In [1]:
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
from sklearn.cluster import KMeans
from sklearn.preprocessing import StandardScaler
import seaborn as sns
from sklearn.decomposition import PCA


import warnings
warnings.filterwarnings('ignore')
```

In [2]:
```
# Load Iris dataset directly from seaborn
df = sns.load_dataset("iris")

# Display first 5 rows
df
```

Out[2]:

	sepal_length	sepal_width	petal_length	petal_width	species
0	5.1	3.5	1.4	0.2	setosa
1	4.9	3.0	1.4	0.2	setosa
2	4.7	3.2	1.3	0.2	setosa
3	4.6	3.1	1.5	0.2	setosa
4	5.0	3.6	1.4	0.2	setosa
...	...	...	...	...	...
145	6.7	3.0	5.2	2.3	virginica
146	6.3	2.5	5.0	1.9	virginica
147	6.5	3.0	5.2	2.0	virginica
148	6.2	3.4	5.4	2.3	virginica
149	5.9	3.0	5.1	1.8	virginica

150 rows × 5 columns

In [3]:
```
# Select features (attributes) for clustering (e.g., sepal_length, sepal_width, petal_length, petal_width)
X = df.iloc[:, 1:-1]  # Exclude the first column (id) and the last column (species)
```

In [18]:
```
X
```

Out[18]:

	sepal_width	petal_length	petal_width
0	3.5	1.4	0.2
1	3.0	1.4	0.2
2	3.2	1.3	0.2
3	3.1	1.5	0.2
4	3.6	1.4	0.2
...	...	...	...
145	3.0	5.2	2.3
146	2.5	5.0	1.9
147	3.0	5.2	2.0
148	3.4	5.4	2.3
149	3.0	5.1	1.8

150 rows × 3 columns

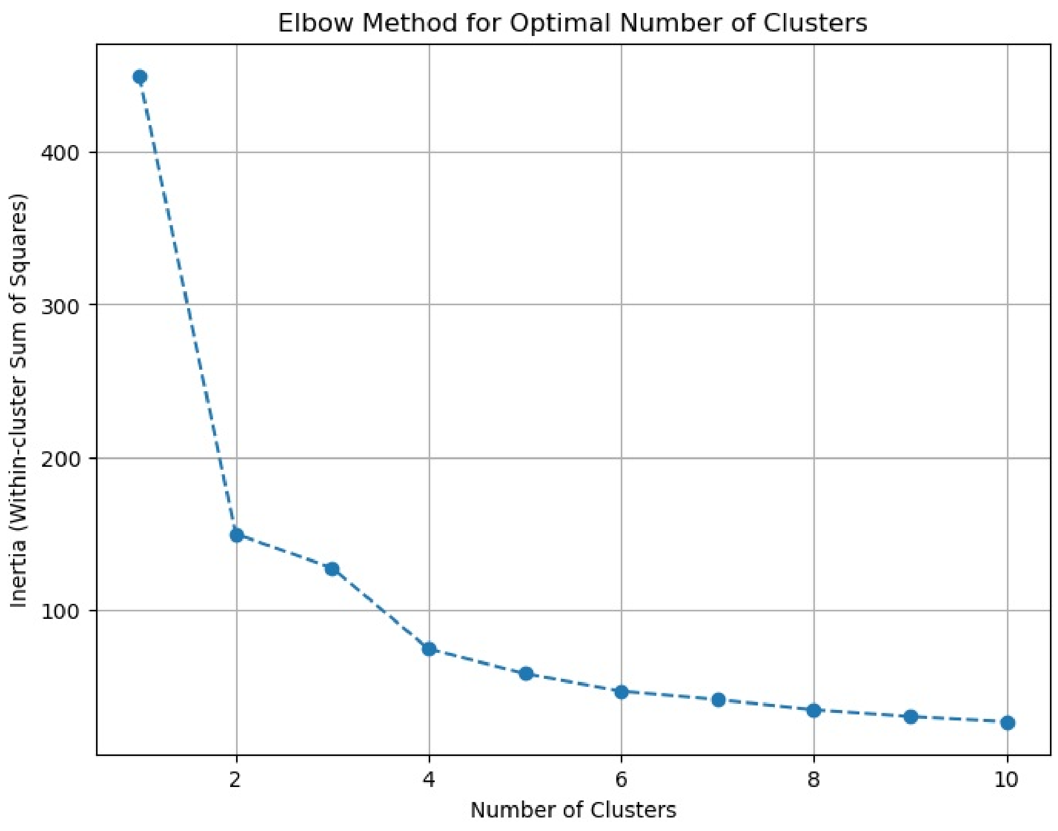
In [4]:
```
# Standardize the feature matrix (important for K-Means)
scaler = StandardScaler()
X_scaled = scaler.fit_transform(X)
```

In [20]:
```
# Determine the optimal number of clusters using the elbow method
inertia = []
for k in range(1, 11):
    kmeans = KMeans(n_clusters=k, random_state=42)
    kmeans.fit(X_scaled)
    inertia.append(kmeans.inertia_)
```

```
In [22]: inertia
```

```
Out[22]: [450.0,
          149.5644912164707,
          127.31742412220018,
          74.24391953311728,
          57.94932812049257,
          46.507154272195756,
          40.97340775686134,
          34.29606921621072,
          29.819669802832685,
          26.442321160268044]
```

```
In [7]: # Plot the elbow curve
        plt.figure(figsize=(8, 6))
        plt.plot(range(1, 11), inertia, marker='o', linestyle='--')
        plt.xlabel('Number of Clusters')
        plt.ylabel('Inertia (Within-cluster Sum of Squares)')
        plt.title('Elbow Method for Optimal Number of Clusters')
        plt.grid()
        plt.show()
```



```
In [ ]:
```

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