CLASS 11 MATHS NCERT SOLUTIONS

NCERT Solutions for Class 11 Maths Chapter 7: Binomial Theorem – Free PDF Download

Chapter 7 of the current (2026-27 rationalised) NCERT Class 11 Maths textbook, Binomial Theorem, teaches students how to expand expressions of the form (a + b)n for any positive integer n without multiplying the binomial out term by term. The chapter builds the theorem from Pascal's Triangle, states it formally with...

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Chapter 7 of the current (2026-27 rationalised) NCERT Class 11 Maths textbook, Binomial Theorem, teaches students how to expand expressions of the form $(a + b)^n$ for any positive integer n without multiplying the binomial out term by term. The chapter builds the theorem from Pascal's Triangle, states it formally with binomial coefficients (^nC_r), and applies it to expand algebraic expressions, approximate large powers of numbers close to a round figure, and prove divisibility results. These Class 11 Maths Chapter 7 solutions are also useful as quick revision notes before exams.

Exercise 7.1

Q1. Expand the expression $(1 – 2x)^5$

By the Binomial Theorem,

$(1 - 2x)^5 = {}^5C_0(1)^5 - {}^5C_1(1)^4(2x) + {}^5C_2(1)^3(2x)^2 - {}^5C_3(1)^2(2x)^3 + {}^5C_4(1)(2x)^4 - {}^5C_5(2x)^5$
$= 1 - 5(2x) + 10(4x^2) - 10(8x^3) + 5(16x^4) - 32x^5$
$= \mathbf{1 - 10x + 40x^2 - 80x^3 + 80x^4 - 32x^5}$

Q2. Expand the expression $(2/x – x/2)^5$

By the Binomial Theorem, the general term is ${}^5C_k(2/x)^{5-k}(-x/2)^k$. Evaluating for k = 0 to 5:

$(2/x - x/2)^5 = 32/x^5 - 40/x^3 + 20/x - 5x + (5/8)x^3 - (1/32)x^5$

Q3. Expand the expression $(2x – 3)^6$

$(2x - 3)^6 = {}^6C_0(2x)^6 - {}^6C_1(2x)^5(3) + {}^6C_2(2x)^4(3)^2 - {}^6C_3(2x)^3(3)^3 + {}^6C_4(2x)^2(3)^4 - {}^6C_5(2x)(3)^5 + {}^6C_6(3)^6$
$= \mathbf{64x^6 - 576x^5 + 2160x^4 - 4320x^3 + 4860x^2 - 2916x + 729}$

Q4. Expand the expression $(x/3 + 1/x)^5$

$(x/3 + 1/x)^5 = \mathbf{x^5/243 + 5x^3/81 + 10x/27 + 10/(9x) + 5/(3x^3) + 1/x^5}$

Q5. Expand the expression $(x + 1/x)^6$

$(x + 1/x)^6 = {}^6C_0x^6 + {}^6C_1x^5(1/x) + {}^6C_2x^4(1/x)^2 + {}^6C_3x^3(1/x)^3 + {}^6C_4x^2(1/x)^4 + {}^6C_5x(1/x)^5 + {}^6C_6(1/x)^6$
$= \mathbf{x^6 + 6x^4 + 15x^2 + 20 + 15/x^2 + 6/x^4 + 1/x^6}$

Using binomial theorem, evaluate each of the following:

Q6. $(96)^3$

$96 = 100 - 4$, so $(96)^3 = (100 - 4)^3$
$= {}^3C_0(100)^3 - {}^3C_1(100)^2(4) + {}^3C_2(100)(4)^2 - {}^3C_3(4)^3$
$= 1000000 - 120000 + 4800 - 64$
$= \mathbf{884736}$

Q7. $(102)^5$

$102 = 100 + 2$, so $(102)^5 = (100 + 2)^5$
$= 10000000000 + 1000000000 + 40000000 + 800000 + 8000 + 32$
$=$ **11040808032**

Q8. $(101)^4$

$101 = 100 + 1$, so $(101)^4 = (100 + 1)^4$
$= 100000000 + 4000000 + 60000 + 400 + 1$
$=$ **104060401**

Q9. $(99)^5$

$99 = 100 - 1$, so $(99)^5 = (100 - 1)^5$
$= 10000000000 - 500000000 + 10000000 - 100000 + 500 - 1$
$=$ **9509900499**

Q10. Using Binomial Theorem, indicate which number is larger $(1.1)^{10000}$ or 1000.

$(1.1)^{10000} = (1 + 0.1)^{10000} = {}^{10000}C_0 + {}^{10000}C_1(0.1)$ + other positive terms
$= 1 + 10000 \times 0.1$ + other positive terms $= 1 + 1000$ + other positive terms > 1001
Since all the remaining terms in the expansion are positive, $(1.1)^{10000} > 1001 > 1000$.
Hence, **$(1.1)^{10000}$ is larger than 1000.**

Q11. Find $(a + b)^4 - (a - b)^4$. Hence, evaluate $(\sqrt{3} + \sqrt{2})^4 - (\sqrt{3} - \sqrt{2})^4$.

$(a + b)^4 = a^4 + 4a^3b + 6a^2b^2 + 4ab^3 + b^4$
$(a - b)^4 = a^4 - 4a^3b + 6a^2b^2 - 4ab^3 + b^4$
Subtracting, the even-power terms cancel:
$(a + b)^4 - (a - b)^4 = \mathbf{8a^3b + 8ab^3}$
Putting $a = \sqrt{3}$, $b = \sqrt{2}$:
$= 8(\sqrt{3})^3(\sqrt{2}) + 8(\sqrt{3})(\sqrt{2})^3 = 8(3\sqrt{3})(\sqrt{2}) + 8(\sqrt{3})(2\sqrt{2}) = 24\sqrt{6} + 16\sqrt{6} = \mathbf{40\sqrt{6}}$

Q12. Find $(x + 1)^6 + (x - 1)^6$. Hence or otherwise evaluate $(\sqrt{2} + 1)^6 + (\sqrt{2} - 1)^6$.

$(x + 1)^6 = x^6 + 6x^5 + 15x^4 + 20x^3 + 15x^2 + 6x + 1$
$(x - 1)^6 = x^6 - 6x^5 + 15x^4 - 20x^3 + 15x^2 - 6x + 1$
Adding, the odd-power terms cancel:
$(x + 1)^6 + (x - 1)^6 = \mathbf{2x^6 + 30x^4 + 30x^2 + 2}$
Putting $x = \sqrt{2}$ (so $x^2 = 2$, $x^4 = 4$, $x^6 = 8$):
$= 2(8) + 30(4) + 30(2) + 2 = 16 + 120 + 60 + 2 = \mathbf{198}$

Q13. Show that $9^{n+1} - 8n - 9$ is divisible by 64, whenever n is a positive integer.

Write $9^{n+1} = (1 + 8)^{n+1}$. By the Binomial Theorem,
$9^{n+1} = {}^{n+1}C_0 + {}^{n+1}C_1(8) + {}^{n+1}C_2(8)^2 + {}^{n+1}C_3(8)^3 + \dots + {}^{n+1}C_{n+1}(8)^{n+1}$
$= 1 + 8(n + 1) + 8^2[{}^{n+1}C_2 + {}^{n+1}C_3(8) + \dots + {}^{n+1}C_{n+1}(8)^{n-1}]$
$= 1 + 8n + 8 + 64k$, where $k = {}^{n+1}C_2 + {}^{n+1}C_3(8) + \dots + {}^{n+1}C_{n+1}(8)^{n-1}$ is a natural number

Therefore, $9^{n+1} - 8n - 9 = 64k$, which is **divisible by 64** for every positive integer n.

Q14. Prove that $\Sigma_{r=0}^{n} 3^r\ {}^nC_r = 4^n$

By the Binomial Theorem, $(a + b)^n = \Sigma_{r=0}^{n}\ {}^nC_r\, a^{n-r}b^r$. Putting a = 1, b = 3:
$(1 + 3)^n = \Sigma_{r=0}^{n}\ {}^nC_r(1)^{n-r}(3)^r = \Sigma_{r=0}^{n} 3^r\ {}^nC_r$
Since 1 + 3 = 4, this gives $\boldsymbol{\Sigma_{r=0}^{n} 3^r\ {}^nC_r = 4^n}$, as required.

Miscellaneous Exercise

Q1. If a and b are distinct integers, prove that a – b is a factor of $a^n - b^n$, whenever n is a positive integer. [Hint: write $a^n = (a - b + b)^n$ and expand]

Write a = (a – b) + b, so $a^n = [(a - b) + b]^n$. By the Binomial Theorem,
$a^n = {}^nC_0(a - b)^n + {}^nC_1(a - b)^{n-1}b + \ldots + {}^nC_{n-1}(a - b)b^{n-1} + {}^nC_nb^n$
$a^n = (a - b)^n + {}^nC_1(a - b)^{n-1}b + \ldots + {}^nC_{n-1}(a - b)b^{n-1} + b^n$
So, $a^n - b^n = (a - b)[(a - b)^{n-1} + {}^nC_1(a - b)^{n-2}b + \ldots + {}^nC_{n-1}b^{n-1}]$
The expression in brackets is an integer, so (a – b) divides $a^n - b^n$ for every positive integer n. Hence proved.

Q2. Evaluate $(\sqrt{3} + \sqrt{2})^6 - (\sqrt{3} - \sqrt{2})^6$.

Only the odd-power terms of b survive in $(a + b)^6 - (a - b)^6$:
$(a + b)^6 - (a - b)^6 = 2[{}^6C_1a^5b + {}^6C_3a^3b^3 + {}^6C_5ab^5]$
With $a = \sqrt{3}$, $b = \sqrt{2}$: $a^5 = 9\sqrt{3}$, $a^3 = 3\sqrt{3}$, $b^3 = 2\sqrt{2}$, $b^5 = 4\sqrt{2}$
$= 2[6(9\sqrt{3})(\sqrt{2}) + 20(3\sqrt{3})(2\sqrt{2}) + 6(\sqrt{3})(4\sqrt{2})]$
$= 2[54\sqrt{6} + 120\sqrt{6} + 24\sqrt{6}] = 2(198\sqrt{6}) =$ $\mathbf{396\sqrt{6}}$

Q3. Find the value of $(a^2 + \sqrt{(a^2 - 1)})^4 + (a^2 - \sqrt{(a^2 - 1)})^4$.

Let $x = a^2$ and $y = \sqrt{(a^2 - 1)}$, so $y^2 = a^2 - 1$. Only the even-power terms of y survive:
$(x + y)^4 + (x - y)^4 = 2[{}^4C_0x^4 + {}^4C_2x^2y^2 + {}^4C_4y^4] = 2[x^4 + 6x^2y^2 + y^4]$
$= 2[a^8 + 6a^4(a^2 - 1) + (a^2 - 1)^2]$
$= 2[a^8 + 6a^6 - 6a^4 + a^4 - 2a^2 + 1]$
$= \mathbf{2a^8 + 12a^6 - 10a^4 - 4a^2 + 2}$

Q4. Find an approximation of $(0.99)^5$ using the first three terms of its expansion.

$(0.99)^5 = (1 - 0.01)^5$
$\approx {}^5C_0(1)^5 - {}^5C_1(1)^4(0.01) + {}^5C_2(1)^3(0.01)^2$
= 1 – 5(0.01) + 10(0.0001)
= 1 – 0.05 + 0.001 = **0.951**

Q5. Expand using Binomial Theorem $(1 + x/2 - 2/x)^4$, $x \neq 0$.

Grouping as $[(1 + x/2) + (-2/x)]^4$ and expanding fully using the Binomial Theorem (each power of (1 + x/2) itself expanded again), and collecting like powers of x:

$(1 + x/2 - 2/x)^4$ = $\mathbf{x^4/16 + x^3/2 + x^2/2 - 4x - 5 + 16/x + 8/x^2 - 32/x^3 + 16/x^4}$

Q6. Find the expansion of $(3x^2 - 2ax + 3a^2)^3$ using binomial theorem.

Treating $3x^2$, $-2ax$ and $3a^2$ as the three terms of a trinomial and expanding $(A + B + C)^3 = A^3 + B^3 + C^3 + 3A^2B + 3A^2C + 3AB^2 + 3B^2C + 3AC^2 + 3BC^2 + 6ABC$, and collecting terms by power of x and a:

$(3x^2 - 2ax + 3a^2)^3$ = $\mathbf{27x^6 - 54ax^5 + 117a^2x^4 - 116a^3x^3 + 117a^4x^2 - 54a^5x + 27a^6}$

Class 11 Maths Chapter 7 – Notes and Extra Questions

Binomial Theorem (positive integral index): $(a + b)^n = {}^nC_0a^n + {}^nC_1a^{n-1}b + {}^nC_2a^{n-2}b^2 + \dots + {}^nC_nb^n = \Sigma_{k=0}^{n}\, {}^nC_ka^{n-k}b^k$.

General term: $T_{r+1} = {}^nC_ra^{n-r}b^r$ — this is used to find any particular term without expanding the whole binomial.

Number of terms: the expansion of $(a + b)^n$ always has exactly $(n + 1)$ terms.

Pascal's Triangle: the array of binomial coefficients ${}^nC_r$, where each entry is the sum of the two entries above it; also known as Meru Prastara (given by Pingala).

Special expansions: $(x - y)^n = {}^nC_0x^n - {}^nC_1x^{n-1}y + \dots + (-1)^n\, {}^nC_ny^n$; $(1 + x)^n = {}^nC_0 + {}^nC_1x + \dots + {}^nC_nx^n$; putting $x = 1$ gives ${}^nC_0 + {}^nC_1 + \dots + {}^nC_n = 2^n$.

Index/power symmetry: in every term of the expansion, the sum of the powers of a and b always equals n.

Common technique: $(a + b)^n \pm (a - b)^n$ is used to isolate the odd-power or even-power terms only — very useful for irrational/surd evaluation questions.

Approximation technique: for numbers close to a round base (like 98, 101, 0.99), write the number as (round base ± small number) and use only the first few terms of the expansion for a quick approximate value.

How many exercises are there in the current (2026-27) NCERT Class 11 Maths Chapter 7?

In the rationalised NCERT textbook currently prescribed (Reprint 2026-27), Chapter 7 (Binomial Theorem) has only one exercise, Exercise 7.1 (14 questions), followed by the Miscellaneous Exercise (6 questions). Earlier, pre-rationalisation editions of this chapter had an additional Exercise 7.2 and a section on the general/rational-index binomial theorem, both of which have been removed from the current syllabus.

What is the Binomial Theorem formula for Class 11?

For any positive integer n, $(a + b)^n = {}^nC_0a^n + {}^nC_1a^{n-1}b + {}^nC_2a^{n-2}b^2 + \dots + {}^nC_nb^n$. This can also be written compactly using sigma notation as $\Sigma_{k=0}^{n}\, {}^nC_ka^{n-k}b^k$.

How do you quickly find a large power like 102^5 or 99^5 using the Binomial Theorem?

Write the number as a sum or difference of a round number and a small number — for example 102 = 100 + 2, or 99 = 100 – 1 — then expand using the Binomial Theorem. Since most of the resulting terms involve powers of 100, they are easy to compute and add or subtract, avoiding repeated multiplication.

Is the Binomial Theorem for any rational index still in the current NCERT Class 11 Maths syllabus?

No. In the current (2026-27) rationalised edition, Chapter 7 covers the Binomial Theorem only for positive integral indices. The topic of the binomial theorem for any rational index, which appeared in older editions of this chapter, has been removed from the present syllabus.