Introduction to Power BI, Charts, DAX & Creating Reports

Question 1 : Define Power BI and What are the key components of the Power BI ecosystem? Briefly explain:
- **Power BI Desktop**
- **Power BI Service**
- **Power BI Mobile**
- **Power BI Gateway**

Answer :

Power BI is a business analytics service by Microsoft that allows users to visualize data, share insights, and make data-driven decisions. It connects to multiple data sources, transforms raw data into interactive dashboards and reports, and provides a platform for monitoring business performance in real time.

The key components of the Power BI ecosystem include:

1. **Power BI Desktop**
   - A Windows application used to create reports and data models.
   - Allows importing, cleaning, transforming, and visualizing data from multiple sources.
   - Used to design interactive reports and dashboards before publishing them to the Power BI Service.

2. **Power BI Service**
   - A cloud-based platform (SaaS) for sharing and collaborating on reports and dashboards.
   - Enables users to access reports online, schedule data refreshes, and work in team workspaces.
   - Supports publishing apps, dashboards, and sharing insights with stakeholders.

3. **Power BI Mobile**
   - A mobile application for iOS and Android devices.
   - Allows users to view and interact with reports and dashboards on the go, receive alerts, and monitor key metrics anytime.

4. **Power BI Gateway**

   - Acts as a secure bridge between on-premises data sources and the Power BI Service.
   - Ensures automatic and scheduled data refresh while maintaining data security.
   - Available in two types:

- Personal Gateway – for individual use.
- Enterprise Gateway – for organizational and team use.

Question 2 : Compare the following Power BI visuals:
- **Pie Chart vs Donut Chart**
- **Bar Chart vs Column Chart**

When would you prefer one over the other? Give one example for each pair.

<u>**Answer :**</u>

1. <u>Pie Chart vs Donut Chart</u>:

Feature	Pie Chart	Donut Chart
Shape	Circular chart divided into slices representing proportions of a whole	Circular chart with a hole in the center (like a donut), also showing proportions
Use Case	Best for showing percentage contribution of categories when the number of categories is small	Similar use as Pie Chart, but the center can display additional info (like total value)
Visual Preference	Simple, easy to understand for small datasets	Cleaner look, better for dashboards where space is limited and center can show metrics
Example	Showing Sales distribution by Region (e.g., North, South, East, West)	Showing Profit contribution by Product Category with total profit in the center

When to Prefer:

- Use a Pie Chart for simple proportion comparisons.
- Use a Donut Chart when you want to include total or other key metrics in the center for a dashboard view.

2. <u>Bar Chart vs Column Chart</u>:

Feature	Bar Chart	Column Chart
Orientation	Horizontal bars	Vertical columns
Use Case	Useful when category labels are long or there are many categories	Useful for time series or smaller number of categories

Comparison	Easier to compare values across categories horizontally	Easier to show trends over time vertically
Example	Comparing Customer Satisfaction scores across multiple countries	Showing Monthly Sales Revenue over a year

When to Prefer:

- Use a Bar Chart when category names are long or there are many categories.
- Use a Column Chart for time-based data or fewer categories to show trends clearly.

Tip: Pie/Donut charts are better for parts-to-whole, while Bar/Column charts are better for comparing individual values across categories.

Question 3 : Explain the significance of:
- **● Star schema vs Snowflake schema**
- **● Primary key vs Foreign key in relationships (Power BI)**

Why is cardinality important?

Answer :

1. Star Schema vs Snowflake Schema:

Feature	Star Schema	Snowflake Schema
Structure	Central fact table connected to denormalized dimension tables	Central fact table connected to normalized dimension tables (dimension tables further split into sub-tables)
Complexity	Simple, easy to understand	More complex due to multiple levels of dimension tables
Performance	Faster query performance because fewer joins are required	Slightly slower queries due to multiple joins
Storage	Uses more storage (dimension tables are denormalized)	Uses less storage (dimension tables are normalized)
Use Case	Best for quick reporting and dashboards	Best for detailed data analysis with normalized data

Example:

- **Star Schema:** Sales Fact table connected to Customer, Product, Region dimension tables.
- **Snowflake Schema:** Product dimension further split into Product Category and Product Subcategory tables.

2. Primary Key vs Foreign Key in Power BI Relationships:

Feature	Primary Key	Foreign Key
Definition	Unique identifier for each row in a table	Column that references the primary key of another table to create a relationship
Purpose	Ensures **uniqueness** and identifies each record	Enables **linking tables** and **relational analysis**
Example	CustomerID in the Customer table	CustomerID in the Sales table linking to Customer table

Significance in Power BI:

- Primary keys and foreign keys define relationships between tables.
- Correct relationships are essential for accurate calculations, filtering, and aggregations in reports.

Cardinality:

- Cardinality refers to the uniqueness of values in a column and the type of relationship between tables in Power BI.
- Common cardinality types:
  - **One-to-One (1:1):** Each value in one table matches one value in another table.
  - **One-to-Many (1:*):** One value in the primary table matches many values in the related table.
  - **Many-to-Many (*:*):** Multiple values in both tables can match.
- **Importance:**
  - Ensures accurate aggregation and filtering in visuals.
  - Helps Power BI determine how data should be joined for calculations like SUM, COUNT, and AVERAGE.

Example:

- A Customer table (1) linked to Sales table (Many) via CustomerID is a One-to-Many relationship.
- Without proper cardinality, measures like total sales per customer would be incorrect.

Question 4 : Differentiate between:
● **Calculated column vs Measure**
Also, define Row context and Filter context with simple examples.

Answer:

1. Calculated Column vs Measure:

Feature	Calculated Column	Measure
Definition	A column added to a table in Power BI using a DAX formula	A dynamic calculation performed on aggregated data in visuals using DAX
Storage	Stored in the data model	Not stored in the data model; calculated on the fly
Calculation Scope	Calculated row by row for each record	Calculated based on the context of the report or visual
Usage	Useful for categorization, labels, or derived columns	Useful for aggregations like SUM, AVERAGE, MAX, MIN
Example (Superstore Dataset)	`Profit Margin = [Profit] / [Sales]` (creates a new column for each row)	`Total Profit = SUM([Profit])` (calculates total profit dynamically in a visual)

Key Point:

- Calculated Columns are row-level and stored in the table.
- Measures are dynamic and depend on the context of the visual.

2. Row Context vs Filter Context:

Term	Definition	Example
Row Context	Refers to working on a single row of a table. Each row is evaluated individually when a calculated column or a formula is applied.	In a calculated column: `Profit Margin = [Profit] / [Sales]` → Power BI calculates for each row in the Sales table.
Filter Context	Refers to the set of filters applied to a calculation in a visual or measure. It determines which rows are considered in the calculation.	In a measure: `Total Profit = SUM([Profit])` → If the visual shows Region = East, only rows where Region = East are included in the calculation.

Simple Way to Remember:

- **Row Context:** Think "this row only" → used in calculated columns.
- **Filter Context:** Think "which rows are visible/selected" → used in measures and visuals.

Question 5: What is the difference between a report and a dashboard in Power BI?
Answer:

Power BI provides two main ways to present data: Reports and Dashboards. Both are used to visualize data, but they serve different purposes and have distinct features.

Comparison Table:

Feature	Report	Dashboard
Definition	A multi-page collection of interactive visuals created from a dataset to explore and analyze data in detail.	A single-page, consolidated view of key metrics and insights, often combining visuals from multiple reports or datasets.
Number of Pages	Can have multiple pages to show detailed analysis.	Always single-page, designed to summarize important information at a glance.
Interactivity	Highly interactive – supports slicers, filters, drill-throughs, and detailed exploration of data.	Limited interactivity – tiles can link to reports, but users cannot directly slice or drill visuals on the dashboard.
Data Source	Built from one dataset per report (though can include multiple tables in the dataset).	Can combine visuals from multiple datasets or multiple reports.
Purpose	For detailed analysis and insight discovery.	For quick monitoring of KPIs and high-level decision making.
Example (Superstore Dataset)	A report with Sales by Region, Profit by Product Category, Monthly Sales Trend, and Customer Segmentation.	A dashboard showing Total Sales, Total Profit, Top 5 Products, Sales by Region, and Key Alerts on a single page.

Key Differences in Summary:

1. Reports are meant for in-depth analysis, while Dashboards are meant for at-a-glance monitoring.
2. Reports can be multi-page and interactive; Dashboards are single-page and mostly static tiles.
3. Reports are built from a single dataset; Dashboards can aggregate visuals from multiple reports/datasets.

Question 6 : Using the Sample Superstore dataset:
 ● **Create a Clustered Bar Chart to display Total Sales by Sub-Category**
 ● **Create a Donut Chart for Sales % by Region**
Provide screenshots of both visuals.
Answer :

Dataset Used:

Global_superstore2 (Sample Superstore Dataset)
 Key fields used:

   ● Sales
   ● Sub-Category
   ● Region

1. Clustered Bar Chart – Total Sales by Sub-Category
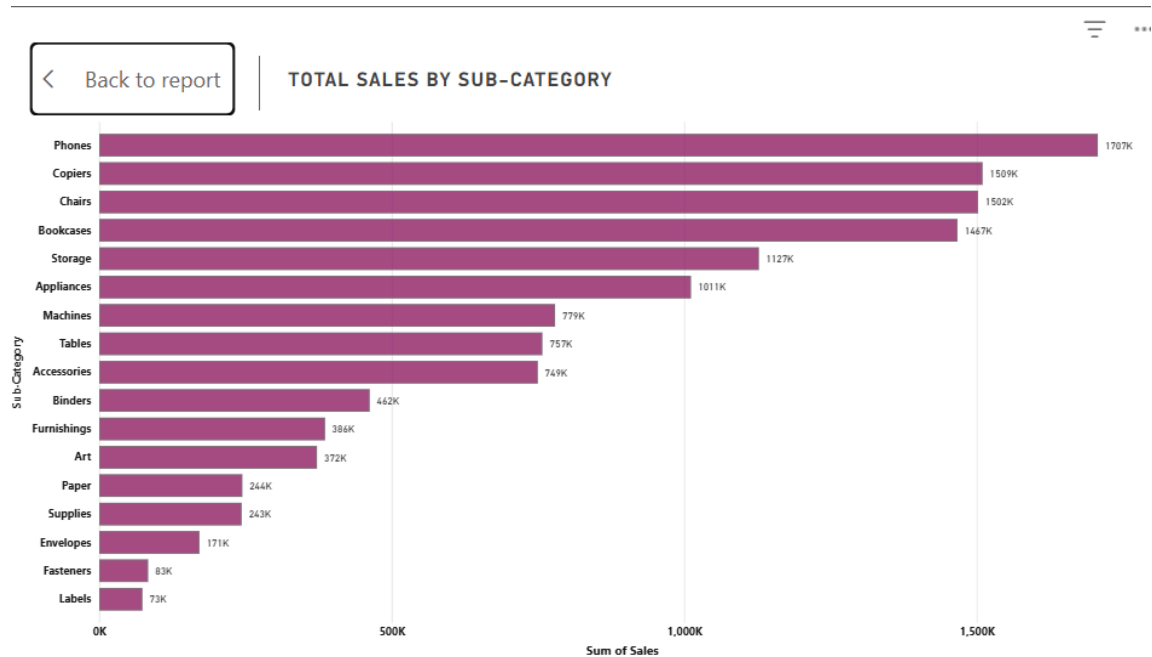
Objective:

To compare total sales across different product sub-categories and identify high-performing and low-performing sub-categories.

Steps to Create the Visual in Power BI Desktop

1. Open Power BI Desktop
2. Click Get Data → Text/CSV
3. Load the Global_superstore2 dataset
4. From the Visualizations pane, select Clustered Bar Chart
5. Drag fields:
     ○ Y-Axis → `Sub-Category`
     ○ X-Axis (Values) → `Sales`
6. Ensure aggregation is set to:
     ○ Sales → Sum
7. Format the chart:
     ○ Enable Data labels
     ○ Set title as:
        "Total Sales by Sub-Category"

Insight:

   ● Sub-categories such as Phones, Chairs, Bookcases, and Copiers show higher sales.
   ● Helps management decide which product lines generate maximum revenue.

Sub-Category / Sum of Sales:
- Phones — 1707K
- Copiers — 1509K
- Chairs — 1502K
- Bookcases — 1467K
- Storage — 1127K
- Appliances — 1011K
- Machines — 779K
- Tables — 757K
- Accessories — 749K
- Binders — 462K
- Furnishings — 386K
- Art — 372K
- Paper — 244K
- Supplies — 243K
- Envelopes — 171K
- Fasteners — 83K
- Labels — 73K

2. Donut Chart – Sales Percentage by Region

Objective:

To show the **proportional contribution of each region** to total sales.
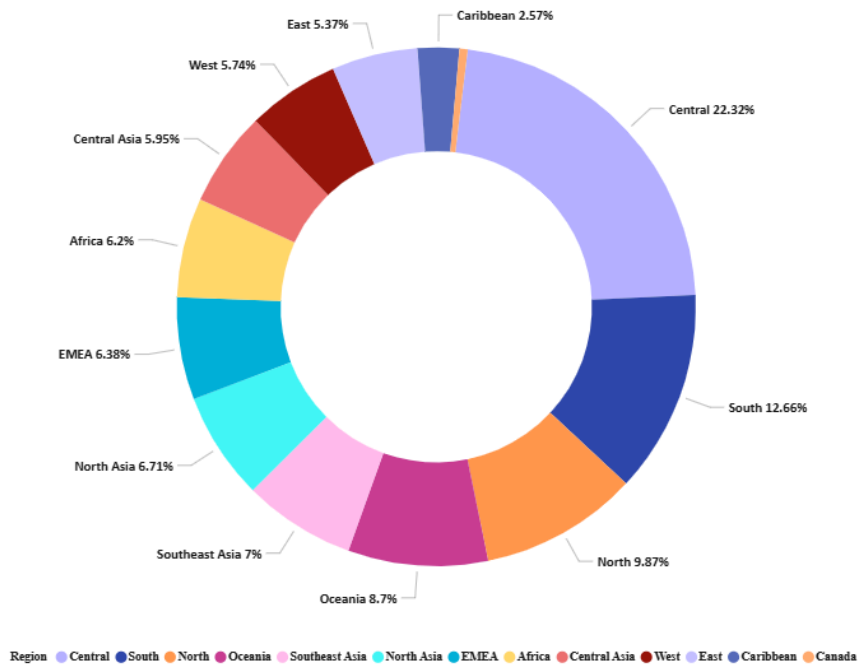
Steps to Create the Visual in Power BI Desktop

1. From the Visualizations pane, select Donut Chart
2. Drag fields:
   - Legend → Region
   - Values → Sales
3. Ensure aggregation:
   - Sales → Sum
4. Turn on:
   - Detail labels
   - Set label style to Percent of Total
5. Add title:
   "Sales Percentage by Region"

Insight:

- Regions like Central, South, North contribute the highest sales.
- Useful for regional performance analysis and market strategy.

East 5.37%
Caribbean 2.57%
West 5.74%
Central Asia 5.95%
Central 22.32%
Africa 6.2%
EMEA 6.38%
South 12.66%
North Asia 6.71%
Southeast Asia 7%
North 9.87%
Oceania 8.7%

Region ● Central ● South ● North ● Oceania ● Southeast Asia ● North Asia ● EMEA ● Africa ● Central Asia ● West ● East ● Caribbean ● Canada

Question 7 : Write and apply the following measures:
  - **Total Profit = SUM([Profit])**
  - **Average Discount = AVERAGE([Discount])**
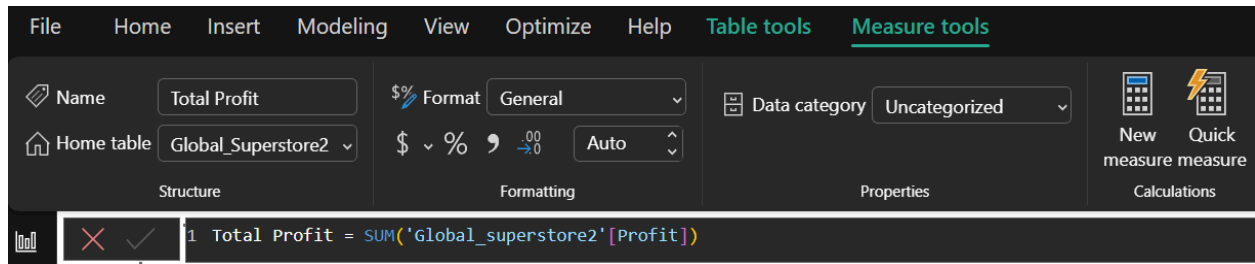**Display both in a KPI Card, and use a Line Chart to show profit trend over months. Add visuals and DAX formulas.**
Answer :

1 Measures in Power BI:

A. Total Profit:

Go to Modeling → New Measure, and write:

```
Total Profit = SUM('Global_superstore2'[Profit])
```

  - This will sum up all the Profit values.

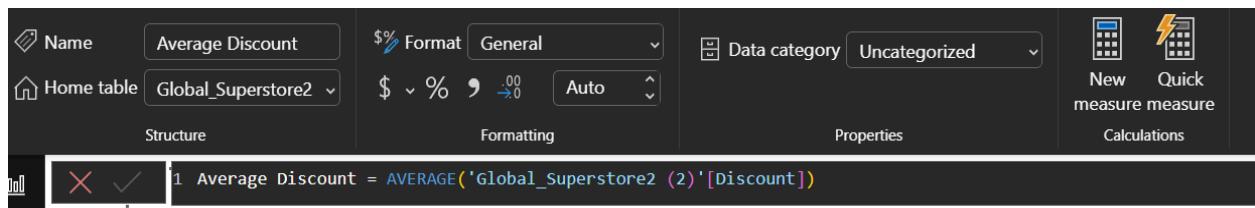 - Zeros in Profit are included naturally (correct behavior).

B. Average Discount:

Go to Modeling → New Measure, and write:

```
Average Discount = AVERAGE('Global_superstore2'[Discount])
```

- This calculates the average discount across all sales.
- Nulls in Discount column (if any) are ignored automatically.

2️⃣ KPI Cards:

1. From Visualizations, select Card visual.
2. Drag Total Profit measure → Values of Card 1.
3. Drag Average Discount measure → Values of Card 2.

✅ This will show the total profit and average discount in separate KPI cards.

3️⃣ Profit Trend over Months:

1. Make sure your Order Date column is formatted as Date type.
2. Create a Line Chart visual.
3. Drag Order Date → Axis.
   - Click the dropdown on Order Date → select Month or Month-Year for proper trend.
4. Drag Total Profit measure → Values.
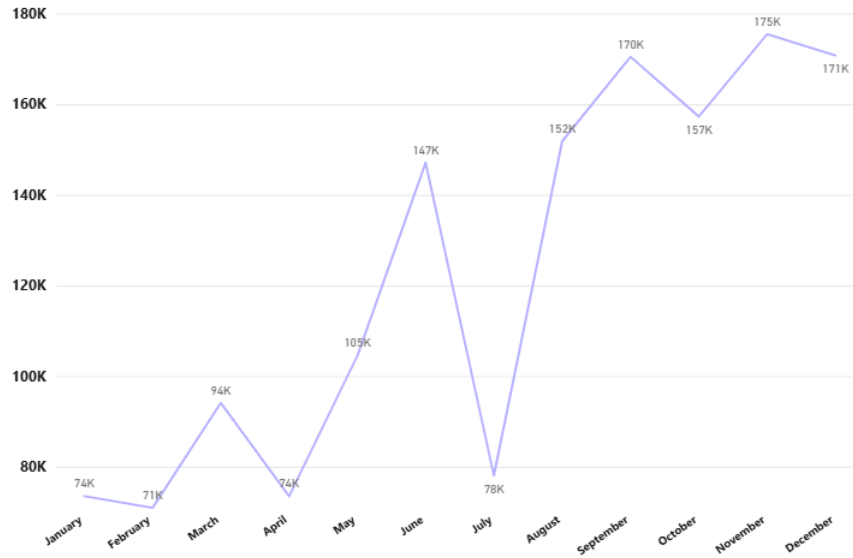
This will show the profit trend month by month.

Sum of Profit by Month

1.47M
Total Profit

0.14
Average Discount

Line chart "Sum of Profit by Month" with monthly values: January 74K, February 71K, March 94K, April 74K, May 105K, June 147K, July 78K, August 152K, September 170K, October 157K, November 175K, December 171K. Y-axis from 80K to 180K.

Question 8 : Implement a DAX measure that calculates the percentage of total sales by product category.

Product_category	Sales_Amount
Electronics	5000
Clothing	3000
Home Appliances	7000
Books	2000
Tables & Chairs	8000
Toy	1500
Sports Equipment	1200
Office Supplies	1000
Beauty Products	4400
Garden Supplies	1000
Jewelry	1800
Automative	2600

Answer:

Step 1: Open Power BI Desktop

- Click Home → Enter data

Step 2: Create the Table

Enter the data like this:

Product_category	Sales_Amount
Electronics	5000
Clothing	3000
Home Appliances	7000
Books	2000
Tables & Chairs	8000
Toy	1500
Sports Equipment	1200
Office Supplies	1000
Beauty Products	4400
Garden Supplies	1000
Jewelry	1800
Automotive	2600

Step 3: Name the Table

- Table name: Sales_Table
- Click Load

✔ Data is now added to Power BI.

After Data Is Added – Create the Measure

Go to Modeling → New Measure:

```
Sales % by Category =
DIVIDE(
    SUM('Sales_Table'[Sales_Amount]),
    CALCULATE(
        SUM('Sales_Table'[Sales_Amount]),
        ALL('Sales_Table'[Product_category])
    )
)
```
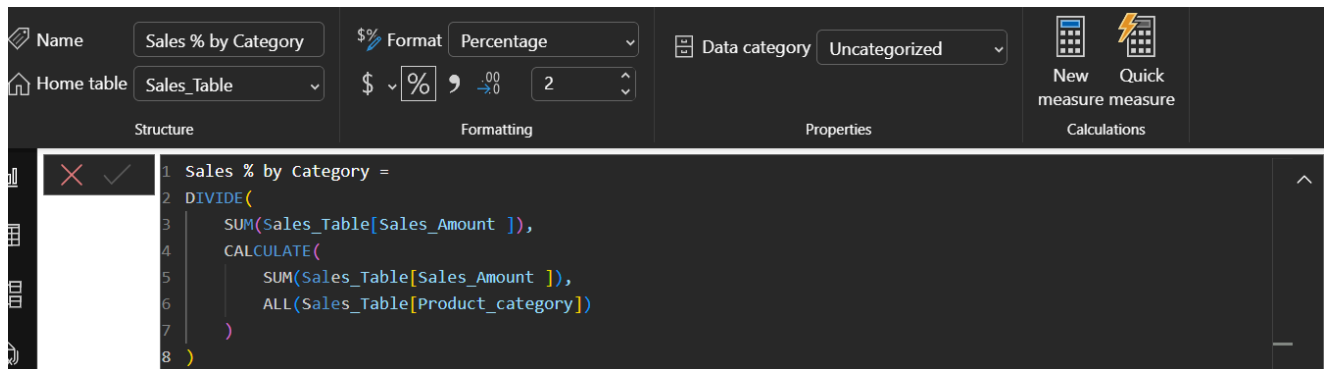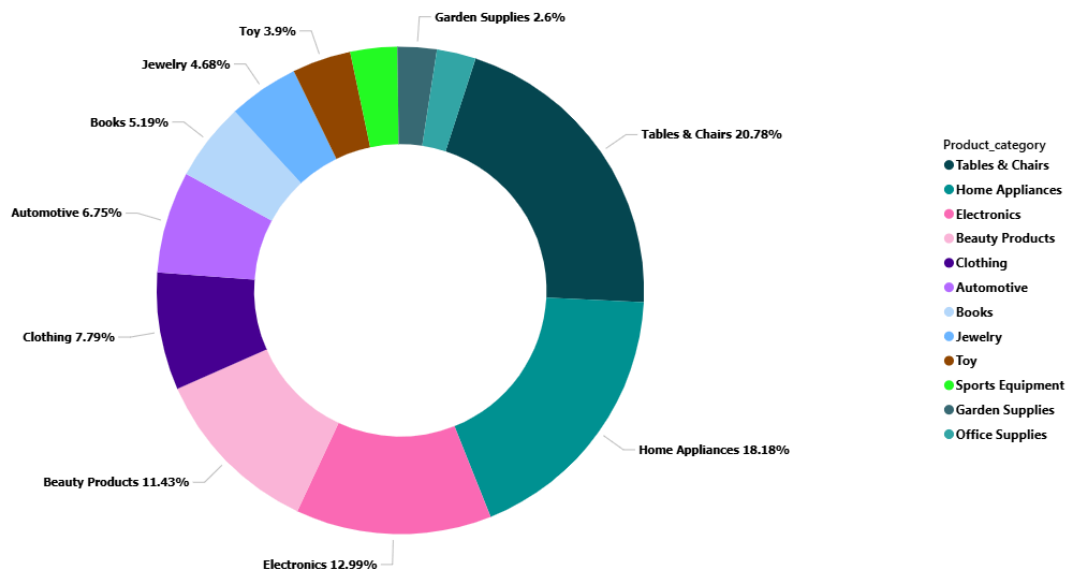
Format:

- Modeling → Format → Percentage
- Decimal places → 2

For understanding the data Visually I created Doughnut Chart:

- Legend → Product_category
- Values → Sales % by Category

Sales % by Category by Product_category

Product_category
- ● Tables & Chairs
- ● Home Appliances
- ● Electronics
- ● Beauty Products
- ● Clothing
- ● Automotive
- ● Books
- ● Jewelry
- ● Toy
- ● Sports Equipment
- ● Garden Supplies
- ● Office Supplies

Question 9 :

● **Create a DAX Measure for Total Profit**

● **Use it in a Waterfall Chart to analyze how different Sub-Categories contribute to overall profit**

● **Add a Slicer for Region to filter the visual**

● **Write brief business insights (4–5 lines) from the chart and provide 2–3 data-driven recommendations to improve profit.**

Provide a steps, screenshot of the Waterfall chart and the DAX formula DATASET
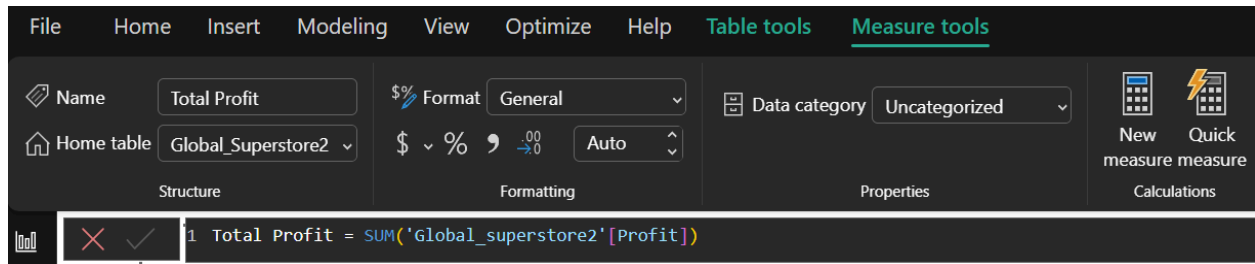
Answer:

1. DAX Measure – Total Profit

In Power BI Desktop:

Modeling → New Measure

```
Total Profit = SUM('Global_superstore2'[Profit])
```

This measure calculates the total profit dynamically and responds to filters such as Region and Sub-Category.
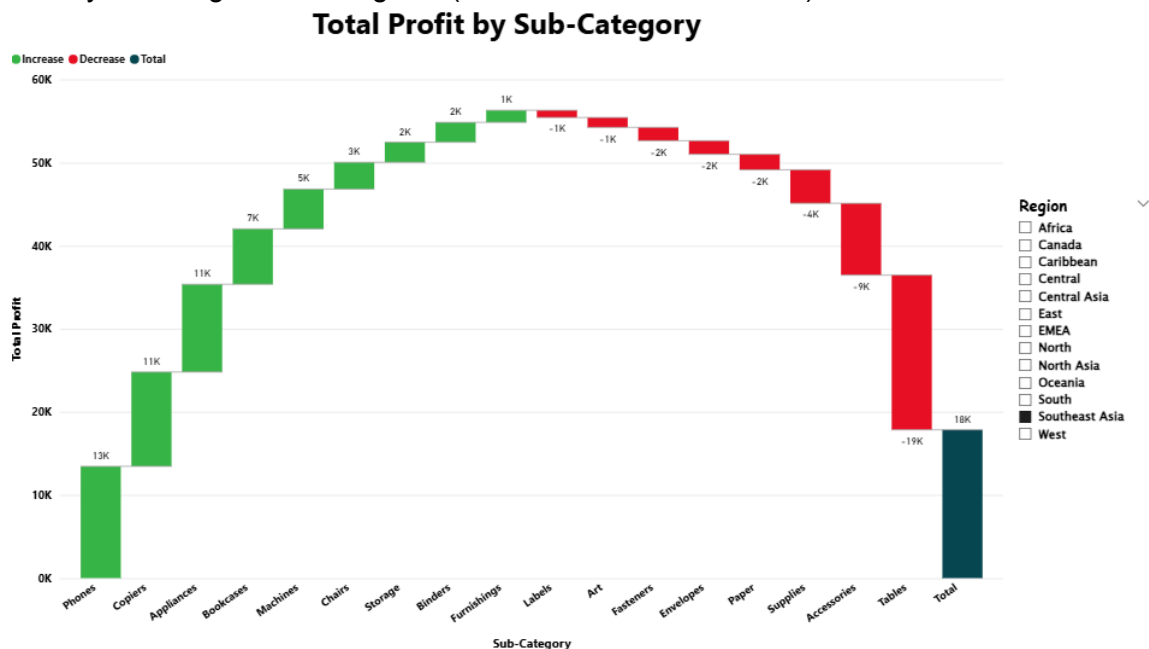
2.Create the Waterfall Chart

Steps:

1. Go to Report View
2. From Visualizations, select Waterfall Chart
3. Add the following fields:
    Category → Subcategory
    Y-axis → Total_Profit

4. Sort the chart by Total Profit (descending) for clarity
5. Turn Data Labels → ON for better readability

3. Add Region Slicer

Steps:

1. Select Slicer visual
2. Drag Region into the slicer field
3. Place the slicer near the Waterfall chart
4. Test by selecting different regions (Central, East, West, South)

Business Insights:

- The Waterfall chart highlights how individual sub-categories contribute positively or negatively to overall profit.
- Certain sub-categories such as Technology-related items contribute significantly to profit.
- Some Furniture sub-categories show negative or low profit impact, indicating higher costs or heavy discounting.
- Regional filtering shows that profit contribution varies significantly across regions.
- Loss-making sub-categories have a noticeable downward impact on total profitability.

Conclusion:

The Waterfall chart provides a clear visualization of profit contribution by sub-category. Combined with a Region slicer, it enables interactive analysis and supports data-driven decision-making to improve overall profitability.

Question 10 : Scenario: VitaTrack Wellness, a digital health company in FitZone, has collected data on users' daily habits and health vitals. The analytics team is tasked with drawing actionable insights from this data to improve lifestyle suggestions and prevent heart-related risks.

Your Task: Using the provided dataset (includes Age, Gender, BMI, Steps, Calories, Sleep, Heart Rate, Blood Pressure, Smoking, Alcohol, Exercise, Diabetic & Heart Disease status):
Build a one-page Power BI dashboard that answers:

1. Are users maintaining a balanced lifestyle (Steps, Sleep, Calories)
2. What lifestyle patterns (Smoking, Alcohol, BMI, etc.) indicate heart disease risk?
3. Is there any visible relationship between Sleep and Physical Activity?
4. How does BMI vary across Age Groups and Genders?
5. What is the impact of smoking and alcohol on heart rate and blood pressure?
6. Segment people based on their health activity to suggest lifestyle changes
Answer:

Objective

The objective of this dashboard is to analyze users' lifestyle habits and health indicators to identify balanced lifestyle patterns, assess heart disease risk, and provide data-driven lifestyle recommendations.

<u>Dashboard Design</u>

A single-page Power BI dashboard was created using appropriate visuals such as Cards, Column Charts, Bar Charts, Scatter Charts, Tables, and Slicers.
 Interactive slicers were added to allow filtering by Gender, Age Group, Smoking, Alcohol Consumption, and Heart Disease status.

<u>Conclusion:</u>

The one-page dashboard effectively integrates multiple lifestyle and health indicators to identify risks, reveal behavioral patterns, and support proactive wellness recommendations. The use of appropriate Power BI visuals enhances clarity, interactivity, and decision-making.