

**Homework 3 Due: 12:00 3 June 2022**

**Problem 1**

Consider the Van der Pol differential equation:

$$y'' + \epsilon (y^2 - 1) y' + y = 0 \quad (1)$$

which has the nonlinear damping term  $\epsilon (y^2 - 1) y'$ .

- (a) With  $\epsilon = 0.1$ , solve the equation and write out the solution for  $t \in [0 : 0.5 : 30]$  for initial conditions  $y(0) = 0.1$  and  $y'(0) = -1$ . Repeat with  $\epsilon = 1$  and  $\epsilon = 20$ .

- (b) Now consider the problem when the parameter epsilon is not constant, but rather

$$\epsilon = \epsilon(t) = \begin{cases} 0.1 & t \in [0, 10] \\ 1 & t \in [10, 20] \\ 20 & t \in [20, 30] \end{cases} \quad (2)$$

Generate the trajectory for  $t \in [0 : 0.5 : 30]$  for initial conditions  $y(0) = 0.1$  and  $y'(0) = -1$ .