Department of Mathematical and Computational Sciences
National Institute of Technology Karnataka, Surathkal

sam.nitk.ac.in nitksam@gmail.com

Numerical Methods - MA 207
Numerical Solutions of Ordinary Differential Equations

1. Apply Euler method to the following ivp choosing $h = 0.2$. $y' = x + y, y(0) = 0$. Compute $y(0.2)$ and improve the solution by applying Euler modified method.

2. Given $y' = x + y^2, y(0) = 1$ Runge Kutta method of order 4 is used to find an approximate value of y at $x = 0.1$ using steplength $h = 0.1$. The following values of k's are computed $k_1 = 0.10000, k_2 = 0.1152$. Compute $y(0.1)$.

3. Given $y' = x - y^2$ and the follwing values of x and y

x	0.0	0.2	0.4	0.6
y	0.0000	0.0200	0.0795	0.1762

   Apply Milnes Predictor. Corrector method to find the solution at $x = 0.8$

4. Given $y' = \frac{1}{2}xy$ and the following values of x and y

x	0.0	0.1	0.2	0.3
y	1.0000	1.0025	1.0101	1.0228

   Determine $y(0.4)$ usin Adams Bashforth formula. Improve the solution using Adam-Moulton formula.

5. Given $y'' = x^3y' + y, y(0) = 1, y'(0) = 1/2$. Write down the equivalent set of two first order equations. Apply Taylor series method of order 3, to detemine y at $x = 0.2$ using $h = 0.2$.

6. Apply Dalquist method $y'' - y = x, y(0) = 1, y'(0) = 2, h = 0.1$ to detemine $y(0.2)$.

7. Give $y' = 3x + 0.5, y(0) = 1.0$, find $y(0.1)$ using Taylor series of order 4 with $h = 0.1$.

8. Apply RK method of order 2 to evaluate $y(0.5)$ given $y' = x + y^2, y(0) = 1.0$ taking $h = 0.5$.

9. Given $5xy' + y^2 - 2 = 0, y(4.0) = 1.0, y(4.1) = 1.009, y(4.2) = 1.0097, y(4.3)1.0143$. Apply Milnes Predictor formula to evaluate $y(4.4)$.

10. Given $y'' = xy, y(0) = 0, y'(0) = 1.0$. Reduce the equation to a system of first order initial value problems.

****