

Power BI – Labs



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Lab 01A - Getting Started

Overview

The estimated time to complete the lab is 15 minutes

In this lab, you connect to the classroom virtual machine and setup the environment. Before commencing this lab, you must have received an account and password. It's important that you complete the labs by using the provided account.

In this lab, you learn how to:

- Sign in to the Power BI service
- Create a workspace
- Open Power BI Desktop

Exercise 1: Getting Started

In this exercise, you connect to the classroom virtual machine and setup the environment.

Task 1: Record your account details

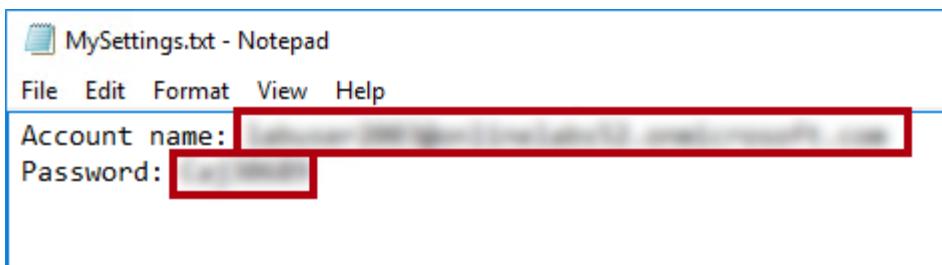
In this task, you will open the **MySettings.txt** file, and record your account details.

An account has been provided to you by your instructor, and it's important that you use this account to complete all of the labs. If an account was not provided to you, please browse to <https://powerbi.microsoft.com/en-us/documentation/powerbi-admin-signing-up-for-power-bi-with-a-new-office-365-trial> and follow the steps to create an account before continuing with this lab.

1. To open File Explorer, on the taskbar, click the File Explorer program shortcut.



2. In File Explorer, navigate to the **D:\DA100\Setup** folder.
3. To open the **MySettings.txt** file, double-click the file.
4. In the **MySettings.txt** file, enter your account name and password next to the labels.



5. To save the **MySettings.txt** file, on the **File** menu, select **Save** (or press **Ctrl+S**).
6. Leave the **MySettings.txt** file open.
7. Leave File Explorer open.

Task 2: Sign in to the Power BI service

In this task, you will sign in to the Power BI service.

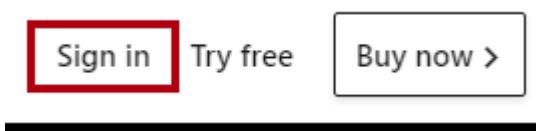
1. To open Edge, on the taskbar, click the Microsoft Edge program shortcut.



2. In Edge, navigate to <http://powerbi.com>.

Tip: You can also use the Power BI Service favorite on the Edge favorites bar.

3. Click **Sign In** (located at the top-right corner).



4. Enter your account details from the **MySettings.txt** file.
5. When prompted to update the password, reenter the provided password, and then enter and confirm a new password. Be sure to update the **MySettings.txt** file with your new password.
6. Complete the sign in process.
7. If prompted by Edge to stay signed in, click **Yes**.
8. In the Power BI service, at the top-right corner, if the "New Look" is not enabled, click the slider control to turn it on.



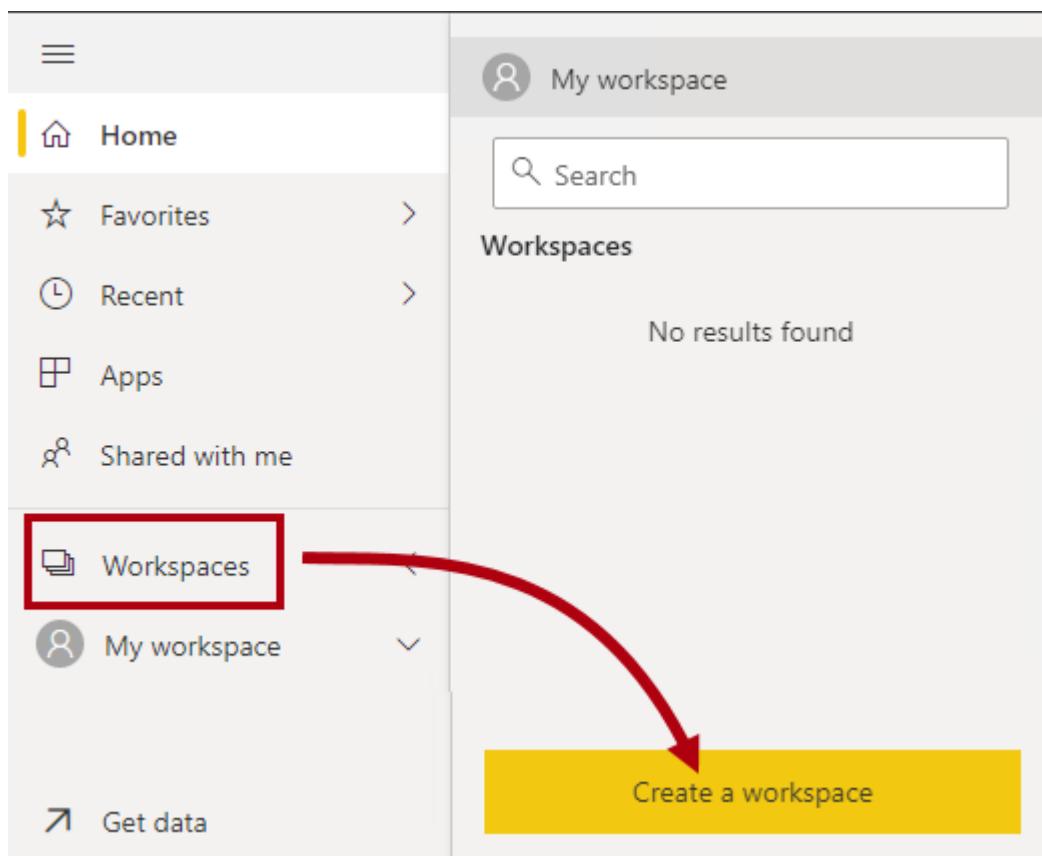
- Leave the Edge window open.

Task 3: Create a workspace

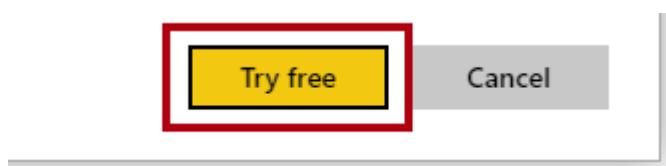
In this task, you will create a workspace. You will also upgrade your account to Power BI Pro.

All content you develop in this course will be added to this workspace.

- To create a workspace, in the **Navigation** pane (located at the left), click **Workspaces**, and then click **Create a Workspace**.

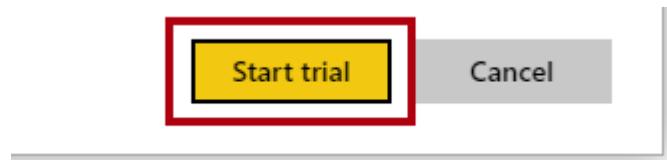


- When prompted to upgrade your account to Power BI Pro, click **Try Free**.



A Power BI Pro license is required to create and work with workspaces. It's also required when sharing content. The trial will allow you to work with Pro features for up to 60 days.

- When prompted to start the 60-day free Pro trial, click **Start Trial**.



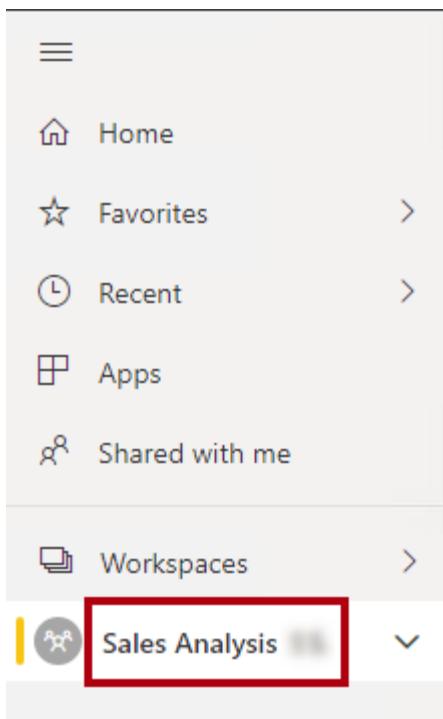
- When the trial has been extended, click **Close**.
- Repeat the first step in this task to create the workspace.
- In the **Create a Workspace** pane (located at the right), in the **Workspace Name** box, enter a name for your workspace.

*The name you enter must be unique within the tenant. We suggest you name the workspace **Sales Analysis**, and that you also append your initials. For example, the name could be **Sales Analysis AB**.*

- To create the workspace, at the bottom of the pane, click **Save**.



- In the **Navigation** pane, notice that your workspace is open.



9. You will publish content to the workspace in **Lab 03D**.

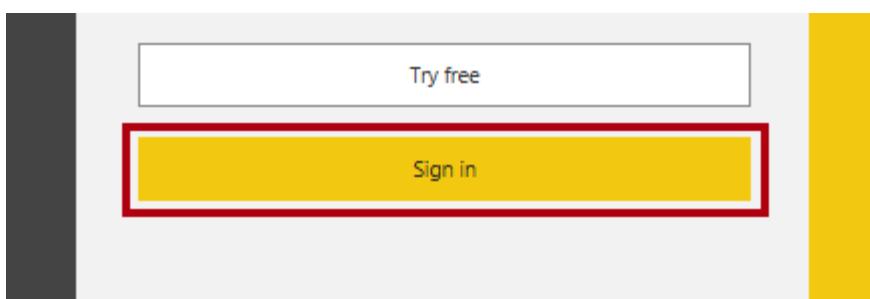
Task 4: Open Power BI Desktop

In this task, you will open Power BI Desktop, and then sign in using your account.

26. To open the Power BI Desktop, on the taskbar, click the Microsoft Power BI Desktop shortcut.

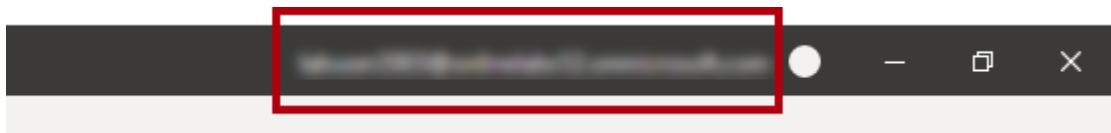


27. When prompted, click **Sign In**.



28. Complete the sign in process by using the **MySettings.txt** account details.

29. In Power BI Desktop, at the top-right corner, verify that you see your account.



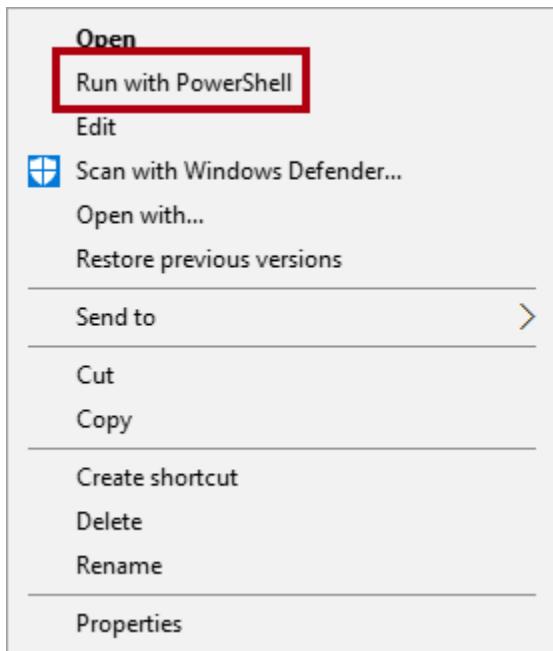
30. Leave Power BI Desktop open.

*You will commence the development of a data model in **Lab 02A**.*

Task 5: Update the lab database

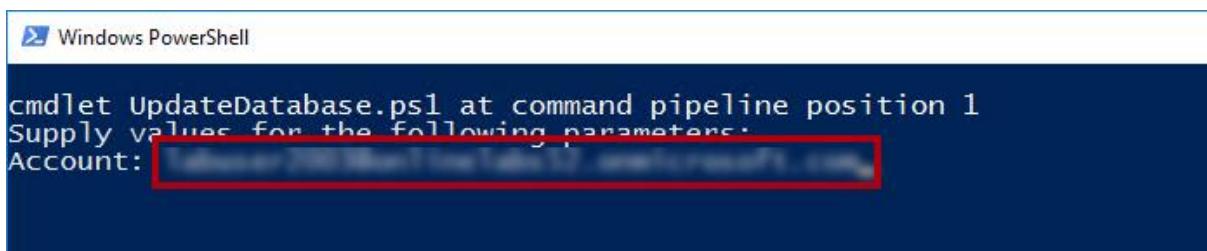
In this task, you will run a PowerShell script to update data in the **AdventureWorksDW2020** database.

1. In File Explorer, inside the **D:\DA100\Setup** folder, right-click the **UpdateDatabase-1-UpdateAccount.ps1** file, and then select **Run with PowerShell**.



2. In the **Windows PowerShell** window, when prompted to enter your account, paste in your account name from the **MySettings.txt** file.

*Tip: To paste into the **Windows PowerShell** window, right-click at the **Account** prompt.*



3. To update the database, press **Enter**.
4. When prompted to press any key to continue, press **Enter** again.

*The **AdventureWorksDW2020** database has been updated to use your account details. You are now the salesperson Michael Blythe, whose sales performance is measured by the sales of three sales territory regions: US Northeast, US Central, and US Southeast.*

*These facts will become relevant when implementing row-level security in **Lab 03B**.*

Lab 02A - Preparing Data in Power BI Desktop

Overview

The estimated time to complete the lab is 45 minutes

In this lab, you commence the development of a Power BI Desktop solution for the Adventure Works company. It involves connecting to source data, previewing the data, and using data preview techniques to understand the characteristics and quality of the source data.

In this lab, you learn how to:

- Open Power BI Desktop
- Set Power BI Desktop options
- Connect to source data
- Preview source data
- Use data preview techniques to better understand the data

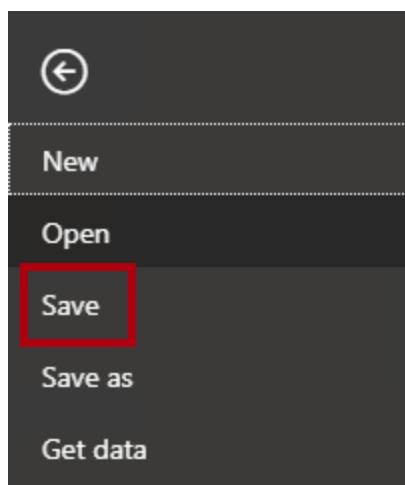
Exercise1: Prepare Data

In this exercise, you will create eight Power BI Desktop queries. Six queries will source data from SQL Server, and two from CSV files.

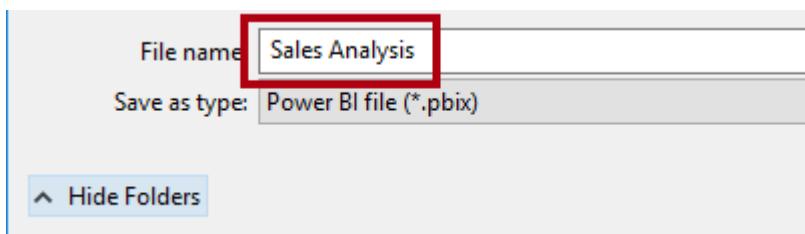
Task 1: Save the Power BI Desktop file

In this task, you will first save the Power BI Desktop file.

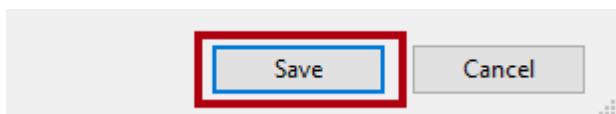
1. In Power BI Desktop, click the **File** ribbon tab to open the backstage view.
2. Select **Save**.



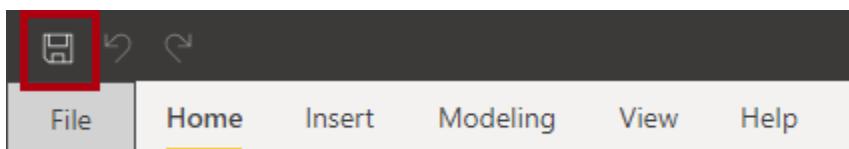
3. In the **Save As** window, navigate to the **D:\DA100\MySolution** folder.
4. In the **File Name** box, enter **Sales Analysis**.



5. Click **Save**.



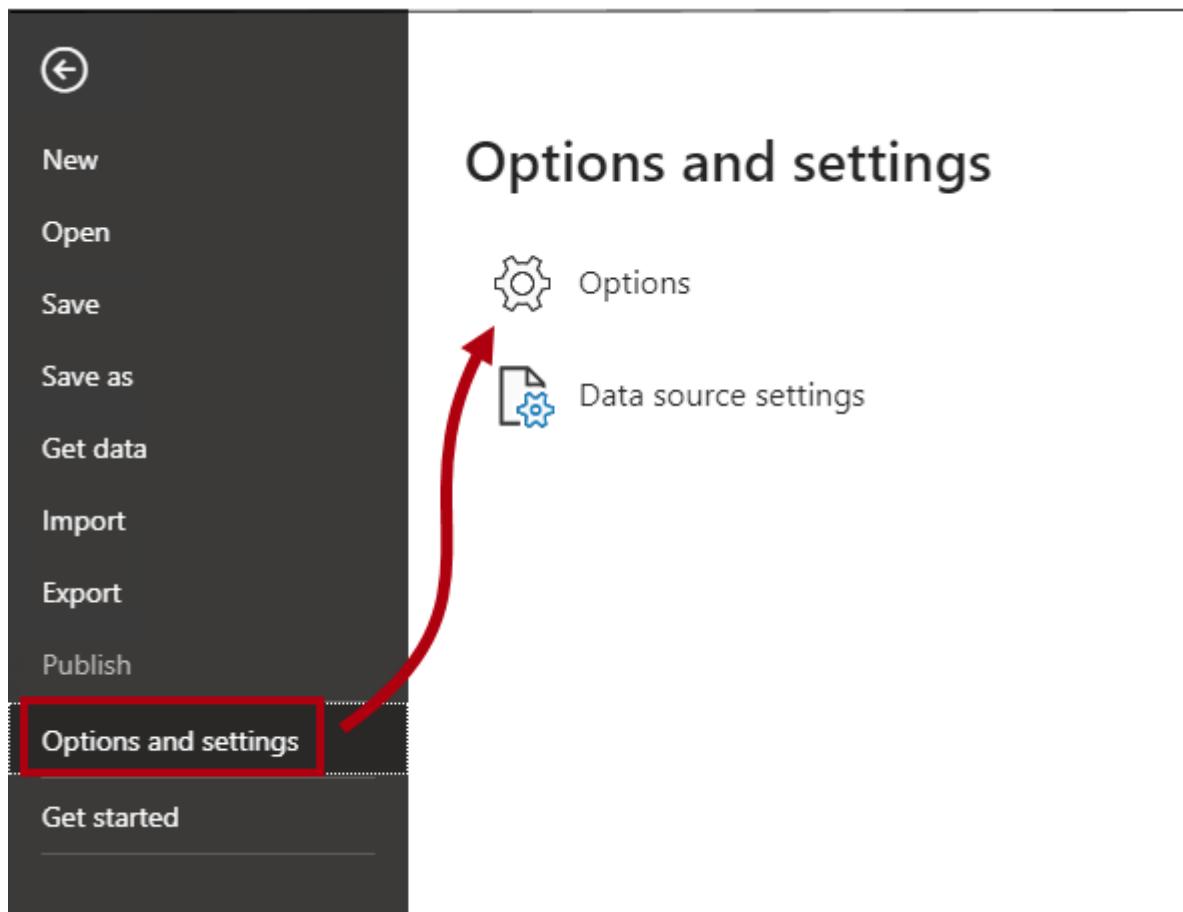
*Tip: You can also save the file by click the **Save** icon located at the top-right.*



Task 2: Set Power BI Desktop options

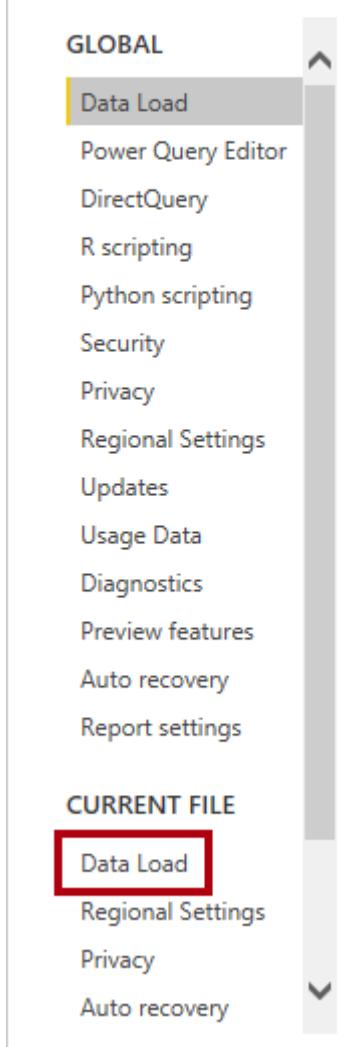
In this task, you will set Power BI Desktop options.

1. In Power BI Desktop, click the **File** ribbon tab to open the backstage view.
2. At the left, select **Options and Settings**, and then select **Options**.



3. In the **Options** window, at the left, in the **Current File** group, select **Data Load**.

Options



The **Data Load** settings for the current file allow setting options that determine default behaviors when modeling.

4. In the **Relationships** group, uncheck the two options that are checked.

Type Detection

Automatically detect column types and headers for unstructured sources

Relationships

Import relationships from data sources on first load ⓘ

Update or delete relationships when refreshing data ⓘ

Autodetect new relationships after data is loaded ⓘ

*While these two options can be helpful when developing a data model, they have been disabled to support the lab experience. When you create relationships in **Lab 03A**, you will learn why you are adding each one.*

5. Click **OK**.

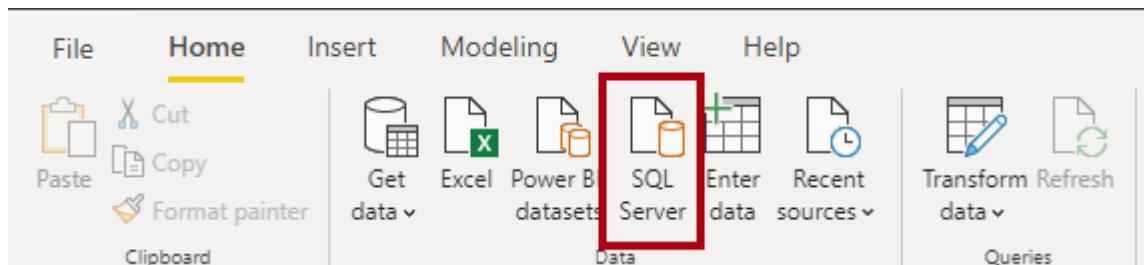


6. Save the Power BI Desktop file.

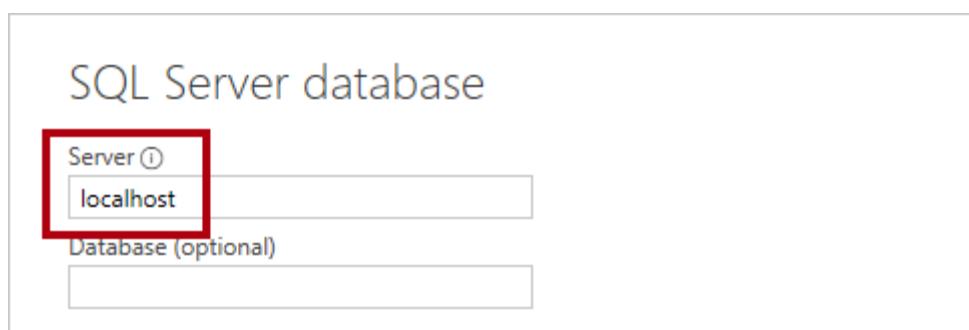
Task 3: Get data from SQL Server

In this task, you will create queries based on SQL Server tables.

1. On the **Home** ribbon tab, from inside the **Data** group, click **SQL Server**.



2. In the **SQL Server Database** window, in the **Server** box, enter **localhost**.

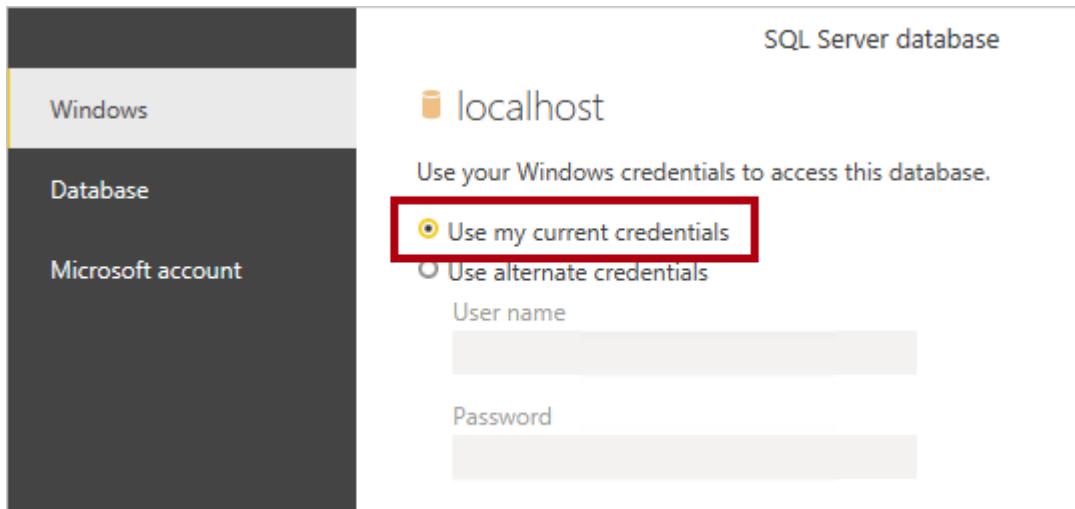


*In the labs, you will connect to the SQL Server database by using **localhost**. This isn't a recommended practice, however, when creating your own solutions. It's because gateway data sources cannot resolve **localhost**.*

3. Click **OK**.



4. Notice that the default authentication is to **Use My Current Credentials**.



5. Click **Connect**.

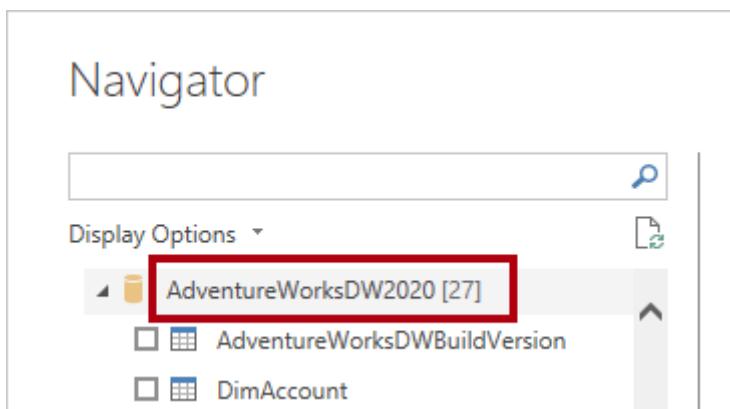


6. When prompted about encryption support, click **OK**.



7. In the **Navigator** window, at the left, expand the **AdventureWorksDW2020** database.

*The **AdventureWorksDW2020** database is based on the **AdventureWorksDW2017** sample database. It has been modified to support the learning objectives of the course labs.*



8. Select—but don't check—the **DimEmployee** table.

The screenshot shows the 'AdventureWorksDW2020 [27]' database in the Object Explorer. Under the 'Tables' node, several tables are listed: AdventureWorksDWBuildVersion, DimAccount, DimCurrency, DimCustomer, DimDate, DimDepartmentGroup, DimEmployee, DimEmployeeSalesTerritory, and DimGeography. The 'DimEmployee' table is highlighted with a red box.

9. In the right pane, notice a preview of the table.

The preview allows you to determine the columns and a sample of rows.

10. To create queries, check the following six tables:

- DimEmployee
- DimEmployeeSalesTerritory
- DimProduct
- DimReseller
- DimSalesTerritory
- FactResellerSales

11. To apply transformations to the data of the selected tables, click **Transform Data**.

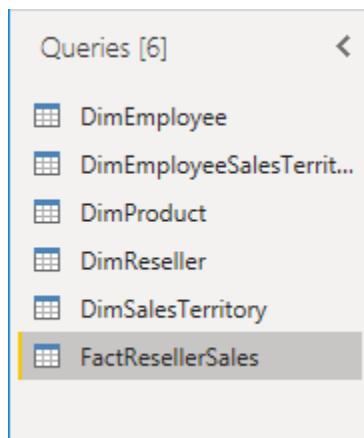
*You won't be transforming the data in this lab. The objectives of this lab are to explore and profile the data in the **Power Query Editor** window.*



Task 4: Preview SQL Server queries

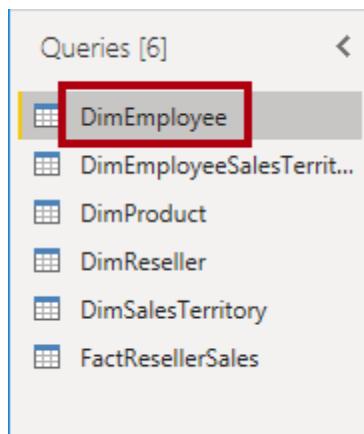
In this task, you will preview the data of the SQL Server queries. First, you will learn relevant information about the data. You will also use column quality, column distribution, and column profile tools to understand the data, and assess data quality.

1. In the **Power Query Editor** window, at the left, notice the **Queries** pane.



The **Queries** pane contains one query for each selected table.

2. Select the first query—**DimEmployee**.



The **DimEmployee** table stores one row for each employee. A subset of the rows represent the salespeople, which will be relevant to the model you'll develop.

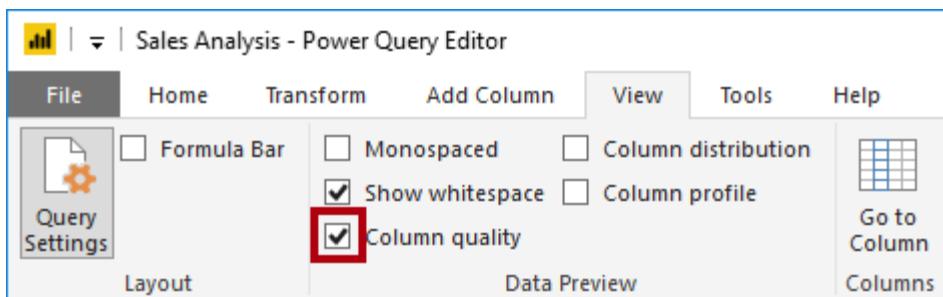
3. At the bottom left, in the status bar, notice the table statistics—the table has 33 columns, and 296 rows.

33 COLUMNS, 296 ROWS Column profiling based on top 1000 rows

4. In the data preview pane, scroll horizontally to review all columns.
5. Notice that the last five columns contain **Table** or **Value** links.

These five columns represent relationships to other tables in the database. They can be used to join tables together. You will join tables in **Lab 03A**.

6. To assess column quality, on the **View** ribbon tab, from inside the **Data Preview** group, check **Column Quality**.

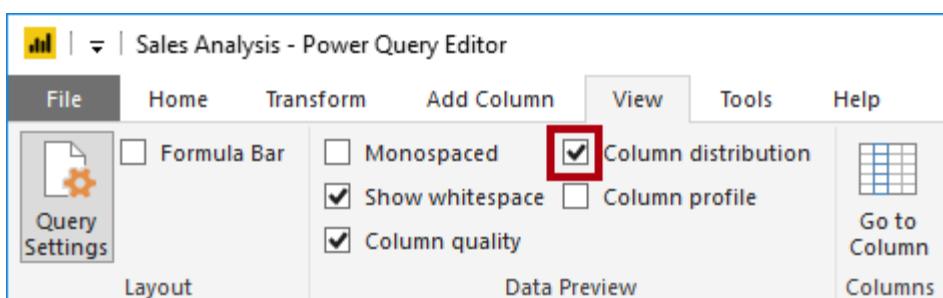


Column quality allows you to easily determine the percentage of valid, error, or empty values.

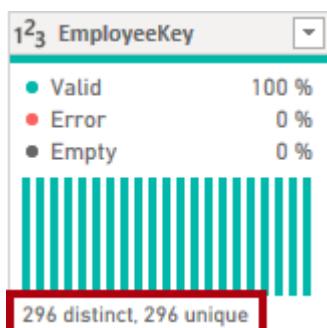
- For the **Position** column (sixth last column), notice that 94% of rows are empty (null).



- To assess column distribution, on the **View** ribbon tab, from inside the **Data Preview** group, check **Column Distribution**.



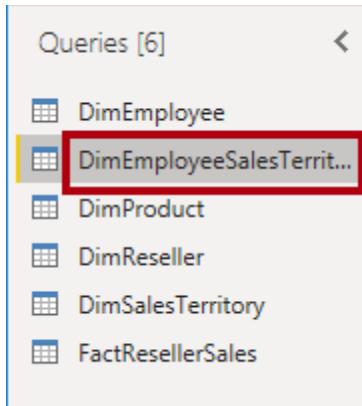
- Review the **Position** column again, and notice that there are four distinct values, and one unique value.
- Review the column distribution for the **EmployeeKey** (first) column—there are 296 distinct values, and 296 unique values.



When the distinct and unique counts are the same, it means the column contains unique values. When modeling, it's important that some tables contain unique

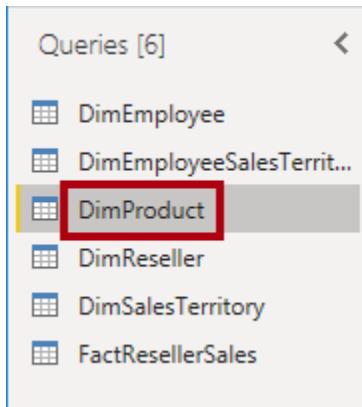
columns. They will be used to create one-to-many relationships, which you will do in **Lab 04A**.

11. In the **Queries** pane, select the **DimEmployeeSalesTerritory** query.



The **DimEmployeeSalesTerritory** table stores one row for each employee and the sales territory regions they manage. The table supports relating many regions to a single employee. Some employees manage one, two, or possibly more regions. When you model this data, you will need to define a many-to-many relationship, which you will do in **Lab 05A**.

12. In the **Queries** pane, select the **DimProduct** query.



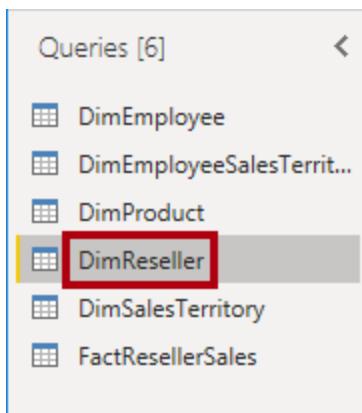
The **DimProduct** table contains one row per product sold by the company.

13. Horizontally scroll to reveal the last columns.

14. Notice the **DimProductSubcategory** column.

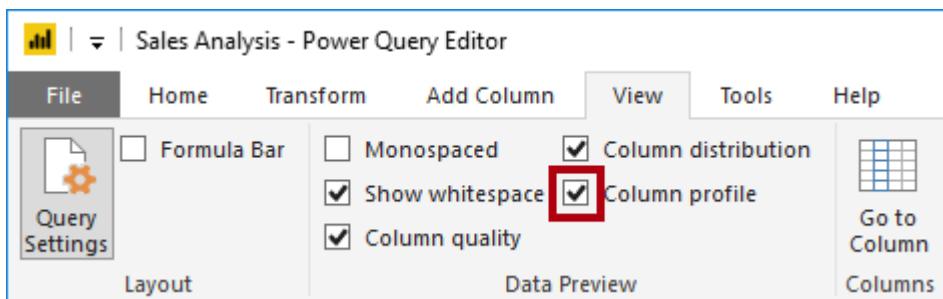
When you add transformations to this query in the next lab, you'll use the **DimProductSubcategory** column to join tables.

15. In the **Queries** pane, select the **DimReseller** query.



The **DimReseller** table contains one row per reseller. Resellers sell, distribute, or value add Adventure Works' products.

16. To view column values, on the **View** ribbon tab, from inside the **Data Preview** group, check **Column Profile**.

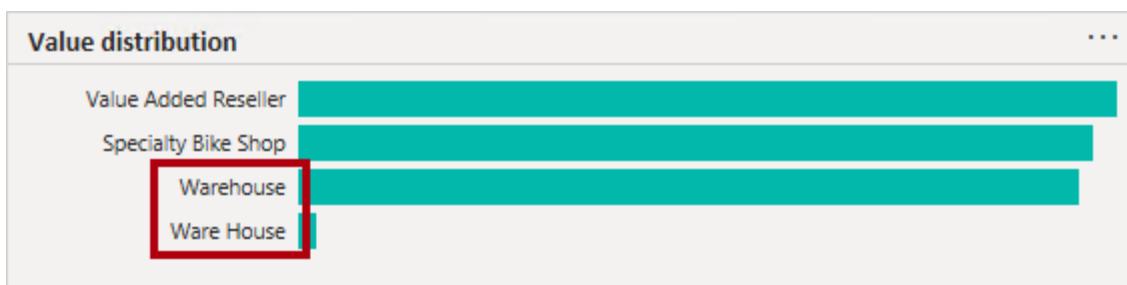


17. Select the **BusinessType** column header.

18. Notice that a new pane opens beneath the data preview pane.

19. Review the column statistics and value distribution.

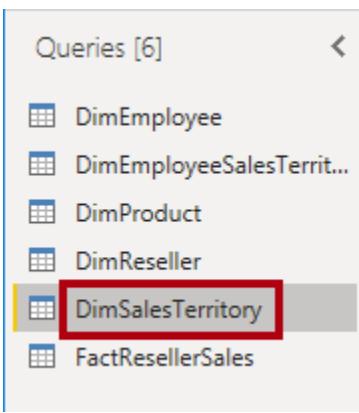
20. Notice the data quality issue: there are two labels for warehouse (**Warehouse**, and the misspelled **Ware House**).



21. Hover the cursor over the **Ware House** bar, and notice that there are five rows with this value.

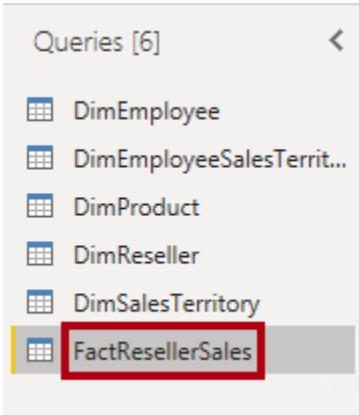
In the next lab, you will apply a transformation to relabel these five rows.

22. In the **Queries** pane, select the **DimSalesTerritory** query.



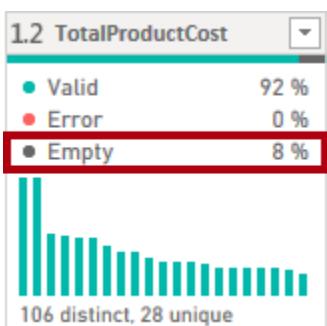
The **DimSalesTerritory** table contains one row per sales region, including **Corporate HQ** (headquarters). Regions are assigned to a country, and countries are assigned to groups. In **Lab 04A**, will create a hierarchy to support analysis at region, country, or group level.

23. In the **Queries** pane, select the **FactResellerSales** query.



The **FactResellerSales** table contains one row per sales order line—a sales order contains one or more line items.

24. Review the column quality for the **TotalProductCost** column, and notice that 8% of the rows are empty.

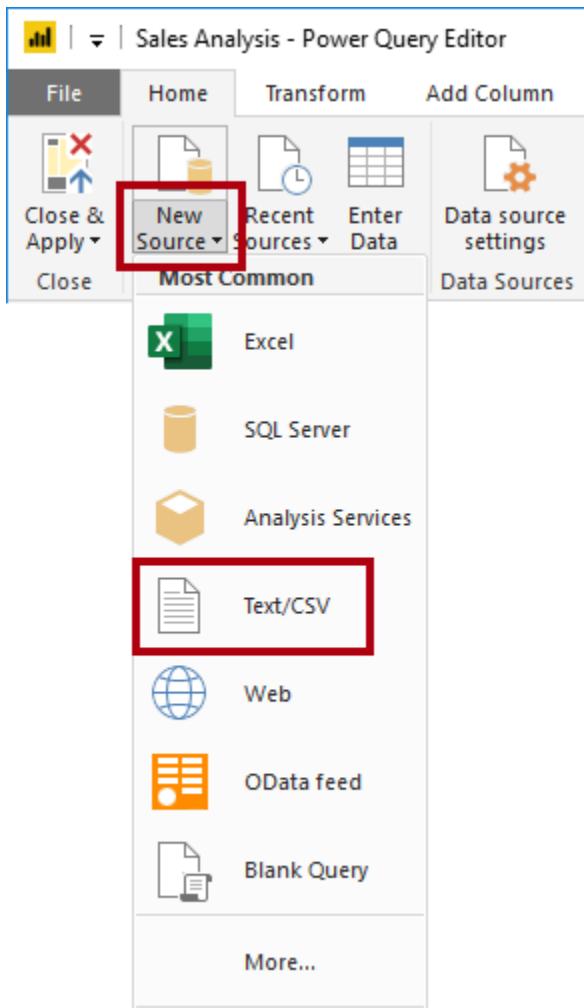


Missing **TotalProductCost** column values is a data quality issue. To address the issue, in the next lab you will apply transformations to fill in missing values by using the product standard cost, which is stored in the **DimProduct** table.

Task 5: Get data from a CSV file

In this task, you will create a query based on a CSV file.

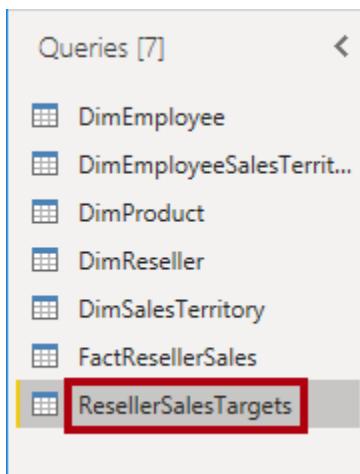
1. To add a new query, in the **Power Query Editor** window, on the **Home** ribbon tab, from inside the **New Query** group, click the **New Source** down-arrow, and then select **Text/CSV**.



2. In the **Open** window, navigate to the **D:\DA100\Data** folder, and select the **ResellerSalesTargets.csv** file.
3. Click **Open**.
4. In the **ResellerSalesTargets.csv** window, notice the data preview.
5. Click **OK**.



6. In the **Queries** pane, notice the addition of the **ResellerSalesTargets** query.

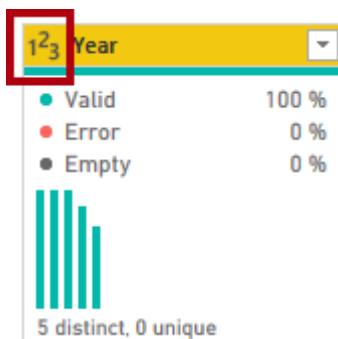


The **ResellerSalesTargets** CSV file contains one row per salesperson, per year. Each row records 12 monthly sales targets (expressed in thousands). The business year for the Adventure Works company commences on July 1.

7. Notice that no columns contain empty values.

When there isn't a monthly sales target, a hyphen character is stored instead.

8. Review the icons in each column header, to the left of the column name.



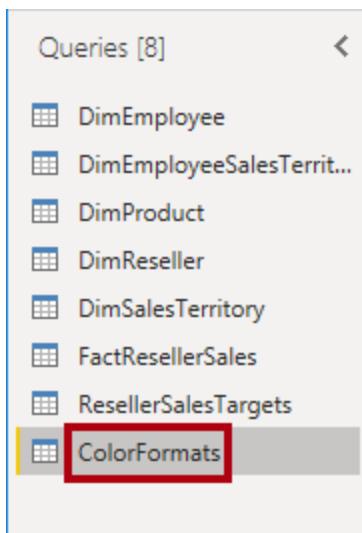
*The icons represent the column data type. **123** is whole number, and **ABC** is text.*

*In the next lab, you'll apply many transformations to achieve a different shaped result consisting of only three columns: **Date**, **EmployeeKey**, and **TargetAmount**.*

Task 6: Get additional data from a CSV file

In this task, you will create an additional query based on a different CSV file.

1. Use the steps in the previous task to create a query based on the **D:\DA100\Data\ColorFormats.csv** file.

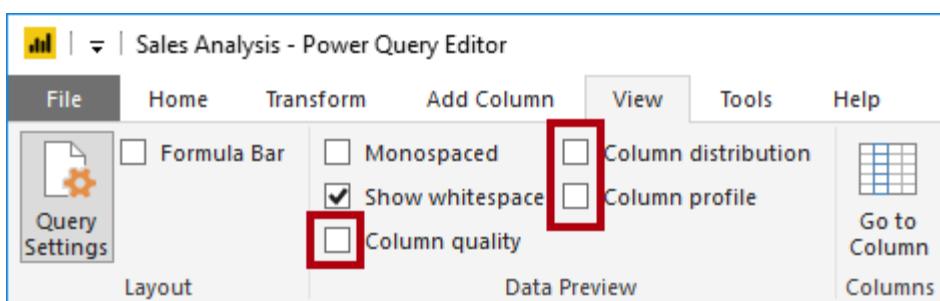


The **ColorFormats** CSV file contains one row per product color. Each row records the HEX codes to format background and font colors. In the next lab, you will integrate this data with the **DimProduct** query data.

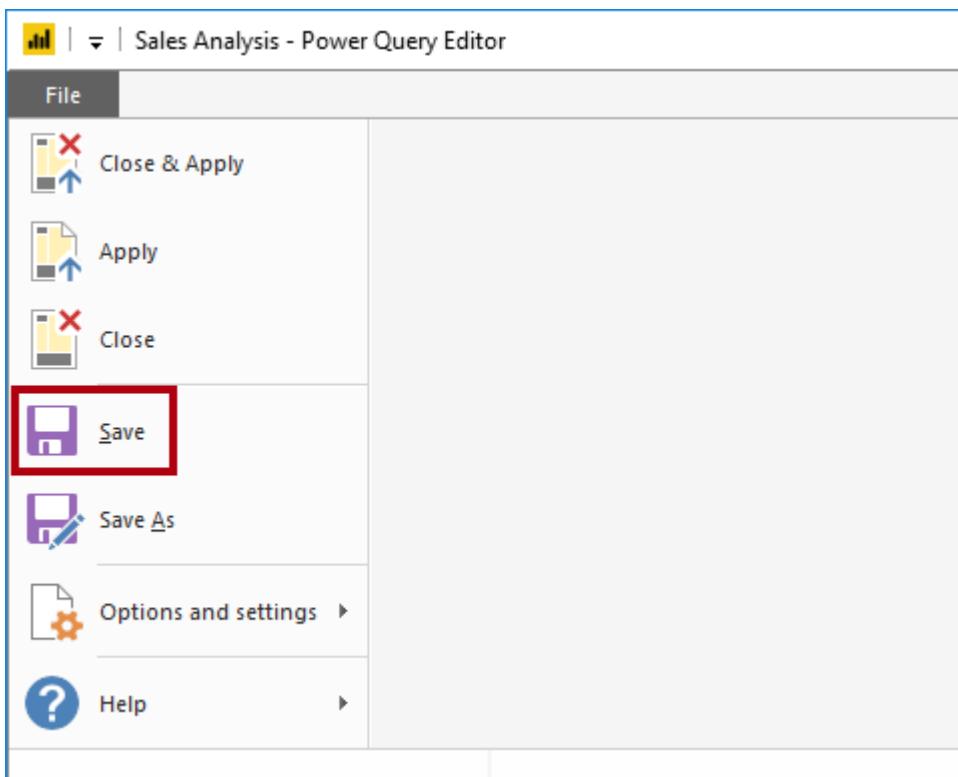
Finish up

In this task, you will complete the lab.

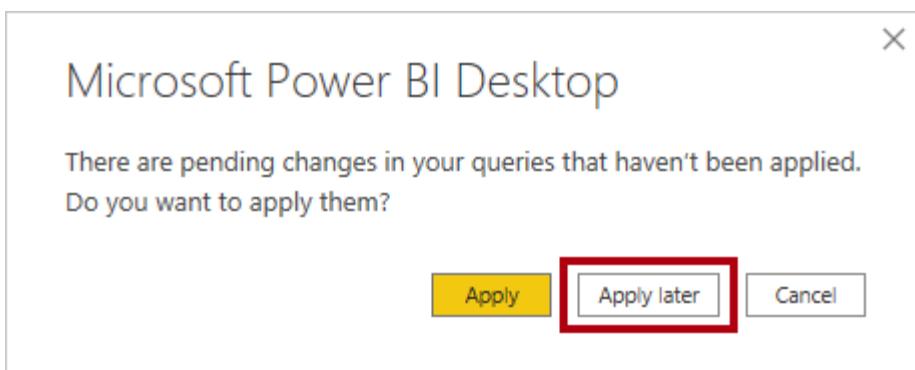
1. On the **View** ribbon tab, from inside the **Data Preview** group, uncheck the three data preview options:
 - Column quality
 - Column distribution
 - Column profile



2. To save the Power BI Desktop file, on the **File** backstage view, select **Save**.



3. When prompted to apply the queries, click **Apply Later**.



Applying the queries will load their data to the data model. You're not ready to do that, as there are many transformations that must be applied first.

4. Leave Power BI Desktop open.

In the next lab, you will apply various transformations to the queries, and then apply the queries to load them to the data model.

Lab 03A - Loading Data in Power BI Desktop

Overview

The estimated time to complete the lab is 45 minutes

In this lab, you will commence apply transformations to each of the queries created in the previous lab. You will then apply the queries to load each as a table to the data model.

In this lab, you learn how to:

- Apply various transformations
- Apply queries to load them to the data model

Exercise 1: Load Data

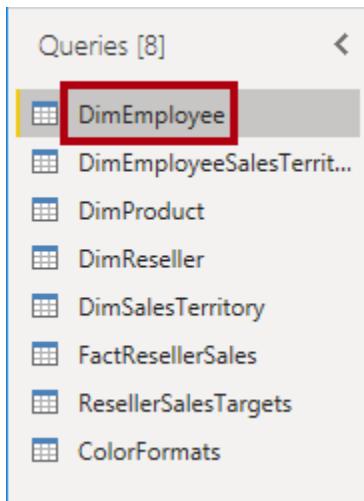
In this exercise, you will apply transformations to each of the queries created in the previous lab.

*If you're not confident you completed the previous lab successfully, you can open the previous lab's solution file, which is found in the **D:\DA100\Lab02A\Solution** folder.*

Task 1: Configure the Salesperson query

In this task, you will configure the **Salesperson** query.

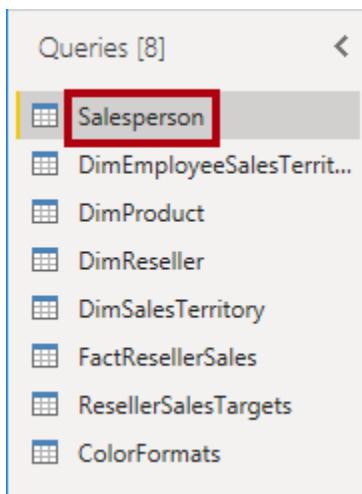
1. In the **Power Query Editor** window, in the **Queries** pane, select the **DimEmployee** query.



2. To rename the query, in the **Query Settings** pane (located at the right), in the **Name** box, replace the text with **Salesperson**, and then press **Enter**.

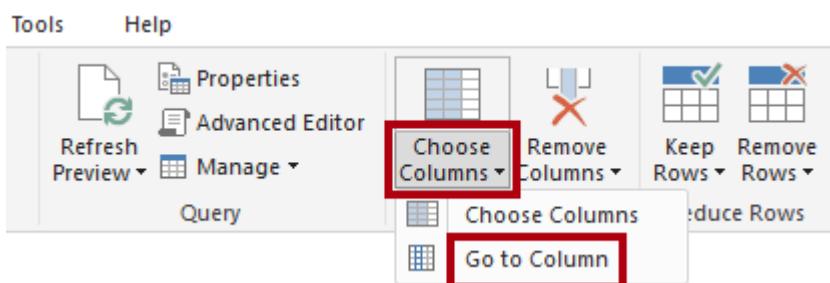
The query name will determine the model table name. It's recommended to define concise, yet friendly, names.

- In the **Queries** pane, verify that the query name has updated.



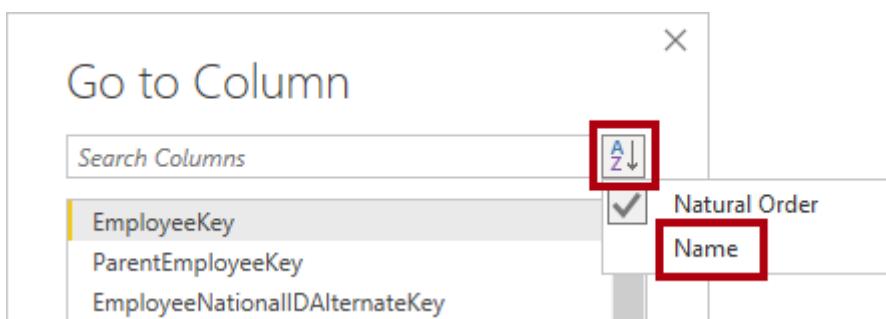
You will now filter the query rows to retrieve only employees who are salespeople.

- To locate a specific column, on the **Home** ribbon tab, from inside the **Manage Columns** group, click the **Choose Columns** down-arrow, and then select **Go to Column**.

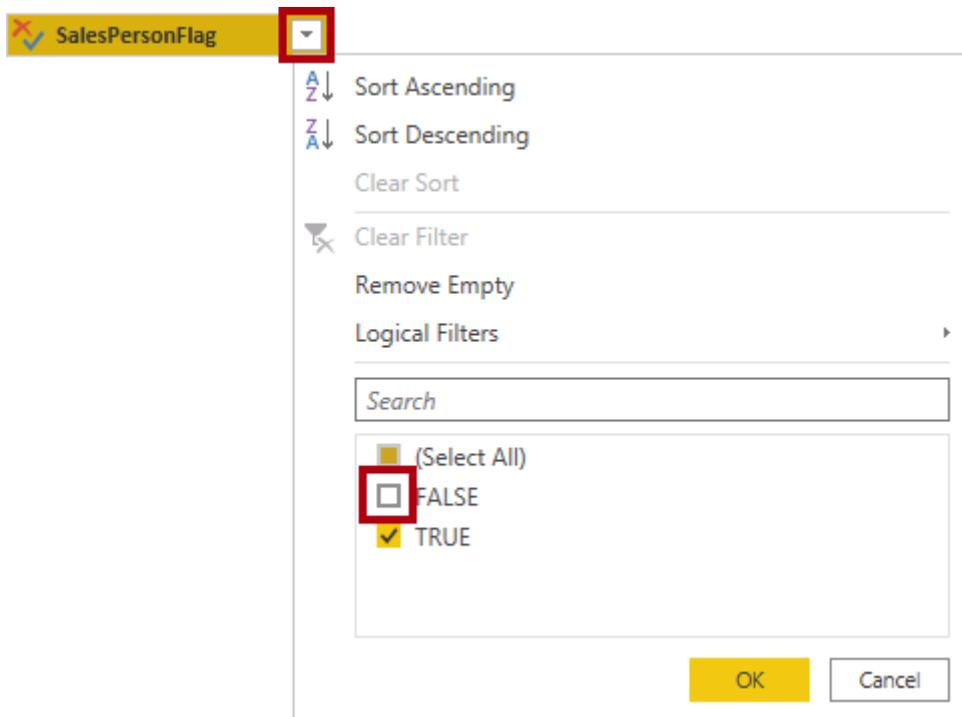


Tip: This technique is useful when a query contains many columns. Usually, you can simply horizontally scroll to locate the column.

- In the **Go to Column** window, to order the list by column name, click the **AZ** sort button, and then select **Name**.



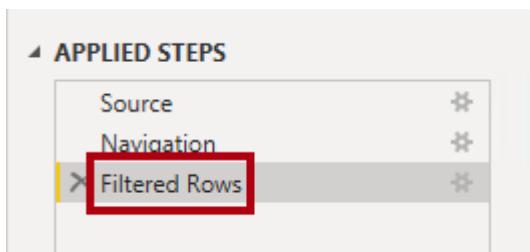
- Select the **SalesPersonFlag** column, and then click **OK**.
- To filter the query, in the **SalesPersonFlag** column header, click the down-arrow, and then uncheck **FALSE**.



8. Click **OK**.

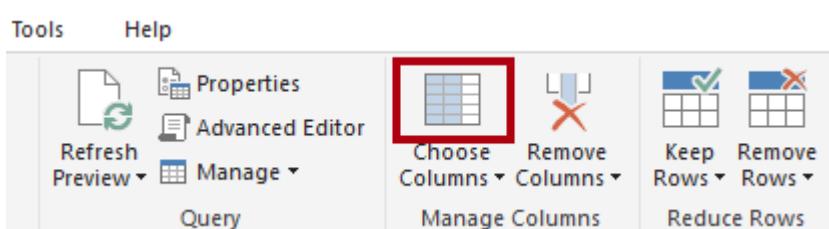


9. In the **Query Settings** pane, in the **Applied Steps** list, notice the addition of the **Filtered Rows** step.

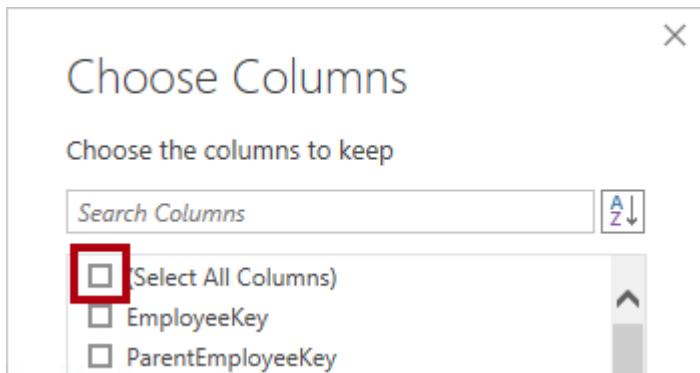


Each transformation you create results in additional step logic. It's possible to edit or delete steps. It's also possible to select a step to preview the query results at that stage of transformation.

10. To remove columns, on the **Home** ribbon tab, from inside the **Manage Columns** group, click the **Choose Columns** icon.



11. In the **Choose Columns** window, to uncheck all columns, uncheck the (**Select All Columns**) item.



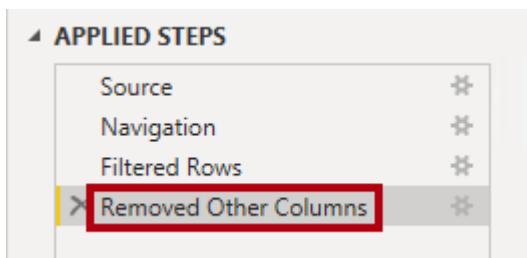
12. To include columns, check the following six columns:

- EmployeeKey
- EmployeeNationalIDAlternateKey
- FirstName
- LastName
- Title
- EmailAddress

13. Click **OK**.



14. In the **Applied Steps** list, notice the addition of another query step.

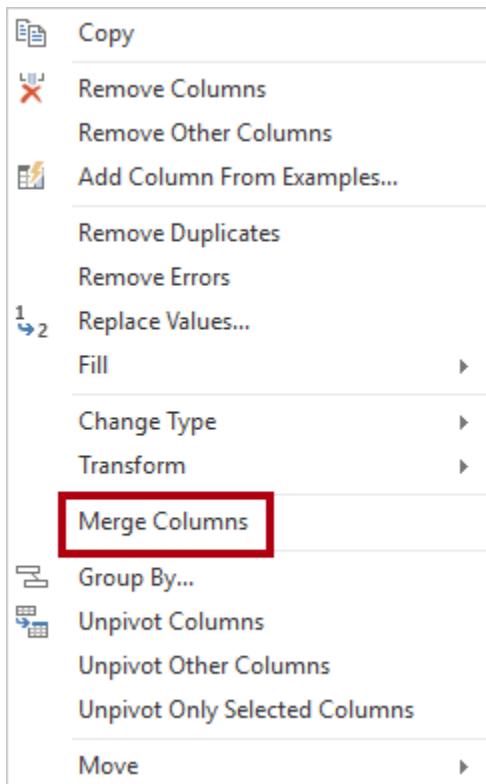


15. To create a single name column, first select the **FirstName** column header.

16. While pressing the **Ctrl** key, select the **LastName** column.

EmployeeID	EmployeeName	FirstName	LastName	Title
502097814	Stephen	Jiang		North American Sales Manager
112432117	Brian	Welcker		Director of Sales
841560125	Michael	Blythe		Sales Representative

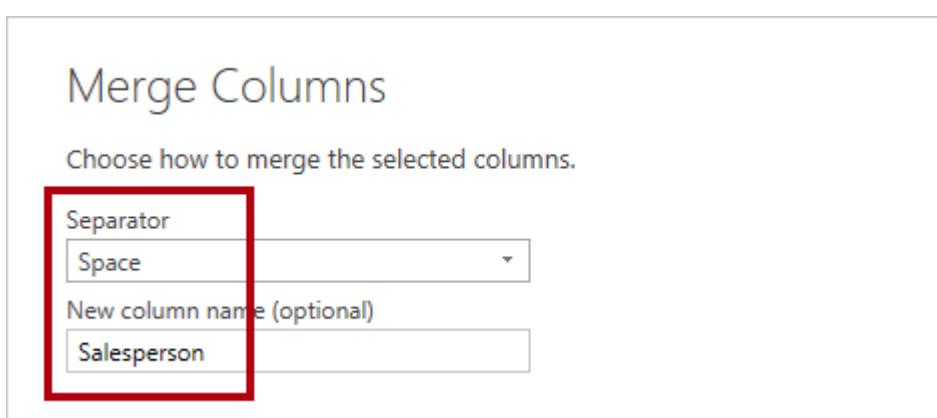
17. Right-click either of the select column headers, and then in the context menu, select **Merge Columns**.



Many common transformations can be applied by right-clicking the column header, and then choosing them from the context menu. Note, however, that all transformations—and more—are available in the ribbon.

18. In the **Merge Columns** window, in the **Separator** dropdown list, select **Space**.

19. In the **New Column Name** box, replace the text with **Salesperson**.



20. Click **OK**.



21. To rename the **EmployeeNationalIDAlternateKey** column, double-click the **EmployeeNationalIDAlternateKey** column header.

22. Replace the text with **EmployeeID**, and then press **Enter**.

When instructed to rename columns, it's important that you rename them exactly as described.

23. Use the previous steps to rename the **EmailAddress** column to **UPN**.

*UPN is an acronym for User Principal Name. The values in this column will be used when you configure row-level security in **Lab 05A**.*

24. At the bottom-left, in the status bar, verify that the query has five columns and 18 rows.

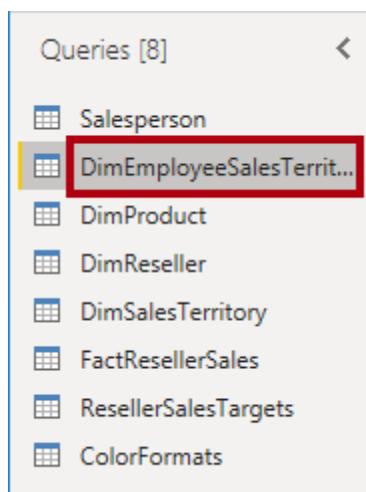
5 COLUMNS, 18 ROWS Column profiling based on top 1000 rows

It's important that you do not proceed if your query does not produce the correct result—it won't be possible to complete later labs. If it doesn't, refer back to the steps in this task to fix any problems.

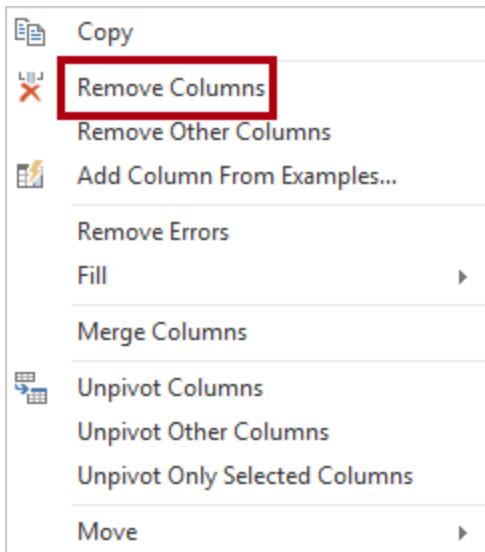
Task 2: Configure the SalespersonRegion query

In this task, you will configure the **SalespersonRegion** query.

1. In the **Queries** pane, select the **DimEmployeeSalesTerritory** query.



2. In the **Query Settings** pane, rename the query to **SalespersonRegion**.
3. To remove the last two columns, first select the **DimEmployee** column header.
4. While pressing the **Ctrl** key, select the **DimSalesTerritory** column header.
5. Right-click either of the selected column headers, and then in the context menu, select **Remove Columns**.



6. In the status bar, verify that the query has two columns and 39 rows.

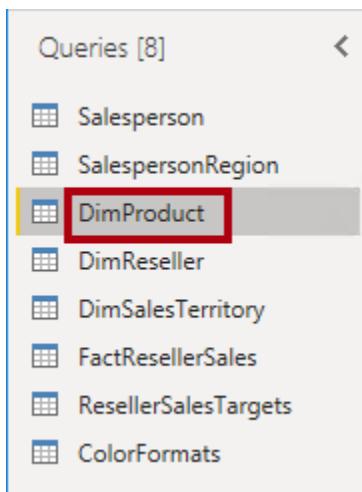
2 COLUMNS, 39 ROWS Column profiling based on top 1000 rows

Task 3: Configure the Product query

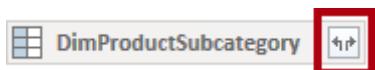
In this task, you will configure the **Product** query.

When detailed instructions have already been provided in the labs, the lab steps will now provide more concise instructions. If you need the detailed instructions, you can refer back to other tasks.

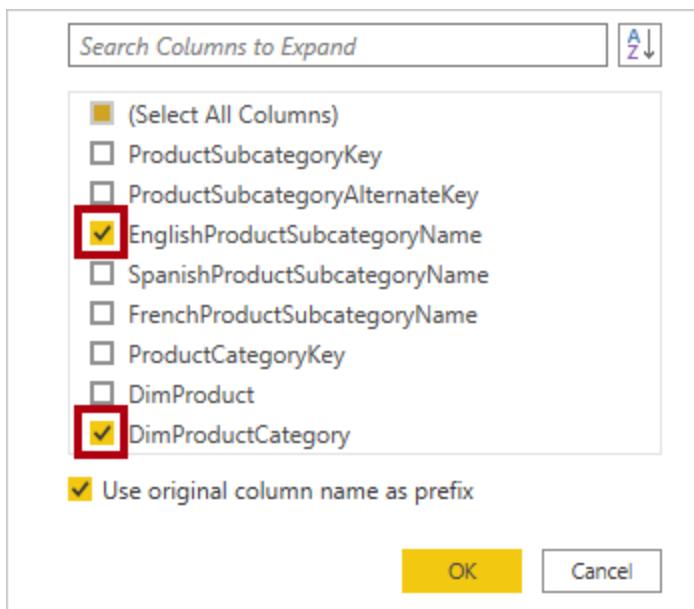
1. Select the **DimProduct** query.



2. Rename the query to **Product**.
3. Locate the **FinishedGoodsFlag** column, and then filter the column to retrieve products that are finished goods (i.e. TRUE).
4. Remove all columns, except the following:
 - ProductKey
 - EnglishProductName
 - StandardCost
 - Color
 - DimProductSubcategory
5. Notice that the **DimProductSubcategory** column represents a related table (it contains **Value** links).
6. In the **DimProductSubcategory** column header, at the right of the column name, click the expand button.

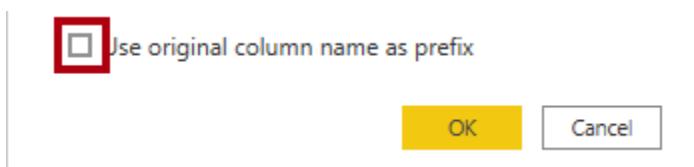


7. To uncheck all columns, uncheck the **(Select All Columns)** item.
8. Check the **EnglishProductSubcategoryName** and **DimProductCategory** columns.



By selecting these two columns, a transformation will be applied to join to the **DimProductSubcategory** table, and then include these columns. The **DimProductCategory** column is, in fact, another related table.

9. Uncheck the **Use Original Column Name as Prefix** checkbox.



Query column names must always be unique. When checked, this checkbox would prefix each column with the expanded column name (in this case **DimProductSubcategory**). Because it's known that the selected columns don't collide with columns in the **Product** query, the option is deselected.

10. Click **OK**.



11. Notice that the transformation resulted in two columns, and that the **DimProductCategory** column has been removed.

12. Expand the **DimProductCategory**, and then introduce only the **EnglishProductName** column.

13. Rename the following four columns:

- **EnglishProductName** to **Product**
- **StandardCost** to **Standard Cost** (include a space)

- **EnglishProductSubcategoryName** to **Subcategory**
- **EnglishProductCategoryName** to **Category**

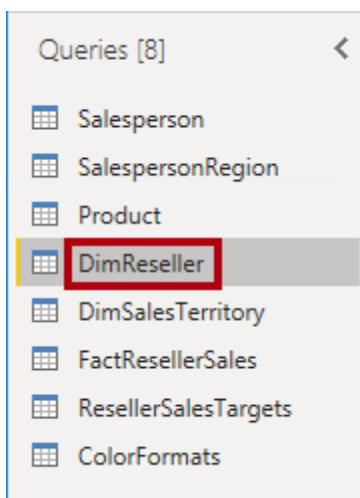
14. In the status bar, verify that the query has six columns and 397 rows.

6 COLUMNS, 397 ROWS Column profiling based on top 1000 rows

Task 4: Configure the Reseller query

In this task, you will configure the **Reseller** query.

1. Select the **DimReseller** query.



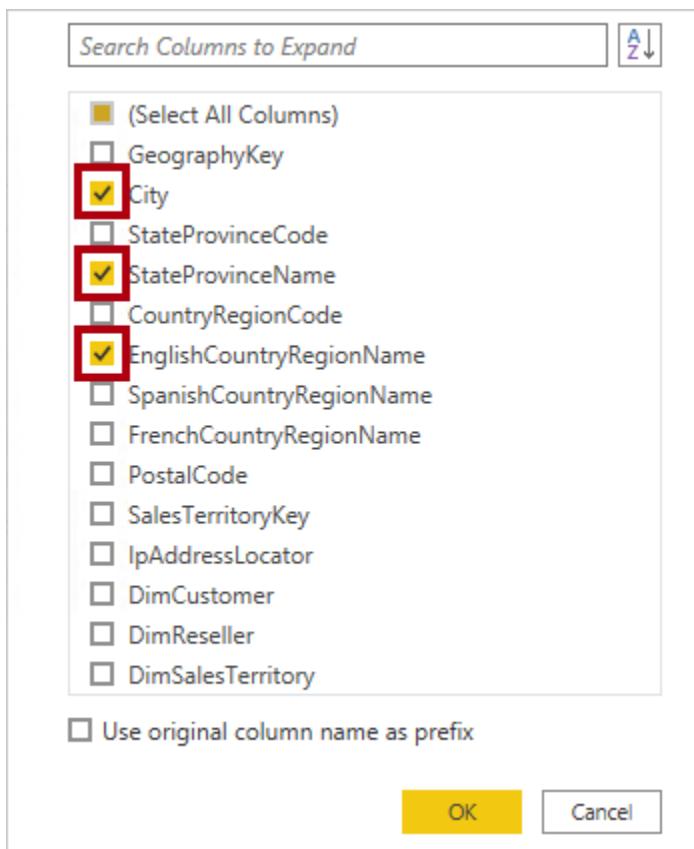
2. Rename the query to **Reseller**.

3. Remove all columns, except the following:

- ResellerKey
- BusinessType
- RellerName
- DimGeography

4. Expand the **DimGeography** column, to include only the following three columns:

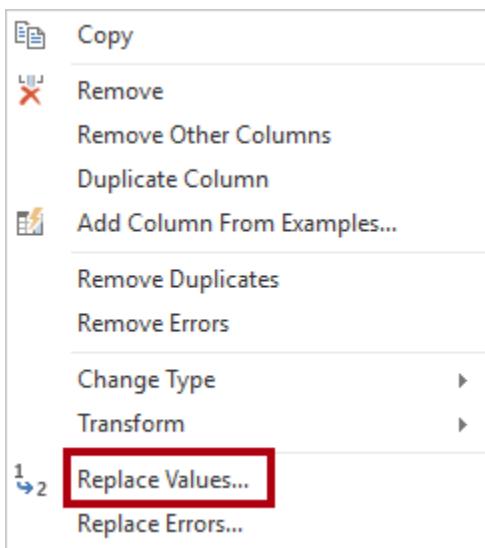
- City
- StateProvinceName
- EnglishCountryRegionName



5. In the **Business Type** column header, click the down-arrow, and then review the items, and the incorrect spelling of warehouse.

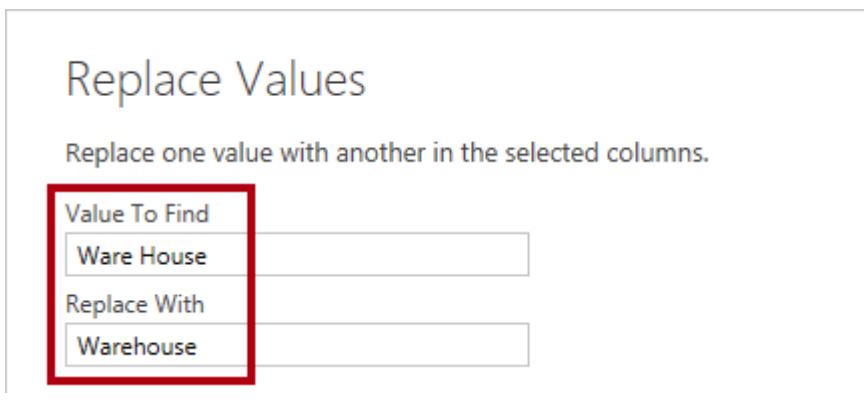


50. Right-click the **Business Type** column header, and then select **Replace Values**.



51. In the **Replace Values** window, configure the following values:

- In the **Value to Find** box, enter **Ware House**
- In the **Replace With** box, enter **Warehouse**



52. Click **OK**.



53. Rename the following four columns:

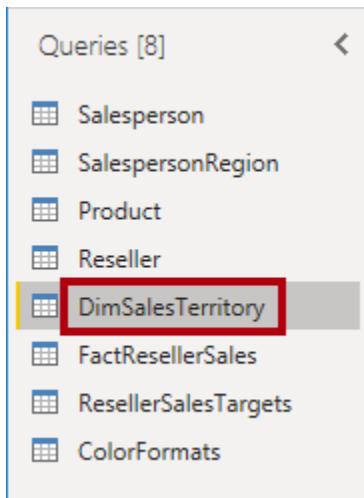
- **BusinessType** to **Business Type** (include a space)
- **ResellerName** to **Reseller**
- **StateProvinceName** to **State-Province**
- **EnglishCountryRegionName** to **Country-Region**

54. In the status bar, verify that the query has six columns and 701 rows.

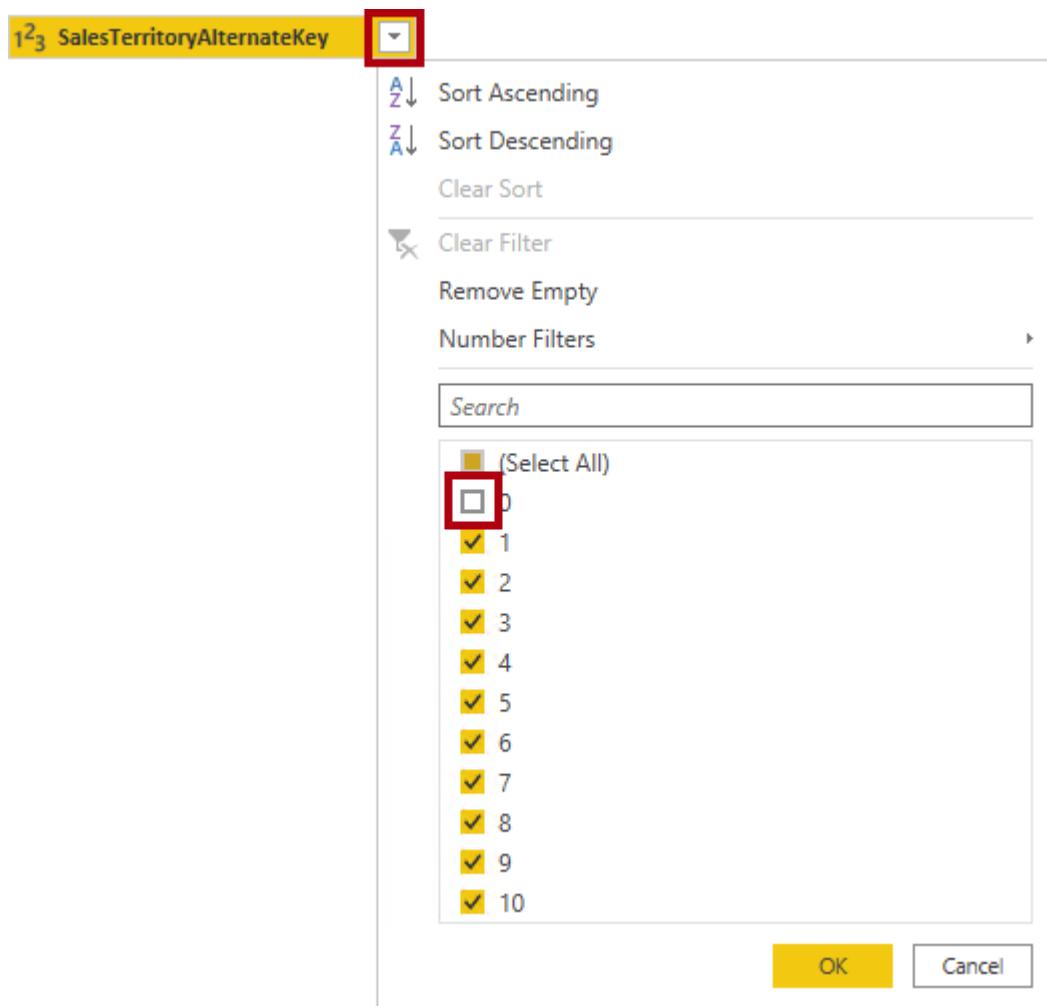
Task 5: Configure the Region query

In this task, you will configure the **Region** query.

1. Select the **DimSalesTerritory** query.



2. Rename the query to **Region**.
3. Apply a filter to the **SalesTerritoryAlternateKey** column to remove the value 0 (zero).



4. Remove all columns, except the following:

- SalesTerritoryKey
- SalesTerritoryRegion
- SalesTerritoryCountry
- SalesTerritoryGroup

5. Rename the following three columns:

- **SalesTerritoryRegion** to **Region**
- **SalesTerritoryCountry** to **Country**
- **SalesTerritoryGroup** to **Group**

6. In the status bar, verify that the query has four columns and 10 rows.

4 COLUMNS, 10 ROWS Column profiling based on top 1000 rows

Task 6: Configure the Sales query

In this task, you will configure the **Sales** query.

1. Select the **FactResellerSales** query.

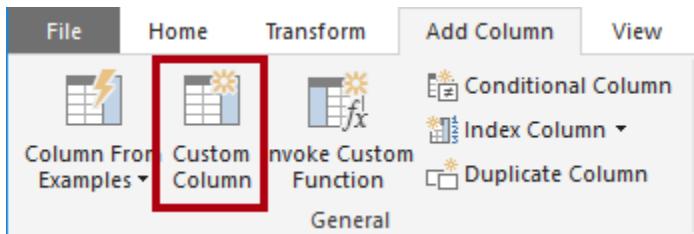


2. Rename the query to **Sales**.
3. Remove all columns, except the following:
 - SalesOrderNumber
 - OrderDate
 - ProductKey
 - ResellerKey
 - EmployeeKey
 - SalesTerritoryKey
 - OrderQuantity
 - UnitPrice
 - TotalProductCost
 - SalesAmount
 - DimProduct

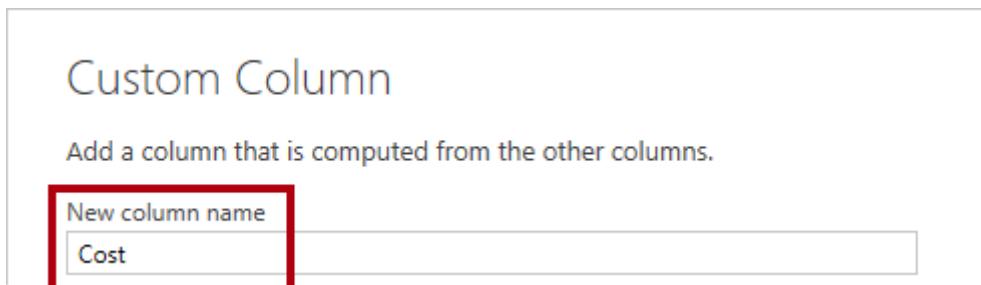
*Recall in **Lab 02A** that a small percentage of **FactResellerSales** rows had missing **TotalProductCost** values. The **DimProduct** column has been included to retrieve the product standard cost, to fix the missing values.*

4. Expand the **DimProduct** column, and then include the **StandardCost** column.

- To create a custom column, on the **Add Column** ribbon tab, from inside the **General** group, click **Custom Column**.



- In the **Custom Column** window, in the **New Column Name** box, replace the text with **Cost**.



- In the **Custom Column Formula** box, enter the following expression (after the equals symbol):
- For your convenience, you can copy the expression from the **D:\DA100\Lab03A\Assets\Snippets.txt** file.

Power Query

```
if [TotalProductCost] = null then [OrderQuantity] * [StandardCost] else  
[TotalProductCost]
```

*This expression tests if the **TotalProductCost** value is missing. If it is, produces a value by multiplying the **OrderQuantity** value by the **StandardCost** value; otherwise, it uses the existing **TotalProductCost** value.*

- Click **OK**.



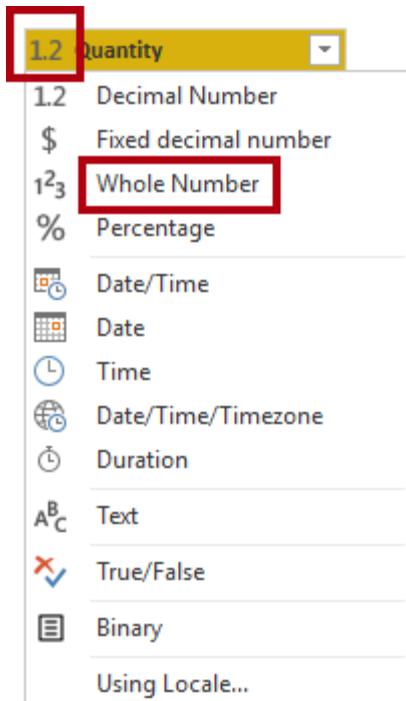
- Remove the following two columns:

- TotalProductCost
- StandardCost

- Rename the following three columns:

- **OrderQuantity** to **Quantity**
- **UnitPrice** to **Unit Price** (include a space)
- **SalesAmount** to **Sales**

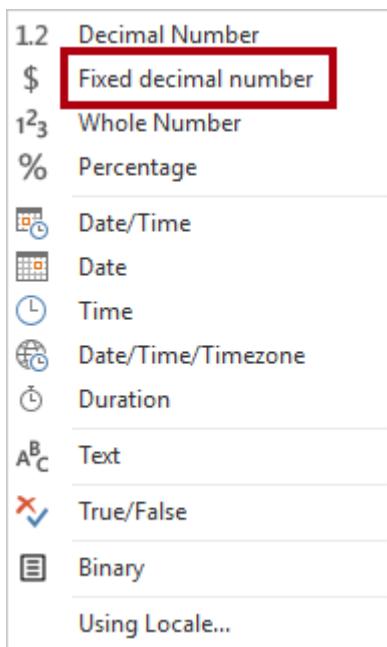
12. To modify the column data type, in the **Quantity** column header, at the left of the column name, click the **1.2** icon, and then select **Whole Number**.



Configuring the correct data type is important. When the column contains numeric value, it's also important to choose the correct type if you expect to perform mathematic calculations.

13. Modify the following three column data types to **Fixed Decimal Number**.

- Unit Price
- Sales
- Cost



The fixed decimal number data type stores values with full precision, and so requires more storage space than decimal number. It's important to use the fixed decimal number type for financial values, or rates (like exchange rates).

14. In the status bar, verify that the query has 10 columns and 999+ rows.

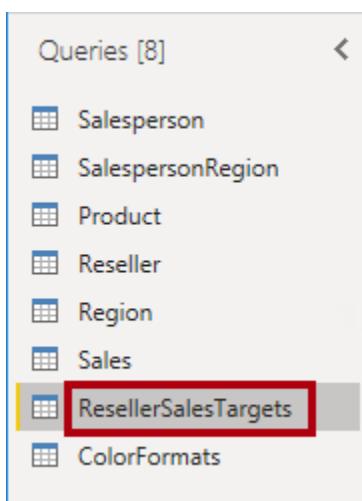
10 COLUMNS, 999+ ROWS Column profiling based on top 1000 rows

A maximum of 1000 rows will be loaded as preview data for each query.

Task 7: Configure the Targets query

In this task, you will configure the **Targets** query.

1. Select the **ResellerSalesTargets** query.

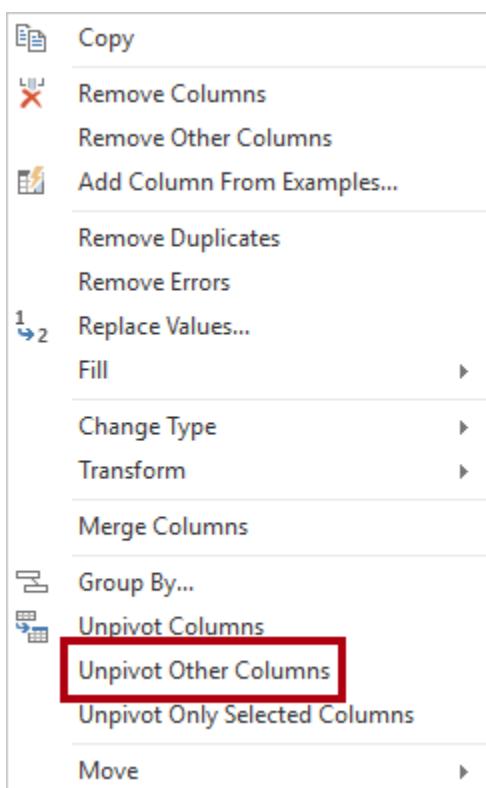


2. Rename the query to **Targets**.

3. To unpivot the 12 month columns (**M01-M12**), first multi-select the **Year** and **EmployeeID** column headers.

	1 2 3 Year	1 2 3 EmployeeID	A ^B _C M01	A ^B _C M02
1	2017	61181880	-	-
2	2017	90836195	-	-
3	2017	112432117	-	-
4	2017	139397894	-	-
5	2017	191644724	-	-
6	2017	234474252	-	-

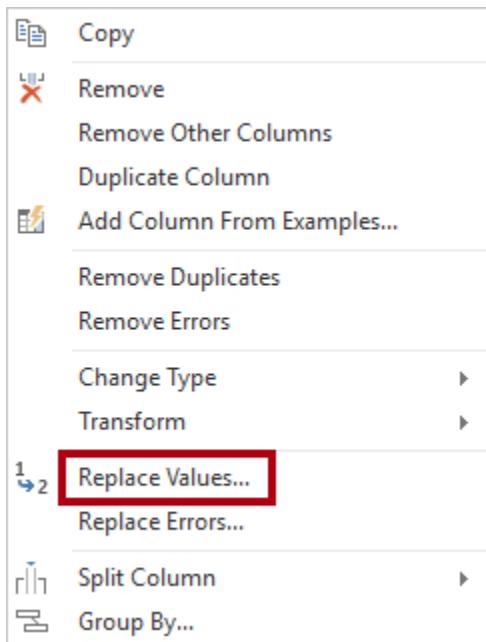
4. Right-click either of the select column headers, and then in the context menu, select **Unpivot Other Columns**.



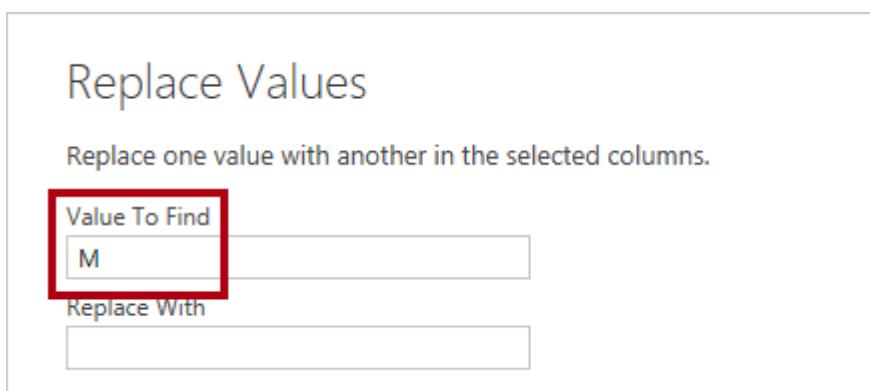
5. Notice that the column names now appear in the **Attribute** column, and the values appear in the **Value** column.
6. Apply a filter to the **Value** column to remove hyphen (-) values.
7. Rename the following two columns:
- Attribute to **MonthNumber** (no space between the two words—it will be removed later)
 - Value to **Target**

You will now apply transformations to produce a date column. The date will be derived from the **Year** and **MonthNumber** columns. You will create the column by using the **Columns From Examples** feature.

8. To prepare the **MonthNumber** column values, right-click the **MonthNumber** column header, and then select **Replace Values**.

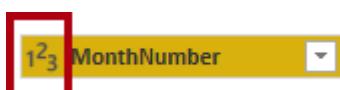


9. In the **Replace Values** window, in the **Value To Find** box, enter **M**.

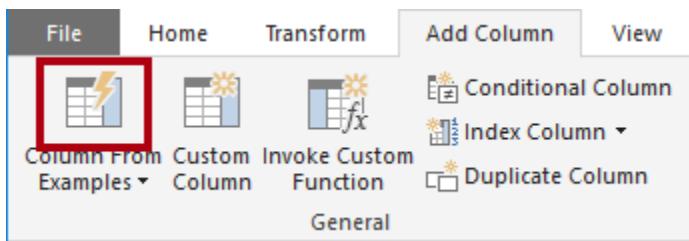


10. Click **OK**.

11. Modify the **MonthNumber** column data type to **Whole Number**.



12. On the **Add Column** ribbon tab, from inside the **General** group, click The **Column From Examples** icon.



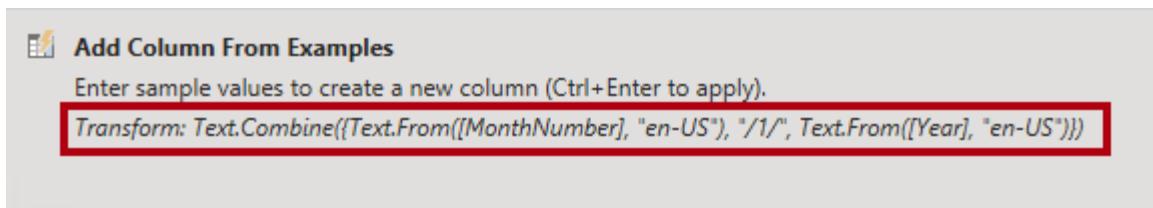
13. Notice that the first row is for year **2017** and month number **7**.
14. In the **Column1** column, in the first grid cell, commence enter **7/1/2017**, and then press **Enter**.

The virtual machine uses US regional settings, so this date is in fact July 1, 2017.

15. Notice that the grid cells update with predicted values.

The feature has accurately predicted that you are combining values from two columns.

16. Notice also the formula presented above the query grid.

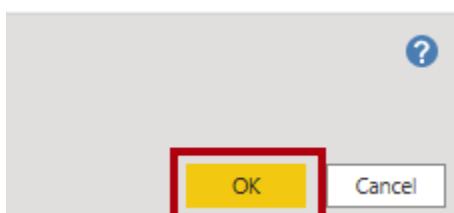


17. To rename the new column, double-click the **Merged** column header.

18. Rename the column as **TargetMonth**.

TargetMonth
7/1/2017
8/1/2017
9/1/2017
10/1/2017
11/1/2017
12/1/2017
7/1/2017

19. Click **OK**.



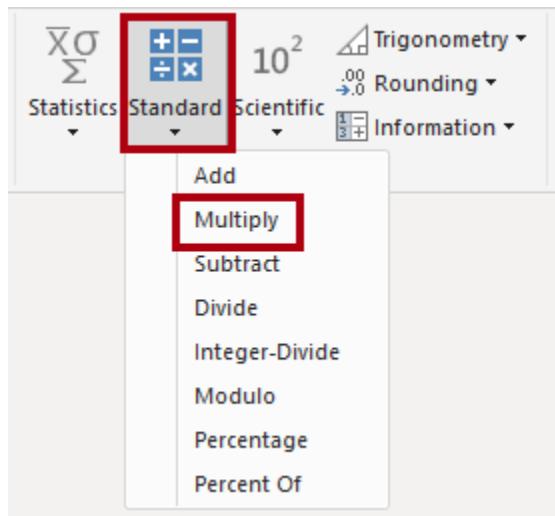
20. Remove the following columns:

- o Year
- o MonthNumber

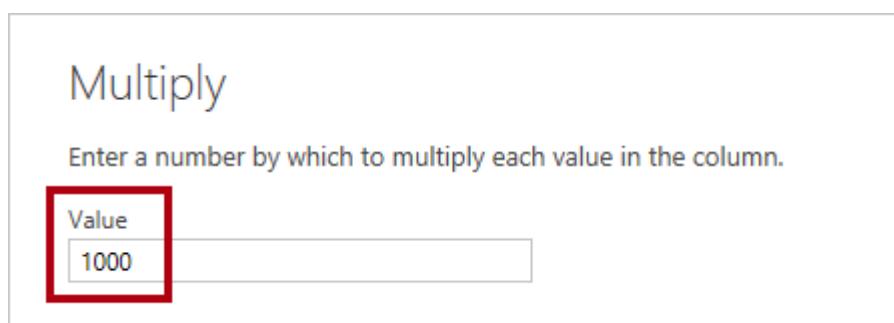
21. Modify the following column data types:

- o **Target** as fixed decimal number
- o **TargetMonth** as date

22. To multiply the **Target** values by 1000, select the **Target** column header, and then on the **Transform** ribbon tab, from inside the **Number Column** group, click **Standard**, and then select **Multiply**.



23. In the **Multiply** window, in the **Value** box, enter **1000**.



24. Click **OK**.



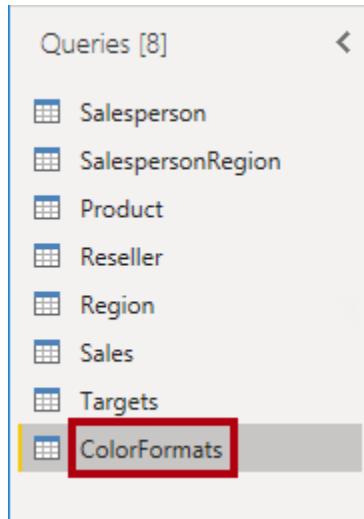
25. In the status bar, verify that the query has three columns and 809 rows.

3 COLUMNS, 809 ROWS Column profiling based on top 1000 rows

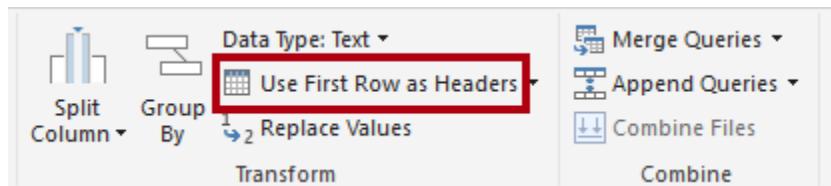
Task 8: Configure the ColorFormats query

In this task, you will configure the **ColorFormats** query.

1. Select the **ColorFormats** query.



2. Notice that the first row contains the column names.
3. On the **Home** ribbon tab, from inside the **Transform** group, click **Use First Row as Headers**.



4. In the status bar, verify that the query has three columns and 10 rows.

3 COLUMNS, 10 ROWS Column profiling based on top 1000 rows

Task 9: Update the Product query

In this task, you will update the **Product** query by merging the **ColorFormats** query.

1. Select the **Product** query.

The screenshot shows a list of eight queries: Salesperson, SalespersonRegion, Product, Reseller, Region, Sales, Targets, and ColorFormats. The 'Product' query is highlighted with a red box.

2. To merge the **ColorFormats** query, on the **Home** ribbon tab, from inside the **Combine** group, click **Merge Queries**.

The screenshot shows the Power BI ribbon with the 'Combine' group open. The 'Merge Queries' button is highlighted with a red box.

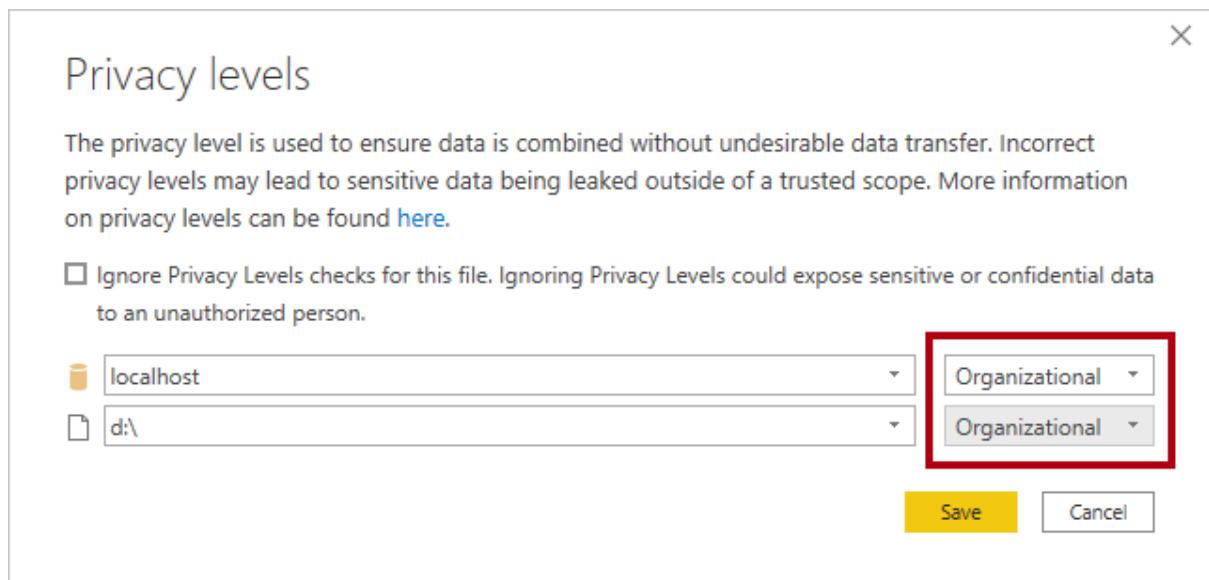
Merging queries allows integrating data, in this case from different data sources (SQL Server and a CSV file).

3. In the **Merge** window, in the **Product** query grid, select the **Color** column header.

The screenshot shows the 'Merge' window for the 'Product' query. A red box highlights the 'Color' column header in the grid.

ProductKey	Product	Standard Cost	Color	Subcategory	Category
210	HL Road Frame - Black, 58	868.63	Black	Road Frames	Components
211	HL Road Frame - Red, 58	868.63	Red	Road Frames	Components
212	Sport-100 Helmet, Red	12.03	Red	Helmets	Accessories
213	Sport-100 Helmet, Red	13.88	Red	Helmets	Accessories
214	Sport-100 Helmet, Red	13.09	Red	Helmets	Accessories

4. Beneath the **Product** query grid, in the dropdown list, select the **ColorFormats** query.
5. In the **ColorFormats** query grid, select the **Color** column header.
6. When the **Privacy Levels** window opens, for each of the two data sources, in the corresponding dropdown list, select **Organizational**.



*Privacy levels can be configured for data source to determine whether data can be shared between sources. Setting each data source as **Organizational** allows them to share data, if necessary. Note that Private data sources can never be shared with other data sources. It doesn't mean that Private data cannot be shared; it means that the Power Query engine cannot share data between the sources.*

7. Click **Save**.

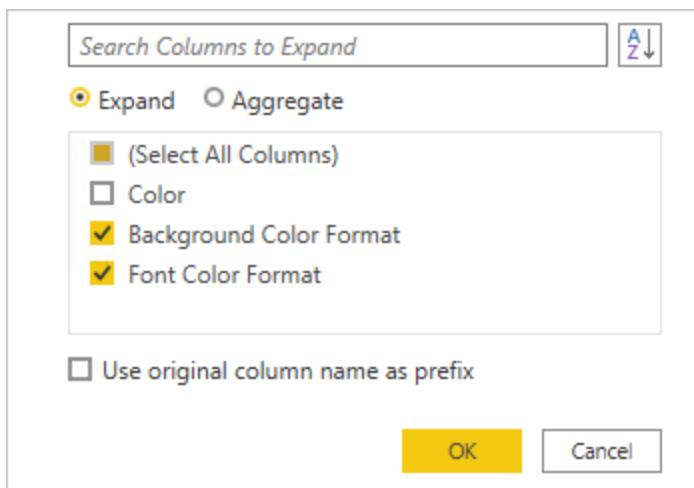


8. In the **Merge** window, click **OK**.



9. Expand the **ColorFormats** column to include the following two columns:

- Background Color Format
- Font Color Format



10. In the status bar, verify that the query now has eight columns and 397 rows.

8 COLUMNS, 397 ROWS Column profiling based on top 1000 rows

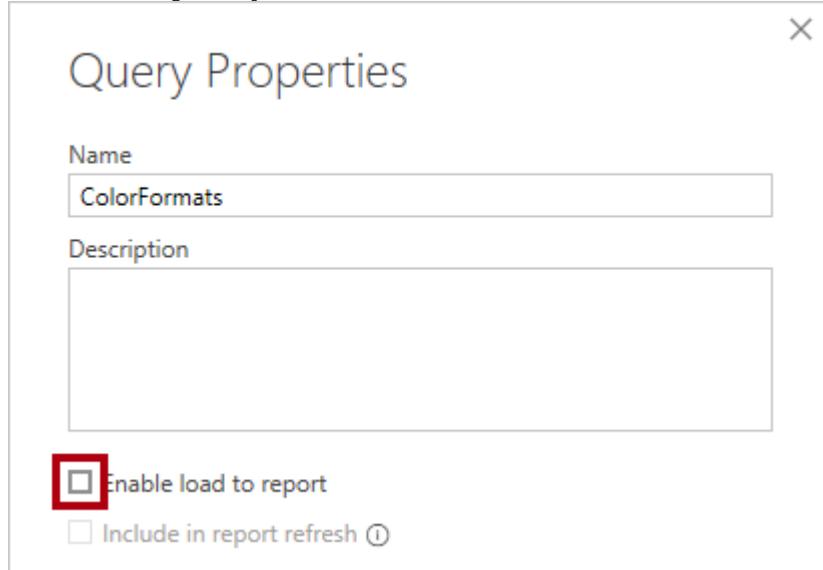
Task 10: Update the ColorFormats query

In this task, you will update the **ColorFormats** to disable its load.

1. Select the **ColorFormats** query.

2. In the **Query Settings** pane, click the **All Properties** link.

3. In the **Query Properties** window, uncheck the **Enable Load To Report** checkbox.



Disabling the load means it will not load as a table to the data model. This is done because the query was merged with the Product query, which is enabled to load to the data model.

4. Click **OK**.

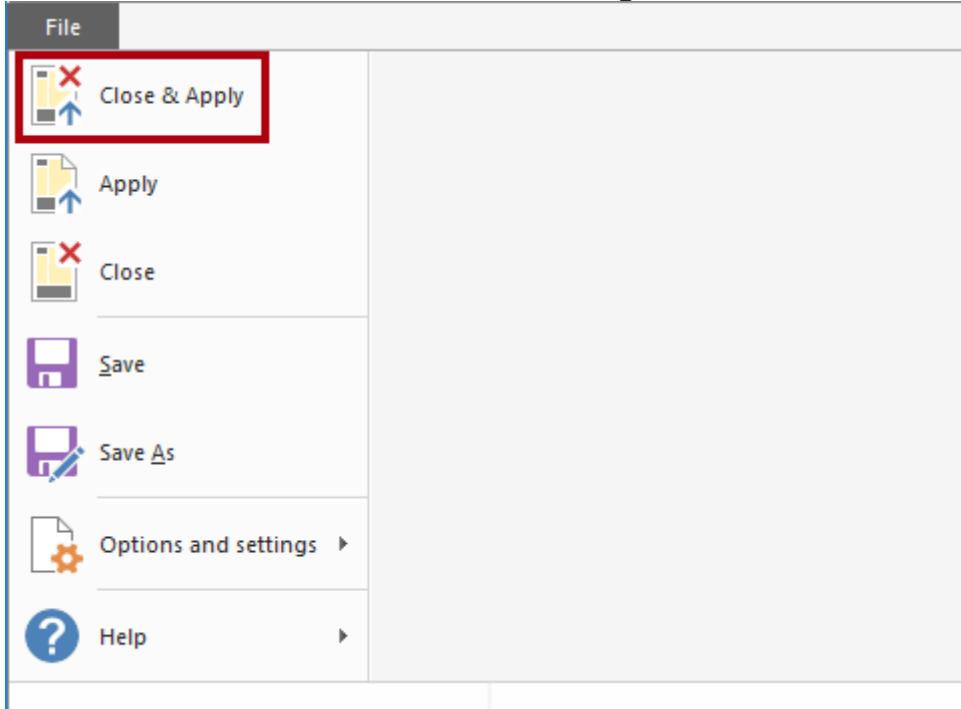


Finish up

In this task, you will complete the lab.

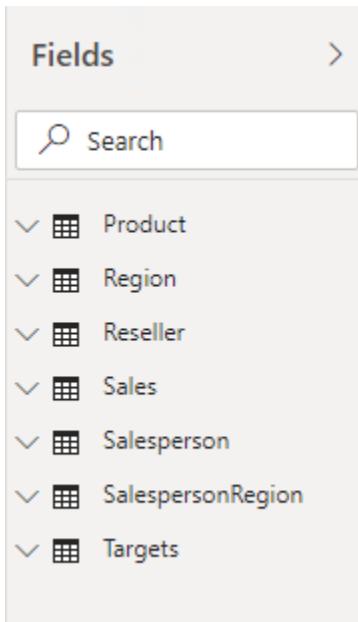
1. Verify that you have eight queries, correctly named as follows:
 - Salesperson
 - SalespersonRegion
 - Product
 - Reseller
 - Region
 - Sales
 - Target
 - ColorFormats (which will not load to the data model)

2. To load the data model, on the **File** backstage view, select **Close & Apply**.



All load-enabled queries are now loaded to the data model.

3. In the **Fields** pane (located at the right), notice the seven tables loaded to the data model.



4. Save the Power BI Desktop file.
5. Leave Power BI Desktop open.

In the next lab, you will configure data model tables and relationships.

Lab 04A - Data Modeling in Power BI Desktop

Overview

The estimated time to complete the lab is 45 minutes

In this lab, you will commence developing the data model. It will involve creating relationships between tables, and then configuring table and column properties to improve the friendliness and usability of the data model. You will also create hierarchies and create quick measures.

In this lab, you learn how to:

- Create model relationships
- Configure table and column properties
- Create hierarchies
- Create quick measures

Exercise 1: Create Model Relationships

In this exercise, you will create model relationships.

If you're not confident you completed the previous lab successfully, you can open the previous lab's solution file, which is found in the **D:\DA100\Lab03A\Solution** folder.

Task 1: Create model relationships

In this task, you will create model relationships.

1. In Power BI Desktop, at the left, click the **Model** view icon.



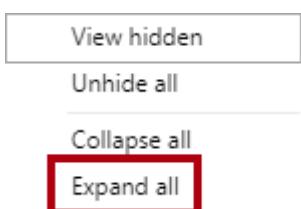
2. If you do not see all seven tables, scroll horizontally to the right, and then drag and arrange the tables more closely together so they can all be seen at the same time.

*In Model view, it's possible to view each table and relationships (connectors between tables). Presently, there are no relationships because in **Lab 02A**, you disabled the data load relationship options.*

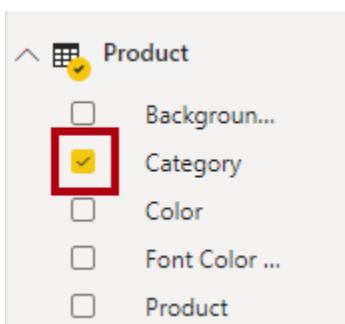
- To return to Report view, at the left, click the **Report** view icon.



- To view all table fields, in the **Fields** pane, right-click an empty area, and then select **Expand All**.



- To create a table visual, in the **Fields** pane, from inside the **Product** table, check the **Category** field.



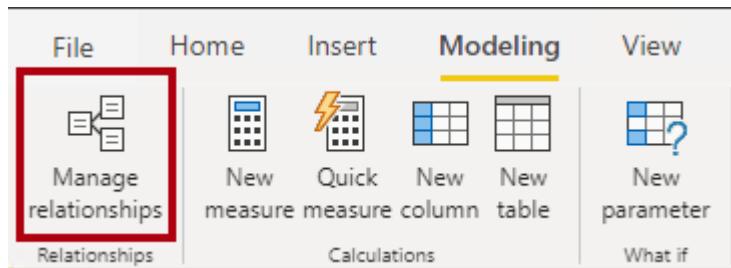
From now on, the labs will use a shorthand notation to reference a field. It will look like this: **Product | Category**.

- To add a column to the table, in the **Fields** pane, check the **Sales | Sales** field.
- Notice that the table visual lists four product categories, and that the sales value is the same for each, and the same for the total.

Category	Sales
Accessories	\$77,548,570.2
Bikes	\$77,548,570.2
Clothing	\$77,548,570.2
Components	\$77,548,570.2
Total	\$77,548,570.2

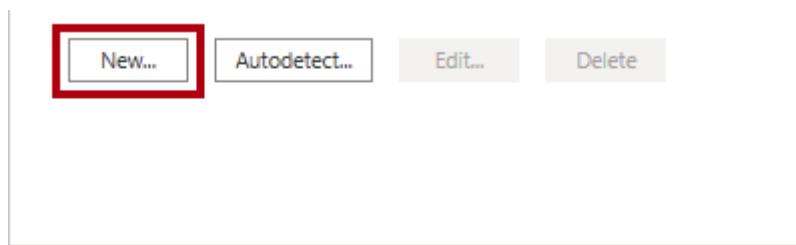
The issue is that the table is based on fields from different tables. The expectation is that each product category displays the sales for that category. However, because there isn't a model relationship between these tables, the **Sales** table is not filtered. You will now add a relationship to propagate filters between the tables.

8. On the **Modeling** ribbon tab, from inside the **Relationships** group, click **Manage Relationships**.

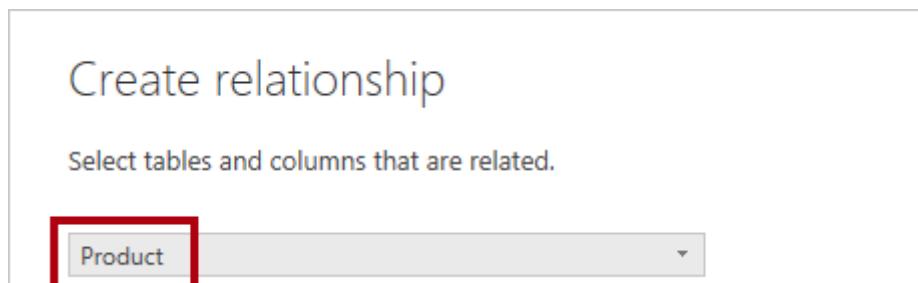


9. In the **Manage Relationships** window, notice that no relationships are yet defined.

10. To create a relationship, click **New**.



11. In the **Create Relationship** window, in the first dropdown list, select the **Product** table.



12. In the second dropdown list (beneath the **Product** table grid), select the **Sales** table.

Create relationship

Select tables and columns that are related.

Product							
ProductKey	Product	Standard Cost	Color	Subcategory	Category	Background Color Form	
210	HL Road Frame - Black, 58	\$868.63	Black	Road Frames	Components	#000000	
215	Sport-100 Helmet, Black	\$12.03	Black	Helmets	Accessories	#000000	
216	Sport-100 Helmet, Black	\$13.88	Black	Helmets	Accessories	#000000	

Sales	
-------	--

13. Notice the **ProductKey** columns in each table have been selected.

The columns were automatically selected because they share the same name.

14. In the **Cardinality** dropdown list, notice that **One To Many** is selected.

*The cardinality was automatically detected, because Power BI understands that the **ProductKey** column from the **Product** table contains unique values. One-to-many relationships are the most common cardinality, and all relationship you create in this lab will be this type. You will work with a Many-to-many cardinality in **Lab 05A**.*

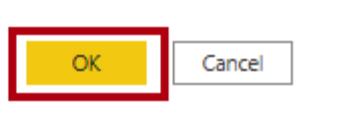
15. In the **Cross Filter Direction** dropdown list, notice that **Single** is selected.

*Single filter direction means that filters propagate from the "one side" to the "many side". In this case, it means filters applied to the **Product** table will propagate to the **Sales** table, but not in the other direction. You will work with a bi-directional relationship in **Lab 05A**.*

16. Notice that the **Mark This Relationship Active** is checked.

*Active relationships will propagate filters. It's possible to mark a relationship as inactive so filters don't propagate. Inactive relationships can exist when there are multiple relationship paths between tables. In which case, model calculations can use special functions to activate them. You'll work with an inactive relationship in **Lab 05A**.*

17. Click **OK**.



18. In the **Manage Relationships** window, notice that the new relationship is listed, and then click **Close**.

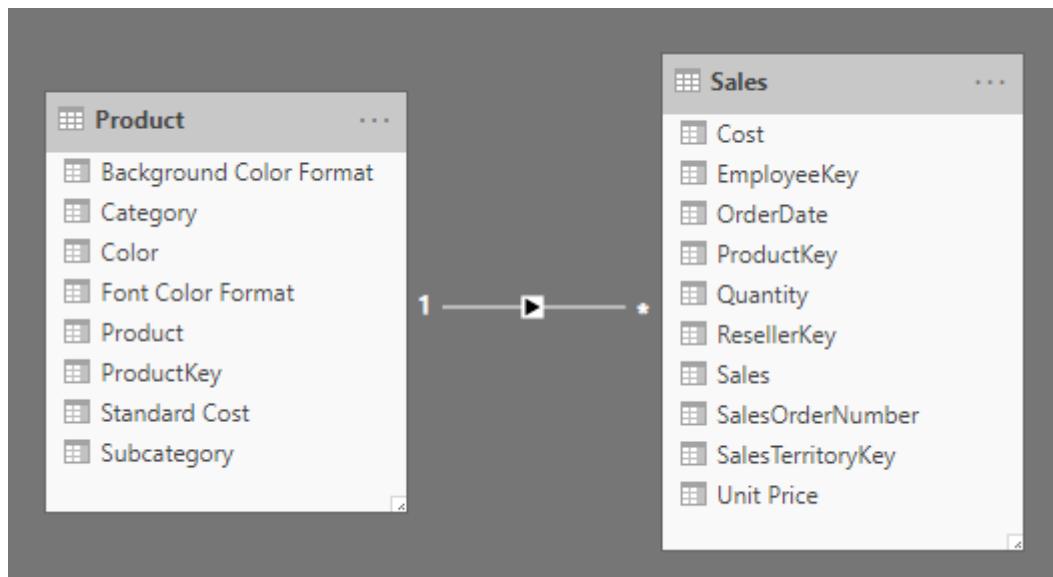


19. In the report, notice that the table visual has updated to display different values for each product category.

Category	Sales
Accessories	\$539,106.09
Bikes	\$64,069,033.16
Clothing	\$1,714,056.05
Components	\$11,226,374.9
Total	\$77,548,570.2

20. Filters applied to the **Product** table now propagate to the **Sales** table.

21. Switch to Model view, and then notice there is now a connector between the two tables.



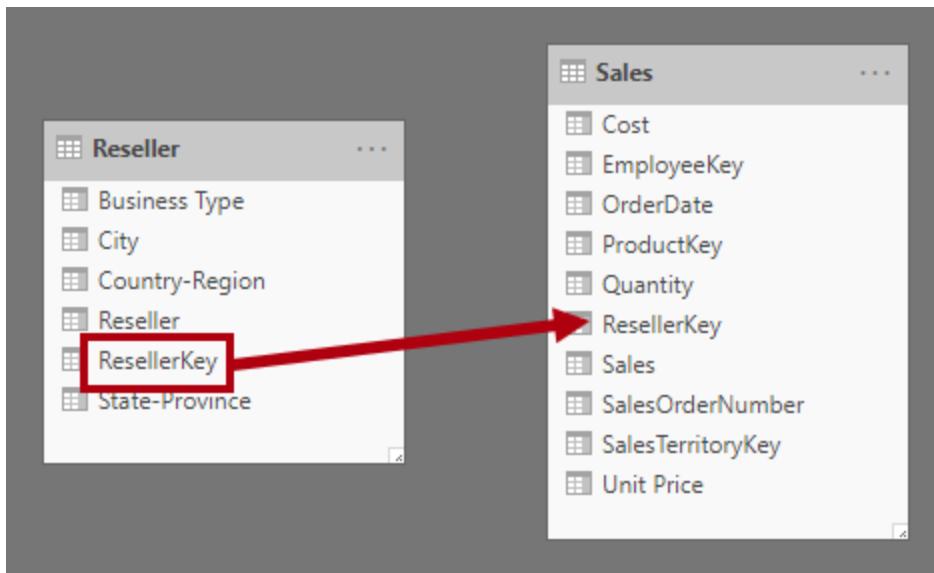
22. In the diagram, notice that you can interpret the cardinality which is represented by the **1** and ********* indicators.

Filter direction is represented by the arrow head. And, a solid line represents an active relationship; a dashed line represents an inactive relationship.

23. Hover the cursor over the relationship to reveal the related columns.

There's an easier way to create a relationship. In the model diagram, you can drag and drop columns to create a new relationship.

24. To create a new relationship, from the **Reseller** table, drag the **ResellerKey** column on to the **ResellerKey** column of the **Sales** table.



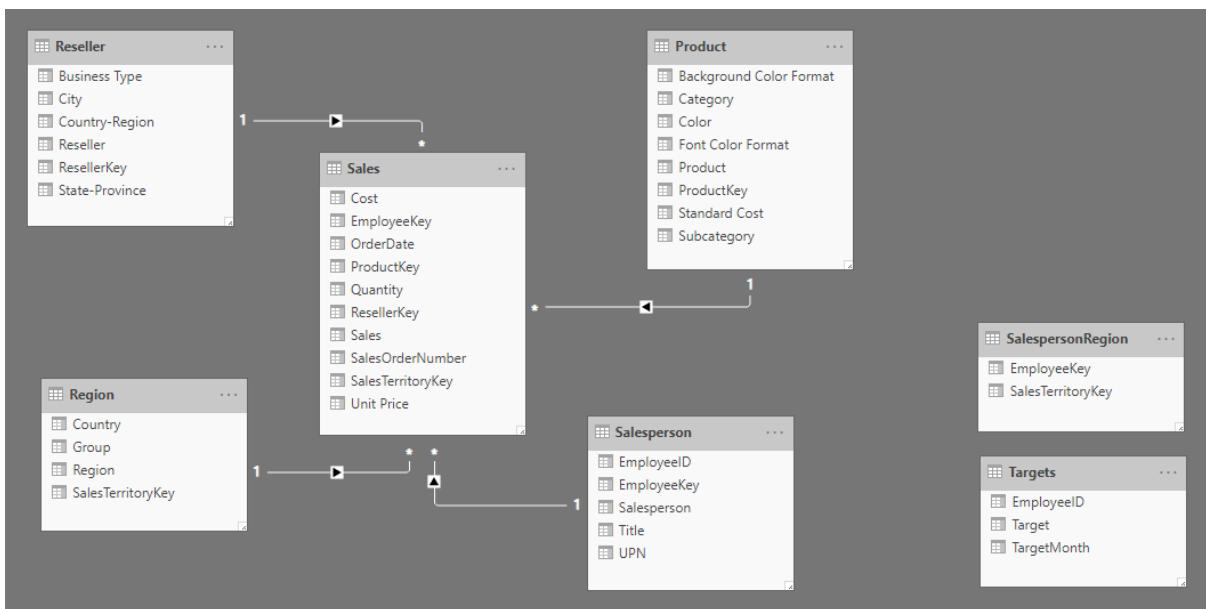
Tip: Sometime a column doesn't want to be dragged. If this situation arises, select a different column, and then select the column you intend to drag again, and try again.

25. Create the following two model relationships:

- **Region | SalesTerritoryKey** to **Sales | SalesTerritoryKey**
- **Salesperson | EmployeeKey** to **Sales | EmployeeKey**

*In this lab, the **SalespersonRegion** and **Targets** tables will remain disconnected. There's a many-to-many relationship between salespeople and regions, you will work this advanced scenario in the next lab.*

26. In the diagram, placing the tables with the **Sales** table in the center, and arranging the related tables about it.



27. Save the Power BI Desktop file.

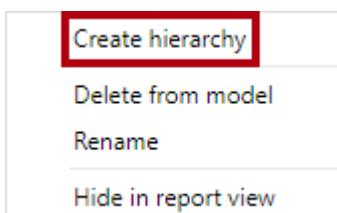
Exercise 2: Configure Tables

In this exercise, you will configure each table by creating hierarchies, and hiding, formatting, and categorizing columns.

Task 1: Configure the Product table

In this task, you will configure the **Product** table.

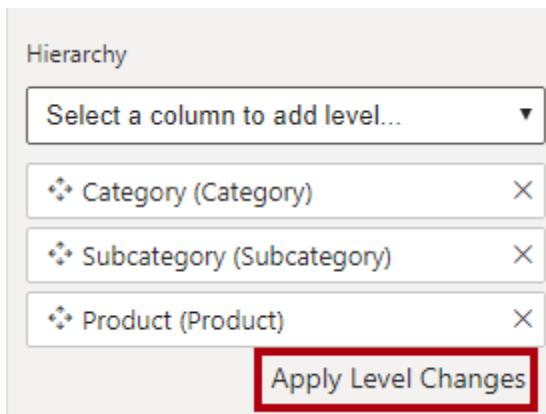
1. In Model view, in the **Fields** pane, if necessary, expand the **Product** table.
2. To create a hierarchy, in the **Fields** pane, right-click the **Category** column, and then select **Create Hierarchy**.



3. In the **Properties** pane (to the left of the **Fields** pane), in the **Name** box, replace the text with **Products**.

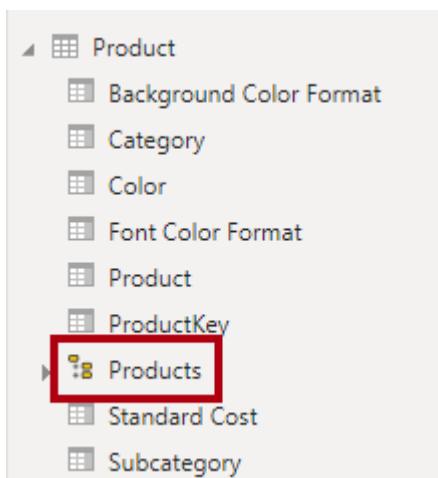


4. To add the second level to the hierarchy, in the **Hierarchy** dropdown list, select **Subcategory**.
5. To add the third level to the hierarchy, in the **Hierarchy** dropdown list, select **Product**.
6. To complete the hierarchy design, click **Apply Level Changes**.

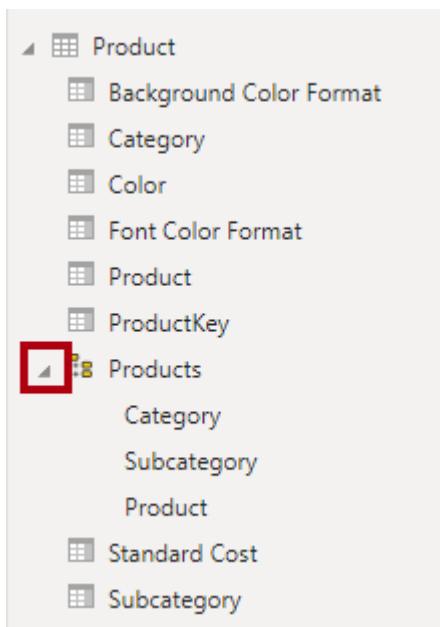


*Tip: Don't forget to click **Apply Level Changes**—it's a common mistake to overlook this step.*

7. In the **Fields** pane, notice the **Products** hierarchy.



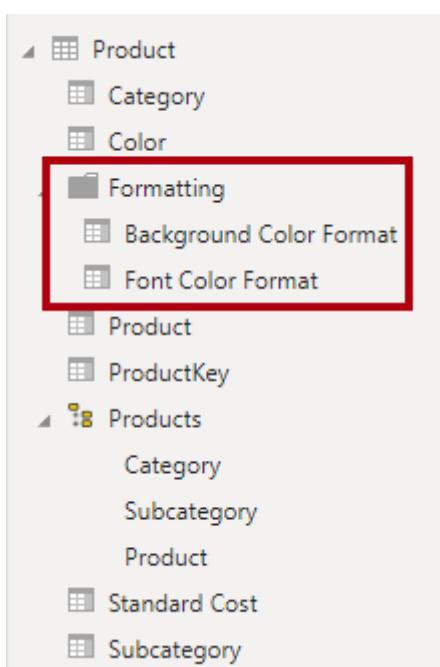
8. To reveal the hierarchy levels, expand the **Products** hierarchy.



9. To organize columns into a display folder, in the **Fields** pane, first select the **Background Color Format** column.
10. While pressing the **Ctrl** key, select the **Font Color Format**.
11. In the **Properties** pane, in the **Display Folder** box, enter **Formatting**.



12. In the **Fields** pane, notice that the two columns are now inside a folder.

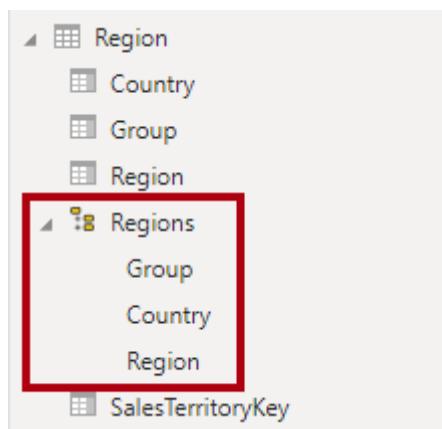


Display folders are a great way to declutter tables—especially those that contain lots of fields.

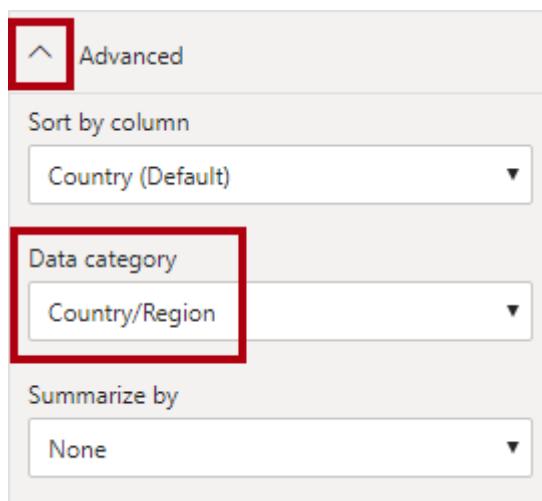
Task 2: Configure the Region table

In this task, you will configure the **Region** table.

1. In the **Region** table, create a hierarchy named **Regions**, with the following three levels:
 - o Group
 - o Country
 - o Region



2. Select the **Country** column (not the **Country** level).
3. In the **Properties** pane, expand the **Advanced** section, and then in the **Data Category** dropdown list, select **Country/Region**.

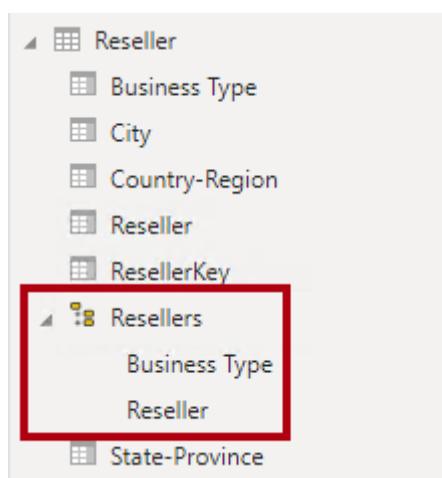


Data categorization can provide hints to the report designer. In this case, categorizing the column as country or region, provides more accurate information when rendering a map visualization.

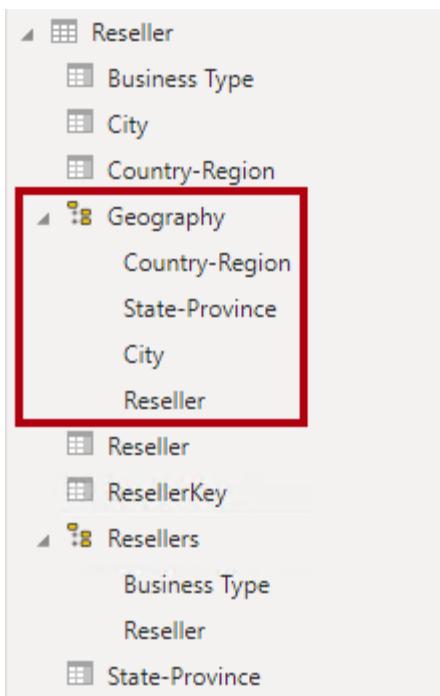
Task 3: Configure the Reseller table

In this task, you will configure the **Reseller** table.

1. In the **Reseller** table, create a hierarchy named **Resellers**, with the following two levels:
 - o Business Type
 - o Reseller



2. Create a second hierarchy named **Geography**, with the following four levels:
 - o Country-Region
 - o State-Province
 - o City
 - o Reseller



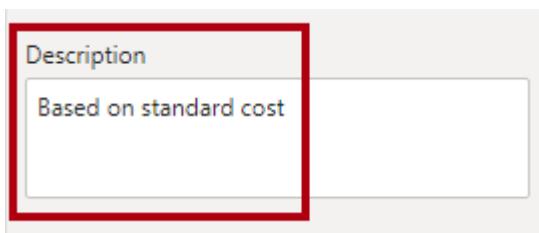
- Categorize the following three columns:

- Country-Region** as **Country/Region**
- State-Province** as **State or Province**
- City** as **City**

Task 4: Configure the Sales table

In this task, you will configure the **Sales** table.

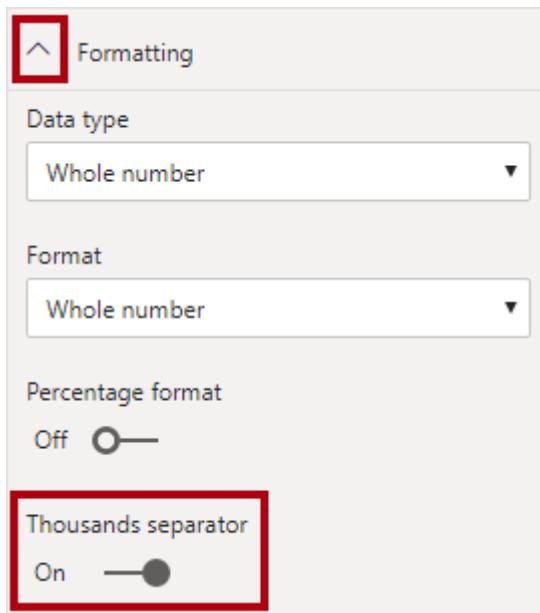
- In the **Sales** table, select the **Cost** column.
- In the **Properties** pane, in the **Description** box, enter: **Based on standard cost**



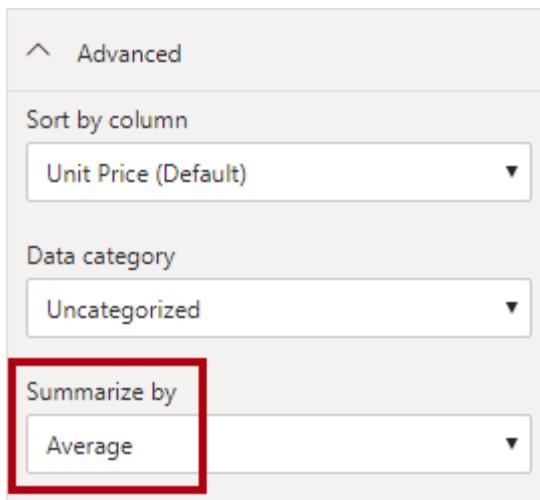
*Descriptions can be applied to table, columns, hierarchies, or measures. In the **Fields** pane, description text is revealed in a tooltip when a report author hovers their cursor over the field.*

- Select the **Quantity** column.

- In the **Properties** pane, from inside the **Formatting** section, slide the **Thousands Separator** property to **On**.



- Select the **Unit Price** column.
- In the **Properties** pane, from inside the **Formatting** section, slide the **Decimal Places** property to **2**.
- In the **Advanced** group (you may need to scroll down to locate it), in the **Summarize By** dropdown list, select **Average**.



*By default, numeric columns will summarize by summing values together. This default behavior is not suitable for a column like **Unit Price**, which represents a rate. Setting the default summarization to average will produce a useful and accurate result.*

Task 5: Bulk update properties

In this task, you will update multiple columns in a single bulk update. You will use this approach to hide columns, and format column values.

1. While pressing the **Ctrl** key, select the following 13 columns (spanning multiple tables):
 - Product | ProductKey
 - Region | SalesTerritoryKey
 - Reseller | ResellerKey
 - Sales | EmployeeKey
 - Sales | ResellerKey
 - Sales | SalesOrderNumber
 - Sales | SalesTerritoryKey
 - Salesperson | EmployeeID
 - Salesperson | EmployeeKey
 - Salesperson | UPN
 - SalespersonRegion | EmployeeKey
 - SalespersonRegion | SalesTerritoryKey
 - Targets | EmployeeID
2. In the **Properties** pane, slide the **Is Hidden** property to **On**.



The columns were hidden because they are either used by relationships or will be used in row-level security configuration or calculation logic.

*You will define row-level security in the next lab using the **UPN** column. You will use the **SalesOrderNumber** in a calculation in **Lab 06A**.*

3. Multi-select the following columns:

- Product | Standard Cost
- Sales | Cost

- Sales | Sales
4. In the **Properties** pane, from inside the **Formatting** section, set the **Decimal Places** property to **0** (zero).



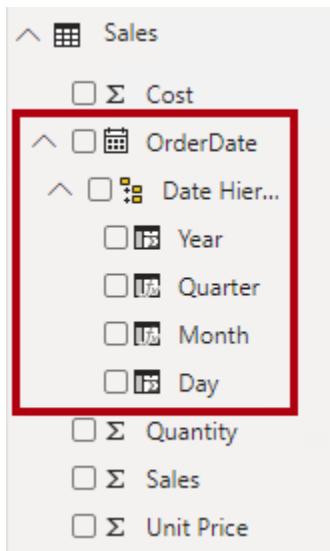
Exercise 3: Review the Model Interface

In this exercise, you will switch to Report view, and review the model interface.

Task 1: Review the model interface

In this task, you will switch to Report view, and review the model interface.

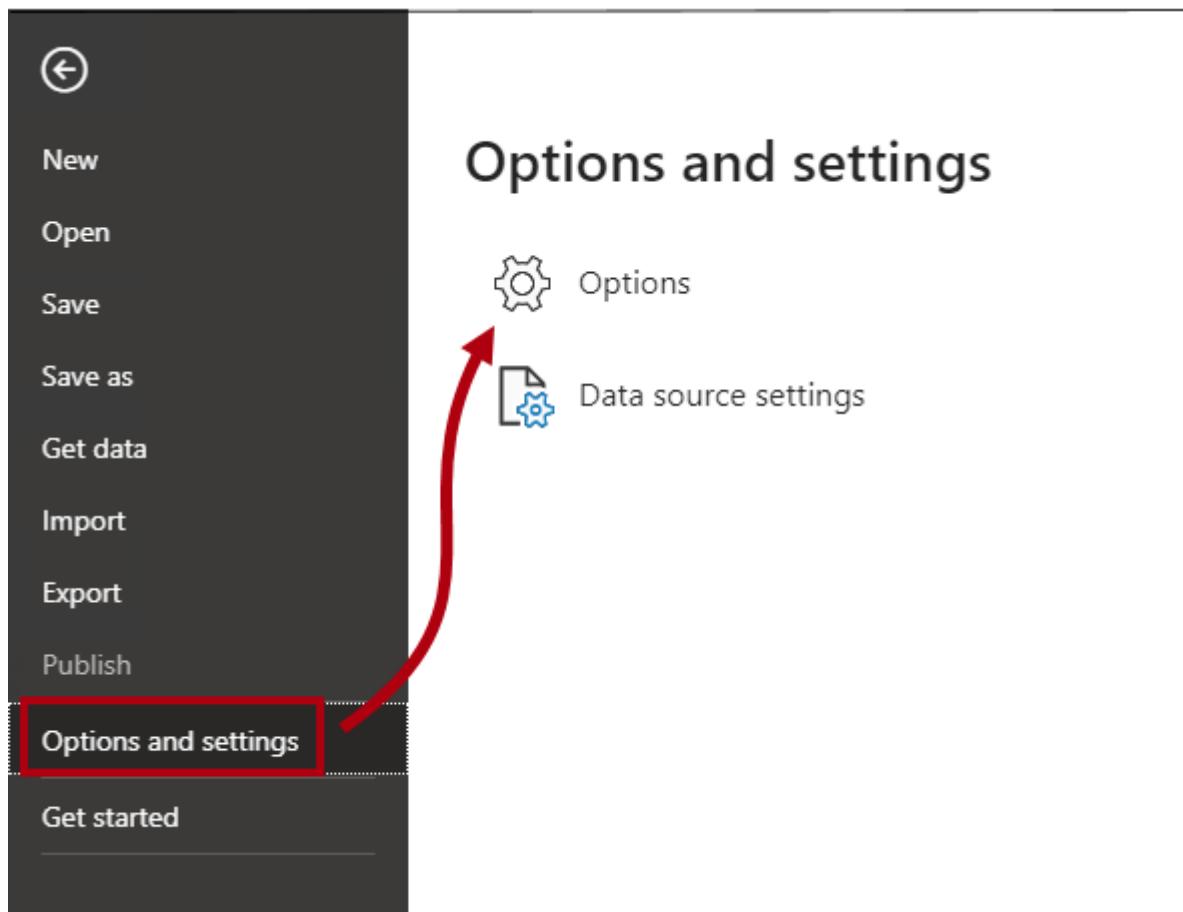
1. Switch to Report view.
2. In the **Fields** pane, notice the following:
 - Columns, hierarchies and their levels are fields, which can be used to configure report visuals
 - Only fields relevant to report authoring are visible
 - The **SalespersonRegion** table is not visible—because all of its fields are hidden
 - Spatial fields in the **Region** and **Reseller** table are adorned with a spatial icon
 - Fields adorned with the sigma symbol (Σ) will summarize, by default
 - A tooltip appears when hovering the cursor over the **Sales | Cost** field
3. Expand the **Sales | OrderDate** field, and then notice that it reveals a date hierarchy.



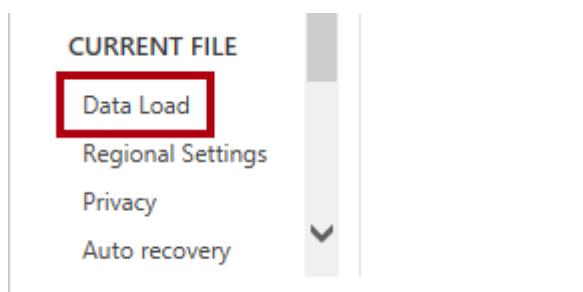
The **Targets | TargetMonth** presents the same hierarchy. These hierarchies were not created by you. They are created automatically. There is a problem, however. The Adventure Works financial year commences on July 1 of each year. But, the date hierarchy year commences on January 1 of each year.

You will now turn this automatic behavior off. In **Lab 06A**, you will use DAX to create a date table, and configure it define the Adventure Works' calendar.

4. To turn off auto/date time, click the **File** ribbon tab to open the backstage view.
5. At the left, select **Options and Settings**, and then select **Options**.



6. In the **Options** window, at the left, in the **Current File** group, select **Data Load**.



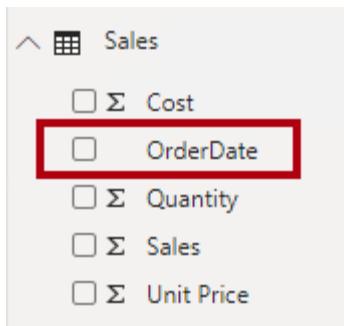
7. In the **Time Intelligence** section, uncheck **Auto Date/Time**.



8. Click **OK**.



9. In the **Fields** pane, notice that the date hierarchies are no longer available.



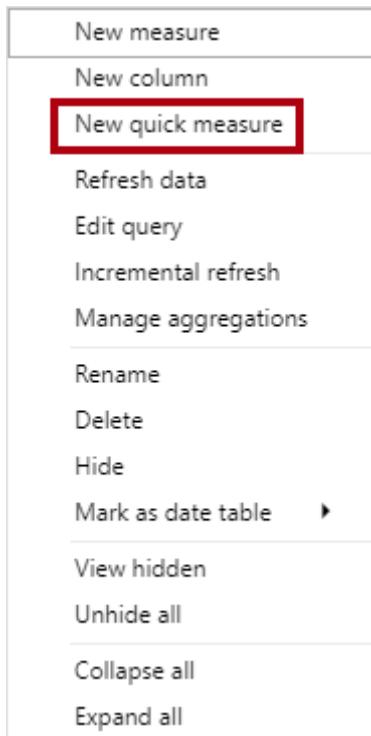
Exercise 4: Create Quick Measures

In this exercise, you will create two quick measures.

Task 1: Create quick measures

In this task, you will create two quick measures to calculate profit and profit margin.

1. In the **Fields** pane, right-click the **Sales** table, and then select **New Quick Measure**.



2. In the **Quick Measures** window, in the **Calculation** dropdown list, from inside the **Mathematical Operations** group, select **Subtraction**.

Quick measures

Calculation

Select a calculation ▾

- Quarter-to-date total
- Month-to-date total
- Year-over-year change
- Quarter-over-quarter change
- Month-over-month change
- Rolling average
- Totals**
- Running total
- Total for category (filters applied)
- Total for category (filters not applied)
- Mathematical operations**
- Addition
- Subtraction**
- Multiplication
- Division
- Percentage difference
- Correlation coefficient
- Text**
- Star rating
- Concatenated list of values

3. In the **Fields** pane, expand the **Sales** table.
4. Drag the **Sales** field into the **Base Value** box.
5. Drag the **Cost** field into the **Value to Subtract** box.

Quick measures

Calculation

Subtraction ▾

Calculate the difference between two values.
[Learn more](#)

Base value ⓘ

Sum of Sales ▾ ✖

Value to subtract ⓘ

Sum of Cost ▾ ✖

6. Click **OK**.



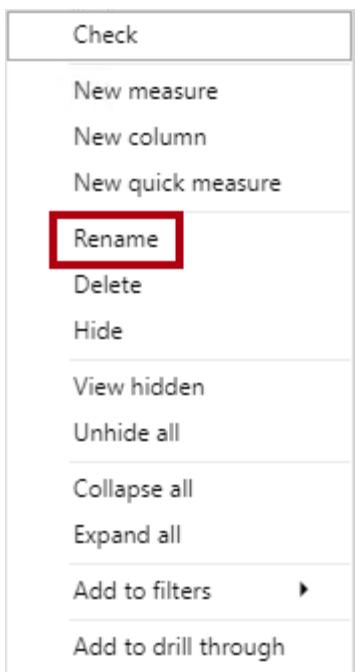
A quick measure creates the calculation for you. They're easy and fast to create for simple and common calculations. You'll create measures without this tool using the formula language in **Lab 06A**.

7. In the **Fields** pane, inside the **Sales** table, notice that new measure.

- Cost
- OrderDate
- Quantity
- Sales
- Sales minus...**
- Unit Price

Measures are adorned with the calculator icon.

8. To rename the measure, right-click it, and then select **Rename**.



*Tip: To rename a field, you can also double-click it, or select it and press **F2**.*

9. Rename the measure to **Profit**, and then press **Enter**.
10. In the **Sales** table, add a second quick measure, based on the following requirements:
 - o Use the **Division** mathematical operation
 - o Set the **Numerator** to the **Sales | Profit** field
 - o Set the **Denominator** to **Sales | Sales** field
 - o Rename the measure as **Profit Margin**

Quick measures

Calculation

Division ▾

Calculate the ratio of a value to another one.
[Learn more](#)

Numerator ⓘ
Profit ×

Denominator ⓘ
Sum of Sales ▼ ×

^ Sales

- Σ Cost
- OrderDate
- Profit
- Profit Margin
- Σ Quantity
- Σ Sales
- Σ Unit Price

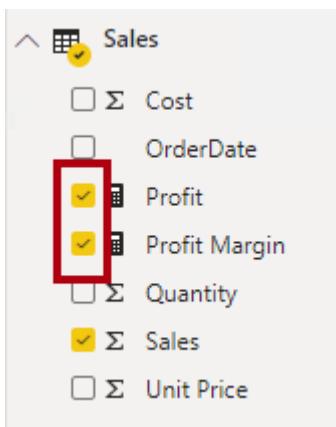
11. Ensure the **Profit Margin** measure is selected, and then on the **Measure Tools** contextual ribbon, set the format to **Percentage**, with two decimal places.

Name	Profit Margin
Home table	Sales
Structure	
Formatting	
\$% 2	

The 'Formatting' section shows the current measure format as '\$% 2'. A red box highlights the percentage symbol '%'. Another red box highlights the digit '2' in the decimal places dropdown, indicating it needs to be changed to '00'.

12. To test the two measures, first select the table visual on the report page.

13. In the **Fields** pane, check the two measures.



14. Click and drag the right guide to widen the table visual.

Category	Sales	Profit	Pr
Accessories	\$539,106	\$188,081	
Bikes	\$64,069,033	(\$435,679)	
Clothing	\$1,714,056	\$245,857	
Components	\$11,226,375	\$1,001,235	
Total	\$77,548,570	\$999,495	

15. Verify that the measures produce reasonable result that are correctly formatted.

Category	Sales	Profit	Profit Margin
Accessories	\$539,106	\$188,081	34.89 %
Bikes	\$64,069,033	(\$435,679)	-0.68 %
Clothing	\$1,714,056	\$245,857	14.34 %
Components	\$11,226,375	\$1,001,235	8.92 %
Total	\$77,548,570	\$999,495	1.29 %

Finish up

In this task, you will complete the lab.

1. To remove the table, select the table (by clicking it), and then press the **Delete** key.
2. Save the Power BI Desktop file.

In the next lab, you will enhance the data model by configuring a many-to-many relationship, and row-level security.

Lab 05A - Advanced Data Modeling in Power BI Desktop

Overview

The estimated time to complete the lab is 45 minutes

In this lab, you will create a many-to-many relationship between the **Salesperson** table and the **Sales** table. You will also enforce row-level security to ensure that a salesperson can only analyze sales data for their assigned region(s).

In this lab, you learn how to:

- Configure many-to-many relationships
- Enforce row-level security

Exercise 1: Create a Many-to many Relationship

In this exercise, you will create a many-to-many relationship between the **Salesperson** table and the **Sales** table.

If you're not confident you completed the previous lab successfully, you can open the previous lab's solution file, which is found in the **D:\DA100\Lab04A\Solution** folder.

Task 1: Create a many-to-many relationship

In this task, you will create a many-to-many relationship between the **Salesperson** table and the **Sales** table.

1. In Power BI Desktop, in Report view, in the **Fields** pane, check the follow two fields to create a table visual:
 - Salesperson | Salesperson
 - Sales | Sales

Salesperson	Sales
Amy Alberts	\$737,568
David Campbell	\$3,614,761
Garrett Vargas	\$3,486,102
Jae Pak	\$8,099,817
Jillian Carson	\$9,755,992
José Saraiva	\$5,536,439
Linda Mitchell	\$10,158,635
Lynn Tsolfias	\$1,216,917
Michael Blythe	\$8,952,751
Pamela Anzman-Wolfe	\$3,187,720
Rachel Valdez	\$1,681,208
Total	\$77,548,570

The table displays sales made by each salesperson. However, there is another relationship between salespeople and sales. Some salespeople belong to one, two, or possibly more sales regions. In addition, sales regions can have multiple salespeople assigned to them.

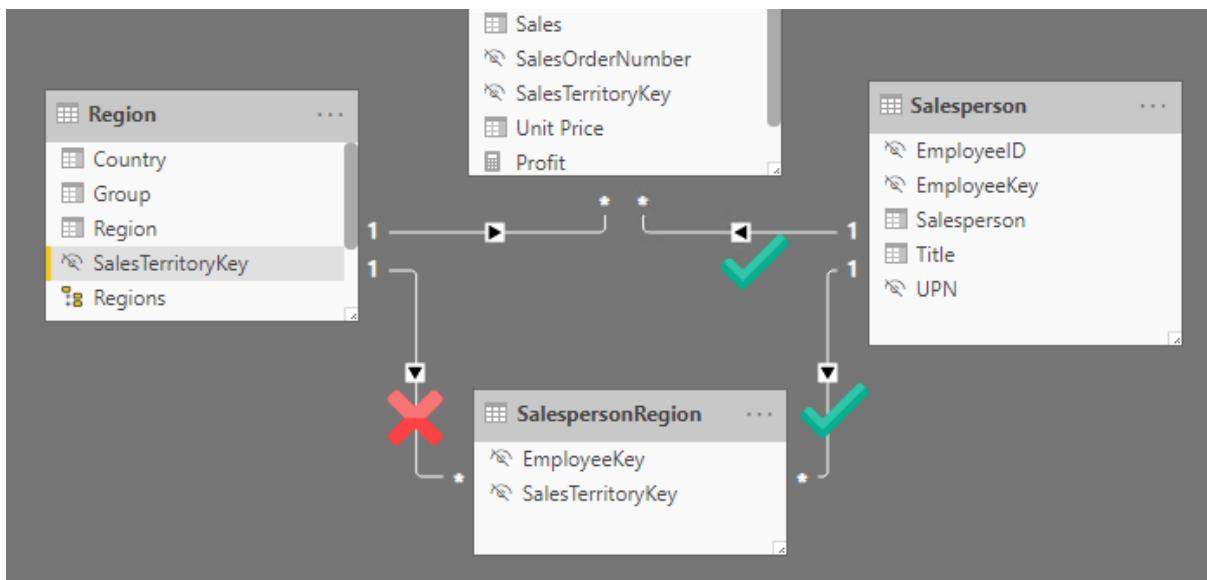
From a performance management perspective, a salesperson's sales (based on their assigned territories) need to be analyzed and compared with sales targets. In this exercise, you will create relationships to support this analysis.

2. Notice that Michael Blythe has sold almost \$9 million.
3. Switch to Model view.
4. Use the drag-and-drop technique to create the following two model relationships:
 - o **Salesperson | EmployeeKey** to **SalespersonRegion | EmployeeKey**
 - o **Region | SalesTerritoryKey** to **SalespersonRegion | SalesTerritoryKey**

The **SalespersonRegion** table can be considered to be a bridging table.

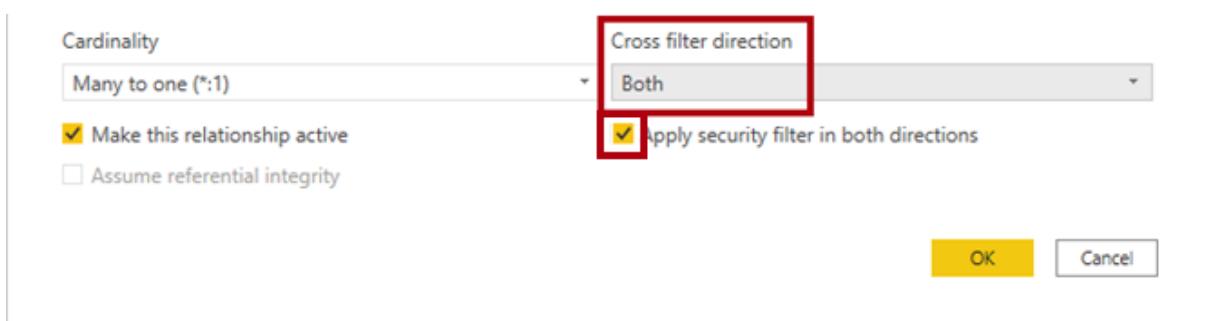
5. Switch to Report view, and then notice that the visual has not updated—the sales result for Michael Blythe has not changed.
6. Switch back to Model view, and then follow the relationship filter directions (arrowhead) from the **Salesperson** table.

Consider this: the **Salesperson** table filters the **Sales** table. It also filters the **SalespersonRegion** table, but it does not continue to propagate to the **Region** table (the arrowhead is pointing the wrong way).



7. To edit the relationship between the **Region** and **SalespersonRegion** tables, double-click the relationship.
8. In the **Edit Relationship** window, in the **Cross Filter Direction** dropdown list, select **Both**.
9. Check the **Apply Security Filter in Both Directions** checkbox.

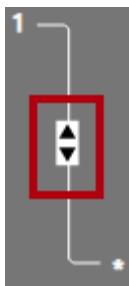
This setting will ensure that bi-directional filtering is applied when row-level security is being enforced. You will configure a security role in the next exercise.



10. Click **OK**.



11. Notice that the relationship has a double arrowhead.



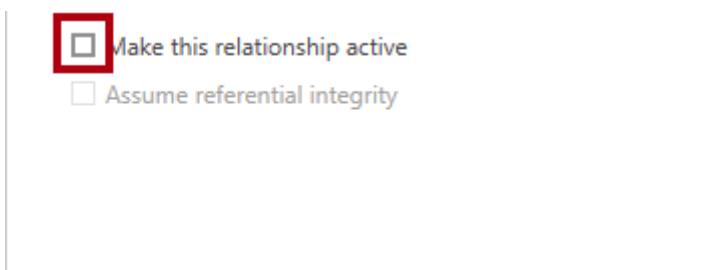
12. Switch to Report view, and then notice that the sales values have not changed.

*The issue now relates to the fact that there are two possible filter propagation paths between the **Salesperson** and **Sales** tables. This ambiguity is internally resolved, based on a “least number of tables” assessment. To be clear, you should not design models with this type of ambiguity—it will be addressed in part in this lab, and by the next lab.*

13. Switch to Model view.

14. To force filter propagation via the bridging table, double-click the relationship between the **Salesperson** and **Sales** tables.

15. In the **Edit Relationship** window, uncheck the **Make This Relationship Active** checkbox.



16. Click **OK**.



The filter propagation is now forced to take the only active path.

17. In the diagram, notice that the inactive relationship is represented by a dashed line.



18. Switch to Report view, and then notice that the sales for Michael Blythe is now nearly \$22 million.

Salesperson	Sales
Amy Alberts	\$10,288,626
Brian Welcker	\$77,548,570
David Campbell	\$12,004,822
Garrett Vargas	\$13,875,633
Jae Pak	\$8,410,883
Jillian Carson	\$7,633,387
José Saraiva	\$13,875,633
Linda Mitchell	\$25,634,503
Lynn Tsolfias	\$1,391,025
Michael Blythe	\$21,987,348
Pamela Ansman-Wolfe	\$30,005,939
Total	\$77,548,570

19. Notice also, that the sales for each salesperson—if added—would exceed the total.

This observation is a many-to-many relationships, due to the double, triple, etc. counting of regional sales results. Consider Brian Welcker, the second salesperson listed. His sales amount equals the total sales amount. It's the correct result simply due to the fact he's the Director of Sales; his sales are measured by the sales of all regions.

While the many-to-many relationship is now working, it's now not possible to analyze sales made by a salesperson (the relationship is inactive). In the next lab, you'll introduce a calculated table that will represent salesperson for performance analysis (of their regions).

20. Switch to Modeling view, and then in the diagram, select the **Salesperson** table.

21. In the **Properties** pane, in the **Name** box, replace the text with **Salesperson (Performance)**.

The renamed table now reflects its purpose: it is used to report and analyze the performance of salespeople based on the sales of their assigned sales regions.

Task 2: Relate the Targets table

In this task, you will create a relationship to the **Targets** table

1. Create a relationship from the **Salesperson (Performance) | EmployeeID** column and the **Targets | EmployeeID** column.
2. In Report view, add the **Targets | Target** field to the table visual.

Widen the table visual to reveal all data.

Salesperson	Sales	Target
Amy Alberts	\$10,288,626	\$19,450,000
Brian Welcker	\$77,548,570	\$221,700,000
David Campbell	\$12,004,822	\$19,625,000
Garrett Vargas	\$13,875,633	\$23,675,000
Jae Pak	\$8,410,883	\$13,575,000
Jillian Carson	\$7,633,387	\$13,675,000
José Saraiva	\$13,875,633	\$18,875,000
Linda Mitchell	\$25,634,503	\$40,850,000
Lynn Tsoflias	\$1,391,025	\$3,210,000
Michael Blythe	\$21,987,348	\$31,150,000
Pamela Ansman-Wolfe	\$30,005,939	\$53,850,000
Total	\$77,548,570	\$676,210,000

- It's now possible to visualize sales and targets—but take care, for two reasons. First, there is no filter on a time period, and so targets also include future target values. Second, targets are not additive, and so the total should not be displayed. They can either be disabled by using a visual formatting property or removed by using calculation logic. You'll write a target measure in **Lab 06B** that will return BLANK when more than one salesperson is filtered.

Exercise 2: Enforce row-level security

In this exercise, you will enforce row-level security to ensure a salesperson can only ever see sales made in their assigned region(s).

Task 1: Enforce row-level security

In this task, you will enforce row-level security to ensure a salesperson can only ever see sales made in their assigned region(s).

- Switch to Data view.



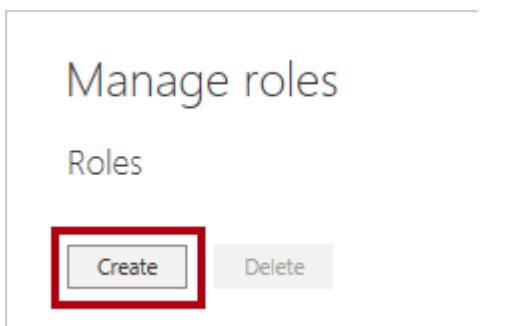
- In the **Fields** pane, select the **Salesperson (Performance)** table.
- Review the data, noticing that Michael Blythe (EmployeeKey 281) has been assigned your Power BI account (**UPN** column).

Recall that Michael Blythe is assigned to three sales regions: US Northeast, US Central, and US Southeast.

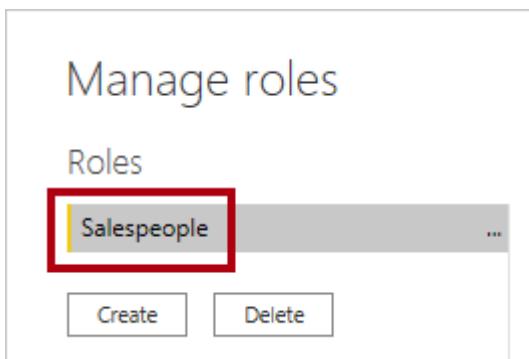
4. Switch to Report view.
5. On the **Modeling** ribbon tab, from inside the **Security** group, click **Manage Roles**.



6. In the **Manage Roles** window, click **Create**.



7. In the box, replace the selected text with the name of the role: **Salespeople**, and then press **Enter**.



8. To assign a filter, for the **Salesperson (Performance)** table, click the ellipsis (...) character, and then select **Add Filter | [UPN]**.

The screenshot shows the Power BI Data View interface. On the left, there's a list of tables: Product, Region, Reseller, Sales, Salesperson (Performance), SalespersonRegion, Targets. The 'Salesperson (Performance)' table is selected and highlighted with a yellow border. A context menu is open over this table, with the 'Add filter...' option highlighted. To the right, the 'Table filter DAX expression' pane is visible, containing the expression '[UPN]'. There are also other options like 'Copy table filter from...', 'Clear table filter', and a list of columns: [EmployeeKey], [EmployeeID], [Salesperson], [Title], and [UPN]. A checkmark icon is at the top right of the pane.

9. In the **Table Filter DAX Expression** box, modify the expression by replacing “**Value**” with **USERNAME()**.

The screenshot shows the 'Table filter DAX expression' dialog box. It contains the expression '[UPN] = USERNAME()'. The 'USERNAME()' part of the expression is highlighted with a red box.

*USERNAME() is a Data Analysis Expressions (DAX) function that retrieves the authenticated user. This means that the **Salesperson (Performance)** table will filter by the User Principal Name (UPN) of the user querying the model.*

10. Click **Save**.



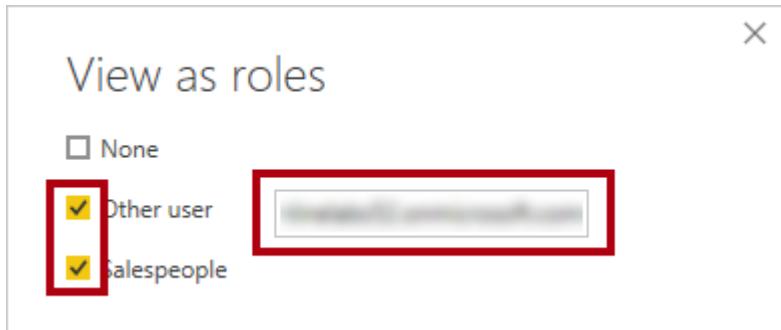
11. To test the security role, on the **Modeling** ribbon tab, from inside the **Security** group, click **View As**.



12. In the **View as Roles** window, check the **Other User** item, and then in the corresponding box, enter your account name.

*Tip: You can copy it from the **MySettings.txt** file.*

13. Check the **Salespeople** role.



*This configuration results in using the **Salespeople** role and impersonating the user with your account name.*

14. Click **OK**.



15. Notice the yellow banner above the report page, describing the test security context.



16. In the table visual, notice that only the salesperson **Michael Blythe** is listed.

Salesperson	Sales	Target
Michael Blythe	\$21,987,348	\$31,150,000
Total	\$21,987,348	\$31,150,000

17. To stop testing, at the right of the yellow banner, click **Stop Viewing**.



*When the Power BI Desktop file is published to the Power BI service, there will be a post-publication task to map security principals to the **Salespeople** role. You will do this in **Lab 06B**.*

Finish up

In this task, you will complete the lab.

1. Save the Power BI Desktop file.
2. Leave Power BI Desktop open.

In the next lab, you will enhance the data model with calculations using DAX.

Lab 06A - Using DAX in Power BI Desktop, Part 1

Overview

The estimated time to complete the lab is 45 minutes

In this lab, you will create calculated tables, calculated columns, and simple measures using Data Analysis Expressions (DAX).

In this lab, you learn how to:

- Create calculated tables
- Create calculated columns
- Create measures

Exercise 1: Create Calculated Tables

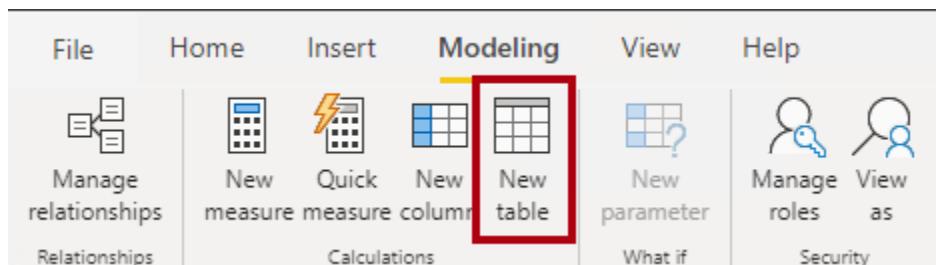
In this exercise, you will create two calculated tables. The first will be the **Salesperson** table, to allow a direct relationship between it and the **Sales** table. The second will be the **Date** table.

If you're not confident you completed the previous lab successfully, you can open the previous lab's solution file, which is found in the **D:\DA100\Lab05A\Solution** folder.

Task 1: Create the Salesperson table

In this task, you will create the **Salesperson** table (direct relationship to **Sales**).

1. In Power BI Desktop, in Report view, on the **Modeling** ribbon, from inside the **Calculations** group, click **New Table**.



2. In the formula bar (which opens directly beneath the ribbon when creating or editing calculations), type **Salesperson** =, press **Shift+Enter**, type '**Salesperson (Performance)**', and then press **Enter**.



For your convenience, all DAX definitions in this lab can be copied from the **D:\DA100\Lab06A\Assets\Snippets.txt** file.

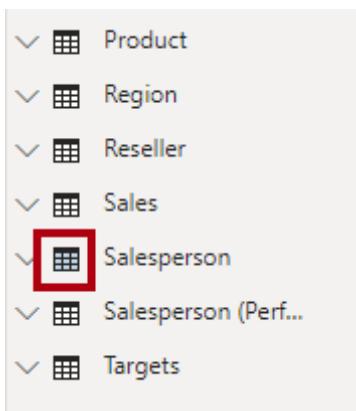
A calculated table is created by first entering the table name, followed by the equals symbol (=), followed by a DAX formula that returns a table. The table name cannot already exist in the data model.

The formula bar supports entering a valid DAX formula. It includes features like auto-complete, Intellisense and color-coding, enabling you to quickly and accurately enter the formula.

This table definition creates a copy of the **Salesperson (Performance)** table. It copies the data only, however properties like visibility, formatting, etc. are not copied.

Tip: You are encouraged to enter “white space” (i.e. carriage returns and tabs) to layout formulas in an intuitive and easy-to-read format—especially when formulas are long and complex. To enter a carriage return, press **Shift+Enter**. “White space” is optional.

3. In the **Fields** pane, notice that the table icon is a shade of blue (denoting a calculated table).



Calculated tables are defined by using a DAX formula which returns a table. It is important to understand that calculated tables increase the size of the data model because they materialize and store values. They are recomputed whenever formula dependencies are refreshed, as will be the case in this data model when new (future) date values are loaded into tables.

Unlike Power Query-sourced tables, calculated tables cannot be used to load data from external data sources. They can only transform data based on what has already been loaded into the data model.

4. Switch to Model view.
5. Notice that the **Salesperson** table is available (take care, it might be hidden from view—scroll horizontally to locate it).

6. Create a relationship from the **Salesperson | EmployeeKey** column to the **Sales | EmployeeKey** column.
7. Right-click the inactive relationship between the **Salesperson (Performance)** and **Sales** tables, and then select **Delete**.



8. When prompted to confirm the deletion, click **Delete**.



9. In the Salesperson table, multi-select the following columns, and then hide them:
 - EmployeeID
 - EmployeeKey
 - UPN
10. In the diagram, select the **Salesperson** table.

11. In the **Properties** pane, in the **Description** box, enter: **Salesperson related to s sale**

*Recall that description appear as tooltips in the **Fields** pane when the user hovers their cursor over a table or field.*

12. For the **Salesperson (Performance)** table, set the description to: **Salesperson related to region(s)**

*The data model now provides to alternatives when analyzing salespeople.
The **Salesperson** table allows analyzing sales made by a salesperson, while
the **Salesperson (Performance)** table allows analyzing sales made in the sales
region(s) assigned to the salesperson.*

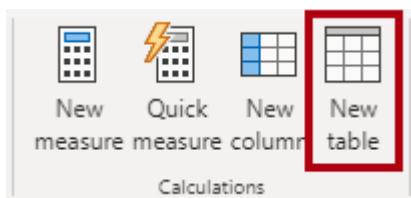
Task 2: Create the Date table

In this task, you will create the **Date** table.

1. Switch to Data view.



2. On the **Home** ribbon tab, from inside the **Calculations** group, click **New Table**.



3. In the formula bar, enter the following:

DAX

```
Date =  
CALENDARAUTO(6)
```



The `CALENDARAUTO()` function returns a single-column table consisting of date values. The "auto" behavior scans all data model date columns to determine the earliest and latest date values stored in the data model. It then creates one row for each date within this range, extending the range in either direction to ensure full years of data is stored.

This function can take a single optional argument which is the last month number of a year. When omitted, the value is 12, meaning that December is the last month of the year. In this case 6 is entered, meaning that June is the last month of the year.

4. Notice the column of date values.

If the column does not appear, in the **Fields** pane, select a different table, and then select the **Date** table.

Date
07/01/2017 00:00:00
07/02/2017 00:00:00
07/03/2017 00:00:00
07/04/2017 00:00:00
07/05/2017 00:00:00
07/06/2017 00:00:00

The dates shown are formatted using US regional settings (i.e. mm/dd/yyyy).

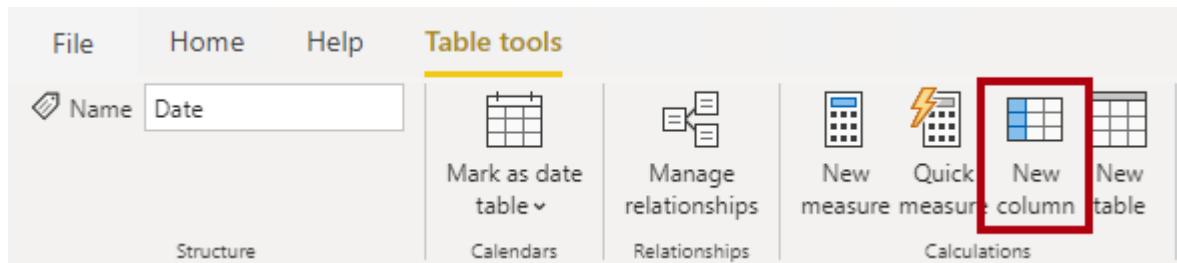
- At the bottom-left corner, in the status bar, notice the table statistics, confirming that 1826 rows of data have been generated, which represents five full years' data.

TABLE: Date (1,826 rows)

Task 3: Create calculated columns

In this task, you will add additional columns to enable filtering and grouping by different time periods. You will also create a calculated column to control the sort order of other columns.

- On the **Table Tools** contextual ribbon, from inside the **Calculations** group, click **New Column**.



- In the formula bar, type the following, and then press **Enter**:

DAX

Year =

```
"FY" & YEAR('Date'[Date]) + IF(MONTH('Date'[Date]) > 6, 1)
```

A calculated column is created by first entering the column name, followed by the equals symbol (=), followed by a DAX formula that returns a single-value result. The column name cannot already exist in the table.

The formula uses the date's year value but adds one to the year value when the month is after June. This is how fiscal years at Adventure Works are calculated.

- Verify that the new column was added.

X	✓	1 Date =	
		2 CALENDARAUTO(6)	
Date	Year		
07/01/2017 00:00:00	FY2018		
07/02/2017 00:00:00	FY2018		
07/03/2017 00:00:00	FY2018		
07/04/2017 00:00:00	FY2018		
07/05/2017 00:00:00	FY2018		
07/06/2017 00:00:00	FY2018		
07/07/2017 00:00:00	FY2018		

4. Use the snippets file definitions to create the following two calculated columns for the **Date** table:

- Quarter
- Month

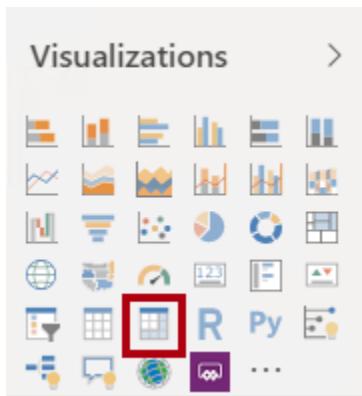
Date	Year	Quarter	Month
07/01/2017 00:00:00	FY2018	FY2018 Q1	2017 Jul
07/02/2017 00:00:00	FY2018	FY2018 Q1	2017 Jul
07/03/2017 00:00:00	FY2018	FY2018 Q1	2017 Jul
07/04/2017 00:00:00	FY2018	FY2018 Q1	2017 Jul
07/05/2017 00:00:00	FY2018	FY2018 Q1	2017 Jul
07/06/2017 00:00:00	FY2018	FY2018 Q1	2017 Jul
07/07/2017 00:00:00	FY2018	FY2018 Q1	2017 Jul

5. To validate the calculations, switch to Report view.
6. To create a new report page, at the bottom-left, click the plus icon.



7. To add a matrix visual to the new report page, in the **Visualizations** pane, select the matrix visual type.

Tip: You can hover the cursor over each icon to reveal a tooltip describing the visual type.



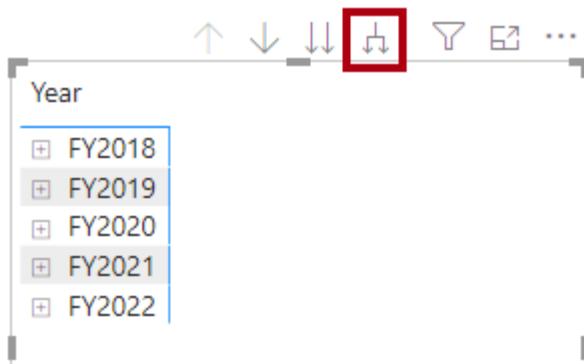
8. In the **Fields** pane, from inside the **Date** table, drag the **Year** field into the **Rows** well.

The screenshot shows the Power BI Fields pane on the right and the Rows well on the left. The Fields pane has a search bar and a list of tables: Date, Product, and Region. The Date table is expanded, showing its fields: Date, Month, Quarter, and Year. The Year field is selected and highlighted with a red box. The Rows well on the left has three sections: Rows, Columns, and Values, each with a 'Add data fields here' box. A red arrow points from the 'Add data fields here' box in the Rows well to the Year field in the Fields pane.

9. Drag the **Month** field into the **Rows** well, directly beneath the **Year** field.

The screenshot shows the Power BI Rows well. It contains two items: 'Year' and 'Month'. Both items have a small downward arrow and an 'X' icon to their right. The 'Month' item is highlighted with a red box.

10. At the top-right of the matrix visual, click the forked-double arrow icon (which will expand all years down one level).



11. Notice that the years expand to months, and that the months are sorted alphabetically rather than chronologically.



By default, text values sort alphabetically, numbers sort from smallest to largest, and dates sort from earliest to latest.

12. To customize the **Month** field sort order, switch to Data view.

13. Add the **MonthKey** column to the **Date** table.

DAX

```
MonthKey =
```

```
(YEAR('Date'[Date]) * 100) + MONTH('Date'[Date]) + MONTH([Date])
```

This formula computes a numeric value for each year/month combination.

14. In Data view, verify that the new column contains numeric values (e.g. 201707 for July 2017, etc.).

The screenshot shows the Power BI Data view with a table containing the following data:

Date	Year	Quarter	Month	MonthKey
07/01/2017 00:00:00	FY2018	FY2018 Q1	2017 Jul	201707
07/02/2017 00:00:00	FY2018	FY2018 Q1	2017 Jul	201707
07/03/2017 00:00:00	FY2018	FY2018 Q1	2017 Jul	201707
07/04/2017 00:00:00	FY2018	FY2018 Q1	2017 Jul	201707
07/05/2017 00:00:00	FY2018	FY2018 Q1	2017 Jul	201707
07/06/2017 00:00:00	FY2018	FY2018 Q1	2017 Jul	201707
07/07/2017 00:00:00	FY2018	FY2018 Q1	2017 Jul	201707

The formula bar at the top shows the DAX code for calculating MonthKey:

```

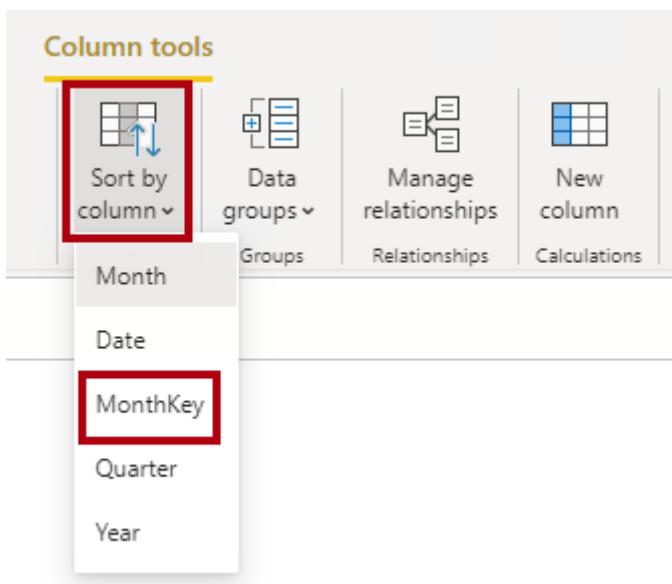
1 MonthKey =
2 (YEAR('Date'[Date]) * 100) + MONTH('Date'[Date])

```

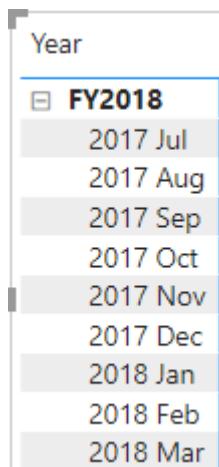
15. Switch back to Report view.

16. In the **Fields** pane, ensure that the **Month** field is selected (when selected, it will have a dark gray background).

17. On the **Column Tools** contextual ribbon, from inside the **Sort** group, click **Sort by Column**, and then select **MonthKey**.



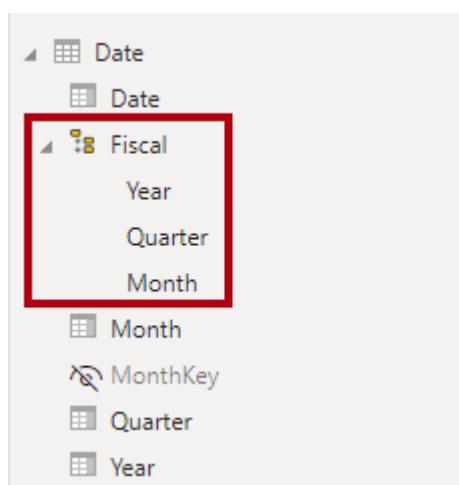
18. In the matrix visual, notice that the months are now chronologically sorted.



Task 4: Complete the Date table

In this task, you will complete the design of the **Date** table by hiding a column and creating a hierarchy. You will then create relationships to the **Sales** and **Targets** tables.

1. Switch to Model view.
2. In the **Date** table, hide the **MonthKey** column.
3. In the **Date** table, create a hierarchy named **Fiscal**, with the following three levels:
 - o Year
 - o Quarter
 - o Month



4. Create the follow two model relationships:
 - o **Date | Date to Sales | OrderDate**
 - o **Date | Date to Targets | TargetMonth**

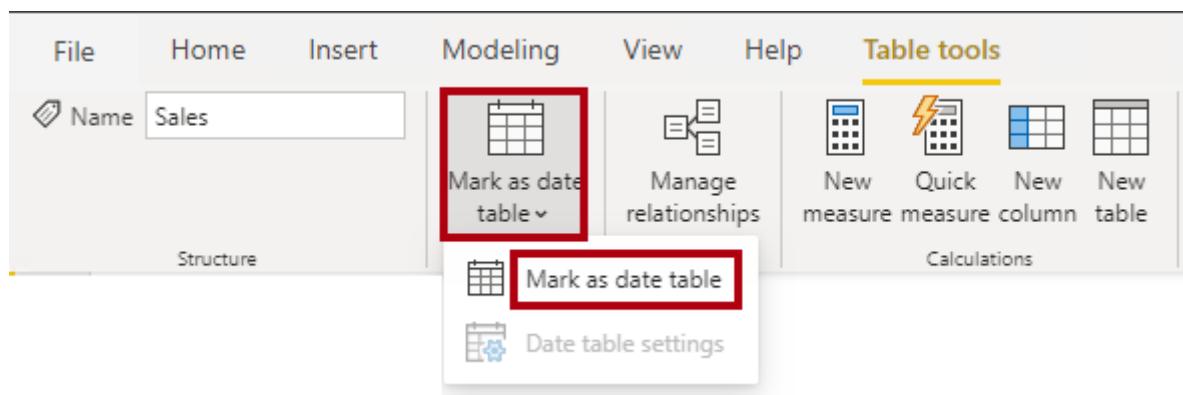
5. Hide the following two columns:

- o Sales | OrderDate
- o Targets | TargetMonth

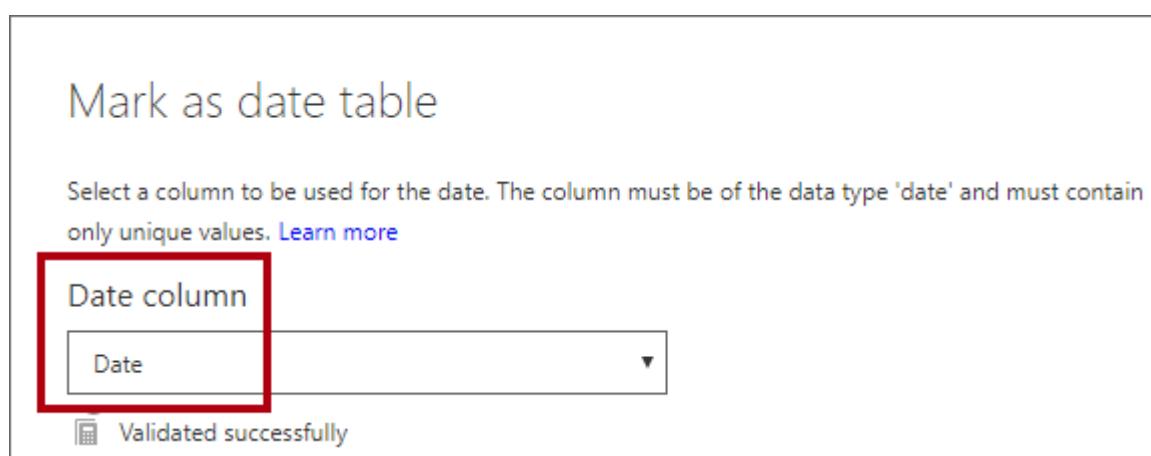
Task 5: Mark the Date table

In this task, you will mark the **Date** table as a date table.

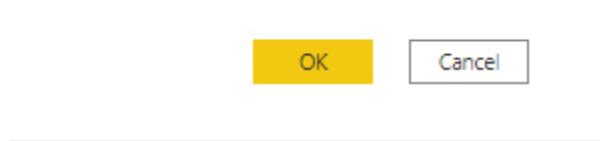
1. Switch to Report view.
2. In the **Fields** pane, select the **Date** table (not field).
3. On the **Table Tools** contextual ribbon, from inside the **Calendars** group, click **Mark as Date Table**, and then select **Mark as Date Table**.



4. In the **Mark as Date Table** window, in the **Date Column** dropdown list, select **Date**.



5. Click **OK**.



6. Save the Power BI Desktop file.

*Power BI Desktop now understands that this table defines date (time). This is important when relying on time intelligence calculations. You will work with time intelligence calculations in **Lab 06B**.*

Note that this design approach for a date table is suitable when you don't have a date table in your data source. If you have access to a data warehouse, it would be appropriate to load date data from its date dimension table rather than "redefining" date logic in your data model.

Exercise 2: Create Measures

In this exercise, you will create and format several measures.

Task 1: Create simple measures

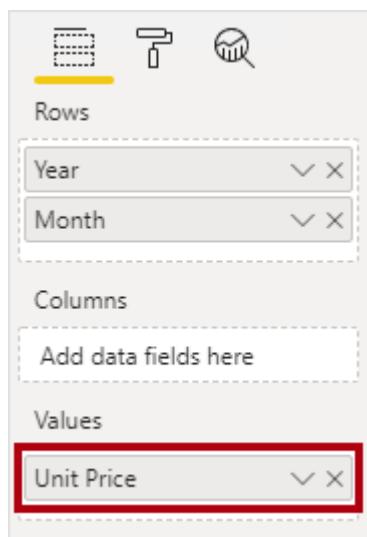
In this task, you will create simple measures. Simple measures aggregate a single column or table.

1. In Report view, on **Page 2**, in the **Fields** pane, drag the **Sales | Unit Price** field into the matrix visual.

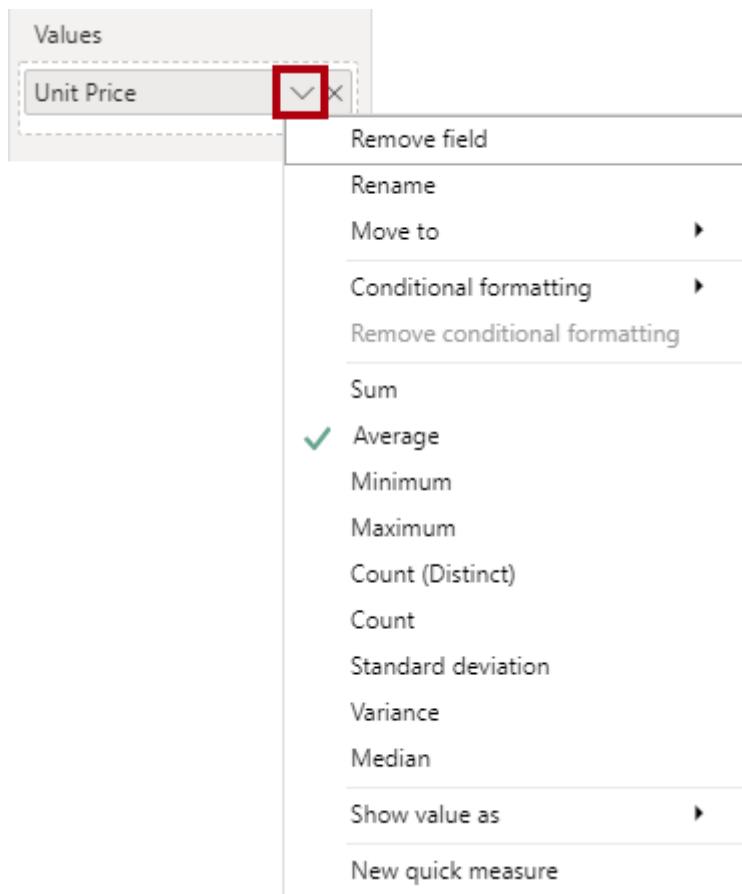
Year	Unit Price
FY2018	\$748.68
2017 Jul	\$655.59
2017 Aug	\$758.93
2017 Sep	\$741.85
2017 Oct	\$677.45

*Recall that in **Lab 05A**, you set the **Unit Price** column to summarize by **Average**. The result you see in the matrix visual is the monthly average unit price.*

2. In the visual fields pane (located beneath the **Visualizations** pane), in the **Values** well, notice that **Unit Price** is listed.

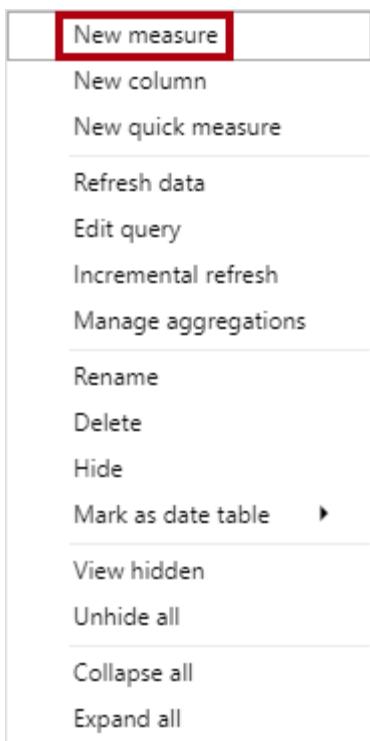


3. Click the down-arrow for **Unit Price**, and then notice the available menu options.



Visible numeric columns allow report authors to decide at report design time how a column will summarize (or not). This can result in inappropriate reporting. Some data modelers do not like leaving things to chance, however, and choose to hide these columns and instead expose aggregation logic defined by measures. This is the approach you will now take in this lab.

4. To create a measure, in the **Fields** pane, right-click the **Sales** table, and then select **New Measure**.

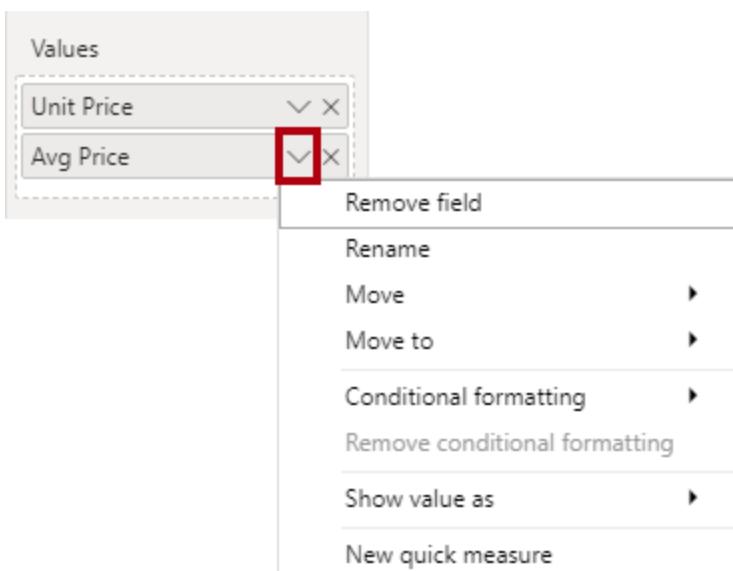


5. In the formula bar, add the following measure definition:

DAX

```
Avg Price = AVERAGE(Sales[Unit Price])
```

6. Add the **Avg Price** measure to the matrix visual.
7. Notice that it produces the same result as the **Unit Price** column (but with different formatting).
8. In the **Values** well, open the context menu for the **Avg Price** field, and notice that it is not possible to change the aggregation technique.



9. Use the snippets file definitions to create the following five measures for the **Sales** table:

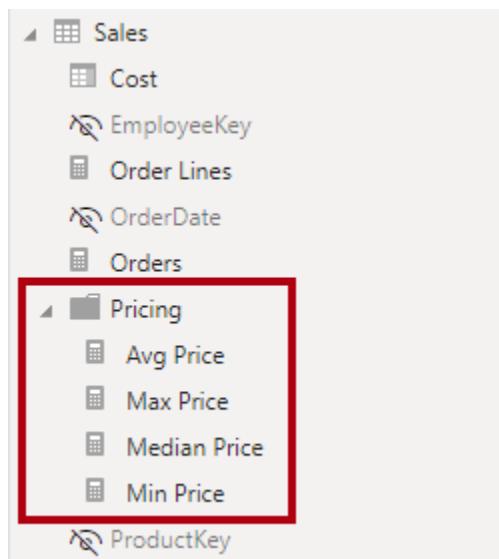
- Median Price
- Min Price
- Max Price
- Orders
- Order Lines

The **DISTINCTCOUNT()** function used in the **Orders** measure will count orders only once (ignoring duplicates). The **COUNTROWS()** function used in the **Order Lines** measure operates over a table. In this case, the number of orders is calculated by counting the distinct **SalesOrderNumber** column values, while the number of order lines is simply the number of table rows (each row is a line of an order).

10. Switch to Model view, and then multi-select the four price measures: **Avg Price**, **Max Price**, **Median Price**, and **Min Price**.

11. For the multi-selection of measures, configure the following requirements:

- Set the format to two decimal places
- Assign to a display folder named **Pricing**

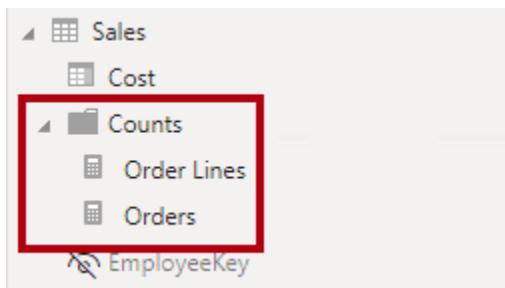


12. Hide the **Unit Price** column.

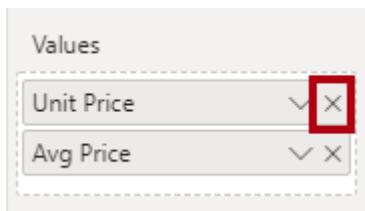
The **Unit Price** column is now not available to report authors. They must use the measure you've added to the model. This design approach ensures that report authors won't inappropriately aggregate prices, for example, by summing them.

13. Multi-select the **Orders** and **Order Lines** measures, and configure the following requirements:

- Set the format use the thousands separator
- Assign to a display folder named **Counts**



14. In Report view, in the **Values** well of the matrix visual, for the **Unit Price** field, click X to remove it.



15. Increase the size of the matrix visual to fill the page width and height.

16. Add the following five new measures to the matrix visual:

- Median Price
- Min Price
- Max Price
- Orders
- Order Lines

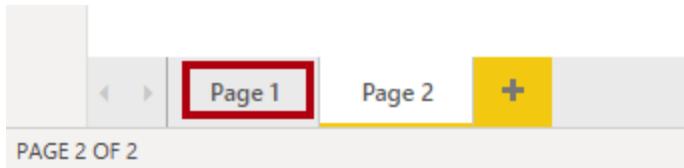
17. Verify that the results looks sensible and are correctly formatted.

Year	Avg Price	Median Price	Min Price	Max Price	Orders	Order Lines
FY2018	\$748.68	\$419.46	\$4.75	\$2,146.96	739	8,459
2017 Jul	\$655.59	\$419.46	\$5.19	\$2,146.96	38	352
2017 Aug	\$758.93	\$419.46	\$4.75	\$2,146.96	75	785
2017 Sep	\$741.85	\$419.46	\$5.19	\$2,146.96	60	593
2017 Oct	\$677.45	\$419.46	\$5.19	\$2,146.96	40	499
2017 Nov	\$752.31	\$419.46	\$5.01	\$2,146.96	90	1,106
2017 Dec	\$734.58	\$419.46	\$5.01	\$2,146.96	63	803

Task 2: Create additional measures

In this task, you will create additional measures that use more complex expressions.

1. In Report view, select **Page 1**.

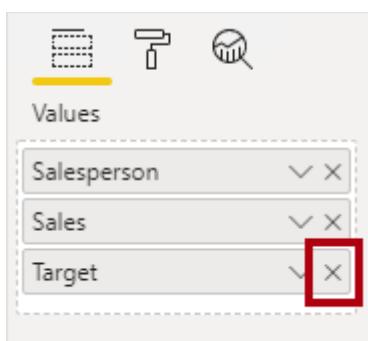


2. Review the table visual, noticing the total for the **Target** column.

Salesperson	Sales	Target
Amy Alberts	\$10,288,626	\$19,450,000
Brian Welcker	\$77,548,570	\$221,700,000
David Campbell	\$12,004,822	\$19,625,000
Garrett Vargas	\$13,875,633	\$23,675,000
Jae Pak	\$8,410,883	\$13,575,000
Jillian Carson	\$7,633,387	\$13,675,000
José Saraiva	\$13,875,633	\$18,875,000
Linda Mitchell	\$25,634,503	\$40,850,000
Lynn Tsolfias	\$1,391,025	\$3,210,000
Michael Blythe	\$21,987,348	\$31,150,000
Pamela Ansman-Wolfe	\$30,005,939	\$53,850,000
Total	\$77,548,570	\$676,210,000

Summing the target values together doesn't make sense because salespeople targets are set for each salesperson based on their sales region assignment(s). A target value should only be shown when a single salesperson is filtered. You will implement a measure now to do just that.

3. In the table visual, remove the **Target** field.



4. Rename the **Targets | Target** column as **Targets | TargetAmount**.

*Tip: There are several ways to rename the column in Report view: In the **Fields** pane, you can right-click the column, and then select **Rename**—or, double-click the column, or press **F2**.*

*You're about to create a measure named **Target**. It's not possible to have a column and measure in the same table, with the same name.*

5. Create the following measure on the **Targets** table:

DAX

```
Target =  
IF(  
HASONEVALUE('Salesperson (Performance)'[Salesperson]),  
SUM(Targets[TargetAmount])  
)
```

*The HASONEVALUE() function tests whether a single value in the **Salesperson** column is filtered. When true, the expression returns the sum of target amounts (for just that salesperson). When false, BLANK is returned.*

6. Format the **Target** measure for zero decimal places.

*Tip: You can use the **Measure Tools** contextual ribbon.*

7. Hide the **TargetAmount** column.
8. Add the **Target** measure to the table visual.
9. Notice that the **Target** column total is now BLANK.

Salesperson	Sales	Target
Amy Alberts	\$10,288,626	\$19,450,000
Brian Welcker	\$77,548,570	\$221,700,000
David Campbell	\$12,004,822	\$19,625,000
Garrett Vargas	\$13,875,633	\$23,675,000
Jae Pak	\$8,410,883	\$13,575,000
Jillian Carson	\$7,633,387	\$13,675,000
José Saraiva	\$13,875,633	\$18,875,000
Linda Mitchell	\$25,634,503	\$40,850,000
Lynn Tsolfias	\$1,391,025	\$3,210,000
Michael Blythe	\$21,987,348	\$31,150,000
Pamela Ansman-Wolfe	\$30,005,939	\$53,850,000
Total	\$77,548,570	BLANK

10. Use the snippets file definitions to create the following two measures for the **Targets** table:

- Variance
- Variance Margin

11. Format the **Variance** measure for zero decimal places.

12. Format the **Variance Margin** measure as percentage with two decimal places.

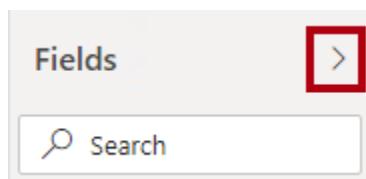
13. Add the **Variance** and **Variance Margin** measures to the table visual.

14. Widen the table visual so all values are displayed.

Salesperson	Sales	Target	Variance	Variance Margin
Amy Alberts	\$10,288,626	\$19,450,000	(\$9,161,374)	-47.10 %
Brian Welcker	\$77,548,570	\$221,700,000	(\$144,151,430)	-65.02 %
David Campbell	\$12,004,822	\$19,625,000	(\$7,620,178)	-38.83 %
Garrett Vargas	\$13,875,633	\$23,675,000	(\$9,799,367)	-41.39 %
Jae Pak	\$8,410,883	\$13,575,000	(\$5,164,117)	-38.04 %
Jillian Carson	\$7,633,387	\$13,675,000	(\$6,041,613)	-44.18 %
José Saraiva	\$13,875,633	\$18,875,000	(\$4,999,367)	-26.49 %
Linda Mitchell	\$25,634,503	\$40,850,000	(\$15,215,497)	-37.25 %
Lynn Tsoflias	\$1,391,025	\$3,210,000	(\$1,818,975)	-56.67 %
Michael Blythe	\$21,987,348	\$31,150,000	(\$9,162,652)	-29.41 %
Pamela Ansman-Wolfe	\$30,005,939	\$53,850,000	(\$23,844,061)	-44.28 %
Total	\$77,548,570			

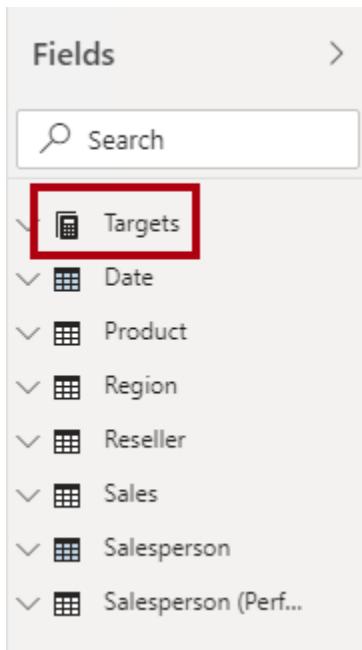
*While it appears all salespeople are not meeting target, remember that the measures aren't yet filtered by a specific time period. You'll produce sales performance reports that filter by a user-selected time period in **Lab 07A**.*

15. At the top-right corner of the **Fields** pane, collapse and then expand open the pane.



Collapsing and re-opening the pane resets the content.

16. Notice that the **Targets** table now appears at the top of the list.



Tables that comprise only visible measures are automatically listed at the top of the list.

Finish up

In this task, you will complete the lab.

1. Save the Power BI Desktop file.
2. Leave Power BI Desktop open.

In the next lab, you will enhance the data model with more advanced calculations using DAX.

Lab 06B - Using DAX in Power BI Desktop, Part 2

Overview

The estimated time to complete the lab is 45 minutes

In this lab, you will create measures with DAX expressions involving filter context manipulation.

In this lab, you learn how to:

- Use the CALCULATE() function to manipulate filter context
- Use Time Intelligence functions

Exercise 1: Work with Filter Context

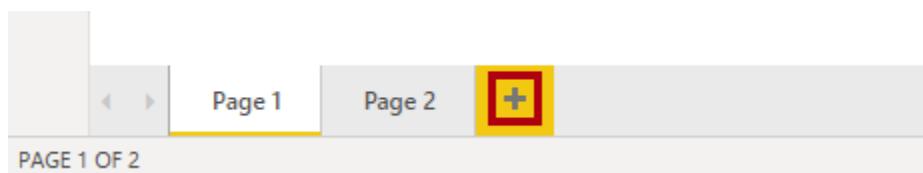
In this exercise, you will create measures with DAX expressions involving filter context manipulation.

If you're not confident you completed the previous lab successfully, you can open the previous lab's solution file, which is found in the **D:\DA100\Lab06A\Solution** folder.

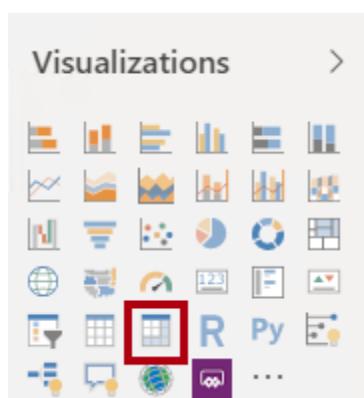
Task 1: Create a matrix visual

In this task, you will create a matrix visual to support testing your new measures.

1. In Power BI Desktop, in Report view, create a new report page.

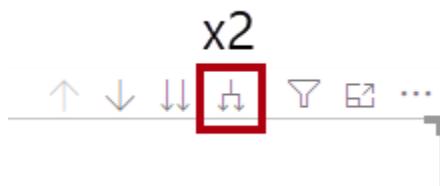


2. On **Page 3**, add a matrix visual.



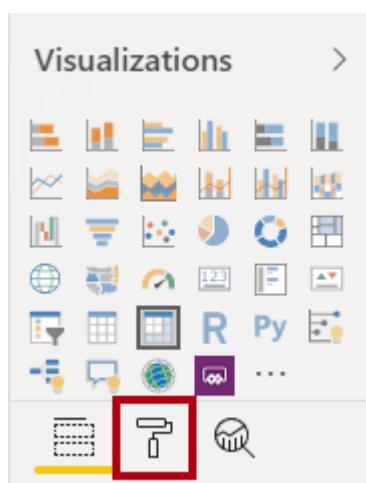
3. Resize the matrix visual to fill the entire page.

4. To configure the matrix visual fields, from the **Fields** pane, drag the **Region | Regions** hierarchy, and drop it inside the visual.
5. Add also the **Sales | Sales** field.
6. To expand the entire hierarchy, at the top-right of the matrix visual, click the forked-double arrow icon twice.

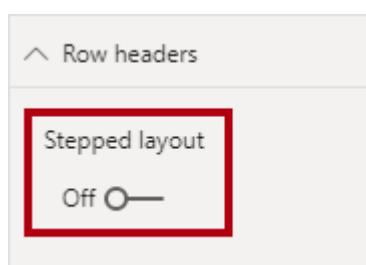


*Recall that the **Regions** hierarchy has the levels **Group**, **Country**, and **Region**.*

7. To format the visual, beneath the **Visualizations** pane, select the **Format** pane.



8. In the **Search** box, enter **Stepped**.
9. Set the **Stepped Layout** property to **Off**.



10. Verify that the matrix visual has four column headers.

Group	Country	Region	Sales
Europe	France	France	\$4,527,840
		Total	\$4,527,840
	Germany	Germany	\$1,877,743
		Total	\$1,877,743
	United Kingdom	United Kingdom	\$3,883,043
		Total	\$3,883,043
		Total	\$10,288,626
North America	Canada	Canada	\$13,875,633
		Total	\$13,875,633
	United States	Central	\$7,633,387
		Northeast	\$6,715,354
		Northwest	\$12,004,822
		Southeast	\$7,638,607
		Southwest	\$18,001,116
		Total	\$51,993,286
		Total	\$65,868,919
Pacific	Australia	Australia	\$1,391,025
		Total	\$1,391,025
		Total	\$1,391,025
		Total	\$77,548,570

At Adventure Works, the sales regions are organized into groups, countries, and regions. All countries—except the United States—have just one region, which is named after the country. As the United States is such a large sales territory, it is divided into five regions.

You'll create several measures in this exercise, and then test them by adding them to the matrix visual.

Task 2: Manipulate filter context

In this task, you will create several measures with DAX expressions that use the CALCULATE() function to manipulate filter context.

- Add a measure to the **Sales** table, based on the following expression:

For your convenience, all DAX definitions in this lab can be copied from the **D:\DA100\Lab06B\Assets\Snippets.txt** file.

DAX

```
Sales All Region =
CALCULATE(SUM(Sales[Sales]), REMOVEFILTERS(Region))
```

The **CALCULATE()** function is a powerful function used to manipulate the filter context. The first argument takes an expression or a measure (a measure is just a named expression). Subsequent arguments allow modifying the filter context.

The **REMOVEFILTERS()** function removes active filters. It can take either no arguments, or a table, a column, or multiple columns as its argument.

In this formula, the measure evaluates the sum of the **Sales** column in a modified filter context, which removes any filters applied to the **Region** table.

2. Add the **Sales All Region** measure to the matrix visual.

Group	Country	Region	Sales	Sales All Region
Europe	France	France	\$4,527,840	\$77,548,570.2
		Total	\$4,527,840	\$77,548,570.2
	Germany	Germany	\$1,877,743	\$77,548,570.2
		Total	\$1,877,743	\$77,548,570.2
	United Kingdom	United Kingdom	\$3,883,043	\$77,548,570.2
		Total	\$3,883,043	\$77,548,570.2
			\$10,288,626	\$77,548,570.2
North America	Canada	Canada	\$13,875,633	\$77,548,570.2
		Total	\$13,875,633	\$77,548,570.2
	United States	Central	\$7,633,387	\$77,548,570.2
		Northeast	\$6,715,354	\$77,548,570.2
		Northwest	\$12,004,822	\$77,548,570.2
		Southeast	\$7,638,607	\$77,548,570.2
		Southwest	\$18,001,116	\$77,548,570.2
		Total	\$51,993,286	\$77,548,570.2
			\$65,868,919	\$77,548,570.2
Pacific	Australia	Australia	\$1,391,025	\$77,548,570.2
		Total	\$1,391,025	\$77,548,570.2
			\$1,391,025	\$77,548,570.2
		Total	\$77,548,570	\$77,548,570.2

3. Notice that the **Sales All Region** measure computes the total of all region sales for each region, country (subtotal) and group (subtotal).

This measure is yet to deliver a useful result. When the sales for a group, country, or region is divided by this value it produces a useful ratio known as "percent of grand total".

4. In the **Fields** pane, ensure that the **Sales All Region** measure is selected, and then in the formula bar, replace the measure name and formula with the following formula:

*Tip: To replace the existing formula, first copy the snippet. Then, click inside the formula bar and press **Ctrl+A** to select all text. Then, press **Ctrl+V** to paste the snippet to overwrite the selected text. Then press **Enter**.*

DAX

```
Sales % All Region =  
DIVIDE(  
    SUM(Sales[Sales]),  
    CALCULATE(  
        SUM(Sales[Sales]),  
        REMOVEFILTERS(Region)  
    )  
)
```

The measure has been renamed to accurately reflect the updated formula.

The **DIVIDE()** function divides the **Sales** measure (not modified by filter context) by the **Sales** measure in a modified context which removes any filters applied to the **Region** table.

5. In the matrix visual, notice that the measure has been renamed and that different values now appear for each group, country, and region.
6. Format the **Sales % All Region** measure as a percentage with two decimal places.
7. In the matrix visual, review the **Sales % All Region** measure values.

Group	Country	Region	Sales	Sales % All Region
Europe	France	France	\$4,527,840	5.84 %
		Total	\$4,527,840	5.84 %
	Germany	Germany	\$1,877,743	2.42 %
		Total	\$1,877,743	2.42 %
	United Kingdom	United Kingdom	\$3,883,043	5.01 %
		Total	\$3,883,043	5.01 %
		Total	\$10,288,626	13.27 %

8. Add another measure to the **Sales** table, based on the following expression, and format as a percentage:

DAX

```
Sales % Country =  
DIVIDE(  
    SUM(Sales[Sales]),  
    CALCULATE(  
        SUM(Sales[Sales]),  
        REMOVEFILTERS(Region[Region])  
    )  
)
```

9. Notice that the **Sales % Country** measure formula differs slightly from the **Sales % All Region** measure formula.

The different is that the denominator modifies the filter context by removing filters on the **Region** column of the **Region** table, not all columns of the **Region** table. It means

that any filters applied to the group or country columns are preserved. It will achieve a result which represents the sales as a percentage of country.

10. Add the **Sales % Country** measure to the matrix visual.

11. Notice that only the United States' regions produce a value which is not 100%.

□ North America	□ Canada	Canada	\$13,875,633	17.89 %	100.00 %
		Total	\$13,875,633	17.89 %	100.00 %
	□ United States	Central	\$7,633,387	9.84 %	14.68 %
		Northeast	\$6,715,354	8.66 %	12.92 %
		Northwest	\$12,004,822	15.48 %	23.09 %
		Southeast	\$7,638,607	9.85 %	14.69 %
		Southwest	\$18,001,116	23.21 %	34.62 %
		Total	\$51,993,286	67.05 %	100.00 %

Recall that only the United States has multiple regions. All other countries have a single region which explains why they are all 100%.

12. To improve the readability of this measure in visual, overwrite the **Sales % Country** measure with this improved formula.

DAX

```
Sales % Country =
IF(
    ISINSCOPE(Region[Region]),
    DIVIDE(
        SUM(Sales[Sales]),
        CALCULATE(
            SUM(Sales[Sales]),
            REMOVEFILTERS(Region[Region])
        )
    )
)
```

Embedded within the IF() function, the ISINSCOPE() function is used to test whether the region column is the level in a hierarchy of levels. When true, the DIVIDE() function is evaluated. The absence of a false part means that blank is returned when the region column is not in scope.

13. Notice that the **Sales % Country** measure now only returns a value when a region is in scope.

Group	Country	Region	Sales	Sales % All Region	Sales % Country
□ Europe	□ France	France	\$4,527,840	5.84 %	100.00 %
		Total	\$4,527,840	5.84 %	
	□ Germany	Germany	\$1,877,743	2.42 %	100.00 %
		Total	\$1,877,743	2.42 %	
	□ United Kingdom	United Kingdom	\$3,883,043	5.01 %	100.00 %
		Total	\$3,883,043	5.01 %	

14. Add another measure to the **Sales** table, based on the following expression, and format as a percentage:

DAX

```
Sales % Group =
DIVIDE(
    SUM(Sales[Sales]),
    CALCULATE(
        SUM(Sales[Sales]),
        REMOVEFILTERS(
            Region[Region],
            Region[Country]
        )
    )
)
```

To achieve sales as a percentage of group, two filters can be applied to effectively remove the filters on two columns.

15. Add the **Sales % Group** measure to the matrix visual.

16. To improve the readability of this measure in visual, overwrite the **Sales % Group** measure with this improved formula.

DAX

```
Sales % Group =
IF(
    ISINSCOPE(Region[Region])
    || ISINSCOPE(Region[Country]),
    DIVIDE(
        SUM(Sales[Sales]),
        CALCULATE(
            SUM(Sales[Sales]),
            REMOVEFILTERS(
                Region[Region],
                Region[Country]
            )
        )
    )
)
```

17. Notice that the **Sales % Group** measure now only returns a value when a region or country is in scope.

18. In Model view, place the three new measures into a display folder named **Ratios**.



19. Save the Power BI Desktop file.

*The measures added to the **Sales** table have modified filter context to achieve hierarchical navigation. Notice that the pattern to achieve the calculation of a subtotal requires removing some columns from the filter context, and to arrive at a grand total, all columns must be removed.*

Exercise 2: Work with Time Intelligence

In this exercise, you will create a sales year-to-date (YTD) measure and sales year-over-year (YoY) growth measure.

Task 1: Create a YTD measure

In this task, you will create a sales YTD measure.

1. In Report view, on **Page 2**, notice the matrix visual which displays various measures with years and months grouped on the rows.
2. Add a measure to the **Sales** table, based on the following expression, and formatted to zero decimal places:

DAX

```
Sales YTD =  
TOTALYTD(SUM(Sales[Sales]), 'Date'[Date], "6-30")
```

*The TOTALYTD() function evaluates an expression—in this case the sum of the **Sales** column—over a given date column. The date column must belong to a date table marked as a date table, as you did in **Lab 06A**. The function can also take a third optional argument representing the last date of a year. The absence of this date means that December 31 is the last date of the year. For Adventure Works, June is the last month of their year, and so "6-30" is used.*

3. Add the **Sales** field and the **Sales YTD** measure to the matrix visual.
4. Notice the accumulation of sales values within the year.

Sales	Sales YTD
\$16,429,043	\$16,429,043
\$489,328	\$489,328
\$1,540,072	\$2,029,400
\$1,166,332	\$3,195,733
\$844,833	\$4,040,566
\$2,325,755	\$6,366,320
\$1,703,435	\$8,069,756
\$713,230	\$8,782,985
\$1,900,794	\$10,683,780
\$1,455,280	\$12,139,060
\$883,011	\$13,022,071
\$2,269,720	\$15,291,791
\$1,137,252	\$16,429,043
\$27,979,780	\$27,979,780
\$2,411,559	\$2,411,559
\$3,615,914	\$6,027,473

The *TOTALYTD()* function performs filter manipulation, specifically time filter manipulation. For example, to compute YTD sales for September 2017 (the third month of the fiscal year), all filters on the **Date** table are removed and replaced with a new filter of dates commencing at the beginning of the year (July 1, 2017) and extending through to the last date of the in-context date period (September 30, 2017).

Note that many Time Intelligence functions are available in DAX to support common time filter manipulations.

Task 2: Create a YoY growth measure

In this task, you will create a sales YoY growth measure.

1. Add an additional measure to the **Sales** table, based on the following expression:

DAX

```
Sales YoY Growth =
VAR SalesPriorYear =
    CALCULATE(
        SUM(Sales[Sales]),
        PARALLELPERIOD(
            'Date'[Date],
            -12,
            MONTH
        )
    )
RETURN
    SalesPriorYear
```

The **Sales YoY Growth** measure formula declares a variable. Variables can be useful for simplifying the formula logic, and more efficient when an expression needs to be

evaluated multiple times within the formula (which will be the case for the YoY growth logic). Variables are declared by a unique name, and the measure expression must then be output after the **RETURN** keyword.

The **SalesPriorYear** variable is assigned an expression which calculates the sum of the **Sales** column in a modified context that uses the **PARALLELPERIOD()** function to shift 12 months back from each date in filter context.

2. Add the **Sales YoY Growth** measure to the matrix visual.
3. Notice that the new measure returns blank for the first 12 months (there were no sales recorded before fiscal year 2017).
4. Notice that the **Sales YoY Growth** measure value for **2017 Jul** is the **Sales** value for **2016 Jan**.

Sales	Sales YTD	Sales YoY Growth
\$16,429,043	\$16,429,043	
\$489,328	\$489,328	
\$1,540,72	\$2,029,400	
\$1,166,353	\$3,195,733	
\$844,833	\$4,040,566	
\$2,325,755	\$6,366,320	
\$1,703,435	\$8,069,756	
\$713,230	\$8,782,985	
\$1,900,794	\$10,683,780	
\$1,455,280	\$12,139,260	
\$883,011	\$13,022,071	
\$2,269,720	\$15,291,791	
\$1,137,252	\$16,429,043	
\$27,979,780	\$27,979,780	\$16,429,042.6
\$2,411,559	\$2,411,559	\$489,328.4
\$3,615,914	\$6,027,473	\$1,540,072.02

Now that the "difficult part" of the formula has been tested, you can overwrite the measure with the final formula which computes the growth result.

5. To complete the measure, overwrite the **Sales YoY Growth** measure with this formula, formatting it as a percentage with two decimal places:

DAX

```
Sales YoY Growth =
VAR SalesPriorYear =
    CALCULATE(
        SUM(Sales[Sales]),
        PARALLELPERIOD(
            'Date'[Date],
            -12,
```

```

        MONTH
    )
)
RETURN
DIVIDE(
    (SUM(Sales[Sales]) - SalesPriorYear),
    SalesPriorYear
)

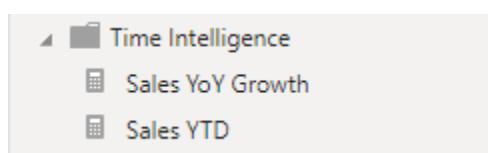
```

6. In the formula, in the **RETURN** clause, notice that the variable is referenced twice.
7. Verify that the YoY growth for **2018 Jul** is **392.83%**.

Sales	Sales YTD	Sales YoY Growth
\$16,429,043	\$16,429,043	
\$489,328	\$489,328	
\$1,540,072	\$2,029,400	
\$1,166,332	\$3,195,733	
\$844,833	\$4,040,566	
\$2,325,755	\$6,366,320	
\$1,703,435	\$8,069,756	
\$713,230	\$8,782,985	
\$1,900,794	\$10,683,780	
\$1,455,280	\$12,139,060	
\$883,011	\$13,022,071	
\$2,269,720	\$15,291,791	
\$1,137,252	\$16,429,043	
\$27,979,780	\$27,979,780	70.31 %
\$2,411,559	\$2,411,559	392.83 %
\$3,615,914	\$6,027,473	134.79 %

This means that July 2018 sales (\$2,411,559) represents a nearly 400% (almost 4x) improvement over the sales achieved for the prior year (\$489,328).

8. In Model view, place the two new measures into a display folder named **Time Intelligence**.



9. Save the Power BI Desktop file.

DAX includes many Time Intelligence functions to make it easy to implement time filter manipulations for common business scenarios.

This exercise completes the data model development. In the next exercise, you will publish the Power BI Desktop file to your workspace, ready for creating a report in the next lab.

Exercise 3: Publish the Power BI Desktop File

In this exercise, you will publish the Power BI Desktop file to Power BI.

Task 1: Publish the file

In this task, you will publish the Power BI Desktop file to Power BI.

1. Save the Power BI Desktop file.

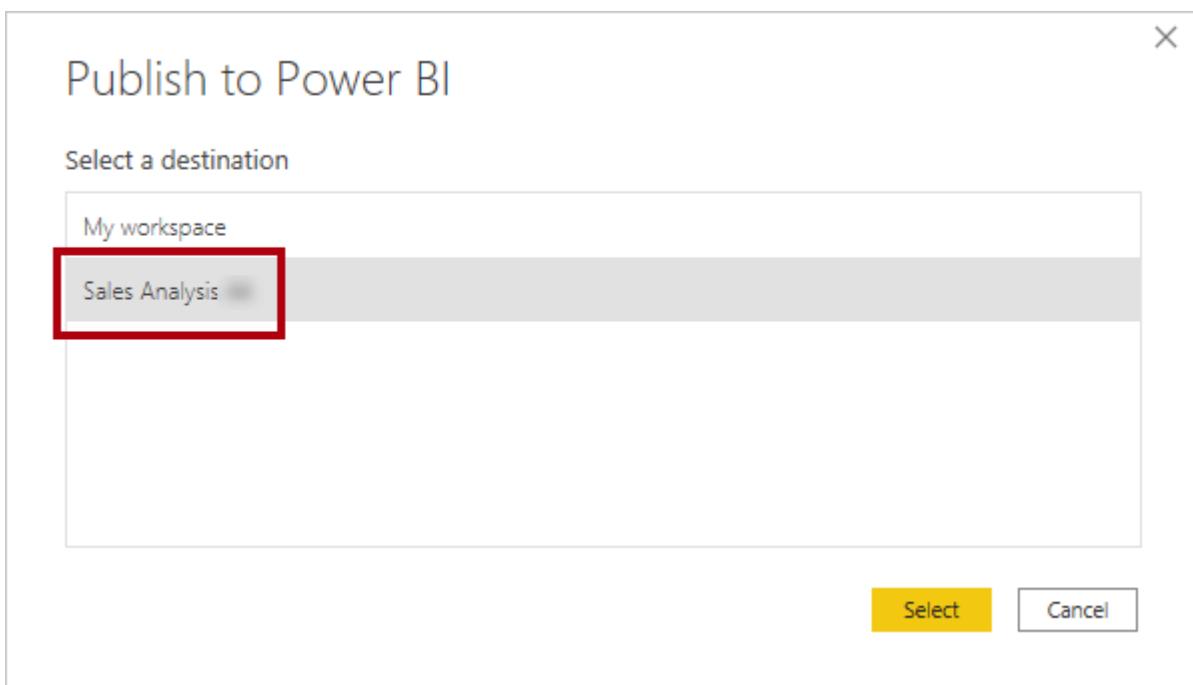
If you're not confident you completed this lab successfully, you should publish the Power BI Desktop file found in the D:\DA100\Lab06B\Solution folder. In this case, close your current Power BI Desktop file, and then open the solution file. First, perform a data refresh (using the Refresh command on the ribbon), and then continue with the instructions in this task.

2. To publish the file, on the **Home** ribbon tab, from inside the **Share** group, click **Publish**.

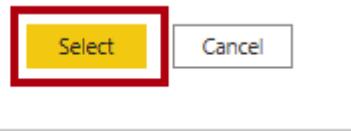


3. In the **Publish to Power BI** window, select your **Sales Analysis** workspace.

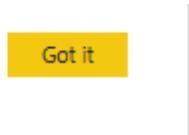
*It's important that you publish it to the workspace you created in **Lab 01A**, and not "My workspace".*



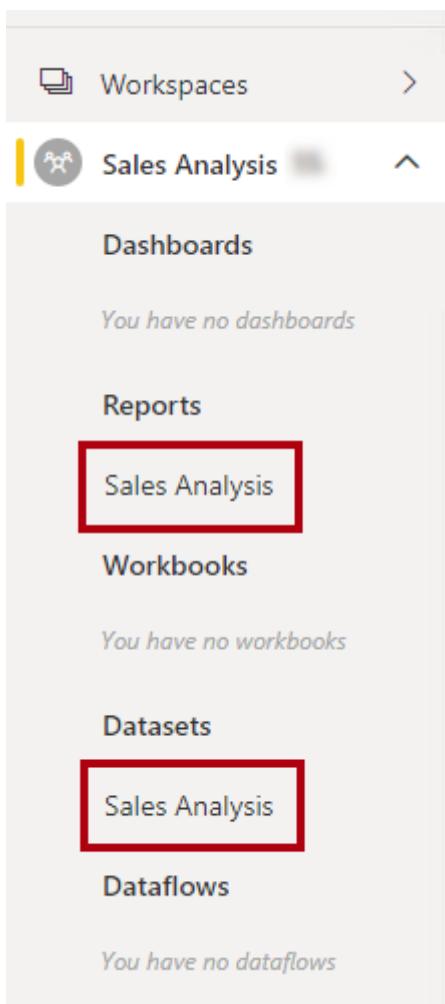
4. Click **Select**.



- When the file has been successfully published, click **Got It**.



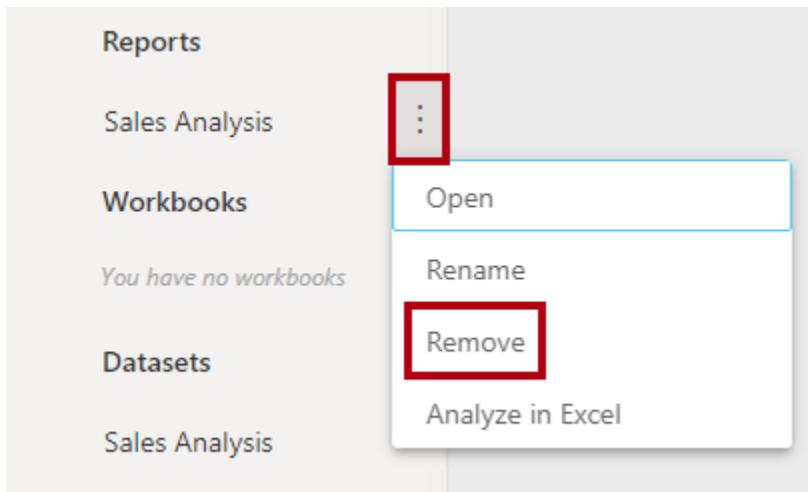
- Close Power BI Desktop.
- In the Edge, in the Power BI service, in the **Navigation** pane (located at the left), review the contents of your **Sales Analysis** workspace.



The publication has added a report and a dataset. If you don't see them, press **F5** to reload the browser, and then expand the workspace again.

The data model has been published to become a dataset. The report—used to test your model calculations—has been added as a report. This report is not required, so you will now delete it.

8. Hover the cursor over the **Sales Analysis** report, click the vertical ellipsis (...), and then select **Remove**.



9. When prompted to confirm the deletion, click **Delete**.



In the next lab, you will create a report based on the published dataset.

Finish up

In this task, you will complete the lab.

1. Leave the Edge browser window open.

Lab 08A - Designing a Report in Power BI Desktop, Part 1

Overview

The estimated time to complete the lab is 45 minutes

In this lab, you will create a three-page report named **Sales Report**. You will then publish it to Power BI, whereupon you will open and interact with the report.

In this lab, you learn how to:

- Use Power BI Desktop to create a live connection
- Design a report
- Configure visual fields and format properties

Exercise 1: Create a Report

In this exercise, you will create a three-page report named **Sales Report**.

Task 1: Create a new file

In this task, you will create a live connection to the **Sales Analysis** dataset.

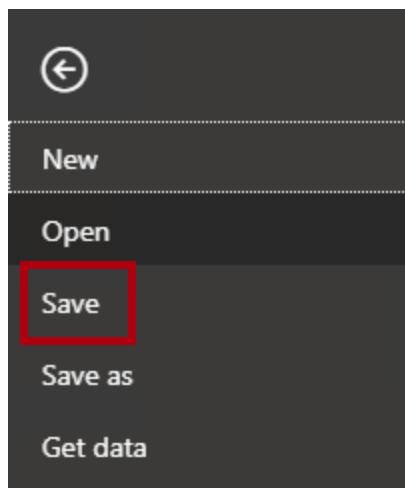
1. To open the Power BI Desktop, on the taskbar, click the Microsoft Power BI Desktop shortcut.



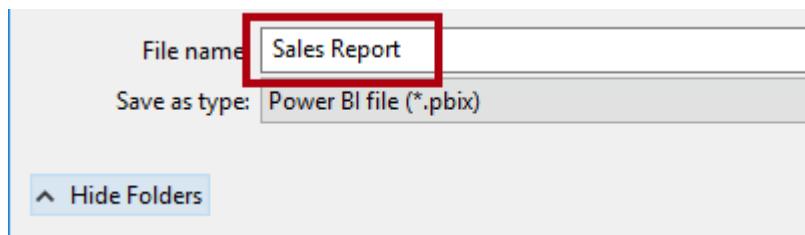
2. At the top-right corner of the welcome screen, click X.



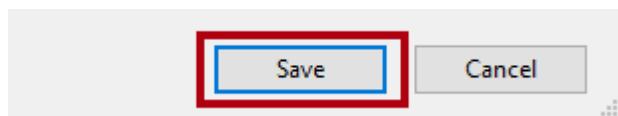
3. Click the **File** ribbon tab to open the backstage view, and then select **Save**.



4. In the **Save As** window, navigate to the **D:\DA100\MySolution** folder.
5. In the **File Name** box, enter **Sales Report**.



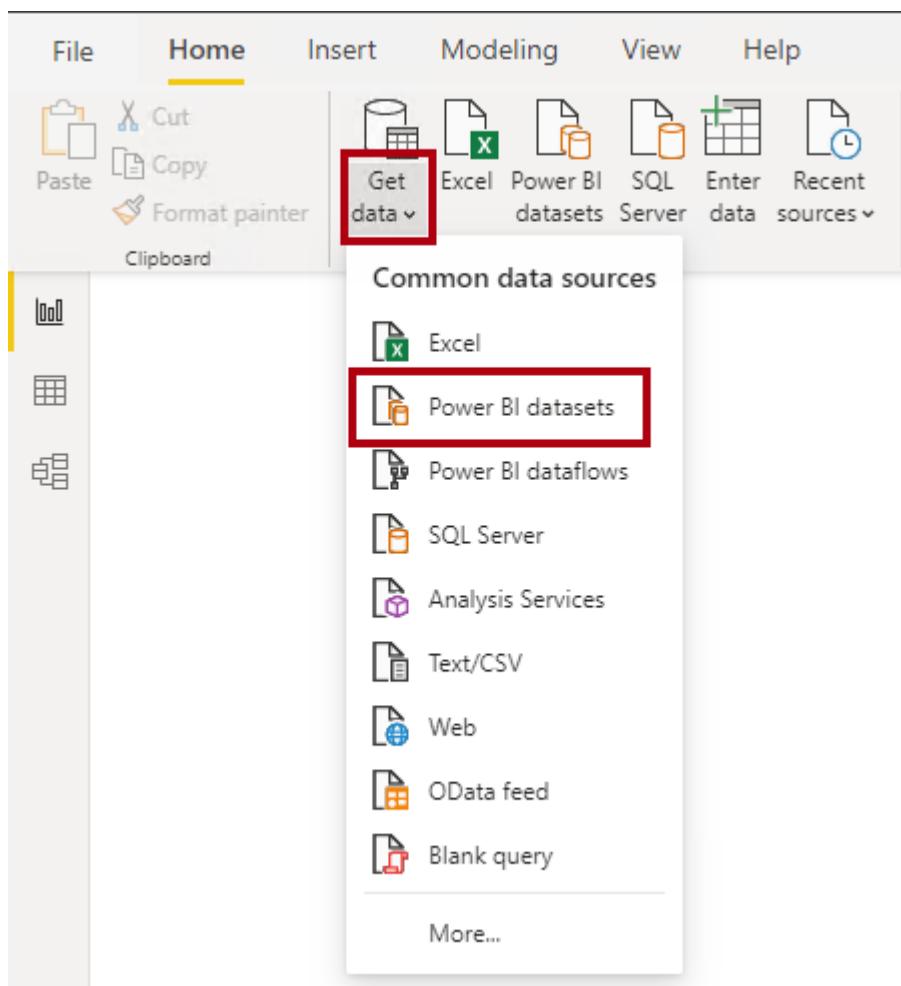
6. Click **Save**.



Task 2: Create a live connection

In this task, you will create a live connection to the **Sales Analysis** dataset.

1. To create a live connection, on the **Home** ribbon tab, from inside the **Data** group, click **Get Data**, down-arrow, and then select **Power BI Datasets**.



2. In the **Select a Dataset to Create a Report** window, select the **Sales Analysis** dataset.

This screenshot shows a modal dialog box titled 'Select a dataset to create a report'. At the top is a search bar with a magnifying glass icon and the placeholder text 'Search'. Below the search bar is a list of datasets. The first item in the list, 'Sales Analysis', is highlighted with a red box. Other items in the list include 'Name', 'Blank query', and 'More...'. The background of the dialog is white, and the overall interface is clean and modern.

3. Click **Create**.



4. At the bottom-right corner, in the status bar, notice that the live connection has been established.
5. In the **Fields** pane, notice that the data model table are listed.

Power BI Desktop can no longer be used to develop the data model; in live connection mode, it's only a report authoring tool. It is possible, however, to create measures—but they are measures that are only available within the report. You won't add any report-scoped measures in this lab.

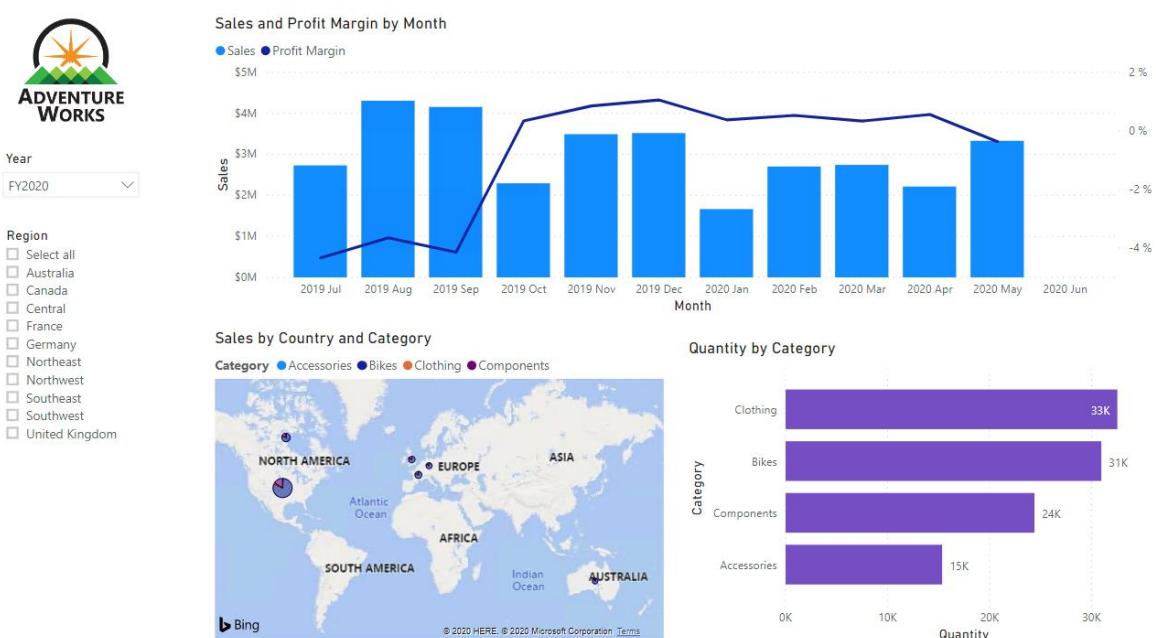
6. Save the Power BI Desktop file.

*Recall that you added the **Salespeople** role to the model in **Lab 05A**. Because you're the owner of the Power BI dataset, the roles are not enforced. This explains why, in this lab, you can see all data.*

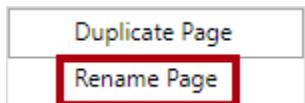
*When you share reports and dashboards to non-owners of the dataset, their account (or a security group of which they're a member) must be mapped to the **Salespeople** role. You will configure this before sharing content in **Lab 12A**.*

Task 3: Design page 1

In this task, you will design the first report page. When you've completed the design, the page will look like the following:

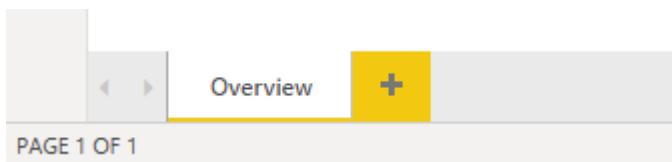


1. To rename the page, at the bottom-left, right-click **Page 1**, and then select **Rename**.

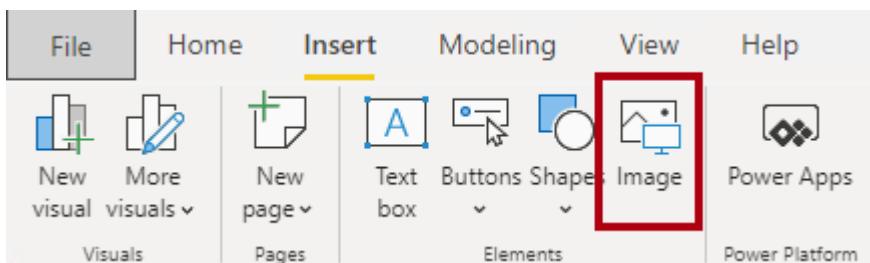


Tip: You can also double-click the page name.

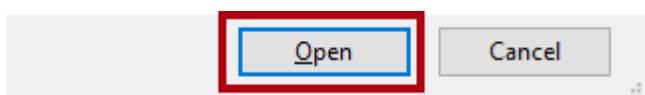
2. Rename the page as **Overview**, and then press **Enter**.



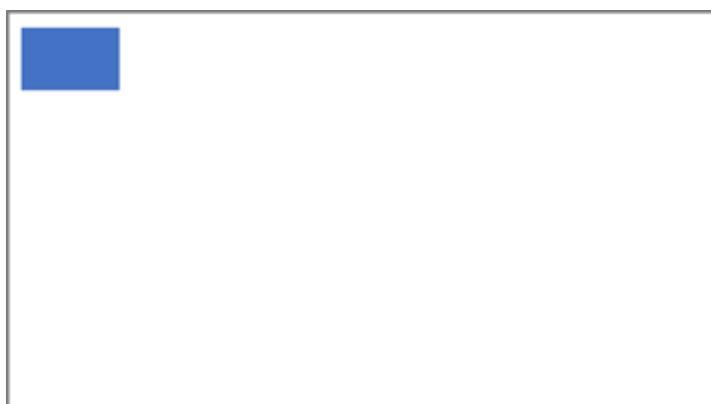
3. To add an image, on the **Insert** ribbon tab, from inside the **Elements** group, click **Image**.



4. In the **Open** window, navigate to the **D:\DA100\Data** folder.
5. Select the **AdventureWorksLogo.jpg** file, and then click **Open**.

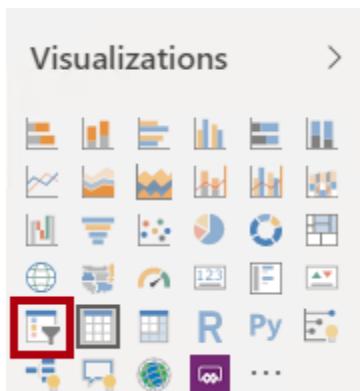


6. Drag the image to reposition it at the top-left corner, and also drag the guide markers to resize it.

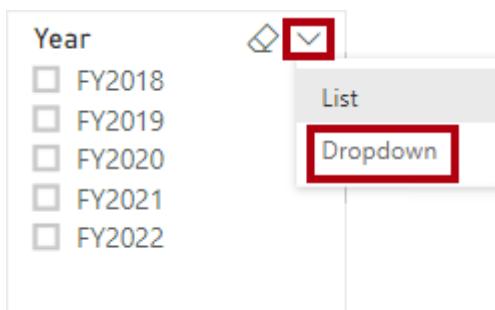


7. To add a slicer, first de-select the image by clicking an empty area of the report page.
8. In the **Fields** pane, select the **Date | Year** field (not the **Year** level of the hierarchy).

9. Notice that a table of year values has been added to the report page.
10. To convert the visual from a table to a slicer, in the **Visualizations** pane, select the **Slicer**.



11. To convert the slicer from a list to a dropdown, at the top-right of the slicer, click the down-arrow, and then select **Dropdown**.



12. Resize and reposition the slicer so it sits beneath the image, and so it is the same width as the image.



13. In the **Year** slicer, select **FY2020**, and then collapse the dropdown list.

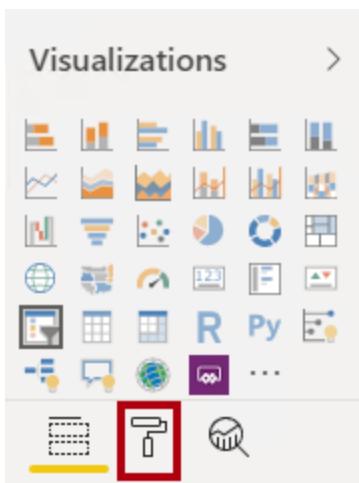


The report page is now filtered by year **FY2020**.

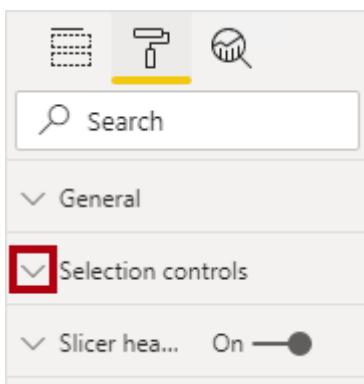
14. De-select the slicer by clicking an empty area of the report page.
15. Create a second slicer, based on the **Region | Region** field (not the **Region** level of the hierarch).
16. Leave the slicer as a list, and then resize and reposition the slicer beneath the **Year** slicer.



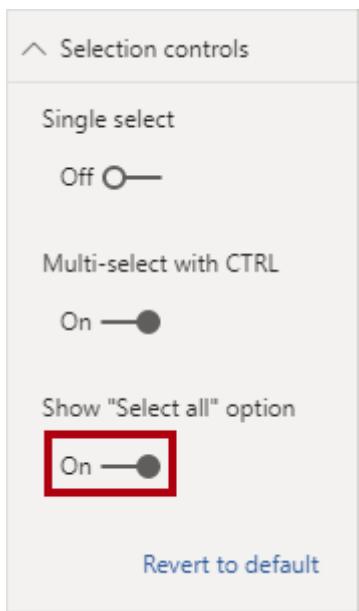
17. To format the slicer, beneath the **Visualizations** pane, open the **Format** pane.



18. Expand then **Selection Controls** group.



19. Set the **Show “Select All” Option** to **On**.

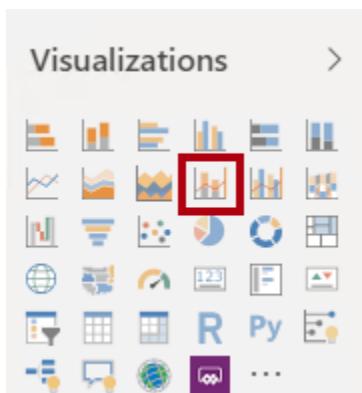


20. In the **Region** slicer, notice that the first item is now **Select All**.

When selected, this item either selects all, or de-selects all items. It makes it easier for report users to set the right filters.

21. De-select the slicer by clicking an empty area of the report page.

22. To add a chart to the page, in the **Visualizations** pane, click the **Line and Stacked Column Chart** visual type.



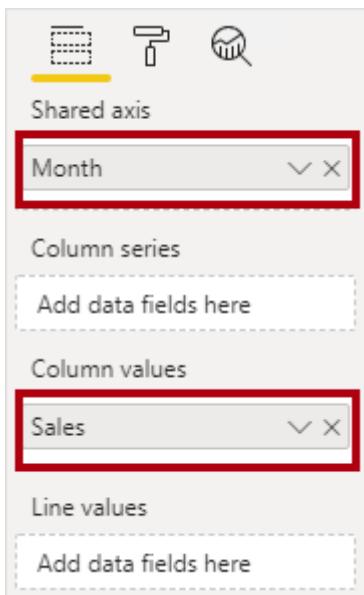
23. Resize and reposition the visual so it sits to the right of the logo, and so it fills the width of the report page.



24. Drag the following fields into the visual:

- o Date | Month
- o Sales | Sales

25. In the visual fields pane (not the **Fields** pane—the visual fields pane is located beneath the **Visualizations** pane), notice that the fields are assigned to the **Shared Axis** and **Column Values** wells.



By dragging visuals into a visual, they will be added to default wells. For precision, you can drag fields directly into the wells, as you will do now.

26. From the **Fields** pane, drag the **Sales | Profit Margin** field into the **Line Values** well.

The screenshot shows the Power BI visual fields pane on the left and the Data pane on the right. In the visual fields pane, under 'Shared axis', there is a 'Month' field. Under 'Column series', there is a 'Sales' field. Under 'Line values', there is a placeholder 'Add data fields here'. A red arrow points from the 'Add data fields here' placeholder to the 'Profit Margin' field in the Data pane.

Visual Fields Pane:

- Shared axis: Month
- Column series: Sales
- Line values: Add data fields here

Data Pane:

- Sales
 - Σ Cost
 - Counts
 - Pricing
 - Profit
 - Profit Margin
 - Σ Quantity
 - Ratios
 - Σ Sales
 - Time Intelligence

27. Notice that the visual has 11 months only.

The last month of the year, 2020 June, does not have any sales (yet). By default, the visual has eliminated months with BLANK sales. You will now configure the visual to show all months.

28. In the visual fields pane, in the **Shared Axis** well, for the **Month** field, click the down-arrow, and then select **Show Items With No Data**.

The screenshot shows the Power BI visual fields pane. A context menu is open over the 'Month' field in the 'Shared axis' well. The menu options are: Remove field, Rename, Move to, New quick measure, and Show items with no data. The 'Show items with no data' option is highlighted with a red box.

Visual Fields Pane:

- Shared axis: Month

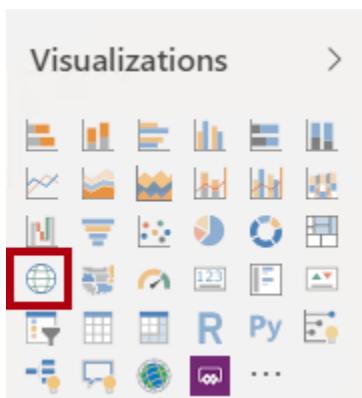
Context Menu Options:

- Remove field
- Rename
- Move to
- New quick measure
- Show items with no data

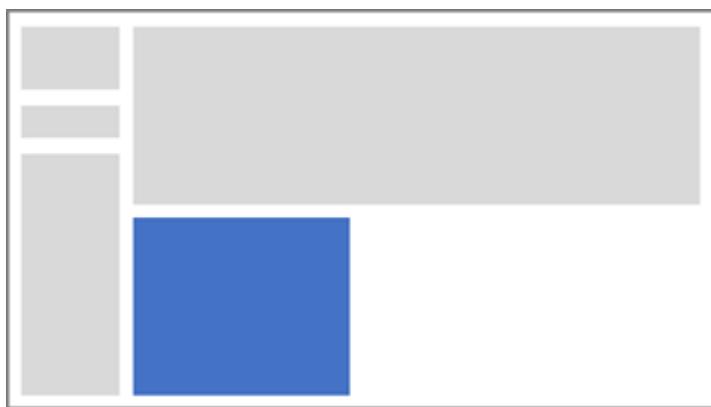
29. Notice that the month **2020 June** now appears.

30. De-select the chart by clicking an empty area of the report page.

31. To add a chart to the page, in the **Visualizations** pane, click the **Map** visual type.



32. Resize and reposition the visual so it sits beneath the column/line chart, and so it fills half the width of the report page.

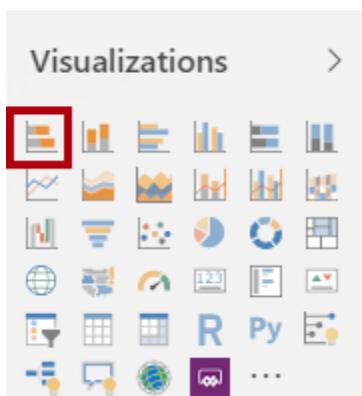


33. Add the following fields to the visual wells:

- Location: **Region | Country**
- Legend: **Product | Category**
- Size: **Sales | Sales**

34. De-select the chart by clicking an empty area of the report page.

35. To add a chart to the page, in the **Visualizations** pane, click the **Stacked Bar Chart** visual type.



36. Resize and reposition the visual so it fills the remaining report page space.



37. Add the following fields to the visual wells:

- Axis: **Product | Category**
- Value: **Sales | Quantity**

38. To format the visual, open the **Format** pane.



39. Expand the **Data Colors** group, and then set the **Default Color** property to a suitable color (in contrast to the column/line chart).

40. Set the **Data Labels** property to **On**.



41. Save the Power BI Desktop file.

The design of the first page is now complete.

Task 4: Design page 2

In this task, you will design the second report page. When you've completed the design, the page will look like the following:

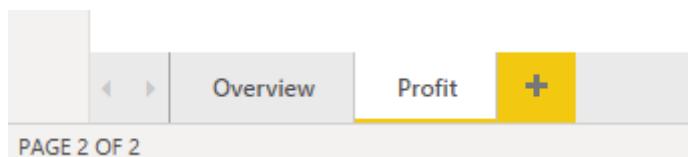
Region	Year	Orders	Sales	Cost	Profit	Profit Margin
<input type="checkbox"/> Select all						
<input type="checkbox"/> Australia	FY2018	739	\$16,429,043	\$16,297,680	\$131,362	0.80 %
<input type="checkbox"/> Canada	FY2019	1,255	\$27,979,780	\$26,768,232	\$1,211,548	4.33 %
<input type="checkbox"/> Central	FY2020	1,802	\$36,568,898	\$36,914,218	(\$345,320)	-0.94 %
<input type="checkbox"/> France	Total	3,796	\$80,977,720	\$79,980,130	\$997,590	1.23 %
<input type="checkbox"/> Germany						
<input type="checkbox"/> Northeast						
<input type="checkbox"/> Northwest						
<input type="checkbox"/> Southeast						
<input type="checkbox"/> Southwest						
<input type="checkbox"/> United Kingdom						

When detailed instructions have already been provided in the labs, the lab steps will now provide more concise instructions. If you need the detailed instructions, you can refer back to other tasks.

1. To create a new page, at the bottom-left, click the plus icon.



2. Rename the page to **Profit**.



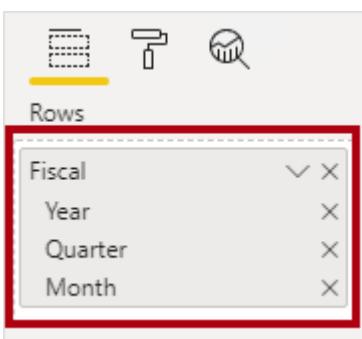
3. Add a slicer based on the **Region | Region** field.
4. Use the **Format** pane to enable the "Select All" option (in the **Selection Controls** group).
5. Resize and reposition the slicer so it sits at the left side of the report page, and so it is about half the page height.



6. Add a matrix visual, and resize and reposition it so it fills the remaining space of the report page



7. Add the **Date | Fiscal** hierarchy to the matrix **Rows** well.



8. Add the following five **Sales** table fields to the **Values** well:

- Orders (from the **Counts** folder)
- Sales
- Cost
- Profit
- Profit Margin

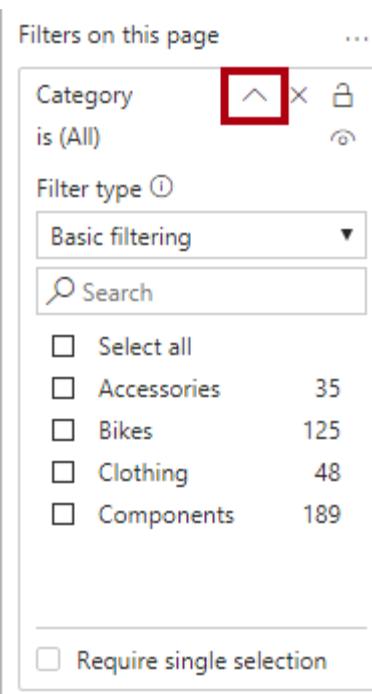
Year	Orders	Sales	Cost	Profit	Profit Margin
FY2018	739	\$16,429,043	\$16,297,680	\$131,362	0.80 %
FY2019	1,255	\$27,979,780	\$26,768,232	\$1,211,548	4.33 %
FY2020	1,802	\$36,568,898	\$36,914,218	(\$345,320)	-0.94 %
Total	3,796	\$80,977,720	\$79,980,130	\$997,590	1.23 %

9. In the **Filters** pane (located at the left of the **Visualizations** pane), notice the **Filter On This Page** well (you may need to scroll down).



10. From the **Fields** pane, drag the **Product | Category** field into the **Filter On This Page** well.

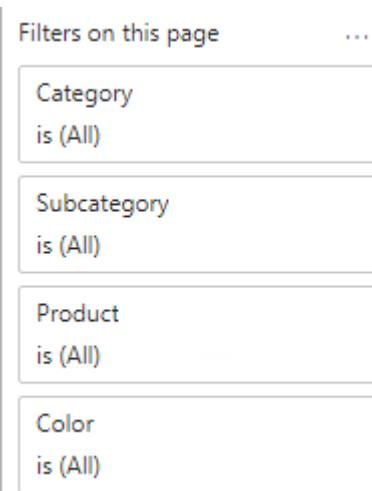
11. Inside the filter card, at the top-right, click the arrow to collapse the card.



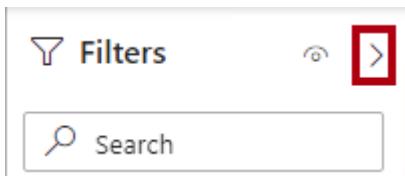
Fields added to the **Filters** pane can achieve the same result as a slicer. One difference is they don't take up space on the report page. Another difference is that they can be configured for more advanced filtering requirements.

12. Add each of the following **Product** table fields to the **Filter On This Page** well, collapsing each, directly beneath the **Category** card:

- Subcategory
- Product
- Color



13. To collapse the **Filters** pane, at the top-right of the pane, click the arrow.

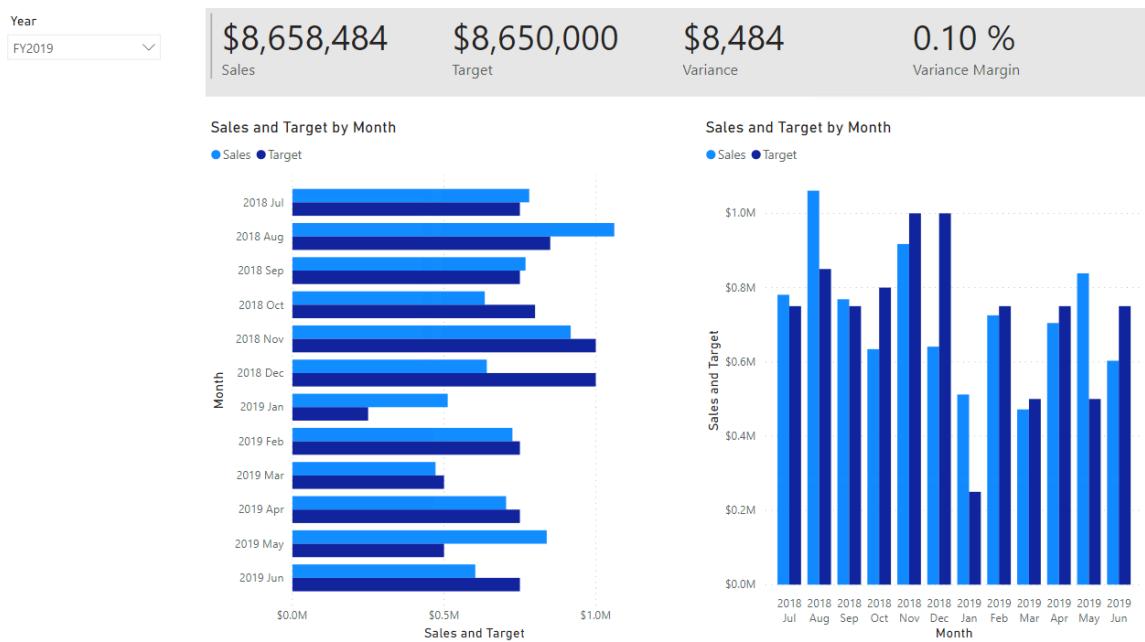


14. Save the Power BI Desktop file.

The design of the second page is now complete.

Task 5: Design page 3

In this task, you will design the third and final report page. When you've completed the design, the page will look like the following:



- Create a new page, and then rename it as **My Performance**.

Recall that row-level security was configured to ensure users only ever see data for their sales regions and targets. When this report is distributed to salespeople, they will only ever see their sales performance results.

- To simulate the row-level security filters during report design and testing, add the **Salesperson (Performance) | Salesperson** field to the **Filters** pane, inside the **Filters On This Page** well.
- In the filter card, scroll down the list of salespeople, and then check **Michael Blythe**.

Filters on this page ...

Salesperson

is Michael Blythe

Filter type ⓘ

Basic filtering ▾

🔍 Search

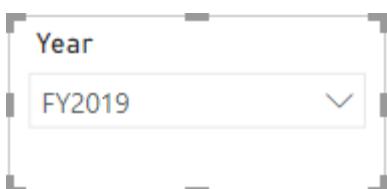
	Salesperson	Count
<input type="checkbox"/>	Lynn Tsoflias	1
<input checked="" type="checkbox"/>	Michael Blythe	1
<input type="checkbox"/>	Pamela Ansman-W...	1

You will be instructed to delete this filter before you distribute the report in an app in **Lab 12A**.

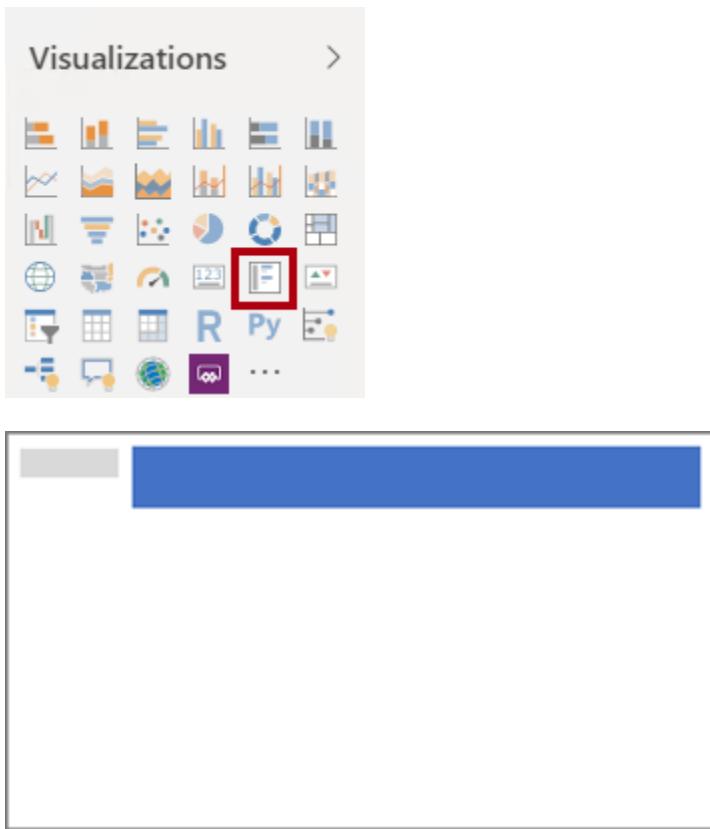
4. Add a dropdown slicer based on the **Date | Year** field, and then resize and reposition it so it sits at the top-left corner of the page.



5. In the slicer, select **FY2019**.



6. Add a **Multi-row Card** visual, and then resize and reposition it so it sits to the right of the slicer and fills the remaining width of the page.



7. Add the following four fields to the visual:

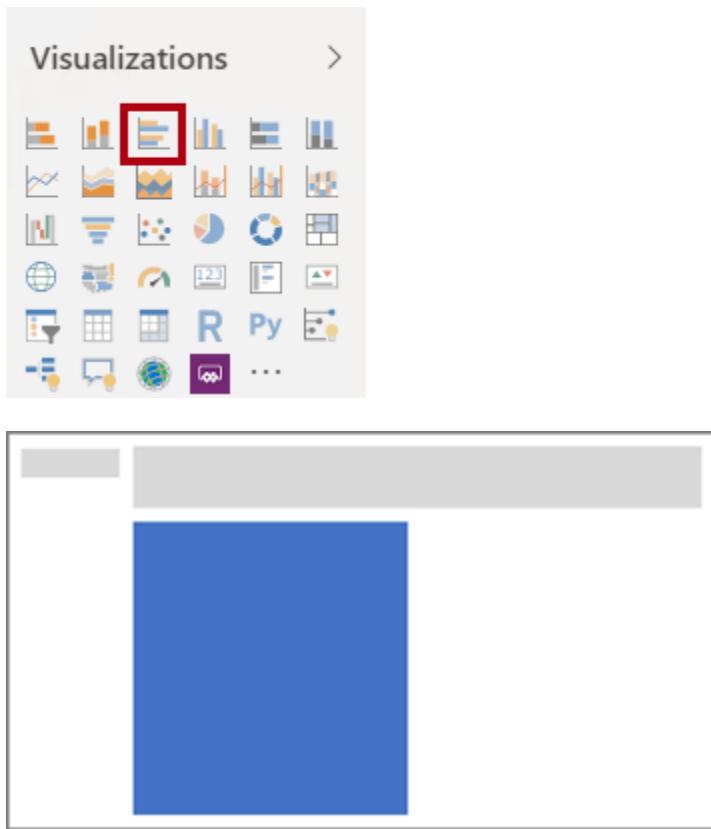
- Sales | Sales
- Targets | Target
- Targets | Variance
- Targets | Variance Margin

8. Format the visual:

- In the **Data Labels** group, increase the **Text Size** property to **28pt**
- In the **Background** group, set the **Color** to a light gray color

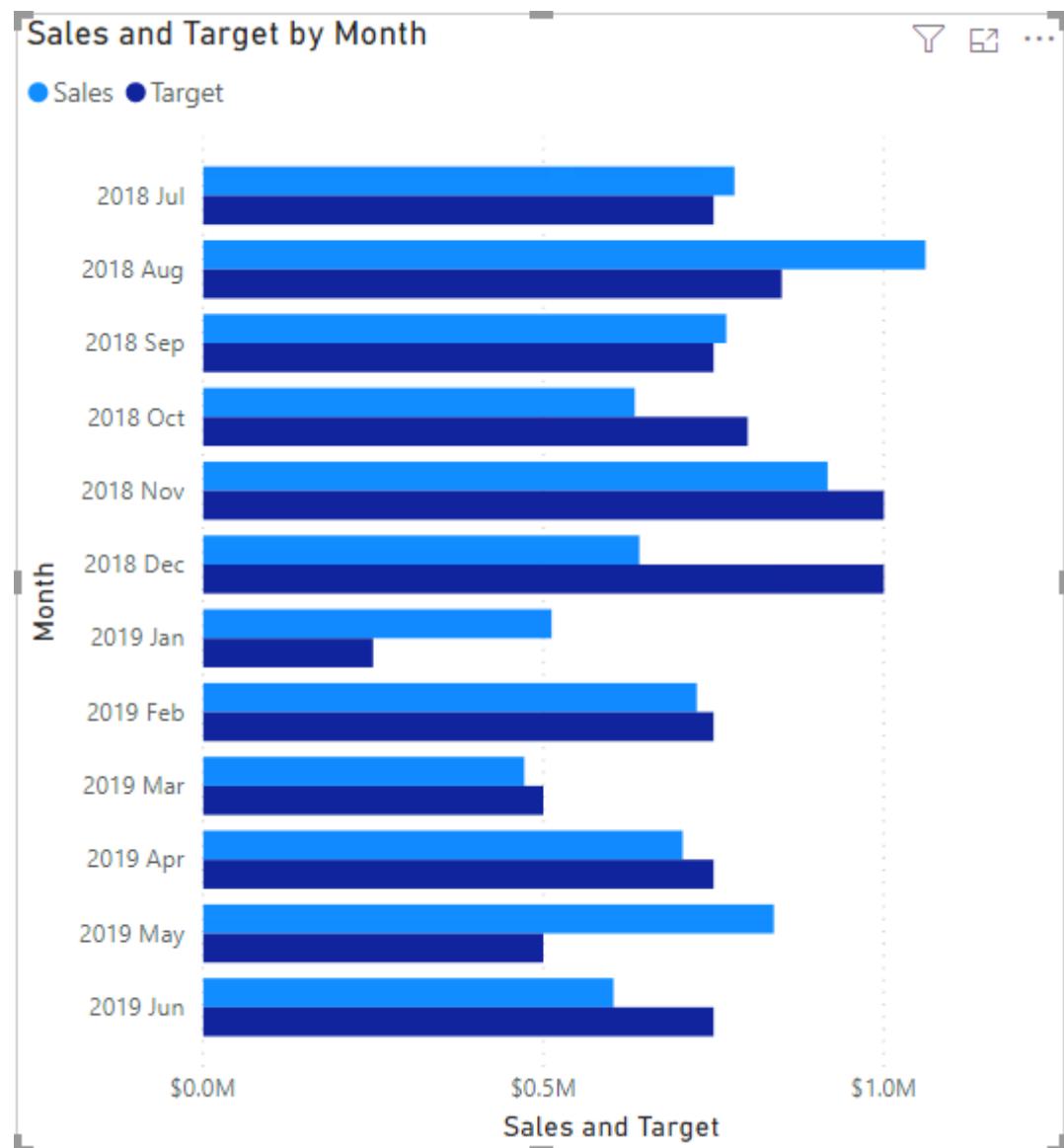
\$8,658,484	\$8,650,000	\$8,484	0.10 %
Sales	Target	Variance	Variance Margin

9. Add a **Clustered Bar Chart** visual, and then resize and reposition it so it sits beneath the multi-row card visual and fills the remaining height of the page, and half the width of the multi-row card visual.



10. Add the following fields to the visual wells:

- Axis: **Date | Month**
 - Value: **Sales | Sales and Targets | Target**

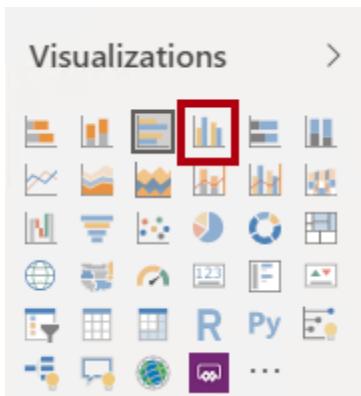


11. To create a copy of the visual, press **Ctrl+C**, and then press **Ctrl+V**.

12. Position the copied visual to the right of the original visual.



13. To modify the visualization type, in the **Visualizations** pane, select **Clustered Column Chart**.



*It's now possible to see the same data expressed by two different visualization types. This isn't a good use of the page layout, but you will improve it in **Lab 09A** by superimposing the visuals. By adding buttons to the page, you will allow the report user to determine which of the two visuals is visible.*

The design of the third and final page is now complete.

Task 6: Publish the report

In this task, you will publish the report.

1. Select the **Overview** page.
2. Save the Power BI Desktop file.
3. On the **Home** ribbon tab, from inside the **Share** group, click **Publish**.



4. Publish the report to your **Sales Analysis** workspace.
5. Leave Power BI Desktop open.

In the next exercise, you will explore the report in the Power BI service.

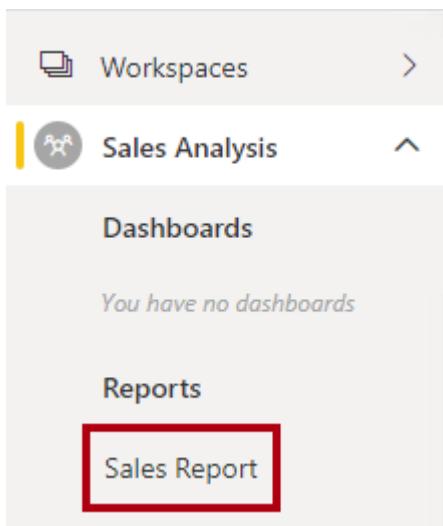
Exercise 2: Explore the Report

In this exercise, you will explore the **Sales Report** in the Power BI service.

Task 1: Explore the report

In this task, you will explore the **Sales Report** in the Power BI service.

1. In the Edge, in the Power BI service, in the **Navigation** pane, review the contents of your **Sales Analysis** workspace, and then click the **Sales Report** report.



*The report publication has added a report to your workspace. If you don't see it, press **F5** to reload the browser, and then expand the workspace again.*

2. In the **Regions** slicer, while pressing the **Ctrl** key, select multiple regions.
3. In the column/line chart, select any month column to cross filter the page.
4. While pressing the **Ctrl** key, select an additional month.

By default, cross filtering filters the other visuals on the page.

5. Notice that the bar chart is filtered and highlighted, with the bold portion of the bars representing the filtered months.
6. Hover the cursor over the visual, and then at the top-right, click the filter icon.



The filter icon allows you to understand all filters that are applied to the visual, including slicers and cross filters from other visual.

7. Hover the cursor over a bar, and then notice the tooltip information.
8. To undo the cross filter, in the column/line chart, click an empty area of the visual.
9. Hover the cursor over the map visual, and then at the top-right, click the **In Focus** icon.



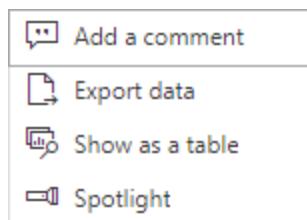
In focus mode zooms the visual to full page size.

10. Hover the cursor over different segments of the pie charts to reveal tooltips.

11. To return to the report page, at the top-left, click **Back to Report**.

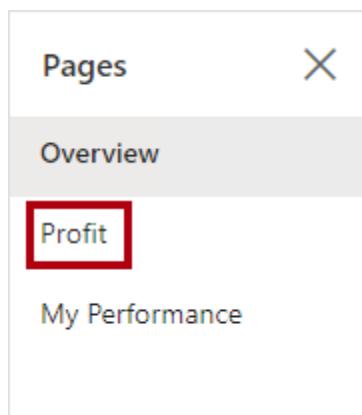


12. Hover the cursor over the map visual again, and then click the ellipsis (...), and notice the menu options.



13. Try out each of the options.

14. At the left, in the **Pages** pane, select the **Profit** page.



15. Notice that the **Region** slicer has a different selection to the **Region** slicer on the Overview page.

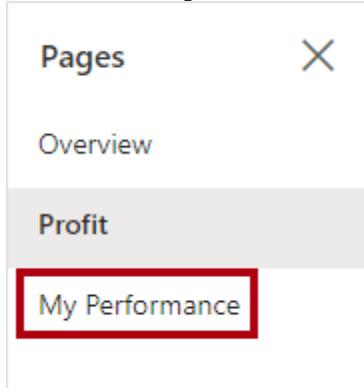
The slicers are not synchronized. In the next lab, you will modify the report design to ensure they sync between pages.

16. In the **Filters** pane (located at the right), expand a filter card, and apply some filters.

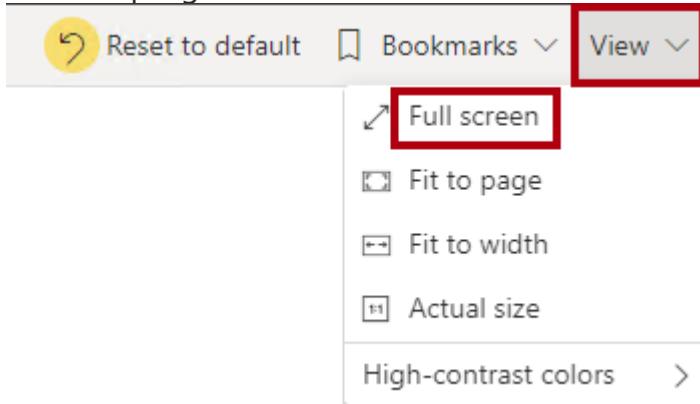
The Filters pane allows you to define more filters than could possibly fit on a page as slicers.

17. In the matrix visual, use the plus (+) button to expand into the **Fiscal** hierarchy.

18. Select the **My Performance** page.



19. At the top-right on the menu bar, click View, and then select Full Screen.



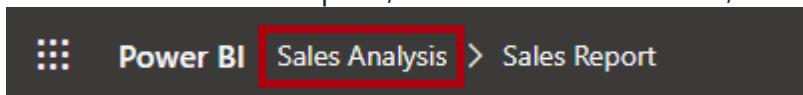
20. Interact with the page by modifying the slicer, and cross filtering the page.

21. At the bottom-left, notice the commands to change page, navigate backwards or forwards between pages, or to exit full screen mode.

22. Exit full screen mode.



23. To return to the workspace, in the breadcrumb trail, click your workspace name.



24. Leave the Edge browser window open.

*You will enhance the report design with advanced features in **Lab 09A**.*

Lab 09A - Designing a Report in Power BI Desktop, Part 2

Overview

The estimated time to complete the lab is 45 minutes

In this lab, you will enhance the **Sales Report** with advanced design features.

In this lab, you learn how to:

- Sync slicers
- Create a drillthrough page
- Apply conditional formatting
- Create and use bookmarks

Exercise 1: Configure Sync Slicers

In this exercise, you will sync the report page slicers.

Task 1: Sync slicers

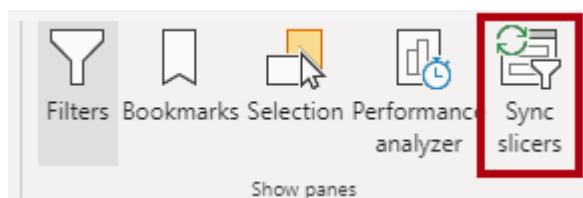
In this task, you will sync the **Year** and **Region** slicers.

You will continue the development of the report that you commenced designing in **Lab 08A**.

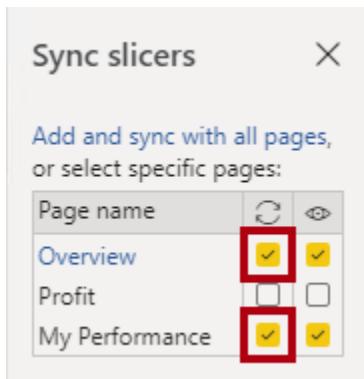
1. In Power BI Desktop, in the **Sales Report** file, on the **Overview** page, set the **Year** slicer to **FY2018**.
2. Go to the **My Performance** page, and then notice that the **Year** slicer is a different value.

When slicers aren't synced, it can contribute to misrepresentation of data and frustration for report users. You'll now sync the report slicers.

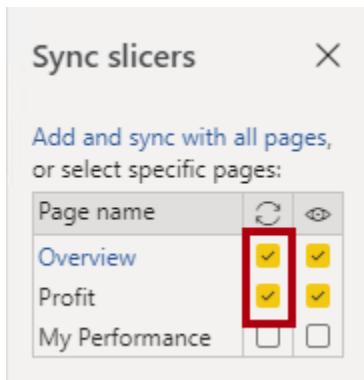
3. Go to the **Overview** page, and then select the **Year** slicer.
4. On the **View** ribbon tab, from inside the **Show Panes** group, click **Sync Slicers**.



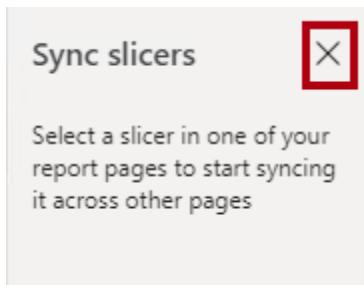
- In the **Sync Slicers** pane (at the left of the **Visualizations** pane), in the second column (which represents syncing), check the checkboxes for the **Overview** and **My Performance** pages.



- On the **Overview** page, select the **Region** slicer.
- Sync the slicer with the **Overview** and **Profit** pages.



- Test the sync slicers by selecting different filter options, and then verifying that the synced slicers filter by the same options.
- To close the **Sync Slicer** page, click the **X** located at the top-right of the pane.



Exercise 2: Configure Drill Through

In this exercise, you will create a new page and configure it as a drill through page. When you've completed the design, the page will look like the following:



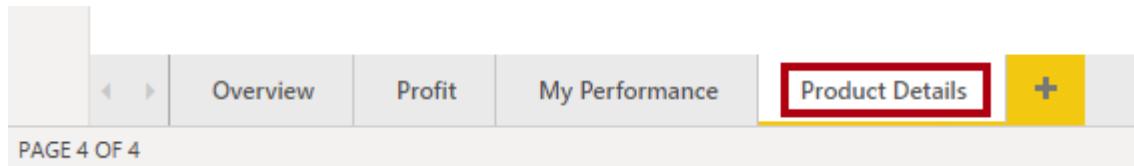
Bikes

Subcategory	Color	Quantity	Sales	Profit Margin
Mountain Bikes	Black	12,371	\$14,219,696	6.13 %
Mountain Bikes	Silver	10,083	\$11,660,457	5.91 %
Road Bikes	Black	13,908	\$9,625,464	-3.36 %
Road Bikes	Red	15,310	\$12,116,381	-3.01 %
Road Bikes	Yellow	8,960	\$6,940,054	-5.25 %
Touring Bikes	Blue	6,415	\$5,593,085	-5.58 %
Touring Bikes	Yellow	4,833	\$3,913,896	-16.17 %
Total		71,880	\$64,069,033	-0.68 %

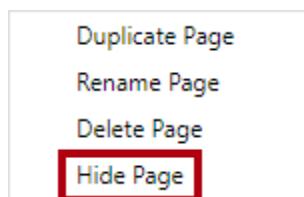
Task 1: Create a drill through page

In this task, you will create a new page and configure it as a drill through page.

1. Add a new report page named **Product Details**.

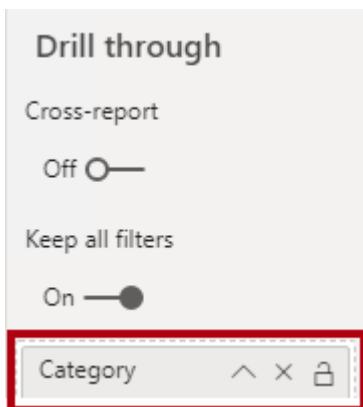


2. Right-click the **Product Details** page tab, and then select **Hide Page**.

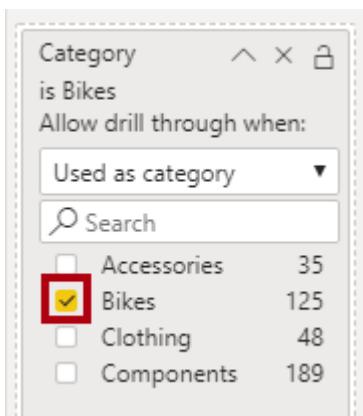


Report users won't be able to go to the drill through page directly. They'll need to access it from visuals on other pages. You'll learn how to drill through to the page in the final exercise of this lab.

3. Beneath the **Visualizations** pane, in the **Drill Through** section, add the **Product | Category** field to the **Add Drill-Through Fields Here** box.



4. To test the drill through page, in the drill through filter card, select **Bikes**.

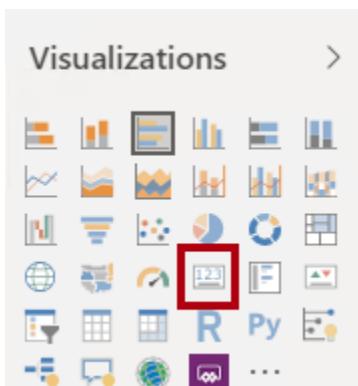


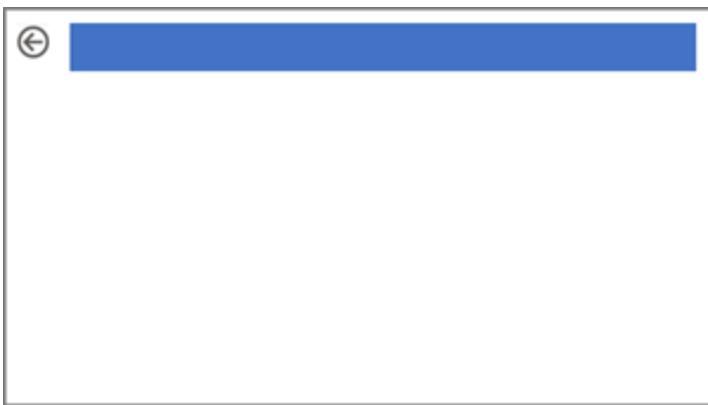
5. At the top-left of the report page, notice the arrow button.



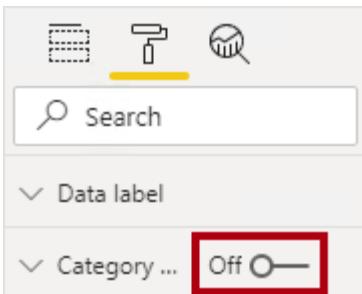
The button was added automatically. It allows report users to navigate back to the page from which they drilled through.

6. Add a **Card** visual to the page, and then resize and reposition it so it sits to the right of the button and fills the remaining width of the page.

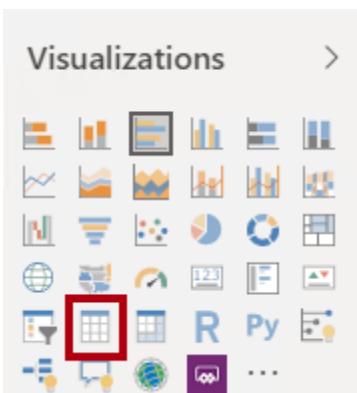




7. Drag the **Product | Category** field into the card visual.
8. Configure the format options for the visual, and then turn the **Category Label** property to **Off**.



9. Set the **Background Color** property to a light shade of gray.
10. Add a **Table** visual to the page, and then resize and reposition it so it sits beneath the card visual and fills the remaining space on the page.





11. Add the following fields to the visual:

- Product | Subcategory
- Product | Color
- Sales | Quantity
- Sales | Sales
- Sales | Profit Margin

12. Configure the format options for the visual, and in the **Grid** section, set the **Text Size** property to **20pt**.

The design of the drill through page is almost complete. In the next exercise, you'll define conditional formatting.

Exercise 3: Add Conditional Formatting

In this exercise, you will enhance the drill through page with conditional formatting. When you've completed the design, the page will look like the following:



Bikes

Subcategory	Color	Quantity	Sales	Profit Margin	
Mountain Bikes	Black	12,371	\$14,219,696	6.13 %	
Mountain Bikes	Silver	10,083	\$11,660,457	5.91 %	
Road Bikes	Black	13,908	\$9,625,464	-3.36 %	
Road Bikes	Red	15,310	\$12,116,381	-3.01 %	
Road Bikes	Yellow	8,960	\$6,940,054	-5.25 %	
Touring Bikes	Blue	6,415	\$5,593,085	-5.58 %	
Touring Bikes	Yellow	4,833	\$3,913,896	-16.17 %	
Total		71,880	\$64,069,033	-0.68 %	

Task 1: Add conditional formatting

In this task, you will enhance the drill through page with conditional formatting.

1. Select the table visual.
2. In the visual fields pane, for the **Profit Margin** field, click the down-arrow, and then select **Conditional Formatting | Icons**.

The screenshot shows the Power BI visual fields pane with the following structure:

- Values** tab selected.
- Fields listed: Subcategory, Color, Quantity, Sales, Profit Margin.
- For the **Profit Margin** field, a context menu is open:
 - Remove field
 - Rename
 - Move
 - Conditional formatting** (highlighted with a red box)
 - Remove conditional formatting
 - Show value as
 - New quick measure
- On the right, a secondary context menu is open for the **Icons** option:
 - Background color
 - Font color
 - Data bars
 - Icons** (highlighted with a red box)
 - Web URL

3. In the **Icons – Profit Margin** window, in the **Icon Layout** dropdown list, select **Right of Data**.

The screenshot shows the 'Icons - Profit Margin' configuration window. At the top, there's a 'Format by' section with a 'Rules' dropdown and a 'Learn more' link. Below it, a 'Based on field' dropdown is set to 'Profit Margin'. Underneath, there's a 'Icon layout' section with a dropdown menu. The 'Right of data' option in this dropdown is highlighted with a red box.

4. To delete the middle rule, at the left of the yellow triangle, click **X**.

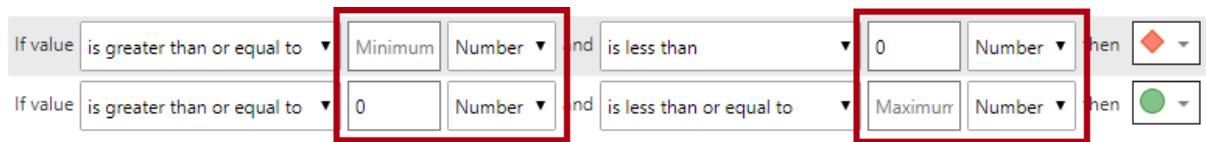


5. Configure the first rule (red diamond) as follows:

- In the second control, remove the value
- In the third control, select **Number**
- In the fifth control, enter **0**
- In the sixth control, select **Number**

6. Configure the second rule (green circle) as follows:

- In the second control, enter **0**
- In the third control, select **Number**
- In the fifth control, remove the value
- In the sixth control, select **Number**



The rules are as follows: display a red diamond if the profit margin value is less than 0; otherwise if the value is great or equal to zero, display the green circle.

- Click **OK**.



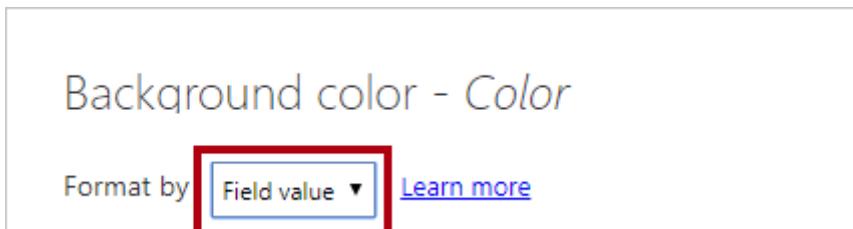
- In the table visual, verify that the correct icons are displayed.

Profit Margin

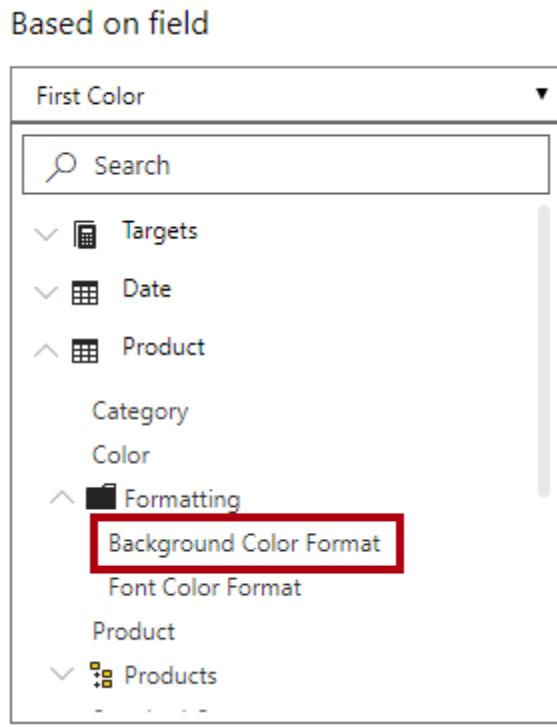
6.13 %	
5.91 %	
-3.36 %	
-3.01 %	
-5.25 %	
-5.58 %	
-16.17 %	
-0.68 %	

- Configure background color conditional formatting for the **Color** field.

- In the **Background Color – Color** window, in the **Format By** dropdown list, select **Field Value**.



- In the **Based on Field** dropdown list, select **Product | Formatting | Background Color Format**.



12. Click **OK**.

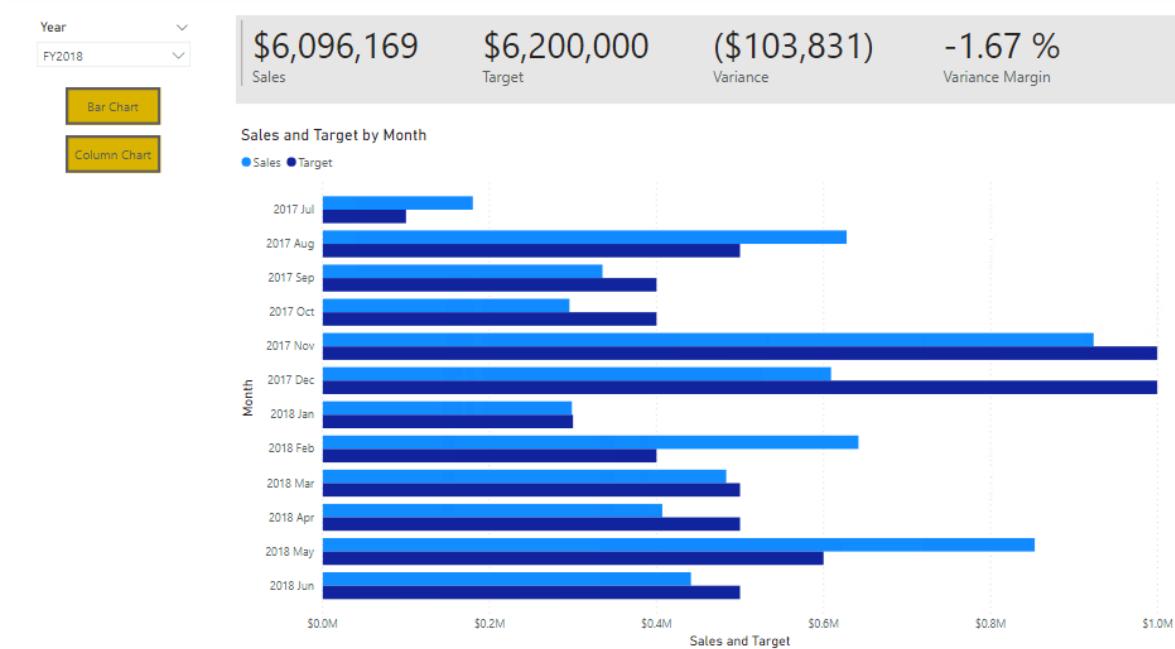


13. Repeat the previous steps to configure font color conditional formatting for the **Color** field, using the **Product | Formatting | Font Color Format** field

*Recall that the background and font colors were source from the **ColorFormats.csv** file in **Lab 02A**, and then integrated with the **Product** query in **Lab 03A**.*

Exercise 4: Add Bookmarks and Buttons

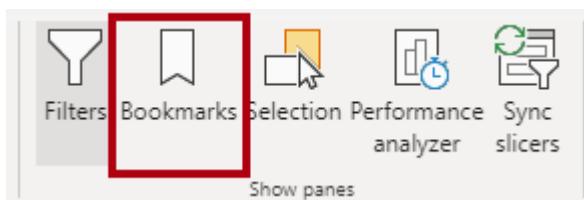
In this exercise, you will enhance the **My Performance** page with buttons, allowing the report user to select the visual type to display. When you've completed the design, the page will look like the following:



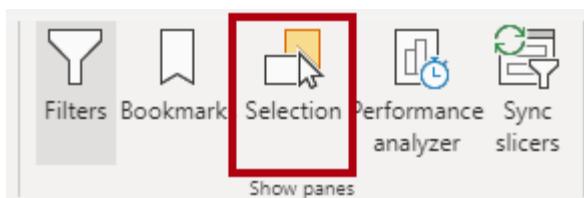
Task 1: Add bookmarks

In this task, you will add two bookmarks, one to display each of the monthly sales/targets visuals.

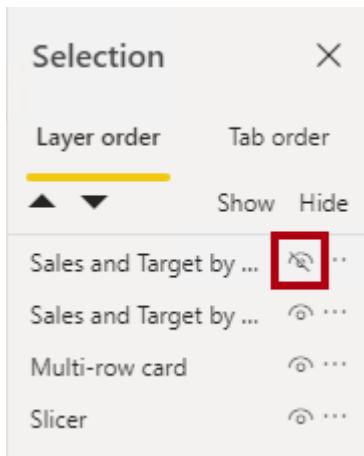
1. Go to the **My Performance** page.
2. On the **View** ribbon tab, from inside the **Show Panes** group, click **Bookmarks**.



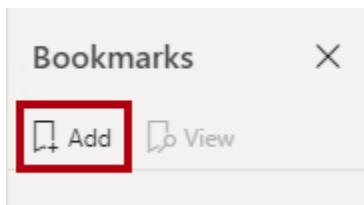
3. On the **View** ribbon tab, from inside the **Show Panes** group, click **Selection**.



4. In the **Selection** pane, beside one of the **Sales and Target by Month** items, to hide the visual, click the eye icon.

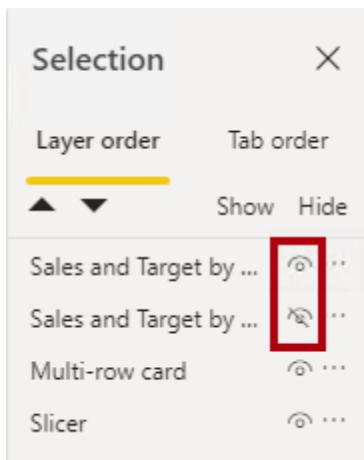


5. In the **Bookmarks** pane, click **Add**.

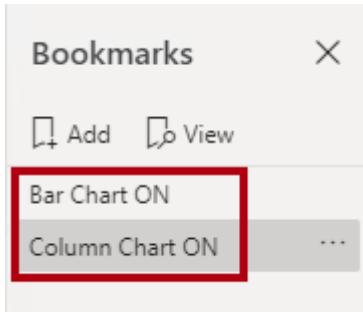


6. To rename the bookmark, double-click the bookmark.
7. If the visible chart is the bar chart, rename the bookmark as **Bar Chart ON**, otherwise rename the bookmark as **Column Chart ON**.
8. In the **Selection** pane, toggle the visibility of the two **Sales and Target by Month** items.

In other words, make the visible visual hidden, and make the hidden visual visible.



9. Create a second bookmark, and name it appropriately (either **Column Chart ON** or **Bar Chart ON**).



10. In the **Selection** pane, to make both visuals visible, simple show the hidden visual.
11. Resize and reposition both visuals so they fill the page beneath the multi-card visual, and completely overlap one another.

*Tip: To select the visual that is covered up, select it in the **Selection** pane.*



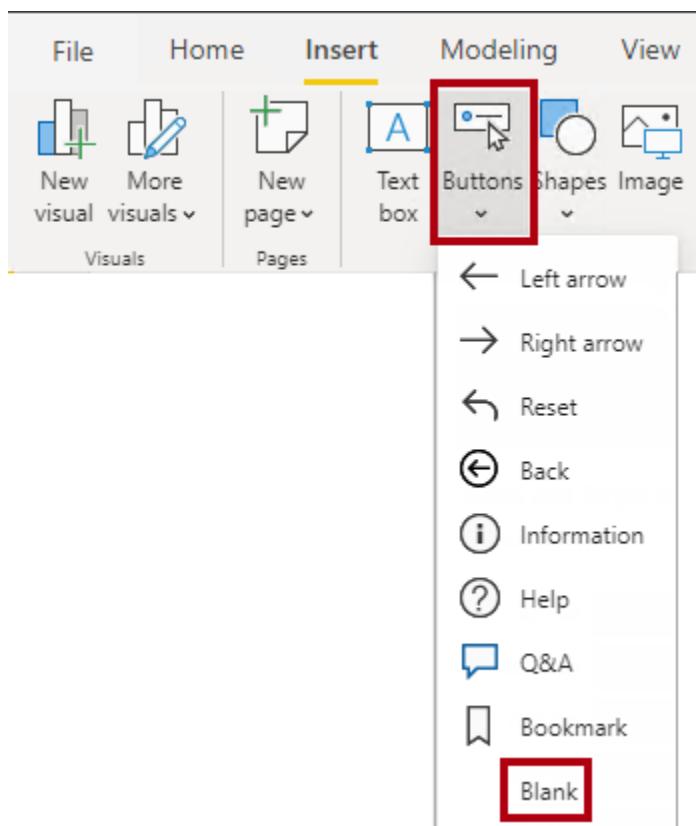
12. In the **Bookmarks** pane, select each of the bookmarks, and notice that only one of the visuals is visible.

The next stage of design is to add two buttons to the page, which will allow the report user to select the bookmarks.

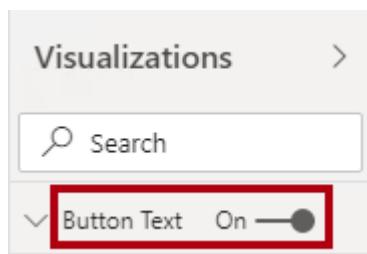
Task 2: Add buttons

In this task, you will add two buttons, and assign bookmark actions to each.

1. On the **Insert** ribbon, from inside the **Elements** group, click **Button**, and then select **Blank**.



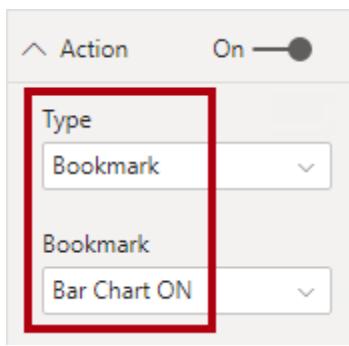
2. Reposition the button directly beneath the **Year** slicer.
3. Select the button, and in the **Visualizations** pane, turn the **Button Text** property to **On**.



4. Expand the **Button Text** section, and then in the **Button Text** box, enter **Bar Chart**.
5. Format the background color, using a suitable color.
6. Turn the **Action** property to **On** (located near the bottom of the list).



7. Expand the **Action** section, and then set the **Type** dropdown list to **Bookmark**.
8. In the **Bookmark** dropdown list, select **Bar Chart ON**.



9. Create a copy of the button by using copy and paste, and then configure the new button as follows:
 - o Set the **Button Text** property to **Column Chart**
 - o In the **Action** section, set the **Bookmark** dropdown list to **Column Chart ON**

Task 3: Publish the report

In this task, you will publish the report.

1. Select the **Overview** page.
2. In the **Year** slicer, select **FY2020**.
3. In the **Region** slicer, select **Select All**.
4. Save the Power BI Desktop file.
5. Publish the report to your **Sales Analysis** workspace.
6. When prompted to replace the report, click **Replace**.



7. Leave Power BI Desktop open.

In the next exercise, you will explore the report in the Power BI service.

Exercise 5: Explore the Report

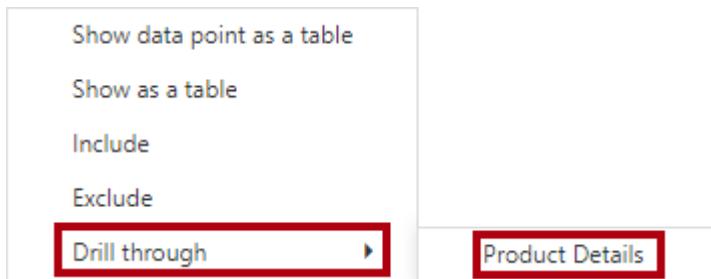
In this exercise, you will explore the **Sales Report** in the Power BI service.

Task 1: Explore the report

In this task, you will explore the **Sales Report** in the Power BI service.

1. In the Edge, in the Power BI service, open the **Sales Report** report.

2. To test the drill through report, in the **Quantity by Category** visual, right-click the **Clothing** bar, and then select **Drill Through | Product Details**.

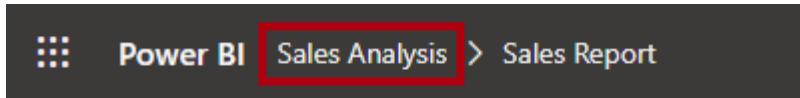


3. Notice that the **Product Details** page is for **Clothing**.
4. To return to the source page, at the top-left corner, click the arrow button.
5. Select the **My Performance** page.
6. Click each of the buttons, and then notice that a different visual is displayed.

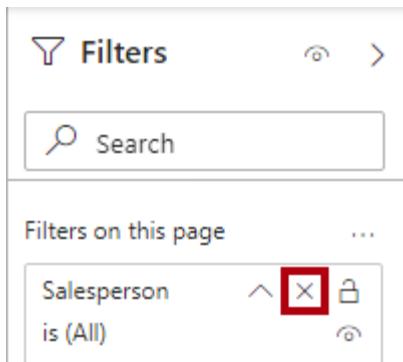
Finish up

In this task, you will complete the lab.

1. To return to the workspace, in the breadcrumb trail, click your workspace name.



2. Leave the Edge browser window open.
3. In Power BI Desktop, go to the **My Performance** page, and in the **Fields** pane, remove the **Salesperson** filter card.



4. Select the **Overview** page.
5. Save the Power BI Desktop file, and then republish to the **Sales Analysis** workspace.
6. Close Power BI Desktop.

*When you share the report in **Lab 12A**, the report will enforce row-level security.*

Lab 10A - Creating a Power BI Dashboard

Overview

The estimated time to complete the lab is 45 minutes

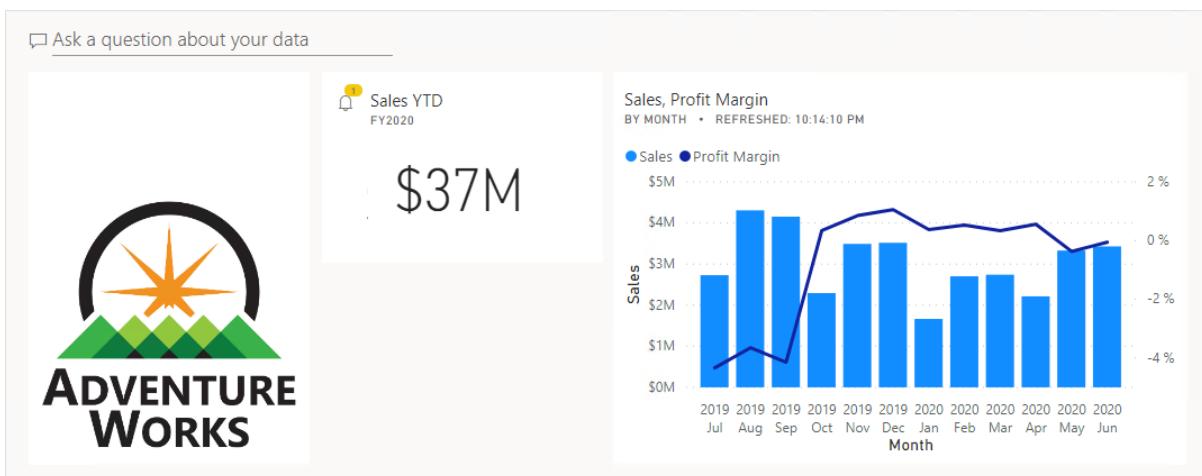
In this lab, you will create the **Sales Monitoring** dashboard.

In this lab, you learn how to:

- Pin visuals to a dashboard
- Use Q&A to create dashboard tiles
- Configure a dashboard tile alert

Exercise 1: Create a Dashboard

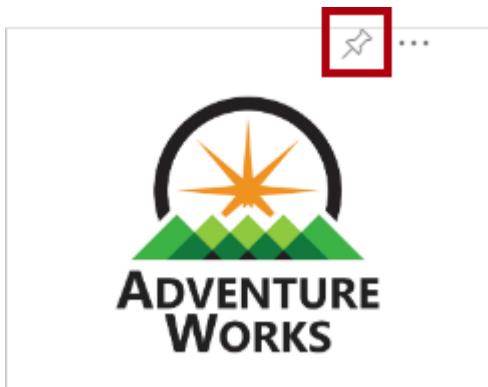
In this exercise, you will create the **Sales Monitoring** dashboard. The completed dashboard will look like the following:



Task 1: Create a dashboard

In this task, you will create the **Sales Monitoring** dashboard.

1. In Edge, in the Power BI service, open the **Sales Report** report.
2. To create a dashboard and pin the logo image, hover the cursor over the Adventure Works logo.
3. At the top-right corner, click the pushpin.



4. In the **Pin to Dashboard** window, in the **Dashboard Name** box, enter **Sales Monitoring**.

Pin to dashboard

Select an existing dashboard or create a new one.

Where would you like to pin to?

- Existing dashboard
 New dashboard

Dashboard name

5. Click **Pin**.



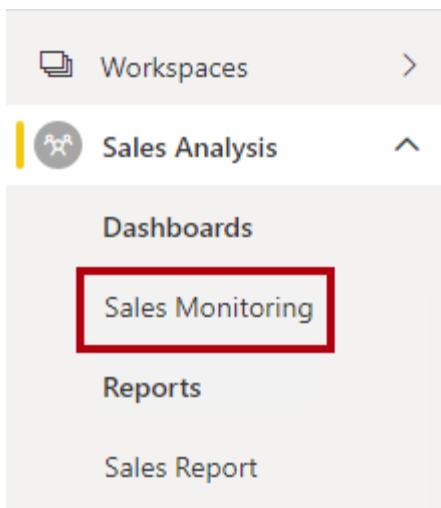
6. Set the **Year** slicer to **FY2020**.



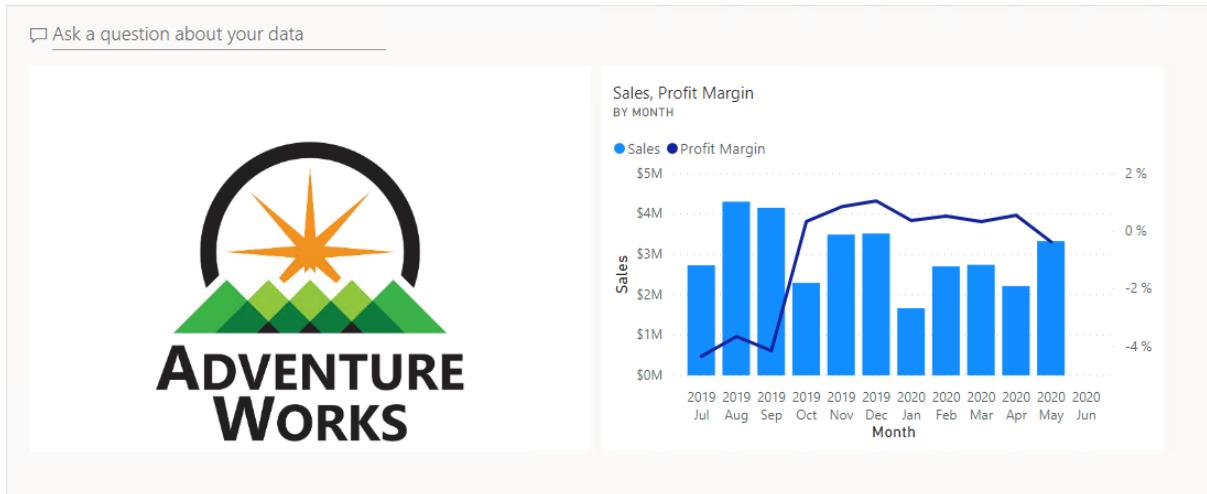
7. Set the **Region** slicer to **Select All**.

When pinning visuals to a dashboard, they will use the current filter context. Once pinned, the filter context cannot be changed. For time-based filters, it's a better idea to use a relative date slicer (or, Q&A using a relative time-based question).

8. Pin the **Sales and Profit Margin by Month** (column/line) visual to the **Sales Monitoring** dashboard.
9. Open the **Navigation** pane, and then open the **Sales Monitoring** dashboard.



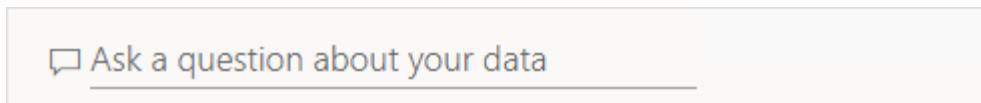
10. Notice that the dashboard has two tiles.



11. To resize the logo tile, drag the bottom-right corner, and resize the tile to become one unit wide, and two units high.

Tile sizes are constrained into a rectangular shape. It's only possible to resize into multiples of the rectangular shape.

12. To add a tile based on a question, at the top-left of the dashboard, click **Ask a Question About Your Data**.



13. You can use the Q&A feature to ask a question, and Power BI will respond with a visual.

14. Click any one of the suggested questions beneath the Q&A box, in gray boxes.

15. Review the response.

16. Remove all text from the Q&A box.

17. In the Q&A box, enter the following: **Sales YTD**

A screenshot of a Q&A box. At the top left is a back arrow labeled 'Exit Q&A'. Below it is a text input field containing the text 'Sales YTD', which is highlighted with a red rectangular border. The background of the box is light gray.

18. Notice the response of **(Blank)**.

(Blank)

Sales YTD

*Recall you added the **Sales YTD** measure in **Lab 06B**. This measure is Time Intelligence expression and it requires a filter on the **Date** table to produce a result.*

19. Extend the question with: **in year FY2020**.

A screenshot of a Q&A box. At the top left is a back arrow labeled 'Exit Q&A'. Below it is a text input field containing the text 'Sales YTD in year FY2020', which is highlighted with a red rectangular border. The background of the box is light gray.

20. Notice the response is now **\$33M**.

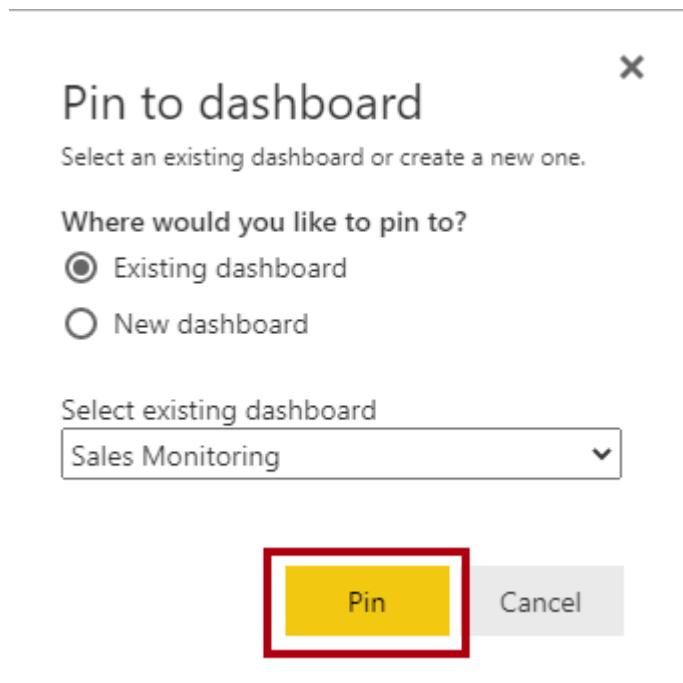
\$33M

Sales YTD

21. To pin the response to the dashboard, at the top-right corner, click **Pin Visual**.

A screenshot of a ribbon-style interface. On the left is a 'Pin visual' button with a red rectangular border around its icon and text. To its right is a toggle switch labeled 'New Q&A experience on' with a yellow circle indicating it is turned on. The background is white.

22. When prompted to pin the tile to the dashboard, click **Pin**.



*There's a possible bug that will only allow you to pin to a new dashboard. It's because your Power BI session has reverted to your "My Workspace". If this happens, do not pin to a new dashboard. Return to your **Sales Analysis** workspace, open the dashboard again, and recreate the Q&A question.*

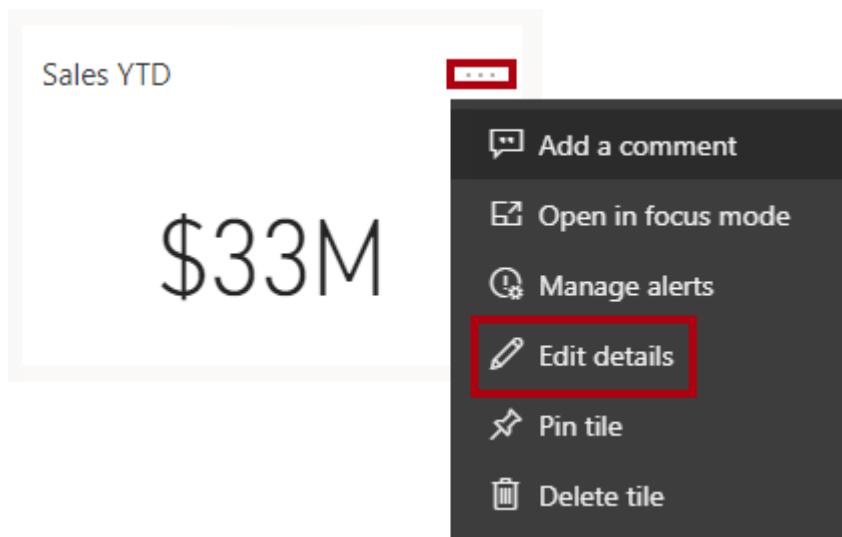
23. To return to the dashboard, at the top-left corner, click **Exit Q&A**.



Task 2: Edit tile details

In this task, you will edit the details of two tiles.

1. Hover the cursor over the **Sales YTD** tile, and then at the top-right of the tile, click the ellipsis, and then select **Edit Details**.



2. In the **Tile Details** pane (located at the right), in the **Subtitle** box, enter **FY2020**.

Tile details

* Required

Details

Display title and subtitle

Title

Sales YTD

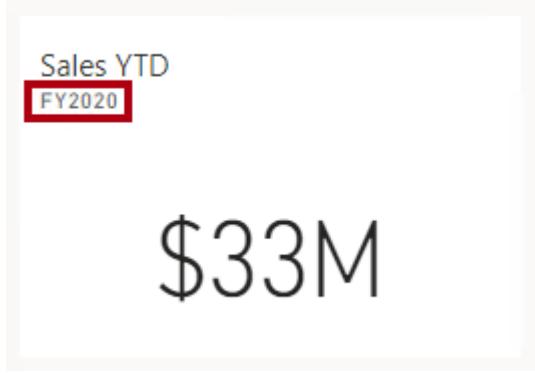
Subtitle

FY2020

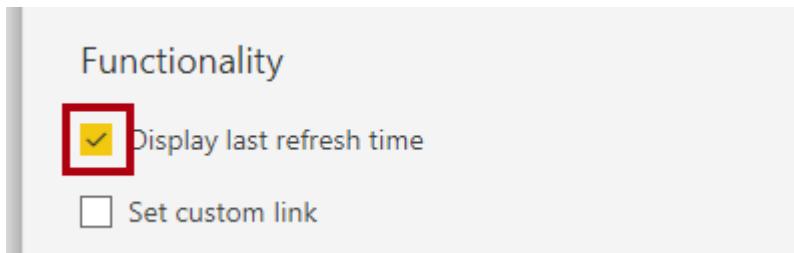
3. At the bottom of the pane, click **Apply**.



4. Notice that the **Sales YTD** tile displays a subtitle.



5. Edit the tile details for the **Sales, Profit Margin** tile.
6. In the **Tile Details** pane, in the **Functionality** section, check **Display Last Refresh Time**.



7. Click **Apply**.



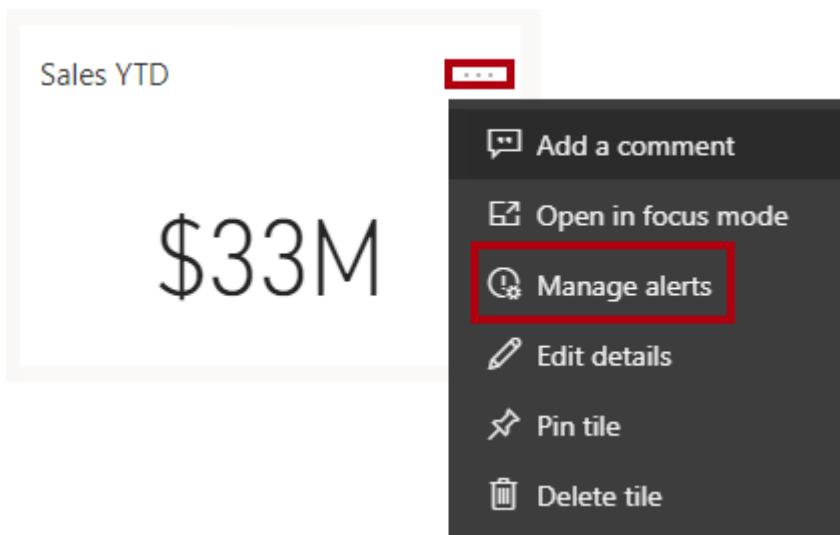
-
8. Notice that the tile describes the last refresh time (which you did when refreshing the data model in Power BI Desktop).

Later in this lab, you'll simulate a data refresh, and notice that the refresh time updates.

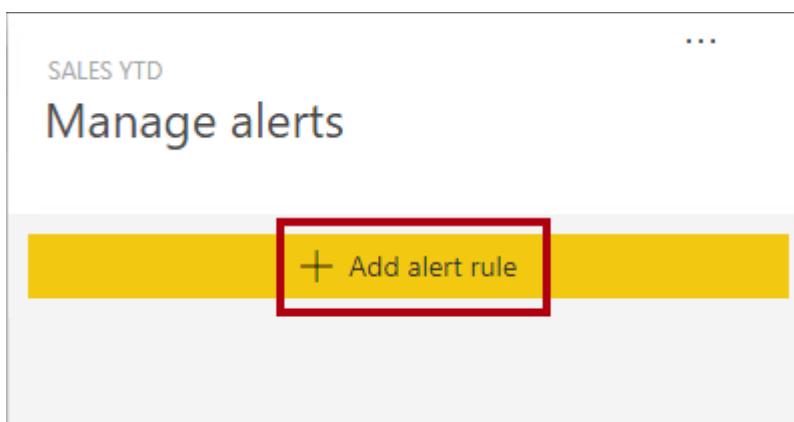
Task 3: Configure an alert

In this task, you will configure a data alert.

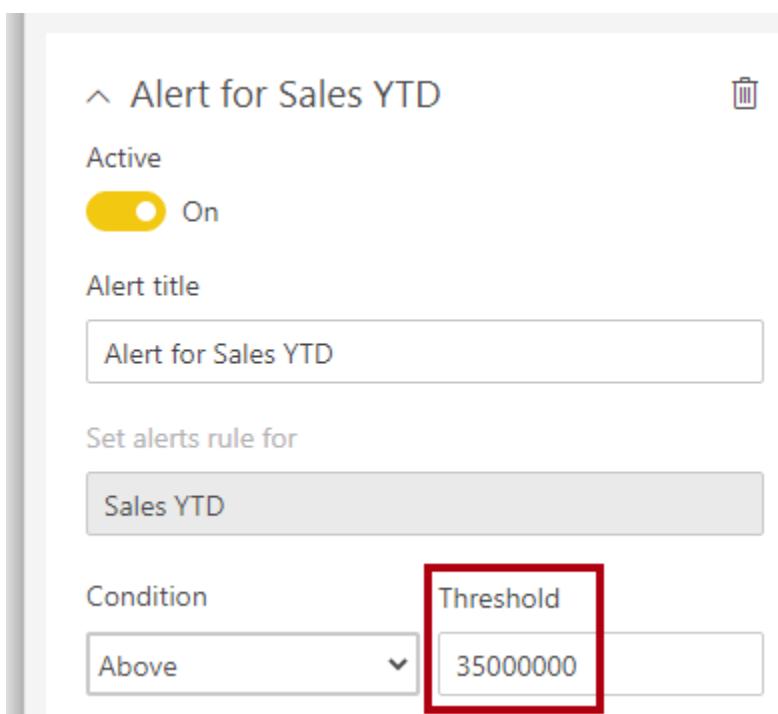
1. Hover the cursor over the **Sales YTD** tile, click the ellipsis, and then select **Manage Alerts**.



2. In the **Manage Alerts** pane (located at the right), click **Add Alert Rule**.



3. In the **Threshold** box, replace the value with **35000000** (35 million).



This configuration will ensure you're notified whenever the tile updates to a value above 35 million.

4. At the bottom of the pane, click **Save and Close**.



In the next exercise, you'll refresh the dataset. Typically, this should be done by using scheduled refresh, and Power BI could use a gateway to connect to the SQL Server database. However, due to constraints in the classroom setup, there is no gateway. So, you'll open Power BI Desktop, perform a manual data refresh, and then upload the file.

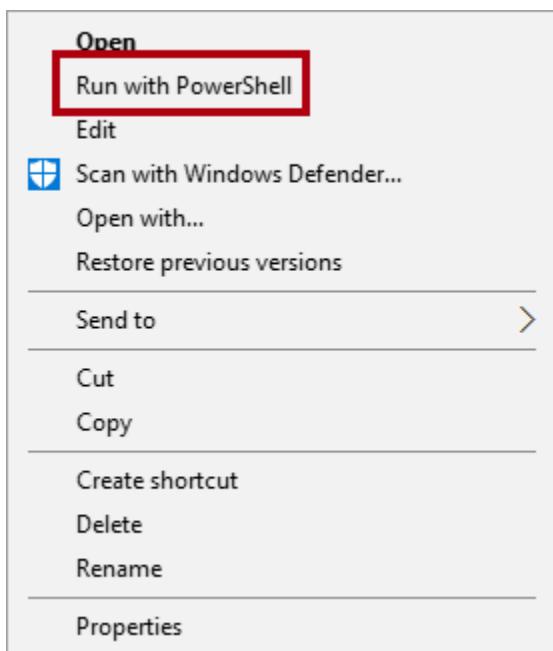
Exercise 2: Refresh the Dataset

In this exercise, you will first load sales order data for June 2020 into the **AdventureWorksDW2020** database, and then add your classroom partner's account to the database.. You will then open your Power BI Desktop file, perform a data refresh, and then upload the file to your **Sales Analysis** workspace.

Task 1: Update the lab database

In this task, you will run a PowerShell script to update data in the **AdventureWorksDW2020** database.

1. In File Explorer, inside the **D:\DA100\Setup** folder, right-click the **UpdateDatabase-2-AddSales.ps1** file, and then select **Run with PowerShell**.



xxxvii. When prompted to press any key to continue, press **Enter** again.

*The **AdventureWorksDW2020** database now includes sales orders June 2020.*

2. Inside the **D:\DA100\Setup** folder, right-click the **UpdateDatabase-3-AddPartnerAccount.ps1** file, and then select **Run with PowerShell**.
3. When prompted, enter the account name of your classroom partner, and then press **Enter**.

*You only need to enter their account name (all characters before the @ symbol). Choose somebody sitting near you—you will work together in pairs to complete **Lab 12A**, which covers sharing Power BI content.*

Their account name is added so you can test the row-level security. Your partner is now Pamela Ansam-Wolfe, whose sales performance is measured by the sales of two sales territory regions: US Northwest and US Southwest.

Task 2: Refresh the Power BI Desktop file

In this task, you will open the Sales Analysis Power BI Desktop file, perform a data refresh, and then upload the file to your **Sales Analysis** workspace.

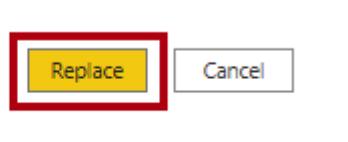
1. Open your **Sales Analysis** Power BI Desktop file, stored in the **D:\DA100\MySolution** folder.

*When the file was published in **Lab 06B**, if you weren't confident you completed the lab successfully you were advised to upload the solution file instead. If you uploaded the solution file, be sure now to open the solution file again now. It's located in the **D:\DA100\Lab06B\Solution** folder.*

2. On the **Home** ribbon, from inside the **Queries** group, click **Refresh**.



3. When the refresh completes, save the Power BI Desktop file.
4. Publish the file to your **Sales Analysis** workspace.
5. When prompted to replace the dataset, click **Replace**.



The dataset in the Power BI service now has June 2020 sales data.

6. Close Power BI Desktop.
7. In Edge, in the Power BI service, in your **Sales Analysis** workspace, notice that the **Sales Analysis** report was also published.

This report was used to test the model a you developed it in **Lab 05A** and **Lab 06A**.

8. Remove the **Sales Analysis** report (not dataset).

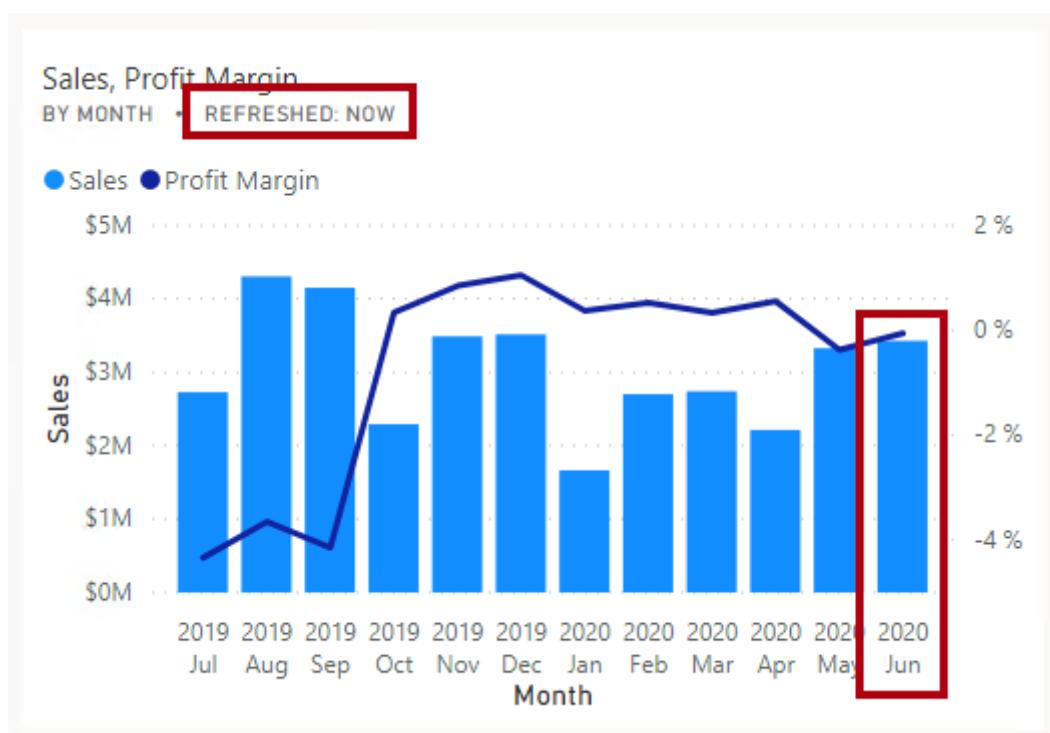
Exercise 3: Review the Dashboard

In this exercise, you will review the dashboard to notice updated sales, and that the alert was triggered.

Task 1: Review the dashboard

In this task, you will review the dashboard to notice updated sales, and that the alert was triggered.

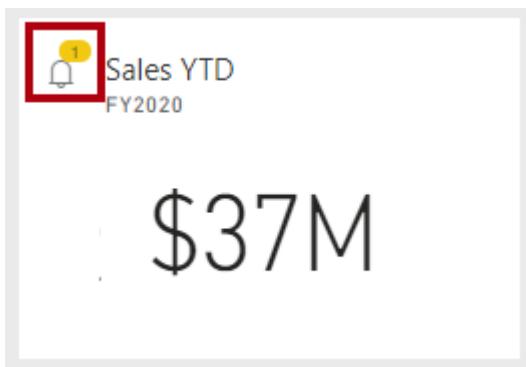
1. In Edge, in the Power BI service, open the **Sales Monitoring** dashboard.
2. In the **Sales, Profit Margin** tile, in the subtitle, notice that the data was refreshed **NOW**.
3. Notice also that there is now a column for **2020 Jun**.



The alert on the **Sales YTD** tile should have triggered also. After a short while, the alert should notify you that sales now exceeds the configured threshold value.

4. Notice that the **Sales YTD** tile has updated to **\$37M**.
5. Verify that the **Sales YTD** tile displays an alert notification icon.

*If you don't see the notification, you might need to press **F5** to reload the browser. If you still don't see the notification, wait some minutes longer.*



Alert notifications appear on the dashboard tile, and can be delivered by email, and push notifications to mobile apps including the Apple Watch8.

Lab 11A - Data Analysis in Power BI Desktop

Overview

The estimated time to complete the lab is 45 minutes

In this lab, you will create the **Sales Exploration** report.

In this lab, you learn how to:

- Create animated scatter charts
- Use a visual to forecast values
- Work with the decomposition tree visual
- Work with the key influences visual

Exercise 1: Create the Report

In this exercise, you will create the **Sales Exploration** report.

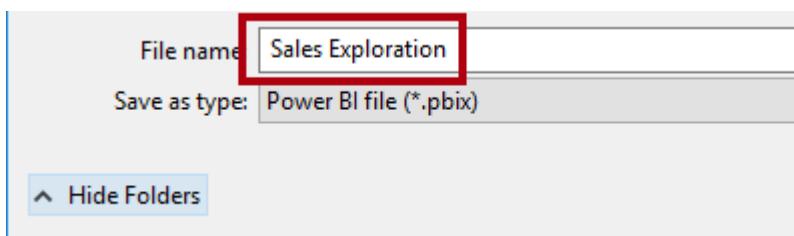
Task 1: Create the report

In this task, you will create the **Sales Exploration** report.

1. Open the Power BI Desktop, and dismiss the welcome screen.

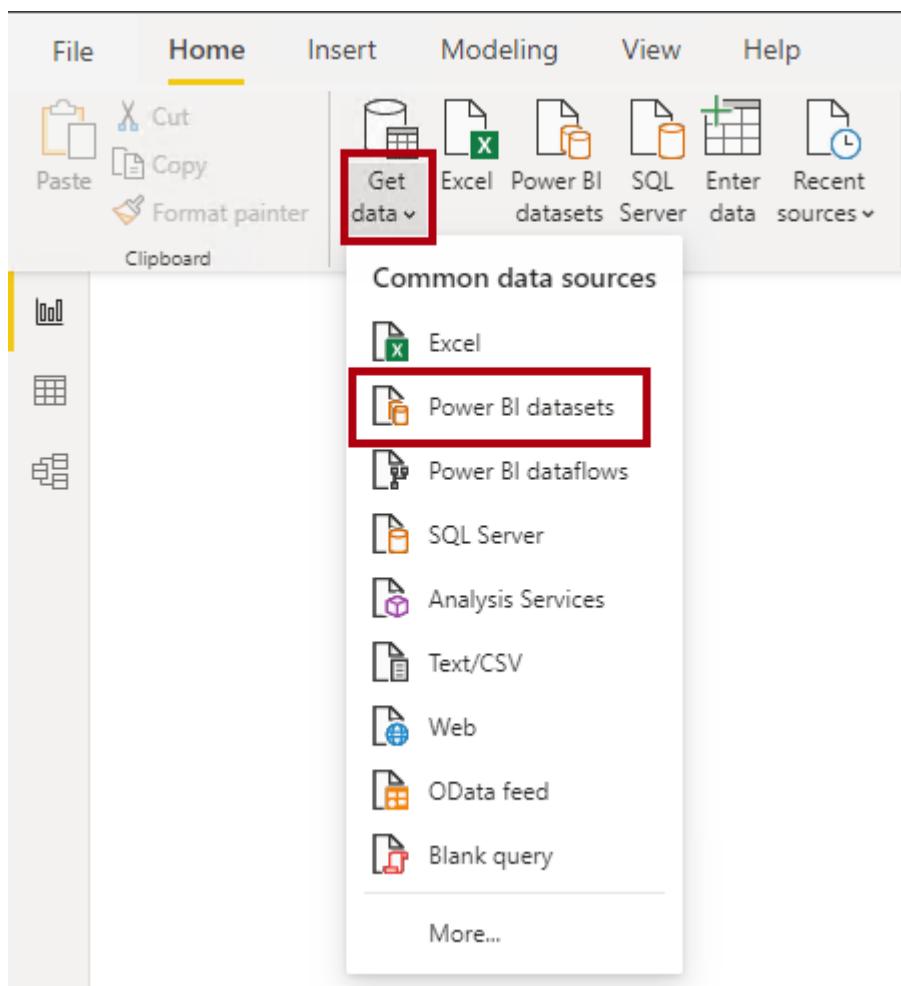


2. Save the file to the **D:\DA100\MySolution** folder, as **Sales Exploration**.



3. Create a live connection to your **Sales Analysis** dataset.

*Tip: Use the **Get Data** command on the **Home** ribbon tab, and then select **Power BI Datasets**.*



You now create four report pages, and on each page you'll work with a different visual to analyze and explore data.

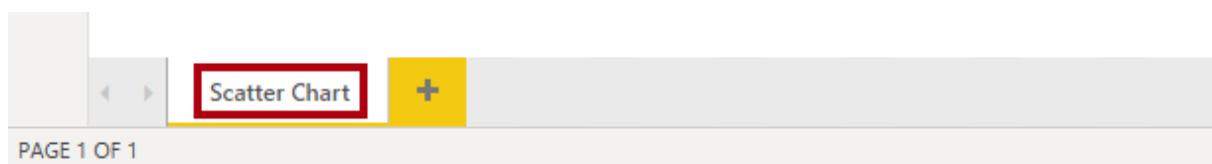
Exercise 2: Create a Scatter Chart

In this exercise, you will create a scatter chart that can be animated.

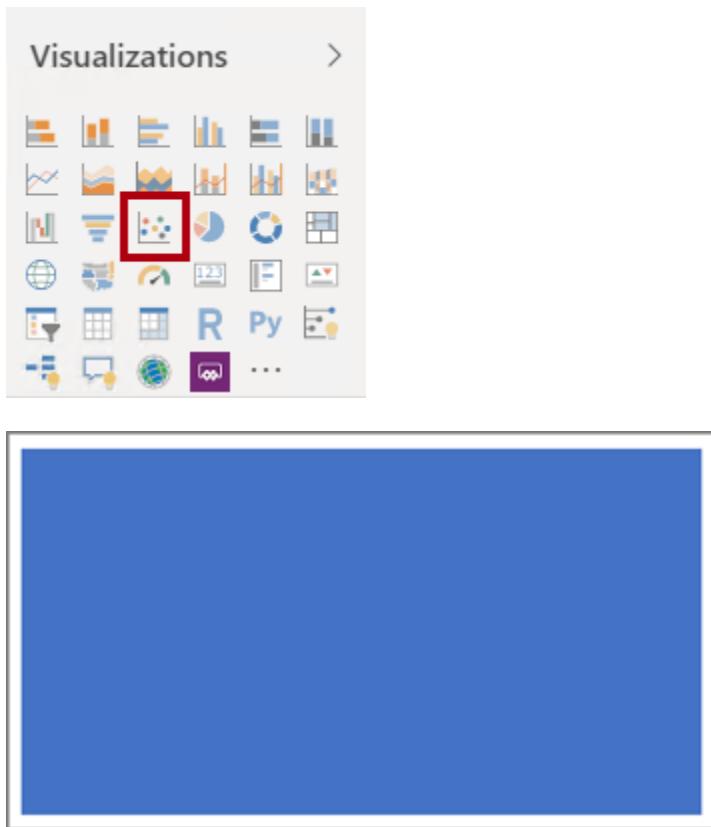
Task 1: Create an animated scatter chart

In this task, you will create a scatter chart that can be animated.

1. Rename **Page 1** as **Scatter Char****rt**.

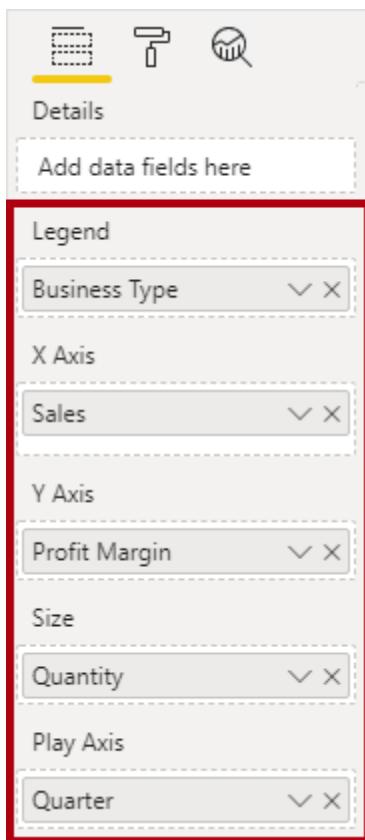


2. Add a **Scatter Chart** visual to the report page, and then reposition and resize it so it fills the entire page.



3. Add the following fields to the visual wells:

- Legend: **Reseller | Business Type**
- X Axis: **Sales | Sales**
- Y Axis: **Sales | Profit Margin**
- Size: **Sales | Quantity**
- Play Axis: **Date | Quarter**



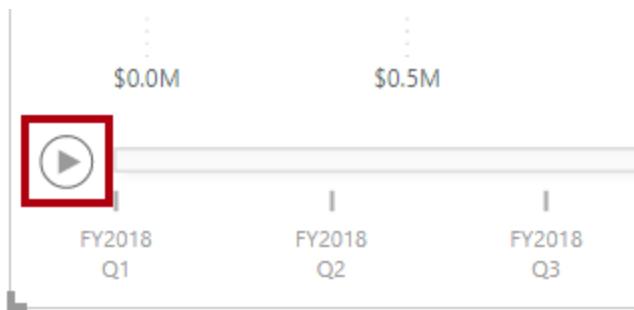
*The chart can be animated when a field is added to the **Play Axis** well.*

4. In the **Filters** pane, add the **Product | Category** field to the **Filters On This Page** well.
5. In the filter card, filter by **Bikes**.

The screenshot shows the Power BI Filters pane with a filter card for "Category". The card has the following sections:

- Category**: is Bikes
- Filter type**: Basic filtering
- Search**: (empty)
- Options**: Select all, Accessories (35), **Bikes** (125) (checkbox checked and highlighted with a red box), Clothing (48), Components (189)

6. To animate the chart, at the bottom left corner, click **Play**.



7. Watch the entire animation cycle from **FY2018 Q1** to **FY2020 Q4**.

The scatter chart allows understanding the measure values simultaneously: in this case, order quantity, sales revenue, and profit margin.

Each bubble represents a reseller business type. Changes in the bubble size reflect increased or decreased order quantities. While horizontal movements represent increases/decreases in sales revenue, and vertical movements represent increases/decreases in profitability.

8. When the animation stops, click one of the bubbles to reveal its tracking over time.
9. Hover the cursor over any bubble to reveal a tooltip describing the measure values for the reseller type at that point in time.
10. In the **Filters** pane, filter by **Clothing** only, and notice that it produces a very different result.
11. Save the Power BI Desktop file.

Exercise 3: Create a Forecast

In this exercise, you will create a forecast to determine possible future sales revenue.

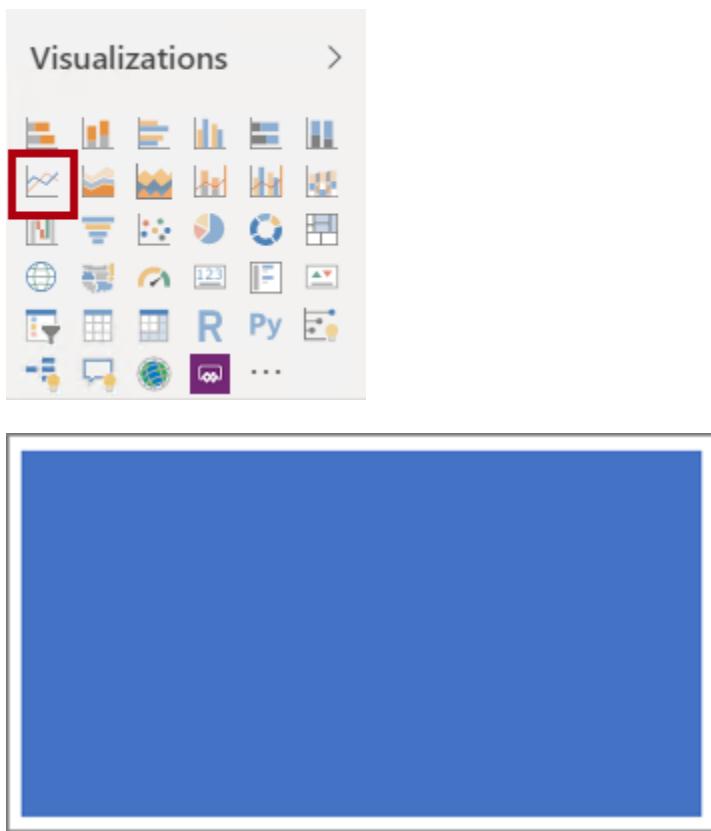
Task 1: Create a forecast

In this task, you will create a forecast to determine possible future sales revenue.

1. Add a new page, and then rename the page to **Forecast**.

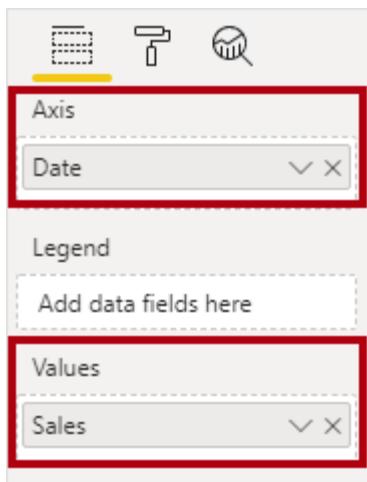


2. Add a **Line Chart** visual to the report page, and then reposition and resize it so it fills the entire page.



3. Add the following fields to the visual wells:

- o Axis: **Date | Date**
- o Values: **Sales | Sales**



4. In the **Filters** pane, add the **Date | Year** field to the **Filters On This Page** well.
5. In the filter card, filter by two years: **FY2019** and **FY2020**.

Filters on this page ...

Year

is FY2019 or FY2020

Filter type ⓘ

Basic filtering ▾

🔍 Search

	Year	Count
<input type="checkbox"/>	Select all	
<input type="checkbox"/>	FY2018	365
<input checked="" type="checkbox"/>	FY2019	365
<input checked="" type="checkbox"/>	FY2020	366
<input type="checkbox"/>	FY2021	365
<input type="checkbox"/>	FY2022	365

When forecasting over a time line, you will need at least two cycles (years) of data to produce an accurate and stable forecast.

6. Add also the **Product | Category** field to the **Filters On This Page** well, and filter by **Bikes**.

Filters on this page ...

Category

is Bikes

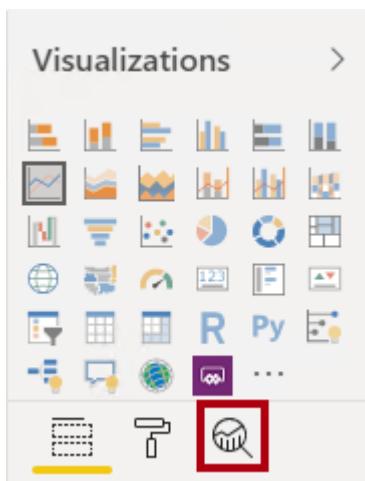
Filter type ⓘ

Basic filtering ▾

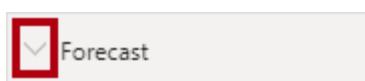
🔍 Search

	Category	Count
<input type="checkbox"/>	Select all	
<input type="checkbox"/>	Accessories	35
<input checked="" type="checkbox"/>	Bikes	125
<input type="checkbox"/>	Clothing	48
<input type="checkbox"/>	Components	189

7. To add a forecast, beneath the **Visualizations** pane, select the **Analytics** pane.

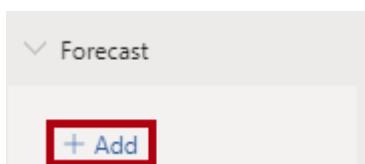


8. Expand the **Forecast** section.



If the **Forecast** section is not available, it's probably because the visual hasn't been correctly configured. Forecasting is only available when two conditions are met: the axis has a single field of type date, and there's only one value field.

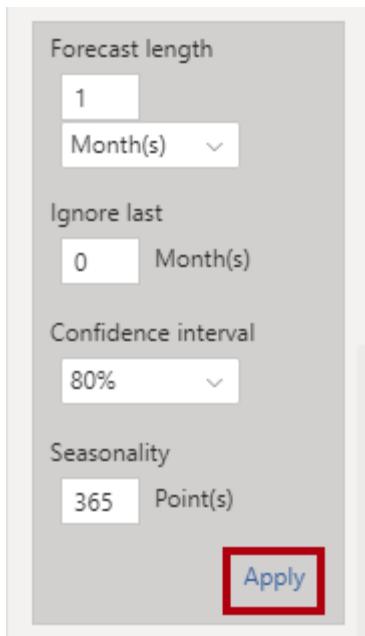
9. Click **Add**.



10. Configure the following forecast properties:

- Forecast length: 1 month
- Confidence interval: 80%
- Seasonality: 365

11. Click **Apply**.



12. In the line visual, notice that the forecast has extended one month beyond the history data.

The gray area represents the confidence. The wider the confidence, the less stable—and therefore the less accurate—the forecast is likely to be.

When you know the length of the cycle, in this case annual, you should enter the seasonality points. Sometimes it could be weekly (7), or monthly (30).

13. In the **Filters** pane, filter by **Clothing** only, and notice that it produces a different result.

14. Save the Power BI Desktop file.

Exercise 4: Work with a Decomposition Tree

In this exercise, you will create a decomposition tree to explore the relationships between reseller geography and profit margin.

Task 1: Work with a decomposition tree

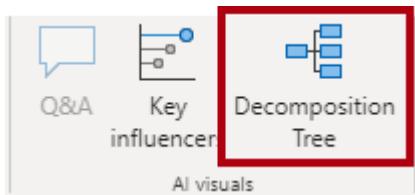
In this task, you will create a decomposition tree to explore the relationships between reseller geography and profit margin.

1. Add a new page, and then rename the page to **Decomposition Tree**.



2. On the **Insert** ribbon, from inside the **AI Visuals** group, click **Decomposition Tree**.

*Tip: The AI visuals are also available in the **Visualizations** pane.*

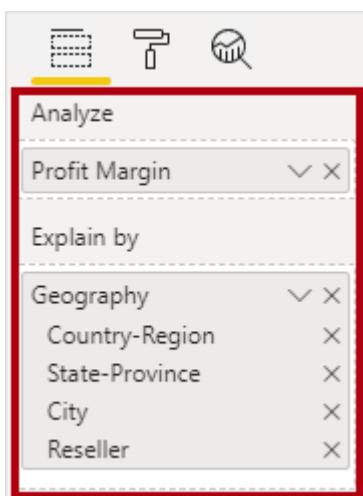


3. Reposition and resize the visual so it fills the entire page.

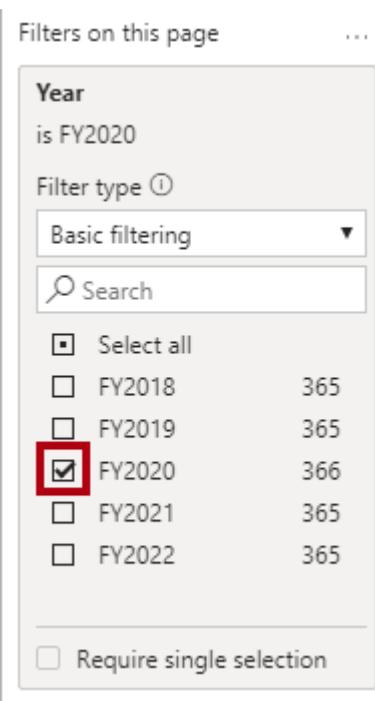


4. Add the following fields to the visual wells:

- Analyze: **Sales | Profit Margin**
- Explain By: **Reseller | Geography** (the entire hierarchy)



5. In the **Filters** pane, add the **Date | Year** field to the **Filters On This Page** well, and set the filter to **FY2020**.



- In the decomposition tree visual, notice the root of the tree: **Profit Margin** at -0.94%



- Click the plus icon, and in the context menu, select **High Value**.



- Notice that the decision tree presents resellers, ordered from highest profit margin.
- To remove the level, at the top of visual, beside the **Reseller** label, click X.

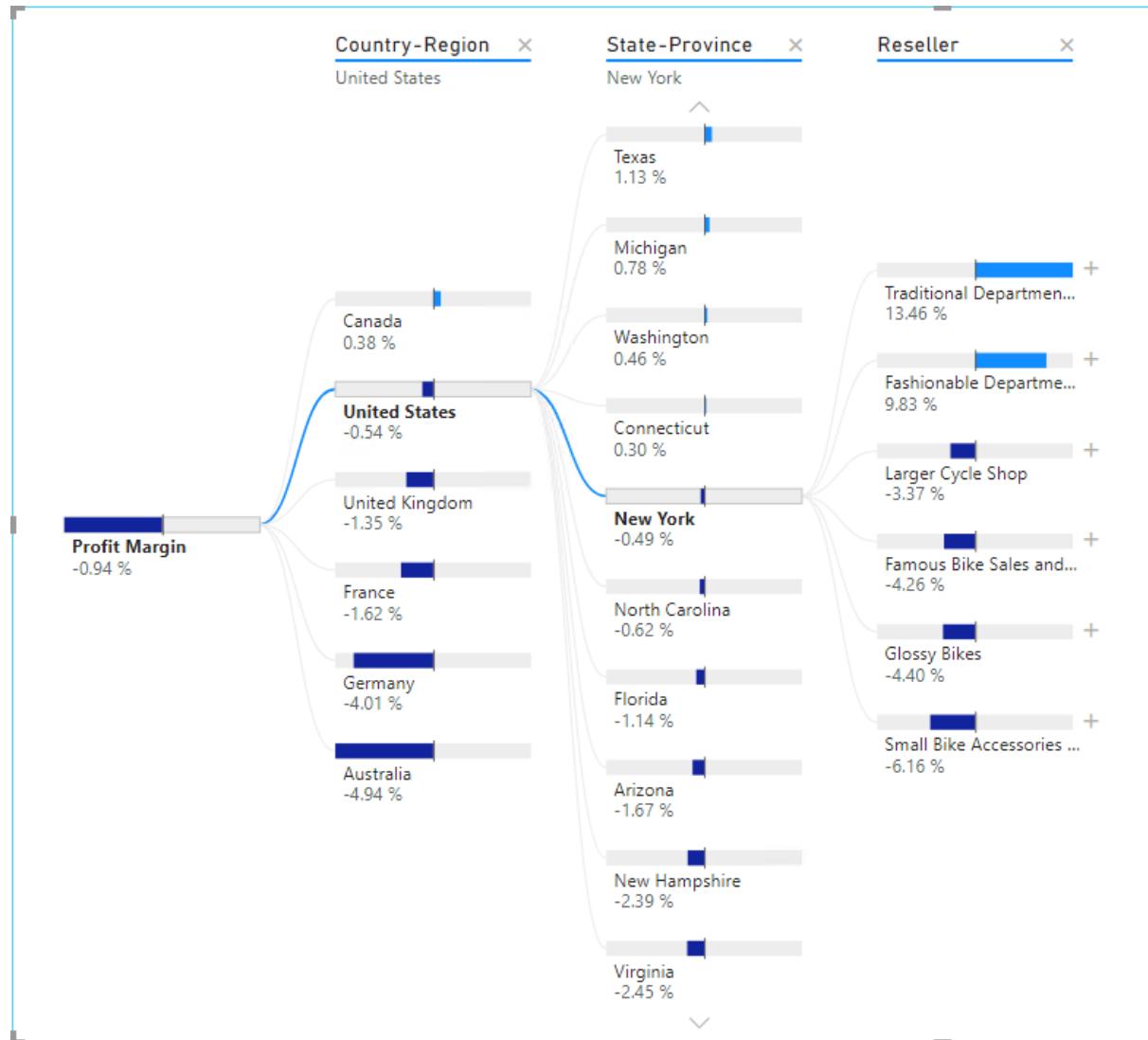


- Click the plus icon again, and then expand to the **Country-Region** level.
- Expand from the **United States** to the **State-Province** level.
- Use the down-arrow located at the bottom of the visual for **State-Province**, and then scroll to the lower profitable states.

13. Notice that **New York** state has negative profitability.

14. Expand from **New York** to the **Reseller** level.

15. Notice that it is easy to isolate root cause.



United States is not producing profit in **FY2020**. **New York** is one state not achieving positive profit, and it's due to four resellers paying less than standard costs for their goods.

16. Save the Power BI Desktop file.

Exercise 5: Work with Key Influencers

In this exercise, you will use the Key Influencers AI visual to determine what influences profitability within reseller business types and geography.

Task 1: Work with key influencers

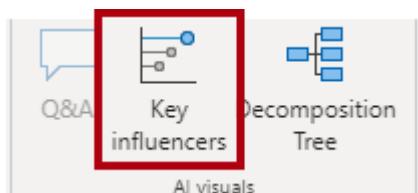
In this task, you will use the Key Influencers AI visual to determine what influences profitability within reseller business types and geography.

1. Add a new page, and then rename the page to **Key Influencers**.



2. On the **Insert** ribbon, from inside the **AI Visuals** group, click **Key Influencers**.

*Tip: The AI visuals are also available in the **Visualizations** pane.*

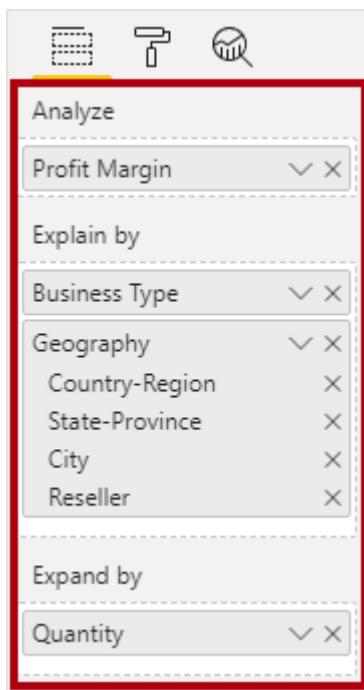


3. Reposition and resize the visual so it fills the entire page.



4. Add the following fields to the visual wells:

- Analyze: **Sales | Profit Margin**
- Explain By: **Reseller | Business Type** and **Reseller | Geography** (the entire hierarchy)
- Expand By: **Sales | Quantity**



5. At the top-left of the visual, notice that **Key Influencers** is in focus, and the specific influence is set to understand what includes profit margin to increase.

The visual has two tabs at the top: **Key influencers** (selected) and **Top segments**. Below the tabs is a dropdown menu labeled "What influences Profit Margin to" with the value "Increase".

6. Review the result, which is that the city of **Bothel** is more likely to increase.
7. Modify the target to determine what influences profit margin to decrease.

The visual has two tabs at the top: **Key influencers** (selected) and **Top segments**. Below the tabs is a dropdown menu labeled "What influences Profit Margin to" with the value "Decrease".

8. Review the result.
9. To detect segments, at the top-left, select **Top Segments**.

The visual has two tabs at the top: **Key influencers** (selected) and **Top segments**. Below the tabs is a dropdown menu labeled "What influences Profit Margin to" with the value "Increase".

10. Notice that the target is now to determine segments when profit margin is likely to be high.

11. When the visual displays the segments (as circles), click one of them to reveal information about it.
12. Review the segment results.

Finish up

In this task, you will complete the lab.

1. Save the Power BI Desktop file.
2. Select the **Scatter Chart** page.
3. Publish the file to your **Sales Analysis** workspace.
4. Close Power BI Desktop.

Lab 12A - Publishing and Sharing Power BI Content

Overview

The estimated time to complete the lab is 45 minutes

In this lab, you will work in pairs with a classroom partner to explore the three core methods for sharing Power BI content.

In this lab, you learn how to:

- Map security principals to dataset roles
- Share a dashboard
- Publish an app

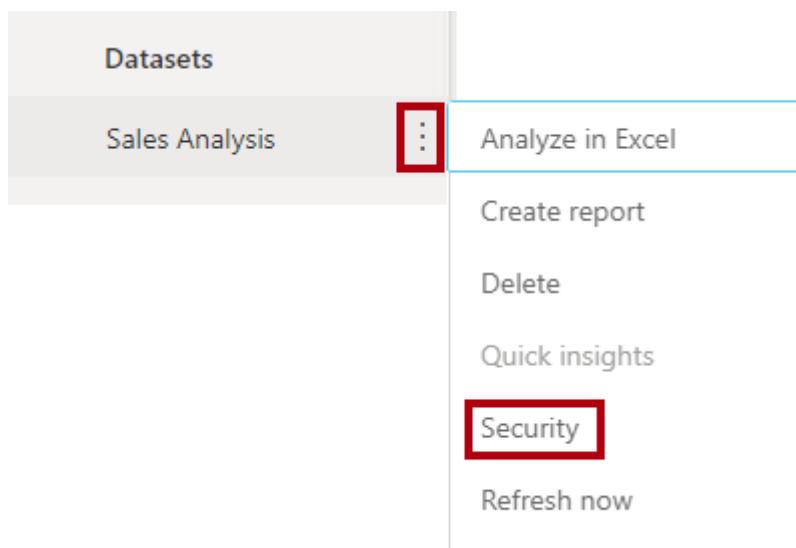
Exercise 1: Configure Dataset Security

In this exercise, you will assign your classroom partner's account to the **Salespeople** role of your dataset.

Task 1: Configure dataset security

In this task, you will assign your classroom partner's account to the **Salespeople** role of your dataset.

1. In Edge, in the Power BI service, in the **Navigation** pane, hover the cursor over the **Sales Analysis** dataset, click the vertical ellipsis (...), and then select **Security**.

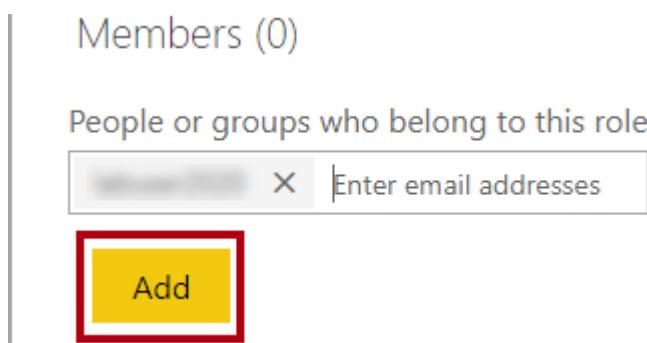


2. In the **Row-Level Security** page, at the left, notice that the **Salespeople** role is selected.

- In the **Members** box, commence typing the account name of your classroom partner—when it is listed, select it.

Adding individual accounts is time consuming and requires a lot of maintenance. Consider that the Adventure Works company would likely have a security group that contains all salespeople accounts. This security group would be the only security principal mapped to the role.

- Click **Add**.



- At the bottom of the page, click **Save**.



*The account of your classroom partner is now mapped to the **Salespeople** role. Recall that their account is for the salesperson Pamela Ansam-Wolfe, whose sales performance is measured by the sales of two sales territory regions: US Northwest and US Southwest.*

Exercise 2: Share a Dashboard

In this exercise, you will share your **Sales Monitoring** dashboard with your classroom partner (and they will share theirs with you).

Task 1: Share a dashboard

In this task, you will each share a dashboard, and then open the shared dashboard shared with you.

With your classroom partner, work through all task steps together, on each of your computers.

- Open the **Sales Monitoring** dashboard.
- On the menu bar, click **Share**.



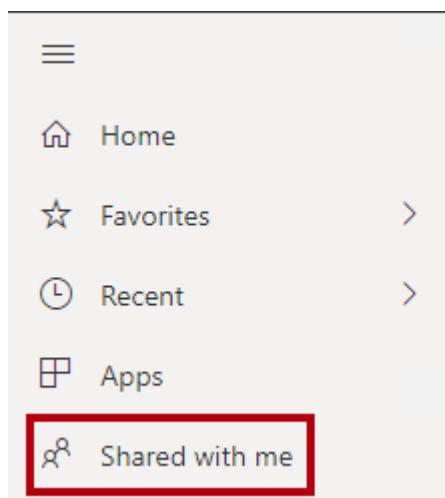
3. In the **Share Dashboard** pane (located at the right), in the **Grant Access To** box, commence typing the account name of your classroom partner—when it is listed, select it.
4. Review the available options—but do not change them.
5. At the bottom of the pane, click **Share**.



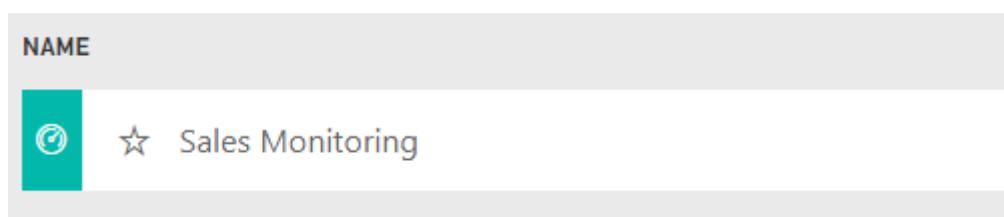
Task 2: Open the shared dashboard

In this task, you will each open the dashboard shared with you.

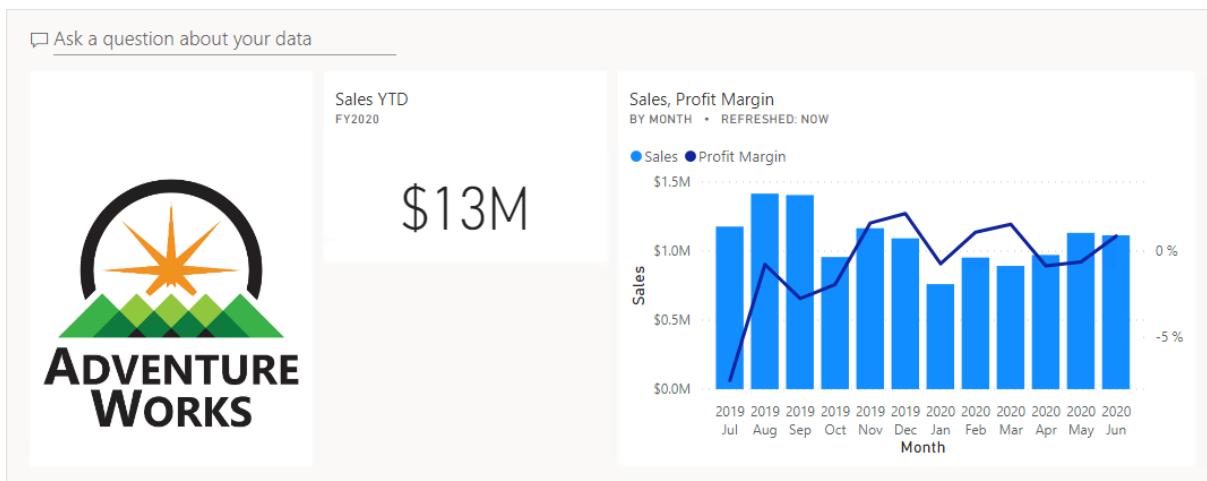
1. In the **Navigation** pane, click **Shared With Me**.



2. Notice that the **Sales Monitoring** dashboard is listed.



3. To open the dashboard, click the **Sales Monitoring** dashboard.
4. Notice that the dashboard **Sales YTD** tile value is **\$13M**.



The **Sales YTD** tile displays a value for US Northwest and US Southwest regions only.

Sharing dashboards (and reports) is easily achieved and managed by the content owner. Power BI provides a read-only experience to recipients. If the owner enables re-sharing, recipients can share the content with others.

This approach should be reserved for ad hoc sharing requirements. If you need to share many Power BI items, then publishing an app is a better option. You'll publish your **Sales Analysis** workspace as an app in the next exercise.

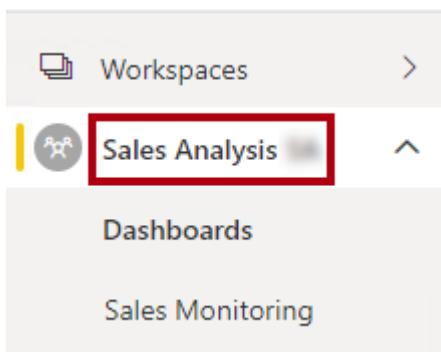
Exercise 3: Publish an App

In this exercise, you will publish the contents of your **Sales Analysis** workspace, and then "get" the app published by your classroom partner.

Task 1: Publish an app

In this task, you will publish the contents of your **Sales Analysis** workspace, and then "get" the app published by your classroom partner.

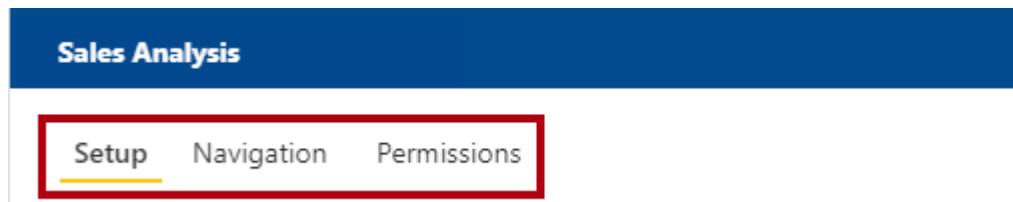
1. In the **Navigation** pane, open your **Sales Analysis** workspace.
2. In the **Navigation** pane, click the name of the workspace.



3. At the top-right, click **Publish App**.



4. Notice that the publish app process requires configuration in three tabs: **Setup**, **Navigation**, and **Permissions**.



5. In the **Description** box, enter: **Sales analysis and exploration**

Build your app

App name *

Description *

6. For the **App Logo**, click **Upload**.

Picture 91](Linked_image_Files/PowerBI_Lab12A_image13.png)

7. In the **Open** window, navigate to the **D:\DA100\Lab12A\Assets\Icons** folder.
8. Select one of the JPG files, and then click **Open**.
9. For the **App Theme Color**, select any color.

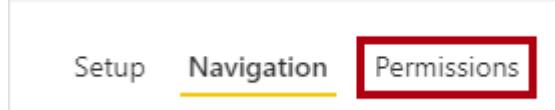
10. Select the **Navigation** tab.



11. In the **Navigation** section, notice the workspace content that will be published.

It is possible to set the order of the workspace content, and also add sections and links. Sections are a single-level grouping of content (similar to a folder). Links are a link to any valid web page. You won't modify the navigation setup in this lab.

12. Select the **Permissions** tab.



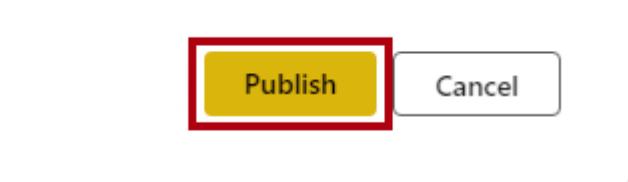
13. In the **Specific Individuals or Groups** box, commence typing the account name of your classroom partner—when it is listed, select it.

*The **Entire Organization** option may be disabled if the tenant admin has restricted it. In this case, the **Install this App Automatically** option will also be disabled. If enabled, the app could be pushed to all users. You will learn how to "get" the app in the next task.*

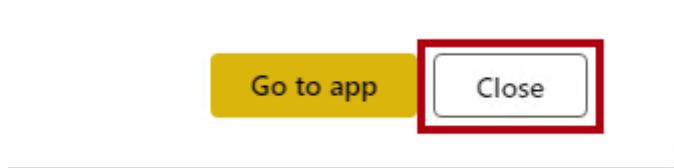
14. At the bottom-right corner, click **Publish App**.



15. When prompted to publish the app, click **Publish**.



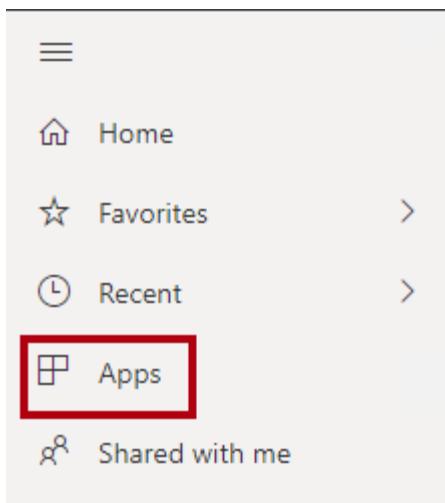
16. When notified that the app was successfully published, click **Close**.



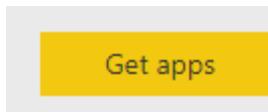
Task 2: Get the app

In this task, you will "get" the app, and explore the app contents.

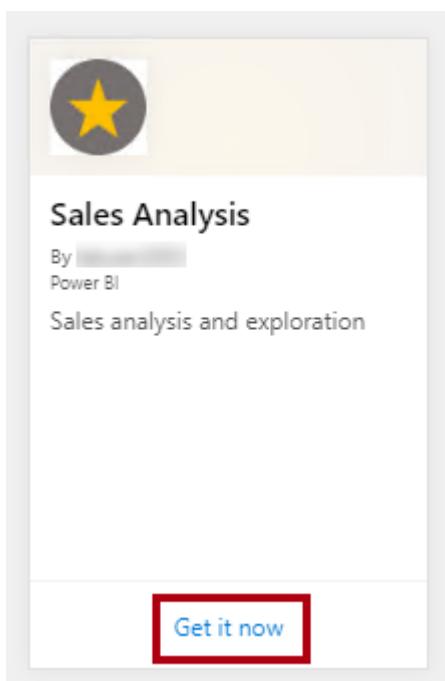
1. In the **Navigation** pane, click **Apps**.



2. In the middle of page, click **Get Apps**.



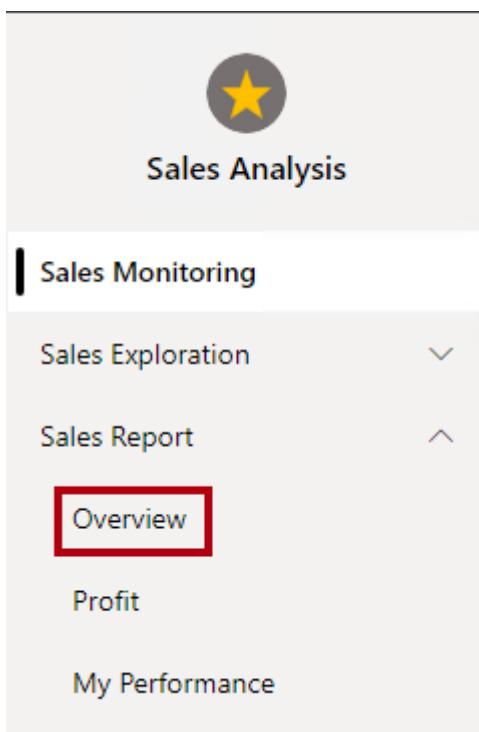
3. In the AppSource window, for the **Sales Analysis** app published by your classroom partner, click the **Get it Now** link.



4. When the app is added, to open the app, click the app tile.



5. When the app opens, review the navigation pane (located at the left).
6. Notice that the first item in the navigation pane has opened.
7. In the navigation pane, expand **Sales Report**, and then select the **Overview** page.



8. Notice that **Region** slicer only displays two regions—the regions assigned to Pamela Ansam-Wolfe.

Region

- Select all
- Northwest
- Southwest

9. Select the **My Performance** page.

10. Notice that the page displays the sales and targets for Pamela Ansam-Wolfe.

11. Open the **Sales Exploration** report, and then interact with the visuals on each page.

Lab 13A - Creating a Paginated Report

Overview

The estimated time to complete the lab is 45 minutes

In this lab, you will use Power BI Report Builder to develop a pixel-perfect paginated report layout that sources data from the **AdventureWorksDW2020** SQL Server database. You will create a data source and dataset, and also configure a report parameter. The report layout will allow data to be rendered over multiple pages, and to be exported in PDF and other formats.

The final report will look like the following:

Sales Order Report

Sales Order: 51721 

Reseller: Permanent Finish Products

Order Date: 08/06/2019

Line	Product	Quantity	Unit Price	Amount
1	Hydration Pack - 70 oz.	12	\$31.89	\$382.68
2	LL Mountain Pedal	6	\$24.29	\$145.74
3	Mountain-200 Black, 38	13	\$1,331.09	\$17,304.17
4	Long-Sleeve Logo Jersey, XL	3	\$29.99	\$89.97
5	LL Mountain Frame - Black, 48	1	\$149.87	\$149.87
6	LL Mountain Seat/Saddle	3	\$16.27	\$48.81
7	LL Bottom Bracket	7	\$32.39	\$226.73
8	Women's Mountain Shorts, L	7	\$41.99	\$293.93
9	Mountain-500 Black, 48	3	\$323.99	\$971.97
10	Mountain-500 Black, 42	1	\$323.99	\$323.99

In this lab, you learn how to:

- Use Power BI Report Builder
- Design a multi-page report layout
- Define a data source
- Define a dataset
- Create a report parameter
- Export a report to PDF

Exercise 1: Getting Started

In this exercise, you will open Power BI Report Builder to create and then save a report.

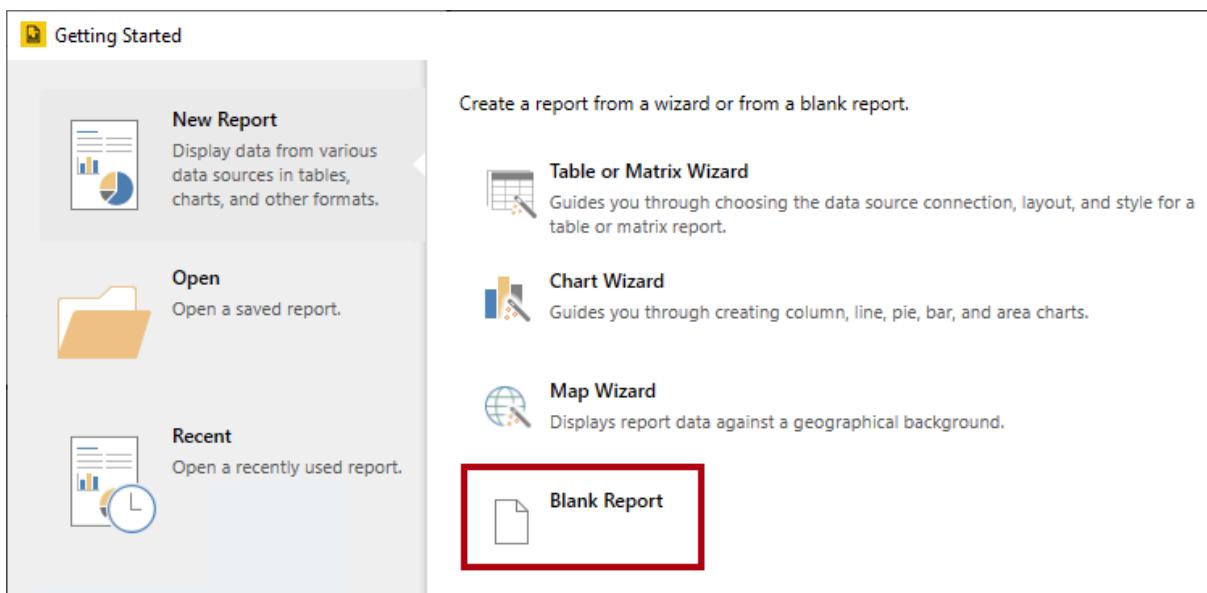
Task 1: Create the report

In this task, you will open Power BI Report Builder to create and then save a report.

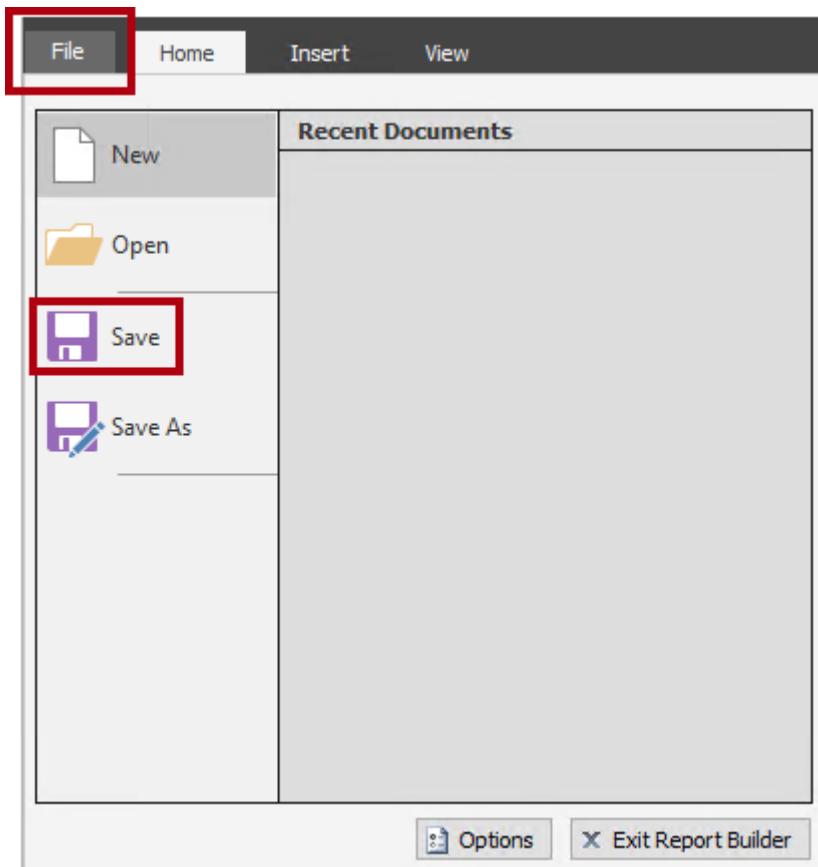
1. To open Power BI Report Builder, on the taskbar, click the **Power BI Report Builder** shortcut.



2. In the Power BI Report Builder window, to create a new report, in the **Getting Started** window, click **Blank Report**.



3. To save the report, click the **File** tab (located at the top-left), and then select **Save**.



4. In the **Save As Report** window, navigate to the **D:\DA100\MySolution** folder.
5. In the **Name** box, enter **Sales Order Report**.
6. Click **Save**.

Exercise 2: Developing the Report Layout

In this exercise, you will develop the report layout, and explore the final report design.

Task 1: Configure the report header

In this task, you will configure the report header.

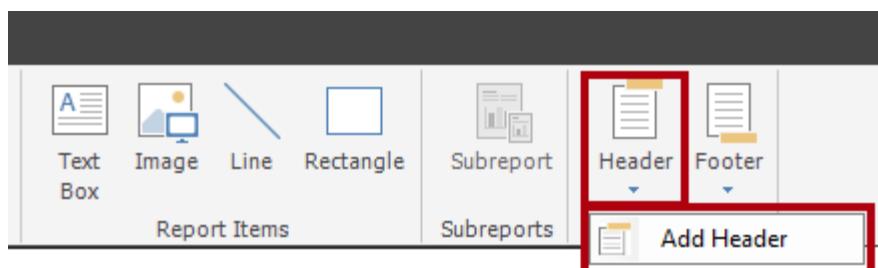
1. In the report designer, notice the default report layout, which consists of a body region and a report footer region.



The body contains a single textbox ready for a report title, and the report footer contains a single textbox describing the report execution time.

The default design will render the report title once, in the body, on the first rendered page. However, you will now modify the report design by adding a report header region, and by moving the report title textbox into this region. This way, the report title will repeat on every page. You will also add an image of the company logo.

2. To add a report header region, on the **Insert** ribbon tab, from inside the **Header & Footer** group, click **Header**, and then select **Add Header**.



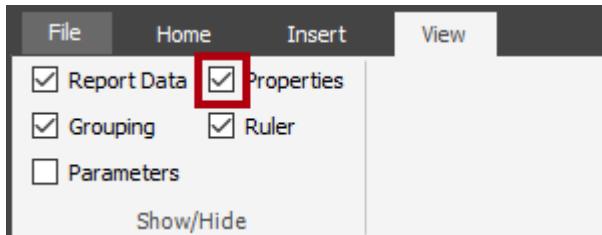
3. In the report designer, notice that a report header region has been added to the report layout.
4. To select the body textbox, click the "Click to add title" textbox.
5. To move the textbox, click the four-headed arrow icon, and then drag it into the header region to then drop it at the very top-left of the report header region.



6. To modify the report title textbox text, click inside the text box, and then enter: **Sales Order Report**

To resize the textbox, you will first open the **Properties** pane. For fine-grained control of location and size properties, you will need use the **Properties** pane.

7. On the **View** ribbon tab, from inside the **Show/Hide** group, check **Properties**.



8. To select the report title textbox, first click an area outside the textbox, and then click the textbox again.

The textbox is selected when you see the border of the textbox highlighted and resizing handles (small circles) appear on the border.

9. In the **Properties** pane (located at the right), scroll down the list to locate the **Position** group.

KeepTogether	True
Parent	Page Header
RepeatWith	
ZIndex	0
Position	
Location	0in, 0in
Size	5.5in, 0.5in
Visibility	
Hidden	False
InitialToggleState	False
ToggleItem	

*The **Position** group allows setting exact values for the location and size of report items.*

It's important that you enter the values as directed in this lab. Pixel-perfect layout is required to achieve the page rendering at the end of the lab.

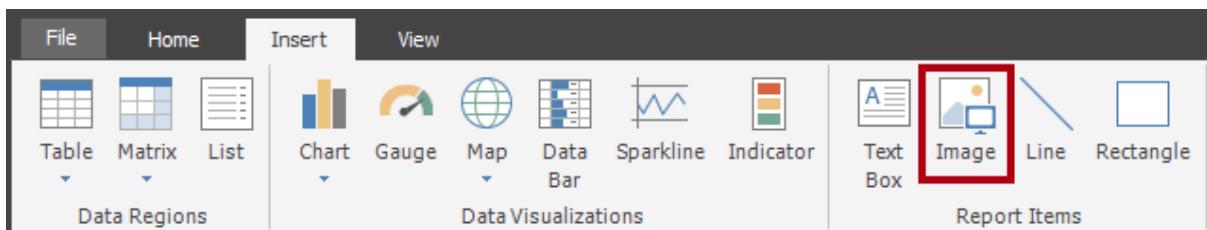
10. Within the **Position** group, expand the **Location** group, and ensure that the **Left** and **Top** properties are each set to **0in**.

The location and size units are in inches because the regional settings of the lab virtual machine is set to the United States. If your region uses metric measurements, centimeters would be the default unit.

11. Within the **Position** group, expand the **Size** group, and then set the **Width** property to **4**.

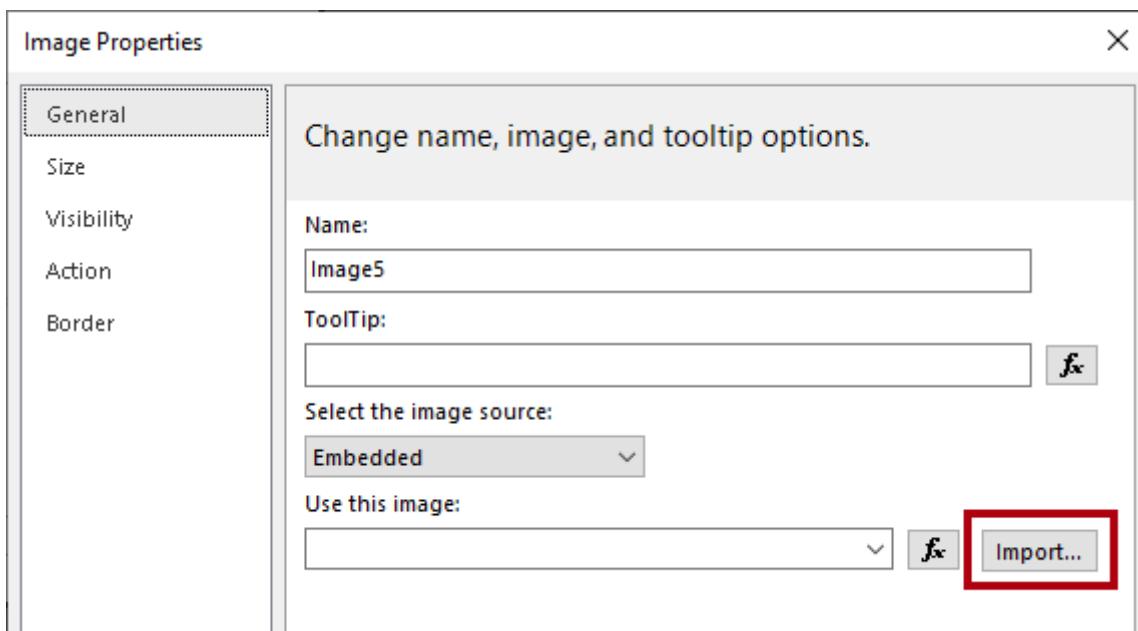
Position	
Location	0in, 0in
Left	0in
Top	0in
Size	4in, 0.5in
Width	4in
Height	0.5in
Visibility	

12. To insert an image, on the **Insert** ribbon tab, from inside the **Report Items** group, click **Image**.



13. To add the image to the report design, click inside the report header region, to the right of the report title textbox.

14. In the **Image Properties** window, to import from an image file, click **Import**.



15. In the **Open** window, navigate to the **D:\DA100\Data** folder, and then select the **AdventureWorksLogo.jpg** file.

16. Click **Open**.

17. In the **Image Properties** window, click **OK**.

18. In the report designer, notice that the image was added, and is selected.

19. To position and resize the image, in the **Properties** pane, configure the following properties:

Property	Value
Position	Location Left 5
Position	Location Top 0
Position	Size Width 1
Position	Size Height 1

20. To resize the report header region, first select the region by clicking a blank area of the region.

21. In the **Properties** pane, set the **General | Height** property to **1**.

22. Verify that the report header region contains a single textbox and image, and looks like the following:



23. To save the report, on the **File** tab, click **Save**.

Tip: You can also click the disk icon located at the top-left.

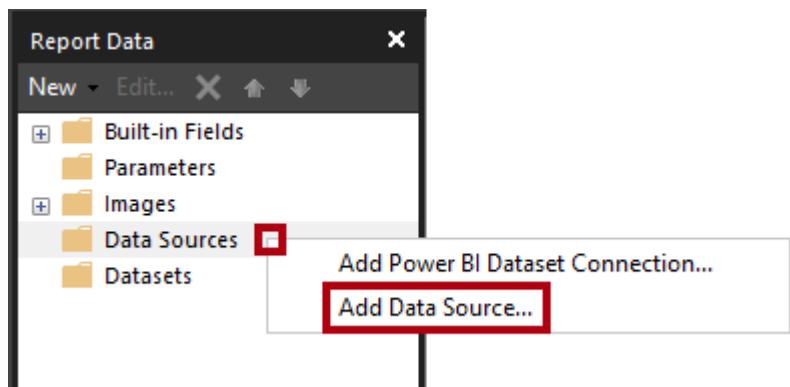


You are now ready to configure the report to retrieve a database query result.

Task 2: Retrieve data

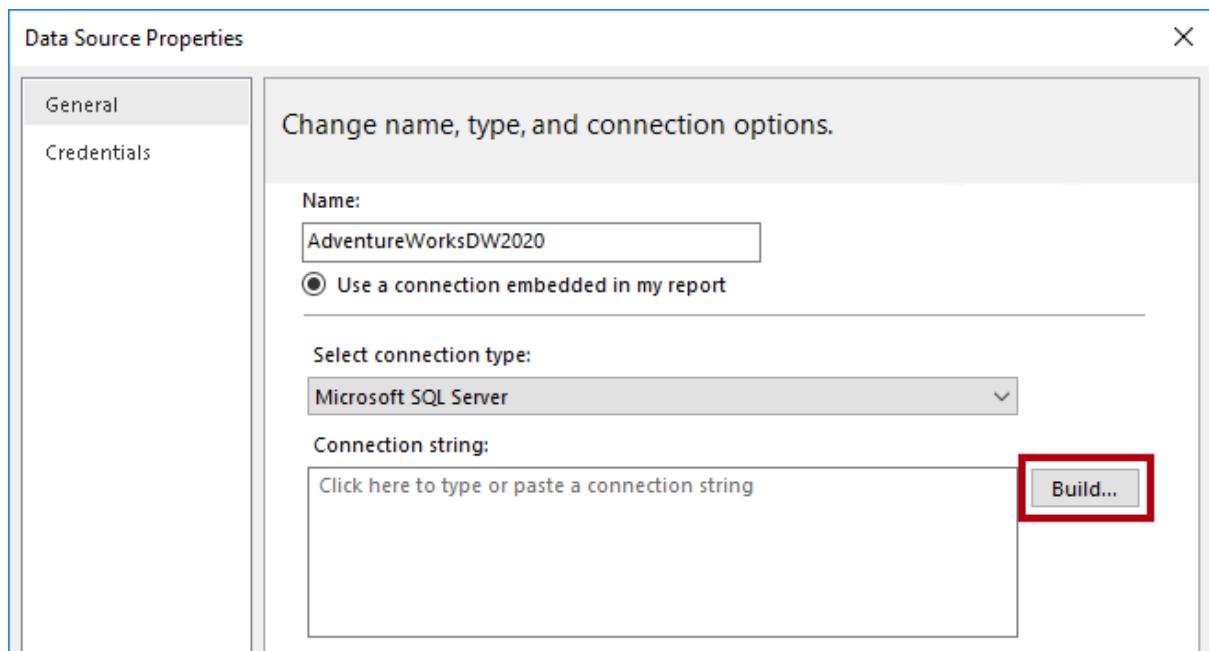
In this task, you will create a data source and dataset to retrieve a query result from the **AdventureWorksDW2020** SQL Server database.

1. In the **Report Data** pane (located at the left), right-click the **Data Sources** folder, and then select **Add Data Source**.



It is possible to retrieve data from cloud or on-premises databases, or a Power BI dataset.

2. In the **Data Source Properties** window, in the **Name** box, replace the text with **AdventureWorksDW2020**.
3. In the **Select Connection Type** dropdown list, notice that **Microsoft SQL Server** is selected.
4. To build the connection string, click **Build**.

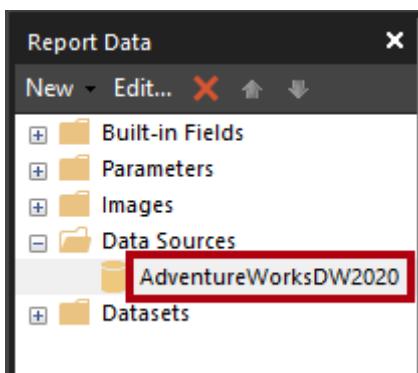


5. In the **Connection Properties** window, in the **Server Name** box, enter **localhost**.

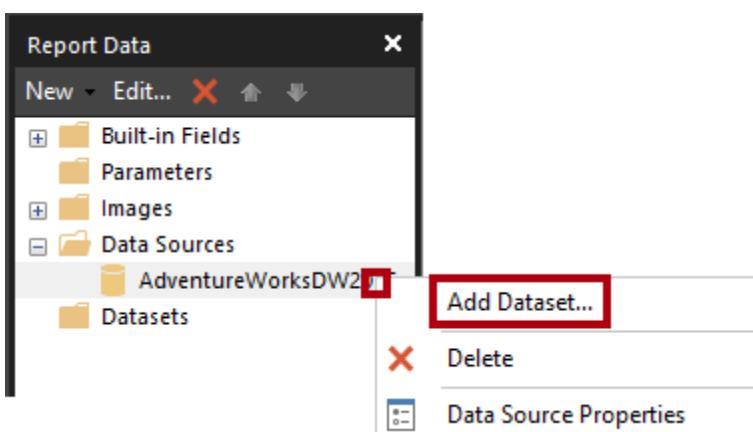
*In the labs, you will connect to the SQL Server database by using **localhost**. This isn't a recommended practice, however, when creating your own solutions. It's because gateway data sources cannot resolve **localhost**.*

6. In the **Select or Enter a Database Name** dropdown list, select the **AdventureWorksDW2020**.

7. Click **OK**.
8. In the **Data Source Properties** window, click **OK**.
9. In the **Report Data** pane, notice the addition of the **AdventureWorksDW2020** data source.

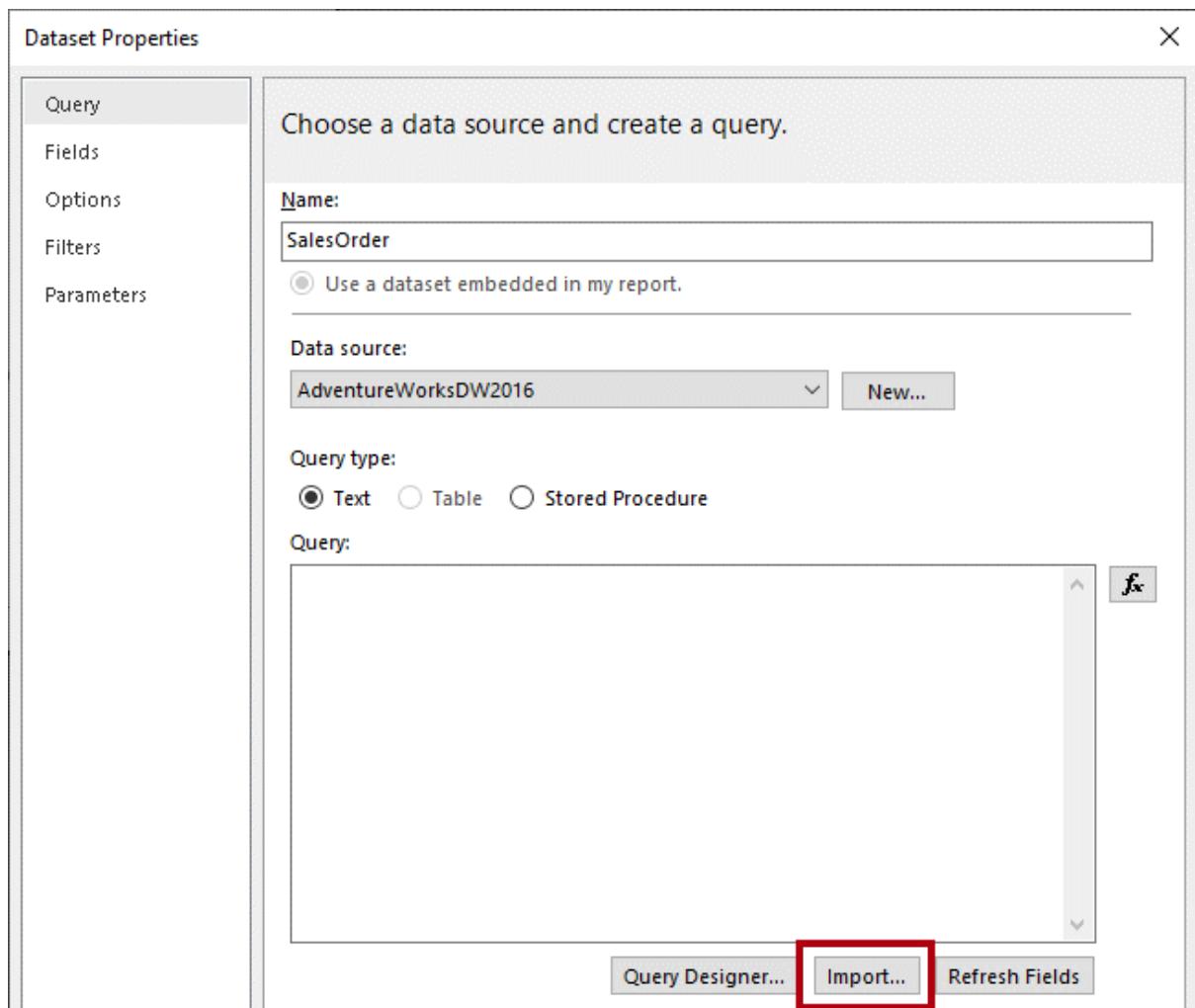


10. To create a dataset, in the **Report Data** pane, right-click the **AdventureWorksDW2020** data source, and then select **Add Dataset**.



A report dataset is a different in purpose and structure from a Power BI dataset.

11. In the **Dataset Properties** window, in the **Name** box, replace the text with **SalesOrder**.
12. To import a pre-defined query, click **Import**.



13. In the **Import Query** window, navigate to the **D:\DA100\Lab13A\Assets** folder, and then select the **SalesOrder.sql** file.
14. Click **Open**.
15. In the **Query** box, review the query, and be sure to scroll down to the bottom of the query text.

It is not important that you understand the details of the query statement. It has been designed to retrieve sales order line details. The WHERE clause includes a predicate to restrict the query result to a single sales order. The ORDER BY clause ensures the rows are returned by line number order.
16. Notice the use of **@SalesOrderNumber** in the WHERE clause, which represents a query parameter.

```

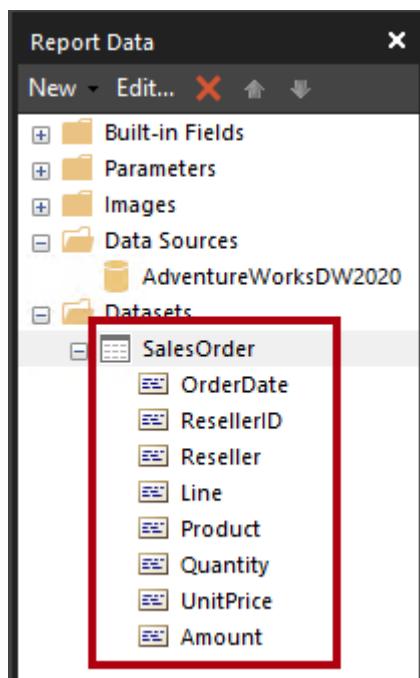
FROM
    [dbo].[FactResellerSales] AS [frs]
    INNER JOIN [dbo].[DimReseller] AS [r]
        ON [r].[ResellerKey] = [frs].[ResellerKey]
    INNER JOIN [dbo].[DimProduct] AS [p]
        ON [p].[ProductKey] = [frs].[ProductKey]
WHERE
    [frs].[SalesOrderNumber] = CONCAT(N'SO' + @SalesOrderNumber)
ORDER BY
    [frs].[SalesOrderLineNumber];

```

A query parameter is a placeholder for a value that will be passed in at query execution time. You will configure a report parameter to prompt the report user for a single sales order number which will then be passed to the query parameter.

17. Click **OK**.

18. In the **Report Data** pane, notice the addition of the **SalesOrder** dataset and its fields.



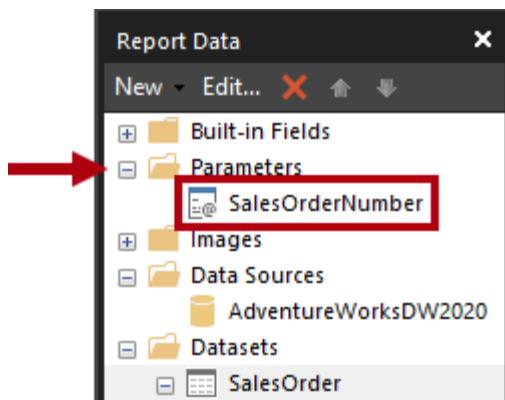
Fields are used to configure data regions in the report layout. They were derived from the dataset query columns.

19. Save the report.

Task 3: Configure the report parameter

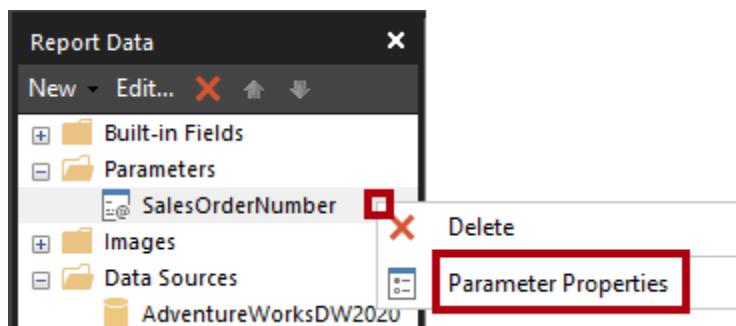
In this task, you will configure the report parameter with a default value.

1. In the **Report Data** pane, expand the **Parameters** folder to reveal the **SalesOrderNumber** report parameter.

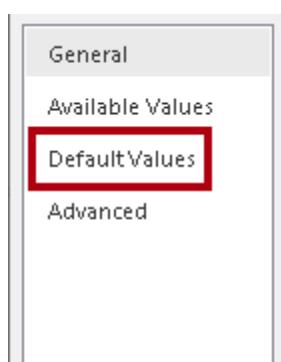


The **SalesOrderNumber** report parameter was added automatically when the dataset was created. This is because the dataset query included the **@SalesOrderNumber** query parameter.

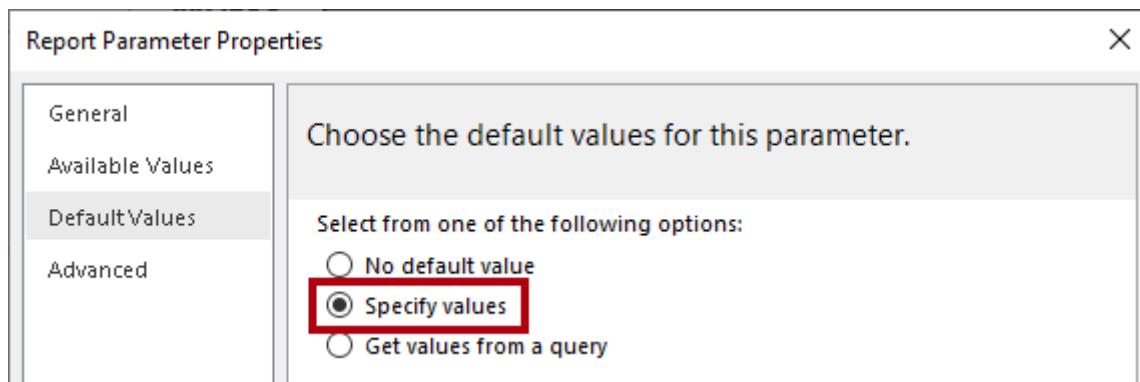
2. To edit the report parameter, right-click the **SalesOrderNumber** report parameter, and then select **Parameter Properties**.



3. In the **Report Parameter Properties** window, at the left, select the **Default Values** pages.



4. Select the **Specify Values** option.



5. To add a default value, click **Add**.
6. In the **Value** dropdown list, replace the text with **43659**.



Sales order 43659 is the value you will initially use to test the report design.

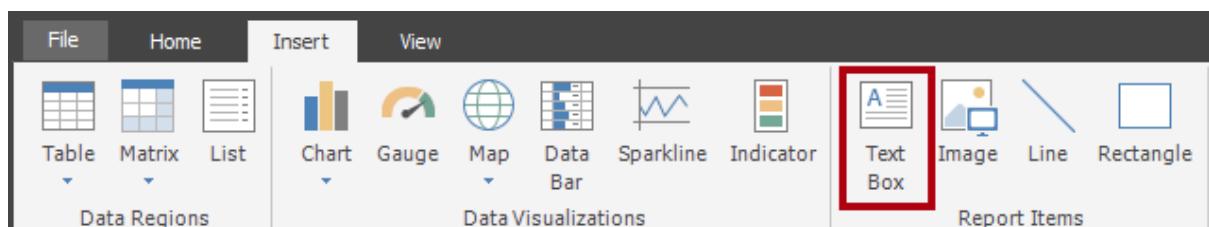
7. Click **OK**.
8. Save the report.

You will now complete the report header region design by adding textboxes to describe the sales order.

Task 4: Finalize the report header layout

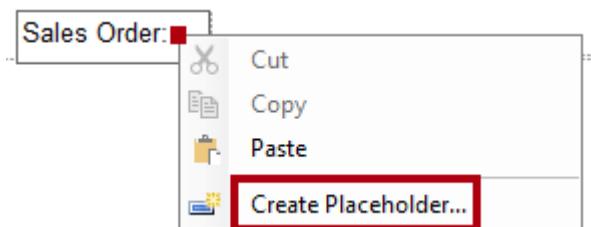
In this task, you will finalize the report header region design by adding textboxes.

1. To add a textbox to the report header region, on the **Insert** ribbon tab, from inside the **Report Items** group, click **Text Box**.

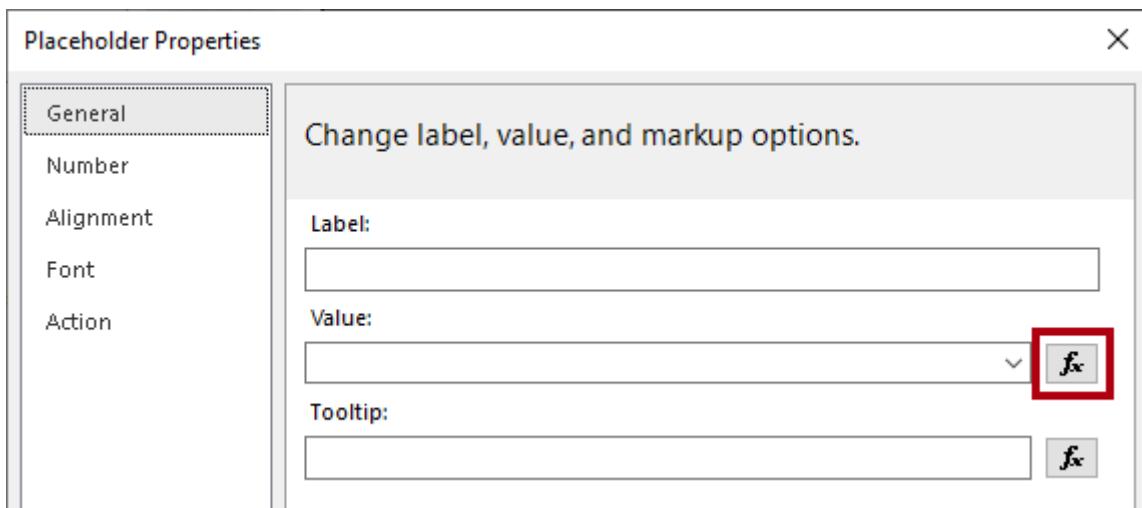


2. Click inside the report header region, directly beneath the report title textbox.
3. Inside the textbox, enter **Sales Order:** followed by a space.

- To insert a place holder, immediately after the space just entered, right-click and then select **Create Placeholder**.

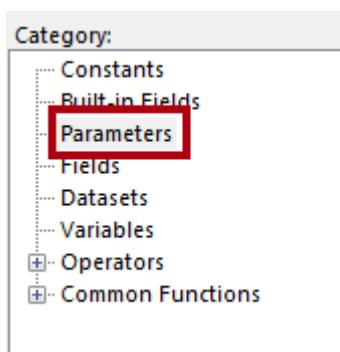


- In the **Placeholder Properties** window, at the right of the **Value** dropdown list, click the **fx** button.

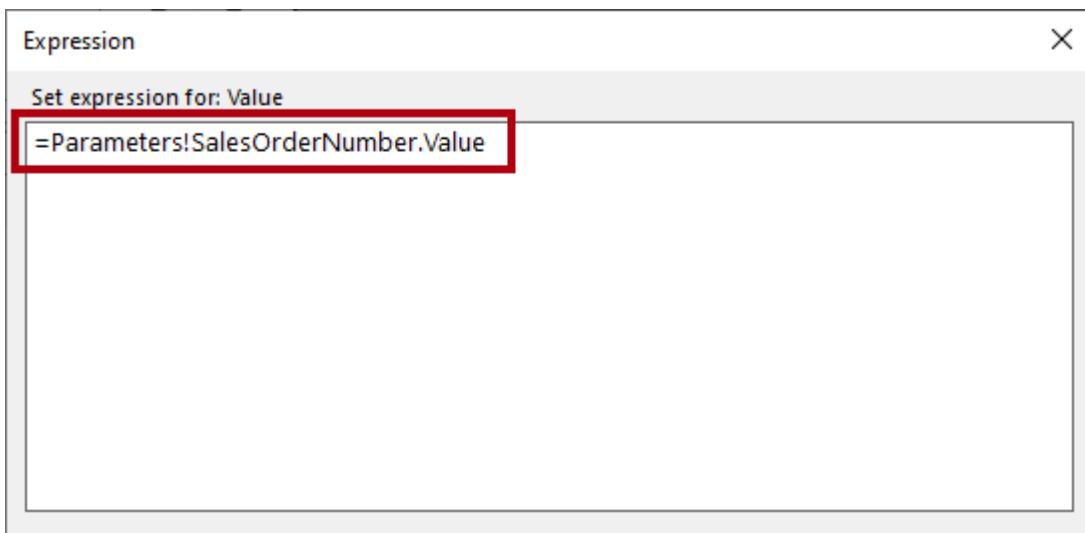


The **fx** button allows entering a custom expression. This expression will be used to return the sales order number.

- In the **Expression** window, in the **Category** list, select **Parameters**.



- In the **Values** list, double-click the **SalesOrderNumber** parameter.
- In the expression box, notice that a programmatic reference to the **SalesOrderNumber** report parameter was added.



9. Click **OK**.

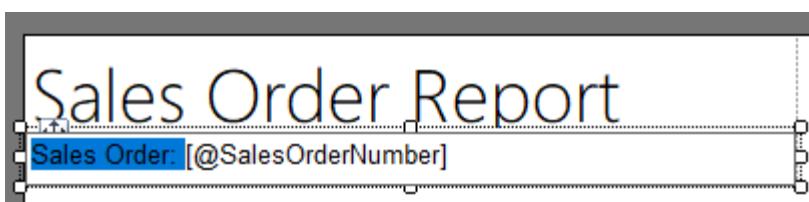
10. In the **Placeholder Properties** window, click **OK**.

11. Click a blank area of the report header region, and then select the new textbox.

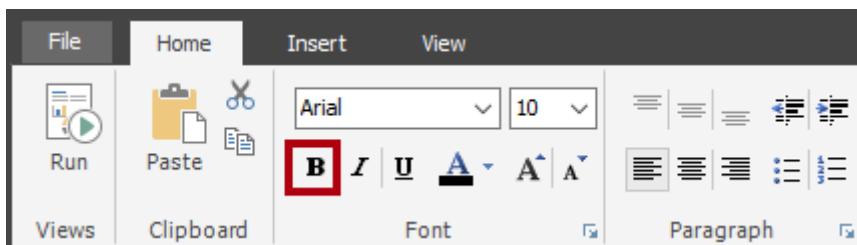
12. In the **Properties** pane, configure the following position properties:

Property	Value
Position Location Left	0
Position Location Top	0.5
Position Size Width	4
Position Size Height	0.25

13. To format part of the textbox text, inside the new textbox, select only the **Sales Order:** text.



14. On the **Home** ribbon tab, from inside the **Font** group, click the **Bold** command.

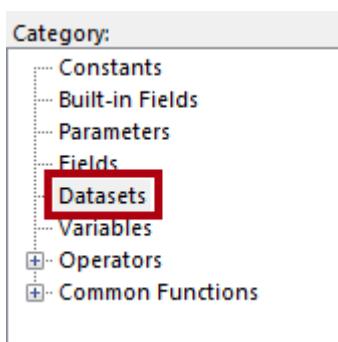


15. Add another textbox to the report header region, and then enter the text **Reseller:** followed by a space.

*Tip: You can also add a textbox by right-clicking the canvas, and then selected **Insert | Text Box**.*

16. After the space, insert a placeholder, and then set the value of the placeholder to use an expression.

17. In the **Expression** window, in the **Category** list, select **Datasets**.



18. Base the expression value on **First(Reseller)** value.

19. In the **Properties** pane, configure the following position properties:

Property	Value
----------	-------

Position | Location | Left 0

Position | Location | Top 0.75

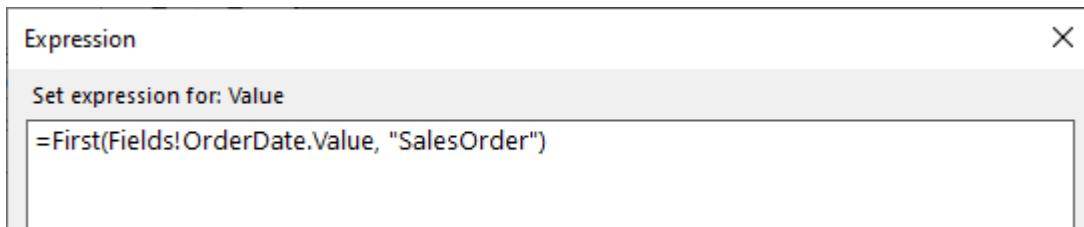
Position | Size | Width 4

Position | Size | Height 0.25

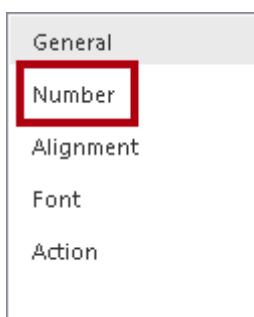
20. Format the **Reseller:** text in bold.

21. Add a third (and last) textbox to the report header region, and then enter the text **Order Date:** followed by a space.

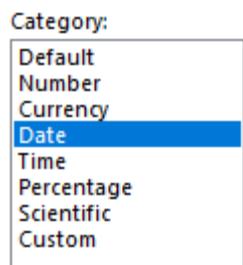
22. After the space, insert a placeholder, and set the value of the placeholder to use an expression based on the **Datasets** category, **First(OrderDate)** value.



23. To format the date value, in the **Placeholder Properties** window, select the **Number** page.



24. In the **Category** list, select **Date**.



25. In the **Type** list, select a suitable date format type.

26. In the **Placeholder Properties** window , click **OK**.

27. In the **Properties** pane, configure the following position properties:

Property	Value
----------	-------

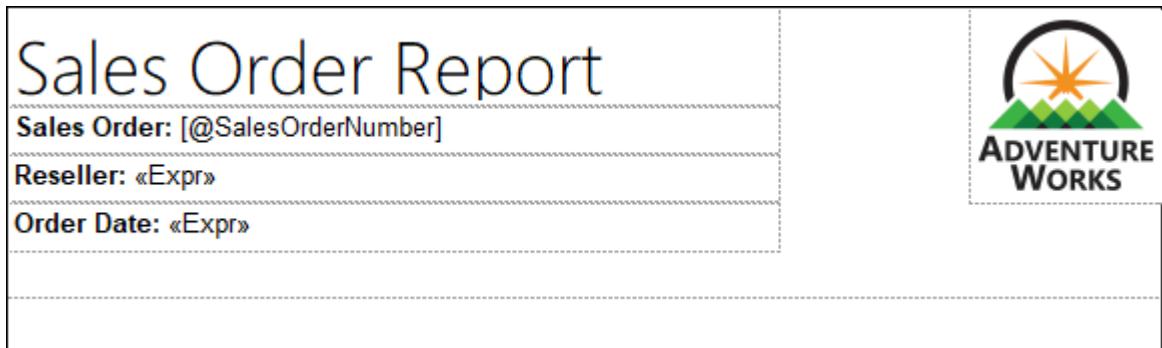
Position Location Left	0
----------------------------	---

Position Location Top	1
---------------------------	---

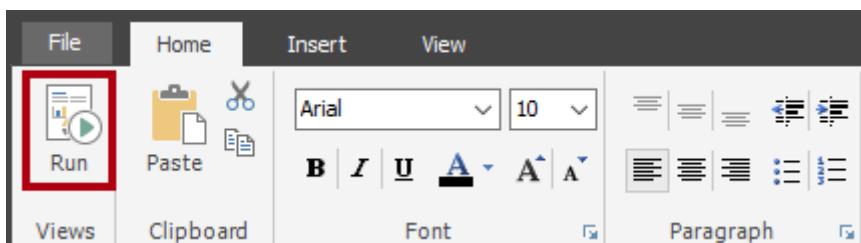
Position Size Width	4
-------------------------	---

Position Size Height	0.25
--------------------------	------

28. Format the **Order Date:** text in bold.
29. Finally, click a blank area of the report header region.
30. In the **Properties** pane, set the **Height** property to **1.5**.
31. Verify that the report header region looks like the following:

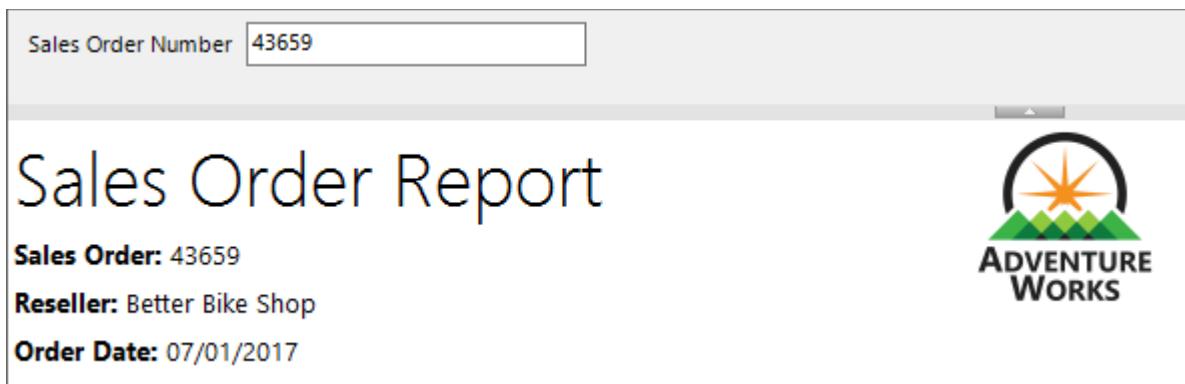


32. Save the report.
33. To preview the report, on the **Home** ribbon tab, from inside the **Views** group, click **Run**.



Running the report renders the report in HTML. As the only report parameter has a default value, the report will run automatically.

34. Verify that the rendered report looks like the following:



35. To return to design view, on the **Run** ribbon tab, from inside the **Views** group, click **Design**.

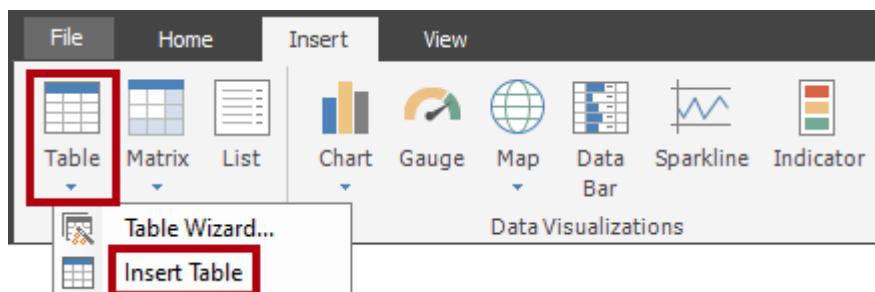


You will now add a table to the report body to display a formatted layout of the sales order lines.

Task 5: Add a table data region

In this task, you will add a table data region to the report body.

1. On the **Insert** ribbon tab, from inside the **Data Regions** group, click **Table**, and then select **Insert Table**.



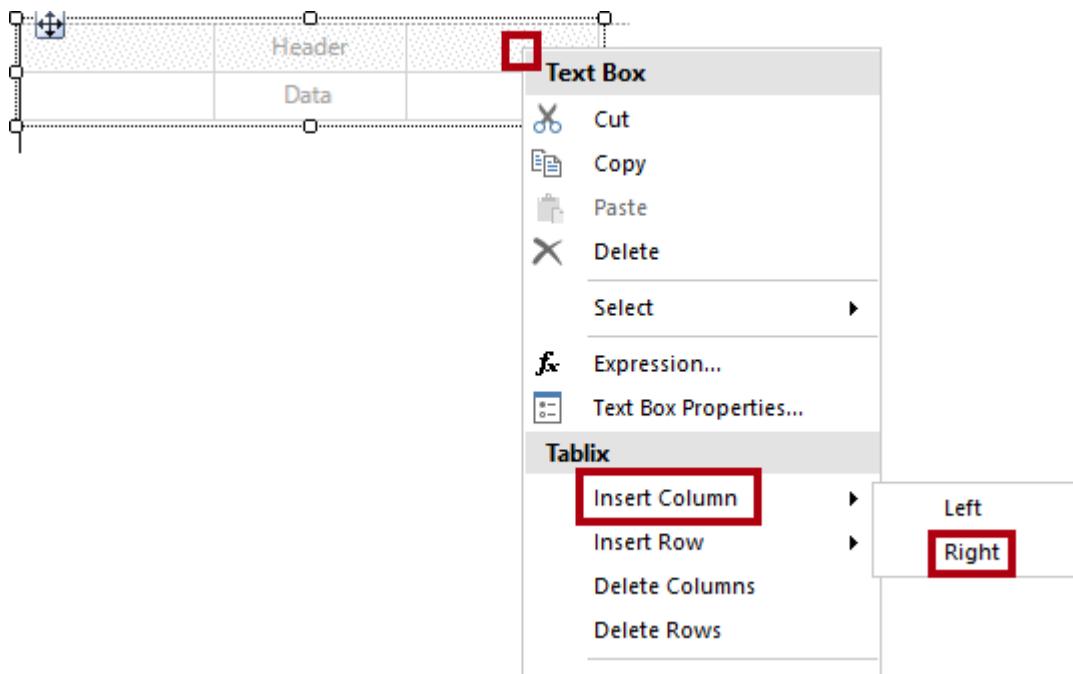
2. To add the table, click a blank area inside the report body.
3. In the **Properties** pane, configure the following position properties:

Property	Value
----------	-------

Position Location Left	0
----------------------------	---

Position Location Top	0
---------------------------	---

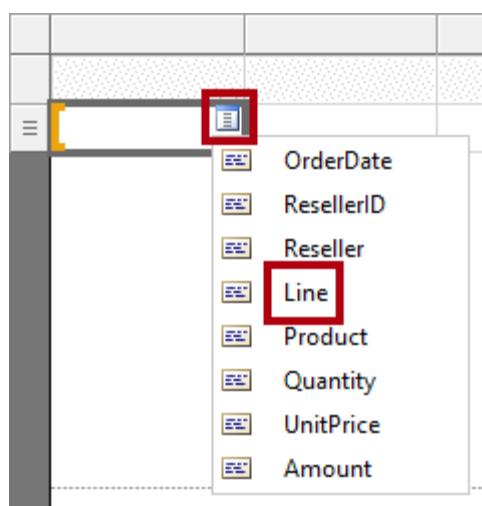
4. The table will display five columns. By default, the table template includes only three columns.
5. To add a column to the table, right-click inside any cell of the last column, and then select **Insert Column | Right**.



6. Repeat the last step to add a second new column.
7. Hover the cursor over the cell in the second row of the first column to reveal the field picker icon.



8. Click the field picker icon, and then select the **Line** field.



9. Notice that the table now includes a text value in the first row (header), and a field reference in the detail row.

Line		Header		
[Line]		Data		

10. Add fields to the next four columns, in order, as follows:

- Product
- Quantity
- UnitPrice
- Amount

11. Verify that the table design looks like the following:

Line	Product	Quantity	Unit Price	Amount
[Line]	[Product]	[Quantity]	[UnitPrice]	[Amount]

12. Save the report.

13. Preview the report.

Sales Order Report

Sales Order: 43659

Reseller: Better Bike Shop

Order Date: 07/01/2017

ADVENTURE WORKS

Line	Product	Quantity	Unit Price	Amount
1	Mountain-100 Black, 42	1	2024.99	2024.99
2	Mountain-100 Black, 44	3	2024.99	6074.97
3	Mountain-100 Black, 48	1	2024.99	2024.99

The table includes a header and 12 sales order line rows. There are many

improvements that can be made by formatting the table layout.

In the next task you will:

- Format the table header by using a background color and bold font style
- Modify column widths to remove redundant space and to prevent long text values from wrapping
- Left-justify the first column values
- Right-justify the last three column values
- Format currency values using a currency symbol (for USD)
- Add and format a total row for the table

Task 6: Format the table data region

In this task, you will format the table data region.

1. Return to design view.
2. Click any cell in the table to reveal the gray cell guides.

Line	Product	Quantity	Unit Price	Amount
[Line]	[Product]	[Quantity]	[UnitPrice]	[Amount]

The cell guides are there to help you configure entire rows or columns.

3. To format the table header, click the header row guide.



Line	Product	Quantity	Unit Price	Amount
[Line]	[Product]	[Quantity]	[UnitPrice]	[Amount]

*Selecting a row or a column guide selects all cells in the row or column. Each cell is in fact a textbox. Formatting single textbox—or a multi-selection of textboxes—can then be achieved by using the **Properties** pane, or the ribbon commands.*

4. In the **Properties** pane (or the ribbon), configure the following properties:

Property	Value
Fill BackgroundColor	DarkGreen (tip: hover the cursor over each color to reveal its name)
Font Color	White

Property	Value
----------	-------

Font | Font |
FontWeight

Bold

5. Select the first column guide.



Line	Product	Quantity	Unit Price	Amount
[Line]	[Product]	[Quantity]	[UnitPrice]	[Amount]

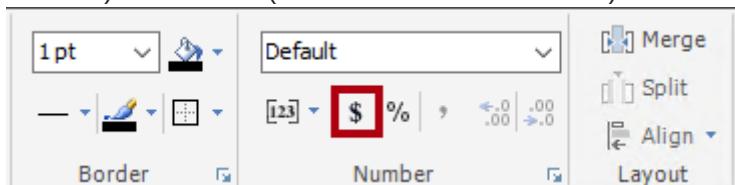
6. In the **Properties** pane, set the **Position | Size | Width** property to **0.5**.
7. Set the width of the second column to **2.5**.
8. While pressing the **Ctrl** key, multi-select the last three column header textboxes (**Quantity**, **Unit Price** and **Amount**).
9. In the **Properties** pane (or ribbon), set the **Alignment | TextAlign** property to **Right**.

10. Set the **Line** detail textbox to left align.

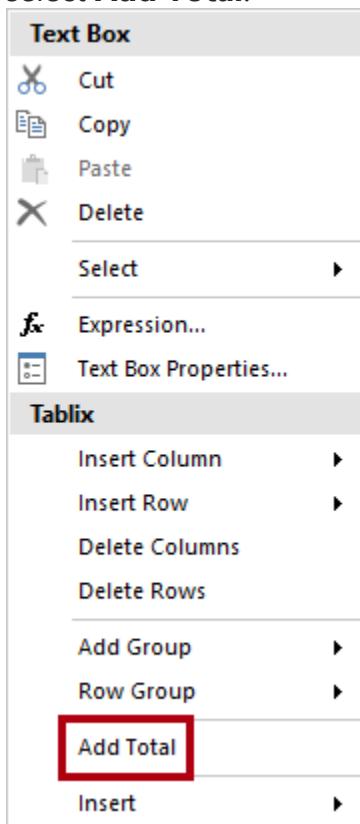


Line	Product	Quantity	Unit Price	Amount
[Line]	[Product]	[Quantity]	[UnitPrice]	[Amount]

11. On the **Home** ribbon tab, from inside the **Number** group, set the last two detail (not header) textboxes (**UnitPrice** and **Amount**) to format with a currency symbol.



12. To add a total row to the table, right-click the **Quantity** detail textbox, and then select **Add Total**.



13. Notice that a new row, which represents the table footer, has been added, and that the expression will evaluate the sum of **Quantity** values.
14. Repeat the last step to add a total for the **Amount** detail textbox.
15. In the first cell of the table footer row, enter the word **Total**.
16. Format all textboxes in the footer row to format as bold.
17. Verify that the table design looks like the following:

Line	Product	Quantity	Unit Price	Amount
[Line]	[Product]	[Quantity]	[UnitPrice]	[Amount]
Total		[Sum(Quantity)]		[Sum(Amount)]

18. To remove any trailing space after the table, hover the cursor over the dashed line between the report body and report footer region, and then drag upwards to touch

the bottom of the table.

Line	Product	Quantity	Unit Price	Amount
[Line]	[Product]	[Quantity]	[UnitPrice]	[Amount]
Total		[Sum(Quantity)]		[Sum(Amount)]
				[&ExecutionTime]

19. Save the report

20. Preview the report.

21. Verify that the rendered report looks like the following:

Sales Order Number

Sales Order Report

Sales Order: 43659 **Reseller:** Better Bike Shop **Order Date:** 07/01/2017



Line	Product	Quantity	Unit Price	Amount
1	Mountain-100 Black, 42	1	\$2,024.99	\$2,024.99
2	Mountain-100 Black, 44	3	\$2,024.99	\$6,074.97
3	Mountain-100 Black, 48	1	\$2,024.99	\$2,024.99
4	Mountain-100 Silver, 38	1	\$2,039.99	\$2,039.99
5	Mountain-100 Silver, 42	1	\$2,039.99	\$2,039.99
6	Mountain-100 Silver, 44	2	\$2,039.99	\$4,079.98
7	Mountain-100 Silver, 48	1	\$2,039.99	\$2,039.99
8	Long-Sleeve Logo Jersey, M	3	\$28.84	\$86.52
9	Long-Sleeve Logo Jersey, XL	1	\$28.84	\$28.84
10	Mountain Bike Socks, M	6	\$5.70	\$34.20
11	AWC Logo Cap	2	\$5.19	\$10.38
12	Sport-100 Helmet, Blue	4	\$20.19	\$80.76
Total		26		\$20,565.60

22. In the **Sales Order Number** parameter box, replace the value with **51721**.

Sales Order Number

23. To re-run the report, at the right, click **View Report**.

This sales order has 72 sales order lines, and so the data will render over many pages.

24. To navigate to the second page of the report, on the **Run** ribbon tab, from inside the **Navigation** group, click **Next**.



25. On page 2, notice that the table header does not appear.

You will address this issue in the next task.

26. Scroll to the bottom of the page, and then notice that the report footer displays only the execution time.

In the next task, you will improve the footer text by appending the page number.

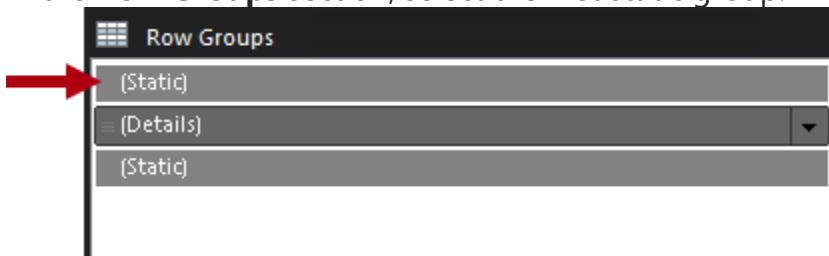
Task 7: Finalize the report design

In this task, you will finalize the report design by ensuring multi-page reports render appropriately.

1. Switch to the design view.
2. To ensure the table header repeats on all pages, first select any textbox of the table.
3. In the **Grouping** pane (located along the bottom of the report designer), at the far right of the **Column Groups**, click the down-arrow, and then select **Advanced Mode**.



4. In the **Row Groups** section, select the first static group.



This selected the table header row.

5. In the **Properties** pane, set the **Other | RepeatOnNewPage** property to **True**.
This ensures that the first static group (representing the table header) will repeat on all pages.

6. In the table footer region, right-click the **ExecutionTime** textbox, and then select **Expression**.

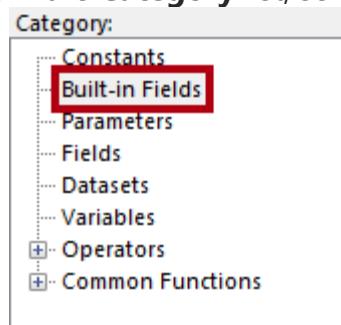


7. In the **Expression** window, in the expression box, append a space, followed by **& " | Page "** &, to produce the following:
VB Script

8. `=Globals!ExecutionTime & " | Page " &`

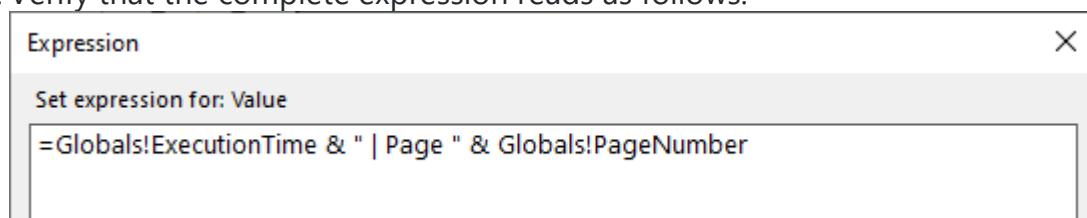
9. Ensure that a space follows the last ampersand (&).

10. In the **Category** list, select **Built-in Fields**.



11. To inject the page number value into the expression, in the **Item** list, double-click **PageNumber**.

12. Verify that the complete expression reads as follows:



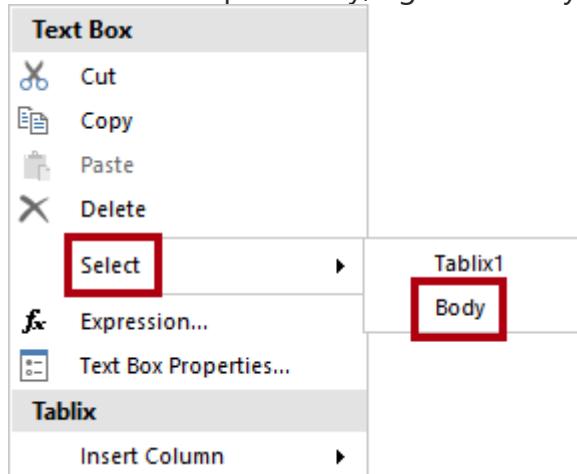
13. Click **OK**.

14. Drag the left side of the textbox to increase the width to the width of the report page.



The design of the report is now complete. Lastly, you will ensure that the page width is set to exactly six inches, and also remove the report parameter default value.

15. To select the report body, right-click any table textbox, and then select **Select | Body**.

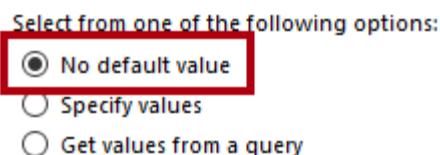


As the table fills the entire report body, this technique must be used to select the report body.

16. In the **Properties** pane, ensure that the **Position | Size | Width** property is set to **6**.
It is important the width is not greater than six inches, as rendering to print format would break the table up across multiple pages.

17. In the **Report Data** pane, open the **SalesOrderNumber** report parameter properties.

18. On the **Default Values** page, select the **No Default Value** option.



19. Click **OK**.

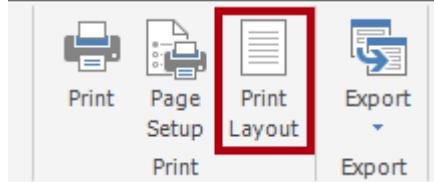
20. Save the report.

Task 8: Explore the final report

In this task, you will view the report in print layout mode.

1. Preview the report.
2. In the **Sales Order Number** parameter box, enter the value with **51721**

3. On the **Run** ribbon tab, from inside the **Print** group, click **Print Layout**.



Print layout mode provides a preview of what the report will look like when printed to the strict page size.

4. Navigate to pages 2 and 3.

In this lab, you won't publish the report. Paginated reports can only be rendered in the Power BI service when they are stored in a workspace on dedicated capacity, and when that capacity has the paginated reports workload enabled. These requirements do not exist for the class.