

Cambridge International AS & A Level

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Mathematics

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Paper 1 Pure Mathematics 1

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Question No (3)

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**Question No (3)**

The coefficient of  $x^7$  in the expansion of  $(px^2 + \frac{4}{p}x)^5$  is 1280.

Find the value of the constant  $p$ .

**Solution:**

Given term

$$(px^2 + \frac{4}{p}x)^5$$

Binomial Expansion formula

$$(a+b)^n = a^n + \binom{n}{1} a^{n-1} b^1 + \binom{n}{2} a^{n-2} b^2 + \dots + \binom{n}{n-1} a b^{n-1} + b^n$$

$$(px^2 + \frac{4}{p}x)^5 = (px^2)^5 + \binom{5}{1} (px^2)^{5-1} (\frac{4}{p}x)^1 + \binom{5}{2} (px^2)^{5-2} (\frac{4}{p}x)^2 + \binom{5}{3} (px^2)^{5-3} (\frac{4}{p}x)^3 + \dots$$

If we observe 4th term of the expansion

$$\binom{5}{3} (px^2)^{5-3} (\frac{4}{p}x)^3$$

$$\binom{5}{3} p^2 x^4 (\frac{4}{p})^3 x^3$$

$$\binom{5}{3} p^2 (\frac{4}{p})^3 x^7$$

As the coefficient of  $x^7$  is 1280, so

$$\binom{5}{3} p^2 (\frac{4}{p})^3 = 1280$$

$$\frac{5 \times 4 \times 3}{3 \times 2 \times 1} p^2 \times \frac{64}{p^3} = 1280$$

$$\frac{64 \times 10}{p} = 1280$$

$$p = \frac{64 \times 10}{1280} = \frac{64}{128} = \frac{1}{2}$$

$$p = \frac{1}{2}$$