1) The following table gives four values of  $f(x) = x^4 - 3x^3 + 6x^2 - 2x + 5$  at  $x_i = 1, 2, 3$  and 4. Obtain a 3<sup>rd</sup> degree polynomial, p(x) using Newton forward difference formula. Further, compare the plots of f(x) vs x, and p(x) vs x in the interval [0 5] in MATLAB.

x:	1	2	3	4
<i>f(x)</i> :	7	17	53	157

NE	WTON	FORWA	$\Delta^2 fi$	Ifi	E 17481 E;
X	L(x)	Afi		Afi	L
7 2 3 4	7 17 53 157	10 36 104	26	42	

Pormula

Newton's Forward Difference formula

$$p = \frac{x - x_0}{h}$$

$$y(x) = y_0 + p\Delta y_0 + \frac{p(p-1)}{2!} \cdot \Delta^2 y_0 + \frac{p(p-1)(p-2)}{3!} \cdot \Delta^3 y_0 + \frac{p(p-1)(p-2)(p-3)}{4!} \cdot \Delta^4 y_0 + \dots$$

Examples

1. Find Solution using Newton's Forward Difference formula

$$h = X_1 - X_0 = 2 - 1 = 1$$
 $P = \frac{x - 1}{7}$ 

$$P_3(x) = 7 + 10p + P(P-1) \cdot 26 + P(P-1)(P-2) \cdot 42$$

$$P_{3}(x) = 7 + \left(\frac{x-7}{7}\right) \cdot 10 + \frac{\left(\frac{x-7}{7}\right)\left(\frac{x-7}{7}-\right) \cdot 26}{2!} + \frac{\left(\frac{x-7}{7}\right)\left(\frac{x-7}{7}-\right)\left(\frac{x-7}{7}-2\right)}{3!} \cdot 42$$

SE MATUAB PLOT: