

$$\text{Now, } a_0 + a_1x + a_2x^2 + a_3x^3 = \alpha(1+x) + \beta(2+x) + \gamma x^2 + \delta x^3$$

$$= (\alpha + 2\beta) + (\alpha + \beta)x + \gamma x^2 + \delta x^3$$

$$a_3 = \delta$$

$$a_2 = \gamma$$

$$a_1 = \alpha + \beta$$

$$a_0 = \alpha + 2\beta$$

$$\Rightarrow \beta = a_0 - a_1$$

$$\alpha = a_1 - a_0 + a_1 = 2a_1 - a_0$$

$$\therefore a_0 + a_1x + a_2x^2 + a_3x^3 = (2a_1 - a_0)(1+x) + (a_0 - a_1)(2+x) + a_2x^2 + a_3x^3$$

$$T(a_0 + a_1x + a_2x^2 + a_3x^3) = (2a_1 - a_0)(1+x) + (a_0 - a_1)(x + 3x^2)$$

$$= 2a_1 - a_0 + (2a_1 - a_0 + a_0 - a_1)x$$

$$+ (a_0 - a_1)3x^2$$

$$= (2a_1 - a_0) + a_1x + 3(a_0 - a_1)x^2$$