1. Competition between two species, hares, the prey, and lynxes, the predators, can be modelled with the modified Lotka–Volterra equations

$$\frac{dx}{dt} = (a - by)x - px^2, \tag{1}$$

$$\frac{dy}{dt} = (cx - d)y - qy^2, \tag{2}$$

where functions x and y are the populations of prey and predator species.

The growth of the prey population is the current size times a constant a, the birth-rate. Decrease is due on the number of predators times a constant b, the rate at which the hares are getting eaten. On the other hand, the number of predators grow depending on the prey population, with a proportionality coefficient c. In the absence of prey, the predators die at a rate d. Constants p and q describe the overcrowding of the living spaces, and thus limit the growth. Naturally, all parameters must be positive.

In one forest, scientist have observed that in the absence of predators, an equilibrium with 1000 hares can be reached. Also, we can assume that the overcrowding effects on both species are equal, $p = q$.

From the given information you can eliminate some of the constants. Your task is to find out the equilibrium values of the populations when predators are present. Simulate the competition between the species by trying different values of the parameters that remain in the equations. Observe the variation of the populations with different initial information and plot the numbers the species as function of time.