Homework 2

Due Janaurary 18th

Numerical Solvers: Implement a numerical ODE solver for the following problems using each of these algorithms: Forward Euler, Trapezoidal, RK(1) and RK(2). You may use the software of your choice. Make a plot of your approximate solution to the ODE against the true solution. Repeat your calculation again with 10 times as many time steps and verify that the error decreases appropriately.

a. $y' = y, \quad y(1) = 2, \quad t \in [1, 4], \quad y_{\text{true}} = 2e^{t-2}$

b. $y' = -2t\, y, \quad y(1) = 2, \quad t \in [1, 4], \quad y_{\text{true}} = 2e^{(1-t^2)}$

c. $y'' = -y, \quad y(0) = 0, \quad t \in [0, 2\pi], \quad y_{\text{true}} = \sin(t)$