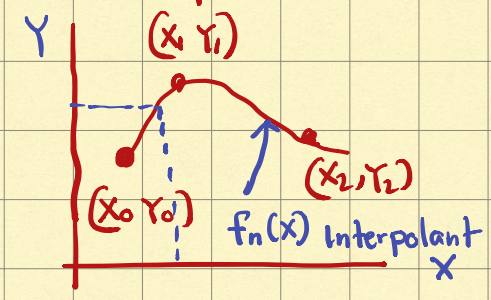
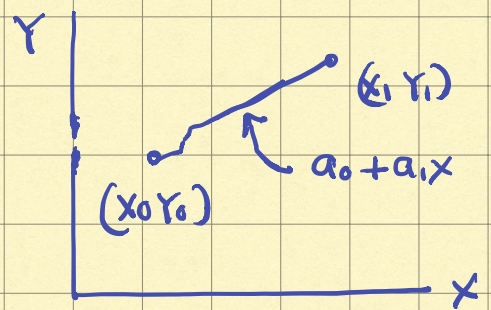
Direct Method

Linear Interpolation





t s	V m/s
0	0
10	227.04
15	362.78
20	517.35
25	602.97
30	901.67

Find $v(16) = ?$

$$V(t) = a_0 + a_1 t$$

$$V(15) = 362.78 = a_0 + a_1(15)$$

$$V(20) = 517.35 = a_0 + a_1(20)$$

$$\begin{bmatrix} 1 & 15 \\ 1 & 20 \end{bmatrix} \begin{bmatrix} a_0 \\ a_1 \end{bmatrix} = \begin{bmatrix} 362.78 \\ 517.35 \end{bmatrix}$$

$$a_0 = -100.93$$

$$a_1 = 30.914$$

$$V(t) = a_0 + a_1 t$$

$$V(t) = -100.93 + 30.914\, t$$

$$V(16) = -100.93 + 30.914(16)$$

$$= 393.7 \text{ m/s}$$

x	0	2	4	6	8	10
f(x)	0	4	56	204	496	980

Find $f(3)$ and $f(5)$ Using Newton's forward Interpolation formula

Soln

x	Y	Δy	$\Delta^2 y$	$\Delta^3 y$	$\Delta^4 y$
0	0				
		4			
2	4		48		
		52		48	
4	56		96		0
		148		48	
6	204		144		0
		292		48	
8	496		192		
		484			
10	980				

Newton's FD formula gives

$$Y_r = Y_0 + r\Delta y_0 + \frac{r(r-1)}{2!}\Delta^2 y_0 + \frac{r(r-1)(r-2)}{3!}\Delta^3 y_0 + \cdots\cdots$$

$$r = \frac{x - x_0}{h} = \frac{x-0}{2} = \frac{x}{2}$$

$$f(x) = 0 + \frac{x}{2}(4) + \frac{\frac{x}{2}\left(\frac{x}{2}-1\right)}{2}(48) + \frac{\frac{x}{2}\left(\frac{x}{2}-1\right)\left(\frac{x}{2}-2\right)}{3!}(48)$$

$$= 2x + x(x-2)6 + x(x-2)(x-4)$$

$$= x^3 - 2x \quad \text{This is the interpolating polynomial}$$

Put $x = 3, 5$

$$f(3) = 3^3 - 2(3) = 21 \qquad f(5) = 115$$