# A second degree polynomial passes through (0,1),(1,3) (2,7), (3,13). Find the polynomial.

We construct the difference table. for the given data is as bellow:

| $x$ | $y$ | $\Delta y$ | $\Delta^2 y$ | $\Delta^3 y$ |
|---|---|---|---|---|
| 0 | $1 = y_0$ | | | |
| | | $2 = \Delta y_0$ | | |
| 1 | 3 | | $2 = \Delta^2 y_0$ | |
| | | 4 | | $0 = \Delta^3 y_0$ |
| 2 | 7 | | 2 | |
| | | 6 | | |
| 3 | 13 | | | |

we know,

Newton's forward interpolation formula,

$$y(x) = y_0 + u\Delta y_0 + \frac{u(u-1)}{2!}\Delta^2 y_0 + \frac{u(u-1)(u-2)}{3!}\Delta^3 y_0 \quad \text{---------- (1)}$$

where $u = \frac{x - x_0}{h} = \frac{x-0}{1} = x$ | $h = 1-0 = 1$, $x_0 = 0$

Now putting those values in equation (1)

$$y(x) = 1 + 2x + \frac{x(x-1)}{2} \times 2 + \frac{x(x-1)(x-2)}{6} \times 0$$

$$= 1 + 2x + x^2 - x$$

$$= 1 + x + x^2$$

$\therefore y(x) = x^2 + x + 1$, which is the required polynomial.