Cambridge International AS & A Level

Mathematics 9709

Paper 1 Pure Mathematics 1

Topic 6-Binomial Expansion

Question No (22)

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Find the term independent of x in the expansion of $\left(2x - \frac{1}{4x^2}\right)^9$.

Solution

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$$\left(2x-\frac{1}{4x^2}\right)^9$$

Binomial expansion

$$(a+b)^n = {}^nC_0\, a^n b^0 + {}^nC_1\, a^{n-1} b^1 + {}^nC_2\, a^{n-2} b^2 + \cdots + {}^nC_n\, a^0 b^n$$

$$= {}^9C_0 (2x)^9 \left(-\frac{1}{4x^2}\right)^0 + {}^9C_1 (2x)^8 \left(-\frac{1}{4x^2}\right)^1 + {}^9C_2 (2x)^7 \left(-\frac{1}{4x^2}\right)^2 + {}^9C_3 (2x)^6 \left(-\frac{1}{4x^2}\right)^3 + \cdots$$

$$= 512x^9 + 9(256x^8)\left(-\frac{1}{4x^2}\right) + 36(128x^7)\left(\frac{1}{16x^4}\right) + 84(64x^6)\left(-\frac{1}{64x^6}\right) + \cdots$$

$$= 512x^9 - 576x^6 + 288x^3 - 84 + \cdots$$

∴ The term independent of $x = -84$