

atomcamp

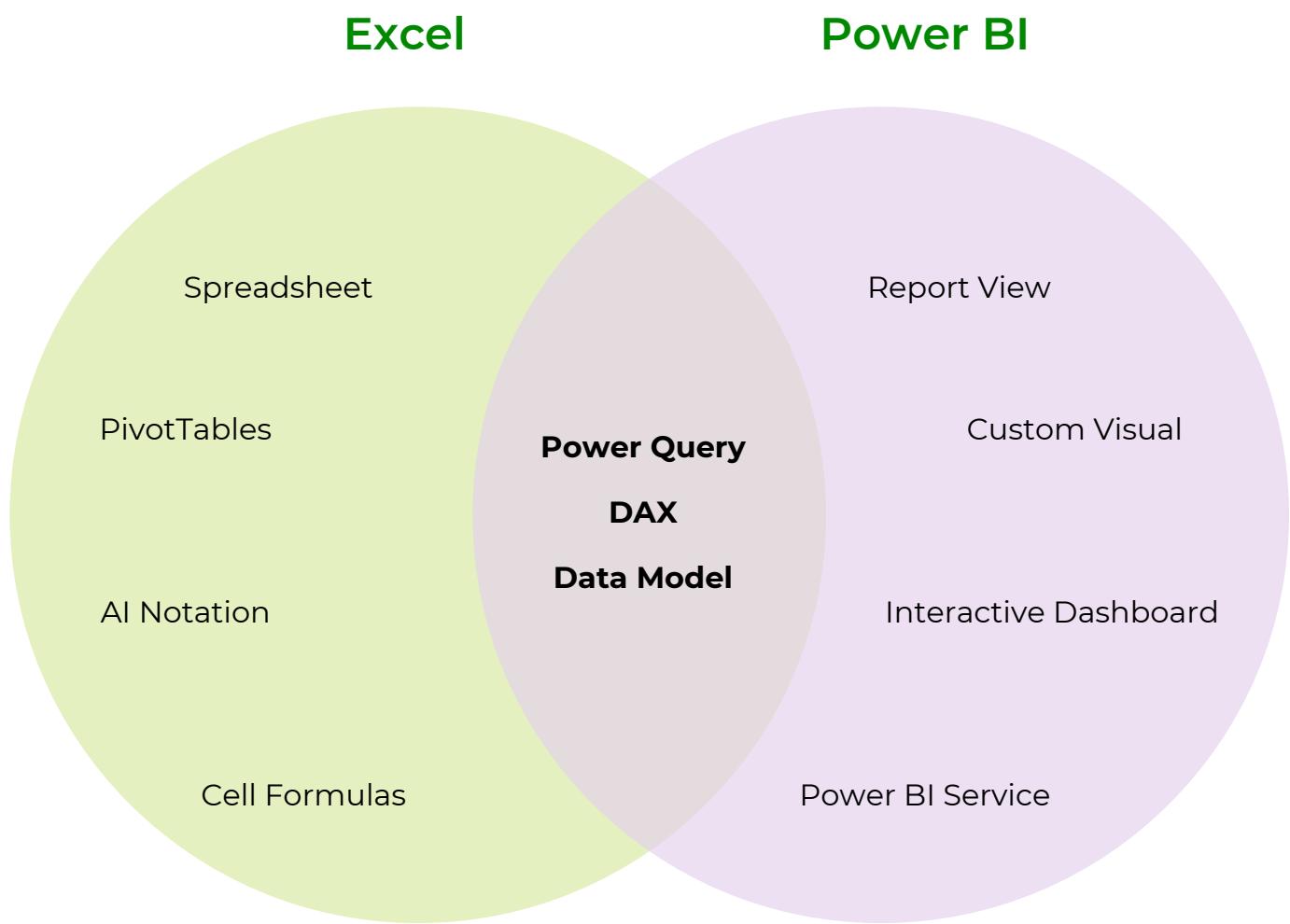
MICROSOFT POWER BI MANUAL FOR DESKTOP



What is Power BI?

Power BI is a self-service tool available for desktop and web based applications. It is used for connecting the data, it's modelling and its visualization .

Power BI VS Excel

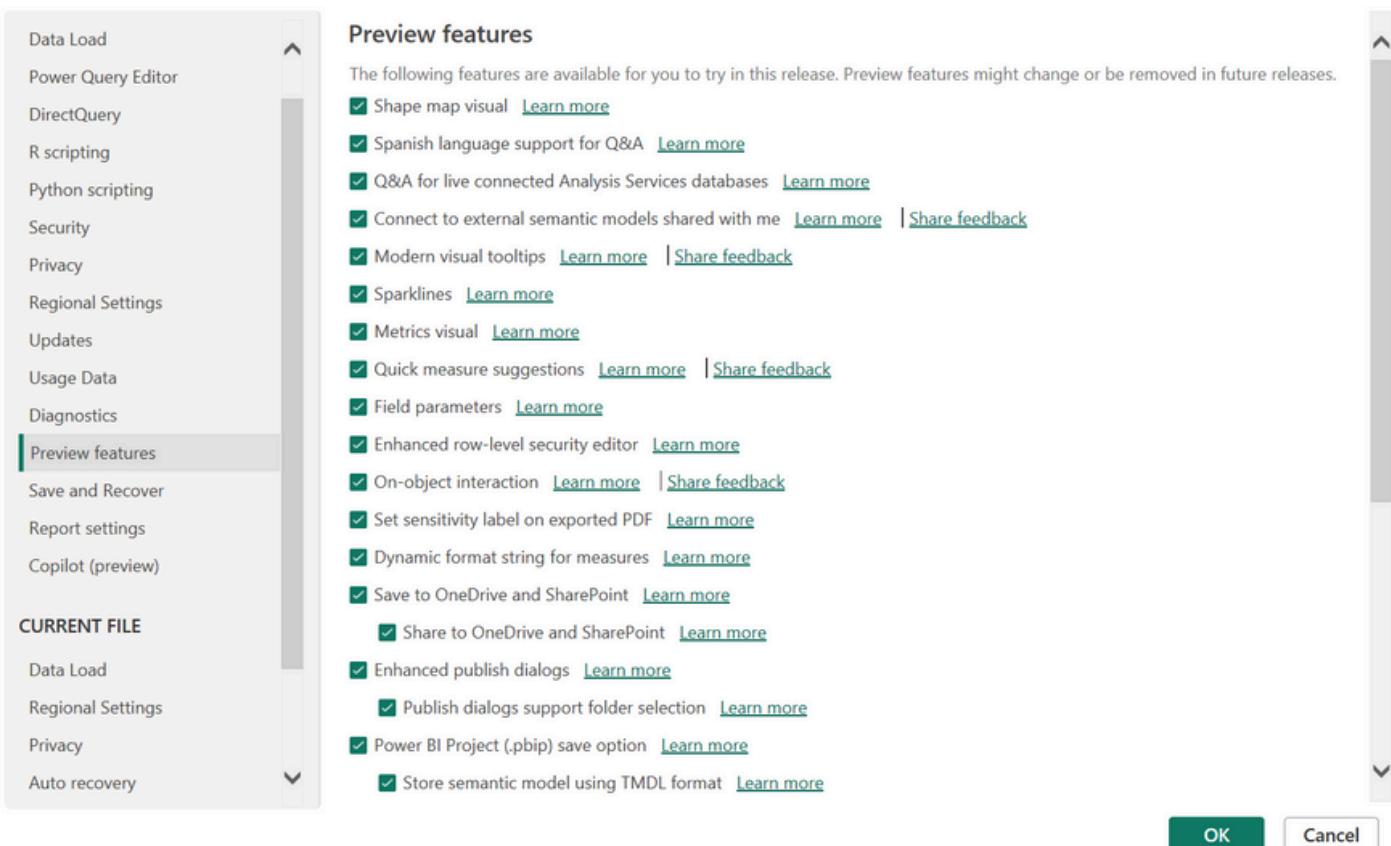


- Excel has limitations in the amount of data it can work with. In contrast, Power BI can handle much larger amounts of data.
- Power BI can connect to a large number of data sources, while Excel's connectivity capacity is limited. Also, unlike Excel, Power BI can be easily used from mobile devices.
- Power BI has faster processing than Excel.
- Power BI dashboards are more visually appealing, interactive and customizable
- Power BI is a more powerful tool than Excel in terms of comparison between tables, reports or data files

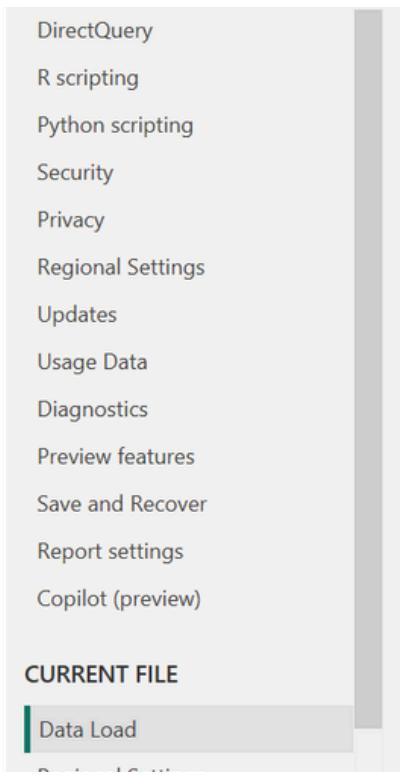
Power BI settings

Following Power BI settings are essential to get the most of the services it has to offer

Options



- Go to file>Settings
- Select all features available in **preview features**



Relationships

Import relationships from data sources on first load [\(i\)](#)

Update or delete relationships when refreshing data [\(i\)](#)

Autodetect new relationships after data is loaded [\(i\)](#)

[Learn more](#)

Time intelligence

Auto date/time [\(i\)](#) [Learn more](#)

Background Data

Allow data previews to download in the background

Parallel loading of tables [\(i\)](#)

Maximum number of concurrent jobs [Learn more](#)

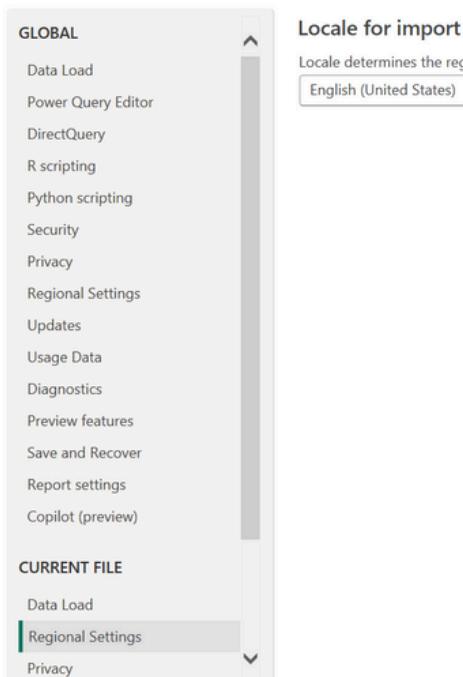
Default

One (disables parallel loading)

Make sure the following highlighted options in **Data Load** are not selected

- Update or Delete relationships when refreshing data
- Autodetect new relationships after a data is loaded
- Time intelligence > Auto date/time

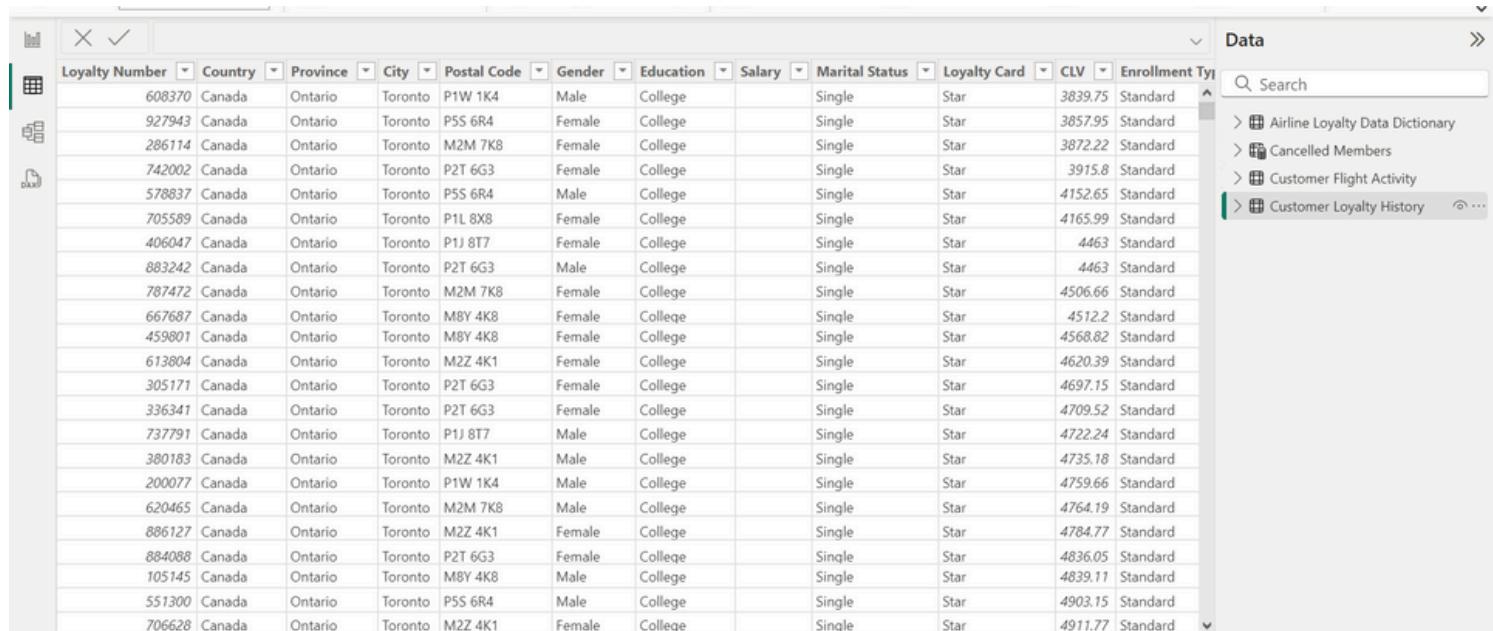
Options



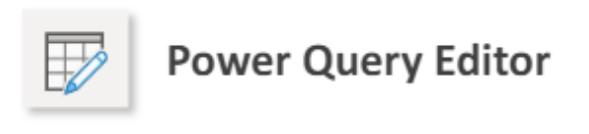
From the dropdown menu select **English(United States)** in Regional Settings> Locale for import

Power BI workflow

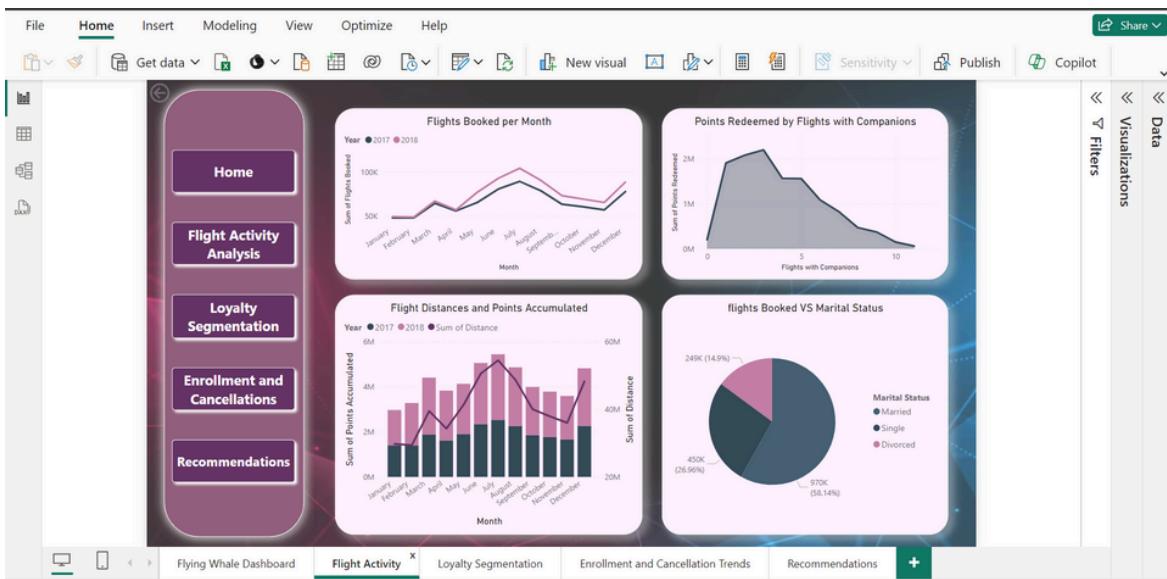
Raw data is extracted and transformed in the Power Query editor, then loaded to the Power BI “front-end”



Loyalty Number	Country	Province	City	Postal Code	Gender	Education	Salary	Marital Status	Loyalty Card	CLV	Enrollment Type
608370	Canada	Ontario	Toronto	P1W 1K4	Male	College		Single	Star	3839.75	Standard
927943	Canada	Ontario	Toronto	P5S 6R4	Female	College		Single	Star	3857.95	Standard
286114	Canada	Ontario	Toronto	M2M 7K8	Female	College		Single	Star	3872.22	Standard
742002	Canada	Ontario	Toronto	P2T 6G3	Female	College		Single	Star	3915.8	Standard
578837	Canada	Ontario	Toronto	P5S 6R4	Male	College		Single	Star	4152.65	Standard
705589	Canada	Ontario	Toronto	P1L 8X8	Female	College		Single	Star	4165.99	Standard
406047	Canada	Ontario	Toronto	P1J 8T7	Female	College		Single	Star	4463	Standard
883242	Canada	Ontario	Toronto	P2T 6G3	Male	College		Single	Star	4463	Standard
787472	Canada	Ontario	Toronto	M2M 7K8	Female	College		Single	Star	4506.66	Standard
667687	Canada	Ontario	Toronto	M8Y 4K8	Female	College		Single	Star	4512.2	Standard
459801	Canada	Ontario	Toronto	M8Y 4K8	Female	College		Single	Star	4568.82	Standard
613804	Canada	Ontario	Toronto	M2Z 4K1	Female	College		Single	Star	4620.39	Standard
305171	Canada	Ontario	Toronto	P2T 6G3	Female	College		Single	Star	4697.15	Standard
336341	Canada	Ontario	Toronto	P2T 6G3	Female	College		Single	Star	4709.52	Standard
737791	Canada	Ontario	Toronto	P1J 8T7	Male	College		Single	Star	4722.24	Standard
380183	Canada	Ontario	Toronto	M2Z 4K1	Male	College		Single	Star	4735.18	Standard
200077	Canada	Ontario	Toronto	P1W 1K4	Male	College		Single	Star	4759.66	Standard
620465	Canada	Ontario	Toronto	M2M 7K8	Male	College		Single	Star	4764.19	Standard
886127	Canada	Ontario	Toronto	M2Z 4K1	Female	College		Single	Star	4784.77	Standard
884088	Canada	Ontario	Toronto	P2T 6G3	Female	College		Single	Star	4836.05	Standard
105145	Canada	Ontario	Toronto	M8Y 4K8	Male	College		Single	Star	4839.11	Standard
551300	Canada	Ontario	Toronto	P5S 6R4	Male	College		Single	Star	4903.15	Standard
706628	Canada	Ontario	Toronto	M2Z 4K1	Female	College		Single	Star	4911.77	Standard



Power BI “Back-End”



The screenshot shows the Power BI desktop application with a dashboard titled "Flying Whale Dashboard". The dashboard contains four visualizations:

- Flights Booked per Month:** A line chart showing the sum of flights booked per month from January to December for the years 2017 and 2018.
- Points Redeemed by Flights with Companions:** A line chart showing the sum of points redeemed versus the number of flights with companions.
- Flight Distances and Points Accumulated:** A line chart showing the sum of points accumulated versus flight distance for the years 2017 and 2018.
- flights Booked VS Marital Status:** A pie chart showing the distribution of flights booked by marital status (Married, Single, Divorced).

The Power BI interface includes a ribbon bar with File, Home, Insert, Modeling, View, Optimize, and Help tabs. Below the ribbon are various icons for data management and visualization creation. On the right side, there are sections for "Visualizations" and "Filters". At the bottom, there are three tabs: "Flight Activity" (selected), "Loyalty Segmentation", "Enrollment and Cancellations Trends", and "Recommendations".

Model View **Data View** **Report View**

Power BI “Front-End”

The screenshot shows the Power Query Editor interface. The ribbon at the top has tabs for File, Home, Help, and Table tools. The Home tab is selected. The ribbon bar includes icons for Paste, Cut, Copy, Get Data (with options for Excel, OneLake, SQL Server, etc.), Transform Data (with sub-options like Refresh, Relationships, Calculations), and Publish.

The main area displays a query titled "Cancelled Members" with the following M code:

```

1 Cancelled Members =
2 FILTER(
3     'Customer Loyalty History',
4     NOT(ISBLANK('Customer Loyalty History'[Cancellation Date]))
5 )
6

```

Below the code is a table titled "Cancelled Members" containing 2,067 rows of data. The columns include Loyalty Number, Country, Province, City, Postal Code, Gender, Education, Salary, Marital Status, Loyalty Card, CLV, Enrollment Type, and various status indicators. The table is sorted by Loyalty Number.

Data is loaded and transformed in **Power Query Editor**

The screenshot shows the Model View interface. The ribbon at the top has tabs for File, Home, Help, and Model View. The Home tab is selected. The ribbon bar includes icons for Get Data, Transform Data, Manage Relationships, New Measure Column, New Table, Calculation Group, Manage Roles, and Publish.

The main area displays a data model diagram showing relationships between three tables: "Customer Loyalty History", "Customer Flight Activity", and "Airline Loyalty Data Dictionary". The "Cancelled Members" table is also shown, indicating it is part of the model. The "Cancelled Members" table is highlighted with a tooltip showing its schema: Customer Flight Activity, Customer's unique loyalty number, Loyalty Number, and Collapsable.

The Properties pane on the right shows the "Cancelled Members" table selected under the "Tables" tab. The Data pane on the right lists the available tables in the model.

Data models are configured in **Model View**

The screenshot shows the Power BI Data View interface. At the top, there are tabs for Power Query Editor, Model View, Data View (which is selected), and Report View. The ribbon menu includes Home, Help, Table tools, and various data import and transformation options. Below the ribbon is a table titled "Customer Flight Activity" with columns: Loyalty Number, Year, Month, Flights Booked, Flights with Companions, Total Flights, Distance, Points Accumulated, and Points Redeemed. The table contains 405,624 rows of data. To the right of the table is a sidebar labeled "Data" with a search bar and a list of related datasets: "Airline Loyalty Data Dictionary", "Cancelled Members", "Customer Flight Activity", and "Customer Loyalty History".

Table features and calculations are added in **Data View**

The screenshot shows the Power BI Report View interface. At the top, there are tabs for Power Query Editor, Model View, Data View, and Report View (selected). The ribbon menu includes Home, Insert, Modeling, View, Optimize, Help, and various data import and visualization creation options. The main area displays a dashboard titled "Flying Whale Dashboard" containing several visualizations: a pie chart of members by marital status, a bar chart of CLV by loyalty card, a stacked bar chart of flights booked by month and loyalty card, and a bar chart of median distance travelled by loyalty card. On the right side of the dashboard, there are "Filters" and "Visualizations" sections. The bottom of the screen shows a navigation bar with tabs for Flying Whale Dashboard, Flight Activity, Loyalty Segmentation (selected), Enrollment and Cancellation Trends, and Recommendations.

Visuals and reports are designed in **Report View**

Front end VS Back end

Power BI Desktop operates in two distinct environments: a front-end and a back-end .

- The **front-end** includes the Data, Model & Report views, where most of the modeling, analysis and visualization takes place .
- The **back-end** includes the Power Query Editor, where raw data is extracted, transformed, and loaded to the front-end (ETL)

Front-end

Here's an overview of what you can expect to find in the front-end:

Data: This is where you import, connect to, and load your data sources. Power BI offers various data connectors to access data from a wide range of platforms, databases, and files.

Data Model: In this section, you define the relationships between tables, create calculated measures and columns, and work with the Data Analysis Expressions (DAX) language to perform complex calculations and aggregations.

Report View: It allows you to create visualizations, charts, tables, and more. You can design interactive and dynamic reports that convey insights effectively.

Dashboards: They offer a concise overview of the most important data and insights. Users can interact with dashboards to explore data and gain a deeper understanding of the information presented.

Power BI Service: You can publish your dashboards to Power BI Service, Microsoft's cloud-based platform. This enables you to collaborate and share your reports with others in your organization.

Back-end

The back-end includes the Power Query Editor and is where you perform the following critical tasks:

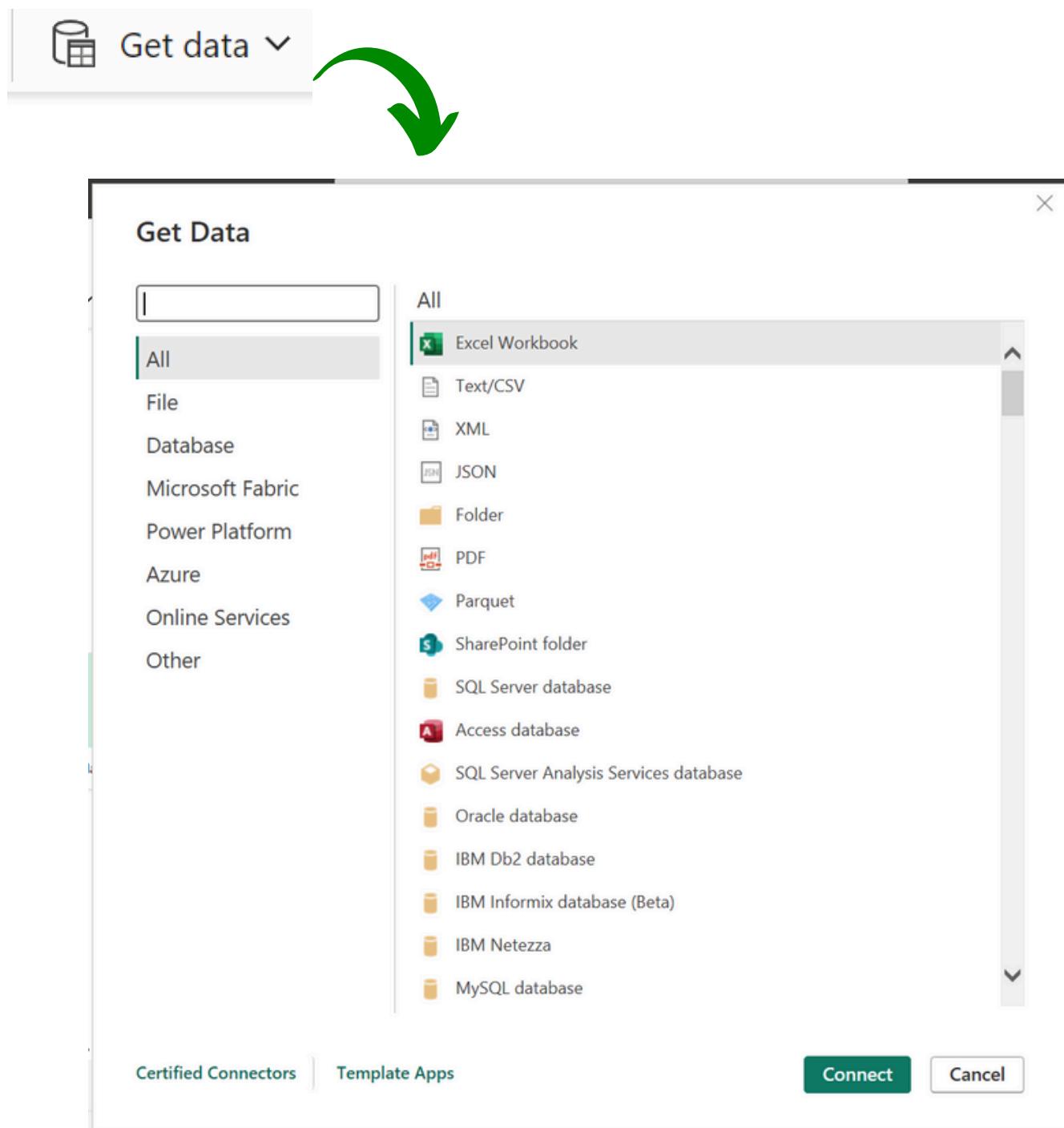
Data Extraction: In the back-end, you can connect to various data sources using pre-built connectors. These connectors simplify the process of extracting raw data, whether it's stored in databases, spreadsheets, or on the web.

Data Transformation: Power Query provides tools for cleaning, shaping, and transforming your data. You can filter out irrelevant information, modify values, group records, and sort and transform columns.

Query Joining: The back-end allows you to merge and append multiple data sources to create a unified dataset before loading it into the front-end data model.

Advanced Transformations: Power Query provides the flexibility to perform complex data transformations.

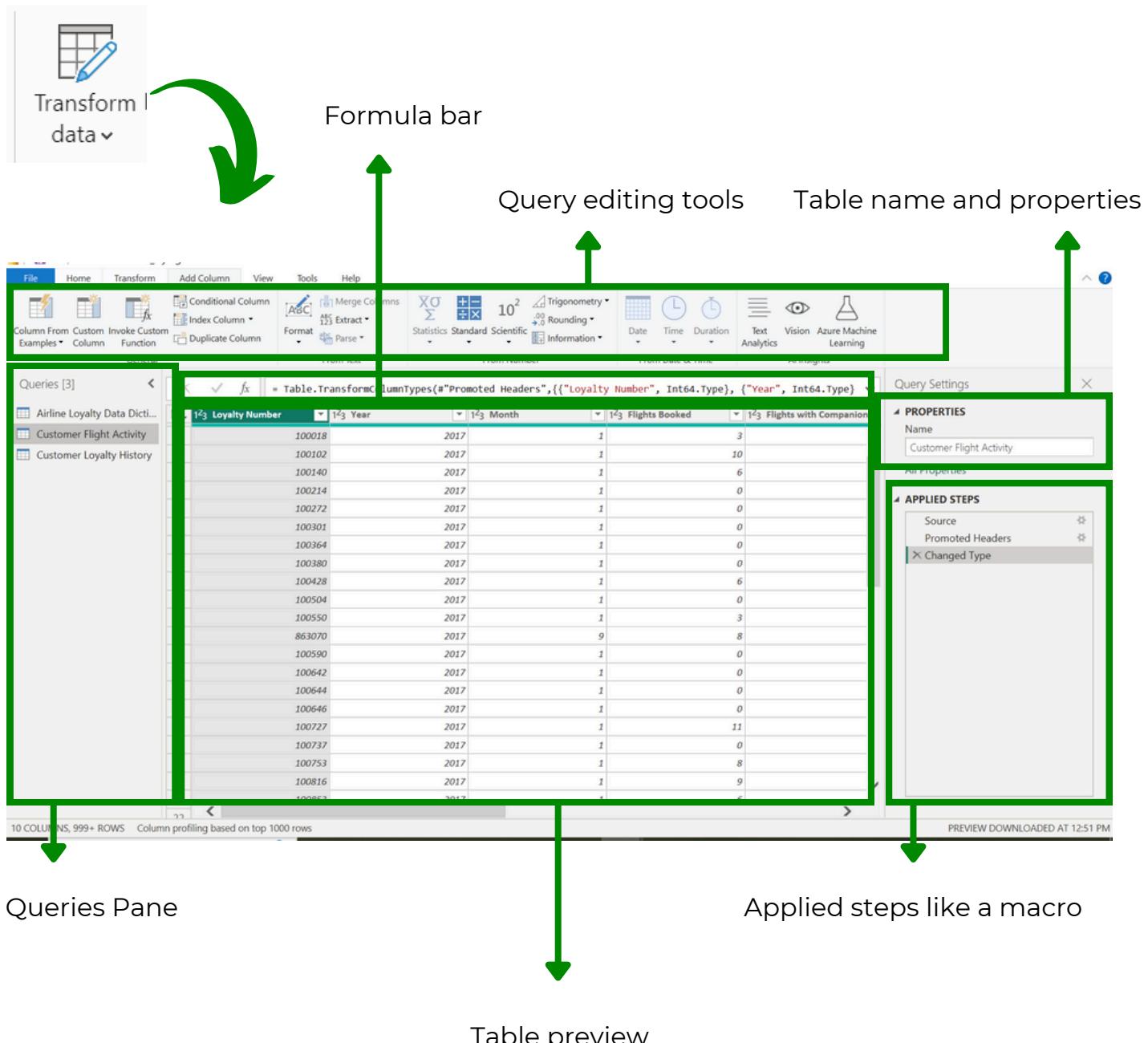
Types of Data Connectors



Power BI can connect to virtually any type of source data, including):

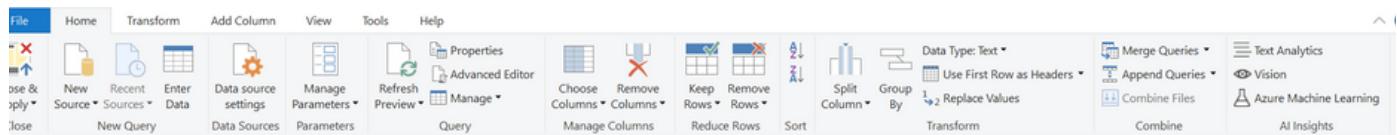
- Flat files & Folders (csv, text, xlsx, etc.)
- Databases (SQL, Access, Oracle, IBM, etc.)
- Power Platform (Datasets, Datamarts, Dataflows, Dataverse, etc.)
- Azure (Azure SQL, Analysis Services, Databricks, etc.)
- Online Services (SharePoint, GitHub, Dynamics 365, Google Analytics, Salesforce, Power BI Service, etc.)
- Other (Web feeds, R scripts, Spark, Hadoop, etc.)

Power Query editor

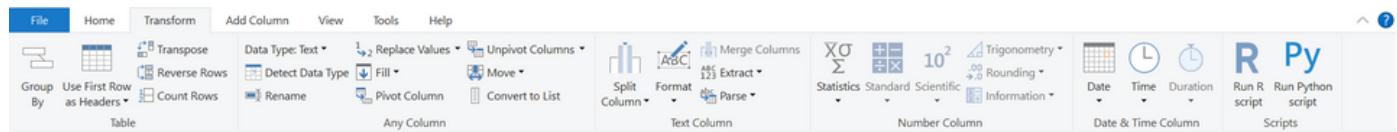


Query Editing Tools

The **HOME** tab includes general settings and common table transformation tools



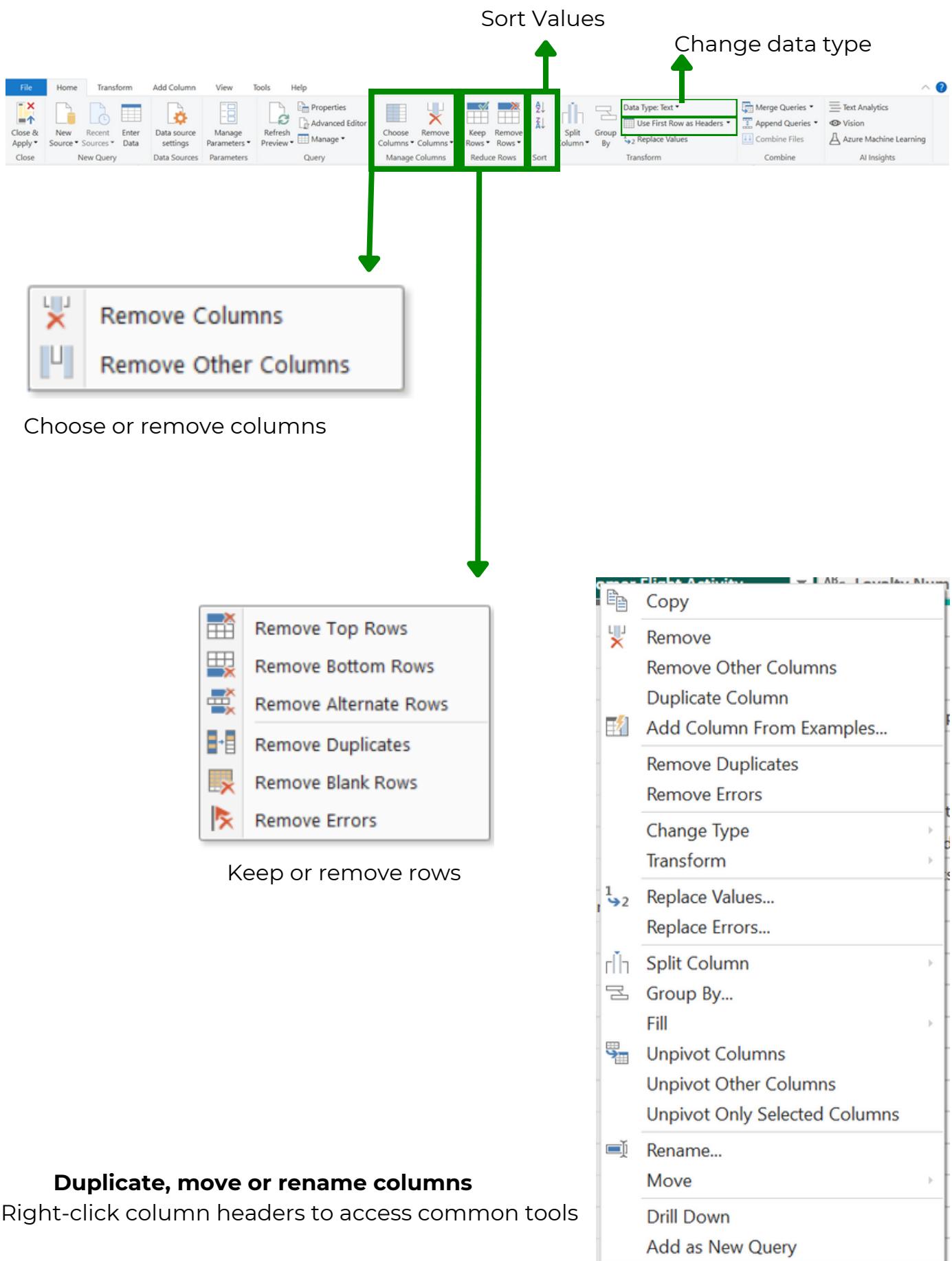
The **TRANSFORM** tab includes tools to modify existing columns (splitting/grouping, transposing, extracting text, etc.)



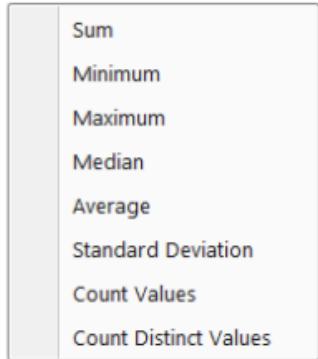
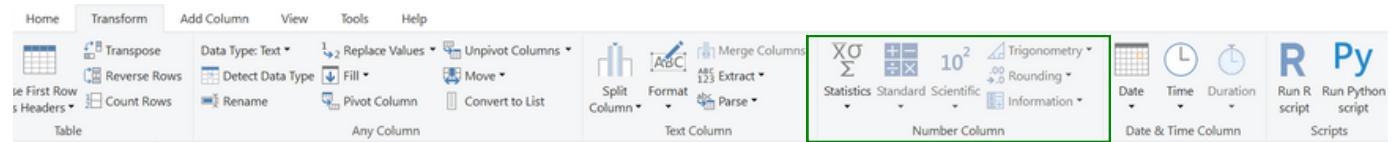
The **ADD COLUMN** tools create new columns (based on conditional rules, text operations, calculations, dates, etc.)



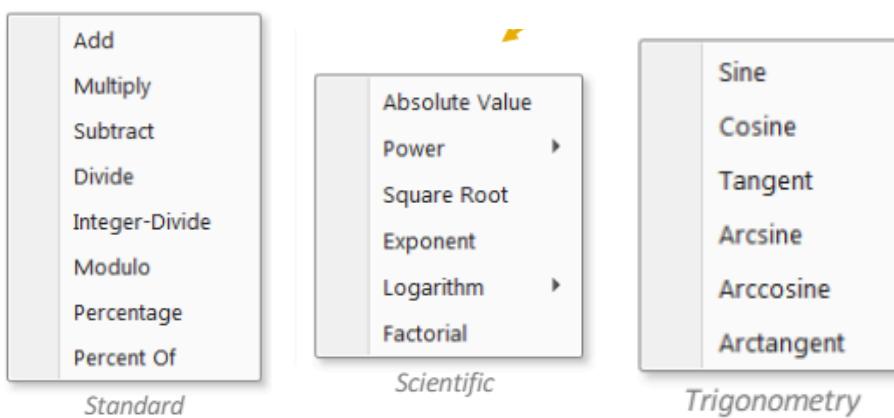
Basic Table Transformations



Numerical Tools

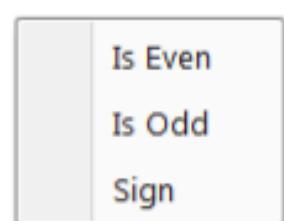


Statistics functions allow you to evaluate basic stats for a selected column (sum, min/max, average, count, count distinct, etc.)

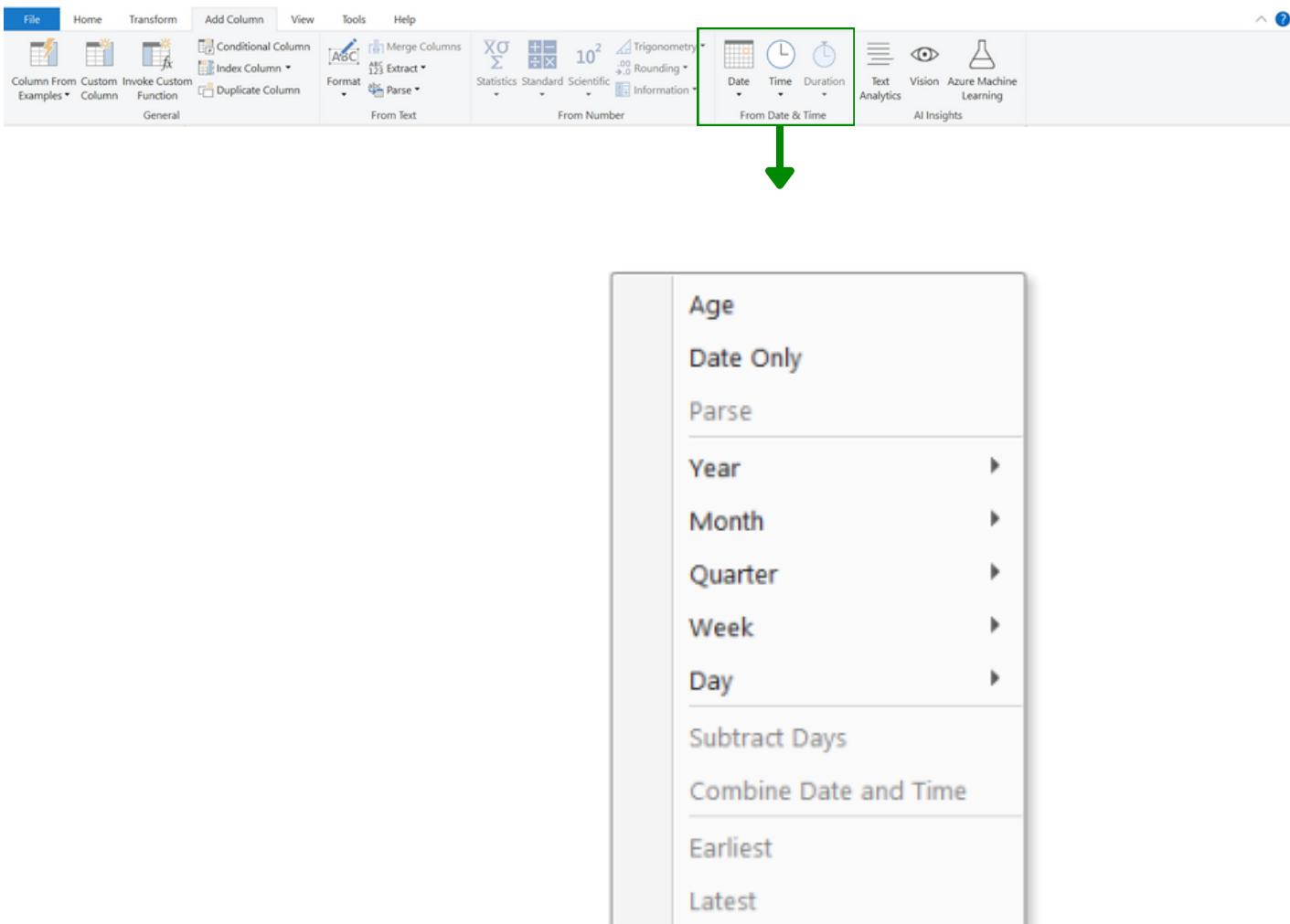


Standard, Scientific and Trigonometry tools allow you to apply standard operations (addition, multiplication, division, etc.) or more advanced calculations (power, logarithm, sine, tangent, etc.) to each value in a column

Information tools allow you to define binary flags (1/0 or TRUE/FALSE) to mark rows as even, odd, positive or negative



Date and time tools



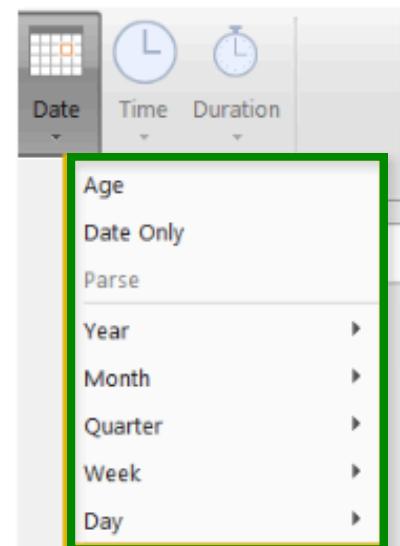
Date & Time tools are relatively straight-forward, and include the following options:

- **Age:** Difference between the current date and the date in each row
- **Date Only:** Removes the time component from a date/time field .
- **Year/Month/Quarter/Week/Day:** Extracts individual components from a date field (timespecific options include Hour, Minute, Second, etc.)
- **Earliest/Latest:** Evaluates the earliest or latest date from a column as a single value (can only be accessed from the “Transform” menu)

Creating a calendar table

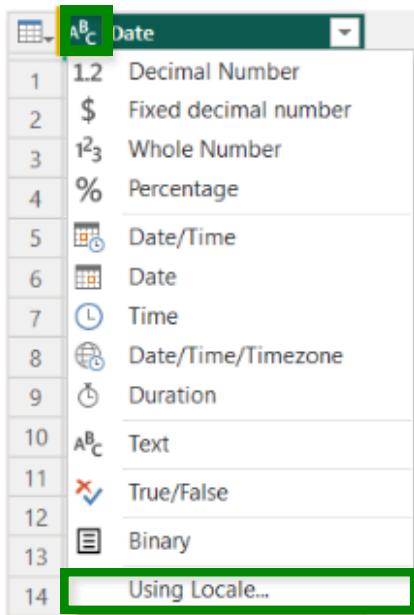
	Date
1	1/1/2020
2	1/2/2020
3	1/3/2020
4	1/4/2020
5	1/5/2020
6	1/6/2020
7	1/7/2020
8	1/8/2020
9	1/9/2020
10	1/10/2020
11	1/11/2020
12	1/12/2020
13	1/13/2020
14	1/14/2020
15	1/15/2020
16	1/16/2020
17	1/17/2020
18	1/18/2020
19	1/19/2020
20	1/20/2020
21	1/21/2020
22	1/22/2020
23	1/23/2020
24	1/24/2020
25	1/25/2020
26	1/26/2020
27	1/27/2020
28	1/28/2020

Use the **Date** options in the **Add Column** menu to quickly build out an entire calendar table from a list of dates



	Date	Day Name	Start of Week	Start of Month	Month Name
1	1/1/2020	Wednesday	12/29/2019	1/1/2020	January
2	1/2/2020	Thursday	12/29/2019	1/1/2020	January
3	1/3/2020	Friday	12/29/2019	1/1/2020	January
4	1/4/2020	Saturday	12/29/2019	1/1/2020	January
5	1/5/2020	Sunday	1/5/2020	1/1/2020	January
6	1/6/2020	Monday	1/5/2020	1/1/2020	January
7	1/7/2020	Tuesday	1/5/2020	1/1/2020	January
8	1/8/2020	Wednesday	1/5/2020	1/1/2020	January
9	1/9/2020	Thursday	1/5/2020	1/1/2020	January
10	1/10/2020	Friday	1/5/2020	1/1/2020	January
11	1/11/2020	Saturday	1/5/2020	1/1/2020	January
12	1/12/2020	Sunday	1/12/2020	1/1/2020	January
13	1/13/2020	Monday	1/12/2020	1/1/2020	January
14	1/14/2020	Tuesday	1/12/2020	1/1/2020	January
15	1/15/2020	Wednesday	1/12/2020	1/1/2020	January
16	1/16/2020	Thursday	1/12/2020	1/1/2020	January
17	1/17/2020	Friday	1/12/2020	1/1/2020	January
18	1/18/2020	Saturday	1/12/2020	1/1/2020	January
19	1/19/2020	Sunday	1/19/2020	1/1/2020	January
20	1/20/2020	Monday	1/19/2020	1/1/2020	January
21	1/21/2020	Tuesday	1/19/2020	1/1/2020	January
22	1/22/2020	Wednesday	1/19/2020	1/1/2020	January
23	1/23/2020	Thursday	1/19/2020	1/1/2020	January
24	1/24/2020	Friday	1/19/2020	1/1/2020	January
25	1/25/2020	Saturday	1/19/2020	1/1/2020	January
26	1/26/2020	Sunday	1/26/2020	1/1/2020	January
27	1/27/2020	Monday	1/26/2020	1/1/2020	January
28	1/28/2020	Tuesday	1/26/2020	1/1/2020	January

Change type with locale



- 1) Left click the data type icon in the column header and select the **Using Locale** option

Change Type with Locale

Change the data type and select the locale of origin.

Data Type	Date
Locale	English (United States)

Sample input values:

3/29/2016
Tuesday, March 29, 2016
March 29
March 2016

- 2) Select **Date** as the data type and **English (United States)** as the locale for all datasets in this course (regardless of your actual location)

	Date
1	1/1/2023
2	2/1/2023
3	3/1/2023
4	4/1/2023
5	5/1/2023
6	6/1/2023
7	7/1/2023
8	8/1/2023
9	9/1/2023
10	10/1/2023
11	11/1/2023
12	12/1/2023
13	Error
14	Error

	Date
1	1/1/2020
2	1/2/2020
3	1/3/2020
4	1/4/2020
5	1/5/2020
6	1/6/2020
7	1/7/2020
8	1/8/2020
9	1/9/2020
10	1/10/2020
11	1/11/2020
12	1/12/2020
13	1/13/2020
14	1/14/2020

- 3) Confirm that the **data type is correctly recognized**. You should see a calendar icon next to the column name in the header and no errors in the column

Index Columns



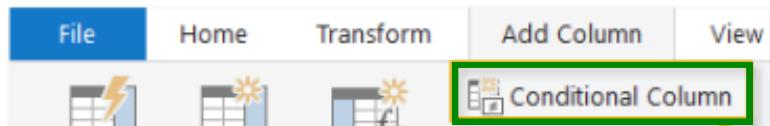
Index Columns contain a list of sequential values that can be used to identify each unique row in a table (typically starting from 0 or 1)

These are often used to create **unique IDs** that can be used to form relationships between tables

		Order Date	Stock Date	Order Number	Product Key
1	1	1/1/2020	9/21/2019	5045080	332
2	2	1/1/2020	12/5/2019	5045079	312
3	3	1/1/2020	10/28/2019	5045082	350
4	4	1/1/2020	11/16/2019	5045081	338
5	5	1/2/2020	12/15/2019	5045083	312
6	6	1/2/2020	10/12/2019	5045084	310
7	7	1/2/2020	12/18/2019	5045086	314
8	8	1/2/2020	10/9/2019	5045085	312
9	9	1/3/2020	10/3/2019	5045093	312
10	10	1/3/2020	9/28/2019	5045090	310
11	11	1/3/2020	12/11/2019	5045088	345
12	12	1/3/2020	10/24/2019	5045092	313
13	13	1/3/2020	12/16/2019	5045089	351
14	14	1/3/2020	10/26/2019	5045091	314
15	15	1/3/2020	9/11/2019	5045087	350
16	16	1/3/2020	9/11/2019	5045094	310
17	17	1/4/2020	10/30/2019	5045096	312
18	18	1/4/2020	10/30/2019	5045097	313
19	19	1/4/2020	9/15/2019	5045098	310
20	20	1/4/2020	12/7/2019	5045095	344

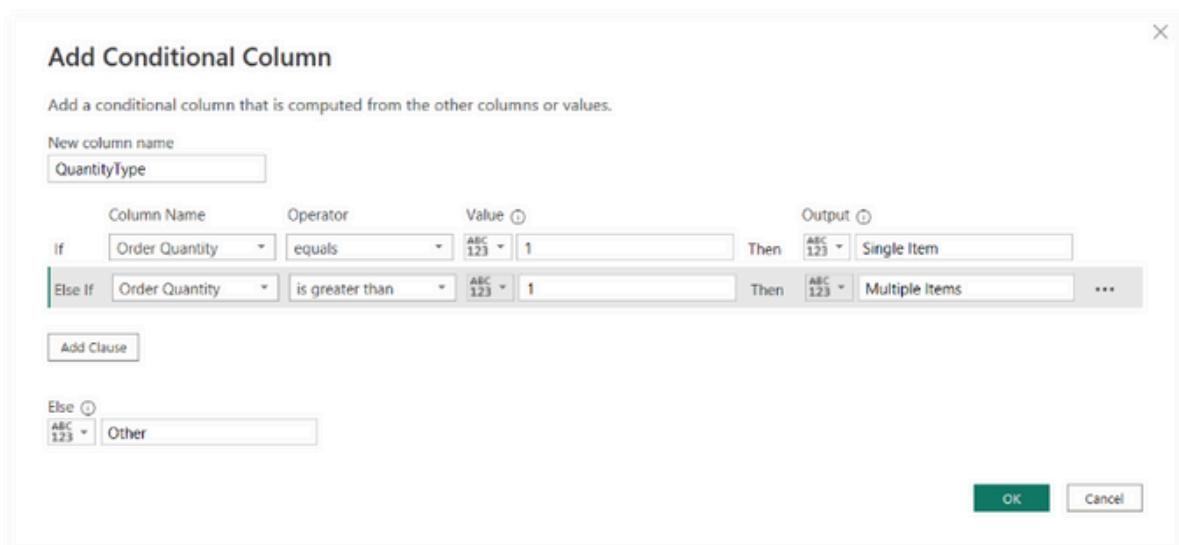
Conditional Columns

Conditional Columns allow you to define new fields based on logical rules and conditions (IF/THEN statements)

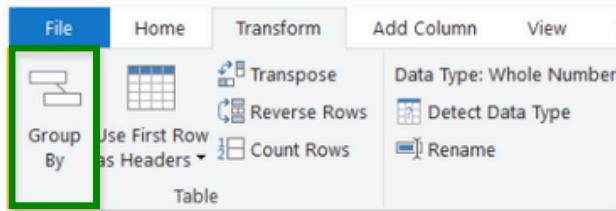


Here we're creating a conditional column named **Quantity Type**, which is based on **Order Quantity**:

- If Order Quantity =1, Quantity Type = “**Single Item**”
- Else If Order Quantity >1, Quantity Type = “**Multiple Items**”
- Else; Quantity Type = “**Other**”

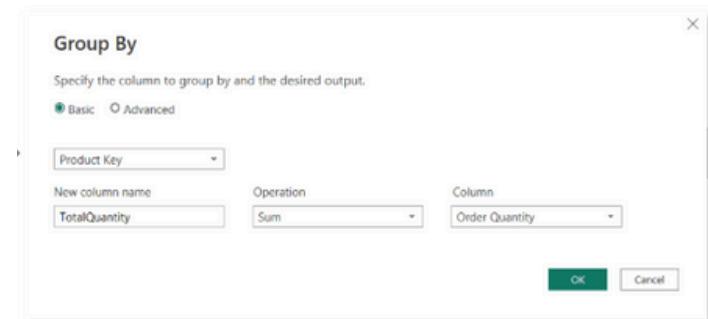


Grouping and aggregating



	Order Date	Product Key	Customer Key	Order Quantity
1	6/25/2022	214	14719	
2	10/6/2021	214	21990	
3	12/10/2021	214	22098	
4	6/29/2022	214	22748	
5	8/16/2021	214	27821	
6	10/9/2021	214	15685	
7	8/9/2021	214	14951	
8	1/19/2022	214	23103	
9	9/23/2021	214	17158	
10	1/19/2022	214	24196	
11	6/29/2022	214	12963	
12	9/13/2021	214	12715	
13	10/2/2021	214	14846	
14	7/31/2021	214	11290	
15	11/24/2021	214	22103	
16	8/1/2021	214	16982	
17	10/12/2021	214	20410	
18	9/10/2021	214	14217	
19	10/22/2021	214	19642	
20	8/11/2021	214	11066	

Group By allows you to aggregate data at a different level or “grain” (i.e. group daily records into monthly, aggregate transactions by store, etc.)

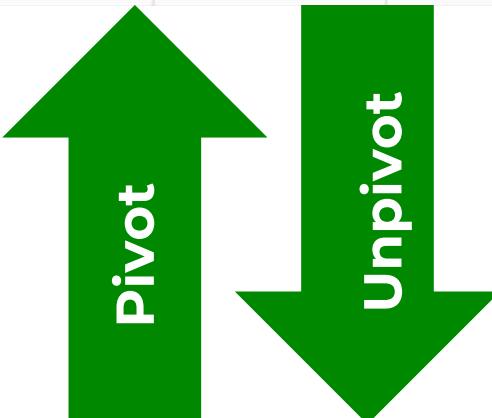


Here we're transforming a daily, transaction-level table into a summary of **Total Quantity by Product Key**

	Product Key	TotalQuantity
1	214	2099
2	215	1540
3	220	1995
4	223	4151
5	226	392
6	229	408
7	232	424
8	235	381
9	310	169
10	311	139
11	312	179
12	313	168
13	314	157
14	320	65
15	322	39
16	324	72
17	326	65

Pivoting and unpivoting

Pivoting describes the process of turning **distinct row values into columns**, and **unpivoting** describes the process of turning **distinct columns into rows**



	Date	Product Category	North Region	Central Region	South Region
1	7/1/2022	Bikes	10	19	25
2	7/1/2022	Components	14	31	16
3	7/1/2022	Clothing	35	32	46

	Region	Quantity Sold
1	North Region	10
2	Central Region	19
3	South Region	25
4	North Region	14
5	Central Region	31
6	South Region	16
7	North Region	35
8	Central Region	32
9	South Region	46

Imagine the table on a hinge; **pivoting** rotates it from **vertical to horizontal**, and **unpivoting** rotates it from **horizontal to vertical**

Merging Queries

Merge

Select a table and matching columns to create a merged table.

Sales Data

Order Date	Product Key	Customer Key	Order Quantity	Index	Stock Date	Order Number	Territory
6/25/2022	214	14719	1	55115	4/20/2022	S073780	
10/8/2021	214	21990	1	14247	7/2/2021	S055746	
12/30/2021	214	22098	1	26322	11/10/2021	S061052	
6/29/2022	214	22748	1	55740	4/9/2022	S074069	

Product Lookup

Product Key	Product Subcategory Key	Product S K U	Product Name	Model Name	
214	31	HL-U509-R	Sport-100 Helmet, Red	Sport-100	Universal fit, v
215	31	HL-U509	Sport-100 Helmet, Black	Sport-100	Universal fit, v
216	23	SO-B909-M	Mountain Bike Socks, M	Mountain Bike Socks	Combination c
217	23	SO-B909-L	Mountain Bike Socks, L	Mountain Bike Socks	Combination c

Join Kind: Left Outer (all from first, matching from second)

Use fuzzy matching to perform the merge

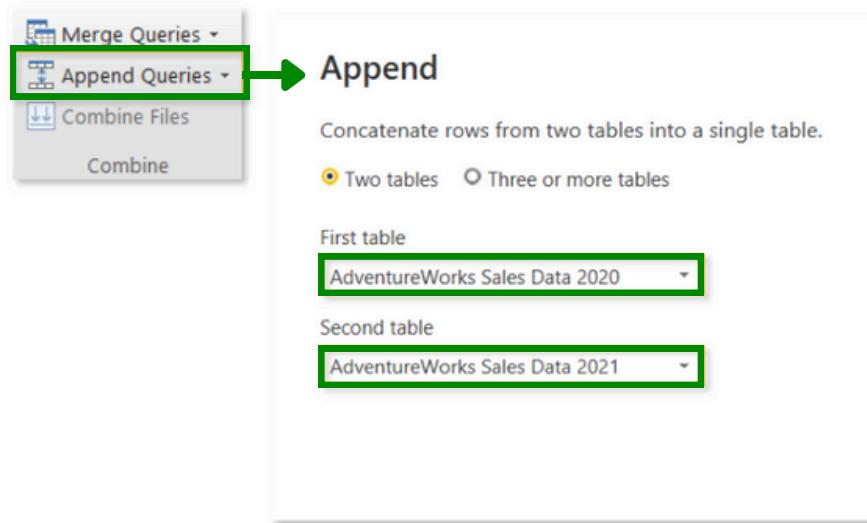
> Fuzzy matching options

✓ The selection matches 56046 of 56046 rows from the first table.

OK Cancel

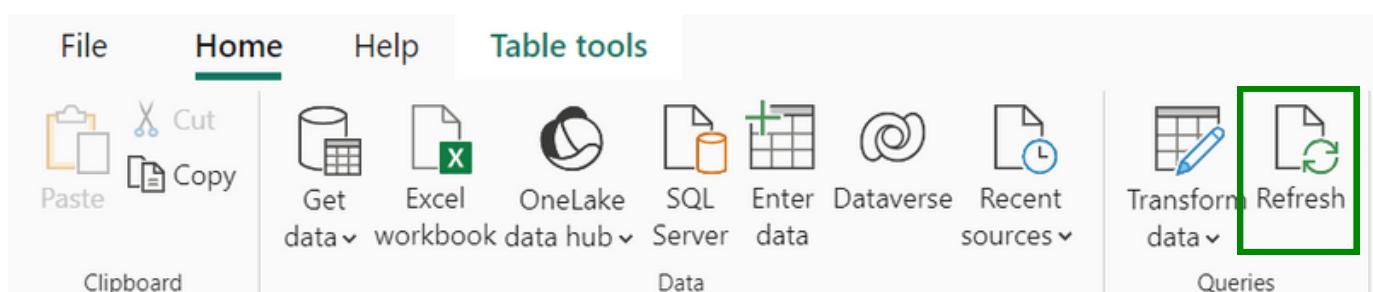
Merging queries allows you to **join tables** based on a common column (like a lookup in Excel). In this case we're merging the **Sales Data** table with the **Product Lookup** table, which share a common **Product Key** column.

Appending Queries



Appending queries allows you to **combine** or **stack** tables sharing the exact same column structure and data types. Here we're appending the **AdventureWorks Sales 2020** table to the **AdventureWorks Sales 2021** table, which is valid since they share identical table structures.

Refreshing Queries



By default, all queries will refresh when you use the Refresh command from the Home tab.