Name:_____
M555: Differential Equations I (Spring 2018)
Instructor: Justin Ryan
Good Problems: Numerical Methods

WICHITA STATE UNIVERSITY

Instructions *Complete all problems, showing enough work. A selection of problems will be graded based on the organization and clarity of the work shown in addition to the final solution (provided one exists).*

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1. Consider the initial value problem

$$\begin{cases} \dfrac{dy}{dt} = \dfrac{y-t}{t^2}, \\ y(1) = 0. \end{cases}$$

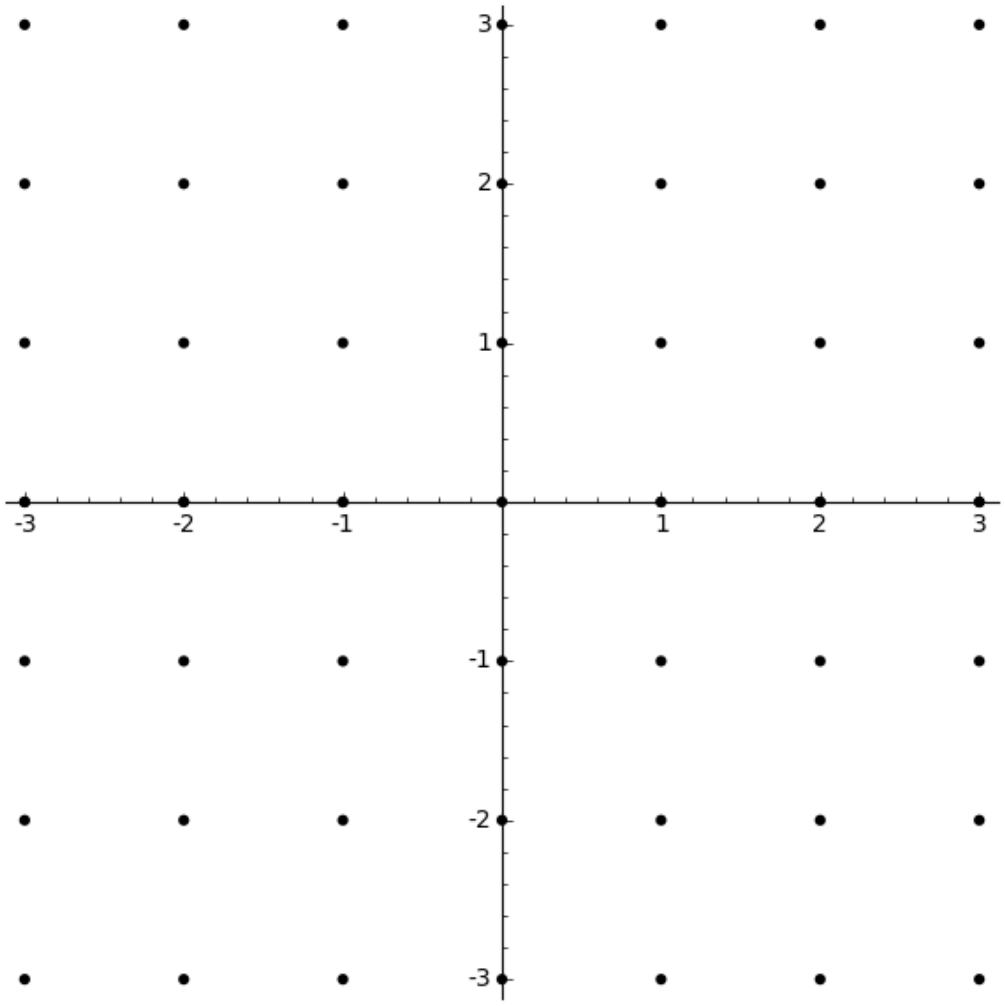
a.) Apply the FEUT to verify that a solution exists.

b.) Using Euler's Method with a step size of $h = 0.5$, make a table that approximates the solution on the interval $[1,3]$.

2. Consider the initial value problem

$$\begin{cases} y' = 3 - 2y, \\ y(-3) = 1 \end{cases}$$

Sketch the curve obtained by applying Euler's Method with a step size of $h = 1$. Does this curve represent a realistic solution? If not, what is "wrong"?



3. Consider the initial value problem

$$\begin{cases} \dfrac{dy}{dt} = e^{2t} - ty, \\ y(0) = 1 \end{cases}$$

a.) Apply the FEUT to verify that a solution exists.

b.) Find the exact solution of the IVP.

c.) Use a computer (Excel, Octave, Sage, *etc.*) to approximate the solution on the interval $[0,2]$ using Euler's Method with step sizes of $h_1 = 0.1$, $h_2 = 0.05$, and $h_3 = 0.01$. Plot the approximate solutions on the same set of axes, together with the exact solution. Label each curve. Print the graphs and include them with your submission.