

# Introduction to Power BI, Charts, DAX & Creating Reports

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Q1. 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 intelligence and data visualization tool developed by Microsoft that allows users to connect to multiple data sources, transform and model data, and create interactive reports and dashboards. It helps organizations make data-driven decisions by visualizing and analyzing data in real time.

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**Key Components of the Power BI Ecosystem:**

## 1. Power BI Desktop

Power BI Desktop is a **free Windows application** used for building data models, creating visuals, and designing reports.

It allows users to connect to various data sources (such as Excel, SQL Server, and online databases), clean and transform the data using Power Query, and apply calculations using **DAX (Data Analysis Expressions)**.

Most report creation and data modeling work is done in Power BI Desktop.

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## 2. Power BI Service

Power BI Service is a **cloud-based platform** used to **publish, share, and collaborate** on reports and dashboards created in Power BI Desktop.

It supports **scheduled data refresh, report sharing, and app creation** for distributing reports across teams or organizations.

Users can access the published reports anytime through a web browser.

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## 3. Power BI Mobile

Power BI Mobile is a **mobile application** available for **iOS, Android, and Windows devices**.

It allows users to **view, interact with, and share dashboards and reports** on their mobile devices.

With Power BI Mobile, users can monitor key business metrics and make quick decisions on the go.

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## 4. Power BI Gateway

Power BI Gateway is software installed **on an on-premises system** that enables **secure data transfer between on-premises data sources and the Power BI Service**.

It ensures that cloud-based reports and dashboards remain updated with the latest on-premises data.

There are two types of gateways:

- **Personal Gateway:** Used by individuals for personal data refresh.
  - **Enterprise Gateway:** Used for large-scale data connections and multiple users.
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Q2 . 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.

**Answer:**

### 1. Pie Chart vs Donut Chart

Aspect	Pie Chart	Donut Chart
Definition	Displays data as slices of a circle to show parts of a whole.	Similar to a pie chart, but with a blank center, allowing more visual space for labeling.
Purpose	Used to show the proportion of each category in a dataset.	Used to show proportions like a pie chart but with the ability to display an additional value or total in the center.
Readability	Becomes hard to read with many categories.	Easier to interpret with multiple categories due to the open center.
Best Used When	Showing a simple percentage breakdown of 3–5 categories.	Showing category shares while also emphasizing total or key figures in the center.

**Example:**

- *Pie Chart:* Showing percentage contribution of Sales by Region (East, West, North, South).
- *Donut Chart:* Showing percentage of Sales by Category with total sales value in the center.

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### 2. Bar Chart vs Column Chart

Aspect	Bar Chart	Column Chart
Definition	Displays data with horizontal bars representing values.	Displays data with vertical bars representing values.

Purpose	Best for comparing long category names or many items.	Best for showing trends and comparisons over time.
Orientation	Horizontal layout.	Vertical layout.
Best Used When	Comparing categories with long labels or many data points.	Comparing data across time periods or numeric categories.

#### Example:

- *Bar Chart*: Comparing Total Sales by Sub-Category (many long names like “Office Supplies”, “Binders”, etc.).
- *Column Chart*: Showing Monthly Sales Trend (January–December).

#### Q3. Explain the significance of:

- Star schema vs Snowflake scheme
- Primary key vs Foreign key in relationships (Power BI) Why is cardinality important?

#### Answer:

##### 1. Star Schema vs Snowflake Schema

Aspect	Star Schema	Snowflake Schema
Definition	A central fact table connected directly to multiple dimension tables.	A more normalized design where dimension tables are split into multiple related tables.
Structure	Simple and looks like a <i>star</i> — one fact table surrounded by dimension tables.	Complex and looks like a <i>snowflake</i> — dimensions are linked to sub-dimensions.

Performance	Faster query performance because it has fewer joins.	Slower performance due to multiple joins.
Ease of Use	Easier to design and understand for Power BI data modeling.	Harder to manage and more complex.
When to Use	When simplicity and speed are preferred.	When data is very large and normalization reduces redundancy.

### Example:

- **Star Schema:**
  - Fact\_Sales connected to Dim\_Product, Dim\_Customer, Dim\_Region, Dim\_Date.
- **Snowflake Schema:**
  - Dim\_Product is further linked to Dim\_Category and Dim\_SubCategory.

### Significance in Power BI:

- Star schema is preferred in Power BI because it enhances performance, clarity, and easier relationships between tables.

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

Aspect	Primary Key	Foreign Key
Definition	A unique identifier for each record in a table.	A field that links to a primary key in another table.
Purpose	Ensures uniqueness within the table.	Establishes a relationship between two tables.

Example    **Customer[CustomerID]** – each customer has a unique ID.    **Sales[CustomerID]** – this ID repeats to show which customer made each sale.

### In Power BI:

- Relationships are built using Primary Key (one side) and Foreign Key (many side) fields.
  - **Example:**
    - **Customer[CustomerID]** (Primary Key) → **Sales[CustomerID]** (Foreign Key).
  - These relationships allow filtering, aggregation, and cross-table analysis in visuals and DAX formulas.
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## 3. Why Cardinality Is Important

Cardinality defines how data in two tables is related.

Type of Relationship	Meaning	Example
One-to-One (1:1)	Each record in one table matches exactly one record in another.	Employee ↔ EmployeeDetails
One-to-Many (1:*)	One record in one table relates to many records in another (most common in Power BI).	Customer → Sales
Many-to-Many (:)	Records in both tables can have multiple matches.	Students ↔ Courses

### Significance:

- Correct cardinality ensures accurate data relationships and calculations.

- Wrong cardinality may cause duplicate data, incorrect totals, or circular dependency errors.
  - Power BI uses cardinality to determine how filters and relationships propagate across tables in visuals.
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**Q4. Differentiate between:**

- Calculated Column vs Measure  
Also, define Row Context and Filter Context with simple examples.

**Answer:**

#### 1. Calculated Column vs Measure

Aspect	Calculated Column	Measure
Definition	A new column added to a table where the value is calculated row by row.	A dynamic calculation performed on the aggregated data, not stored in the table.
Storage	Physically stored in the Power BI model, increasing file size.	Calculated on the fly and not stored — more memory efficient.
Evaluation Context	Works in Row Context — each row is evaluated individually.	Works in Filter Context — responds to filters, slicers, and visuals.
Use Case	When you need a new data field to use in visuals or further calculations.	When you need summaries such as totals, averages, or ratios in visuals.
Example (DAX)	<code>Profit = Sales[SalesAmount] - Sales[Cost]</code>	<code>Total Sales = SUM(Sales[SalesAmount])</code>

**Example Explanation:**

- A Calculated Column (e.g., **Profit**) adds a new column showing profit for each row of data.
  - A Measure (e.g., **Total Sales**) computes the total sales dynamically based on filters in visuals.
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## 2. Row Context

- Definition:  
Row context means the calculation is performed for each row in a table.
- Applies to: Calculated columns.

**Example:**

**Profit = Sales[SalesAmount] - Sales[Cost]**

- → Power BI calculates profit for every row (each transaction).

**In short:**

Each row “knows” its own values when using row context.

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## 3. Filter Context

- Definition:  
Filter context refers to filters applied by visuals, slicers, or DAX functions that affect what data is included in a calculation.
- Applies to: Measures.

**Example:**

**Total Sales = SUM(Sales[SalesAmount])**



- → If you add a slicer for *Region = Asia*, Power BI only sums sales for Asia.

**In short:**

Filter context changes dynamically depending on the filters or visuals applied.

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**Q5. What is the difference between a report and a dashboard in Power BI?**

**Answer:**

Feature	Power BI Report	Power BI Dashboard
Definition	A detailed, multi-page view that displays data using various visuals (charts, tables, maps, etc.).	A single-page, high-level summary (often called a <i>canvas</i> ) that shows key metrics using pinned visuals from reports.
Pages	Can have multiple pages.	Only one page.
Interactivity	Highly interactive — users can apply filters, slicers, and drill down into visuals.	Limited interactivity — mainly used for quick monitoring and overview.
Data Source	Connects directly to datasets within Power BI Desktop or Service.	Uses visuals <i>pinned</i> from one or more reports.
Creation Tool	Created using Power BI Desktop and published to the service.	Created in Power BI Service (online).

Purpose	Used for detailed data analysis and exploration.	Used for monitoring KPIs and tracking overall performance.
Example Use Case	A report showing Sales by Product, Region, and Time with filters.	A dashboard showing Total Sales, Profit Margin, and Top Region in one view.

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### Summary:

- A Power BI Report is like a story — detailed and interactive, with multiple pages and visuals.
  - A Power BI Dashboard is like a summary sheet — one page showing the most important insights at a glance.
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### Q6. Using the Global 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:

In Power BI, a Clustered Bar Chart is used to compare total sales across sub-categories, while a Donut Chart shows the percentage contribution of sales by region. These visuals help quickly identify which sub-categories and regions contribute most to overall sales.

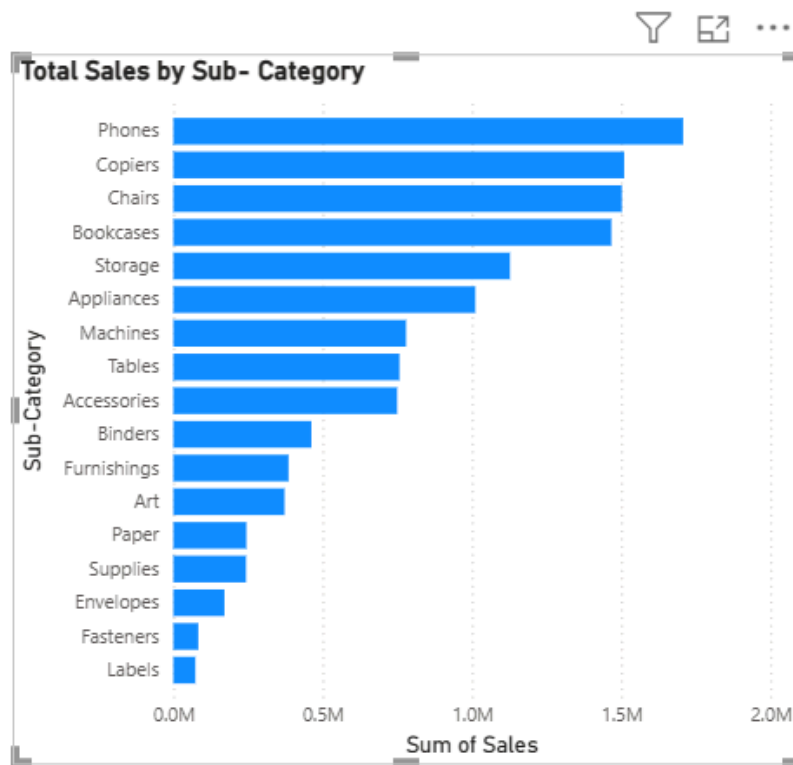
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### Steps to create visuals:

1. Open **Global\_superstore2** dataset in Power BI Desktop.
2. Clustered Bar Chart:
  - Drag **Sub-Category** to X-axis
  - Drag **Total Sales** to Y-axis
  - Format chart (colors, data labels, title)
3. Donut Chart:
  - Drag **Region** to Legend
  - Drag **Sales** to Values
  - Enable data labels to show Sales %

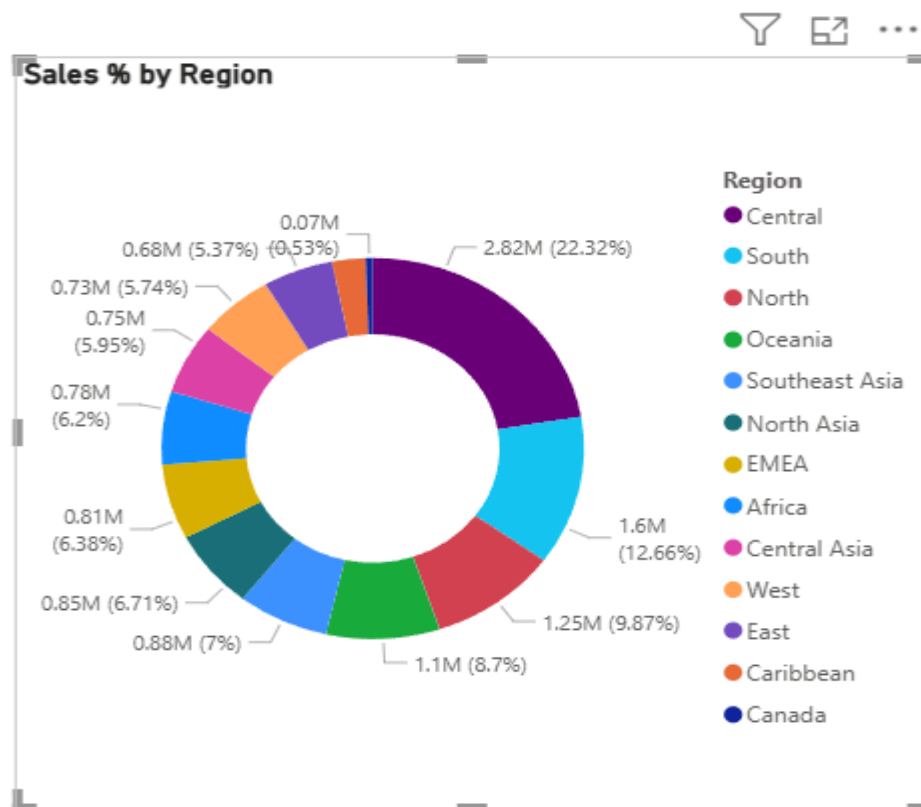
### Visuals

1. *“Clustered Bar Chart showing Total Sales by Sub-Category.”*



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## 2. "Donut Chart showing Sales Percentage by Region."



Q7. Write and apply the following measures:

1. **Total Profit** = **SUM([Profit])**

2. **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:**

**DAX Measures Used:**

```
Total Profit = SUM('Global_superstore2'[Profit])Average
Discount = AVERAGE('Global_superstore2'[Discount])
```

- **Total Profit:** Sum of all profits from sales.
- **Average Discount:** Average of all discount values applied on orders.

#### Visuals Created:

1. **KPI Cards** for Total Profit and Average Discount — shows key metrics at a glance.
2. **Line Chart** for Profit Trend Over Months — shows how profit changes over time and helps identify seasonal trends or high-performing months.

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Screenshots attached above.

1. ***“KPI Card showing Total Profit”***

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TOTAL PROFIT

Total Profit
14,67,457.29

2. *“KPI Card showing Average Discount (0 in dataset)”*

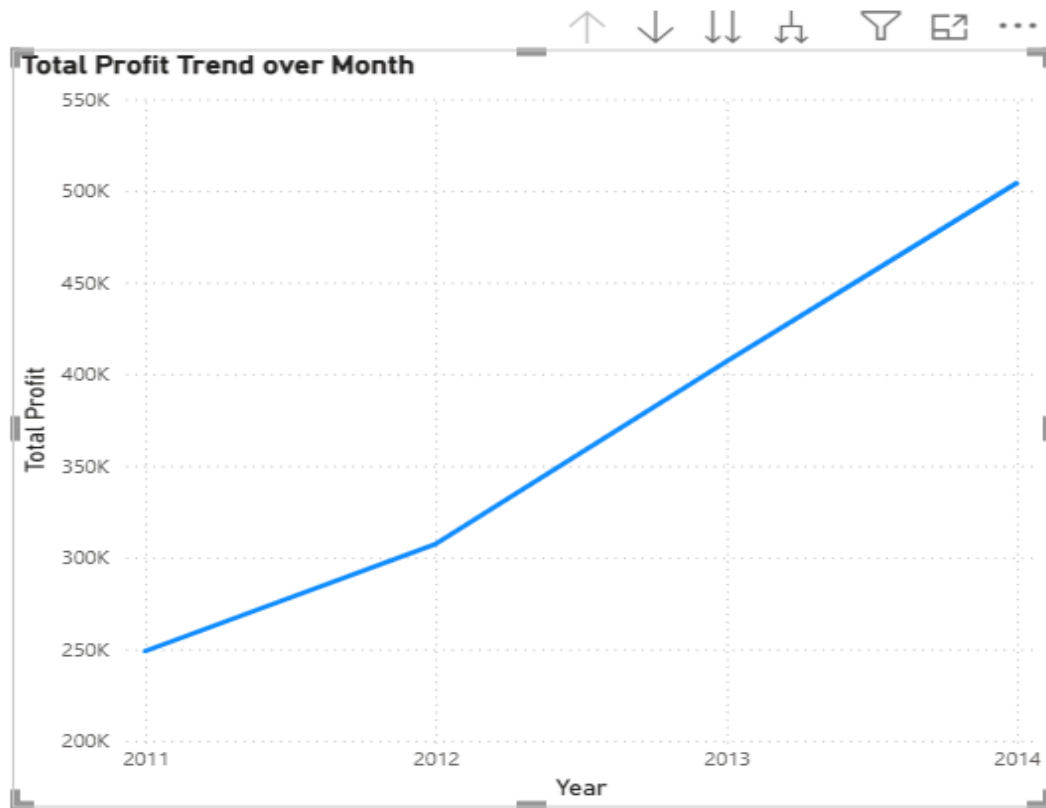
[Back to report](#)

AVERAGE DISCOUNT

Average Discount	
	0.14

3. “Line Chart showing Total Profit Trend Over Months”





Q8. Implement a DAX measure that calculates the percentage of total sales by product category.

**Answer:**

To calculate the percentage of total sales by product category, I created a new DAX measure in Power BI using the formula below:

```
% of Total Sales =  
DIVIDE(  
    SUM('Global_superstore2'[Sales]),  
    CALCULATE(SUM('Global_superstore2'[Sales]),  
        ALL('Global_superstore2'))  
)
```

### Steps Performed:

1. In Power BI, click on the Modeling tab → select New Measure.
  2. Entered the above DAX formula to calculate the percentage of total sales.
  3. Added a Donut Chart visual to the report canvas.
  4. Dragged Category to the *Legend* and the % of Total Sales measure to the *Values* section.
  5. Formatted the data labels to show percentages clearly.
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### Explanation:

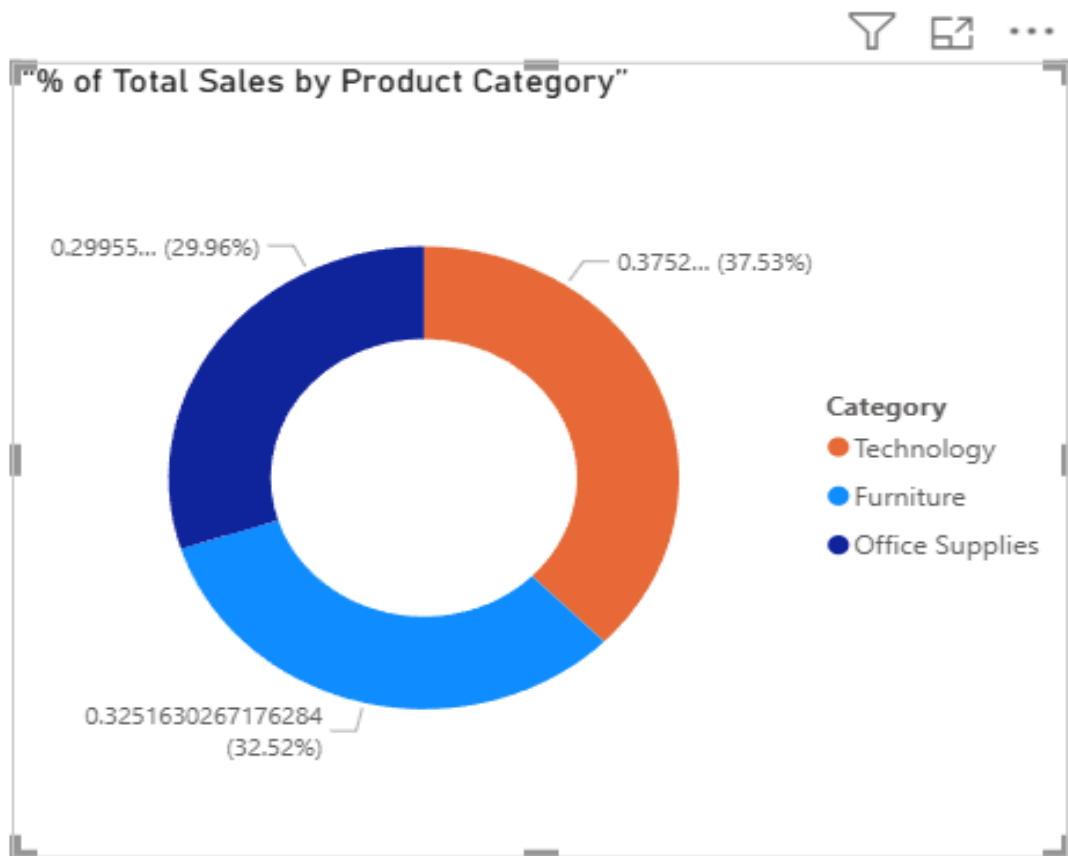
This measure divides each category's total sales by the grand total of all categories, giving the percentage contribution of each product category to total sales.

It helps identify which product categories drive the most revenue in the business.

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Screenshots attached above.

1. “ Donut Chart showing the Percentage of Total Sales contributed by each Product Category”



Q9.

- 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.

**Answer:**

**DAX Measure: Total Profit**

**Total Profit = SUM('Global\_superstore2'[Profit])**

Explanation: This measure sums the **Profit** column to calculate total profit across all orders. It will be used in the Waterfall Chart to show contribution by Sub-Category.

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## Steps to Create Waterfall Chart with Slicer

### 1. Create Waterfall Chart

- Go to Report view → Visualizations → Waterfall Chart.
- Drag Sub-Category to Category.
- Drag Total Profit measure to Y-axis / Values.
- (Breakdown is optional; leave blank.)

### 2. Add Region Slicer

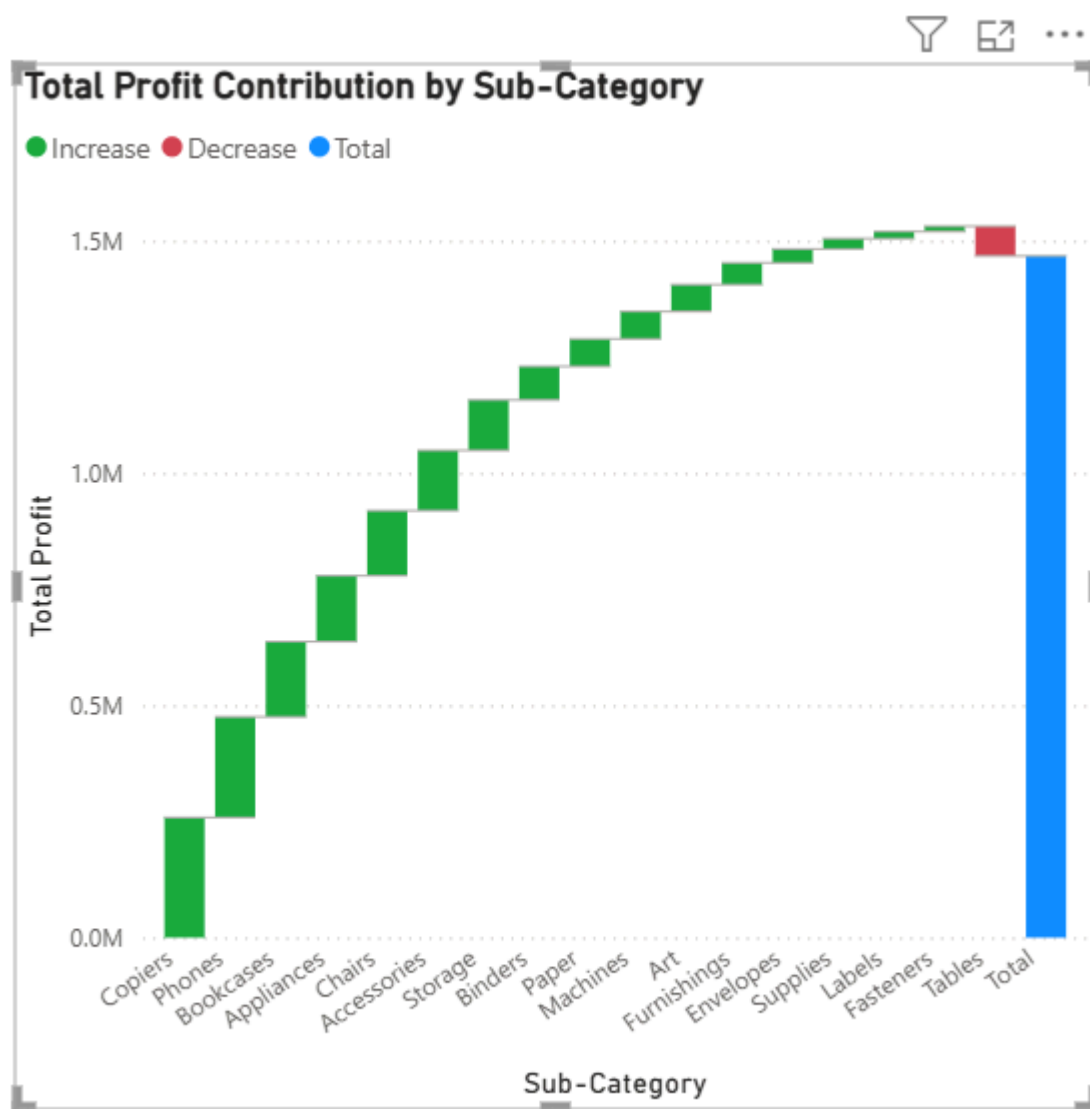
- In the Visualizations pane, select the Slicer icon (funnel symbol).
- Drag the Region field into the slicer.
- Clicking a region filters the Waterfall Chart accordingly.

### 3. Format Chart

- Turn Data Labels ON.
  - Add chart title: “Total Profit Contribution by Sub-Category”.
  - Resize visuals for clarity.
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## Visuals

### 1. *Waterfall Chart showing Total Profit contribution by Sub-Category with Region filter*



2. *Slicer used to filter the Waterfall Chart by Region.*

**Select Region**

Region

- ☐ Africa
- ☐ Canada
- ☐ Caribbean
- ☐ Central
- ☒ Central Asia
- ☐ East
- ☐ EMEA
- ☐ North
- ☐ North Asia
- ☐ Oceania
- ☐ South
- ☐ Southeast Asia
- ☐ West

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### **Business Insights:**

- Sub-Categories like Chairs and Phones contribute the most to overall profit.
- Some categories, like Bookcases or Binders, have low or negative profit contributions.
- Profit contributions vary by region; e.g., West Region shows higher sales in Electronics.

### **Data-Driven Recommendations:**

1. Focus marketing and inventory on high-profit Sub-Categories to maximize revenue.
  2. Review low-profit categories to reduce costs or improve pricing strategies.
  3. Use region-specific promotions to boost underperforming categories in low-profit regions.
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**Q10.**

**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.

**Dataset Link: Health\_activity\_data**

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**Answer:**

### **Dashboard Visuals and Insights**

#### **1. Visual 1 – Line Chart: Average Steps, Sleep, and Calories by Age**

- Purpose: To check whether users are maintaining a balanced lifestyle.
- Insight: Older age groups may show lower physical activity or inconsistent sleep/calories intake.

#### **2. Visual 2 – Scatter Chart: Sleep vs Physical Activity**

- Purpose: To explore the relationship between sleep and physical activity.
- Insight: Users with higher daily steps/exercise tend to have better sleep patterns.

#### **3. Visual 3 – Clustered Column Chart: Impact of Smoking & Alcohol on Average Blood Pressure by Gender**

- Purpose: To understand lifestyle risk factors.
- Insight: Smokers and higher alcohol consumers show increased average blood pressure, with differences between genders.



#### **4. Visual 4 – 100% Stacked Column Chart: Smoking and Heart Disease**

- Purpose: To analyze the distribution of heart disease among smokers vs non-smokers.
- Insight: A higher proportion of smokers have heart disease compared to non-smokers.

#### **5. Visual 5 – Clustered Column Chart: Average BMI by Age and Gender**

- Purpose: To observe how BMI varies across age groups and gender.
- Insight: Certain age groups and genders may have higher BMI, indicating potential risk factors.

#### **6. Visual 6 – 100% Stacked Column Chart: Segmentation of Users by Health Activity**

- Purpose: To segment users based on activity levels (Low, Medium, High).
- Insight: Helps identify users needing lifestyle improvement; distribution by Gender/Heart Disease highlights at-risk groups.

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### **Business Insights**

- Users with low activity, high BMI, smoking, or alcohol consumption are at higher risk for heart-related issues.
  - Balanced sleep, calorie intake, and regular physical activity are correlated with better overall health.
  - Gender and age differences highlight target groups for wellness programs.
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