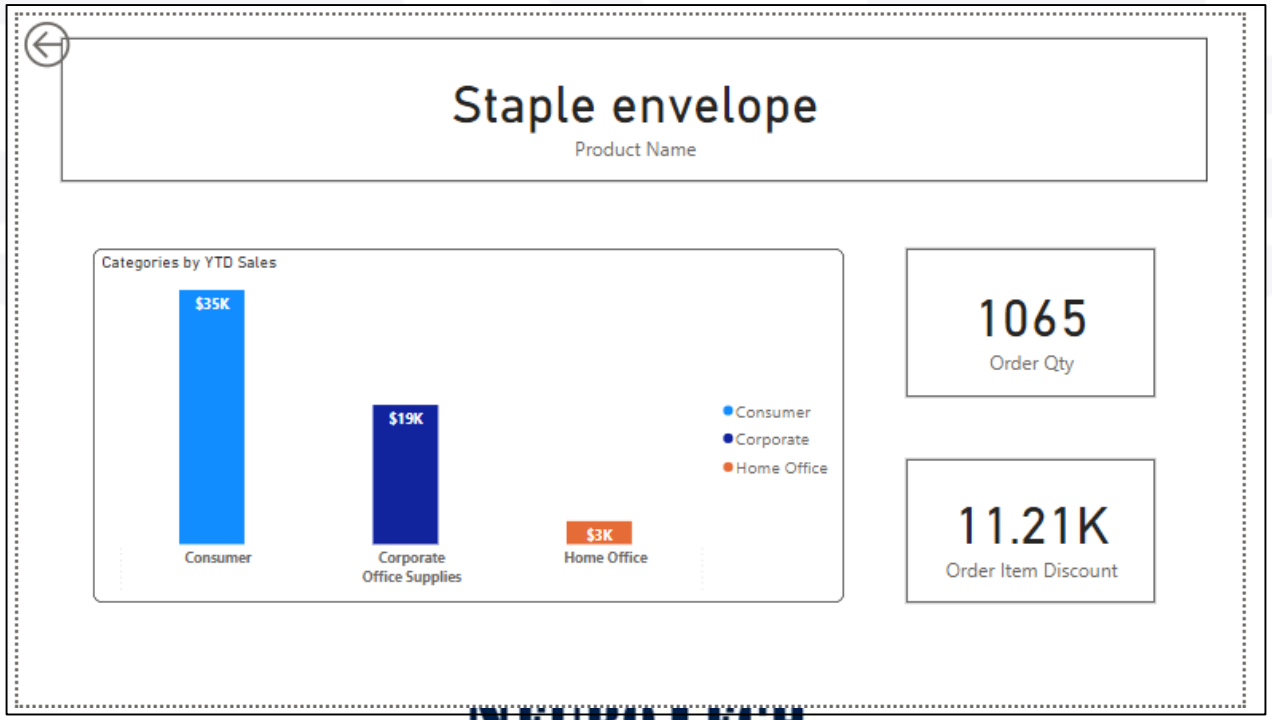

YTD Sales
$11.53M
YTD Profit
1.34M
YTD Qty
107K
YTD Profit Margin
0.12
YTD Sales by category_name
Office Supplies
Furniture
Technology
category_name
$0M
$2M
$4M
$6M
YTD Sales
Top 5 Products by YTD Sales
Staple envelope
$57K
Staples
$52K
Easy-staple pa...
$47K
Staples in misc...
$26K
KI Adjustable-...
$22K
Details


YTD Sales
$57.09K
YTD Profit
4.54K
YTD Qty
531
YTD Profit Margin
0.08
YTD Sales by category_name
Office Supplies
Furniture
Technology
category_name
$0M
$2M
$4M
$6M
YTD Sales
Top 5 Products by YTD Sales
Staple envelope
$57K
Staples
$52K
Easy-staple pa...
$47K
Staples in misc...
$26K
KI Adjustable-...
$22K
Details


Staple envelope
Product Name
Categories by YTD Sales
$35K
Consumer
$19K
Corporate
Office Supplies
$3K
Home Office
Consumer
Corporate
Home Office
1065
Order Qty
11.21K
Order Item Discount

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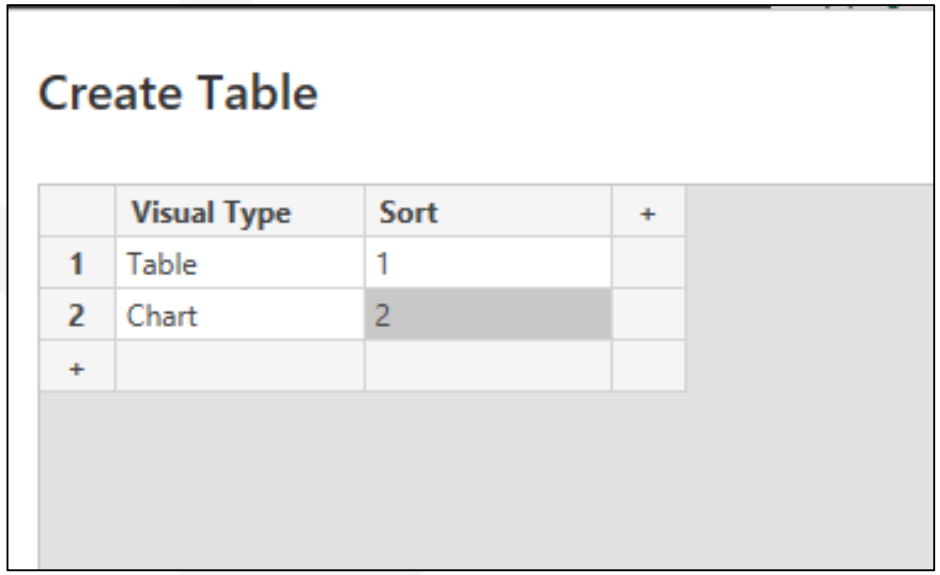
# BOOKMARK

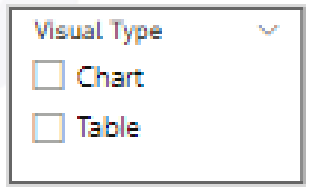
Bookmark enables users to save a particular view of a report page. This ability is extremely useful in enhancing the user experience of navigating a report or opening opportunities to add more depth to a report.

Create table " bookmark"

Home tab → enter data → enter values as shown → name bookmark → load




Create slicer with visual type field
Make it single select in slicer setting option

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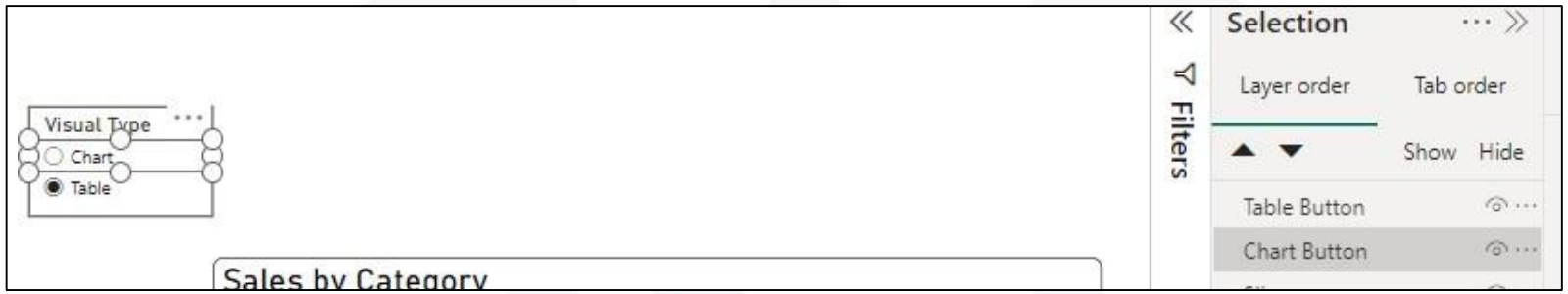
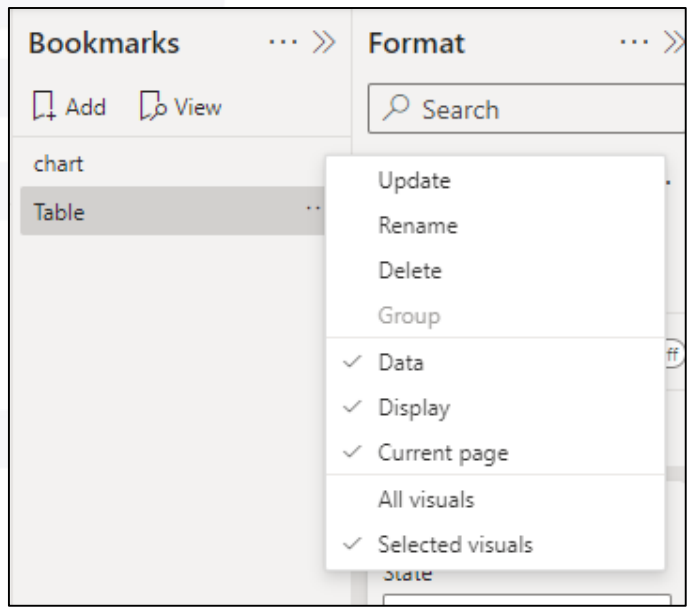
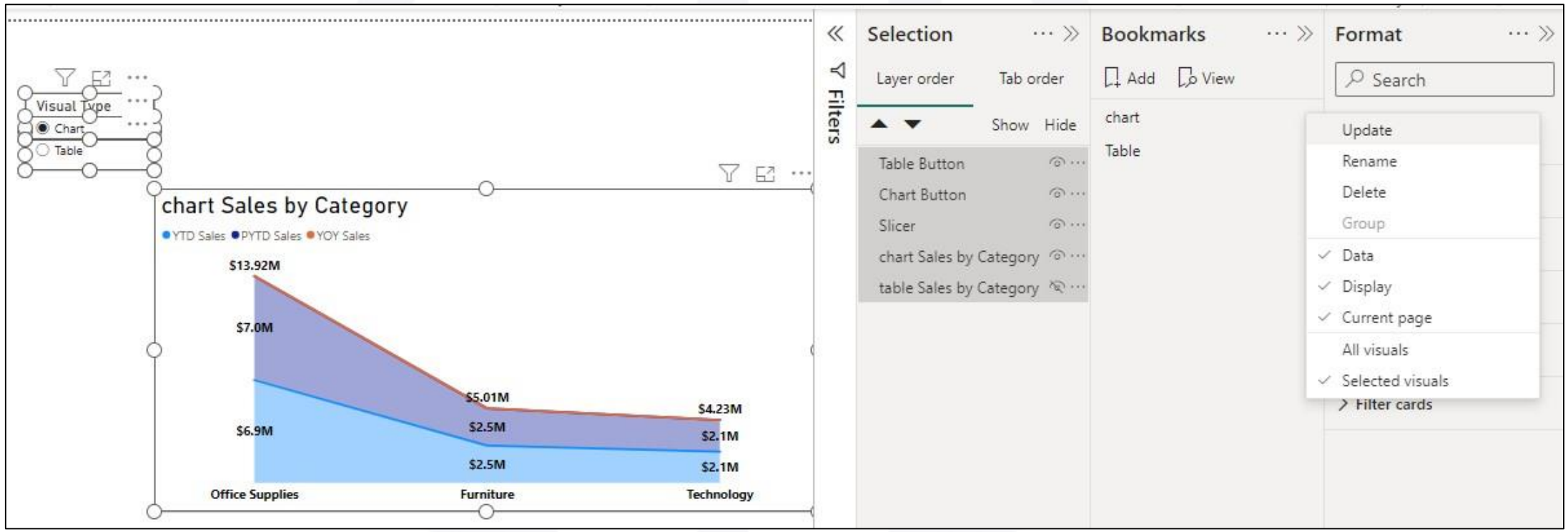
- Turn on selection and bookmark under view tab
- Insert two blank button and overlap them on visuals types and rename them in selection pane



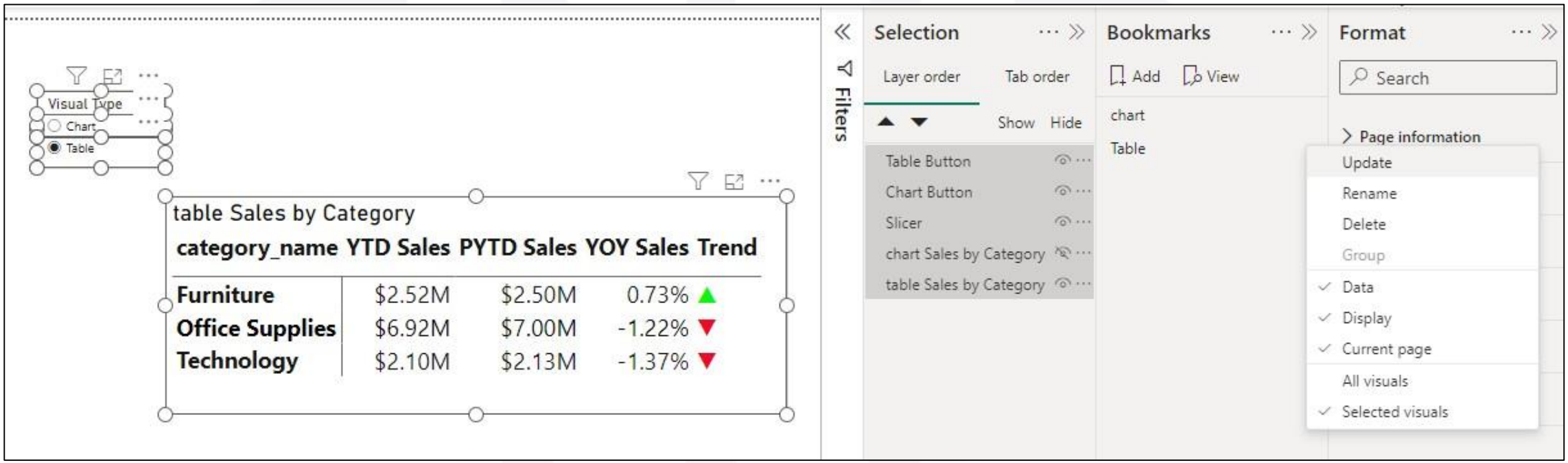

In bookmark pane add two bookmark by clicking on add and rename them chart and table.
Click on 3 dots and make sure all 4 option are tick



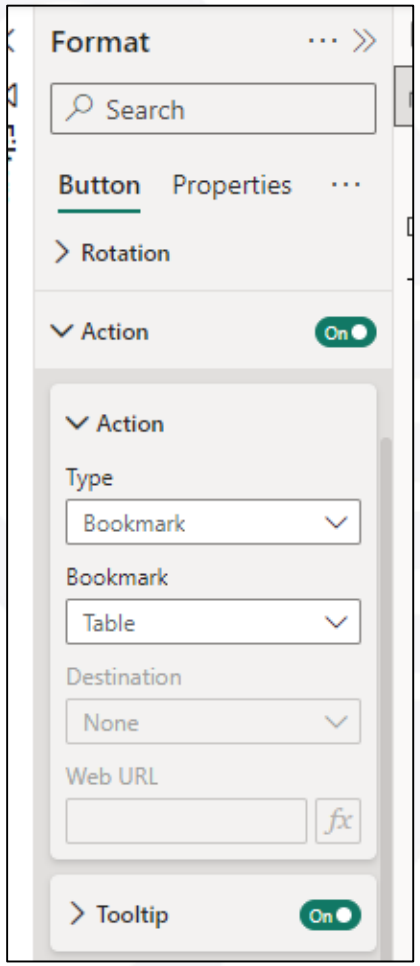
- Select chart on slicer.
- Disable table visual in selection pane
- In bookmark pane, click on 3dots of chart and click update
- Chart bookmark is set

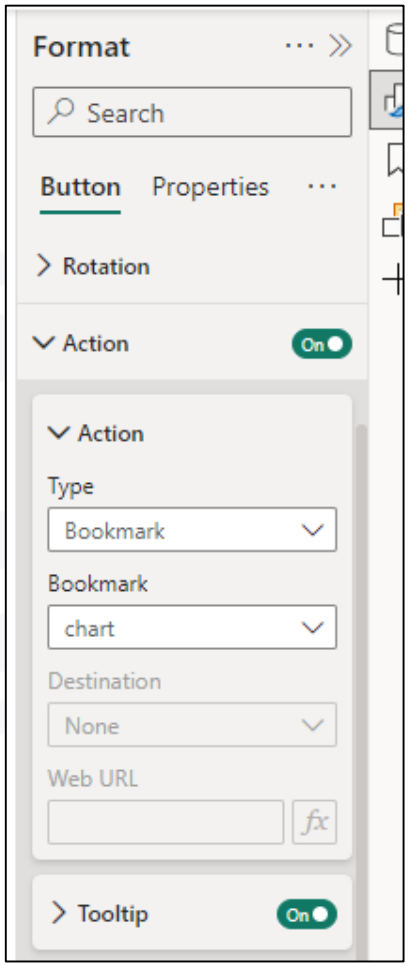


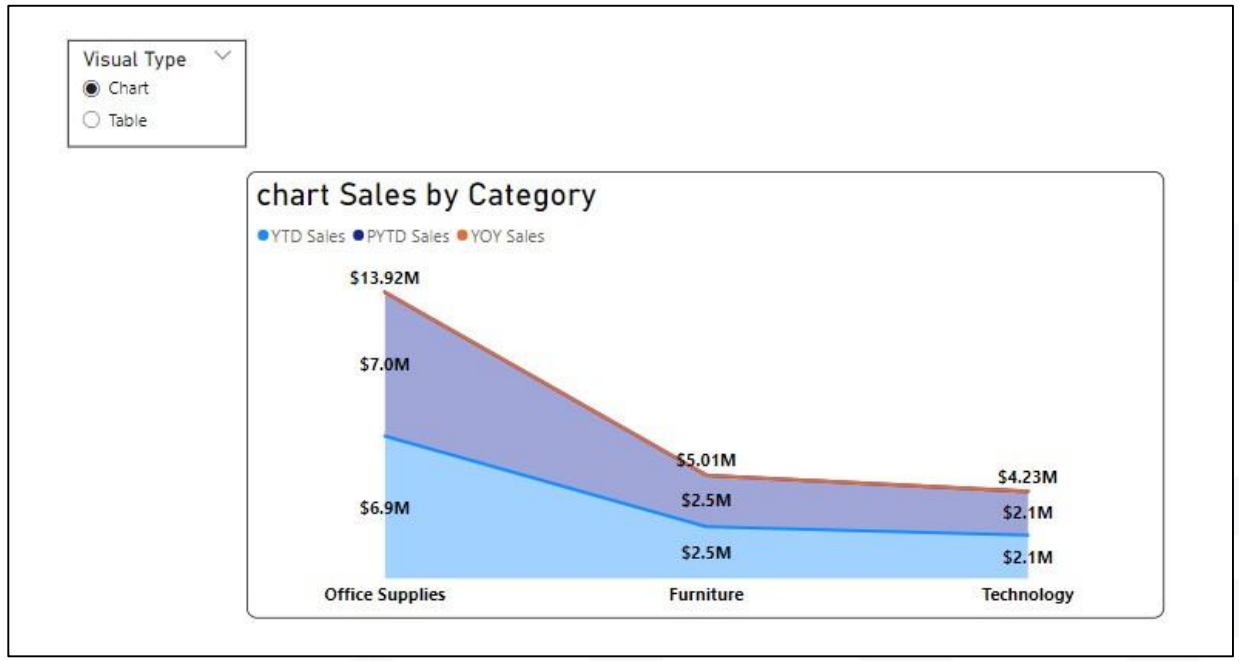
- Select table on slicer.
- Disable chart visual in selection pane
- In bookmark pane, click on 3dots of table and click update
- Table bookmark is set



- To navigate buttons with charts
- click on buttons → format tab → turn on action → select type and bookmark name






Final look

(NOTE– while clicking use CTRL+CLICK)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# Any Questions

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# Thanks

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