

$$\Delta y = 44x^{(3)} + 213x^{(2)} + 188x^{(1)} + 19$$

$$\Delta^2 y = 132x^{(2)} + 426x^{(1)} + 188$$

$$\Delta^3 y = 264x^{(1)} + 426$$

$$\Delta^4 y = 264$$

$$\Delta^5 y = 0$$

2nd Method:

Using Synthetic division rule.

let $y = 11x^{(4)} + Ax^{(3)} + Bx^{(2)} + Cx^{(1)} - 15$

1	11	5	2	1	-15 = D
		11	16	18	
2	11	16	18	19 = C	
		22	76		
3	11	38	94 = B		
		33			
	11	71 = A			

$$\therefore y = 11x^{(4)} + 71x^{(3)} + 94x^{(2)} + 19x^{(1)} - 15$$

4) Represent the function $f(x) = x^4 - 12x^2 - 30x + 9$ and its successive difference in factorial notation.

1st Method:

Ans let $y = x^{(4)} + Ax^{(3)} + Bx^{(2)} + Cx^{(1)} + D$ — ①

$$\Rightarrow x^4 - 12x^2 - 30x + 9 = x(x-1)(x-2)(x-3) + Ax(x-1)(x-2) + Bx(x-1) + Cx + D$$