CLASS 11 MATHEMATICS — FORMULA SHEET

Chapter 6 : Permutations and Combinations (NCERT)

6.1 Fundamental Principle of Counting

Principle	Statement / Formula
Multiplication principle (AND)	If one event happens in m ways AND another in n ways, both happen in m × n ways
Addition principle (OR)	If one event happens in m ways OR another in n ways (mutually exclusive), total = m + n ways
Key distinction	AND → multiply ; OR → add

6.2 Factorial Notation

Concept	Formula
Factorial n!	$n! = n \times (n-1) \times (n-2) \times \ldots \times 2 \times 1$
Zero & one	$0! = 1$; $1! = 1$
Recursive relation	$n! = n \times (n-1)!$
Example values	2!=2, 3!=6, 4!=24, 5!=120, 6!=720
Note	Factorial defined only for non-negative integers

6.3 Permutations (Arrangement — Order Matters)

Case	Formula
Permutations of n distinct, taken r	${}^nP_r = n! \div (n-r)!$
All n taken at a time	${}^nP_n = n!$
${}^nP_0$	= 1
Repetition allowed (r places)	n^r (each place filled in n ways)
Objects with repetition (p, q alike)	$n! \div (p!\, q!\, r! \ldots)$
Circular permutation (n objects)	$(n-1)!$
Circular (clockwise = anticlockwise)	$(n-1)! \div 2$ (e.g. necklace, garland)

6.4 Combinations (Selection — Order Doesn't Matter)

Case	Formula
Combinations of n distinct, taken r	${}^nC_r = n! \div [r!(n-r)!]$
${}^nC_0$ and ${}^nC_n$	= 1
${}^nC_1$	= n
Symmetry property	${}^nC_r = {}^nC_{(n-r)}$
Relation to permutation	${}^nP_r = {}^nC_r \times r!$
Pascal's rule	${}^nC_r + {}^nC_{(r-1)} = {}^{n+1}C_r$

Case	Formula
If ${}^nC_x = {}^nC_y$	Then x = y OR x + y = n
Sum of all combinations	${}^nC_0 + {}^nC_1 + \ldots + {}^nC_n = 2^n$

6.5 Permutation vs Combination

Aspect	Permutation	Combination
Meaning	Arrangement	Selection
Order	Matters	Does NOT matter
Formula	${}^nP_r = n!/(n-r)!$	${}^nC_r = n!/[r!(n-r)!]$
Relation	${}^nP_r = {}^nC_r \times r!$	${}^nC_r = {}^nP_r \div r!$
Keywords	arrange, order, rank, word, number	choose, select, team, group, committee

6.6 Common Problem Patterns

Problem Type	Approach
Words from letters	Use ${}^nP_r$; for repeated letters divide by factorials of repeats
Numbers with digits	Count place by place; watch for 'no repetition' and leading-zero cases
Always together	Tie the group as ONE unit, arrange, then arrange within the unit
Never together	(Total arrangements) − (arrangements with them together)
At least / at most	Add up the required cases (use combinations, sum them)
Forming committees	Use ${}^nC_r$; multiply choices for each sub-group (men AND women)
Handshakes / lines / diagonals	Handshakes = ${}^nC_2$; diagonals of n-gon = ${}^nC_2 - n$

★ QUICK MEMORY AIDS & TRICKS

Order test	Order matters → Permutation (P) ; order doesn't → Combination (C).
AND vs OR	AND → multiply (fundamental principle) ; OR → add.
${}^nPr$ vs ${}^nCr$	${}^nPr = {}^nCr \times r!$ (permutation is r! times bigger — counts arrangements).
Symmetry	${}^nCr = {}^nC(n-r)$. So ${}^{10}C7 = {}^{10}C3$ (pick the smaller for easy calc).
0! = 1	Remember 0! = 1 and ${}^nC0 = {}^nCn = 1$.
Together trick	'Always together' → glue as one unit, then multiply by internal arrangements.
Circular	n objects in a circle → (n−1)! ; necklace/garland → (n−1)!/2.
Handshakes	n people shaking hands = ${}^nC2 = n(n-1)/2$.