sales data analysis

In [26]:

```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
from sklearn.linear_model import LinearRegression
from sklearn.model_selection import train_test_split
from sklearn.metrics import mean_absolute_error, r2_score
```

In [3]:

```
df = pd.read_csv("sales_data.csv")
```

In [4]:

```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 200 entries, 0 to 199
Data columns (total 9 columns):
 #   Column          Non-Null Count  Dtype 
---  ------          --------------  ----- 
 0   Date            200 non-null    object
 1   Invoice_ID      200 non-null    object
 2   Product_Name    200 non-null    object
 3   Category        200 non-null    object
 4   Quantity        200 non-null    int64 
 5   Price           200 non-null    int64 
 6   Total_Sales     200 non-null    int64 
 7   Customer_ID     200 non-null    object
 8   Payment_Method  200 non-null    object
dtypes: int64(3), object(6)
memory usage: 14.2+ KB
```

In [5]:

```
df.head()
```

Out[5]:

	Date	Invoice_ID	Product_Name	Category	Quantity	Price	Total_Sal
0	2024-01-01 00:00:00.000000000	INV1000	Smartphone	Electronics	1	49098	4909
1	2024-01-01 21:49:44.924623115	INV1001	Tablet	Electronics	2	48765	9753
2	2024-01-02 19:39:29.849246231	INV1002	Jeans	Fashion	4	460	184
3	2024-01-03 17:29:14.773869346	INV1003	Tablet	Electronics	2	33618	6723
4	2024-01-04 15:18:59.698492462	INV1004	T-shirt	Fashion	2	4664	932

In [6]:

```
df.describe()
```

Out[6]:

	Quantity	Price	Total_Sales
count	200.000000	200.000000	200.000000
mean	3.015000	12102.030000	36222.185000
std	1.379962	14758.015052	50919.852045
min	1.000000	229.000000	229.000000
25%	2.000000	2264.250000	4767.500000
50%	3.000000	3878.500000	14280.000000
75%	4.000000	19248.250000	43772.500000
max	5.000000	49997.000000	249985.000000

In [7]:

```
df.columns
```

Out[7]:

```
Index(['Date', 'Invoice_ID', 'Product_Name', 'Category', 'Quantity', 'Price',
       'Total_Sales', 'Customer_ID', 'Payment_Method'],
      dtype='object')
```

In [8]:

```
df.isnull().sum()
```

Out[8]:

```
Date              0
Invoice_ID        0
Product_Name      0
Category          0
Quantity          0
Price             0
Total_Sales       0
Customer_ID       0
Payment_Method    0
dtype: int64
```

In [9]:

```
df.drop_duplicates(inplace=True)
```

In [10]:

```
df.head()
```

Out[10]:

	Date	Invoice_ID	Product_Name	Category	Quantity	Price	Total_Sal
0	2024-01-01 00:00:00.000000000	INV1000	Smartphone	Electronics	1	49098	4909
1	2024-01-01 21:49:44.924623115	INV1001	Tablet	Electronics	2	48765	9753
2	2024-01-02 19:39:29.849246231	INV1002	Jeans	Fashion	4	460	184
3	2024-01-03 17:29:14.773869346	INV1003	Tablet	Electronics	2	33618	6723
4	2024-01-04 15:18:59.698492462	INV1004	T-shirt	Fashion	2	4664	932

Exploratory Data Analysis (EDA)

In [11]:

```
total_revenue = df["Total_Sales"].sum()
print("Total Revenue:", df["Total_Sales"].sum())
```

```
Total Revenue: 7244437
```

In [12]:

```
total_invoices = df["Invoice_ID"].nunique()
```

In [13]:

```
total_customers = df["Customer_ID"].nunique()
```

In [14]:

```
best_products = df.groupby("Product_Name")["Total_Sales"].sum().sort_values(asce
```

In [15]:

```
category_sales = df.groupby("Category")["Total_Sales"].sum().sort_values(ascendi
```

In [16]:

```
payment_counts = df["Payment_Method"].value_counts()
```

In [17]:

```
df["Month"] = pd.to_datetime(df["Date"]).dt.month_name()
monthly_sales = df.groupby("Month")["Total_Sales"].sum()
```

In [18]:

```
top_customers = df.groupby("Customer_ID")["Total_Sales"].sum().sort_values(ascen
df.head(5)
```

Out[18]:

	Date	Invoice_ID	Product_Name	Category	Quantity	Price	Total_Sal
0	2024-01-01 00:00:00.000000000	INV1000	Smartphone	Electronics	1	49098	4909
1	2024-01-01 21:49:44.924623115	INV1001	Tablet	Electronics	2	48765	9753
2	2024-01-02 19:39:29.849246231	INV1002	Jeans	Fashion	4	460	184
3	2024-01-03 17:29:14.773869346	INV1003	Tablet	Electronics	2	33618	6723
4	2024-01-04 15:18:59.698492462	INV1004	T-shirt	Fashion	2	4664	932

In [19]:

```
# 1. Overall Sales Summary
print("Total Revenue:", df["Total_Sales"].sum())
print("Total Invoices:", df["Invoice_ID"].nunique())
print("Total Customers:", df["Customer_ID"].nunique())

# 2. Best Selling Products
best_products = df.groupby("Product_Name")["Total_Sales"].sum().sort_values(asce
print("\nTop 5 Products by Sales:\n", best_products)

# 3. Category-wise Sales
category_sales = df.groupby("Category")["Total_Sales"].sum().sort_values(ascendi
print("\nSales by Category:\n", category_sales)

# 4. Payment Method Analysis
payment_counts = df["Payment_Method"].value_counts()
```

```
print("\nPayment Method Counts:\n", payment_counts)

# 5. Monthly Sales
monthly_sales = df.groupby("Month")["Total_Sales"].sum().sort_values(ascending=F
print("\nMonthly Sales:\n", monthly_sales)

# 6. Top Customers
top_customers = df.groupby("Customer_ID")["Total_Sales"].sum().sort_values(ascen
print("\nTop 5 Customers:\n", top_customers)
```

```
Total Revenue: 7244437
Total Invoices: 200
Total Customers: 49

Top 5 Products by Sales:
 Product_Name
Smartphone    2138093
Laptop        1572252
Tablet        1552704
Camera        1005768
Smartwatch     251131
Name: Total_Sales, dtype: int64

Sales by Category:
 Category
Electronics    6268817
Accessories     490573
Fashion         485047
Name: Total_Sales, dtype: int64

Payment Method Counts:
 Payment_Method
UPI            57
Debit Card     52
Cash           46
Credit Card    45
Name: count, dtype: int64

Monthly Sales:
 Month
January     1443709
May         1430654
April       1181917
June        1150446
February    1072267
March        965444
Name: Total_Sales, dtype: int64

Top 5 Customers:
 Customer_ID
CUST39    367185
CUST11    364732
CUST18    363814
CUST43    361005
CUST20    345510
Name: Total_Sales, dtype: int64
```

visualization

Best Selling Products (Bar Chart)

In [20]:

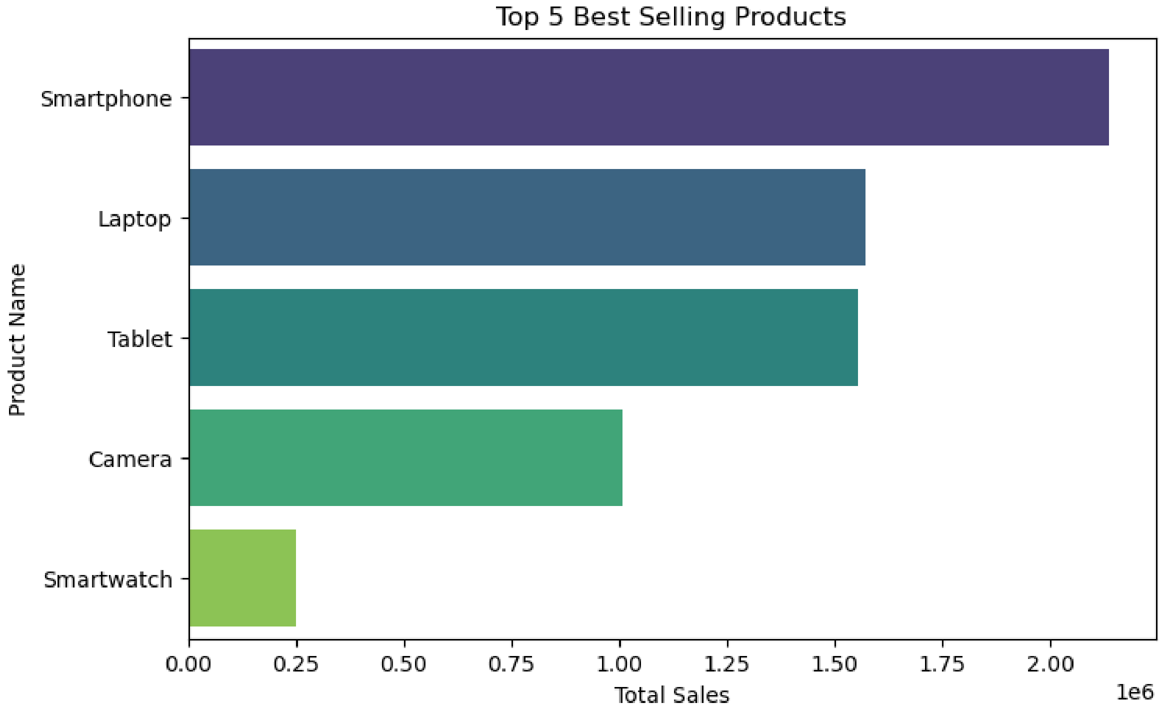
```
# Top 5 Products by Sales
best_products = df.groupby("Product_Name")["Total_Sales"].sum().sort_values(asce

plt.figure(figsize=(8,5))
sns.barplot(x=best_products.values, y=best_products.index, palette="viridis")
plt.title("Top 5 Best Selling Products")
plt.xlabel("Total Sales")
plt.ylabel("Product Name")
plt.show()
```

```
C:\Users\gonda\AppData\Local\Temp\ipykernel_9912\708407496.py:5: FutureWarning:

Passing `palette` without assigning `hue` is deprecated and will be removed in v
0.14.0. Assign the `y` variable to `hue` and set `legend=False` for the same effe
ct.

  sns.barplot(x=best_products.values, y=best_products.index, palette="viridis")
```



Category-wise Sales (Bar Chart)

In [21]:

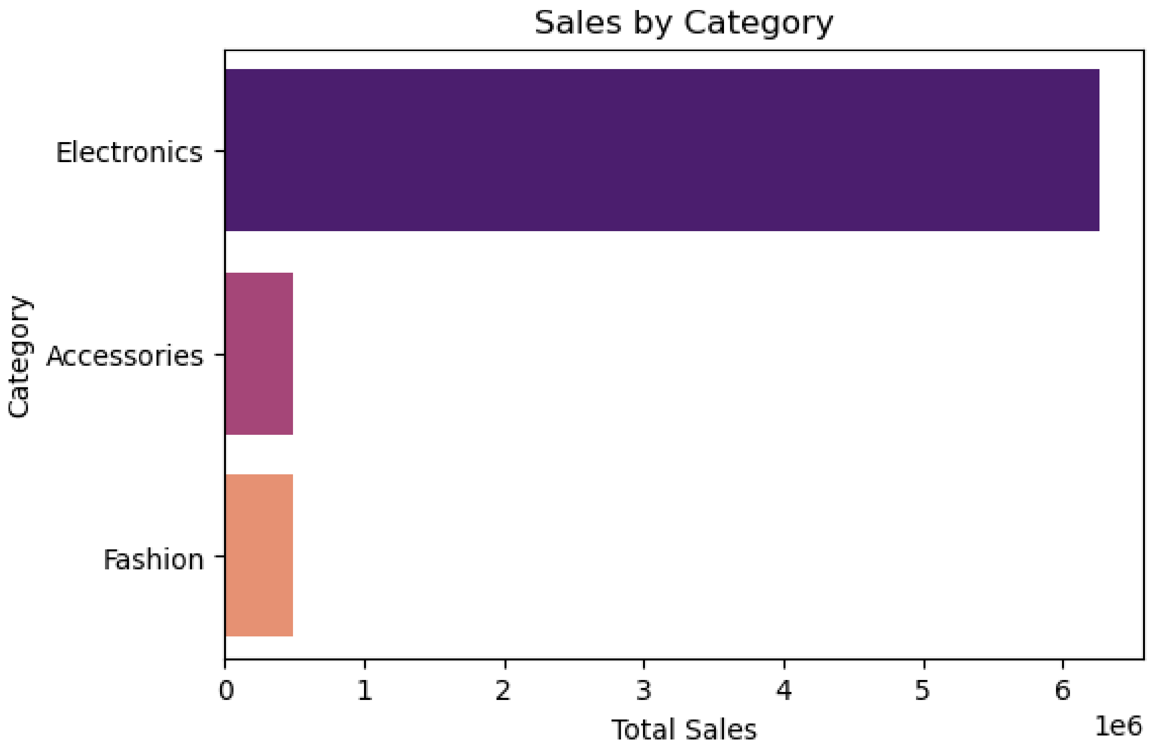
```
category_sales = df.groupby("Category")["Total_Sales"].sum().sort_values(ascendi

plt.figure(figsize=(6,4))
sns.barplot(x=category_sales.values, y=category_sales.index, palette="magma")
plt.title("Sales by Category")
plt.xlabel("Total Sales")
plt.ylabel("Category")
plt.show()
```

```
C:\Users\gonda\AppData\Local\Temp\ipykernel_9912\2733312931.py:4: FutureWarning: 

Passing `palette` without assigning `hue` is deprecated and will be removed in v
0.14.0. Assign the `y` variable to `hue` and set `legend=False` for the same effe
ct.

  sns.barplot(x=category_sales.values, y=category_sales.index, palette="magma")
```

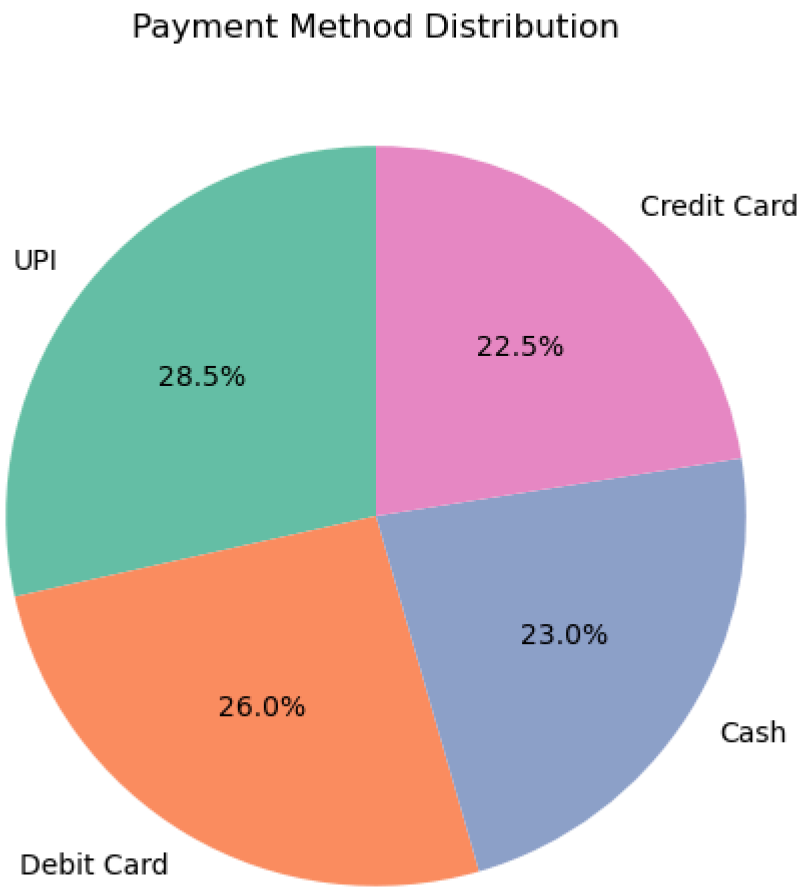


Payment Method Distribution (Pie Chart)

In [22]:

```
payment_counts = df["Payment_Method"].value_counts()

plt.figure(figsize=(6,6))
plt.pie(payment_counts, labels=payment_counts.index, autopct="%1.1f%%", startang
plt.title("Payment Method Distribution")
plt.show()
```

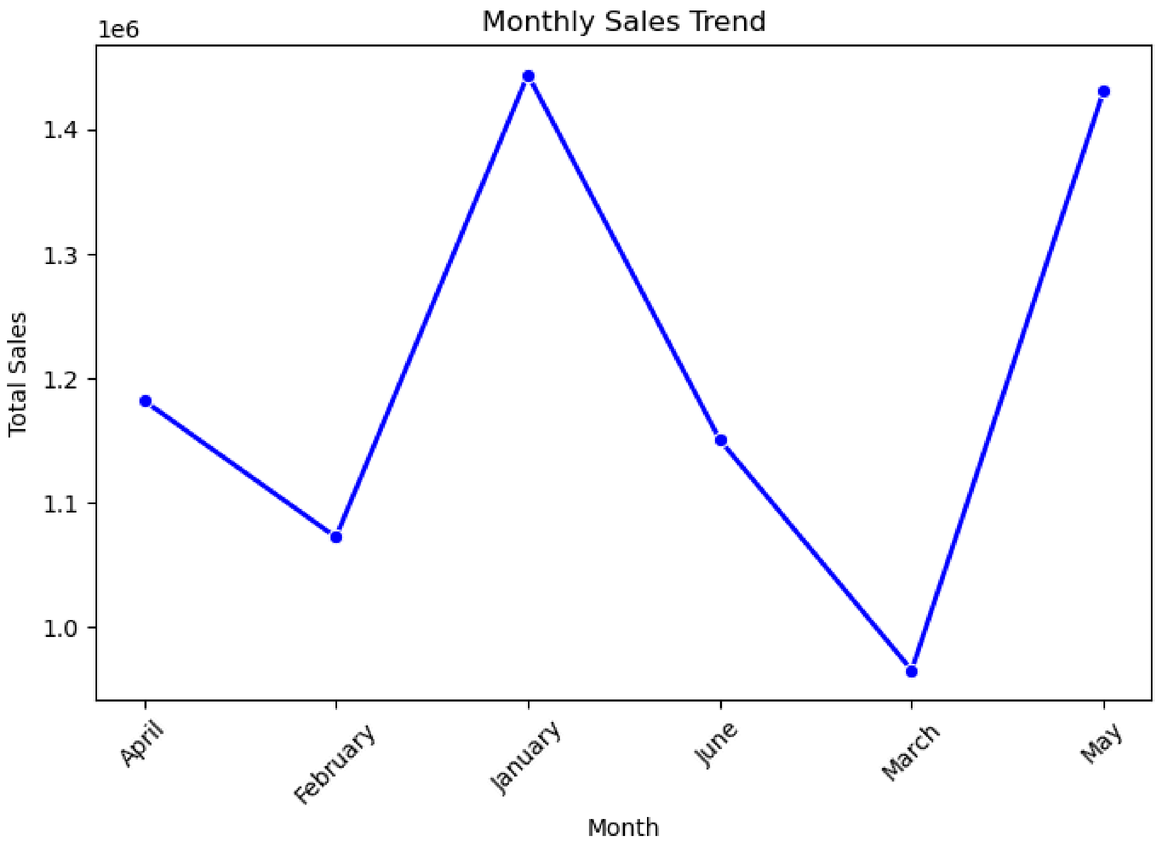


Monthly Sales Trend (Line Chart)

In [23]:

```
monthly_sales = df.groupby("Month")["Total_Sales"].sum()

plt.figure(figsize=(8,5))
sns.lineplot(x=monthly_sales.index, y=monthly_sales.values, marker="o", linewidt
plt.title("Monthly Sales Trend")
plt.xlabel("Month")
plt.ylabel("Total Sales")
plt.xticks(rotation=45)
plt.show()
```



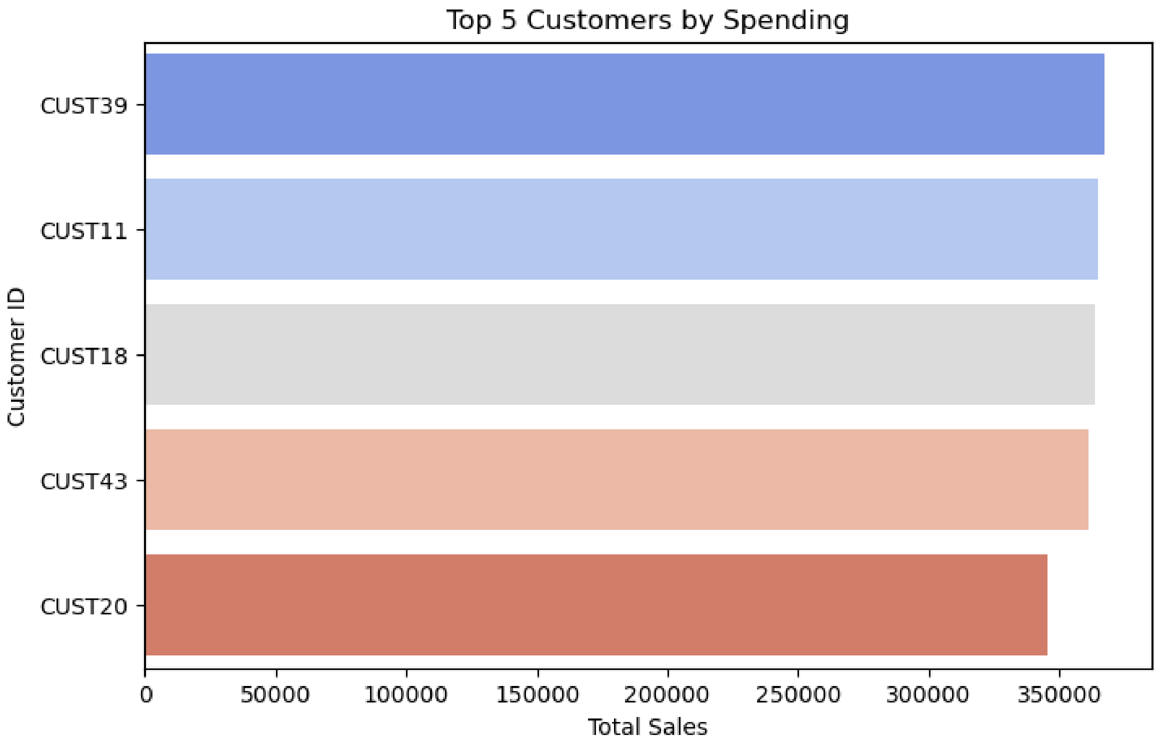
```
In [24]: top_customers = df.groupby("Customer_ID")["Total_Sales"].sum().sort_values(ascen

         plt.figure(figsize=(8,5))
         sns.barplot(x=top_customers.values, y=top_customers.index, palette="coolwarm")
         plt.title("Top 5 Customers by Spending")
         plt.xlabel("Total Sales")
         plt.ylabel("Customer ID")
         plt.show()
```

```
C:\Users\gonda\AppData\Local\Temp\ipykernel_9912\1553665695.py:4: FutureWarning:

Passing `palette` without assigning `hue` is deprecated and will be removed in v
0.14.0. Assign the `y` variable to `hue` and set `legend=False` for the same effe
ct.

  sns.barplot(x=top_customers.values, y=top_customers.index, palette="coolwarm")
```



```
In [27]: # Month wise sales
df['Date'] = pd.to_datetime(df['Date'])
monthly_sales = df.groupby(df['Date'].dt.month)["Total_Sales"].sum().reset_index
monthly_sales.columns = ["Month", "Revenue"]

print(monthly_sales)
```

```
   Month  Revenue
0      1  1443709
1      2  1072267
2      3   965444
3      4  1181917
4      5  1430654
5      6  1150446
```

```
In [28]: # Features (X) and Target (y)
X = monthly_sales[["Month"]]   # month number as feature
y = monthly_sales["Revenue"]

# Train-Test Split
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_

# Model
model = LinearRegression()
model.fit(X_train, y_train)

# Predictions
y_pred = model.predict(X_test)

# Evaluation
print("MAE:", mean_absolute_error(y_test, y_pred))
print("R² Score:", r2_score(y_test, y_pred))
```

```
MAE: 316995.65
R² Score: -3.3928870786432004
```

In [29]:

```
# Predict for month = 7 (July)
future_month = [[7]]
future_sales = model.predict(future_month)
print("Predicted Sales for July:", future_sales[0])
```

```
Predicted Sales for July: 1383051.0
```

```
C:\Users\gonda\anaconda3\Lib\site-packages\sklearn\utils\validation.py:2739: User
Warning: X does not have valid feature names, but LinearRegression was fitted wit
h feature names
  warnings.warn(
```

In [30]:

```
df.to_csv("cleaned_sales_data.csv", index=False)
```

In [ ]: