Numerical method HW1

1. Use

(a) Euler's method
(b) Second order Runge-Kutta
(c) Fourth order Runge Kutta
(d) any multi-step method you choose
(e) Implicit Euler's method

to approximate the solution to the differential equation

$$ut = \cos(\pi t) + u(t) \text{ with initial condition } u(0) = 2.$$

Solve this for time t up to 2.0.

Show a graph of the solution vs. the exact solution, and a graph of the errors for number of points N = 10, 20, 40, 80, 160, 320, 640.

Show the effect of increasing the number of points on the error (using the different norms). What can you conclude about the order of the method? Comment on the behaviour you see and determine which method performed best