```
import pandas as pd
import numpy as np

from sklearn.model_selection import train_test_split
from sklearn.linear_model import LogisticRegression
from sklearn.naive_bayes import GaussianNB
from sklearn.metrics import accuracy_score

data = pd.read_csv("iris.csv")
data
```

	sepal.length	sepal.width	petal.length	petal.width	variety
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 x 5 columns]

```
data.replace("?", np.nan, inplace=True)
data.dropna(inplace=True)
data.isnull().sum()
```

```
sepal.length    0
sepal.width     0
petal.length    0
petal.width     0
variety         0
dtype: int64
```

```
for column in ["sepal.length", "sepal.width", "petal.length",
"petal.width"]:
    data = data[data[column] >= 0]

negative_values = (data[["sepal.length", "sepal.width",
"petal.length", "petal.width"]] < 0).any()
negative_values
```

```
sepal.length    False
sepal.width     False
petal.length    False
petal.width     False
dtype: bool
```

```
from scipy.stats import zscore
z_scores = data[['sepal.length', 'sepal.width', 'petal.length',
'petal.width']].apply(zscore)
data = data[(z_scores.abs() <= 3).all(axis=1)]

z_scores_after = data[['sepal.length', 'sepal.width', 'petal.length',
'petal.width']].apply(zscore)
outliers_after_removal = (z_scores_after.abs() > 3).any(axis=1).sum()
print(f"Number of outliers remaining: {outliers_after_removal}")
print("After outlier removal:", data.shape)
```

```
Number of outliers remaining: 0
After outlier removal: (149, 5)
```

```
from sklearn.preprocessing import StandardScaler
scaler = StandardScaler()
data[["sepal.length", "sepal.width", "petal.length", "petal.width"]] =
scaler.fit_transform(data[["sepal.length", "sepal.width",
"petal.length", "petal.width"]])

data.head()
```

	sepal.length	sepal.width	petal.length	petal.width	variety
0	-0.898927	1.071184	-1.351829	-1.323014	Setosa
1	-1.140478	-0.114599	-1.351829	-1.323014	Setosa
2	-1.382029	0.359714	-1.408792	-1.323014	Setosa
3	-1.502804	0.122557	-1.294865	-1.323014	Setosa
4	-1.019702	1.308340	-1.351829	-1.323014	Setosa

```
from sklearn.preprocessing import LabelEncoder
encoder = LabelEncoder()
data['variety'] = encoder.fit_transform(data['variety'])

data.head()
```

	sepal.length	sepal.width	petal.length	petal.width	variety
0	-0.898927	1.071184	-1.351829	-1.323014	0
1	-1.140478	-0.114599	-1.351829	-1.323014	0
2	-1.382029	0.359714	-1.408792	-1.323014	0
3	-1.502804	0.122557	-1.294865	-1.323014	0
4	-1.019702	1.308340	-1.351829	-1.323014	0

```
X = data[["sepal.length", "sepal.width", "petal.length",
"petal.width"]]
# X = data.drop("variety", axis=1)
y = data["variety"]

X_train, X_test, y_train, y_test = train_test_split(X, y,
test_size=0.3, random_state=42)
```

```
log_reg = LogisticRegression()
log_reg.fit(X_train, y_train)
log_reg_pred = log_reg.predict(X_test)
log_reg_acc = accuracy_score(y_test, log_reg_pred)

nb_model = GaussianNB()
nb_model.fit(X_train, y_train)
nb_pred = nb_model.predict(X_test)
nb_acc = accuracy_score(y_test, nb_pred)

print("Logistic Regression Accuracy:", log_reg_acc)
print("Naive Bayes Accuracy:", nb_acc)
```

```
Logistic Regression Accuracy: 0.9111111111111111
Naive Bayes Accuracy: 0.8666666666666667
```

```
print(classification_report(y_test, log_reg_pred,
target_names=["Setosa","Versicolour","Virginica"]))
```

```
              precision    recall  f1-score   support

      Setosa       1.00      1.00      1.00        19
 Versicolour       0.91      0.77      0.83        13
   Virginica       0.80      0.92      0.86        13

    accuracy                           0.91        45
   macro avg       0.90      0.90      0.90        45
weighted avg       0.92      0.91      0.91        45
```

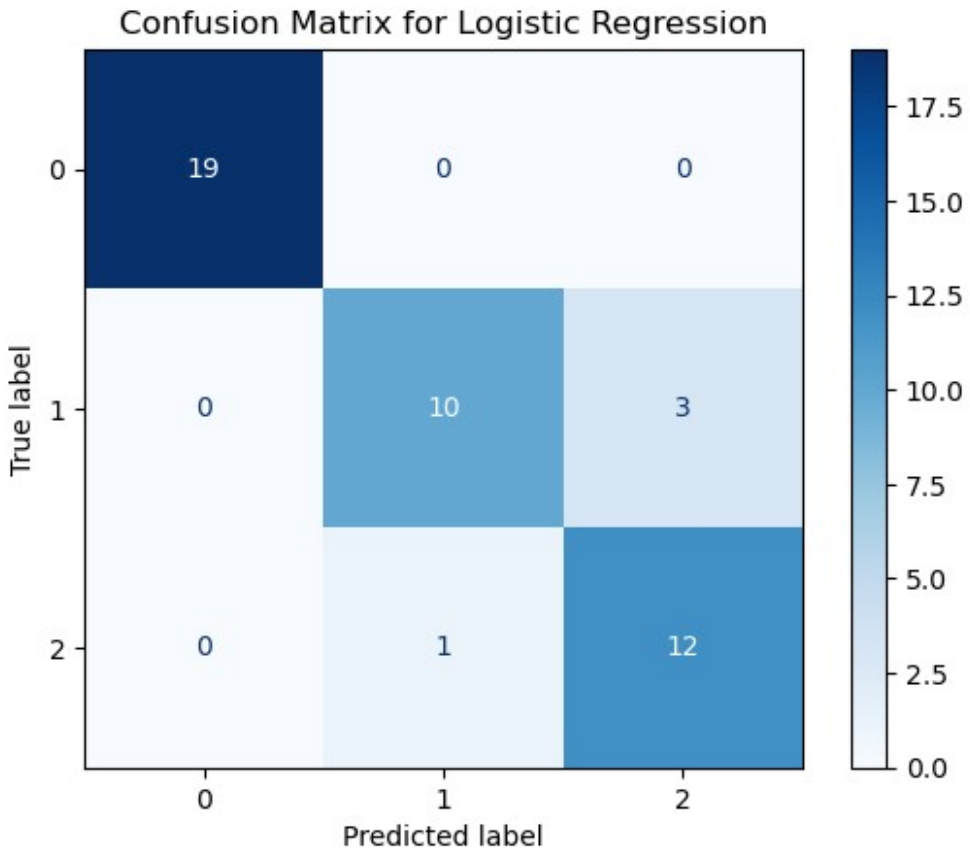
```
conf_lr = confusion_matrix(y_test, log_reg_pred)
print(f'confusion matrix: \n {conf_lr}')
```

```
confusion matrix:
 [[19  0  0]
 [ 0 10  3]
 [ 0  1 12]]
```

```
# Import necessary libraries for confusion matrix
from sklearn.metrics import accuracy_score, classification_report,
confusion_matrix
import matplotlib.pyplot as plt

# Confusion Matrix for Logistic Regression
log_reg_cm = confusion_matrix(y_test, log_reg_pred)

# Plot confusion matrix for Logistic Regression
log_reg_disp = ConfusionMatrixDisplay(confusion_matrix=log_reg_cm,
display_labels=encoder.classes_)
log_reg_disp.plot(cmap=plt.cm.Blues)
plt.title("Confusion Matrix for Logistic Regression")
plt.show()
```




```
print(classification_report(y_test, nb_pred,
target_names=["Setosa","Versicolour","Virginica"]))
```

```
              precision    recall  f1-score   support

      Setosa       1.00      1.00      1.00        19
 Versicolour       0.89      0.62      0.73        13
   Virginica       0.71      0.92      0.80        13

    accuracy                           0.87        45
   macro avg       0.86      0.85      0.84        45
weighted avg       0.88      0.87      0.86        45
```

```
conf_lr = confusion_matrix(y_test, nb_pred)
print(f'confusion matrix: \n {conf_lr}')
```

```
confusion matrix:
 [[19  0  0]
 [ 0  8  5]
 [ 0  1 12]]
```

```
# Confusion Matrix for Naive Bayes
nb_cm = confusion_matrix(y_test, nb_pred)
```

```
# Plot confusion matrix for Naive Bayes
nb_disp = ConfusionMatrixDisplay(confusion_matrix=nb_cm,
display_labels=encoder.classes_)
nb_disp.plot(cmap=plt.cm.Blues)
plt.title("Confusion Matrix for Naive Bayes")
plt.show()
```