Assignment-3

(Linear multi-step methods)

1. Solve the IVP
$$y' = \frac{1}{4}y\left(1 - \frac{y}{20}\right), \quad y(0) = 1$$
using the Adams-Bashforth method of order 2. Use the step sizes $h = 0.1, 0.01$ to approximate $y(1)$.
2. Use the Adams-Bashforth method of order 3 to obtain an approximation to the solution of the IVP
$$y' = 2t - y, \qquad y(0) = -1$$
with $N = 10$, at $t = 1$. Compare with the exact solution $y(t) = e^{-t} + 2t - 2$.
3. Use the Adams-Bashforth of order 4 method to approximate the solution of the IVP
$$y' = 2 + \sqrt{y - 2t + 3}, \qquad y(0) = 1$$
on the interval $[0, 1.5]$ with $h = 0.25$. Compare with the exact solution $y(t) = 1 + 4t + \frac{1}{4}t^2$.
4. Using Milne's method, find solution at $x = 2$ of the ODE
$$\frac{dy}{dx} = x^2y - y, \qquad y(0) = 1$$
with step size $h = 0.5$.
5. Solve the following IVP using the Adams-Bashforth-Moulton predictor-corrector method of order 4
$$y' = e^{-t} - y, \qquad y(0) = 1$$
in the interval $[0, 1.2]$ with $h = 0.2$. Compare with the exact solution $y(t) = e^{-t}(t + 1)$.
6. Using Milne-Simpson predictor-corrector method, find solution at $x = 2$ of the ODE
$$\frac{dy}{dx} = y \sin x, \qquad y(0) = 1$$
with step size $h = 0.5$