Design a Data Model in Power BI

In this exercise, you'll commence developing a 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'll also create hierarchies and create quick measures.

In this lab you learn how to:

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

Connect to the data sources

In the exercise folder, you'll find 3 different CSV files: *Products.csv, Resellers.csv* and *Salesperson.csv*.

You'll also find a subfolder containing 3 csv files that are the historical sales data from 2017 to 2019.

Connect to the 3 data sources as previously seen and load them to PowerBI Desktop.

We'll combine the 3 historical sales data files into one by using the "Connect to folder" connector.

For the sake of the exercise, make sure that no links are created between the tables in the **Model view**. If links are already created, delete them as we'll recreate them later.

Create model relationships

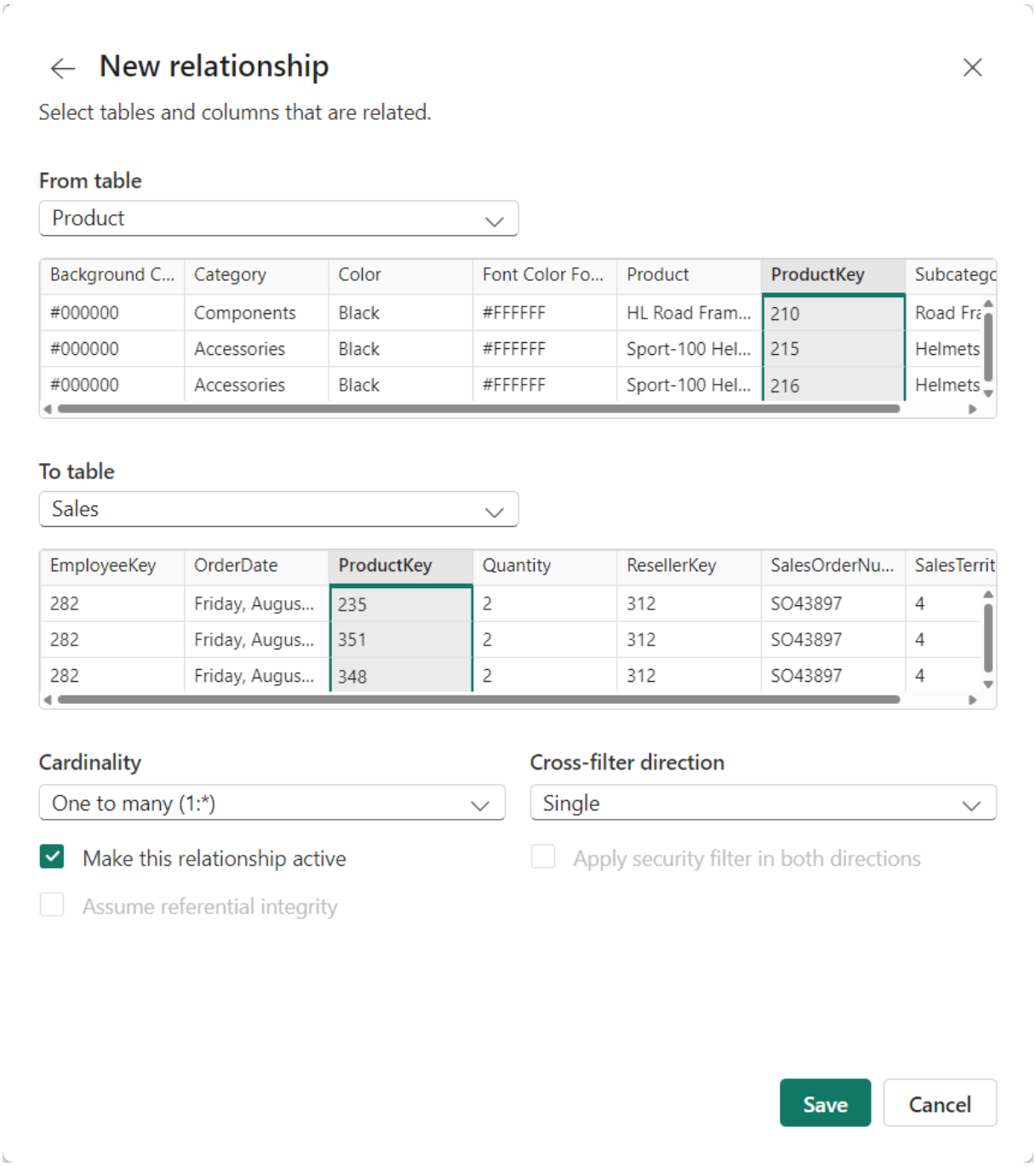
1. In Power BI Desktop, at the left, select the **Report view** icon.
2. To view all table fields, in the **Data** pane, right-click an empty area, and then select **Expand All**.
3. To create a table visual, in the **Data** pane, from inside the **Product** table, check the **Category** field.
4. To add another column to the table, in the **Data** pane, check the **Sales | Sales** field.
5. 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	Sum of Sales
Accessories	77,548,570.20
Bikes	77,548,570.20
Clothing	77,548,570.20
Components	77,548,570.20
Total	**77,548,570.20**

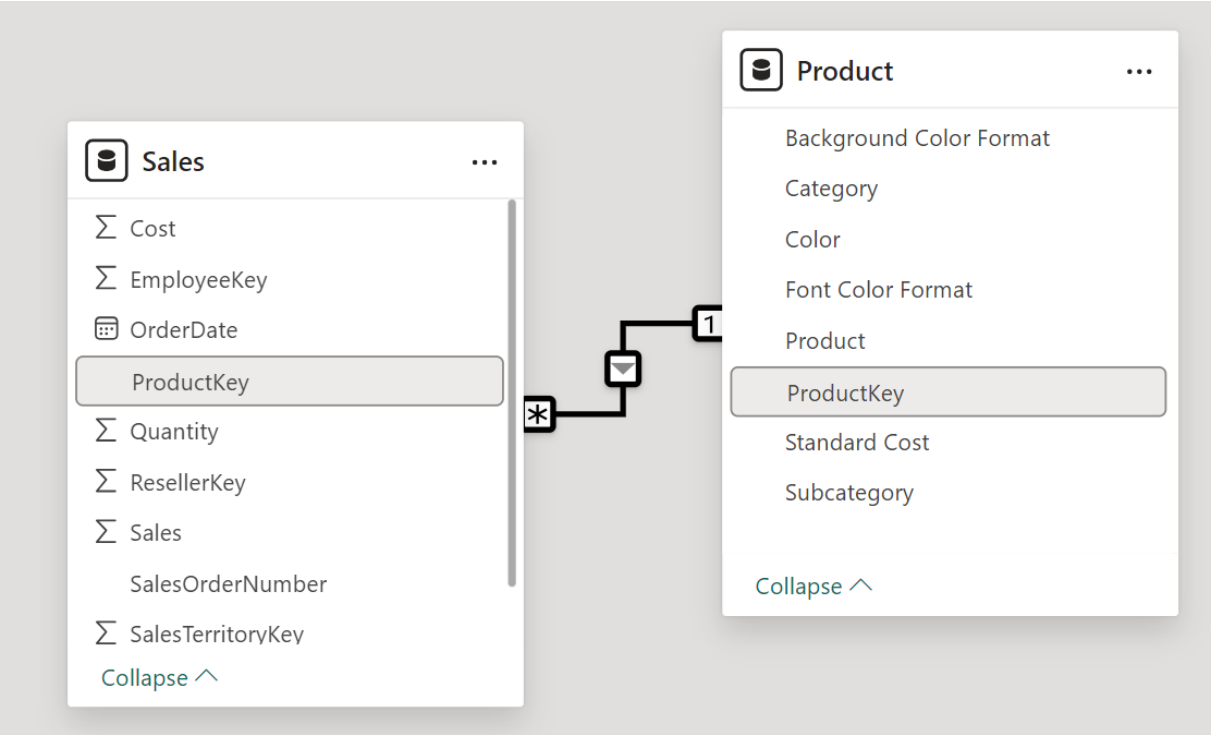
*The issue is that the table is based on fields from different tables. The expectation is that each product category displays the sales for that category. However, because there isn't a model relationship between these tables, the **Sales** table isn't filtered. You'll now add a relationship to propagate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

6. Select the **Model** view icon from the left navigation pane and select **Manage Relationships**.
7. In the **Manage Relationships** window, notice that no relationships are yet defined. To create a relationship, select **New relationship**.
8. Configure the relationship from **Product** table to **Sales** table. Notice the following elements were automatically configured:
    - **ProductKey columns in each table are selected**. *The columns were selected because they share the same name and data type. You may need to find matching columns with different names in real data.*
    - **Cardinality type is One To Many (1:*)**. *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.*

- **Cross Filter Direction type is Single**. *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 opposite direction.*
- **Make This Relationship Active is checked**. *Active relationships 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 this case, model calculations can use special functions to activate them.*



9. Select **OK**, notice in the **Manage Relationships** window that the new relationship is listed, and then select **Close**.

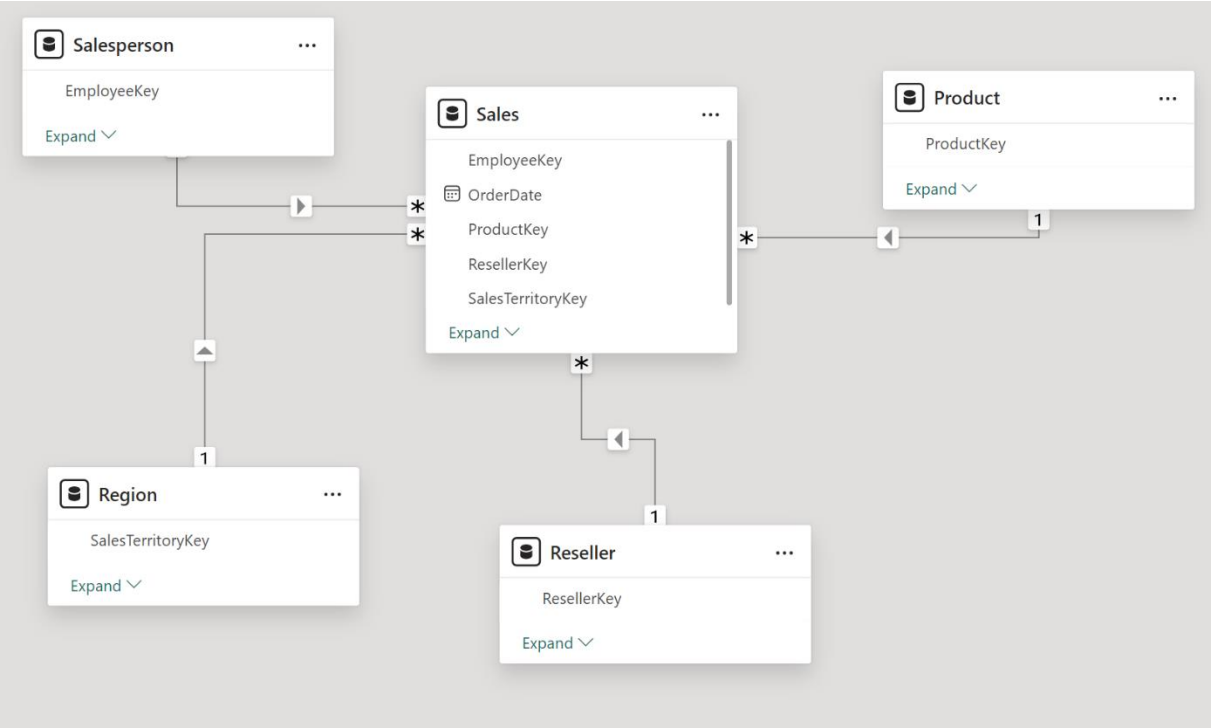


Notice there's now a connector between the two tables (*it doesn't matter if the tables are positioned next to each other*). - You can interpret the cardinality that is represented by the **1** and **(*)** indicators. - Filter direction is represented by the arrow head. - A solid line represents an active relationship; a dashed line represents an inactive relationship. - Hover the cursor over the relationship to highlight the related columns.

Create additional relationships

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

1. To create a new relationship using a different technique, from the **Reseller** table, drag the **ResellerKey** column onto the **ResellerKey** column of the **Sales** table.
2. Use the new technique to create the following two model relationships:
    - **Region | SalesTerritoryKey** to **Sales | SalesTerritoryKey**
    - **Salesperson | EmployeeKey** to **Sales | EmployeeKey**
3. In the diagram, arrange the tables so that the **Sales** table is positioned in the center of the diagram, and the related tables are arranged about it. Position the disconnected tables to the side.



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

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

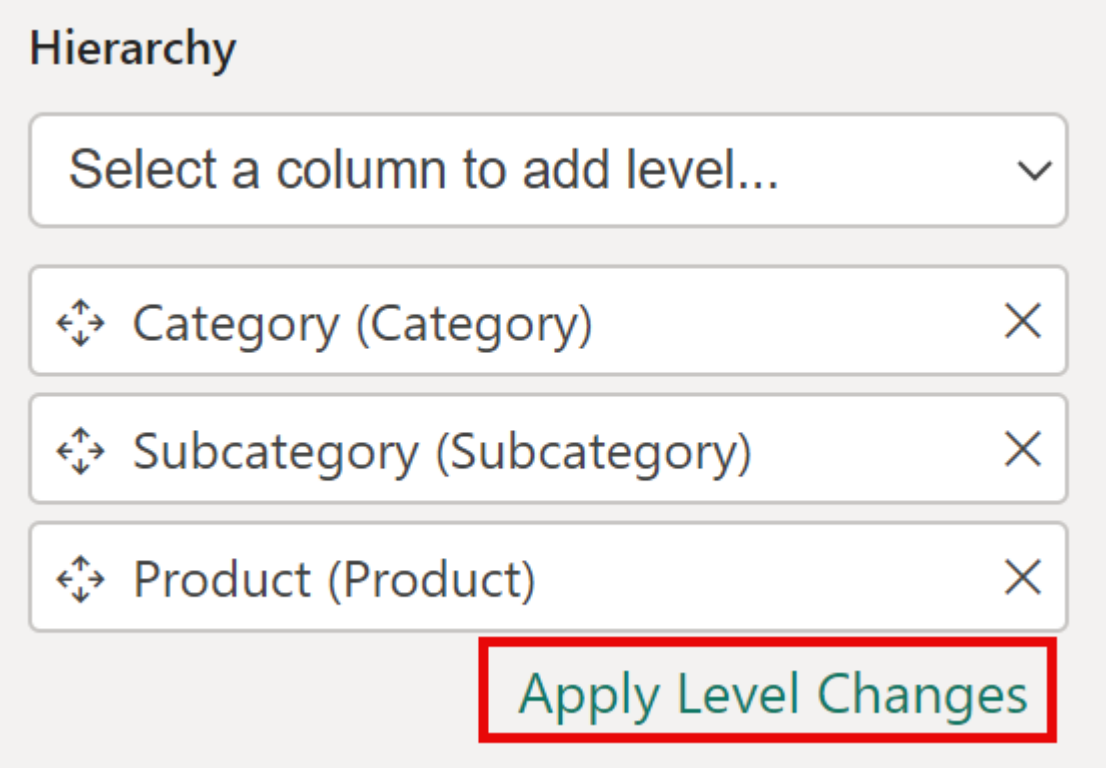
Category	Sum of Sales
Accessories	539,106.09
Bikes	64,069,033.16
Clothing	1,714,056.05
Components	11,226,374.90
Total	**77,548,570.20**

5. **Save** the Power BI Desktop file.

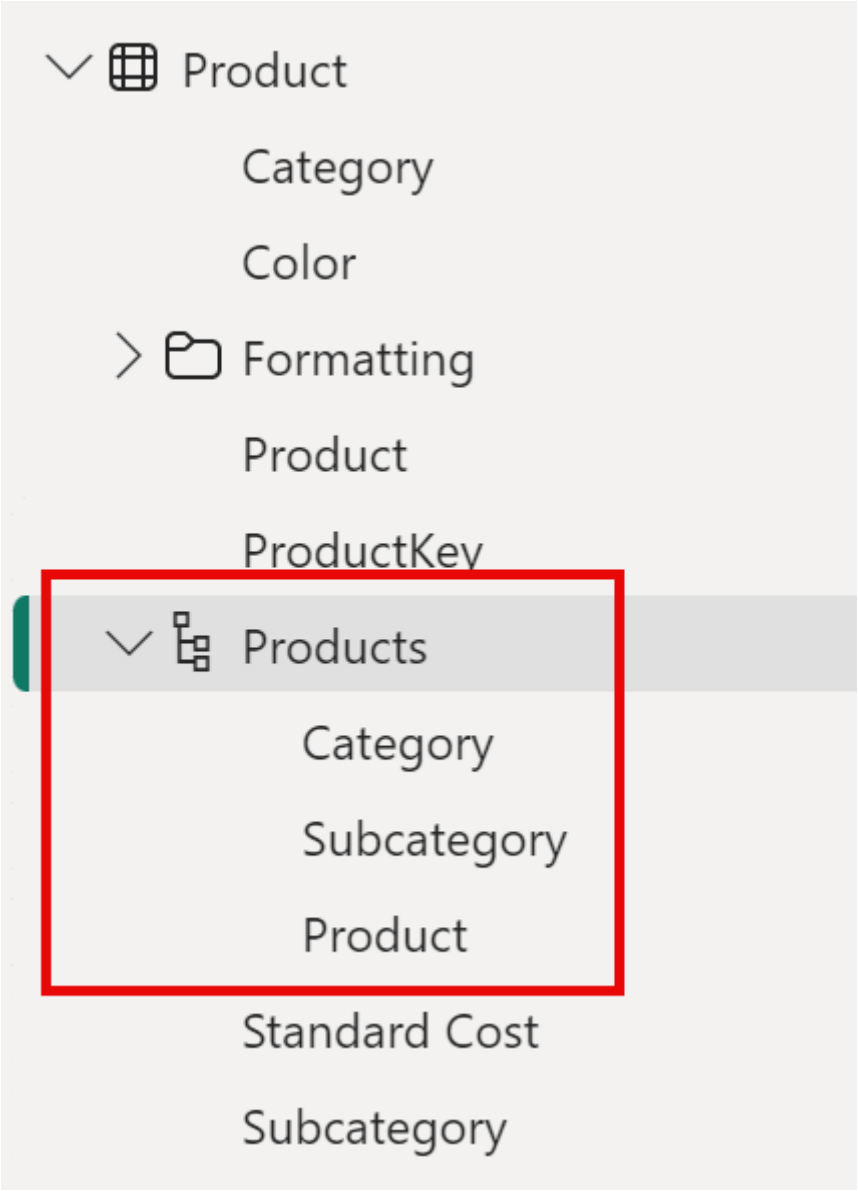
Configure the Product table

In this task, you'll configure the **Product** table with a hierarchy and display folder.

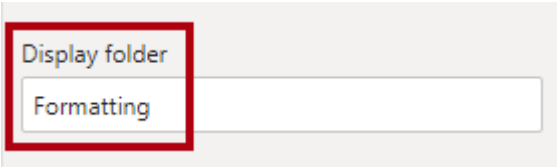
1. In **Model view > Data pane**, if necessary, expand the **Product** table to reveal all fields.
2. To create a hierarchy, in the Data pane, right-click the **Category** column, and then select **Create Hierarchy**.
3. Update the name to **Products** (right-click or double-click to rename).
4. To add the second level to the hierarchy, in the **Properties** pane, in the **Hierarchy** dropdown list, select **Subcategory** (you might need to scroll down inside the pane).
5. To add the third level to the hierarchy, in the **Hierarchy** dropdown list, select **Product**.
6. To complete the hierarchy design, select **Apply Level Changes**.



7. In the **Data** pane, notice the **Products** hierarchy. To reveal the hierarchy levels, expand the **Products** hierarchy.

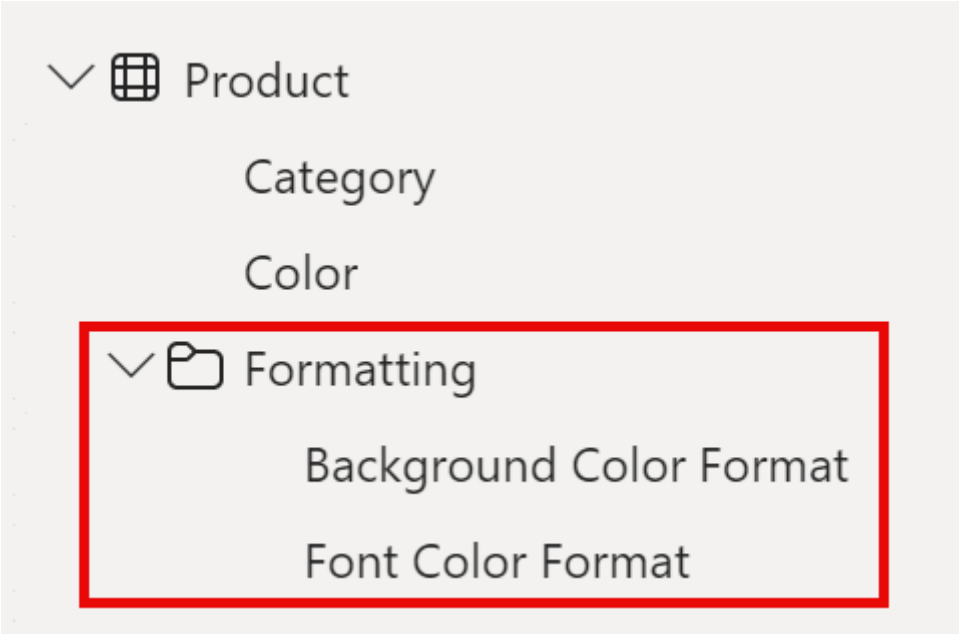


8. To organize columns into a display folder, in the **Data** pane, first select the **Background Color Format** column.
9. While pressing the **Ctrl** key, select the **Font Color Format** column.
10. In the **Properties** pane, in the **Display Folder** box, enter **Formatting**.



11. In the **Data** pane, notice that the two columns are now inside a folder.

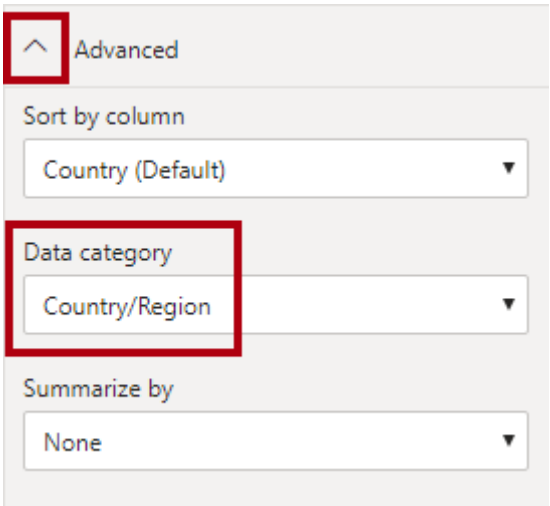
Display folders are a great way to organize tables, especially for tables that comprise many fields. They're logical presentation only.



Configure the Region table

In this task, you'll configure the **Region** table with a hierarchy and updated categories.

1. In the **Region** table, create a hierarchy named **Regions**, with the following three levels:
    - Group
    - Country
    - Region
2. Select the **Country** column (not the **Country** hierarchy level).
3. In the **Properties** pane, expand the **Advanced** section (at the bottom of the pane), 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 to Power BI when it renders a map visualization.

Configure the Reseller table

In this task, you'll configure the **Reseller** table to add a hierarchy and update data categories.

1. In the **Reseller** table, create a hierarchy named **Resellers**, with the following two levels:
    - Business Type
    - Reseller
2. Create a second hierarchy named **Geography**, with the following four levels:
    - Country-Region
    - State-Province
    - City
    - Reseller
3. Set the **Data Category** for the following columns (not within the hierarchy):
    - Country-Region to **Country/Region**
    - State-Province to **State or Province**
    - City to **City**

Configure the Sales table

In this task, you'll configure the **Sales** table with updated descriptions, formatting, and summarization.

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

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

1. Select the **Quantity** column.
2. In the **Properties** pane, from inside the **Formatting** section, slide the **Thousands Separator** property to **Yes**.
3. Select the **Unit Price** column.
4. In the **Properties** pane, from inside the **Formatting** section, set the **Decimal Places** property to **2**.
5. 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 isn't suitable for a column like **Unit Price**, which represents a rate. Setting the default summarization to average will produce a meaningful result.*

Bulk update properties

In this task, you'll update multiple columns using single bulk updates. You'll use this approach to hide columns, and format column values.

1. From the **Model view** > **Data** pane, select the **Product | ProductKey** column.
2. While pressing the **Ctrl** key, select the following 13 columns (spanning multiple tables):
    - Region | SalesTerritoryKey
    - Reseller | ResellerKey
    - Sales | EmployeeKey
    - Sales | ProductKey
    - Sales | ResellerKey
    - Sales | SalesOrderNumber
    - Sales | SalesTerritoryKey
    - Salesperson | EmployeeID
    - Salesperson | EmployeeKey
    - Salesperson | UPN
    - SalespersonRegion | EmployeeKey
    - SalespersonRegion | SalesTerritoryKey
    - Targets | EmployeeID

3. In the **Properties** pane, slide the **Is Hidden** property to **Yes**.

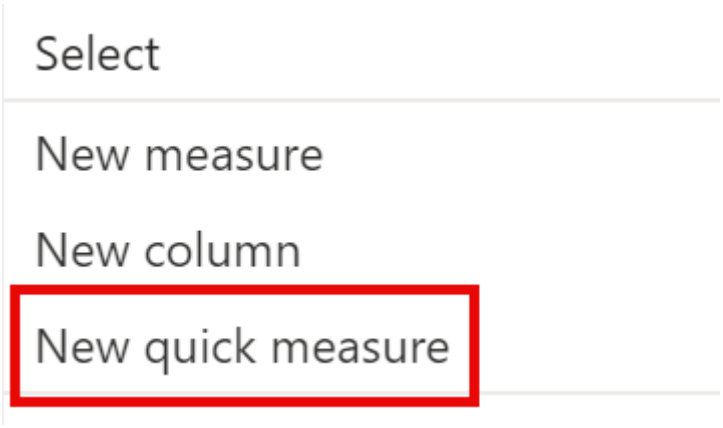
The columns were hidden because they're either used by relationships or will be used in calculation logic only.

1. Multi-select the following three columns:
    - Product | Standard Cost
    - Sales | Cost
    - Sales | Sales
2. In the **Properties** pane, from inside the **Formatting** section, set the **Decimal Places** property to **0** (zero).

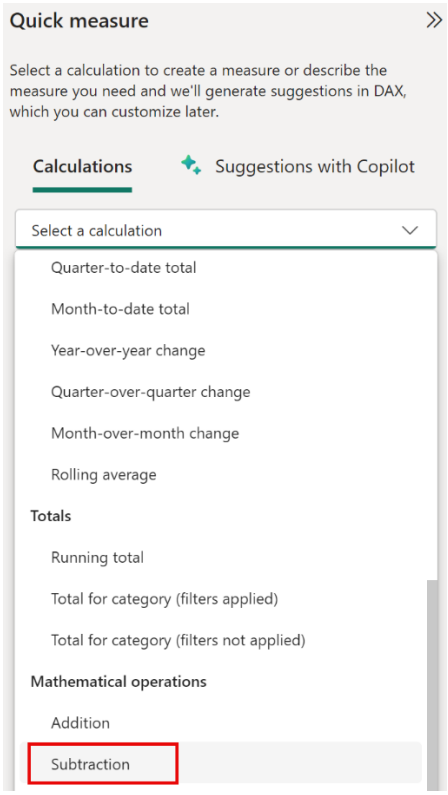
Create quick measures

In this task, you'll create two quick measures to calculate profit and profit margin. A quick measure creates the calculation formula for you. They're easy and fast to create for simple and common calculations.

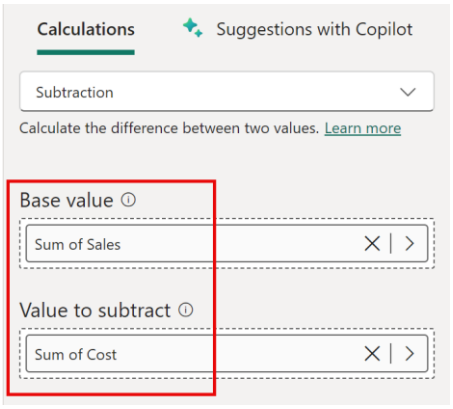
1. In the **Data** pane, right-click the **Sales** table, and then select **New Quick Measure**.

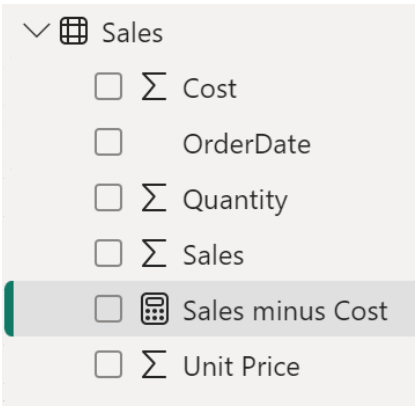


2. In the **Quick Measures** window, in the **Calculation** dropdown list, from inside the **Mathematical Operations** group, select **Subtraction**.



3. In the **Data** pane of the **Quick Measures** window, 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, then select **Add**.

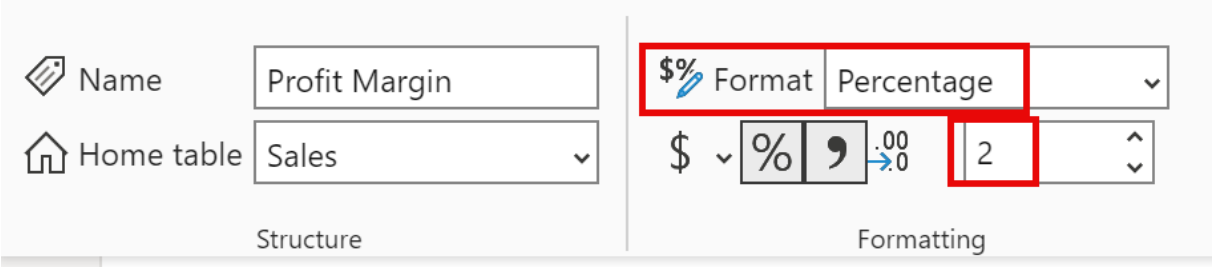




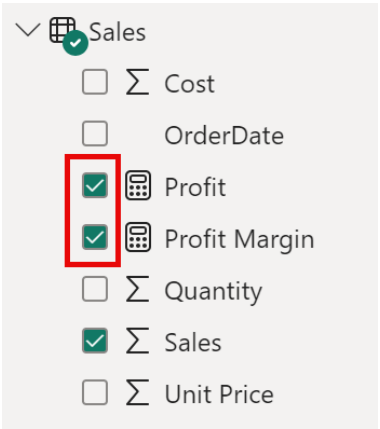
6. In the **Data** pane, inside the **Sales** table, notice that new measure.
7. To rename the measure, right-click it, select **Rename**, then rename to **Profit**.

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

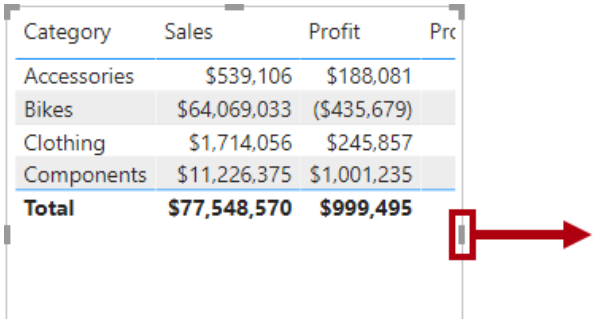
8. In the **Sales** table, add a second quick measure, based on the following requirements:
    - Use the **Division** mathematical operation
    - Set the **Numerator** to the **Sales | Profit** field
    - Set the **Denominator** to **Sales | Sales** field
    - Rename the measure as **Profit Margin**
9. Ensure the **Profit Margin** measure is selected, and then on the **Measure Tools** contextual ribbon, set the format to **Percentage**, with two decimal places.



10. To test the two measures, first select the **Table** visual.
11. In the **Data** pane, check the two measures.



12. Select and drag the right guide to widen the table visual.



Category	Sales	Profit	Pro
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**	

13. Verify that the measures produce reasonable results 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 %**