Exercise 1 – April 26th
Calculate Logistic Regression by Hand

We have four points $x^{(i)}$ in the plane, each with a label $y^{(i)}$ equal to 0 or 1. The coordinates of the four points and their labels are as follows:

$$x^{(1)} = (2, 4),\ y^{(1)} = 1$$
$$x^{(2)} = (1, 3),\ y^{(2)} = 1$$
$$x^{(3)} = (4, 2),\ y^{(3)} = 0$$
$$x^{(4)} = (2, 2),\ y^{(4)} = 0$$

You are asked to perform the beginning of a logistic regression by hand, using the notation from the slides that were presented during the course.

The logistic regression is based on a linear model with bias term combined with a sigmoid function. Therefore the linear function used is determined by three parameters (or weights): θ_0 is the bias term and $\theta_1$and θ_2 are respectively the weights attached to the first coordinate $x_1$and the second coordinate x_2 of each point $x = (x_1, x_2)$.

We want to optimize the weights of the hypothesis function

$$h_\theta(x) = h_\theta(x_1, x_2) = \sigma(\theta_0 + \theta_1 x_1 + \theta_2 x_2) = \frac{1}{1 + e^{-(\theta_0 + \theta_1 x_1 + \theta_2 x_2)}}$$

so that the labels of the four data points are properly approximated.
We assume that the initial weights have been sampled randomly and are equal to:

$$(\theta_0, \theta_1, \theta_2) = (0.9, 1.3, 0.1)$$

You are asked to calculate by hand, assuming we use a learning rate α of 0.1, the updated weights $(\theta_0, \theta_1, \theta_2)$ after the first and the second iteration. Calculations up to three decimal places.

You can finalize your results by filling all the cells of the attached spreadsheet. In the "Iteration 2" column, just fill the values of θ_0, $\theta_1$and θ_2.