CLASS 11 MATHEMATICS — FORMULA SHEET

Chapter 9 : Straight Lines (NCERT)

9.1 Basic Coordinate Formulas

Concept	Formula
Distance between two points	$d = \sqrt{[(x_2-x_1)^2 + (y_2-y_1)^2]}$
Section formula (internal)	$P = [(mx_2+nx_1)/(m+n) , (my_2+ny_1)/(m+n)]$
Section formula (external)	$P = [(mx_2-nx_1)/(m-n) , (my_2-ny_1)/(m-n)]$
Midpoint	$M = [(x_1+x_2)/2 , (y_1+y_2)/2]$
Centroid of triangle	$G = [(x_1+x_2+x_3)/3 , (y_1+y_2+y_3)/3]$
Area of triangle	$\frac{1}{2} \lvert x_1(y_2-y_3) + x_2(y_3-y_1) + x_3(y_1-y_2) \rvert$
Collinearity condition	Area of triangle = 0

9.2 Slope of a Line

Concept	Formula
Slope (two points)	$m = (y_2 - y_1) \div (x_2 - x_1)$
Slope from angle	$m = \tan \theta$ (θ = angle with positive x-axis)
Horizontal line	Slope = 0 (parallel to x-axis)
Vertical line	Slope = undefined (parallel to y-axis)
Parallel lines	$m_1 = m_2$ (equal slopes)
Perpendicular lines	$m_1 \times m_2 = -1$
Angle between two lines	$\tan \theta = \lvert (m_1 - m_2) \div (1 + m_1m_2) \rvert$

9.3 Forms of the Equation of a Line

Form	Equation
Slope-intercept	$y = mx + c$ (m = slope, c = y-intercept)
Point-slope	$y - y_1 = m(x - x_1)$
Two-point	$y - y_1 = [(y_2-y_1)/(x_2-x_1)](x - x_1)$
Intercept form	$x/a + y/b = 1$ (a = x-intercept, b = y-intercept)
Normal (perpendicular) form	$x \cos \omega + y \sin \omega = p$ (p = $\perp$ distance from origin)
General form	$Ax + By + C = 0$
Horizontal line	$y = b$ (or $y = k$)
Vertical line	$x = a$ (or $x = k$)

9.4 General Form Ax + By + C = 0 — Key Results

Quantity	Formula
Slope	$m = -A \div B$
x-intercept	$= -C \div A$
y-intercept	$= -C \div B$
Parallel line	$Ax + By + k = 0$ (only constant changes)
Perpendicular line	$Bx - Ay + k = 0$ (swap & change one sign)
Convert to normal form	Divide by $\pm\sqrt{(A^2 + B^2)}$

9.5 Distance Formulas

Concept	Formula
Point to line	$d = \lvert Ax_1 + By_1 + C\rvert \div \sqrt{(A^2 + B^2)}$
Distance from origin	$d = \lvert C\rvert \div \sqrt{(A^2 + B^2)}$
Between two parallel lines	$d = \lvert C_1 - C_2\rvert \div \sqrt{(A^2 + B^2)}$
Foot of perpendicular	Use point-to-line and slope conditions

9.6 Special Lines & Conditions

Concept	Detail
Line through intersection	$(A_1x + B_1y + C_1) + \lambda(A_2x + B_2y + C_2) = 0$
Concurrent lines	Three lines meet at a point ; determinant of coefficients = 0
Equation of x-axis	$y = 0$; y-axis: $x = 0$
Line parallel to axes	Through (a, b): $x = a$ (vertical), $y = b$ (horizontal)
Angle of inclination	θ where $0° \le \theta < 180°$; slope $m = \tan\theta$
Shifting of origin	New coords: $X = x - h$, $Y = y - k$ (origin moved to (h, k))

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Slope	$m = (y_2-y_1)/(x_2-x_1) = \tan\theta$. Vertical line → undefined slope.
Parallel vs perpendicular	Parallel: $m_1 = m_2$; Perpendicular: $m_1 \cdot m_2 = -1$.
General form slope	For $Ax+By+C=0$, slope $= -A/B$ (just negate A over B).
Point-to-line	$d = \lvert Ax_1+By_1+C\rvert/\sqrt{(A^2+B^2)}$. Same denominator for parallel-line distance.
Which form?	Slope+intercept → $y=mx+c$; two points → two-point form ; intercepts → $x/a+y/b=1$.
Area = 0	Three points are collinear when the triangle area is zero.
Angle between lines	$\tan\theta = \lvert(m_1-m_2)/(1+m_1m_2)\rvert$.
Family of lines	$L_1 + \lambda L_2 = 0$ passes through the intersection of L_1 and L_2 for all λ.