# Import all necessary libraries

```
import numpy as np
from sklearn.cluster import KMeans
import matplotlib.pyplot as plt
```

# Step 1: Generate random 2D data points

```
np.random.seed(42)  # For reproducibility
data_group1 = np.random.randn(100, 2) + [2, 2]  # Offset group 1
data_group2 = np.random.randn(100, 2) + [6, 6]  # Offset group 2
data_group3 = np.random.randn(100, 2) + [10, 2] # Offset group 3
X = np.vstack([data_group1, data_group2, data_group3])  # Combine groups
```

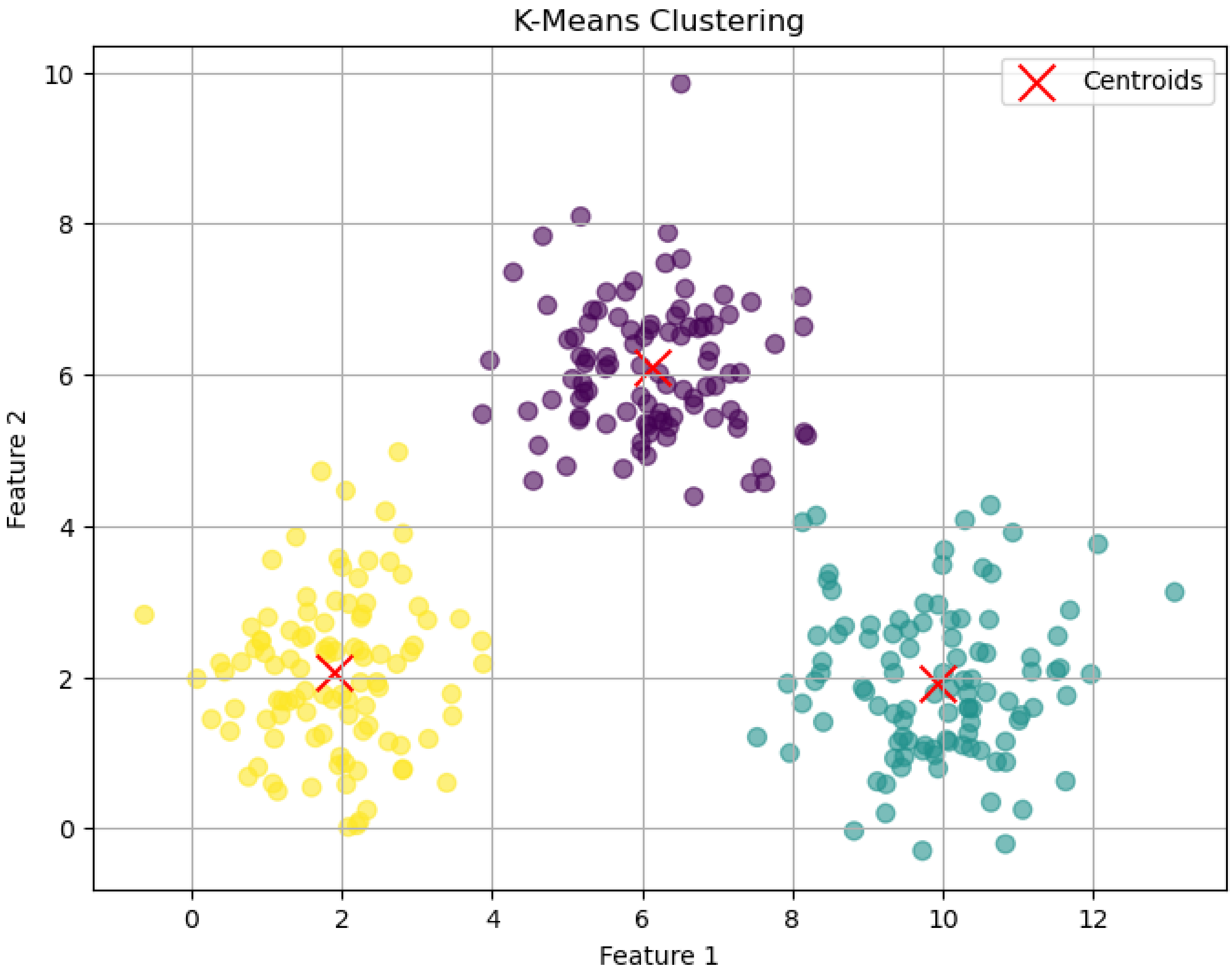
# Step 2: Initialize and fit KMeans model

```
kmeans = KMeans(n_clusters=3, random_state=42)
y_kmeans = kmeans.fit_predict(X)
```

```
C:\Users\Admin\anaconda3\Lib\site-packages\sklearn\cluster\_kmeans.py:1429:
UserWarning: KMeans is known to have a memory leak on Windows with MKL, when there
are less chunks than available threads. You can avoid it by setting the
environment variable OMP_NUM_THREADS=2.
  warnings.warn(
```

# Step 3: Visualize the results

```
plt.figure(figsize=(8, 6))
plt.scatter(X[:, 0], X[:, 1], c=y_kmeans, cmap='viridis', s=50, alpha=0.6)
plt.scatter(kmeans.cluster_centers_[:, 0], kmeans.cluster_centers_[:, 1],
            c='red', marker='x', s=200, label='Centroids')
plt.title('K-Means Clustering')
plt.xlabel('Feature 1')
plt.ylabel('Feature 2')
plt.legend()
plt.grid(True)
plt.show()
```



# Experimenting with different numbers of clusters

```
k_values = [2, 4, 5]  # Different cluster counts
for k in k_values:
    kmeans = KMeans(n_clusters=k, random_state=42)
    y_kmeans = kmeans.fit_predict(X)
    plt.figure(figsize=(8, 6))
    plt.scatter(X[:, 0], X[:, 1], c=y_kmeans, cmap='viridis', s=50, alpha=0.6)
    plt.scatter(kmeans.cluster_centers_[:, 0], kmeans.cluster_centers_[:, 1],
                c='red', marker='x', s=200, label='Centroids')
    plt.title(f'K-Means Clustering with {k} Clusters')
    plt.xlabel('Feature 1')
    plt.ylabel('Feature 2')
    plt.legend()
    plt.grid(True)
    plt.show()
```

```
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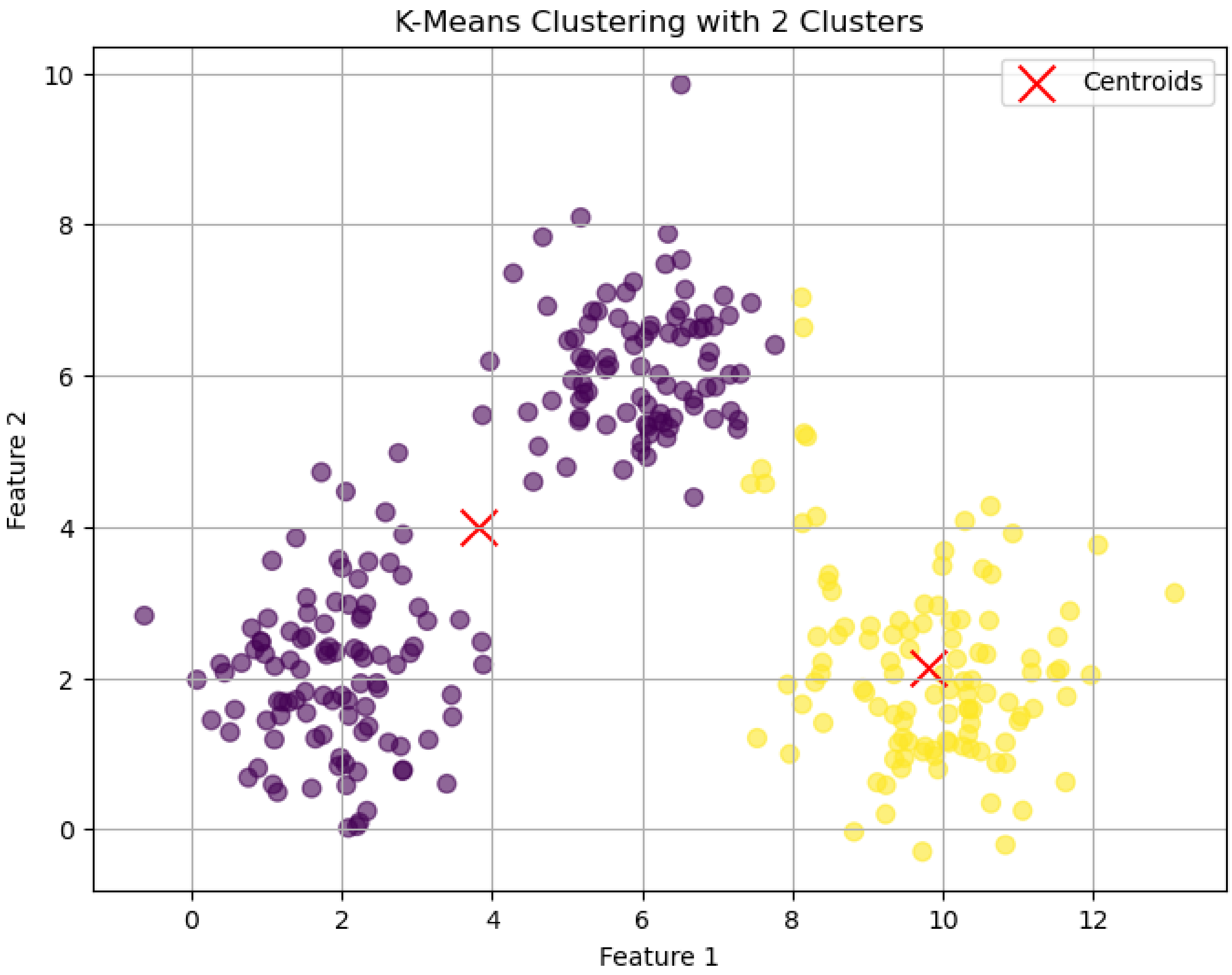

```
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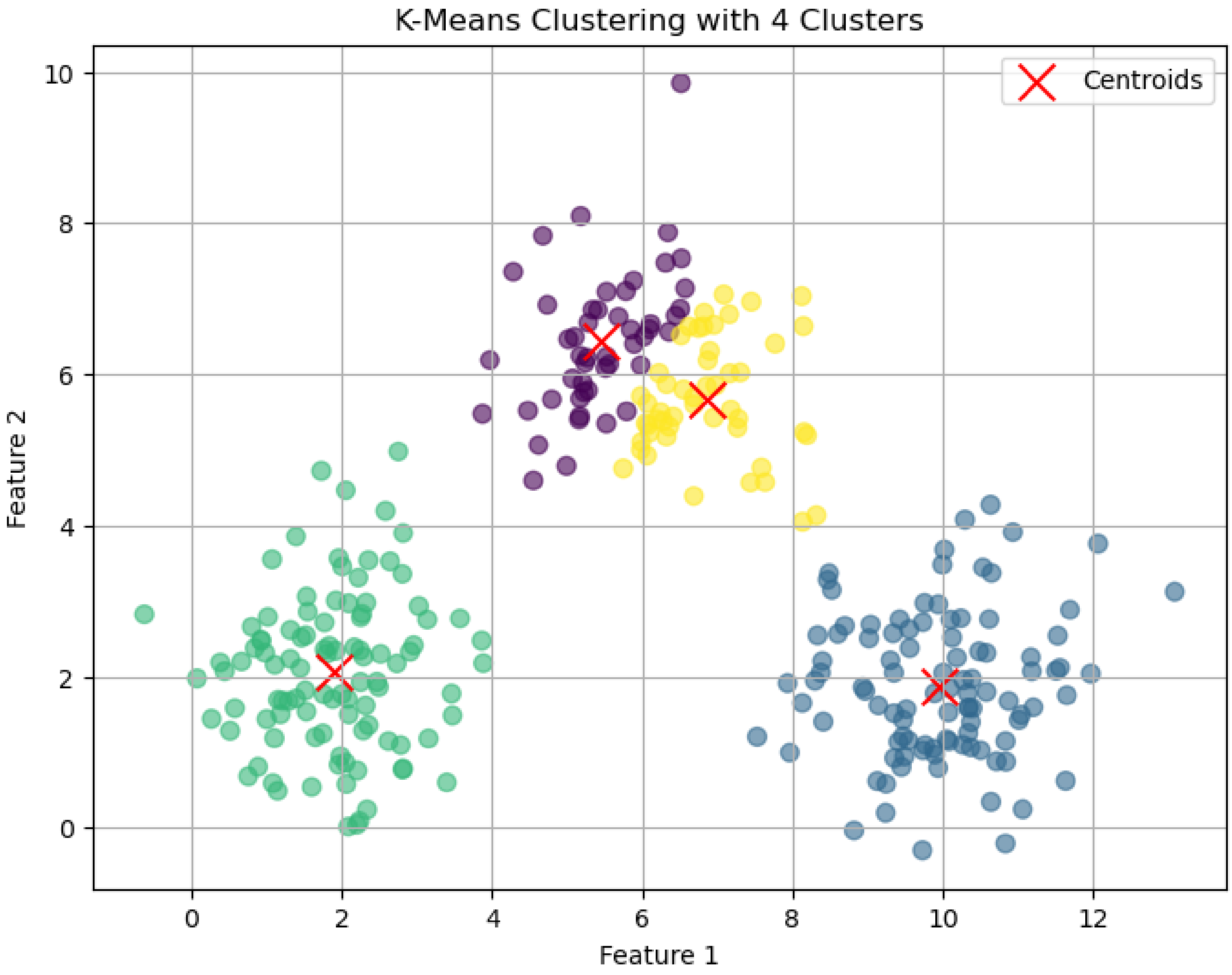

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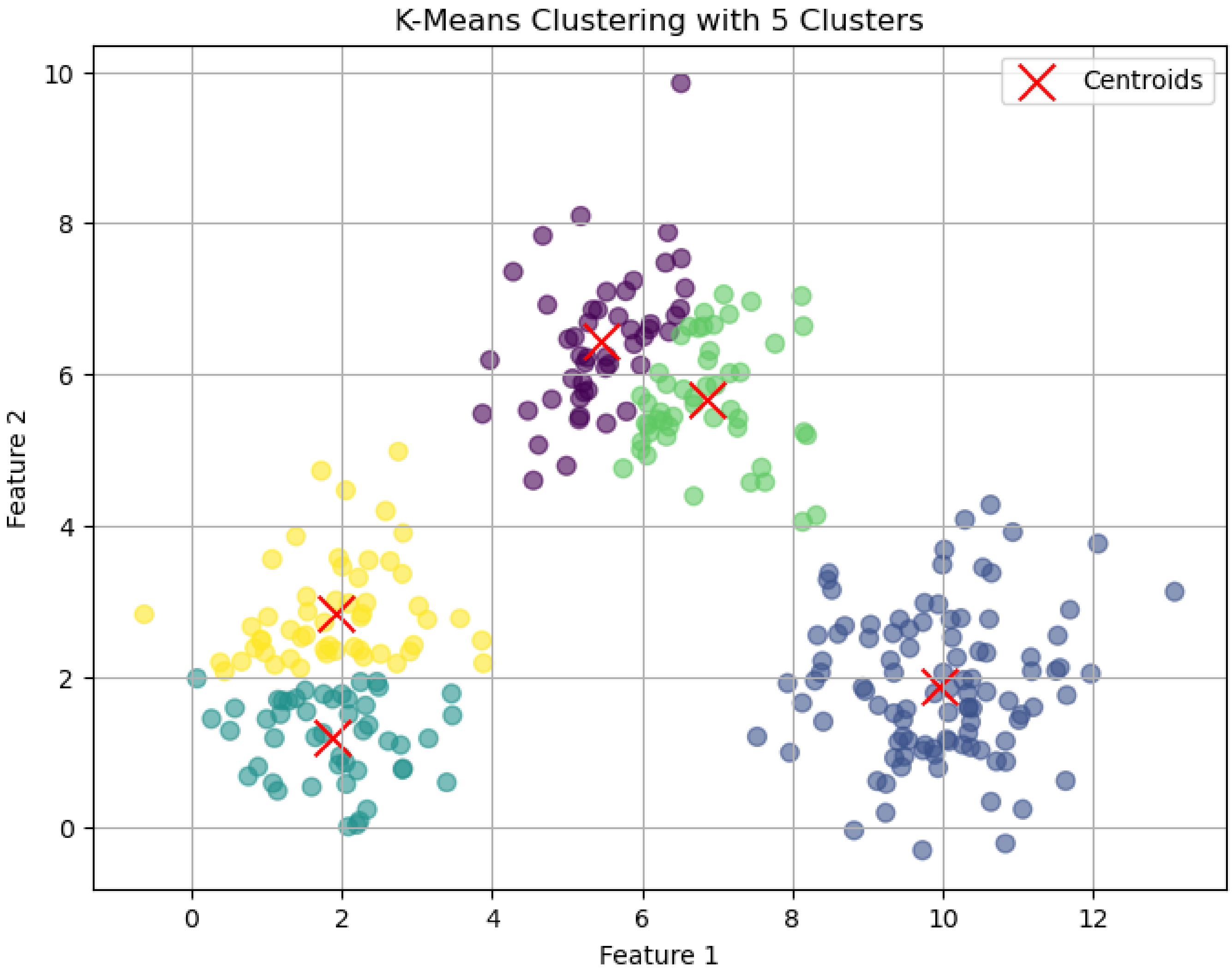
K-Means Clustering with 5 Clusters
Centroids
Feature 1
Feature 2
0
2
4
6
8
10
12
0
2
4
6
8
10