In [1]:
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
from sklearn.cluster import KMeans
from sklearn.model_selection import train_test_split
```

In [2]:
```
df = pd.read_csv('Mall_Customers.csv')
print('Shape of DataSet is :', df.shape)
```

```
Shape of DataSet is : (200, 5)
```

In [3]:
```
df.isnull().sum()
```

Out[3]:
```
CustomerID                0
Genre                     0
Age                       0
Annual Income (k$)        0
Spending Score (1-100)    0
dtype: int64
```

In [4]:
```
df.head()
```

Out[4]:

	CustomerID	Genre	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

In [5]:
```
X = df[['Annual Income (k$)', 'Spending Score (1-100)']]
```

In [6]:
```
(X_train, X_test) = train_test_split(X, test_size=0.25)
print('Train Size :', X_train.shape)
print('Test Size :', X_test.shape)
```

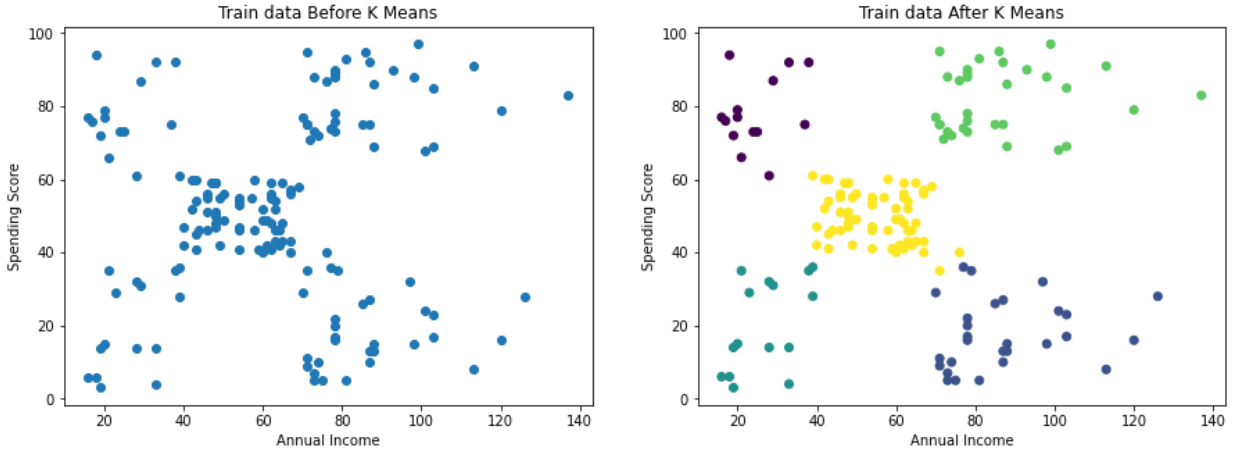
```
Train Size : (150, 2)
Test Size : (50, 2)
```

In [7]:
```
model = KMeans(n_clusters=5, max_iter=10)
model.fit(X_train)
X_train_cluster = model.predict(X_train)
print('Model trained')
```

```
Model trained
```

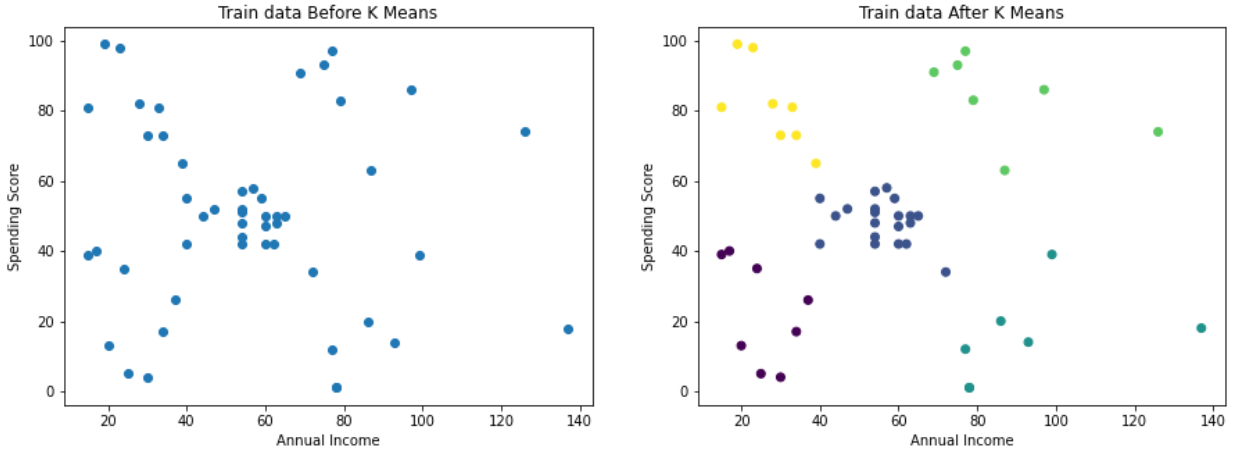
In [8]:
```
(fig, axis) = plt.subplots(1, 2, figsize=(15, 5))
axis[0].scatter(X_train.iloc[:, [0]], X_train.iloc[:, [1]])
axis[0].set_title('Train data Before K Means')
axis[0].set(xlabel = 'Annual Income', ylabel = 'Spending Score')
axis[1].scatter(X_train.iloc[:, [0]], X_train.iloc[:, [1]], c=X_train_cluster)
axis[1].set_title('Train data After K Means')
axis[1].set(xlabel = 'Annual Income', ylabel = 'Spending Score')
```

Out[8]:
```
[Text(0.5, 0, 'Annual Income'), Text(0, 0.5, 'Spending Score')]
```



In [9]:
```
model.fit(X_test)
X_test_cluster = model.predict(X_test)
```

In [10]:
```
(fig, axis) = plt.subplots(1,2, figsize=(15, 5))
axis[0].scatter(X_test.iloc[:, [0]], X_test.iloc[:, [1]])
axis[0].set_title('Train data Before K Means')
axis[0].set(xlabel = 'Annual Income', ylabel ='Spending Score')
axis[1].scatter(X_test.iloc[:, [0]], X_test.iloc[:, [1]], c=X_test_cluster)
axis[1].set_title('Train data After K Means')
axis[1].set(xlabel = 'Annual Income', ylabel ='Spending Score')
plt.show()
```



In [12]:
```
sse = {}

for k in range(1, 10):
    model = KMeans(n_clusters=k, max_iter=100)
    model.fit(X)
    sse[k] = model.inertia_

sse_list = [list(sse.keys()) , list(sse.values())]
plt.figure(figsize = (12, 8))
plt.plot(sse_list[0], sse_list[1])
plt.xlabel('Number of Centroids')
plt.ylabel('Sum Of Squared Error')
plt.title('Performance Evaluation')
plt.show()
```