CLASS 11 MATHEMATICS — FORMULA SHEET

Chapter 7 : Binomial Theorem (NCERT)

7.1 Binomial Theorem for Positive Integer n

Concept	Formula
Binomial expansion	$(a + b)^n = \Sigma\ {}^nC_r\ a^{(n-r)}\ b^r$, $(r = 0$ to $n)$
Expanded form	$(a+b)^n = {}^nC_0a^n + {}^nC_1a^{(n-1)}b + {}^nC_2a^{(n-2)}b^2 + \ldots + {}^nC_nb^n$
Number of terms	$(n + 1)$ terms in the expansion
$(a - b)^n$	Same but with alternating signs: ${}^nC_r\ a^{(n-r)}\ (-b)^r$
$(1 + x)^n$	${}^nC_0 + {}^nC_1x + {}^nC_2x^2 + \ldots + {}^nC_nx^n$
$(1 - x)^n$	${}^nC_0 - {}^nC_1x + {}^nC_2x^2 - \ldots + (-1)^n\ {}^nC_nx^n$
Binomial coefficients	${}^nC_0, {}^nC_1, \ldots, {}^nC_n$ (from Pascal's triangle)

7.2 General Term & Particular Terms

Term	Formula
General term (T_{r+1})	$T_{r+1} = {}^nC_r\ a^{(n-r)}\ b^r$ (the (r+1)th term)
For $(1 + x)^n$	$T_{r+1} = {}^nC_r\ x^r$
Term independent of x	Put the power of x = 0 in the general term, solve for r
Coefficient of x^k	Find r such that the power of x equals k, then evaluate ${}^nC_r$
r-th term from end	$= (n - r + 2)$th term from the beginning

7.3 Middle Term(s)

Case	Middle Term
n is EVEN	One middle term: $T_{(n/2 + 1)}$
n is ODD	Two middle terms: $T_{(n+1)/2}$ and $T_{(n+3)/2}$
Example (n = 6, even)	Middle term = T_4 (the 4th term)
Example (n = 5, odd)	Middle terms = T_3 and T_4

7.4 Properties of Binomial Coefficients

Property	Formula
First & last	${}^nC_0 = {}^nC_n = 1$
Symmetry	${}^nC_r = {}^nC_{(n-r)}$
Sum of all coefficients	${}^nC_0 + {}^nC_1 + \ldots + {}^nC_n = 2^n$ (put a = b = 1)
Sum of even-position	${}^nC_0 + {}^nC_2 + {}^nC_4 + \ldots = 2^{(n-1)}$
Sum of odd-position	${}^nC_1 + {}^nC_3 + {}^nC_5 + \ldots = 2^{(n-1)}$
Alternating sum	${}^nC_0 - {}^nC_1 + {}^nC_2 - \ldots = 0$ (put a = 1, b = −1)

Property	Formula
Pascal's rule	${}^nC_r + {}^nC_{(r-1)} = {}^{n+1}C_r$
Ratio of consecutive	${}^nC_r \div {}^nC_{(r-1)} = (n - r + 1) \div r$

7.5 Pascal's Triangle (Coefficients)

Power n	Coefficients
$(a+b)^0$	1
$(a+b)^1$	1 1
$(a+b)^2$	1 2 1
$(a+b)^3$	1 3 3 1
$(a+b)^4$	1 4 6 4 1
$(a+b)^5$	1 5 10 10 5 1
$(a+b)^6$	1 6 15 20 15 6 1
Rule	Each entry = sum of the two entries above it

7.6 Common Applications

Application	Method
Greatest coefficient	n even → ${}^nC_{(n/2)}$; n odd → ${}^nC_{(n-1)/2} = {}^nC_{(n+1)/2}$
Approximation (small x)	$(1 + x)^n \approx 1 + nx$ (when x is very small, higher powers ignored)
Divisibility / remainder	Write the number as $(\text{something} \pm 1)^n$ and expand
Finding a specific term	Use the general term T_{r+1} and match the required power
Numerically greatest term	Find r using $(n-r+1)\lvert x\rvert \div (r) \geq 1$, solve for the boundary r

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General term	$T_{r+1} = {}^nCr\, a^{(n-r)}\, b^r$. This single formula solves most problems.
Number of terms	Expansion of $(a+b)^n$ has $(n+1)$ terms.
Middle term	n even → ONE middle term $T_{(n/2+1)}$; n odd → TWO middle terms.
Sum of coefficients	Put a=b=1 → 2^n. Put a=1,b=−1 → 0 (for n≥1).
Even = Odd sums	Even-indexed and odd-indexed coefficient sums are each $2^{(n-1)}$.
Independent of x	Set the net power of x to 0 in T_{r+1} and solve for r.
Approximation	For tiny x: $(1+x)^n \approx 1 + nx$ (drop higher powers).
Pascal	Each row's ends are 1 ; inner entries add the two above.