In [82]:
```
%config IPCompleter.greedy=True
```

Given a dataset that contains customer information (such as Age, Income, and Spending Score), perform K-means clustering to group customers into clusters. Use visualization chart, plot the data before and after grouping. Also, use the Elbow Method to determine the optimal number of clusters.

In [106…
```
import matplotlib.pyplot as plt
import pandas as pd
from sklearn.cluster import KMeans
import numpy as np
from sklearn.preprocessing import StandardScaler
```

In [107…
```
df = pd.read_csv("datasets/income_clustering.csv")

df = df[["Age", "Income($)"]]

df.head()
```

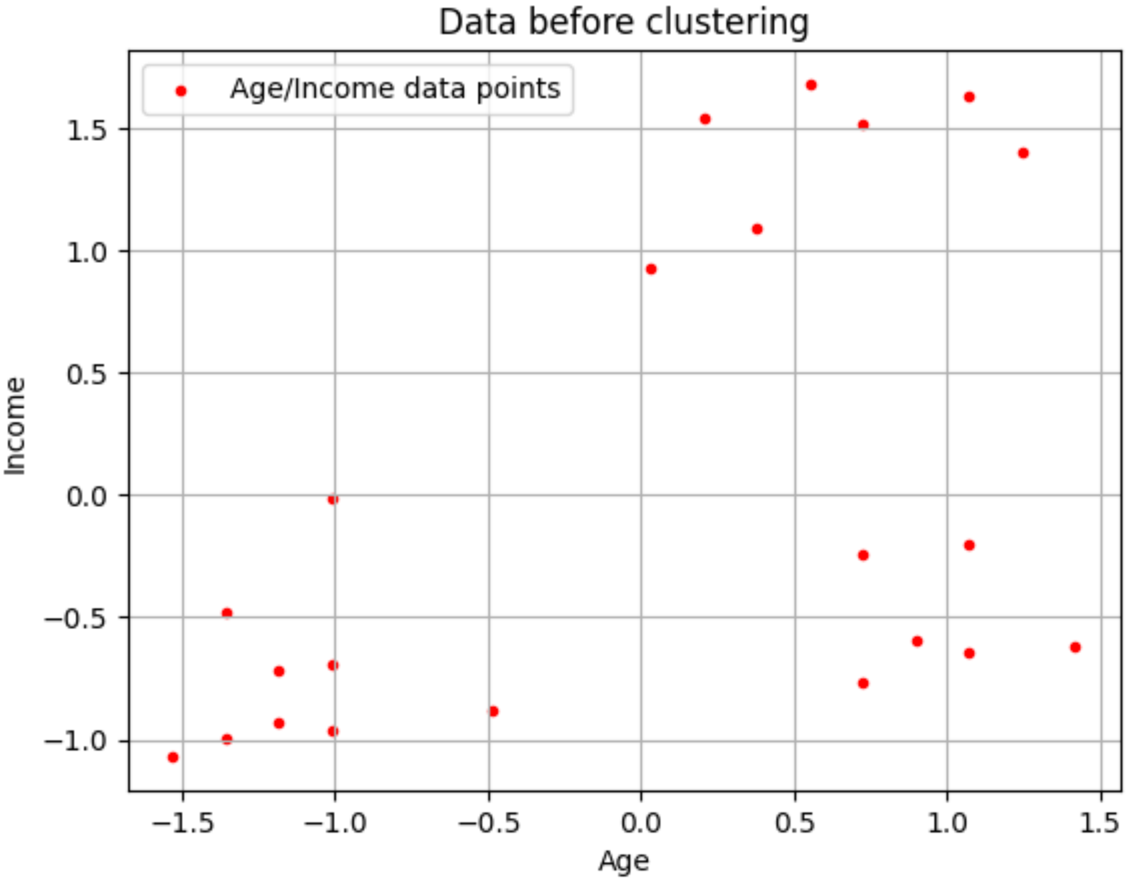
Out[107…
```
   Age  Income($)
0   27      70000
1   29      90000
2   29      61000
3   28      60000
4   42     150000
```

In [108…
```
scaler = StandardScaler()
df_scaled = scaler.fit_transform(df)
df_scaled = pd.DataFrame(df_scaled, columns=df.columns)

df_scaled.head()
```

Out[108…
```
         Age  Income($)
0  -1.356055  -0.480684
1  -1.009157  -0.010159
2  -1.009157  -0.692421
3  -1.182606  -0.715947
4   1.245679   1.401417
```

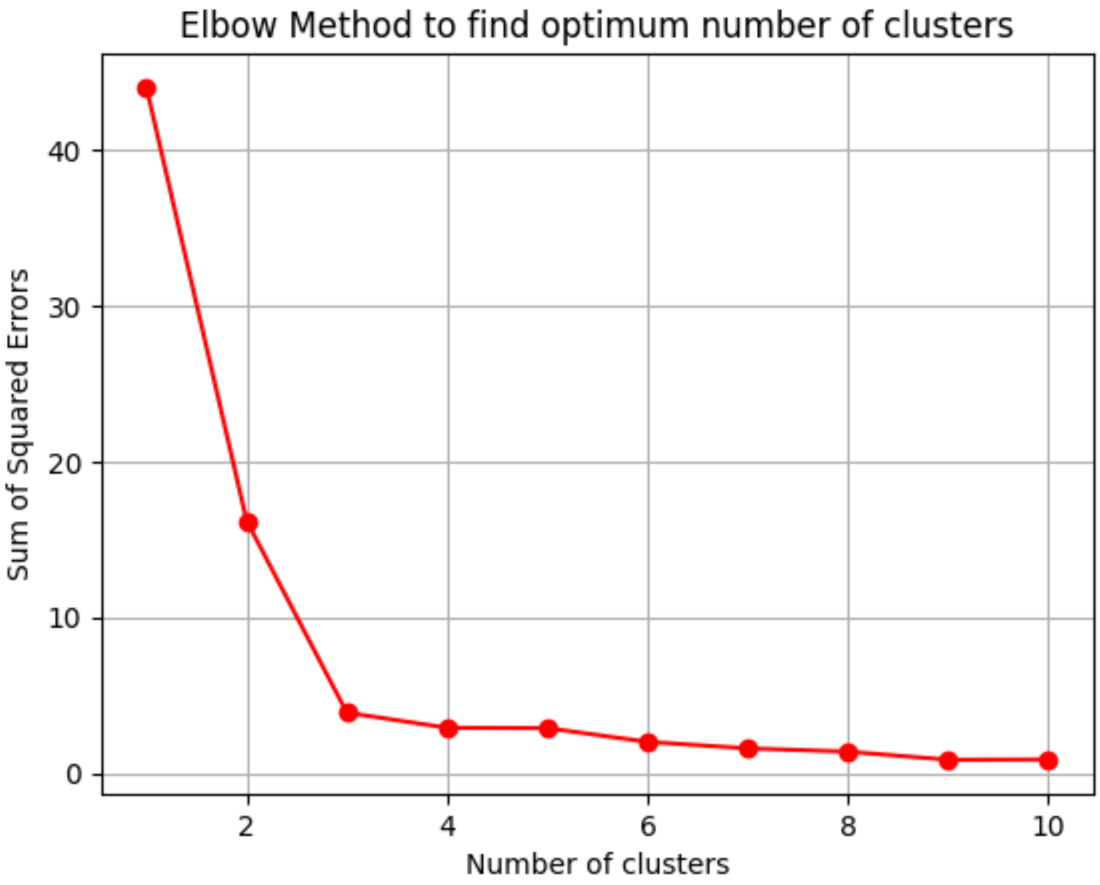
In [109…
```
plt.scatter(df_scaled["Age"], df_scaled["Income($)"], color="red",
marker=".", label="Age/Income data points")
plt.xlabel("Age")
plt.ylabel("Income")
plt.title("Data before clustering")
plt.grid()
plt.legend()
```

Out[109… <matplotlib.legend.Legend at 0x7c151d9aee90>



In [114…

```
inertia = []
for k in range(1, 11):
    km = KMeans(n_clusters=k)
    km.fit(df_scaled)
    inertia.append(km.inertia_)

plt.plot(np.array(range(1, 11)), inertia, marker="o", color="red")
plt.title("Elbow Method to find optimum number of clusters")
plt.xlabel("Number of clusters")
plt.ylabel("Sum of Squared Errors")
plt.grid()
```



In [116…

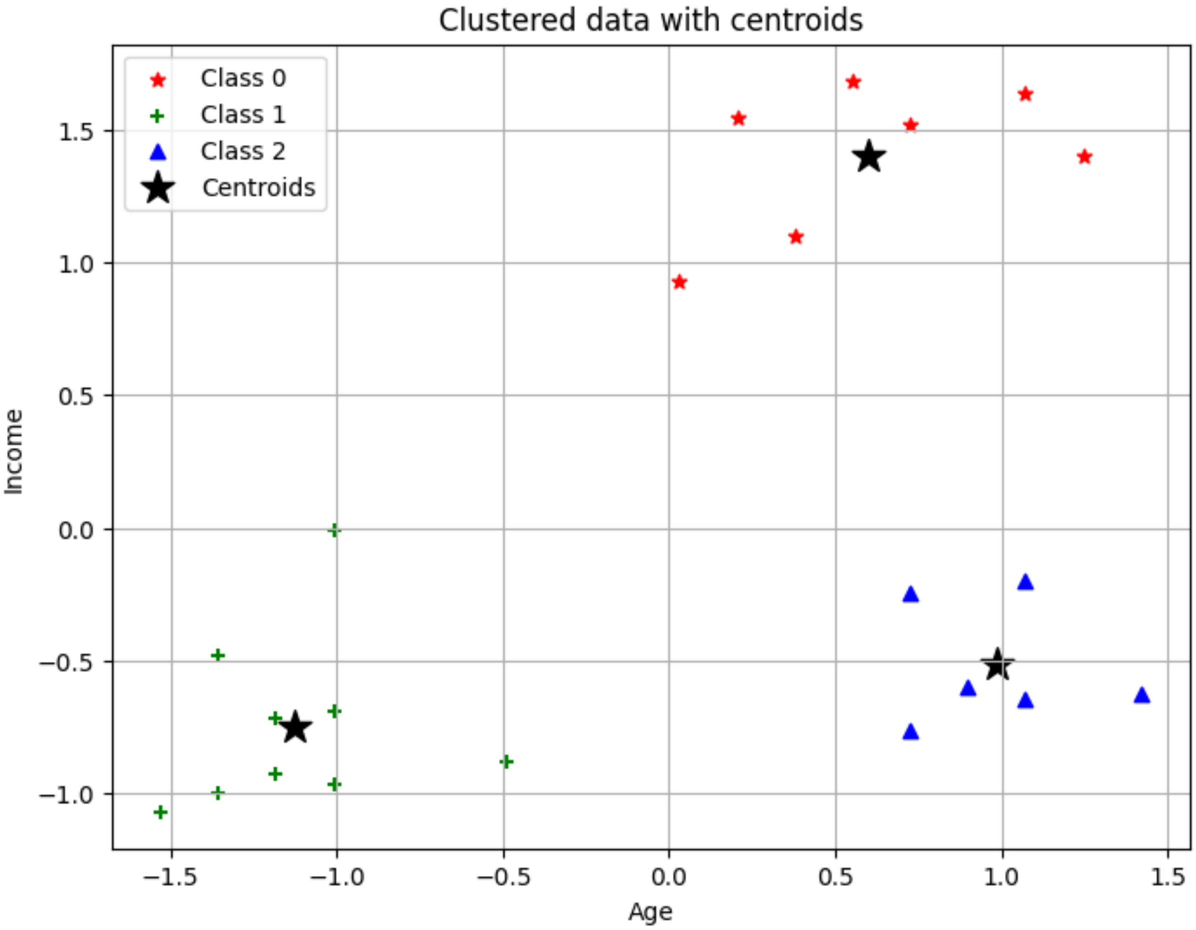
```
km = KMeans(n_clusters=3)

df_scaled["Cluster"] = km.fit_predict(df_scaled)
```

In [132…

```
plt.figure(figsize=(8, 6))

colors = ["r", "g", "b"]
markers = ["*", "+", "^"]

for i in range(3):
    class_points = df_scaled[df_scaled["Cluster"] == i]
    plt.scatter(class_points["Age"], class_points["Income($)"],
marker=markers[i], color=colors[i], label=f"Class {i}")

centroids = km.cluster_centers_
plt.scatter(centroids[:, 0], centroids[:, 1], color="black", s=200,
marker="*", label="Centroids")

plt.xlabel("Age")
plt.ylabel("Income")
plt.title("Clustered data with centroids")
plt.grid()
plt.legend()
```

Out[132…

```
<matplotlib.legend.Legend at 0x7c1513c51090>
```


Clustered data with centroids
Class 0
Class 1
Class 2
Centroids
Income
Age
1.5
1.0
0.5
0.0
−0.5
−1.0
−1.5
−1.0
−0.5
0.0
0.5
1.0
1.5

```
In [ ]:
```