

Computer Problem #2 and Extra Credit Computer Problem

Computer Problem #2

Consider the system

$$x' = -x - 8\pi y \tag{1}$$

$$y' = 2\pi x - y$$

subject to the initial conditions

$$x(0) = 2, \quad y(0) = 0. \tag{2}$$

- (a) Use the improved Euler method to compute approximate solutions to (1)-(2) for the step sizes $h = 0.1, 0.05, 0.01$ and 0.005 .
- (b) Graph the error as a function of t for each of the step sizes in (a).
- (c) Compare the approximate solutions obtained with the exact solution of (1)-(2).

Extra Credit Computer Problem

- (i) Repeat (a) and (b) above using the Runge-Kutta method just for step sizes $h = 0.2, 0.1$ and 0.05 .
- (ii) Plot the exact trajectory of (1)-(2) in the x, y - phase plane and compare this with plots of the approximate trajectories obtained in (i) for the cases $h = 0.2$ and $h = 0.1$.