UMC 202
PROBLEM SET 6

(1) Use the forward difference formula to approximate the derivative of $f(x) = \ln x$ at $x_0 = 1.8$ using $h = 0.1$, $h = 0.05$ and $h = 0.01$. Determine the bounds for the approximation errors.

(2) Redo problem 1 for the backward difference formula and central difference formula.

(3) Consider the IVP

$$y' = \frac{y \ln y}{x},\ y(2) = e.$$

Use Euler's method with h = 0.1 to obtain the approximation to y(3).

(4) Consider the IVP

$$y' = y - x,\ y(0) = \frac{1}{2}.$$

Use Euler's method with h = 0.1 and h = 0.05 to obtain the approximation to y(1). Given that the exact solution to the IVP is

$$y(x) = x + 1 - \frac{e^x}{2},$$

compare the errors in the two approximations to y(1).

(5) Consider the IVP

$$y' = 2xy^2,\ y(0) = 0.5.$$

Use Euler's method with $h = 0.1$ to obtain the approximation to y(1). Write down the MATLAB code for the same.