

MATHEMATICS • CLASS 11

CHAPTER 7

Binomial Theorem

NCERT SOLUTIONS



EXERCISE 7.1 — QUESTIONS 1-2

Q1. $(1 - 2x)^5$

Using the binomial theorem,

$$(a + b)^5 = C(5, 0)a^5 + C(5, 1)a^4b + C(5, 2)a^3b^2 + C(5, 3)a^2b^3 + C(5, 4)ab^4 + C(5, 5)b^5.$$

For $(1 - 2x)^5$, the coefficients are 1, 5, 10, 10, 5, 1 and the signs alternate because of $-2x$.

Hence,

$$(1 - 2x)^5 = 1 - 10x + 40x^2 - 80x^3 + 80x^4 - 32x^5.$$

Q2. $\left(\frac{2}{x} - \frac{x}{2}\right)^5, \quad x \neq 0.$

Using the binomial theorem,

$$(a + b)^5 = C(5, 0)a^5 + C(5, 1)a^4b + C(5, 2)a^3b^2 + C(5, 3)a^2b^3 + C(5, 4)ab^4 + C(5, 5)b^5.$$

Let $a = \frac{2}{x}$ and $b = -\frac{x}{2}$.

Then the terms for $k = 0$ to 5 are

$$C(5, k) \left(\frac{2}{x}\right)^{5-k} \left(-\frac{x}{2}\right)^k.$$

Hence,

$$\left(\frac{2}{x} - \frac{x}{2}\right)^5 = \frac{32}{x^5} - \frac{40}{x^3} + \frac{20}{x} - 5x + \frac{5x^3}{8} - \frac{x^5}{32}.$$

EXERCISE 7.1 – QUESTION 3

Q3. Expand $(2x - 3)^6$ with coefficients 1, 6, 15, 20, 15, 6, 1.

Solution:

The general term in the expansion of $(a + b)^n$ is

$$T_{k+1} = C(n, k) a^{n-k} b^k.$$

Hence the general term in the expansion of $(2x - 3)^6$ is

$$T_{k+1} = C(6, k)(2x)^{6-k}(-3)^k, \quad k = 0, 1, 2, 3, 4, 5, 6.$$

Using the coefficients 1, 6, 15, 20, 15, 6, 1, we get

$$\begin{aligned}(2x - 3)^6 &= 1 \cdot (2x)^6 + 6 \cdot (2x)^5(-3) + 15 \cdot (2x)^4(-3)^2 + 20 \cdot (2x)^3(-3)^3 \\ &\quad + 15 \cdot (2x)^2(-3)^4 + 6 \cdot (2x)(-3)^5 + 1 \cdot (-3)^6.\end{aligned}$$

Simplifying, we obtain

$$(2x - 3)^6 = 64x^6 - 576x^5 + 2160x^4 - 4320x^3 + 4860x^2 - 2916x + 729.$$

EXERCISE 7.1 — QUESTION 4

Q4. Expand $\left(\frac{x}{3} + \frac{1}{x}\right)^5$, $x \neq 0$.

Solution:

The general term is

$$T_{k+1} = C(5, k) \left(\frac{x}{3}\right)^{5-k} \left(\frac{1}{x}\right)^k, \quad k = 0, 1, 2, 3, 4, 5.$$

Thus, the expansion is

$$\left(\frac{x}{3} + \frac{1}{x}\right)^5 = \frac{x^5}{243} + \frac{5x^3}{81} + \frac{10x}{27} + \frac{10}{9x} + \frac{5}{3x^3} + \frac{1}{x^5}.$$

EXERCISE 7.1 – QUESTION 5

Q5. Expand $\left(x + \frac{1}{x}\right)^6$, $x \neq 0$.

Solution:

The general term in the expansion of $\left(x + \frac{1}{x}\right)^6$ is

$$C(6, k) x^{6-k} \left(\frac{1}{x}\right)^k = C(6, k) x^{6-2k}.$$

Substituting $k = 0, 1, 2, 3, 4, 5, 6$ and adding the terms, we get

Result:

$$\left(x + \frac{1}{x}\right)^6 = x^6 + 6x^4 + 15x^2 + 20 + \frac{15}{x^2} + \frac{6}{x^4} + \frac{1}{x^6}.$$

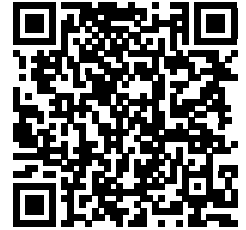


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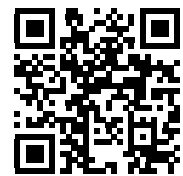


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