

AMATH 301
Homework 5: Autumn 2021

DUE: Midnight on Thursday, November 11

Consider the Van der Pol differential equation

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

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 $\epsilon = 20$.

ANSWER: Should be written out as two column matrices A1, A2 and A3 for $\epsilon = 0.1, 1$ and 20 respectively.

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

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

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

ANSWER: Solution should be written out as two column matrices A4.