□ Class 11 Mathematics – Chapter: Permutations and Combinations

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1. Introduction

- Permutations and combinations are methods of counting arrangements and selections.
- Useful in probability, statistics, and real-life problems involving counting.

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2. Fundamental Principle of Counting

- If one event can happen in mmm ways and another independent event in nnn ways, then total ways = m×nm \times nm×n.

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3. Permutations

- Permutation: Arrangement of objects in a specific order.
- Number of permutations of nnn distinct objects = n!n!n!
- Permutations of nnn objects taken rrr at a time:

  nPr=n!(n−r)!{}^nP_r = \frac{n!}{(n-r)!}nPr=(n−r)!n!
- When some objects are identical:

  n!p!q!r!...\frac{n!}{p!q!r! \ldots}p!q!r!...n!

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4. Combinations

- Combination: Selection of objects without regard to order.
- Number of combinations of nnn distinct objects taken rrr at a time:

  nCr=n!r!(n−r)!{}^nC_r = \frac{n!}{r!(n-r)!}nCr=r!(n−r)!n!
- Relation between permutation and combination:

  nPr=nCr×r!{}^nP_r = {}^nC_r \times r!nPr=nCr×r!

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5. Properties

- nC0=1{}^nC_0 = 1nC0=1
- nCr=nCn−r{}^nC_r = {}^nC_{n-r}nCr=nCn−r

- Pascal’s Identity:

  nCr=n−1Cr−1+n−1Cr{}^nC_r = {}^{n-1}C_{r-1} + {}^{n-1}C_rnCr=n−1Cr−1+n−1Cr

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6. Applications

- Arrangements of letters, digits
- Forming committees, teams
- Probability problems
- Games and puzzles

7. Tips for Exams

- Memorize factorial values for 1 to 10.
- Practice factorial simplifications.
- Understand difference between permutation and combination clearly.
- Solve problems involving repeated elements carefully.