1. Optimization Homework

In the scope of this homework, you are asked to solve some optimization problems that are related to find the minima of a function. You should also attach the Matlab or Python scripts for each exercise.

Exercise 1

Solve the following optimization problem analytically. Then, validate your solution using a computer and dedicated software or library (Python, Matlab)

$$f(x, y) = 0.26(x^2 + y^2) - 0.48xy$$

Exercise 2

Solve the following problem analytically:

$$f(x, y) = 2(x - 3)^2 + (y - 3)^2$$

Then, solve it in a computer by applying the following constraints:

$$x > 1, y < -1$$

Exercise 3

Find all possible minima using a computer for the following function:

$$f(x, y) = -|\sin(x) \cos(y)| e^{\left|1 - \frac{\sqrt{x^2 + y^2}}{\pi}\right|}$$

$$-10 \leq x, y \leq 10$$

What algorithm would you choose for solving this problem? Why? (Hint: Check approaches for solving constrained optimization problems of this form).

If you were asked to find the maximum of a function and you could only find the minimum (this is usually what the algorithms in numerical analysis do) what would be your approach?

Hints:

- In Python you could use the Scipy package
- In Matlab, the recommended package is the optimization toolbox