

## APMA 0350 – PROGRAMMING ASSIGNMENT 1

### Problem 1: (4 points)

Use the dfield app to draw the direction field of

$$y' = y(y + 3)$$

On that direction field, please click on three solutions, one in the region  $y > 0$ , one in the region  $-3 < y < 0$ , and one in the region  $y < -3$ .

**Note:** Don't forget about the  $\star$  otherwise you get an error message. Please take a screenshot of your direction field with your 3 curves and include it in your assignment.

#### Using Python:

To use Python, first go to the Jupyter Website, then click on “Try it in your Browser,” then on the “Jupyter Lab” icon on the left. To open a notebook, click on File > New > Notebook. In the problems below, please take a screenshot of your code and your result, and include it in your assignment.

**Problem 2:** (4 points) Use Python to apply Euler's Method with  $N = 50$  on  $[2, 3]$  where

$$\begin{cases} y' = \cos(y) + ty \\ y(2) = 5 \end{cases}$$

No need to print the  $(t, y)$  values but please plot the points on a graph.

**Problem 3:** (12 points, 4 points each) Use the `dsolve` command in Python to solve the following. Don't solve them by hand.

(a)

$$y' + y = 3 \cos(2t)$$

(b)

$$\begin{cases} y' + 2y = 2te^{2t} \\ y(0) = 1 \end{cases}$$

**Note:** Python uses `exp(2 * t)` for exponential functions

(c)

$$\begin{cases} y' = 20y \left(1 - \frac{y}{20}\right) \\ y(0) = 10 \end{cases}$$

Please also plot the solution in (c), using  $-5$  and  $5$  as the  $t$  limits and  $-1$  and  $21$  as the  $y$  limits.