Exercise set 5. Due 10.05.2023.

Name and surname: _____

Student number: _____

1. Perform a bifurcation analysis (classify the type of bifurcation that occurs if possible as well), on the following systems of differential equations.

   (a)

   $$\frac{dx}{dt} = \mu x - x^2$$
   $$\frac{dy}{dt} = x - y$$

   (b)

   $$\frac{dx}{dt} = \mu x - x^3$$
   $$\frac{dy}{dt} = -y$$

   (c)

   $$\frac{dx}{dt} = y + \mu x$$
   $$\frac{dy}{dt} = -x + \mu y - x^2 y$$

   Note, only consider the origin for this question.

2. Perform a bifurcation analysis on,

   $$\frac{dx}{dt} = -2x^2 + y$$
   $$\frac{dy}{dt} = \mu x - x^3 + y,$$

   but only investigate the steady state at the origin. For which values of μ do bifurcations occur?

3. Nondimensionalize the following differential equation,

   $$\frac{dN}{dt} = RN\left(1 - \frac{N}{K}\right) - \frac{BN^2}{A^2 + N^2}$$

   by choosing $x = \frac{N}{K}$ and $\tau = tR$.

END