CBSE Class 12 Mathematics Formula Sheet

83 formulas across 13 chapters — 2025-26 CBSE board exams

Ch 1. Relations and Functions

Reflexive relation
$(a, a) \in R$ for all $a \in A$

Symmetric relation
$(a,b) \in R \implies (b,a) \in R$

Transitive relation
$(a,b) \in R$ and $(b,c) \in R \implies (a,c) \in R$

Equivalence relation
Relation that is Reflexive + Symmetric + Transitive simultaneously

Injective (one-one) function
$f(x_1) = f(x_2) \implies x_1 = x_2$ (no two inputs give the same output)

Surjective (onto) function
For every y in codomain, $\exists$ x in domain such that $f(x) = y$ (range = codomain)

Bijective function
f is both injective (one-one) and surjective (onto)

Tip: Only bijective functions are invertible

Number of relations on a set with n elements
Total possible relations = $2^{(n^2)}$

Tip: Each of the n^2 ordered pairs either belongs to R or not — 2 choices each

Ch 2. Inverse Trigonometric Functions

Domain and Range of $\sin^{-1}$
Domain: $[-1,1]$ | Range: $[-\pi/2, \pi/2]$

Domain and Range of $\cos^{-1}$
Domain: $[-1,1]$ | Range: $[0, \pi]$

Domain and Range of $\tan^{-1}$
Domain: $\mathbb{R}$ | Range: $(-\pi/2, \pi/2)$

$\sin^{-1}(-x)$
$= -\sin^{-1}x$

$\cos^{-1}(-x)$
$= \pi - \cos^{-1}x$

$\tan^{-1}x + \cot^{-1}x$
$= \pi/2$

$\sin^{-1}x + \cos^{-1}x$
$= \pi/2$

$\tan^{-1}x + \tan^{-1}y$
$= \tan^{-1}[(x+y)/(1-xy)]$ if $xy < 1$

$2\tan^{-1}x$
$= \sin^{-1}(2x/(1+x^2)) = \cos^{-1}((1-x^2)/(1+x^2)) = \tan^{-1}(2x/(1-x^2))$

Ch 3. Matrices

Order of product AB
If A is m×n and B is n×p, then AB is m×p

Transpose properties
$(AB)^T = B^TA^T$ | $(A^T)^T = A$

Symmetric matrix
$A^T = A$

Skew-symmetric matrix
$A^T = -A$

Ch 4. Determinants

2×2 Determinant
$|A| = ad - bc$ for $A = [[a,b],[c,d]]$

Area of triangle (determinant)
$\text{Area} = \frac{1}{2}|x_1(y_2-y_3) + x_2(y_3-y_1) + x_3(y_1-y_2)|$

Cramer's Rule (2 variables)
$x = D_x/D$, $y = D_y/D$

Adjoint and Inverse
$A^{-1} = \text{adj}(A)/|A|$

Tip: $|A| \neq 0$ for inverse to exist

Ch 5. Continuity and Differentiability

Chain Rule
$dy/dx = (dy/du) \times (du/dx)$

Product Rule
$d/dx(uv) = u(dv/dx) + v(du/dx)$

Quotient Rule
$d/dx(u/v) = [v(du/dx) - u(dv/dx)] / v^2$

d/dx(sin x)
$\cos x$

d/dx(cos x)
$-\sin x$

d/dx(tan x)
$\sec^2 x$

d/dx(eˣ)
e^x

d/dx(ln x)
$1/x$

d/dx(xⁿ)
nx^{n-1}

d/dx(sin⁻¹x)
$1/\sqrt{(1-x^2)}$

d/dx(cos⁻¹x)
$-1/\sqrt{(1-x^2)}$

d/dx(tan⁻¹x)
$1/(1+x^2)$

Rolle's Theorem condition
f(a) = f(b), f continuous on [a,b], differentiable on (a,b) ⟹ ∃c such that f'(c) = 0

Mean Value Theorem
$f'(c) = [f(b)-f(a)]/(b-a)$

Ch 6. Application of Derivatives

Increasing function condition
f'(x) > 0 on interval

Decreasing function condition
f'(x) < 0 on interval

Equation of tangent at (x₁,y₁)
$y - y_1 = m(x - x_1)$ where m = dy/dx at (x_1,y_1)

Equation of normal at (x₁,y₁)
$y - y_1 = -(1/m)(x - x_1)$

Maxima/Minima — Second derivative test
f''(c) < 0 ⟹ local max | f''(c) > 0 ⟹ local min

Approximation using derivatives
$\Delta y \approx (dy/dx)\cdot\Delta x$ or $f(x+\Delta x) \approx f(x) + f'(x)\cdot\Delta x$

Tip: Find approximate value of f near a known point; Δx = small increment in x

Ch 7. Integrals

∫xⁿ dx
$x^{n+1}/(n+1) + C \quad (n \neq -1)$

∫1/x dx
$\ln|x| + C$

∫eˣ dx
$e^x + C$

$\int \sin x\,dx$
$-\cos x + C$

$\int \cos x\,dx$
$\sin x + C$

$\int \sec^2 x\,dx$
$\tan x + C$

$\int 1/\sqrt{(1-x^2)}\,dx$
$\sin^{-1} x + C$

$\int 1/(1+x^2)\,dx$
$\tan^{-1} x + C$

$\int 1/\sqrt{(x^2+a^2)}\,dx$
$\ln|x + \sqrt{(x^2+a^2)}| + C$

Integration by parts
$\int u\,dv = uv - \int v\,du$ (ILATE rule)

Tip: ILATE: Inverse trig, Logarithm, Algebraic, Trig, Exponential

Definite integral property
$\int_a^b f(x)\,dx = \int_a^b f(a+b-x)\,dx$

King's property
$\int_0^a f(x)\,dx = \int_0^a f(a-x)\,dx$

Ch 8. Application of Integrals

Area between curve and x-axis
$A = \int_a^b |f(x)|\,dx$

Area between two curves
$A = \int_a^b |f(x) - g(x)|\,dx$

Ch 9. Differential Equations

Order of DE
Highest derivative present

Variable separable method
$f(y)\,dy = g(x)\,dx \Longrightarrow$ integrate both sides

Linear DE (first order)
dy/dx + Py = Q ⟹ IF = e^(∫P dx)

Tip: Solution: y × IF = ∫(Q × IF) dx + C

Ch 10. Vector Algebra

Magnitude of vector
$|\vec{a}| = \sqrt{(a_1^2 + a_2^2 + a_3^2)}$

Dot product
$\vec{a} \cdot \vec{b} = |a||b| \cos\theta = a_1b_1 + a_2b_2 + a_3b_3$

Cross product magnitude
$|\vec{a} \times \vec{b}| = |a||b| \sin\theta$

Unit vector
$\hat{a} = \vec{a}/|\vec{a}|$

Projection of $\vec{a}$ on $\vec{b}$
$(\vec{a} \cdot \vec{b})/|\vec{b}|$

Area of parallelogram
$|\vec{a} \times \vec{b}|$

Area of triangle
$\frac{1}{2}|\vec{a} \times \vec{b}|$

Ch 11. Three Dimensional Geometry

Direction cosines
$l^2 + m^2 + n^2 = 1$ where $l = \cos\alpha$, $m = \cos\beta$, $n = \cos\gamma$

Distance between two points
$d = \sqrt{[(x_2-x_1)^2 + (y_2-y_1)^2 + (z_2-z_1)^2]}$

Equation of line through (x_1,y_1,z_1) with direction (a,b,c)
$(x-x_1)/a = (y-y_1)/b = (z-z_1)/c$

Angle between two lines
$\cos\theta = |l_1l_2 + m_1m_2 + n_1n_2|$

Shortest distance between skew lines
$d = |(\vec{b}_1 \times \vec{b}_2) \cdot (\vec{a}_2 - \vec{a}_1)| \,/\, |\vec{b}_1 \times \vec{b}_2|$

Tip: Lines are coplanar if d = 0 (they intersect or are parallel)

Condition for coplanar lines
$(\vec{a}_2 - \vec{a}_1) \cdot (\vec{b}_1 \times \vec{b}_2) = 0$

Tip: Two lines are coplanar iff this scalar triple product is zero

Ch 12. Linear Programming

Feasible region
Set of all points satisfying all constraints (including non-negativity)

Corner point theorem
Optimal value of objective function occurs at a corner (vertex) of feasible region

Tip: Always evaluate Z at all corner points

Ch 13. Probability

Conditional probability
$P(A|B) = P(A \cap B) \,/\, P(B)$

Multiplication rule
$P(A \cap B) = P(A) \times P(B|A)$

Bayes' Theorem
$P(A_i|B) = P(A_i) \cdot P(B|A_i) \,/\, \Sigma\, P(A_j) \cdot P(B|A_j)$

Binomial distribution mean
$\mu = np$

Binomial distribution variance
$\sigma^2 = npq$ where $q = 1-p$

P(X=r) in binomial
$P(X=r) = {}^{n}C_{r} \times p^{r} \times q^{n-r}$