```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
from sklearn.preprocessing import StandardScaler
from sklearn.cluster import KMeans
from sklearn.metrics import davies_bouldin_score
from sklearn.neighbors import NearestNeighbors
```

```
# Load Data
customers = pd.read_csv('/content/Customers.csv')
products = pd.read_csv('/content/Products.csv')
transactions = pd.read_csv('/content/Transactions.csv')
```

```
customers.shape
```

```
(200, 4)
```

```
products.shape
```

```
(100, 4)
```

```
transactions.shape
```

```
(1000, 7)
```

```
customers.head()
```

	CustomerID	CustomerName	Region	SignupDate
0	C0001	Lawrence Carroll	South America	2022-07-10
1	C0002	Elizabeth Lutz	Asia	2022-02-13
2	C0003	Michael Rivera	South America	2024-03-07
3	C0004	Kathleen Rodriguez	South America	2022-10-09
4	C0005	Laura Weber	Asia	2022-08-15

Next steps: Generate code with `customers` View recommended plots New interactive sheet

```
products.head()
```

	ProductID	ProductName	Category	Price
0	P001	ActiveWear Biography	Books	169.30
1	P002	ActiveWear Smartwatch	Electronics	346.30
2	P003	ComfortLiving Biography	Books	44.12
3	P004	BookWorld Rug	Home Decor	95.69
4	P005	TechPro T-Shirt	Clothing	429.31

Next steps: Generate code with `products` View recommended plots New interactive sheet

```
transactions.head()
```

```
  TransactionID CustomerID ProductID     TransactionDate  Quantity  TotalValue   Price
0        T00001      C0199      P067 2024-08-25 12:38:23         1      300.68  300.68
1        T00112      C0146      P067 2024-05-27 22:23:54         1      300.68  300.68
2        T00166      C0127      P067 2024-04-25 07:38:55         1      300.68  300.68
3        T00272      C0087      P067 2024-03-26 22:55:37         2      601.36  300.68
4        T00363      C0070      P067 2024-03-21 15:10:10         3      902.04  300.68
```

Next steps: Generate code with transactions | View recommended plots | New interactive sheet

```
customers.isnull().sum()
```

```
              0
CustomerID    0
CustomerName  0
Region        0
SignupDate    0

dtype: int64
```

```
products.isnull().sum()
```

```
             0
ProductID    0
ProductName  0
Category     0
Price        0

dtype: int64
```

```
transactions.isnull().sum()
```

	0
TransactionID	0
CustomerID	0
ProductID	0
TransactionDate	0
Quantity	0
TotalValue	0
Price	0

dtype: int64

```
# Task 1: Exploratory Data Analysis (EDA)
# Merge datasets
data = transactions.merge(customers, on='CustomerID').merge(products, on='ProductID')
```

```
# Basic statistics
print(data.describe())
print(data.info())
```

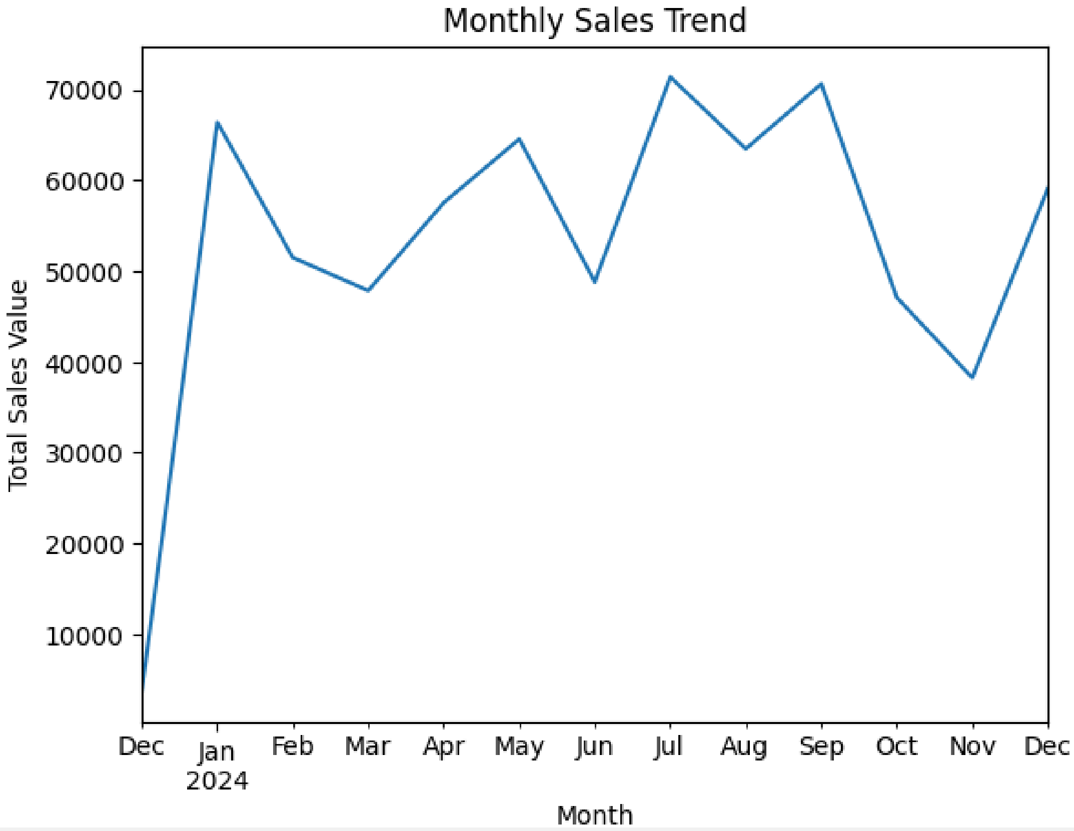
```
          Quantity   TotalValue     Price_x     Price_y
count  1000.000000  1000.000000  1000.00000  1000.00000
mean      2.537000   689.995560   272.55407   272.55407
std       1.117981   493.144478   140.73639   140.73639
min       1.000000    16.080000    16.08000    16.08000
25%       2.000000   295.295000   147.95000   147.95000
50%       3.000000   588.880000   299.93000   299.93000
75%       4.000000  1011.660000   404.40000   404.40000
```

```
max       4.000000  1991.040000   497.76000   497.76000
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 1000 entries, 0 to 999
Data columns (total 13 columns):
 #   Column           Non-Null Count  Dtype  
---  ------           --------------  -----  
 0   TransactionID    1000 non-null   object 
 1   CustomerID       1000 non-null   object 
 2   ProductID        1000 non-null   object 
 3   TransactionDate  1000 non-null   object 
 4   Quantity         1000 non-null   int64  
 5   TotalValue       1000 non-null   float64
 6   Price_x          1000 non-null   float64
 7   CustomerName     1000 non-null   object 
 8   Region           1000 non-null   object 
 9   SignupDate       1000 non-null   object 
 10  ProductName      1000 non-null   object 
 11  Category         1000 non-null   object 
 12  Price_y          1000 non-null   float64
dtypes: float64(3), int64(1), object(9)
memory usage: 101.7+ KB
None
```

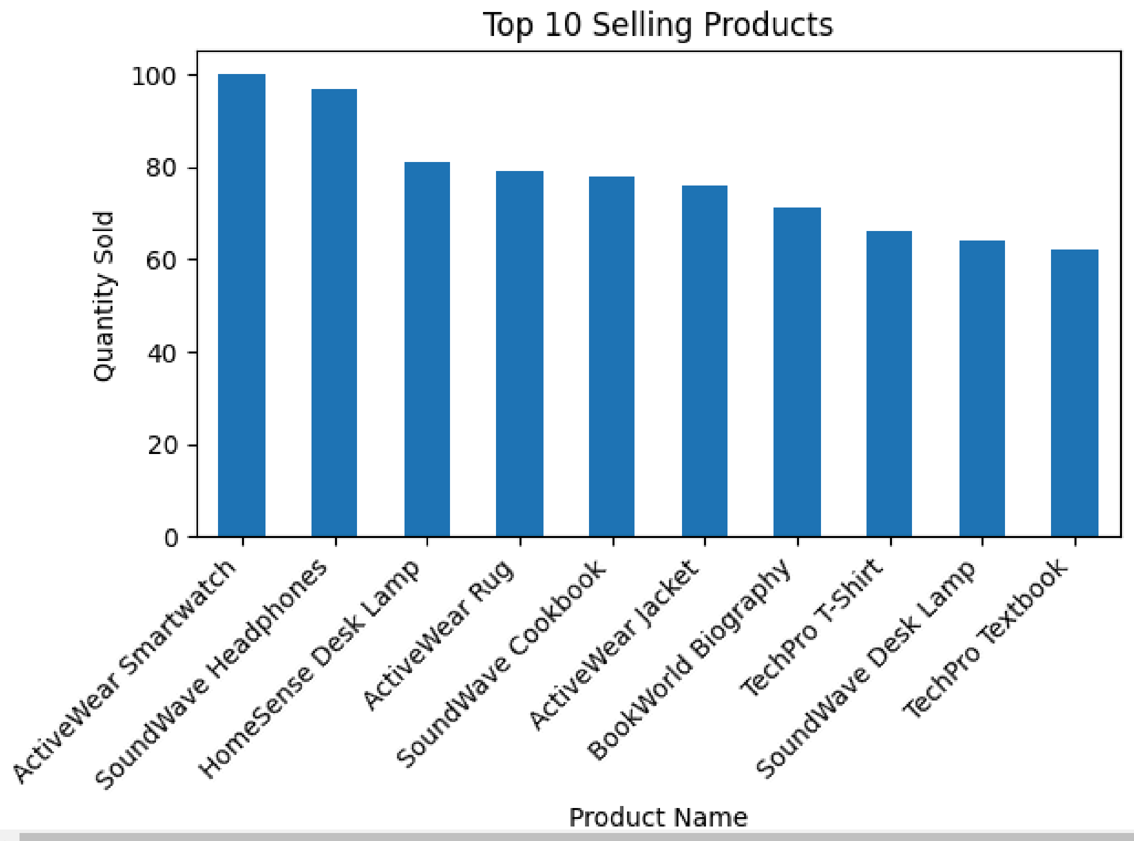
```
# Check for missing values
print(data.isnull().sum())
```

```
TransactionID      0
CustomerID         0
ProductID          0
TransactionDate    0
Quantity           0
TotalValue         0
Price_x            0
CustomerName       0
Region             0
SignupDate         0
ProductName        0
Category           0
Price_y            0
dtype: int64
```

```
import matplotlib.pyplot as plt

# Ensure TransactionDate is in datetime format
data['TransactionDate'] = pd.to_datetime(data['TransactionDate'])

# Group by month and sum 'TotalValue'
monthly_sales = data.groupby(data['TransactionDate'].dt.to_period('M'))['TotalValue'].sum()

# Plot the monthly sales trend
monthly_sales.plot(title='Monthly Sales Trend')
plt.xlabel('Month')
plt.ylabel('Total Sales Value')
plt.show()
```



```
# Group by ProductName and sum only the 'Quantity' column
top_products = data.groupby('ProductName')['Quantity'].sum().sort_values(ascending=False).head(10)

# Plot the top-selling products
top_products.plot(kind='bar', title='Top 10 Selling Products')
plt.xlabel('Product Name')
plt.ylabel('Quantity Sold')
plt.xticks(rotation=45, ha='right')
plt.tight_layout()
plt.show()
```



Business insights

1. Peak sales periods
2. Most popular products
3. Customer distribution by region
4. Average transaction value per region

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