Due Date: April 16th, 2020

1. Manually perform three steps of Euler's method to solve

$$\frac{dx}{dt} = \frac{1}{t+x+1}, x(0) = 0$$

with step size h = 0.2. Then verify your answer with the Euler used for the inclass Worksheet for  $0 \le t \le 2$ .

2. Perform Euler's method to solve using euler.R used for the inclass Worksheet.

$$\frac{dx}{dt} = \sqrt{x}, x(0) = 0.$$

- (a) Plot a comparison of the numerical solution with the exact solution. Does plot indicate any error ? (explain the finding). Peform Midpoint method and Rungekutta order 4 method using the midpoint.R and rungekutta4.R used for the inclass worksheet.
- (b) Suppose x(0) = . Machine \$double.xmin then what happens in previous part.
- 3. Consider

$$\frac{dy}{dt} = y, \ y(0) = 1 \ 0 \le t \le 1$$

Compute its exact solution. Using R-code midpoint.R, compute the numerical solution using the midpoin method in [0, 1] with h = 0.2.Use euler.R, compare this numerical solution with that obtained by Euler's method. For the same accuracy comment on the number of floating point operations required between Euler versus Midpoint method.