Class 11 Maths Chapter 6: Permutations and Combinations - Notes, Important Questions and MCQs (2026-27)

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Class 11 Maths Chapter 6, Permutations and Combinations, teaches systematic counting – how many ways objects can be arranged or selected without listing them all.

These notes cover the fundamental principle of counting, factorial notation, permutations of distinct and repeated objects, combinations, their key properties and typical board problems.

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Chapter Overview

A permutation is an arrangement in a definite order; a combination is a selection where order does not matter.

For example, choosing a captain and vice-captain from 5 players is a permutation (order matters), while choosing a 2-member committee is a combination.

Important Topics and Concepts

Fundamental Principle of Counting

- Multiplication principle: if one event can occur in m ways and, after it, another in n ways, both can occur in $m \times n$ ways.
- This extends to any number of events.
- Example: 3 shirts and 2 trousers give $3 \times 2 = 6$ outfits.

- Example: number of 3-letter codes from 26 letters without repetition = 26 × 25 × 24.

Factorial Notation

- n! = 1 × 2 × 3 × ... × n; 0! = 1.
- n! = n × (n − 1)!.
- Example: 5! = 120; 7!/5! = 42.

Permutations of Distinct Objects

- Number of permutations of n different objects taken r at a time (no repetition): ${}^{n}P_{r} = n!/(n - r)!$, $0 \le r \le n$.
- ${}^{n}P_{n} = n!$.
- With repetition allowed: n^r arrangements.
- Example: 4-digit numbers using 1 to 9 without repetition = ${}^{9}P_{4} = 3024$.

Permutations When Objects Are Not Distinct

- Number of permutations of n objects where p objects are of one kind and the rest distinct: n!/p!.
- If p_1 objects are of one kind, p_2 of another, ..., p_k of kth kind: $n!/(p_1!\ p_2!\ \dots\ p_k!)$.
- Example: arrangements of letters of ALLAHABAD (9 letters; A four times, L twice): 9!/(4! 2!) = 7560.

Combinations

- Number of combinations of n different objects taken r at a time: ${}^{n}C_{r} = n!/(r!(n - r)!)$.
- ${}^{n}P_{r} = {}^{n}C_{r} \times r!$.
- ${}^{n}C_{0} = {}^{n}C_{n} = 1$.
- ${}^{n}C_{r} = {}^{n}C_{n-r}$; if ${}^{n}C_{a} = {}^{n}C_b$ then a = b or a + b = n.
- ${}^{n}C_{r} + {}^{n}C_{r-1} = {}^{n+1}C_{r}$ (Pascal’s rule).

Typical Problems

- Committee selection: choose 3 boys from 5 and 2 girls from 4 = ${}^{5}C_{3} \times {}^{4}C_{2} = 10 \times 6 = 60$.
- Words with letters together: treat the group as one unit and multiply by internal arrangements.
- Words with vowels never together: total arrangements minus arrangements with vowels together.
- Selection with “at least”: add cases or subtract the complement.

Permutation or Combination? Decision Table

Situation	Order matters?	Use
Arranging books on a shelf	Yes	${}^{n}P_{r}$ or n!
Forming numbers or words	Yes	${}^{n}P_{r}$ / $n!/(p_1!\dots)$
Selecting a team or committee	No	${}^{n}C_{r}$
Choosing president and secretary	Yes	${}^{n}P_{r}$
Choosing cards from a pack	No	${}^{n}C_{r}$
Seating people in a row	Yes	n!

Important Definitions and Terms

Term	Meaning
Fundamental principle of counting	If events occur in m and n ways, together they occur in mn ways.
Factorial	n! is the product of first n natural numbers; 0! = 1.
Permutation	An arrangement in a definite order.
Combination	A selection where order does not matter.
${}^{n}P_{r}$	$n!/(n-r)!$.
${}^{n}C_{r}$	$n!/(r!(n-r)!)$.
Pascal’s rule	${}^{n}C_{r} + {}^{n}C_{r-1} = {}^{n+1}C_{r}$.

Short Answer Questions

Q1. Evaluate $8!/(6! \times 2!)$.

$8 \times 7/2 = 28$.

Q2. Find ${}^{6}P_{2}$.

$6!/4! = 30$.

Q3. How many 3-digit numbers can be formed from 1, 2, 3, 4, 5 if repetition is allowed?

$5^{3} = 125$.

Q4. Find ${}^{12}C_{10}$.

${}^{12}C_{2} = 66$.

Q5. If ${}^{n}C_{8} = {}^{n}C_{2}$, find n.

$8 + 2 = n$, so $n = 10$.

Q6. How many arrangements of the letters of the word MISSISSIPPI?

$11!/(4!\,4!\,2!) = 34650$.

Q7. In how many ways can 5 people sit in a row?

$5! = 120$.

Q8. How many chords can be drawn through 21 points on a circle?

${}^{21}C_{2} = 210$.

Long Answer Questions

Q1. How many words, with or without meaning, can be formed from the letters of DAUGHTER so that vowels are always together?

DAUGHTER has 8 letters: vowels A, U, E (3) and consonants D, G, H, T, R (5).

Treat the vowels as one unit: 6 units arranged in $6! = 720$ ways.

Vowels arrange among themselves in $3! = 6$ ways. Total $= 720 \times 6 = 4320$.

Q2. A committee of 7 is to be formed from 9 boys and 4 girls. In how many ways if it has

Choose 3 girls from 4: ${}^4C_3 = 4$.

Choose 4 boys from 9: ${}^9C_4 = 126$.

Total = $4 \times 126 = 504$ ways.

Q3. Prove that ${}^nC_r + {}^nC_{r-1} = {}^{n+1}C_r$.

LHS = $n!/(r!(n-r)!) + n!/((r-1)!(n-r+1)!)$.

Take $n!/((r-1)!(n-r)!)$ common: $= n!/((r-1)!(n-r)!) \times [1/r + 1/(n-r+1)] = n!/((r-1)!(n-r)!) \times (n+1)/(r(n-r+1))$.

$= (n+1)!/(r!(n-r+1)!) = {}^{n+1}C_r$. Hence proved.

MCQs with Answers

1. 0! =(a) 0 (b) 1 (c) Undefined (d) ∞Answer: (b) 1

2. ${}^nP_r$ =(a) $n!/r!$ (b) $n!/(n-r)!$ (c) $n!/(r!(n-r)!)$ (d) $r!$Answer: (b) $n!/(n-r)!$

3. ${}^nC_r = {}^nC_{n-r}$ is:(a) True (b) False (c) True only for r = 1 (d) True only for even nAnswer: (a) True

4. ${}^5C_2$ =(a) 10 (b) 20 (c) 5 (d) 25Answer: (a) 10

5. Arrangements of 4 distinct books:(a) 4 (b) 16 (c) 24 (d) 12Answer: (c) 24

6. Selecting a team is a:(a) Permutation (b) Combination (c) Both (d) NeitherAnswer: (b) Combination

7. ${}^nP_r = {}^nC_r \times$(a) $n!$ (b) $r!$ (c) $(n-r)!$ (d) 1Answer: (b) $r!$

8. Arrangements of letters of BOOK:(a) 24 (b) 12 (c) 6 (d) 4Answer: (b) 12

9. Number of diagonals of a hexagon:(a) 6 (b) 9 (c) 12 (d) 15Answer: (b) 9

10. If ${}^nC_3 = {}^nC_5$, n =(a) 8 (b) 15 (c) 2 (d) 10Answer: (a) 8

Quick Revision Points

- Multiplication principle: $m \times n$ ways.
- $n! = n(n-1)!$; $0! = 1$.
- ${}^nP_r = n!/(n-r)!$.
- With repetition: n^r.
- Repeated objects: $n!/(p_1!p_2!\ldots)$.
- ${}^nC_r = n!/(r!(n-r)!)$.
- ${}^nP_r = r! \times {}^nC_r$.
- ${}^nC_r = {}^nC_{n-r}$.
- ${}^nC_r + {}^nC_{r-1} = {}^{n+1}C_r$.
- Diagonals of n-gon = ${}^nC_2 - n$.

Chapter Summary

Counting problems are solved using the fundamental principle of counting and factorial notation. Permutations count ordered arrangements: ${}^nP_r$ for distinct objects, n^r with repetition,

Combinations count selections where order does not matter, using ${}^{n}C_{r} = n!/(r!(n - r)!)$. Properties like ${}^{n}C_{r} = {}^{n}C_{n-r}$ and Pascal's rule simplify calculations in committee, word and geometry problems.

Exam Tips and PYQ Pattern

- Ask first: does order matter? That decides P or C.
- For "together" problems, treat the group as one unit.
- For "never together", subtract from total arrangements.
- Simplify factorials by cancelling before multiplying.
- Check repeated letters carefully in word problems.
- Use ${}^{n}C_{r} = {}^{n}C_{n-r}$ to reduce large r.

Frequently Asked Questions

Is this chapter in the 2026-27 CBSE syllabus?

Yes. It is part of the NCERT Class 11 Mathematics textbook, prescribed in the CBSE 2026-27 syllabus.

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Yes. Use the free PDF link at the top of this page – no signup needed.

What is the difference between permutation and combination?

Permutation is arrangement where order matters; combination is selection where order does not matter.

What is 0!?

0! = 1 by definition.

How do you count words with repeated letters?

Divide n! by the factorials of the counts of each repeated letter.

Conclusion

Permutations and Combinations rewards clear thinking. Use the decision table, practise word and committee problems, and download the free PDF for quick revision.

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Author Bio: Written and reviewed by the Nextoper Editorial Team, a group of CBSE maths educators who build chapter notes directly from the NCERT textbook and past board paper patterns.

Freshness Note: These notes follow the NCERT Class 11 Maths textbook, Mathematics (Class XI) (NCERT reprint 2026-27, rationalised syllabus), and the CBSE syllabus for the 2026-27 session. Last checked on 28 November 2026.