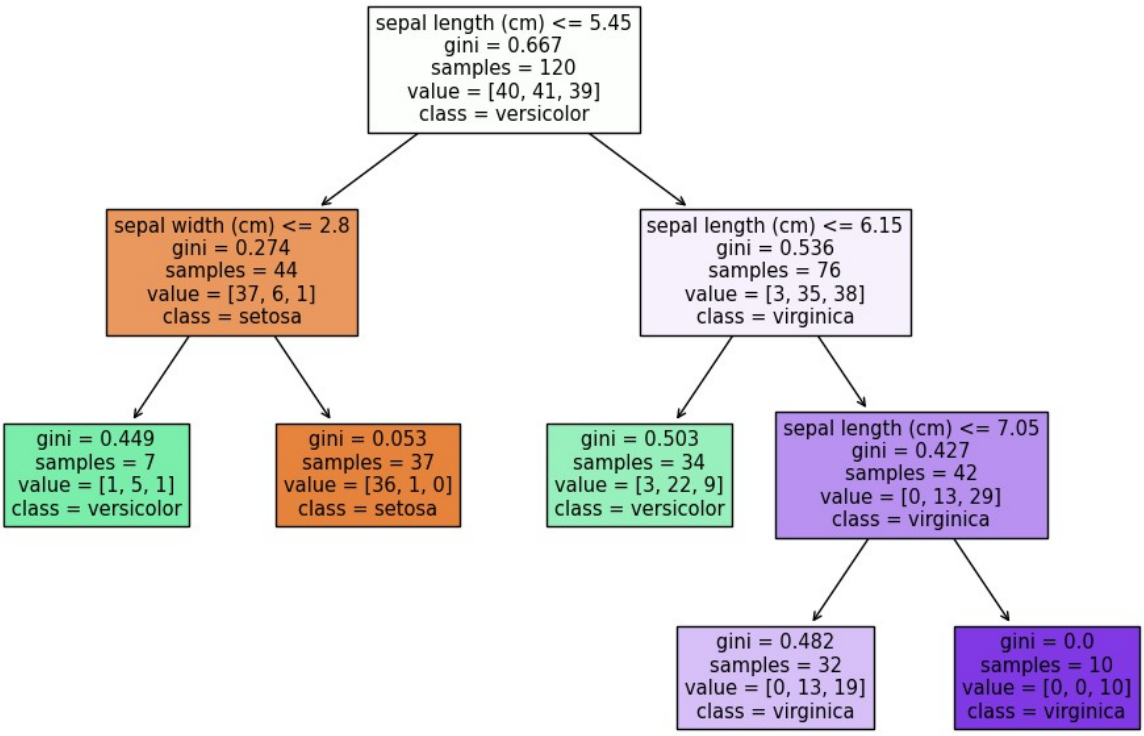
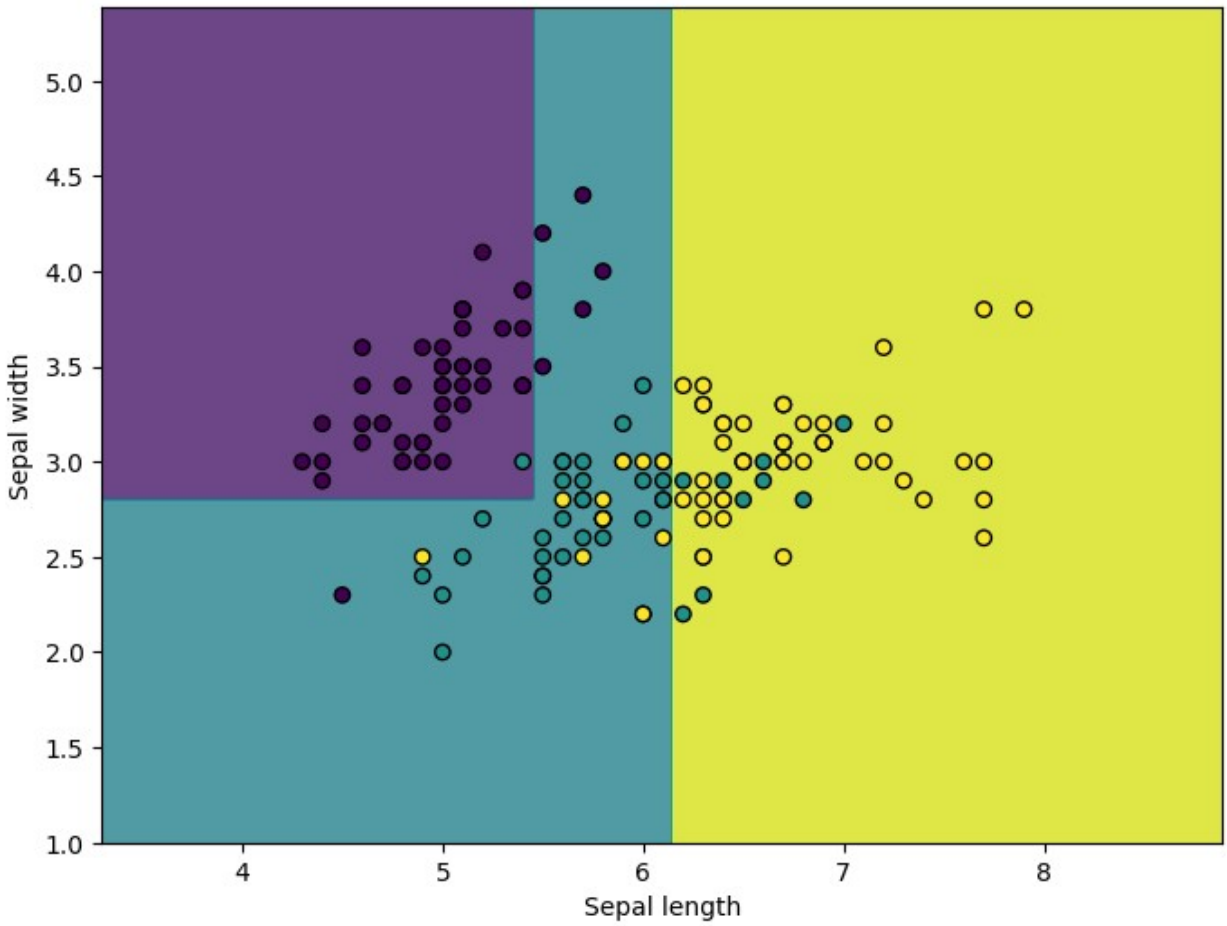
```
from sklearn.datasets import load_iris
from sklearn.model_selection import train_test_split
from sklearn.tree import DecisionTreeClassifier, plot_tree
from sklearn.metrics import accuracy_score
import matplotlib.pyplot as plt
import numpy as np
from sklearn.tree import export_text

# Load iris dataset
iris = load_iris()
X = iris.data[:, :2]  # we only take the first two features.
y = iris.target

# Split data into training and testing sets
X_train, X_test, y_train, y_test = train_test_split(X, y,
test_size=0.2, random_state=42)

# Train a DecisionTreeClassifier
clf = DecisionTreeClassifier(max_depth=3,min_samples_split=40)
clf.fit(X_train, y_train)

# Check accuracy
y_pred = clf.predict(X_test)
print(f"Accuracy: {accuracy_score(y_test, y_pred)}")

# Plot the decision tree
plt.figure(figsize=(12, 8))
plot_tree(clf, filled=True, feature_names=iris.feature_names[:2],
class_names=iris.target_names)
plt.show()

# Plot the decision boundary
plt.figure(figsize=(8, 6))
x_min, x_max = X[:, 0].min() - 1, X[:, 0].max() + 1
y_min, y_max = X[:, 1].min() - 1, X[:, 1].max() + 1
xx, yy = np.meshgrid(np.arange(x_min, x_max, 0.01),
                     np.arange(y_min, y_max, 0.01))

Z = clf.predict(np.c_[xx.ravel(), yy.ravel()])
Z = Z.reshape(xx.shape)

plt.contourf(xx, yy, Z, alpha=0.8)
plt.scatter(X[:, 0], X[:, 1], c=y, edgecolor='k')
plt.xlabel('Sepal length')
plt.ylabel('Sepal width')
plt.show()

Accuracy: 0.8
```


sepal length (cm) <= 5.45
gini = 0.667
samples = 120
value = [40, 41, 39]
class = versicolor
sepal width (cm) <= 2.8
gini = 0.274
samples = 44
value = [37, 6, 1]
class = setosa
sepal length (cm) <= 6.15
gini = 0.536
samples = 76
value = [3, 35, 38]
class = virginica
gini = 0.449
samples = 7
value = [1, 5, 1]
class = versicolor
gini = 0.053
samples = 37
value = [36, 1, 0]
class = setosa
gini = 0.503
samples = 34
value = [3, 22, 9]
class = versicolor
sepal length (cm) <= 7.05
gini = 0.427
samples = 42
value = [0, 13, 29]
class = virginica
gini = 0.482
samples = 32
value = [0, 13, 19]
class = virginica
gini = 0.0
samples = 10
value = [0, 0, 10]
class = virginica




```
r = export_text(clf, feature_names=['sepal_length','sepal_width'])
print(r)
```

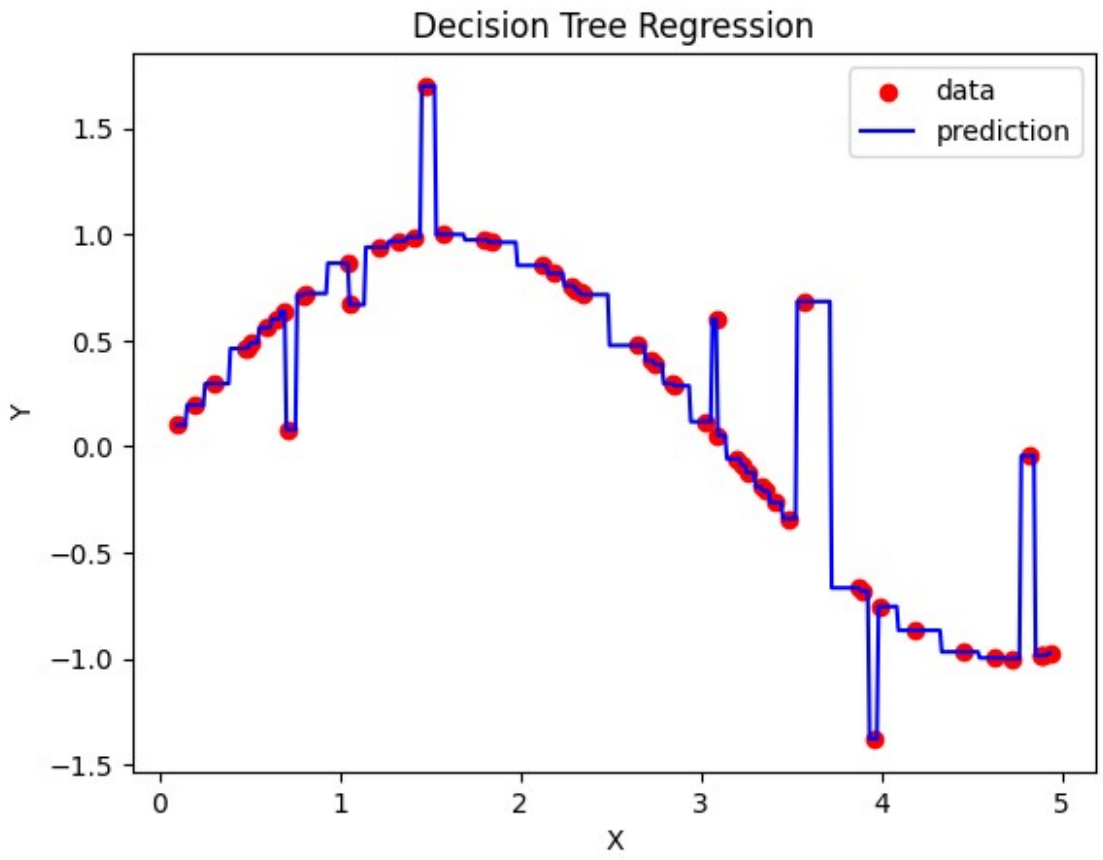
```
|--- sepal_length <= 5.45
|   |--- sepal_width <= 2.80
|   |   |--- class: 1
|   |--- sepal_width >  2.80
|   |   |--- class: 0
|--- sepal_length >  5.45
|   |--- sepal_length <= 6.15
|   |   |--- class: 1
|   |--- sepal_length >  6.15
|   |   |--- class: 2
```

```
clf.feature_importances_
```

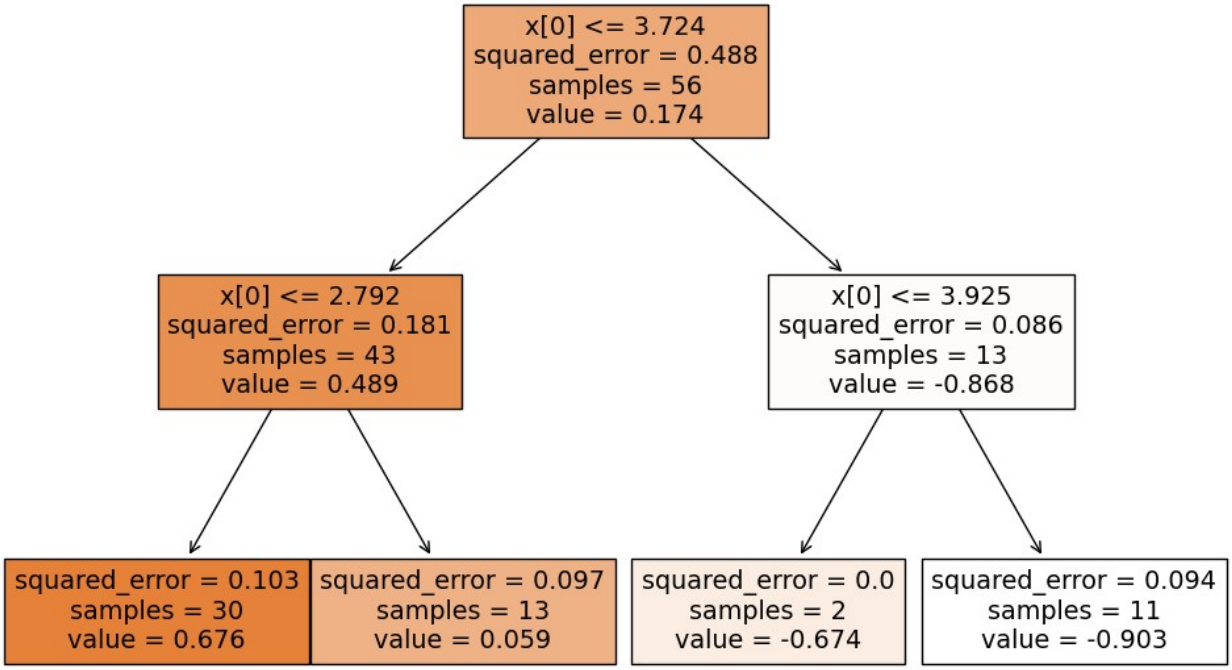
```
array([0.8253173, 0.1746827])
```

```
from sklearn.model_selection import train_test_split
from sklearn.tree import DecisionTreeRegressor
import matplotlib.pyplot as plt
```

```
import numpy as np

# Generate a non-linear dataset based on the sine function
np.random.seed(0)
X = np.sort(5 * np.random.rand(80, 1), axis=0)
y = np.sin(X).ravel()
y[::5] += 3 * (0.5 - np.random.rand(16))  # add some noise to the data

# Split into training and testing datasets
X_train, X_test, y_train, y_test = train_test_split(X, y,
test_size=0.3, random_state=42)

# Fit a Decision Tree regressor
regressor = DecisionTreeRegressor()
regressor.fit(X_train, y_train)

# To plot the regression curve, we'll sort the X values and predict Y
values for the sorted X
X_grid = np.arange(min(X), max(X), 0.01)[:, np.newaxis]
y_grid = regressor.predict(X_grid)

# Plot the training data and the regression curve
plt.scatter(X_train, y_train, color='red', label='data')
plt.plot(X_grid, y_grid, color='blue', label='prediction')
plt.title('Decision Tree Regression')
plt.xlabel('X')
plt.ylabel('Y')
plt.legend()
plt.show()
```




```
from sklearn.tree import plot_tree
# Plot the decision tree
plt.figure(figsize=(12, 8))
plot_tree(regressor, filled=True)
plt.show()
```


x[0] <= 3.724
squared_error = 0.488
samples = 56
value = 0.174
x[0] <= 2.792
squared_error = 0.181
samples = 43
value = 0.489
x[0] <= 3.925
squared_error = 0.086
samples = 13
value = -0.868
squared_error = 0.103
samples = 30
value = 0.676
squared_error = 0.097
samples = 13
value = 0.059
squared_error = 0.0
samples = 2
value = -0.674
squared_error = 0.094
samples = 11
value = -0.903