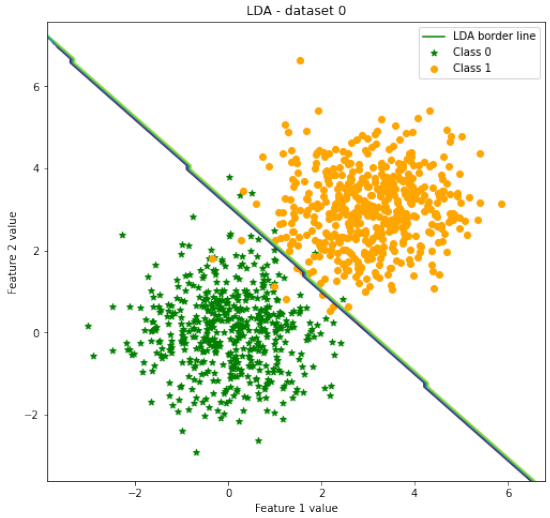
For one chosen setting of parameters (e.g. a = 2, ρ = 0.5) generate a scatter plot showing observations from training set.

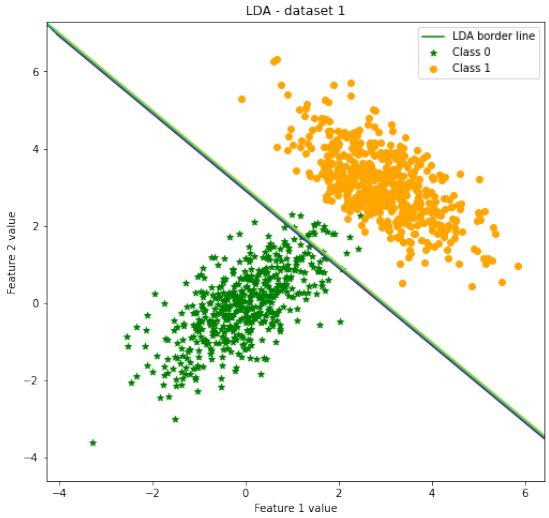
Mark observations belonging to different classes using two different colors and two different symbols.

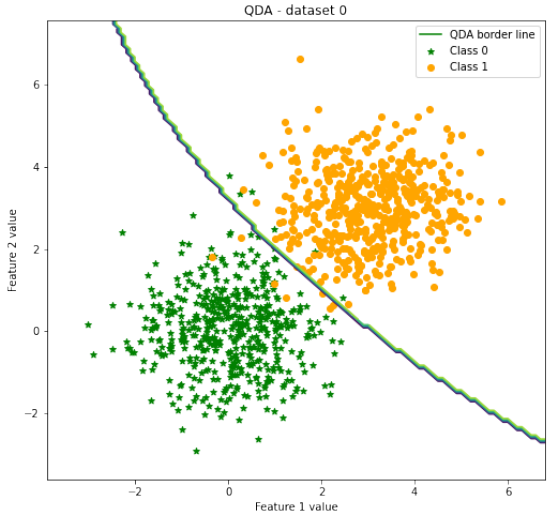
Draw curves that separate classes for LDA and QDA. Save the results in the file BayesianSimulatedData3.pdf

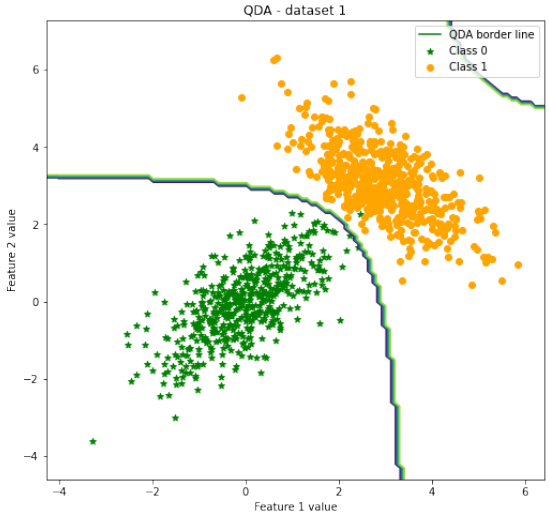
```
import matplotlib.pyplot as plt
import numpy as np

from tools import generate_y, generate_data_1, generate_data_2
from tools import train_test_split

from BinaryClassifiers import BinaryClassifier, LDA, QDA, NaiveBayes

np.random.seed(1337)

prob = 0.5
n = 1000

mean = 0
variance = 1


alpha = 3
rho = 0.7

models = (LDA, QDA, NaiveBayes)

def draw_all(
        models: list[BinaryClassifier],
        datasets: list[np.array]
        ) -> None:

    fig, axs = plt.subplots(3, 2, figsize=(20, 30))
    fig.subplots_adjust(hspace=0.4, wspace=0.4)

    for j, data in enumerate(datasets):
        train, _, = train_test_split(data, 0.7)

        for i, model in enumerate(models):
            model_instance: BinaryClassifier = model()
            model_instance.fit(train[:, 1:], train[:, 0])

            axs[i, j].set_title(f"{model_instance.name} - dataset
{j}")

            xx, yy, z = model_instance.find_border()
            contour = axs[i, j].contour(xx, yy, z)
```

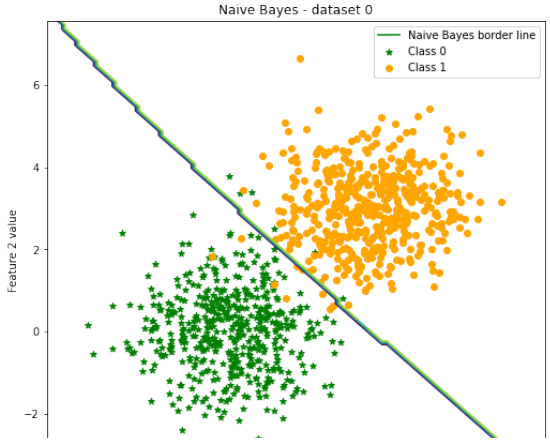
```
            axs[i, j].clabel(contour, fontsize=0)
            axs[i, j].plot(
                [], [], "g",
                label=f"{model_instance.name} border line"
                )

            y0 = data[:, 0] == 0
            axs[i, j].scatter(
                data[y0][:, 1],
                data[y0][:, 2],
                color="green",
                marker="*",
                label="Class 0"
                )

            y1 = data[:, 0] == 1
            axs[i, j].scatter(
                data[y1][:, 1],
                data[y1][:, 2],
                color="orange",
                marker="o",
                label="Class 1"
                )

            axs[i, j].legend()
            axs[i, j].set_xlabel("Feature 1 value")
            axs[i, j].set_ylabel("Feature 2 value")

    plt.savefig("plots/modesl_comparation_0_1_datasets.jpg")
    plt.show()

y = generate_y(prob, n)
data_1 = generate_data_1(y, mean, alpha, variance)
data_2 = generate_data_2(y, rho, alpha)

draw_all((LDA, QDA, NaiveBayes), (data_1, data_2))
```

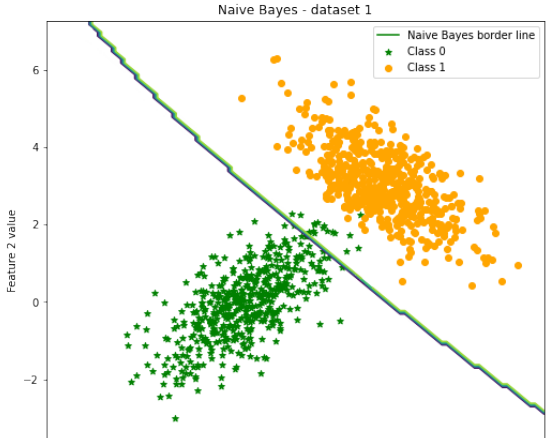

LDA - dataset 0
LDA border line
Class 0
Class 1
Feature 2 value
Feature 1 value


LDA - dataset 1
LDA border line
Class 0
Class 1
Feature 2 value
Feature 1 value


QDA - dataset 0
QDA border line
Class 0
Class 1
Feature 2 value
Feature 1 value


QDA - dataset 1
QDA border line
Class 0
Class 1
Feature 2 value
Feature 1 value


Naive Bayes - dataset 0
Naive Bayes border line
Class 0
Class 1
Feature 2 value


Naive Bayes - dataset 1
Naive Bayes border line
Class 0
Class 1
Feature 2 value

It can be seen here that QDA performs best due to its quadratic form.

LDA is the worst due to its rigid linearity, and Naive Bayes is slightly better.