Problem might seem a bit out of place by notation and all, but it is quite easy, give it a go.

Q15. In the expansion of $(x + a)^n$, if the sum of odd term is denoted by 0 and the sum of even term by Then, prove that

(i) $O^2 - E^2 = (x^2 - a^2)^n$

(ii) $4OE = (x + a)^{2n} - (x - a)^{2n}$

Sol. (i) We have $(x + a)^n = {}^nC_0x^n + {}^nC_1x^{n-1}a^1 + {}^nC_2x^{n-2}a^2 + {}^nC_3x^{n-3}a^3 + \ldots + {}^nC_na^n$

Sum of odd terms, $O = {}^nC_0x^n + {}^nC_2x^{n-2}a^2 + \ldots$

And sum of even terms, $E = {}^nC_1x^{n-1}a + {}^nC_3x^{n-3}a^3 + \ldots$

Since $(x + a)^n = O + E$ (i)

$(x - a)^n = O - E$ (ii)

$\therefore \quad (O + E)(O - E) = (x + a)^n(x - a)^n$

$\Rightarrow \quad O^2 - E^2 = (x^2 - a^2)^n$

(ii) $4OE = (O + E)^2 - (O - E)^2 = [(x + a)^n]^2 - [(x - a)^n]^2 = (x + a)^{2n} - (x - a)^{2n}$