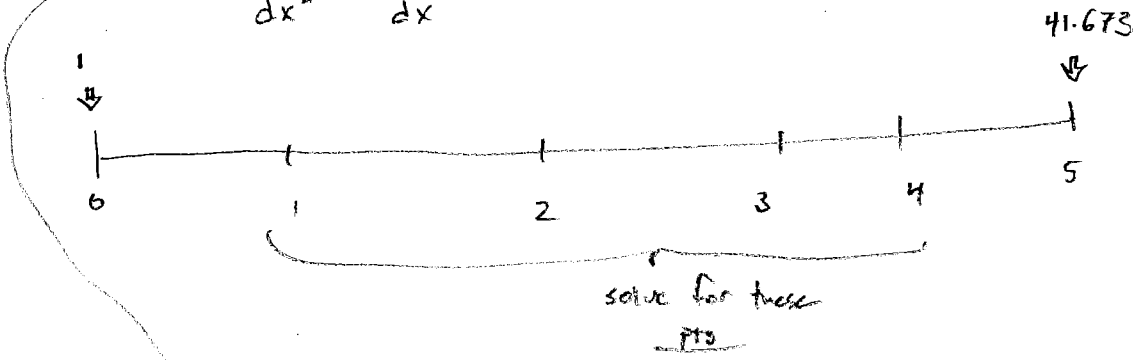
Problem 2 Final

$O(h^2)$

7 pts for derivation

$$\frac{d^2y}{dx^2} + \frac{dy}{dx} = x^2 + 2x$$



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

↙ general equation +2

First point

$$\frac{y_2 - 2y_1 + 1}{(1)^2} + \frac{y_2 - 1}{2} = (1)^2 + 2(1)$$

↖ first pt setup +1

$$-2y_1 + 1.5y_2 = 2.5$$

2nd Point

$$\frac{y_3 - 2y_2 + y_1}{(1)^2} + \frac{y_3 - y_1}{2} = (2)^2 + 2(2)$$

↖ 2nd pt setup +1

$$1.5y_3 - 2y_2 + \frac{y_1}{2} = 8$$

3rd point

$$1.5y_4 - 2y_3 + \frac{y_2}{2} = (3)^2 + 2(3) = 15$$

↙ 3rd pt setup +1

4th point

$$1.5(41.673) - 2y_4 + \frac{y_3}{2} = (4)^2 + 2(4)$$

$$-2y_4 + \frac{y_3}{2} = -38.5095$$

↖ 4th pt setup +1

use A/b to solve?

$$\begin{bmatrix} -2 & 1.5 & 0 & 0 \\ 0.5 & -2 & 1.5 & 0 \\ 0 & 0.5 & -2 & 1.5 \\ 0 & 0 & 0.5 & -2 \end{bmatrix} \begin{bmatrix} y_1 \\ y_2 \\ y_3 \\ y_4 \end{bmatrix} = \begin{bmatrix} 2.5 \\ 8 \\ 15 \\ -38.5 \end{bmatrix}$$

Math correct +1