Cambridge International AS & A Level

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Mathematics 9709/12

Paper 1 Pure Mathematics 1 **October/November 2020**

Question No (1)

1 The coefficient of x^3 in the expansion of $(1 + kx)(1 - 2x)^5$ is 20.

Find the value of the constant k.

Solution:

General term

$$T_{r+1} = C_r^n a^{n-r} b^r$$

Binomial Expansion formula

$$(1 + x)^n = 1 + n(x) + \frac{n(n-1)}{2!}(x)^2 + \frac{n(n-1)(n-2)}{3!}(x)^3 + \cdots$$

$$(1 + kx)(1 - 2x)^5$$

Using Binomial Formula

$$(1 + kx)\left(1 + 5(-2x) + \frac{5(5-1)}{2!}(-2x)^2 + \frac{5(5-1)(5-2)}{3!}(-2x)^2\right)$$

$$(1 + kx)(1 - 10x + 40x^2 - 80x^3)$$

$$1 - 10x + 40x^2 - 80x^3 + kx - 10kx^2 + 40kx^3 - 80kx^4$$

Coefficient of x^3

$$(-80 + 40k)$$

$$=> \ -80 + 40k = 20 \quad (By\ given\ condition)$$

$$40k = 20 + 80$$

$$40\,k = 100$$

$$k = \frac{100}{40} = \frac{10}{4} = \frac{5}{2}$$

$$\boldsymbol{k = \frac{5}{2}}$$