

□ Class 11 Mathematics – Chapter: Binomial Theorem

1. Introduction

- The Binomial Theorem provides a formula to expand powers of binomials like $(a+b)^n$.
 - It is useful for algebraic expansions and solving equations.
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2. Binomial Expression

- Expression of the form $(a+b)^n$, where n is a non-negative integer.

3. Binomial Theorem Statement

$$(a+b)^n = \sum_{k=0}^n \binom{n}{k} a^{n-k} b^k$$

where $\binom{n}{k} = \frac{n!}{k!(n-k)!}$ are binomial coefficients.

4. Binomial Coefficients

- Represent the number of ways to choose k items from n .
 - Also appear in Pascal's Triangle.
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5. Pascal's Triangle

- Each row represents binomial coefficients for increasing n .

- Starts as:

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1
1 1
1 2 1
1 3 3 1
1 4 6 4 1
...
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6. Properties of Binomial Coefficients

- $\binom{n}{0} = 1$ and $\binom{n}{n} = 1$

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Symmetry: $\binom{n}{k} = \binom{n}{n-k}$

- Summation: $\sum_{k=0}^n \binom{n}{k} = 2^n$

7. Important Terms

- First term: a^n
- Last term: b^n
- Middle term:
 - For odd n , single middle term at $k = \frac{n}{2}$

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For even n , two middle terms at $k = \frac{n}{2}$ and $k = \frac{n}{2} - 1$

8. Examples

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Expand $(x+y)^3 = x^3 + 3x^2y + 3xy^2 + y^3$

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Find specific terms using binomial coefficients.

9. Applications

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Algebraic expansions

- Probability
 - Calculations in calculus and combinatorics
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10. Exam Tips

- Memorize binomial coefficient formulas.
- Practice expansions for various powers.
- Use Pascal's triangle for quick coefficients.
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Understand symmetry and term positions.