Binomial Expansion | Past Paper Question | P1 CIE June 2013 Q2

(i) In the expression $(1 - px)^6$, p is a non-zero constant. Find the first three terms when $(1 - px)^6$ is expanded in ascending powers of x. [2]

(ii) It is given that the coefficient of x^2 in the expansion of $(1 - x)(1 - px)^6$ is zero. Find the value of p. [3]

(i)

$$(1 + a)^n \equiv 1 + na + \frac{n(n-1)}{2!}a^2 + \frac{n(n-1)(n-2)}{3!}a^3 + \dots$$

$$(1 - px)^6 \equiv 1 + 6(-px) + \frac{6(5)}{2!}(-px)^2 + \dots$$

$$(a + b)^n \equiv {}^nC_0 a^n b^0 + {}^nC_1 a^{n-1}b^1 + {}^nC_2 a^{n-2}b^2 + \dots$$

$$(1 - px)^6 \equiv {}^6C_0(1)^6(-px)^0 + {}^6C_1(1)^5(-px)^1 + {}^6C_2(1)^4(-px)^2 + \dots$$

$$\equiv 1 - 6px + 15p^2x^2 + \dots$$

(ii) $\quad (1 - x)(1 - px)^6 \equiv (1 - x)(1 - 6px + 15p^2x^2 + \dots)$

$\therefore$ if coefficient of $x^2 = 0$

then $\quad 15p^2 + 6p = 0$

$\therefore 3p(5p + 2) = 0$

$\therefore p = 0$ or $5p + 2 = 0$

but $p \neq 0$

$\therefore 5p + 2 = 0$

$p = -2/5$

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