CS ASSIGNMENT

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Q1 To find the derivative of the function $f(x)$ at $x = 1.5$

x	1.5	2	2.5	3	3.5	4
$f(x)$	3.3	7	13.625	24	38.875	59

Ans) $x_0 = 1.5$, $x_1 = 2$, $x_2 = 2.5$, $x_3 = 3$, $x_4 = 3.5$, $x_5 = 4$
$y_0 = 3.3$, $y_1 = 7$, $y_2 = 13.625$, $y_3 = 24$, $y_4 = 38.875$, $y_5 = 59$

From Newton's forward difference table :—

x	$f(x)$	Δ	Δ^2	Δ^3	Δ^4	Δ^5
1.5	3.3	3.7	2.925	0.825	-0.075	0.075
2	7	6.625	3.75	0.75	0	
2.5	13.625	10.375	4.5	0.75		
3	24	14.875	5.25			
3.5	38.875	20.125				
4	59					

$$\frac{dy}{dx} = \frac{1}{h}\left(\frac{\Delta}{1} - \frac{\Delta^2}{2} + \frac{\Delta^3}{3} - \cdots\right) f(x)$$

Here, $h = 0.5$

$$\frac{dy}{dx} = \frac{1}{h}\left(\frac{\Delta}{1} - \frac{\Delta^2}{2} + \frac{\Delta^3}{3} - \frac{\Delta^4}{4} + \frac{\Delta^5}{5}\right)$$

$$\frac{dy}{dx} = \frac{1}{0.5}\left(\frac{3.7}{1} - \frac{2.925}{2} + \frac{0.825}{3} - \frac{-0.075}{4} + \frac{0.075}{5}\right)$$

$$= 2\left(3.7 - 1.4625 + 0.275 + 0.01875 + 0.015\right)$$

$= 2(2.5 + 0.025)$

$= 5.0925$

So, $\frac{dy}{dx}$ at $x = 1.5$ is 5.0925