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2. Given $y' = 1 - y$ & $y(0) = 0$, find

(i) $y(0.1)$ by Euler method.

(ii) $y(0.2)$ by Modified Euler method.

(iii) $y(0.4)$ by Milne's method.

Soln:

By Euler method,

$$y_1 = y_0 + h f(x_0, y_0) = 0 + (0.1)(1 - 0) = 0.1$$

By Modified Euler method.

$$\begin{aligned} y_2 &= y_1 + h f\left(x_1 + \frac{1}{2}h, y_1 + \frac{1}{2}h f(x_1, y_1)\right) \\ &= (0.1) + (0.1) f\left[0.1 + \frac{0.1}{2}, 0.1 + \frac{1}{2}(0.1)\right] = (0.1, 0.1) \\ &= (0.1) + (0.1) \left[1 - \left(0.1 + \frac{0.1}{2}\right)\right] \\ &= 0.1855 \end{aligned}$$

By $y_3 = 0.2689$.

Now knowing y_0, y_1, y_2, y_3 we will find

By Milne's method.

$$\begin{aligned} y_{4,p} &= y_0 + \frac{4h}{3} [2y_1' - y_2' + 2y_3'] \\ &= 0 + \frac{4(0.1)}{3} [2(1 - y_1) - (1 - y_2) + 2(1 - y_3)] \\ &= \frac{0.4}{3} [3 - 2y_1 + y_2 - 2y_3] = 0.3280 // \end{aligned}$$

$$y_4' = 1 - y_4 = 1 - 0.3280 = 0.6720$$

$$\begin{aligned} y_{4,c} &= y_2 + \frac{h}{3} (y_2' + 4y_3' + y_4', p) \\ &= 0.1855 + \frac{0.1}{3} [1 - y_2 + 4(1 - y_3) + (1 - y_4, p)] \\ &= 0.1855 + \frac{0.1}{3} (6 - y_2 - 4y_3 - y_4, p) \end{aligned}$$

$$y(0.4) = 0.3333 //$$