Topic: 5.6 – **Problems Euler's &Modified Euler's method**

10. Using Euler's method find $y(0.2)$ and $y(0.4)$ from $\frac{dy}{dx} = x+y$, $y(0)=1$ with $h=0.2$. [AU M/J 2000, AIM 2010, 2011] [May/June 2012]

Soln:

$$\frac{dy}{dx} = f(x,y) = x+y.$$

Here $x_0=0$, $y_0=1$, $x_1=0.2$, $x_2=0.4$

By Euler's Algorithm,

$$y_{n+1} = y_n + h f(x_n, y_n), \quad n=0,1,2,\ldots$$

$$y_1 = y_0 + h f(x_0, y_0)$$

$$= 1 + 0.2 (x_0 + y_0) = 1 + 0.2 (0+1) = 1.2.$$

ie) $y(0.2) = 1.2$

$$y_2 = y_1 + h f(x_1, y_1)$$

$$= 1.2 + 0.2 [x_1 + y_1]$$

$$= 1.2 + 0.2 [0.2 + 1.2]$$

$$= 1.2 + 0.28$$

$$y_2(0.4) = 1.48$$

$$y_3 = y_2 + h f(x_2, y_2)$$

$$= 1.48 + (0.2) [x_2 + y_2]$$

$$= 1.48 + 0.2 [0.4 + 1.48]$$

$$= 1.48 + 0.376$$

$$y(0.6) = 1.856$$

2. Using Euler's method solve $\frac{dy}{dx} = \frac{y-x}{y+x}$, $y(0) = 1$ for $x = (0)\ (0.02)\ (0.1)$

3. Find $y(-0.1)$ and $y(-0.2)$ by using modified Euler's method with $h = -0.1$, given that $\frac{dy}{dx} = \frac{y^2-x^2}{y^2+x^2}$, $y(0) = 1$

4. Solve $\frac{d^2y}{dx^2} = y^3$, $y(0) = 10$, $y'(0) = 5$ using fourth order R-K method and evaluate $y(0.1)$, $y(0.2)$