Solve the following

(1) $\frac{d^2y}{dx^2} = xy$,

(2) $\frac{d^2y}{dx^2} + xy = 1$

Sol^n (1)

$y'' = xy$

problems by finite differ

$y(1) = 1$ ✓

$y(0) + y'(0) = 1$ ✓

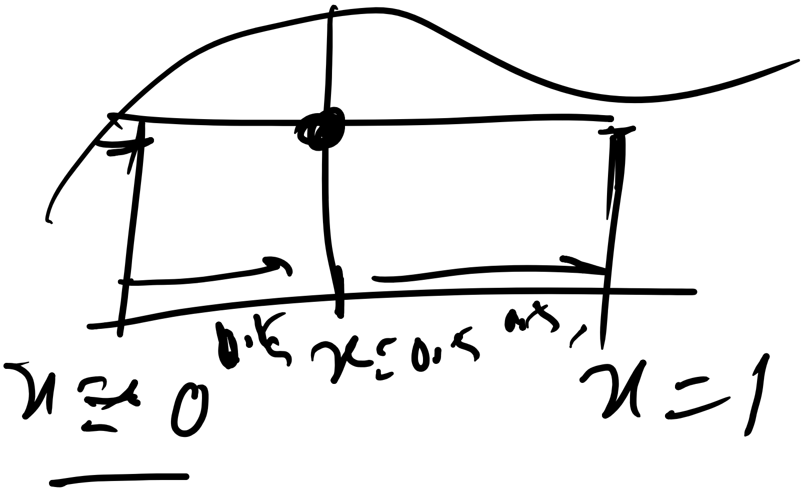
$h = 0.5$

, $y(0) = 1$, $y'(1) = 1$ wi

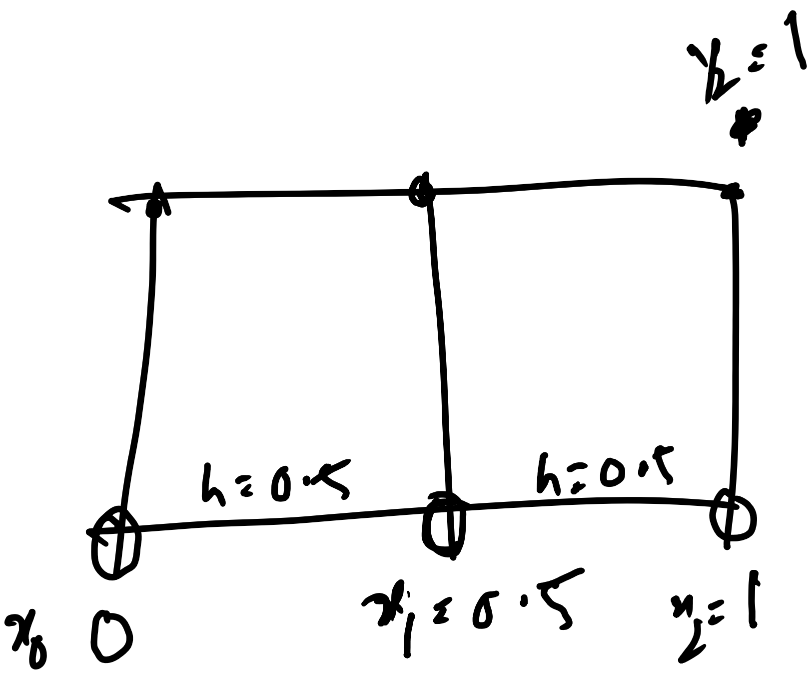
$$y_i'(x_i) = \frac{y_{i+1} - y_{i-1}}{2h}$$

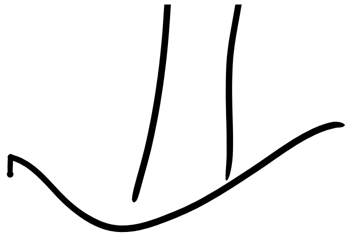
$$y_i''(x_i) = \frac{y_{i-1} - 2y_i + y_{i+1}}{h^2}$$

...nena Method



...th $h = 0.5$





$$y_i'' = x_i y_i$$

$$\Rightarrow \frac{y_{i-1} - 2y_i + y_{i+1}}{h^2}$$

$$\Rightarrow 4(y_{i-1} - 2y_i +$$

$\underline{i = 1}$

$$4(y_0 - 2y_1 + y$$

$$\Rightarrow 4y_0 - 8y_1 + 4$$

$$\Rightarrow 4y_0 - 8y_1 + 4$$

$- x_i y_i = 0$ $\quad h =$

h^2

$y_{i+1}) - x_i y_i = 0$

$2) - x_1 y_1 = 0$

$y_2 - x_1 y_1 = 0 \quad , \; y_2 = 1, \quad ,$

$- \frac{1}{2} y_1 = 0$

$= \frac{1}{2}$

$= \frac{1}{4}$

K

$x_0 = 0, \quad x_2 = 1$

$\Rightarrow 4y_0 - 8.5$

$\Rightarrow \boxed{4y_0 - 8.5}$

$y(0) + y'(0) = 1 \quad , \quad y_2 =$

$\Rightarrow y_0 + y'_0 = 1 \Rightarrow y'_0 =$

cte

$\Rightarrow y'_0 =$

Putting $x = 0$ in (*)

$4(y_{-1} - 2y_0 +$

$y_1 + y = 0$

$$\boxed{y_1 = -y}$$

2

1

$$\frac{y_{i+1} - y_{i-1}}{2h}$$

$$\frac{y_1 - y_{-1}}{2 \times 1.5} \Rightarrow y_0' - y_1 + y_{-1} = 0$$

$\Rightarrow 1 - y_0 - y_1 + y_{-1}$

$\Rightarrow \boxed{y_0 +}$

$y_1) - x_0 y_0 = 0$

$\cdot \frac{1}{2}$

1

$= 0$

$\boxed{y_1 - y_{-1} = 1}$

$4\,(y_{-1} - 2y_0 +$

$\Rightarrow y_{-1} - 2y_0 +$

$\Rightarrow \boxed{-y_0 + 2y_1 = 1}$

$$\boxed{\begin{aligned} 4y_0 - 8.5\,y_1 &= \\ -y_0 + 2y_1 &= \end{aligned}}$$

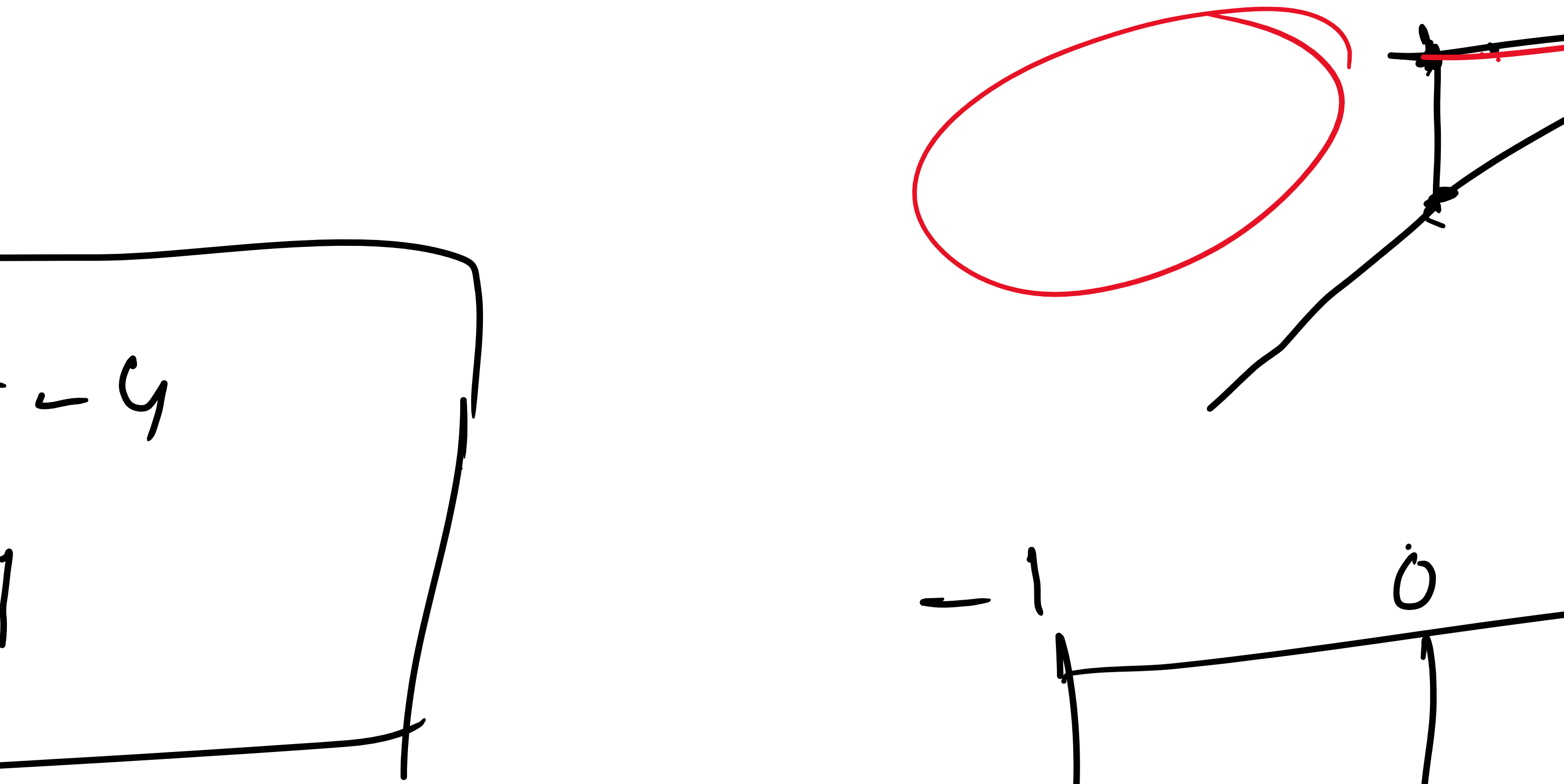
$\Rightarrow$ $y_0 = -1 \leftarrow$

$y_1 = 0 \leftarrow$

$y_2 = 1 \leftarrow$

$+ y_1 = 0$ ✓ ②

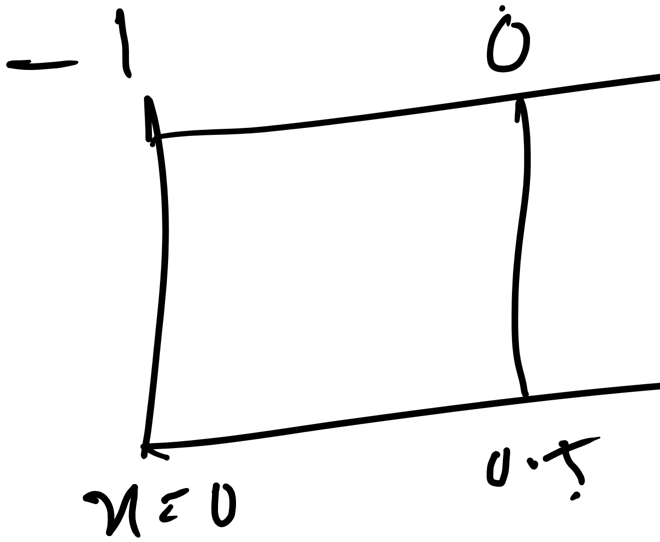
✓

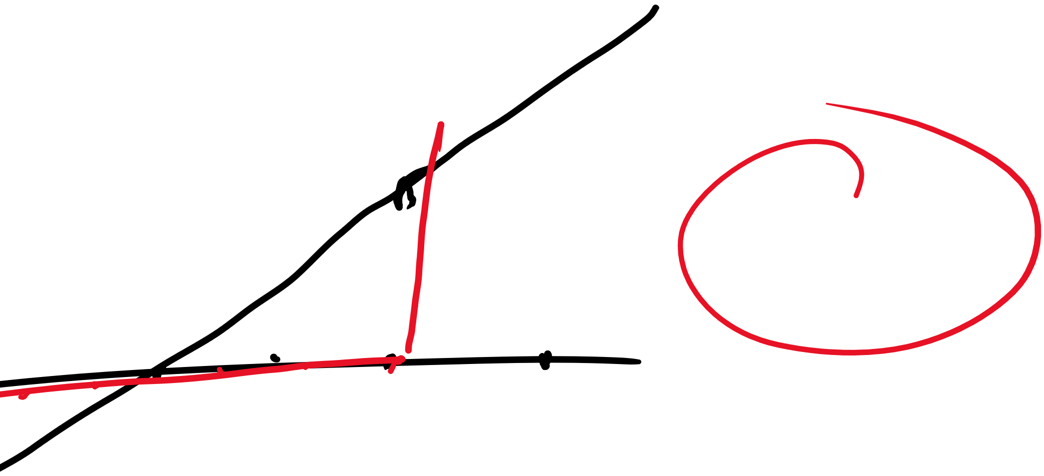


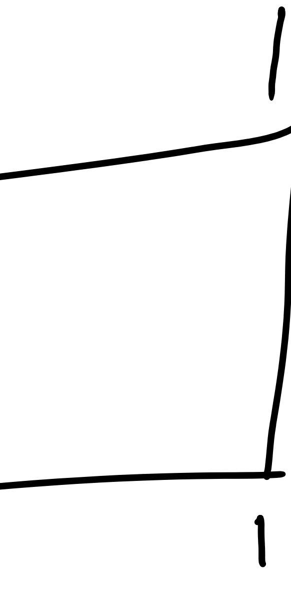
$x_0 = 0$

$x_1 = 0.5$

$x_2 = 1$







$$y'' - xy' + y = 0$$

$$\boxed{\begin{aligned} h &= 0.3 \\ x_0 &= 0 \\ y_0 &= 1 \end{aligned}}$$

let

$$\left\{\begin{aligned} f &= z \\ g &= -y + xz \\ x_0 &= 0 \\ y_0 &= 1 \end{aligned}\right.$$

$$\left[\begin{aligned} y' &= \\ z' &= - \end{aligned}\right.$$

for $y(0.3)$ & $y(0.6)$

$$\left.\begin{array}{l} y(0)=1 \\ y'(0)=-1 \end{array}\right\} , \quad h=\underline{0.3}$$

$y''-xy'+y=0$

$\underline{y'=z}$

$z'-xz+y=0$

$$\left.\begin{array}{ll} z & , \underline{y(0)=1} \\ -y+xz & , z(0)=-1 \end{array}\right\} < \left\{\begin{array}{l} x \text{ ind} \\ y, z : \text{de} \end{array}\right.$$

pend

pendi

$y_0 = 1$
$z_0 = -1$

Let $y' = f(x, y, z) = z$

$z' = g(x, y, z) = -$

$k_1 = hf(x, y, z) = z =$

$k_2 = hf\left(x + \frac{h}{2}, y + \frac{k_1}{2},\right.$

$y'' = 4(y - x)$, 0

F.D.M, Sol^n $x = 0.$

$y + xz$

$$\boxed{y_{n+1} = y_n + \frac{1}{6} (K_1}$$

$$m_1 = g(x, y, z)$$

$z + \frac{m_1}{2})$

$\le x \le 1$, $y(0) = 0$ & $y($

5

$h = \frac{1}{4}$

y_0 ?? ??

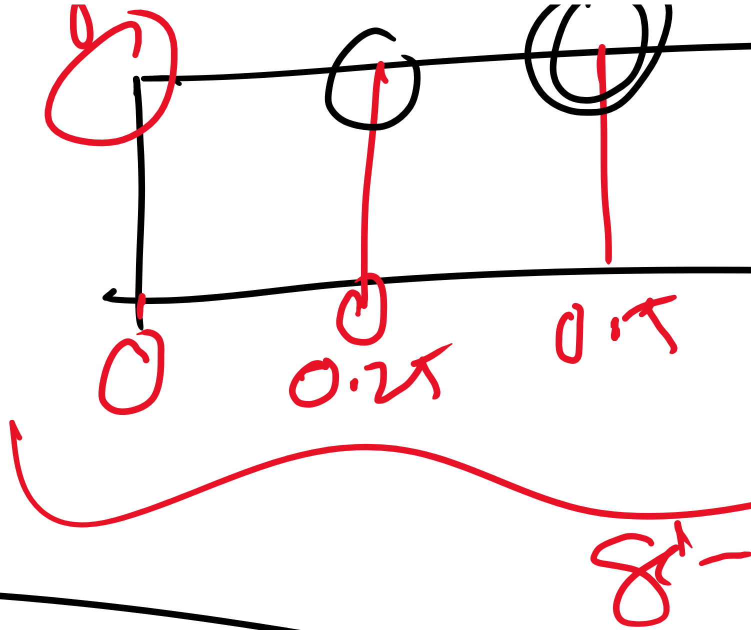
$$\boxed{+ K_4 + 2(K_2 + K_3)}$$

$) = 2$

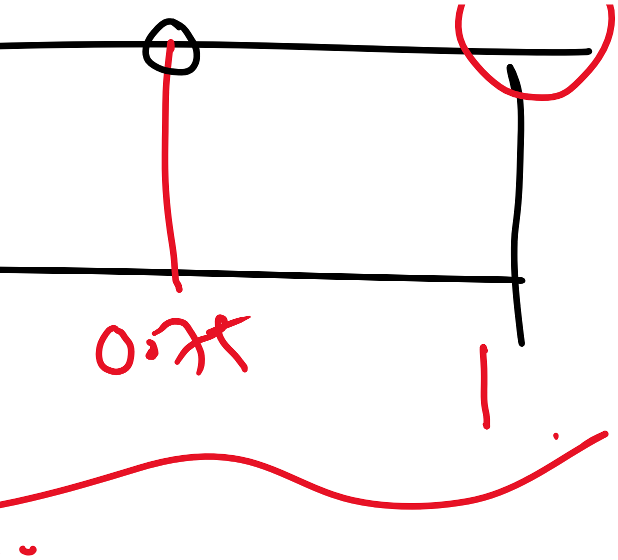
?1

δ'

$y_{i+1} - 2y_i \; (9/8)$



$$+\ Y_i^{j-1} = -\frac{1}{4} x_i^0$$


0.75
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