



DEPARTMENT OF MATHEMATICS

UNIT-V NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS

MODIFIED EULER METHOD :

$$y_1 = y_0 + h \left[f \left(x_0 + \frac{h}{2}, y_0 + \frac{h}{2} f(x_0, y_0) \right) \right] \text{ for } (x_0, y_0)$$

$$y_2 = y_1 + h \left[f \left(x_1 + \frac{h}{2}, y_1 + \frac{h}{2} f(x_1, y_1) \right) \right] \text{ for } (x_1, y_1)$$

$$y_{n+1} = y_n + h \left[f \left(x_n + \frac{h}{2}, y_n + \frac{h}{2} f(x_n, y_n) \right) \right] \text{ for } (x_n, y_n)$$

for $n=0, 1, 2, \dots$

This formula is called modified Euler's formula.

Compute y at $x = 0.25$ by modified Euler method given

$$y' = 2xy, \quad y(0) = 1$$

Given: $f(x, y) = 2xy$

$$x_0 = 0; \quad y_0 = 1; \quad h = 0.25$$



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$$\begin{aligned}y_1 &= y_0 + h f\left[x_0 + \frac{h}{2}, y_0 + \frac{h}{2} f(x_0, y_0)\right] \\&= 1 + (0.25) f\left[0 + \frac{0.25}{2}, 1 + \frac{0.25}{2} [2x_0 y_0]\right] \\&= 1 + (0.25) f(0.125, 1.25) \\&= 1 + 0.25 [2(0.125)(1)] \\&= 1 + 0.0625 \\&= 1.0625\end{aligned}$$

2) Solve $y' = 1 - y$, $y(0) = 0$ by modified Euler's method
with $x_1 = 0.1$, $x_2 = 0.2$, $x_3 = 0.3$.

Soln:

$$\begin{aligned}y(0.1) &= 0.095 \\y(0.2) &= 0.1809 \\y(0.3) &= 0.2587\end{aligned}$$