```
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns

df = pd.read_csv('Mall_Customers.csv')

df.head()
```

	CustomerID	Gender	Age	Annual Income (k$)	Spending Score (1-100)
0	1	Male	19	15	39
1	2	Male	21	15	81
2	3	Female	20	16	6
3	4	Female	23	16	77
4	5	Female	31	17	40

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```
df.describe()
```

	CustomerID	Age	Annual Income (k$)	Spending Score (1-100)
count	200.000000	200.000000	200.000000	200.000000
mean	100.500000	38.850000	60.560000	50.200000
std	57.879185	13.969007	26.264721	25.823522
min	1.000000	18.000000	15.000000	1.000000
25%	50.750000	28.750000	41.500000	34.750000
50%	100.500000	36.000000	61.500000	50.000000
75%	150.250000	49.000000	78.000000	73.000000
max	200.000000	70.000000	137.000000	99.000000

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

	0
CustomerID	0
Gender	0
Age	0
Annual Income (k$)	0
Spending Score (1-100)	0

```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 200 entries, 0 to 199
Data columns (total 5 columns):
 #   Column                  Non-Null Count  Dtype
---  ------                  --------------  -----
 0   CustomerID              200 non-null    int64
 1   Gender                  200 non-null    object
 2   Age                     200 non-null    int64
 3   Annual Income (k$)      200 non-null    int64
 4   Spending Score (1-100)  200 non-null    int64
dtypes: int64(4), object(1)
memory usage: 7.9+ KB
```

```
df.rename(columns = {'Annual Income (k$)': 'AnnualIncome', 'Spending Score (1-100)': 'SpendingScore'}, inplace = True)

df.head()
```

	CustomerID	Gender	Age	AnnualIncome	SpendingScore
0	1	Male	19	15	39
1	2	Male	21	15	81
2	3	Female	20	16	6
3	4	Female	23	16	77
4	5	Female	31	17	40

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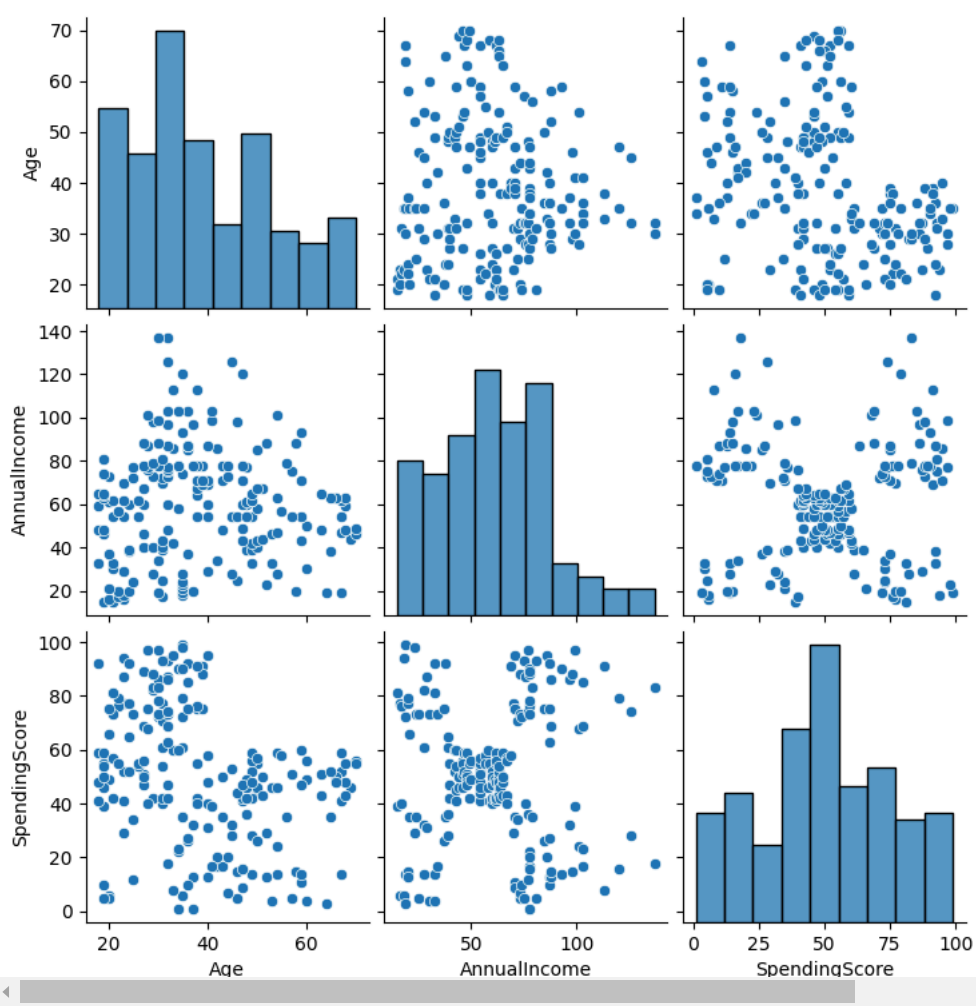
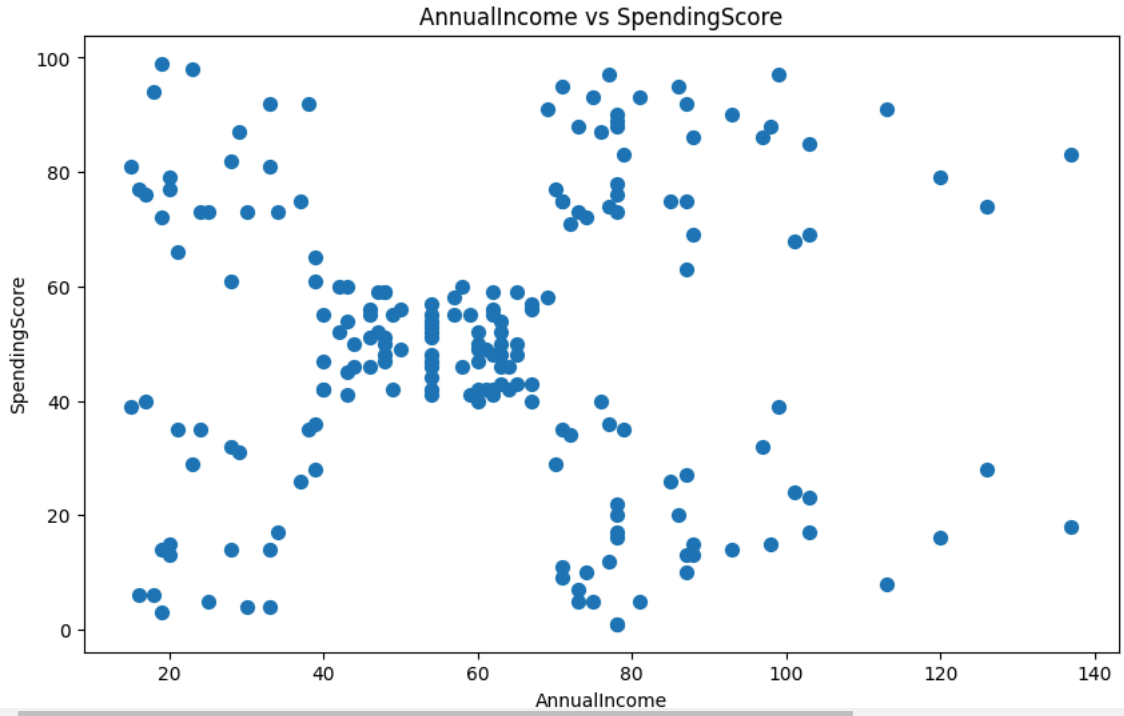
```
sns.pairplot(df[['Age','AnnualIncome','SpendingScore']])
plt.show()
```




```
# Annual income vs Spending Score
plt.figure(figsize = (10,6))
plt.scatter(df['AnnualIncome'],df['SpendingScore'], s=50)
plt.xlabel('AnnualIncome')
plt.ylabel('SpendingScore')
plt.title('AnnualIncome vs SpendingScore')
plt.show()
```




```
from sklearn.cluster import KMeans

X = df[['AnnualIncome','SpendingScore']]

wcss = []

for i in range(1,11):
    kmeans = KMeans(n_clusters = i, init = 'k-means++', max_iter=300, n_init=10, random_state = 0)
    kmeans.fit(X)
    wcss.append(kmeans.inertia_)
```

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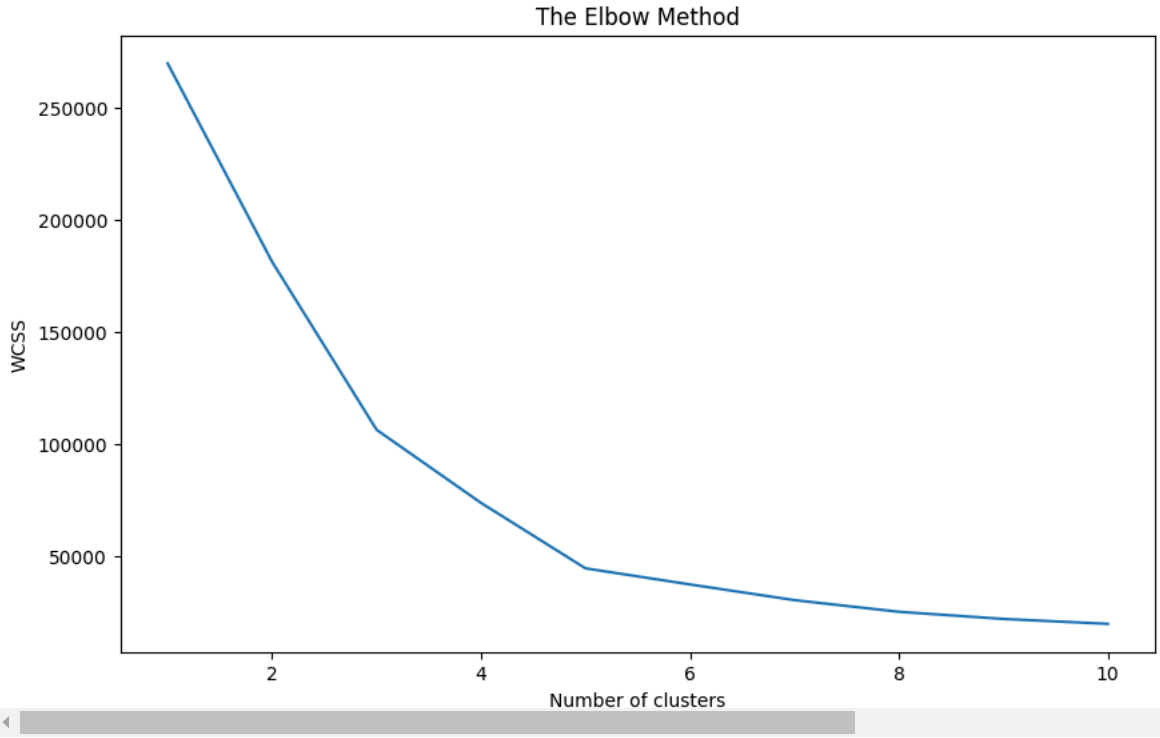
```
plt.figure(figsize = (10,6))
plt.plot(range(1,11),wcss)
plt.title('The Elbow Method')
plt.xlabel('Number of clusters')
plt.ylabel('WCSS')
plt.show()
```



```
kmeans = KMeans(n_clusters = 5, init = 'k-means++', max_iter=300, n_init=10, random_state = 0)
y_kmeans = kmeans.fit_predict(X)
```

```
df['Cluster']=y_kmeans
```

```
df.head()
```

	CustomerID	Gender	Age	AnnualIncome	SpendingScore	Cluster
0	1	Male	19	15	39	3
1	2	Male	21	15	81	4
2	3	Female	20	16	6	3
3	4	Female	23	16	77	4
4	5	Female	31	17	40	3

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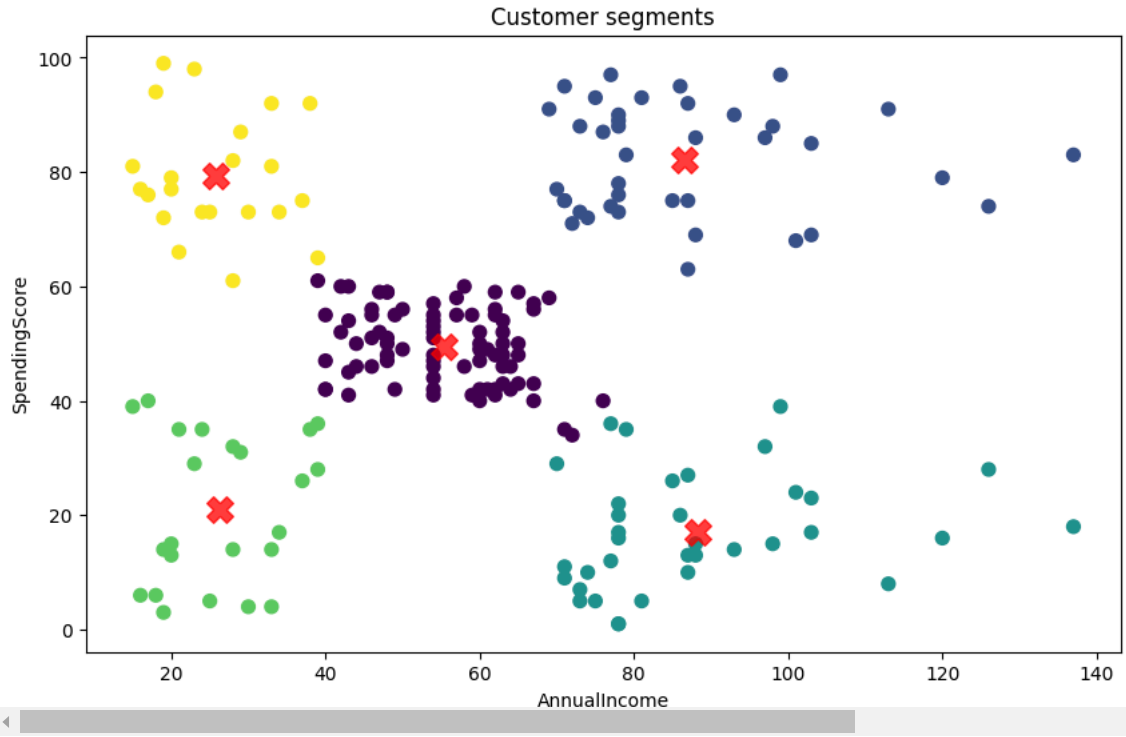
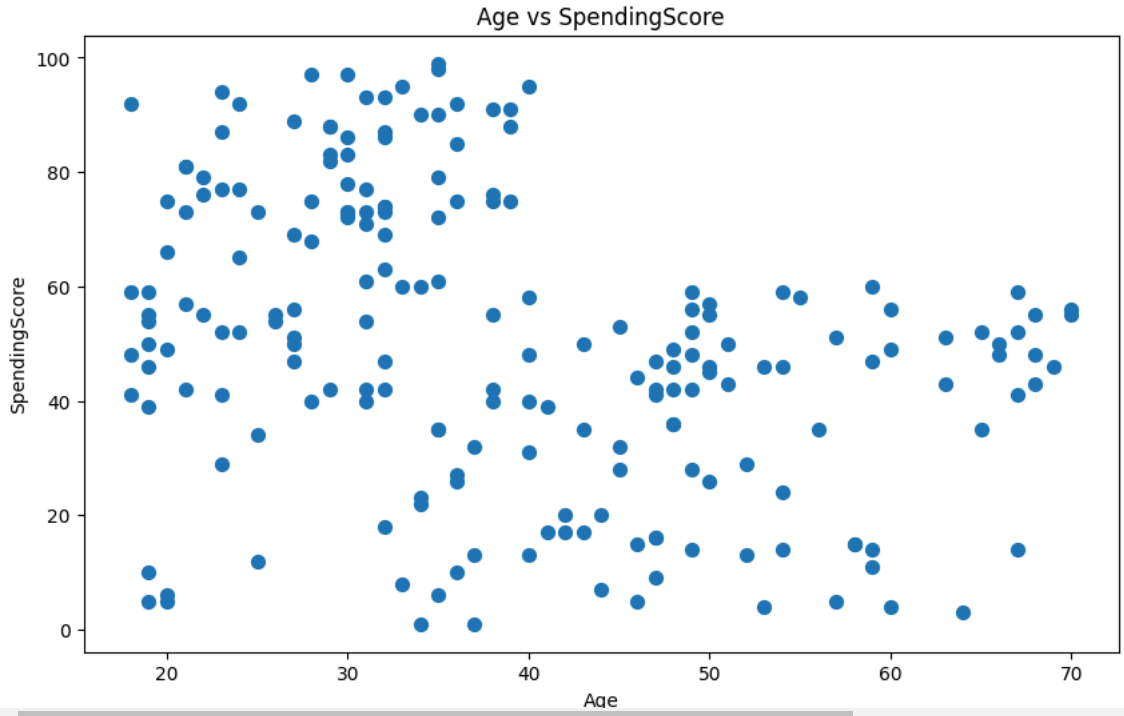
```
plt.figure(figsize=(10,6))
plt.scatter(X.iloc[:,0],X.iloc[:,1], c=y_kmeans, s=50, cmap='viridis')
centers = kmeans.cluster_centers_
plt.scatter(centers[:,0], centers[:,1], c='red', s=200, alpha=0.75, marker='X')
plt.xlabel('AnnualIncome')
plt.ylabel('SpendingScore')
plt.title('Customer segments')
plt.show()
```




```
# Age vs Spending Score
plt.figure(figsize = (10,6))
plt.scatter(df['Age'],df['SpendingScore'], s=50)
plt.xlabel('Age')
plt.ylabel('SpendingScore')
plt.title('Age vs SpendingScore')
plt.show()
```



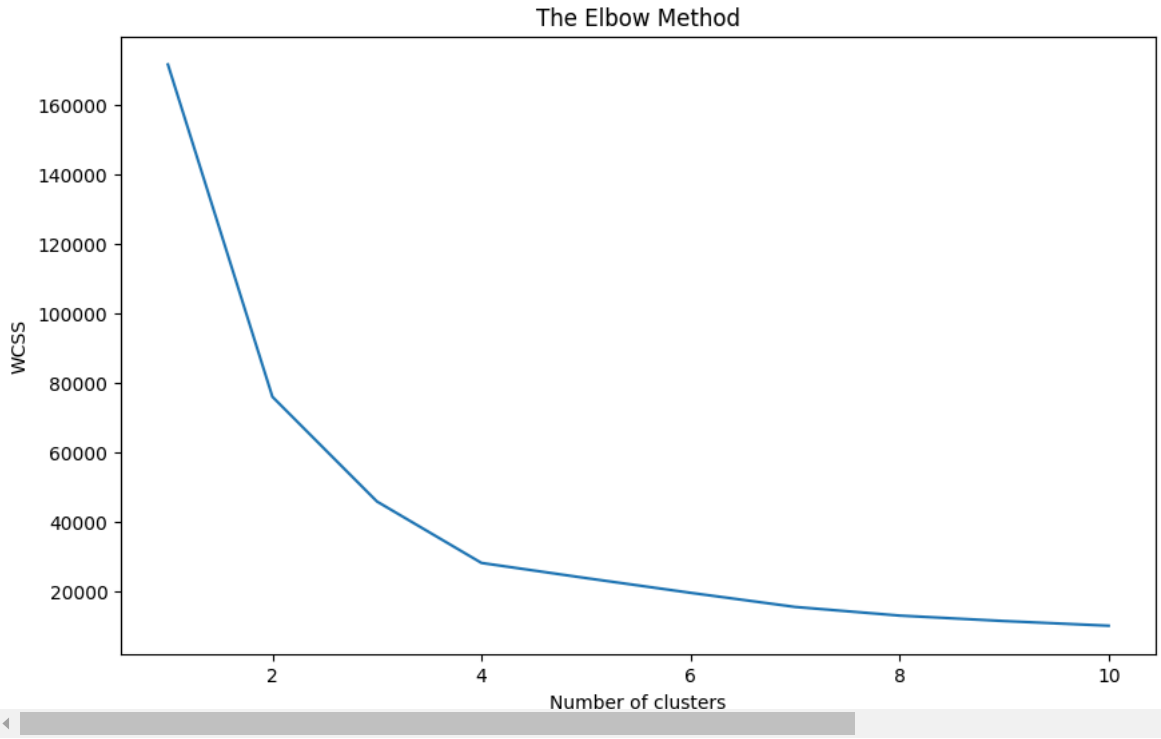

```
from sklearn.cluster import KMeans

X = df[['Age','SpendingScore']]

wcss = []

for i in range(1,11):
    kmeans = KMeans(n_clusters = i, init = 'k-means++', max_iter=300, n_init=10, random_state = 0)
    kmeans.fit(X)
    wcss.append(kmeans.inertia_)

plt.figure(figsize = (10,6))
plt.plot(range(1,11),wcss)
plt.title('The Elbow Method')
plt.xlabel('Number of clusters')
plt.ylabel('WCSS')
plt.show()
```



```
kmeans = KMeans(n_clusters = 4, init = 'k-means++', max_iter=300, n_init=10, random_state = 0)
y_kmeans = kmeans.fit_predict(X)
df['Age_Cluster']= y_kmeans


df.head()
```

	CustomerID	Gender	Age	AnnualIncome	SpendingScore	Cluster	Age_Cluster
0	1	Male	19	15	39	3	3
1	2	Male	21	15	81	4	1
2	3	Female	20	16	6	3	2
3	4	Female	23	16	77	4	1
4	5	Female	31	17	40	3	3

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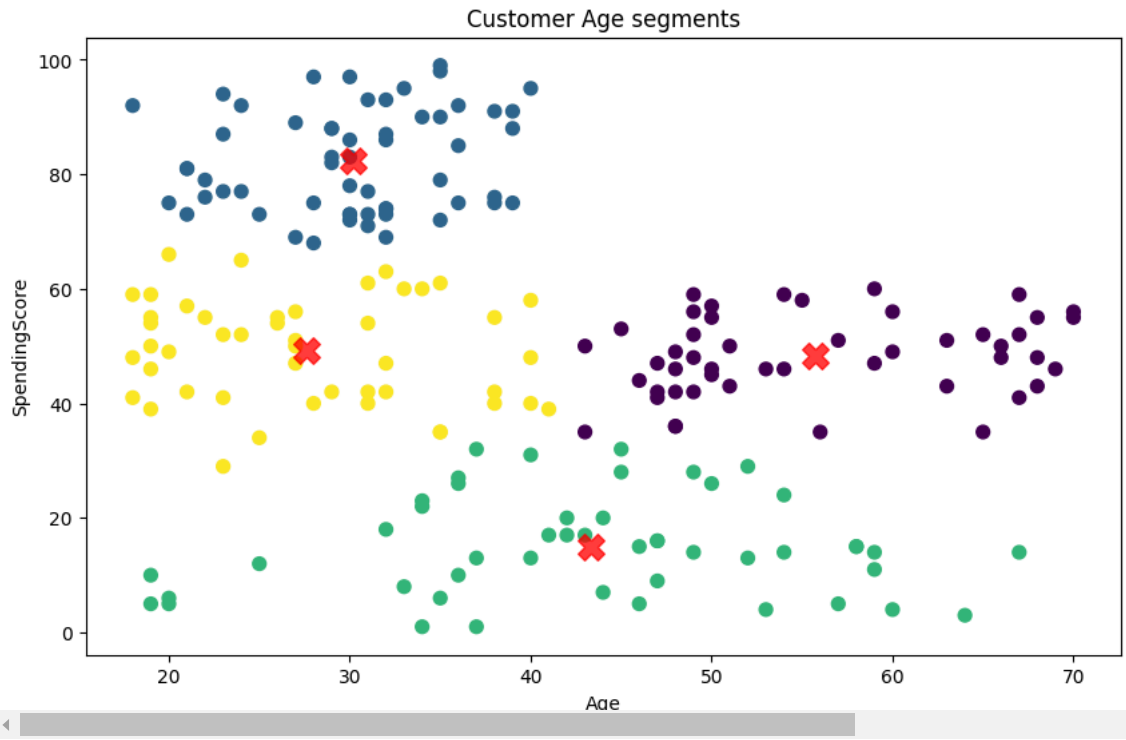
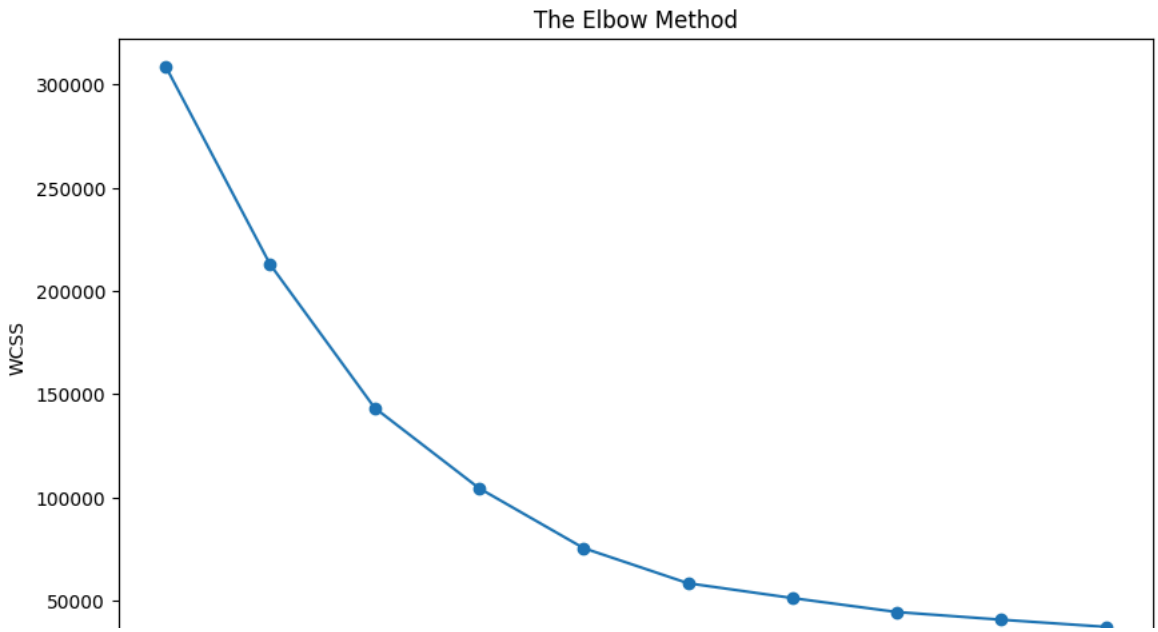
```
plt.figure(figsize=(10,6))
plt.scatter(X.iloc[:,0],X.iloc[:,1], c=y_kmeans, s=50, cmap='viridis')
centers = kmeans.cluster_centers_
plt.scatter(centers[:,0], centers[:,1], c='red', s=200, alpha=0.75, marker='X')
plt.xlabel('Age')
plt.ylabel('SpendingScore')
plt.title('Customer Age segments')
plt.show()
```




```
# Selecting feature for clustering
X = df[['Age','AnnualIncome','SpendingScore']]

# Determing the optimal number of clusters using the elbow method
wcss = []
for i in range(1,11):
    kmeans = KMeans(n_clusters = i, init = 'k-means++', max_iter=300, n_init=10, random_state = 0)
    kmeans.fit(X)
    wcss.append(kmeans.inertia_)

# Plotting the elbow graph
plt.figure(figsize = (10,6))
plt.plot(range(1,11),wcss, marker = 'o')
plt.title('The Elbow Method')
plt.xlabel('Number of clusters')
plt.ylabel('WCSS')
plt.show()
```




```
# Applying K-Means with the chosen number of clusters
kmeans = KMeans(n_clusters = 6, init = 'k-means++', max_iter=300, n_init=10, random_state = 0)
y_kmeans = kmeans.fit_predict(X)

df['Age_Income_Spend_Cluster']= y_kmeans


df.head()
```

	CustomerID	Gender	Age	AnnualIncome	SpendingScore	Cluster	Age_Cluster	Age_Income_Spend_Cluster
0	1	Male	19	15	39	3	3	4
1	2	Male	21	15	81	4	1	5
2	3	Female	20	16	6	3	2	4
3	4	Female	23	16	77	4	1	5
4	5	Female	31	17	40	3	3	4

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```
# Visualising the clusters in a 3D Plot
from mpl_toolkits.mplot3d import Axes3D

fig = plt.figure(figsize = (10,8))
ax = fig.add_subplot(111, projection='3d')
ax.scatter(df['Age'], df['AnnualIncome'], df['SpendingScore'], c=df['Age_Income_Spend_Cluster'], s=50, cmap='viridis')
ax.set_xlabel('Age')
ax.set_ylabel('Annual Income')
ax.set_zlabel('Spending Score')
plt.title('Customer segments')
plt.show()
```