Cambridge International AS & A Level

Mathematics 9709

Paper 1 Pure Mathematics 1

Topic 6-Binomial Expansion

Question No (2)

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Find the coefficient of x^2 in the expansion of $\left(x+\frac{2}{x}\right)^6$.

Solution

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General term formula

$$T_{r+1} = {}^{n}C_{r}\, a^{n-r}\, b^{r}$$

As General term

$$T_{r+1} = {}^{n}C_{r}\, a^{n-r}\, b^{r}$$

$$\Rightarrow {}^{6}C_{r}\, (x)^{6-r} \left(\frac{2}{x}\right)^{r}$$

$$= {}^{6}C_{r}\, (x)^{6-r}\, (2)^{r}\, (x^{-1})^{r}$$

$$= {}^{6}C_{r}\, (x)^{6-r}\, 2^{r}\, x^{-r}$$

$$= {}^{6}C_{r}\, 2^{r}\, x^{6-r-r}$$

$$= {}^{6}C_{r}\, 2^{r}\, x^{6-2r} \longrightarrow (1)$$

For the coefficient of x^2, compare power of x

$$6 - 2r = 2$$
$$-2r = 2 - 6$$
$$-2r = -4$$
$$r = 2$$

Now put $r = 2$ in General term Eq(1)

$$T_{2+1} = {}^{6}C_{2} (2)^{2} x^{6-2(2)}$$

$$= {}^{6}C_{2} (2)^{2} x^{2}$$

$$= \frac{6 \times 5}{2 \times 1} \times 4 \; x^{2}$$

$$= 30 \times 2 \; x^{2}$$

$$= 60 x^{2}$$

$\therefore$ coefficient of x^{2} is 60.