Importing Libraries And Dataset

```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
from sklearn.preprocessing import StandardScaler
from sklearn.cluster import KMeans
from sklearn.metrics import silhouette_score
```

```
df = pd.read_csv("/content/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

Next steps: Generate code with df New interactive sheet

```
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.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.shape
```

```
(200, 5)
```

Fitting K-Means

```
X = df[['Annual Income (k$)', 'Spending Score (1-100)']].values
```

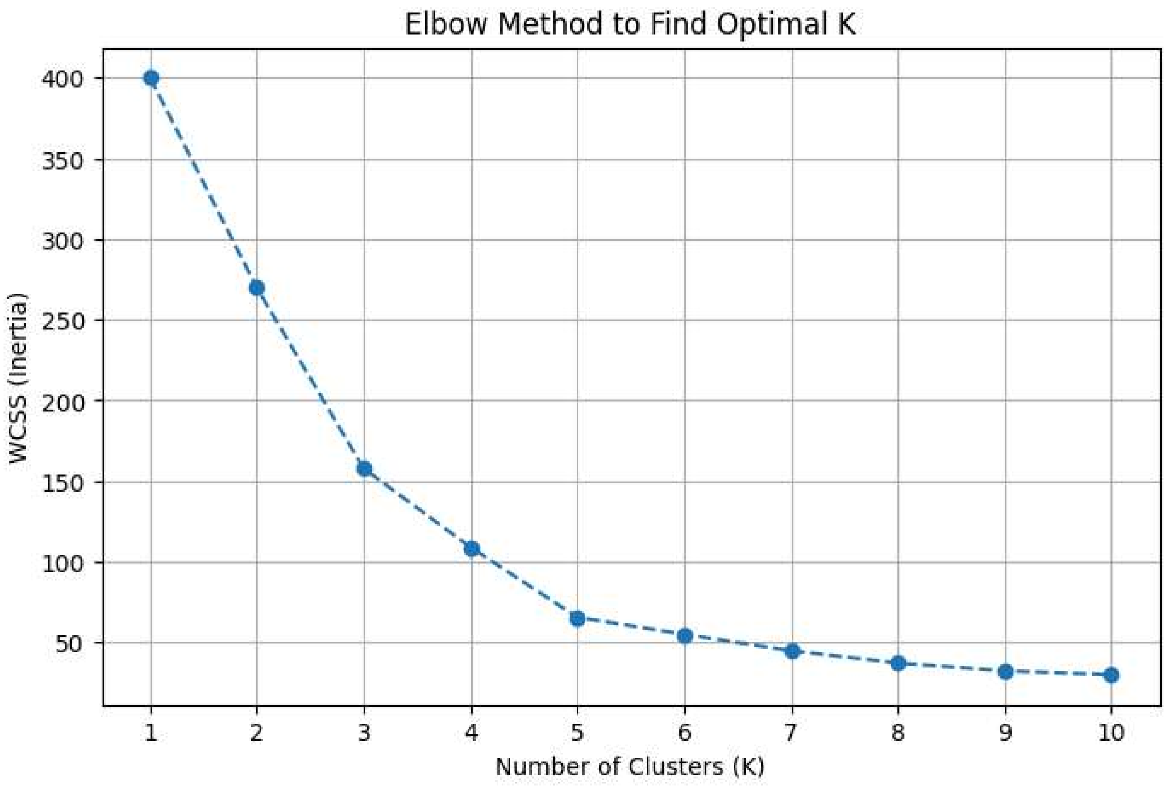
```
scaler = StandardScaler()
X_scaled = scaler.fit_transform(X)
```

```
wcss = []
k_range = range(1, 11)

for k in k_range:
    kmeans = KMeans(n_clusters=k, init='k-means++', max_iter=300, n_init=10,
    kmeans.fit(X_scaled)
    wcss.append(kmeans.inertia_)
```

Elbow Plot

```
plt.figure(figsize=(8, 5))
plt.plot(k_range, wcss, marker='o', linestyle='--')
plt.title('Elbow Method to Find Optimal K')
plt.xlabel('Number of Clusters (K)')
plt.ylabel('WCSS (Inertia)')
plt.xticks(k_range)
plt.grid(True)
plt.show()
```



```
optimal_k = 5
print(f"Fitting K-Means with Optimal K = {optimal_k}")

kmeans_final = KMeans(n_clusters=optimal_k, init='k-means++', max_iter=300,
cluster_labels = kmeans_final.fit_predict(X_scaled)
centroids = kmeans_final.cluster_centers_
```

```
Fitting K-Means with Optimal K = 5
```

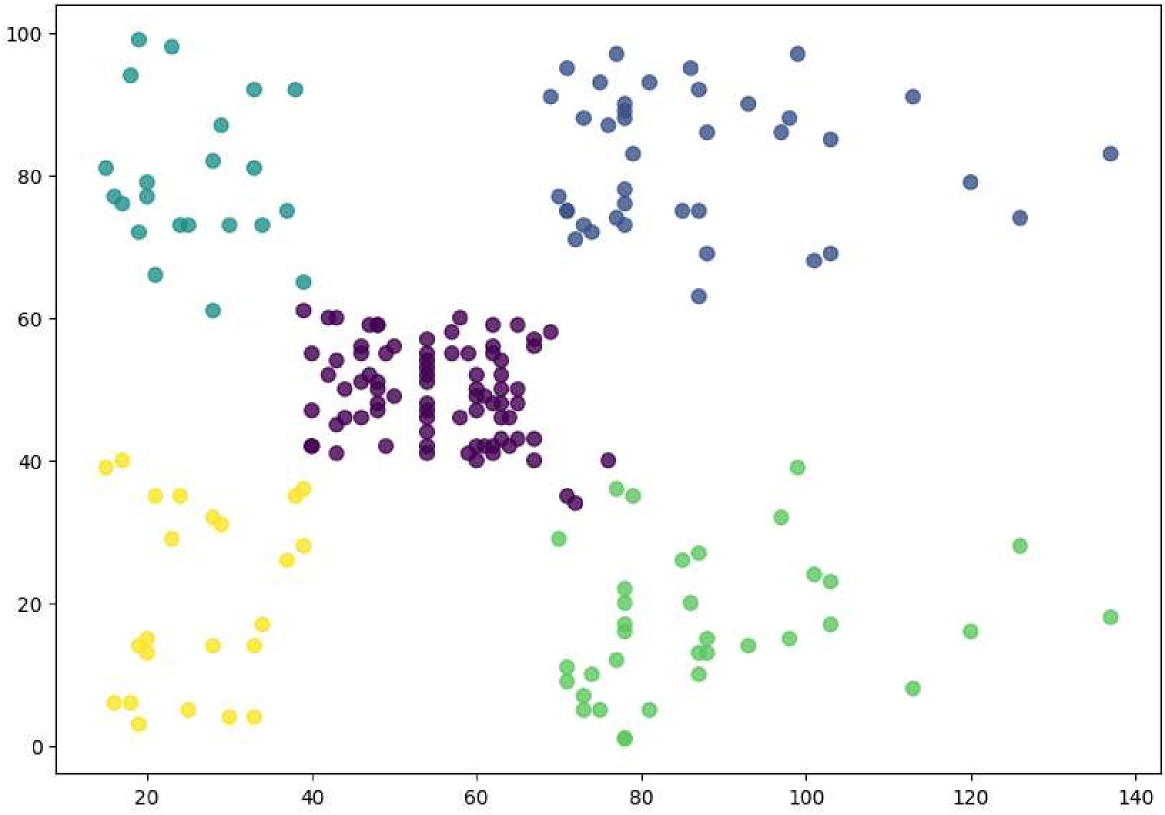
Visualizing Clusters

```
df['Cluster'] = cluster_labels
```

```
plt.figure(figsize=(10, 7))

plt.scatter(X[:, 0], X[:, 1], c=cluster_labels, cmap='viridis', s=50, alpha

X_mean = df['Annual Income (k$)'].mean()
X_std = df['Annual Income (k$)'].std()
Y_mean = df['Spending Score (1-100)'].mean()
Y_std = df['Spending Score (1-100)'].std()
centroids_original_scale = np.array([
    centroids[:, 0] * X_std + X_mean,
```



Silhouette Score

```
score = silhouette_score(X_scaled, cluster_labels)
print(f"Silhouette Score for K={optimal_k}: {score:.5f}")
```

```
Silhouette Score for K=5: 0.55466
```