In [1]:

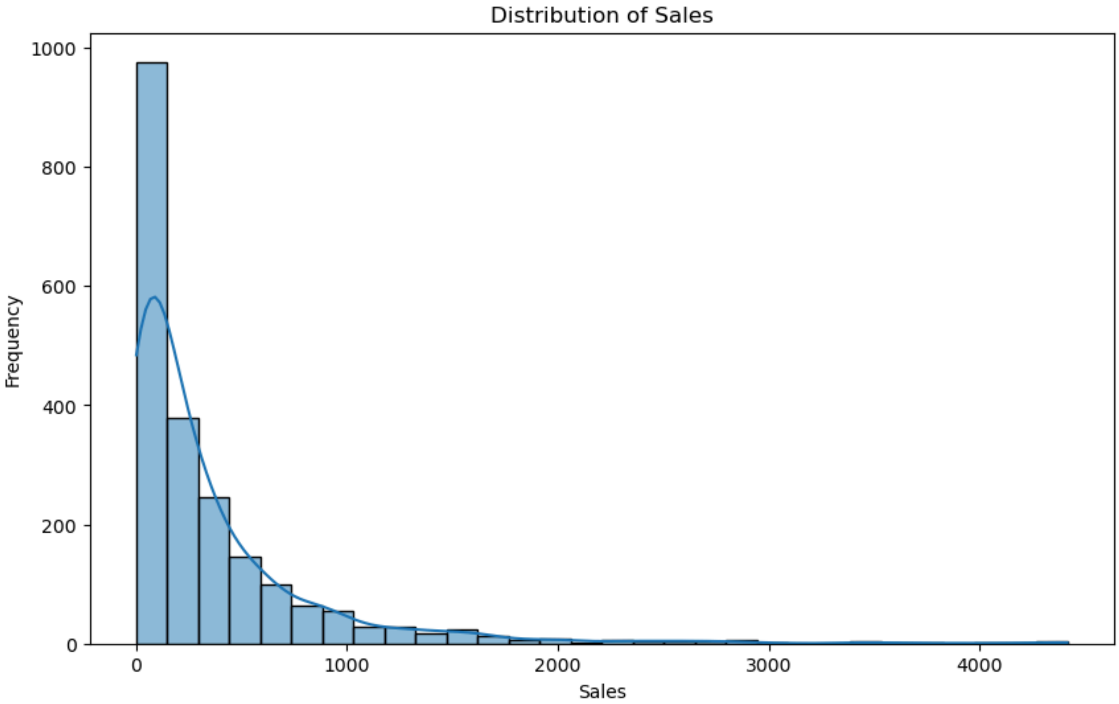
```
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
from sklearn.preprocessing import StandardScaler, OneHotEncoder
from sklearn.compose import ColumnTransformer
from sklearn.pipeline import Pipeline
from sklearn.impute import SimpleImputer

# Load the data
data = pd.read_csv('stores_sales_forecasting.csv')

# Convert date columns to datetime format
data['Order Date'] = pd.to_datetime(data['Order Date'], format='%d-%m-%Y')
data['Ship Date'] = pd.to_datetime(data['Ship Date'], format='%d-%m-%Y')
```

In [2]:

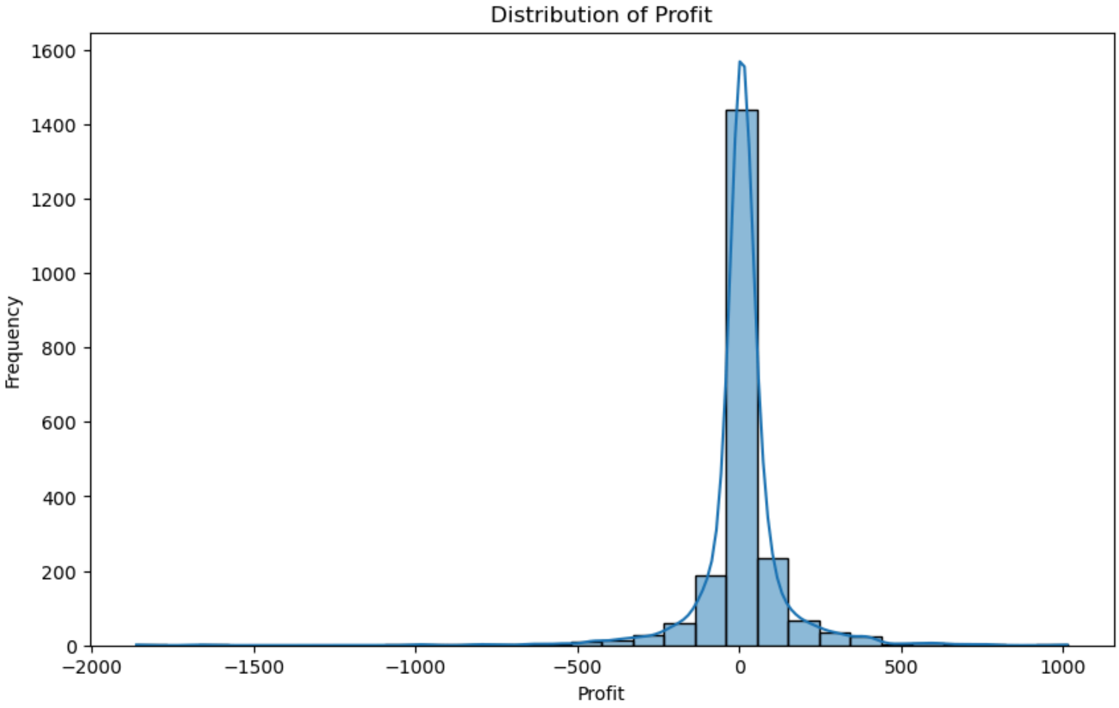
```
# Display basic statistical description of numerical columns
print(data.describe())
```

```
            Row ID                     Order Date  \
count  2121.000000                           2121   
mean   5041.643564  2016-04-09 23:53:12.644978944   
min       1.000000            2014-01-03 00:00:00   
25%    2568.000000            2015-04-30 00:00:00   
50%    5145.000000            2016-05-14 00:00:00   
75%    7534.000000            2017-04-09 00:00:00   
max    9991.000000            2017-12-30 00:00:00   
std    2885.740258                            NaN   

                           Ship Date   Postal Code        Sales     Quant
ity  \
count                           2121   2121.000000  2121.000000  2121.000
000   
mean   2016-04-18 20:43:47.439886848  55726.556341   349.834887     3.785
007   
min              2014-01-04 00:00:00   1040.000000     1.892000     1.000
000   
25%              2015-05-14 00:00:00  22801.000000    47.040000     2.000
000   
50%              2016-06-08 00:00:00  60505.000000   182.220000     3.000
000   
75%              2017-04-19 00:00:00  90032.000000   435.168000     5.000
000   
max              2018-05-01 00:00:00  99301.000000  4416.174000    14.000
000   
std                              NaN  32261.888225   503.179145     2.251
620   

          Discount       Profit  
count  2121.000000  2121.000000  
mean      0.173923     8.699327  
min       0.000000 -1862.312400  
25%       0.000000   -12.849000  
50%       0.200000     7.774800  
75%       0.300000    33.726600  
max       0.700000  1013.127000  
std       0.181547   136.049246  
```

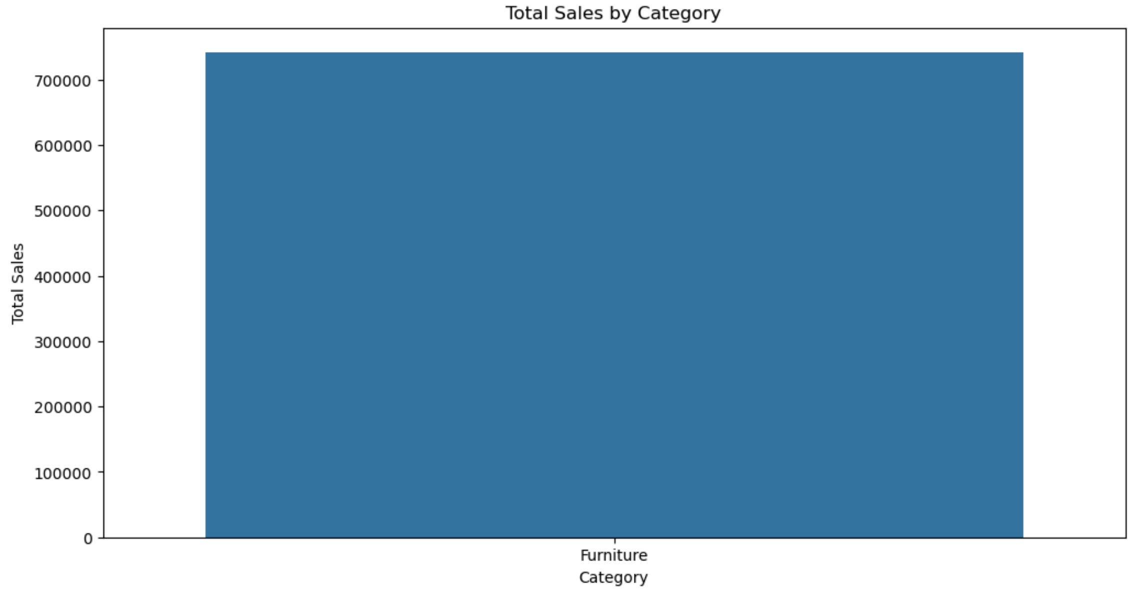
In [3]:
```
# Plot the distribution of Sales
plt.figure(figsize=(10, 6))
sns.histplot(data['Sales'], kde=True, bins=30)
plt.title('Distribution of Sales')
plt.xlabel('Sales')
plt.ylabel('Frequency')
plt.show()
```



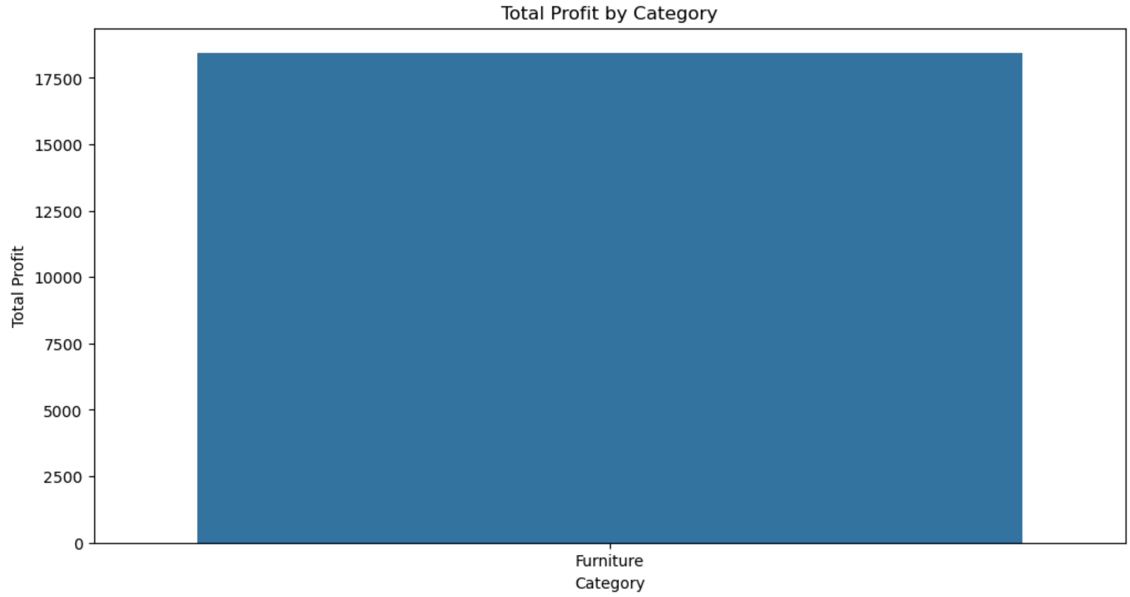
In [4]:
```
# Plot the distribution of Profit
plt.figure(figsize=(10, 6))
sns.histplot(data['Profit'], kde=True, bins=30)
plt.title('Distribution of Profit')
plt.xlabel('Profit')
plt.ylabel('Frequency')
plt.show()
```



In [5]:
```
# Plot the total Sales and Profit by Category
category_sales_profit = data.groupby('Category')[['Sales', 'Profit']].sum()
plt.figure(figsize=(12, 6))
sns.barplot(x='Category', y='Sales', data=category_sales_profit)
plt.title('Total Sales by Category')
plt.xlabel('Category')
plt.ylabel('Total Sales')
plt.show()
```

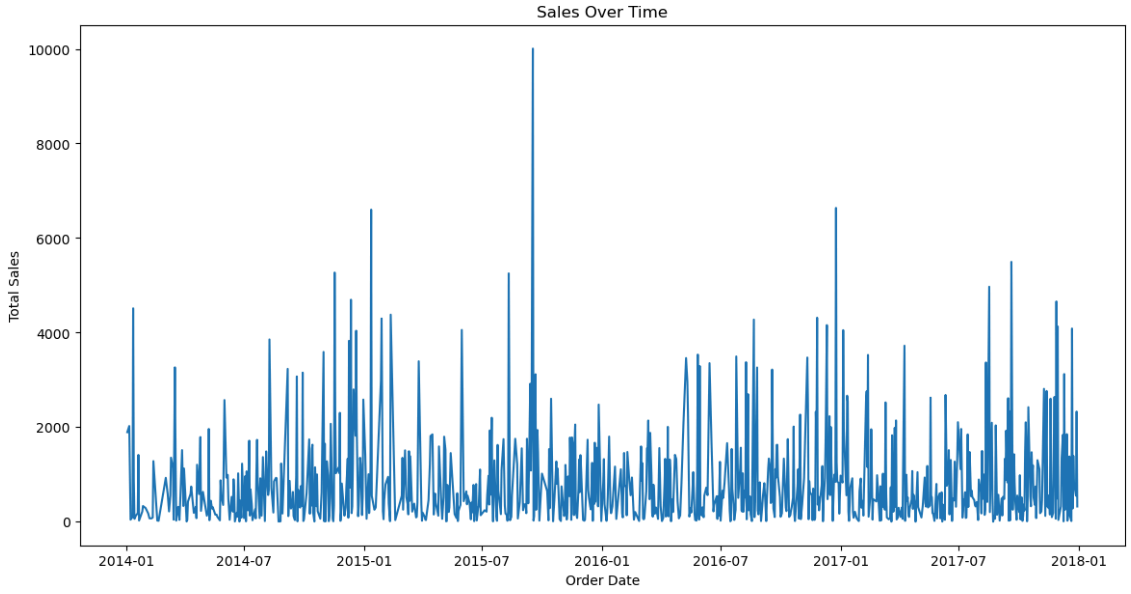


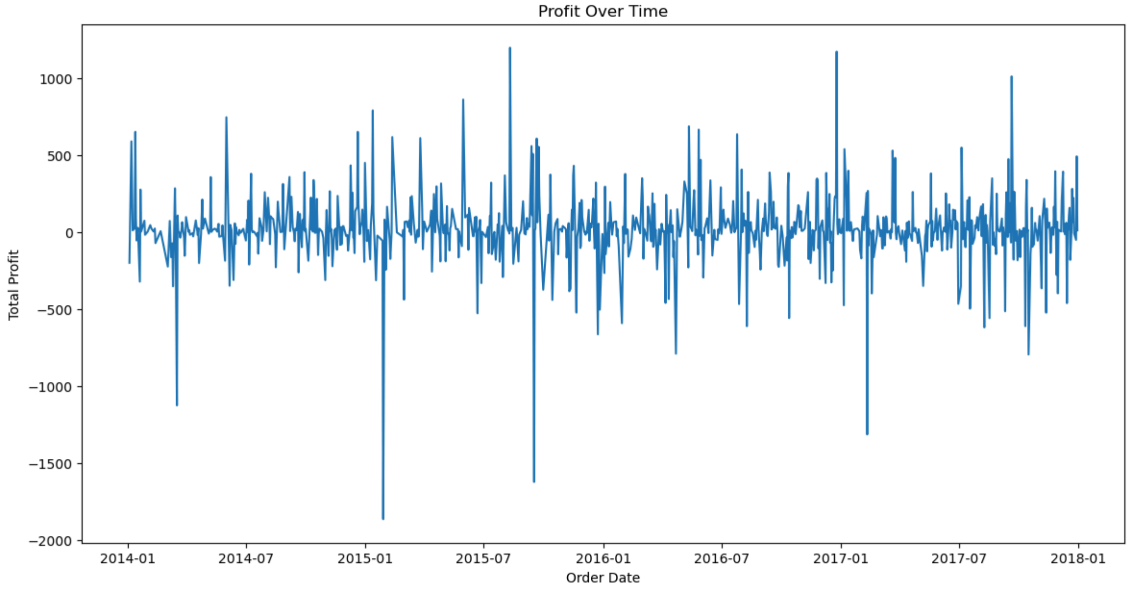
In [6]:
```
plt.figure(figsize=(12, 6))
sns.barplot(x='Category', y='Profit', data=category_sales_profit)
plt.title('Total Profit by Category')
plt.xlabel('Category')
plt.ylabel('Total Profit')
plt.show()
```



In [7]:

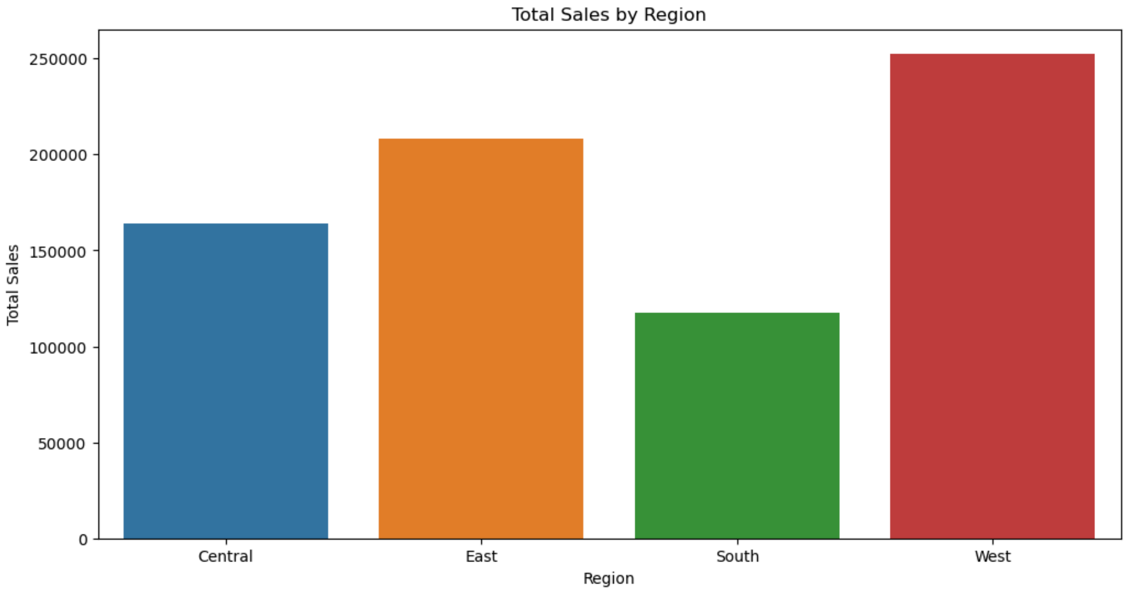
```
# Sales and Profit over Time
sales_profit_over_time = data.groupby('Order Date')[['Sales', 'Profit']].su

plt.figure(figsize=(14, 7))
sns.lineplot(x='Order Date', y='Sales', data=sales_profit_over_time)
plt.title('Sales Over Time')
plt.xlabel('Order Date')
plt.ylabel('Total Sales')
plt.show()

plt.figure(figsize=(14, 7))
sns.lineplot(x='Order Date', y='Profit', data=sales_profit_over_time)
plt.title('Profit Over Time')
plt.xlabel('Order Date')
plt.ylabel('Total Profit')
plt.show()
```

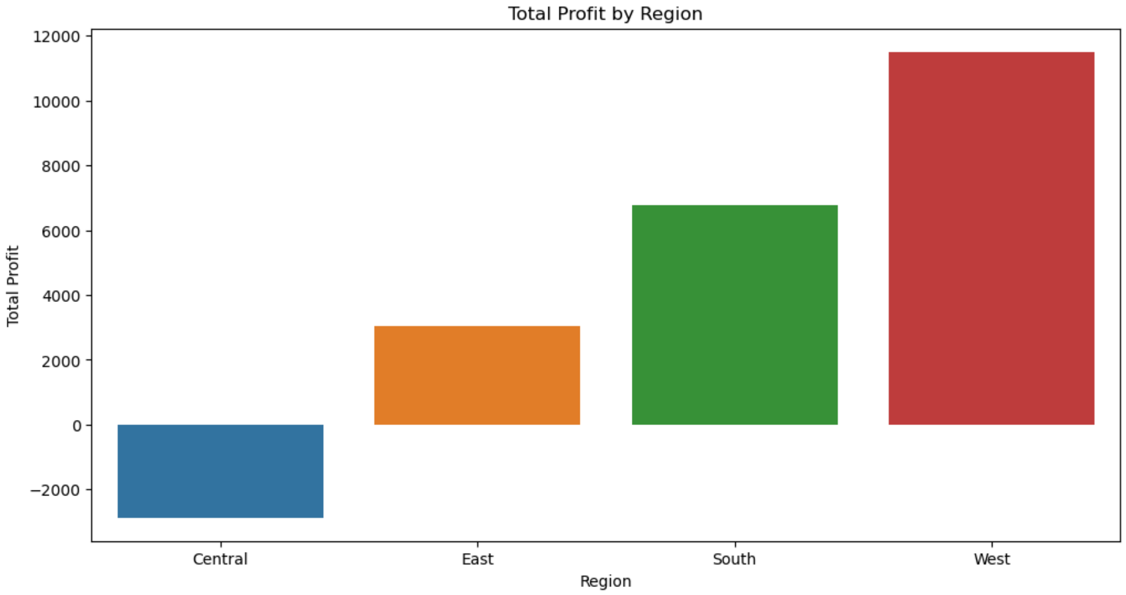




In [8]:

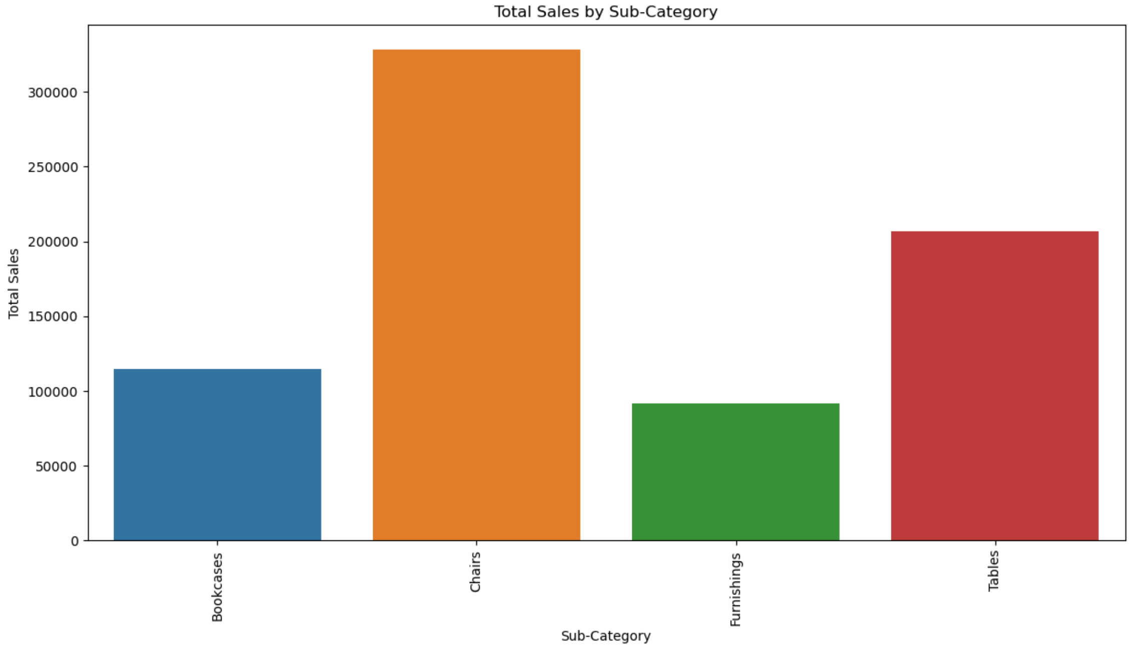
```
# Sales and Profit by Region
region_sales_profit = data.groupby('Region')[['Sales', 'Profit']].sum().res

plt.figure(figsize=(12, 6))
sns.barplot(x='Region', y='Sales', data=region_sales_profit)
plt.title('Total Sales by Region')
plt.xlabel('Region')
plt.ylabel('Total Sales')
plt.show()

plt.figure(figsize=(12, 6))
sns.barplot(x='Region', y='Profit', data=region_sales_profit)
plt.title('Total Profit by Region')
plt.xlabel('Region')
plt.ylabel('Total Profit')
plt.show()
```

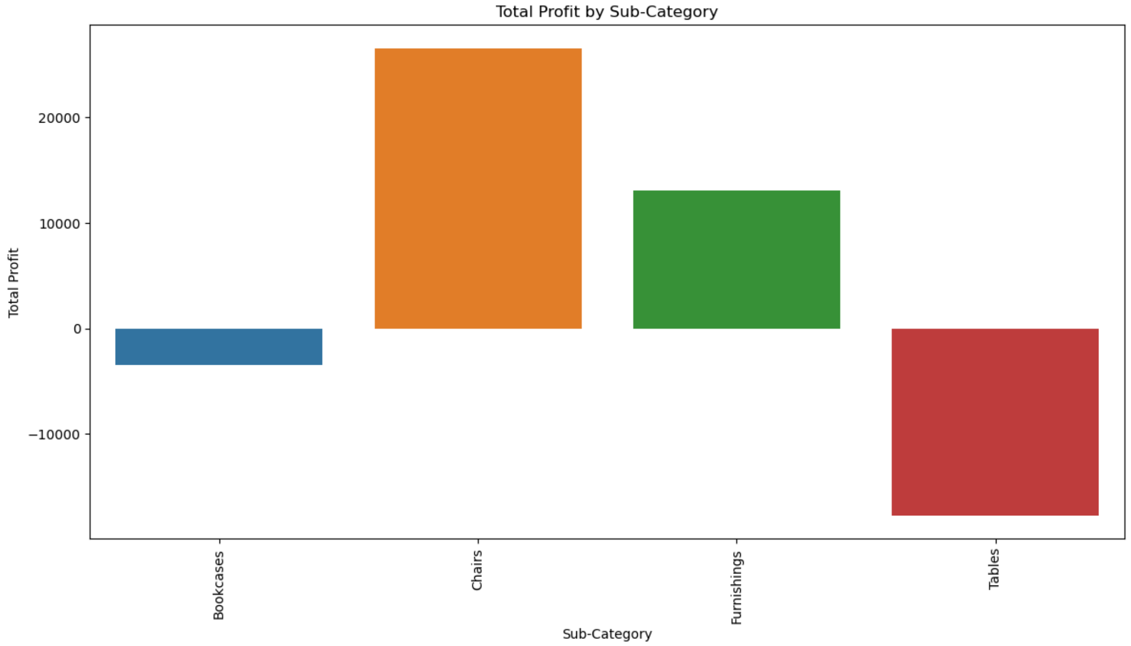




In [9]:

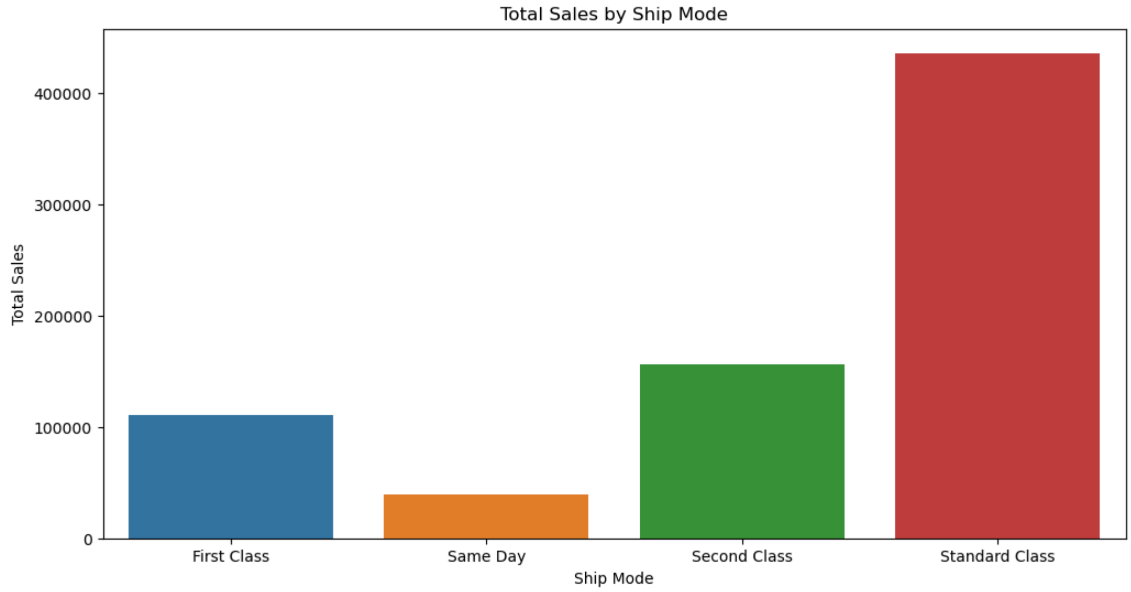
```
# Sales and Profit by Sub-Category
sub_category_sales_profit = data.groupby('Sub-Category')[['Sales', 'Profit'

plt.figure(figsize=(14, 7))
sns.barplot(x='Sub-Category', y='Sales', data=sub_category_sales_profit)
plt.title('Total Sales by Sub-Category')
plt.xlabel('Sub-Category')
plt.ylabel('Total Sales')
plt.xticks(rotation=90)
plt.show()

plt.figure(figsize=(14, 7))
sns.barplot(x='Sub-Category', y='Profit', data=sub_category_sales_profit)
plt.title('Total Profit by Sub-Category')
plt.xlabel('Sub-Category')
plt.ylabel('Total Profit')
plt.xticks(rotation=90)
plt.show()
```

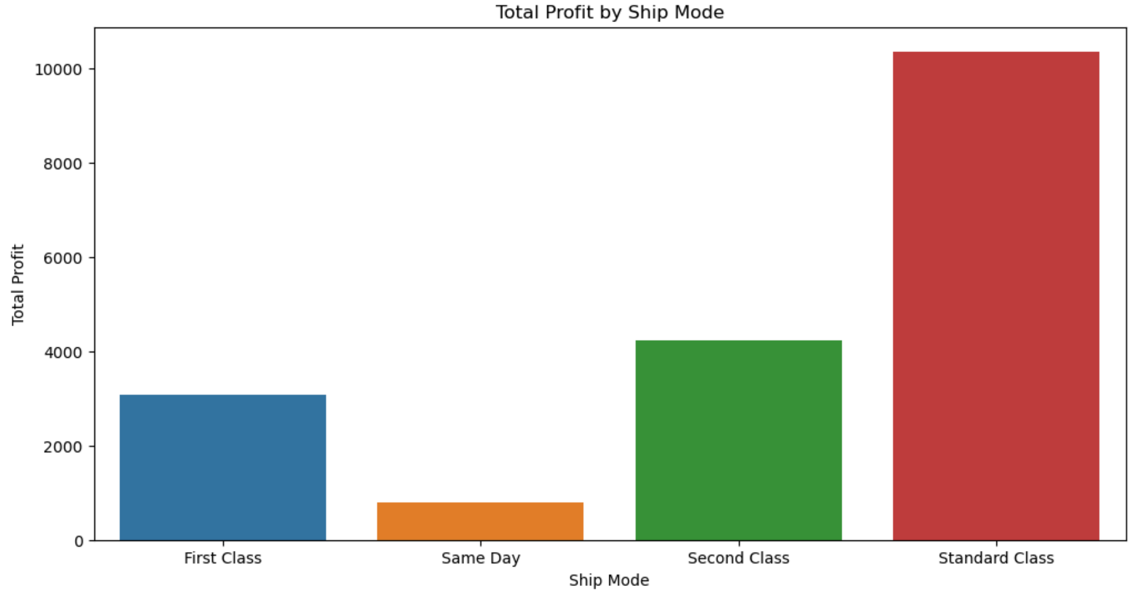




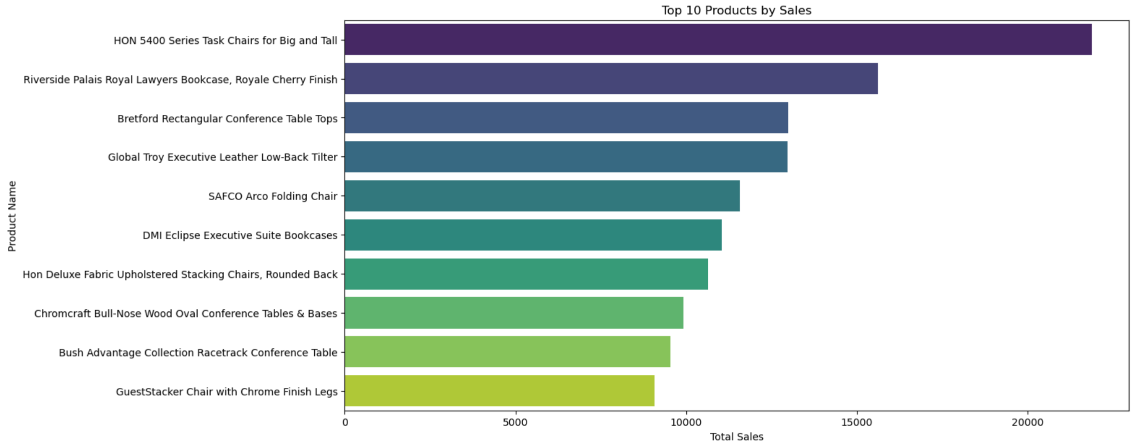
In [10]:

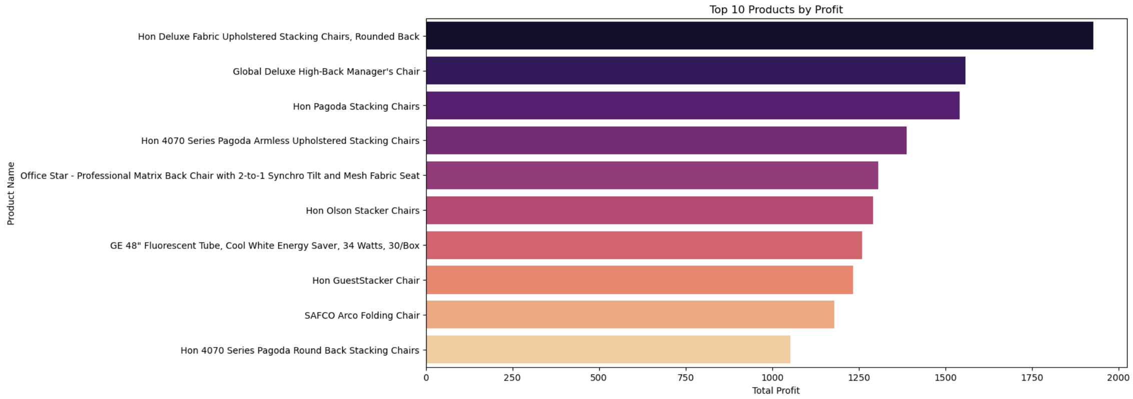
```
# Sales and Profit by Ship Mode
ship_mode_sales_profit = data.groupby('Ship Mode')[['Sales', 'Profit']].sum

plt.figure(figsize=(12, 6))
sns.barplot(x='Ship Mode', y='Sales', data=ship_mode_sales_profit)
plt.title('Total Sales by Ship Mode')
plt.xlabel('Ship Mode')
plt.ylabel('Total Sales')
plt.show()

plt.figure(figsize=(12, 6))
sns.barplot(x='Ship Mode', y='Profit', data=ship_mode_sales_profit)
plt.title('Total Profit by Ship Mode')
plt.xlabel('Ship Mode')
plt.ylabel('Total Profit')
plt.show()
```





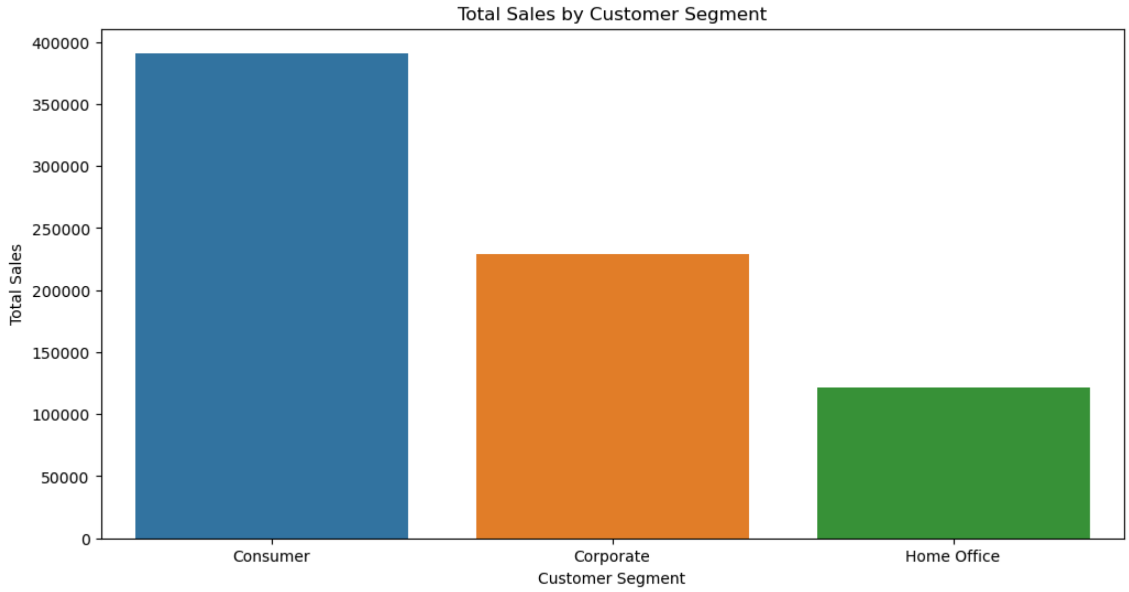
In [11]:
```
# Top 10 Products by Sales
top_10_products_sales = data.groupby('Product Name')['Sales'].sum().nlarges

plt.figure(figsize=(14, 7))
sns.barplot(x='Sales', y='Product Name', data=top_10_products_sales, palett
plt.title('Top 10 Products by Sales')
plt.xlabel('Total Sales')
plt.ylabel('Product Name')
plt.show()

# Top 10 Products by Profit
top_10_products_profit = data.groupby('Product Name')['Profit'].sum().nlarg

plt.figure(figsize=(14, 7))
sns.barplot(x='Profit', y='Product Name', data=top_10_products_profit, pale
plt.title('Top 10 Products by Profit')
plt.xlabel('Total Profit')
plt.ylabel('Product Name')
plt.show()
```

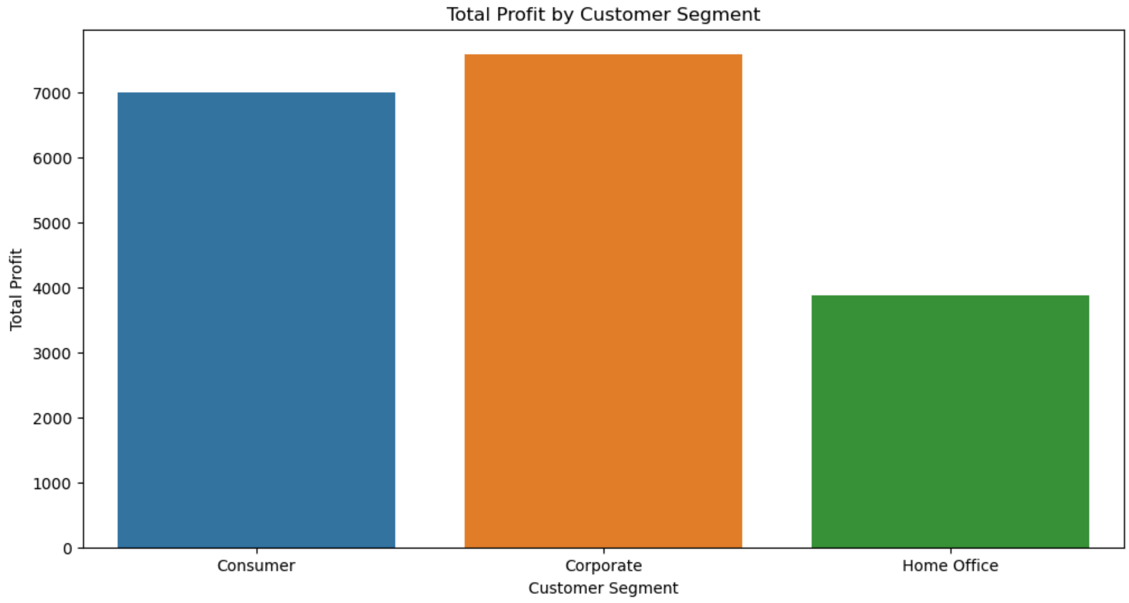




In [12]:

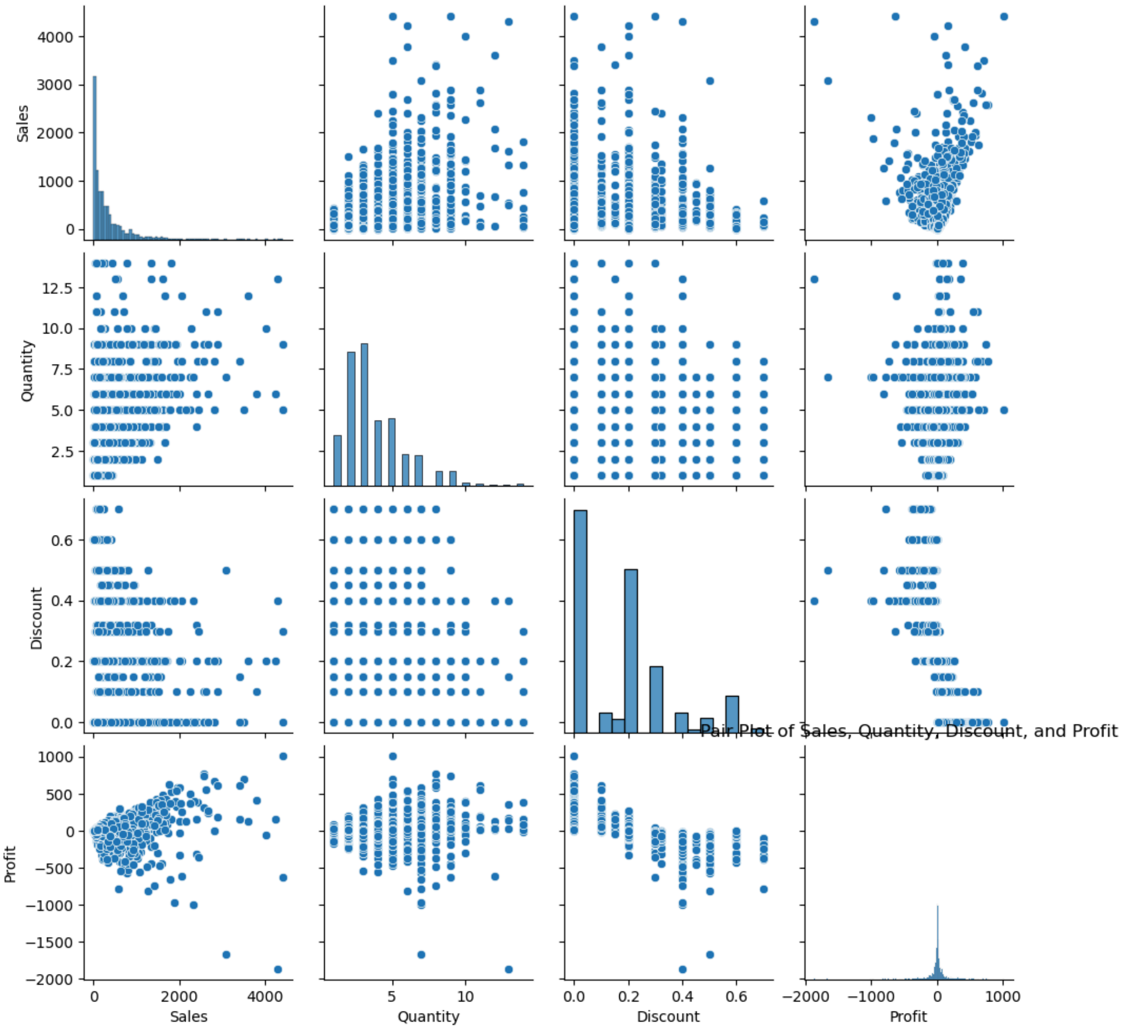
```
# Sales and Profit by Customer Segment
segment_sales_profit = data.groupby('Segment')[['Sales', 'Profit']].sum().r

plt.figure(figsize=(12, 6))
sns.barplot(x='Segment', y='Sales', data=segment_sales_profit)
plt.title('Total Sales by Customer Segment')
plt.xlabel('Customer Segment')
plt.ylabel('Total Sales')
plt.show()

plt.figure(figsize=(12, 6))
sns.barplot(x='Segment', y='Profit', data=segment_sales_profit)
plt.title('Total Profit by Customer Segment')
plt.xlabel('Customer Segment')
plt.ylabel('Total Profit')
plt.show()
```



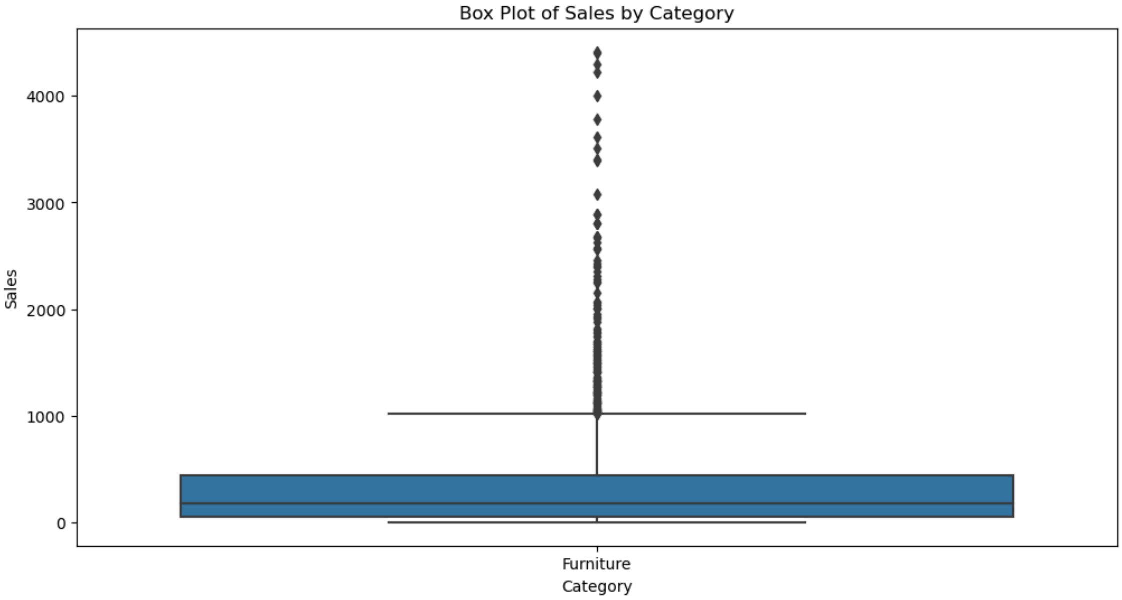


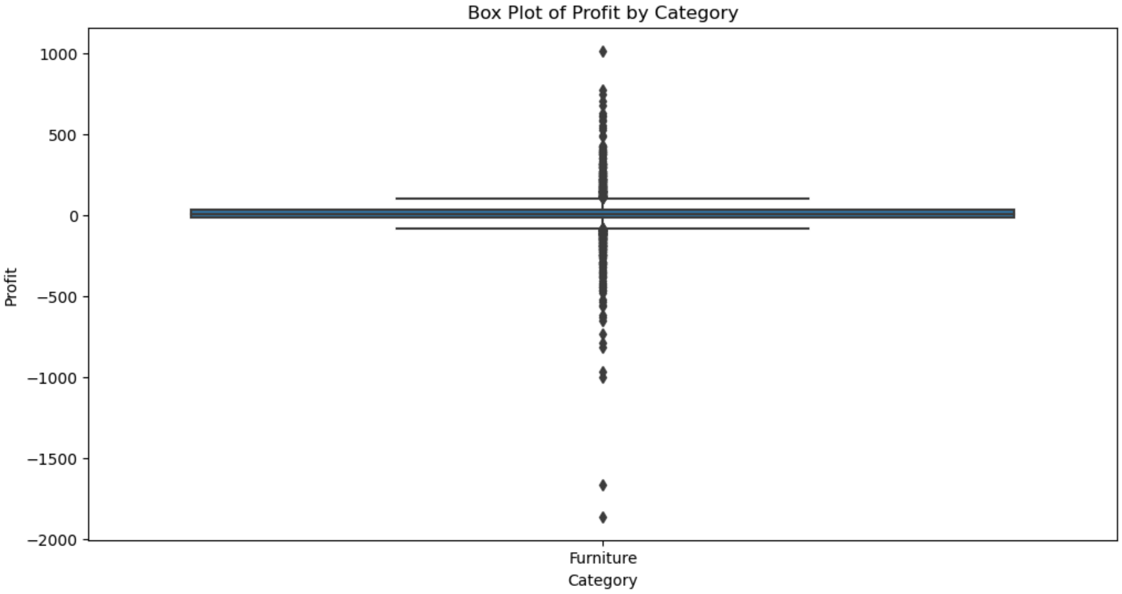
```
In [13]: # Pair Plot
         sns.pairplot(data[['Sales', 'Quantity', 'Discount', 'Profit']])
         plt.title('Pair Plot of Sales, Quantity, Discount, and Profit')
         plt.show()
```

```
C:\Users\Vivek Karia\anaconda3\Lib\site-packages\seaborn\axisgrid.py:118:
UserWarning: The figure layout has changed to tight
  self._figure.tight_layout(*args, **kwargs)
```

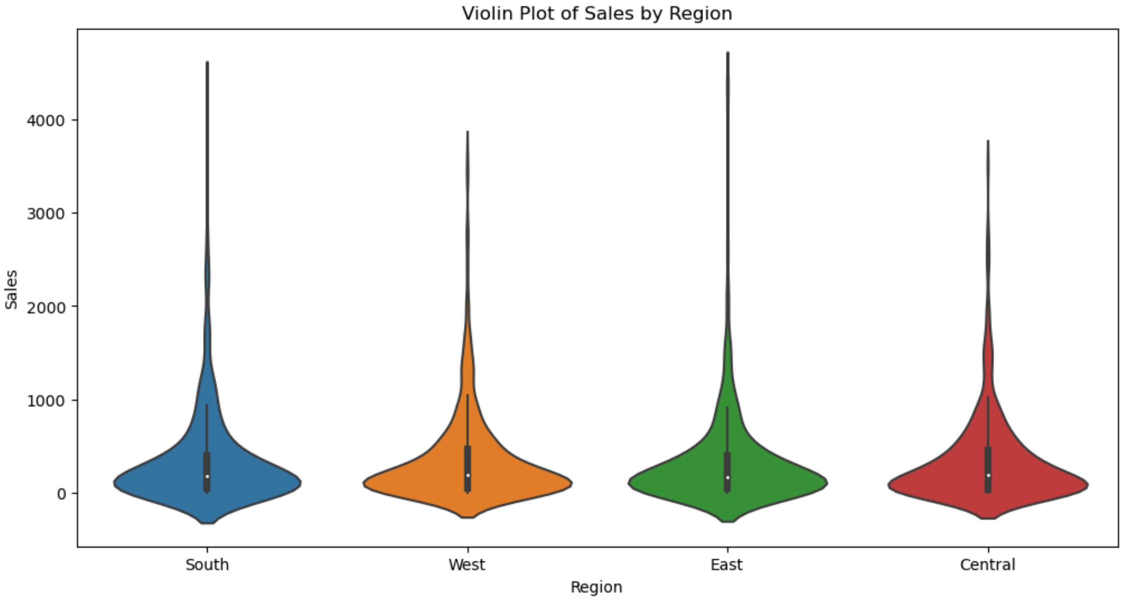


In [14]:
```
# Box Plot of Sales by Category
plt.figure(figsize=(12, 6))
sns.boxplot(x='Category', y='Sales', data=data)
plt.title('Box Plot of Sales by Category')
plt.xlabel('Category')
plt.ylabel('Sales')
plt.show()

# Box Plot of Profit by Category
plt.figure(figsize=(12, 6))
sns.boxplot(x='Category', y='Profit', data=data)
plt.title('Box Plot of Profit by Category')
plt.xlabel('Category')
plt.ylabel('Profit')
plt.show()
```





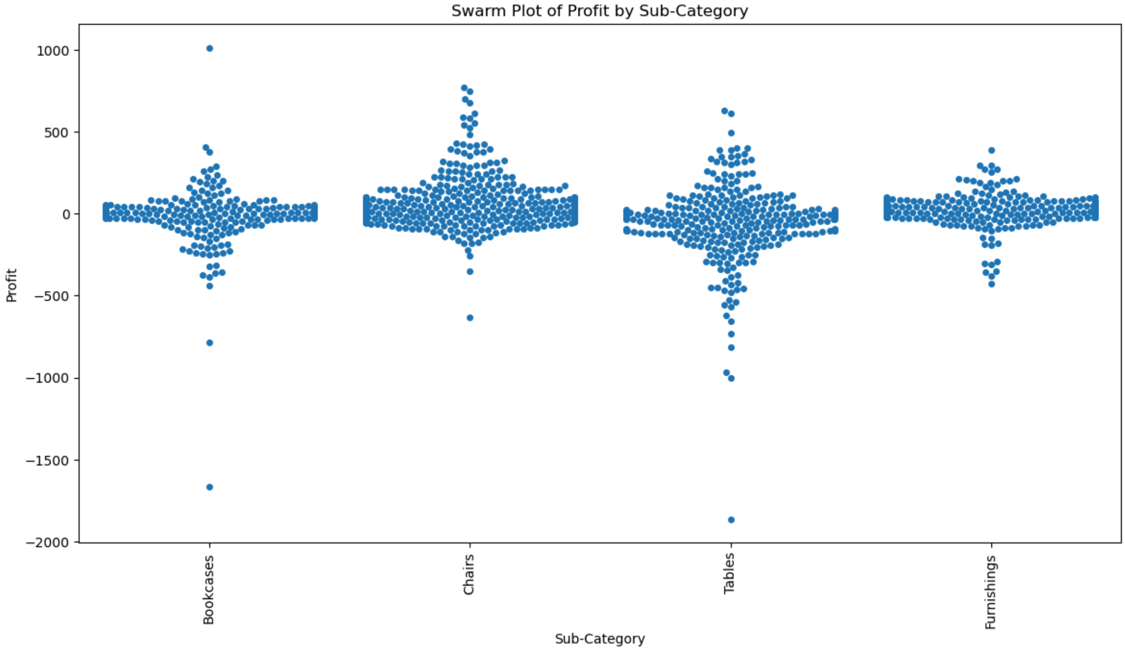
In [15]:
```
# Violin Plot of Sales by Region
plt.figure(figsize=(12, 6))
sns.violinplot(x='Region', y='Sales', data=data)
plt.title('Violin Plot of Sales by Region')
plt.xlabel('Region')
plt.ylabel('Sales')
plt.show()
```



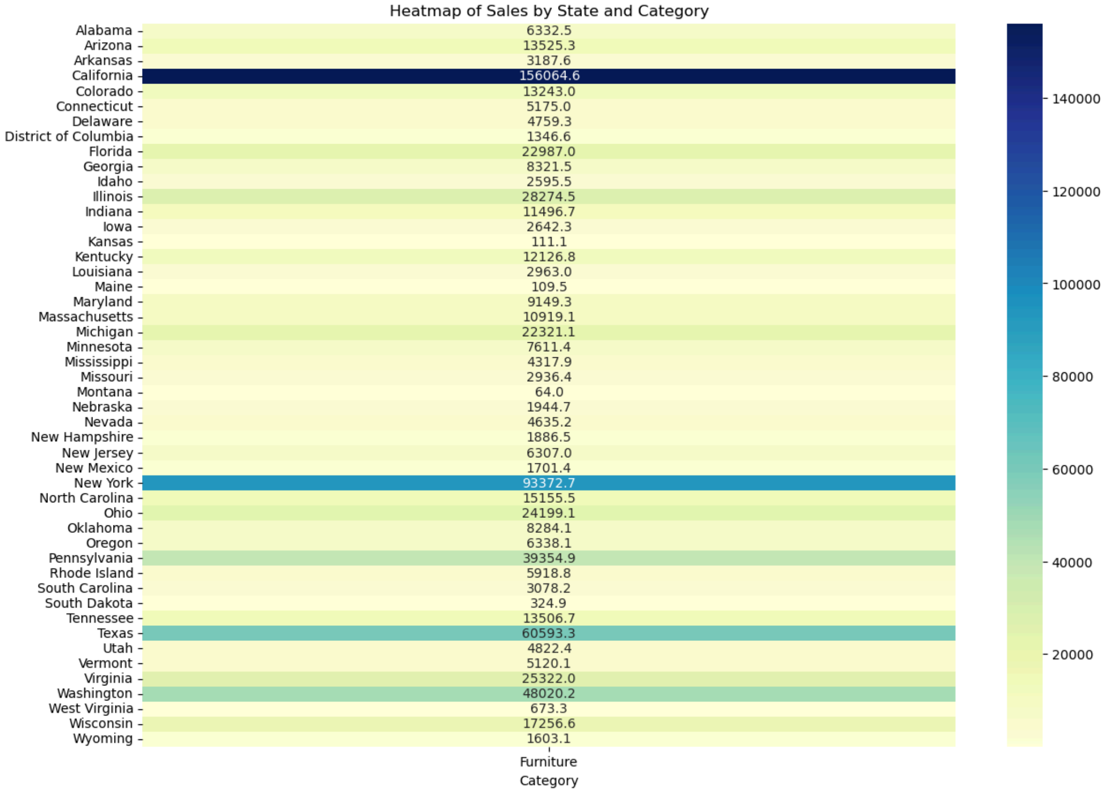
In [16]:

```
# Swarm Plot of Profit by Sub-Category
plt.figure(figsize=(14, 7))
sns.swarmplot(x='Sub-Category', y='Profit', data=data)
plt.title('Swarm Plot of Profit by Sub-Category')
plt.xlabel('Sub-Category')
plt.ylabel('Profit')
plt.xticks(rotation=90)
plt.show()
```

```
C:\Users\Vivek Karia\anaconda3\Lib\site-packages\seaborn\categorical.py:3
544: UserWarning: 16.7% of the points cannot be placed; you may want to d
ecrease the size of the markers or use stripplot.
  warnings.warn(msg, UserWarning)
C:\Users\Vivek Karia\anaconda3\Lib\site-packages\seaborn\categorical.py:3
544: UserWarning: 49.8% of the points cannot be placed; you may want to d
ecrease the size of the markers or use stripplot.
  warnings.warn(msg, UserWarning)
C:\Users\Vivek Karia\anaconda3\Lib\site-packages\seaborn\categorical.py:3
544: UserWarning: 8.2% of the points cannot be placed; you may want to de
crease the size of the markers or use stripplot.
  warnings.warn(msg, UserWarning)
C:\Users\Vivek Karia\anaconda3\Lib\site-packages\seaborn\categorical.py:3
544: UserWarning: 79.2% of the points cannot be placed; you may want to d
ecrease the size of the markers or use stripplot.
  warnings.warn(msg, UserWarning)
C:\Users\Vivek Karia\anaconda3\Lib\site-packages\seaborn\categorical.py:3
544: UserWarning: 22.8% of the points cannot be placed; you may want to d
ecrease the size of the markers or use stripplot.
  warnings.warn(msg, UserWarning)
C:\Users\Vivek Karia\anaconda3\Lib\site-packages\seaborn\categorical.py:3
544: UserWarning: 54.6% of the points cannot be placed; you may want to d
ecrease the size of the markers or use stripplot.
  warnings.warn(msg, UserWarning)
C:\Users\Vivek Karia\anaconda3\Lib\site-packages\seaborn\categorical.py:3
544: UserWarning: 14.1% of the points cannot be placed; you may want to d
ecrease the size of the markers or use stripplot.
  warnings.warn(msg, UserWarning)
C:\Users\Vivek Karia\anaconda3\Lib\site-packages\seaborn\categorical.py:3
544: UserWarning: 81.4% of the points cannot be placed; you may want to d
ecrease the size of the markers or use stripplot.
  warnings.warn(msg, UserWarning)
```

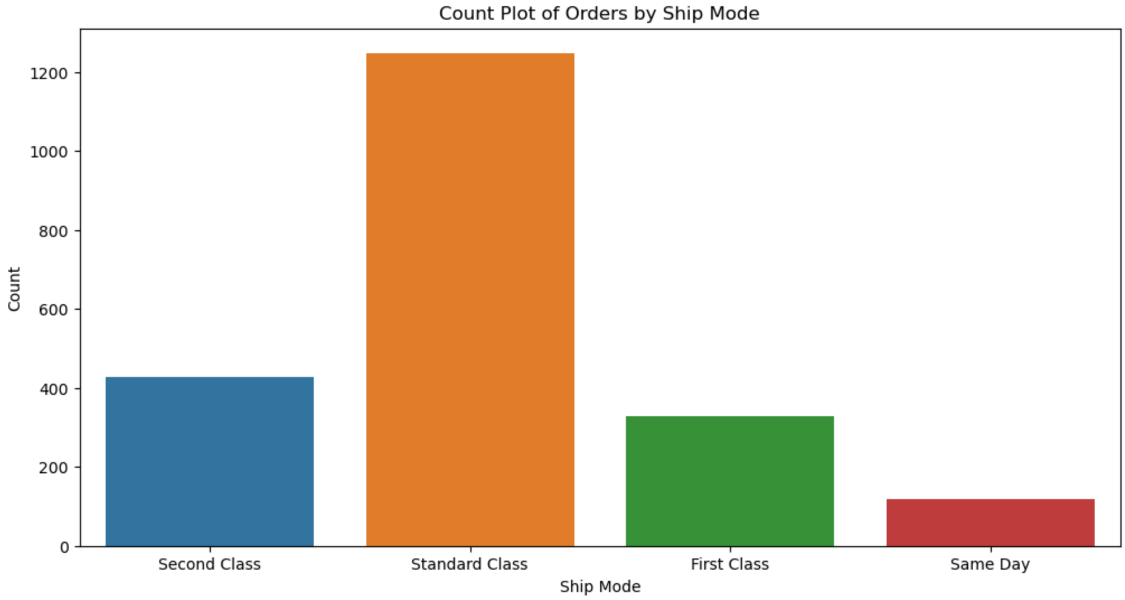


In [17]:
```
# Pivot table for heatmap
heatmap_data = data.pivot_table(values='Sales', index='State', columns='Cat

plt.figure(figsize=(14, 10))
sns.heatmap(heatmap_data, annot=True, fmt='.1f', cmap='YlGnBu')
plt.title('Heatmap of Sales by State and Category')
plt.xlabel('Category')
plt.ylabel('State')
plt.show()
```



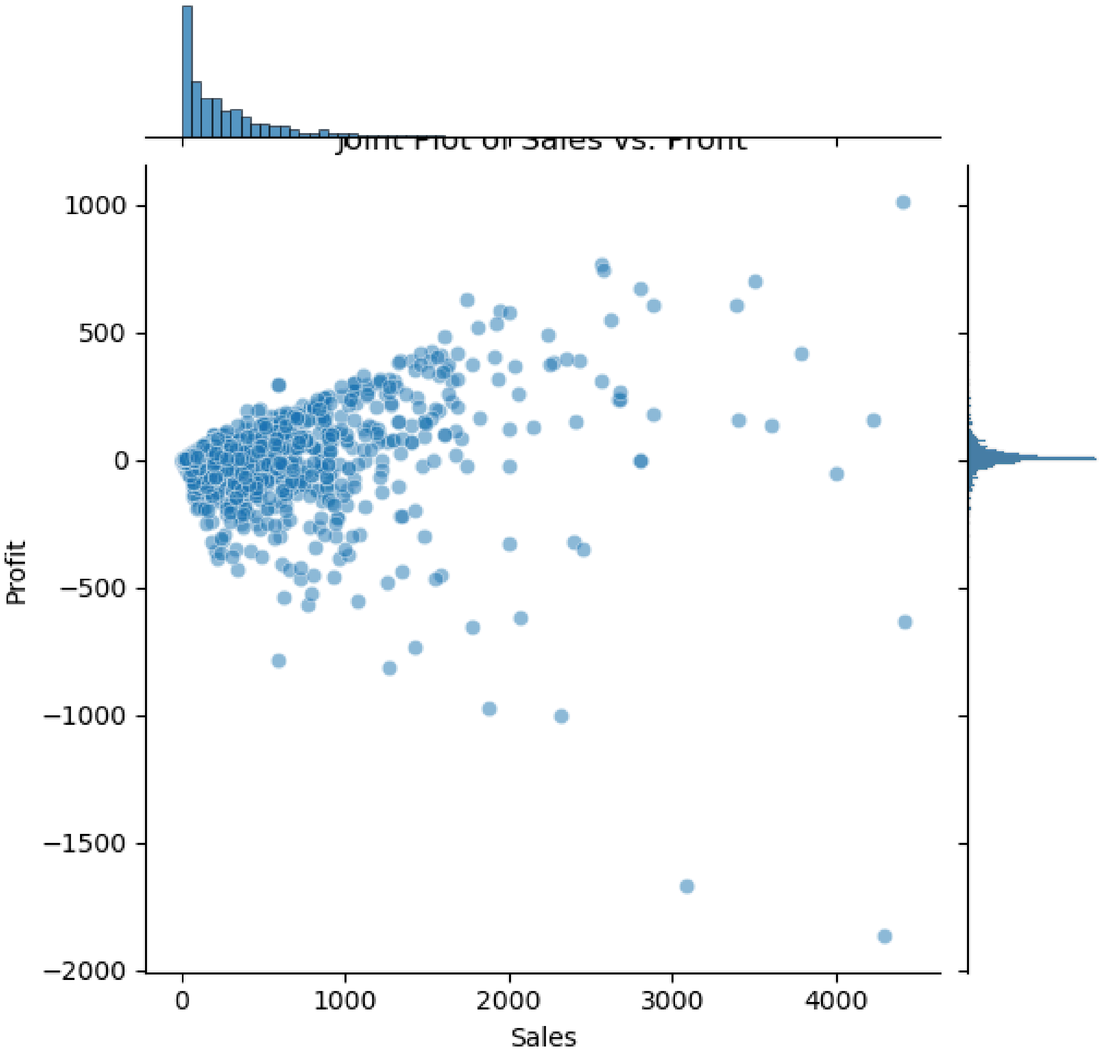
In [18]:

```
# Count Plot of Orders by Ship Mode
plt.figure(figsize=(12, 6))
sns.countplot(x='Ship Mode', data=data)
plt.title('Count Plot of Orders by Ship Mode')
plt.xlabel('Ship Mode')
plt.ylabel('Count')
plt.show()
```



In [19]:

```
# Joint Plot of Sales vs. Profit
sns.jointplot(x='Sales', y='Profit', data=data, kind='scatter', alpha=0.5)
plt.title('Joint Plot of Sales vs. Profit')
plt.show()
```



In [20]:

```
# Extract useful date features
data['Order Month'] = data['Order Date'].dt.month
data['Order Year'] = data['Order Date'].dt.year
data['Ship Month'] = data['Ship Date'].dt.month
data['Ship Year'] = data['Ship Date'].dt.year
```

In [21]:

```
# Drop unnecessary columns
data.drop(columns=['Row ID', 'Order ID', 'Customer Name', 'Product Name'],
```

In [22]:

```
# Handle missing values separately for numerical and categorical features
numeric_features = ['Sales', 'Quantity', 'Discount', 'Profit', 'Order Month
categorical_features = ['Ship Mode', 'Segment', 'City', 'State', 'Region',
```

In [23]:
```
# Fill missing values for numerical features with the median
data[numeric_features] = data[numeric_features].fillna(data[numeric_feature
```

In [24]:
```
# Fill missing values for categorical features with the mode
data[categorical_features] = data[categorical_features].apply(lambda x: x.f
```

In [25]:
```
# Encode categorical variables
data_encoded = pd.get_dummies(data, columns=categorical_features, drop_firs
```

In [26]:
```
# Standardize numerical features
scaler = StandardScaler()
data_encoded[numeric_features] = scaler.fit_transform(data_encoded[numeric_
```

In [27]:
```
# Verify the final shape
print("Final data shape:", data_encoded.shape)
```

```
Final data shape: (2121, 442)
```

In [28]:
```
# Save the cleaned dataset to a CSV file
data_encoded.to_csv('cleaned_stores_sales_forecasting_simplified.csv', inde
```

In [29]:
```
# Display the cleaned dataset
data_encoded.head()
```

Out[29]:

	Order Date	Ship Date	Customer ID	Country	Postal Code	Product ID	Sales	Quantity	Discount	
0	2016-08-11	2016-11-11	CG-12520	United States	42420	FUR-BO-10001798	-0.174681	-0.792953	-0.958228	0.24
1	2016-08-11	2016-11-11	CG-12520	United States	42420	FUR-CH-10000454	0.759561	-0.348723	-0.958228	1.55
2	2015-11-10	2015-10-18	SO-20335	United States	33311	FUR-TA-10000577	1.208090	0.539736	1.521050	-2.88
3	2014-09-06	2014-06-14	BH-11710	United States	90032	FUR-FU-10001487	-0.598288	1.428194	-0.958228	0.04
4	2014-09-06	2014-06-14	BH-11710	United States	90032	FUR-TA-10001539	2.696195	2.316653	0.143673	0.56

5 rows × 442 columns

In [ ]: