CLASS 11 MATHEMATICS — FORMULA SHEET

Chapter 10 : Conic Sections (NCERT)

10.1 Circle

Concept	Formula
Standard equation (centre origin)	$x^2 + y^2 = r^2$
Centre (h, k), radius r	$(x - h)^2 + (y - k)^2 = r^2$
General equation	$x^2 + y^2 + 2gx + 2fy + c = 0$
Centre from general form	$(-g, -f)$
Radius from general form	$r = \sqrt{(g^2 + f^2 - c)}$
Condition for a circle	Coefficient of x^2 = coefficient of y^2, no xy term
Diameter form	$(x - x_1)(x - x_2) + (y - y_1)(y - y_2) = 0$

10.2 Parabola

Type (vertex at origin)	Equation & Key Features
Right: $y^2 = 4ax$	Focus (a, 0) ; directrix $x = -a$; axis: x-axis
Left: $y^2 = -4ax$	Focus (−a, 0) ; directrix $x = a$
Up: $x^2 = 4ay$	Focus (0, a) ; directrix $y = -a$; axis: y-axis
Down: $x^2 = -4ay$	Focus (0, −a) ; directrix $y = a$
Latus rectum length	= 4a (for all standard parabolas)
Eccentricity	$e = 1$
Definition	Set of points equidistant from focus and directrix

10.3 Ellipse

Concept	Horizontal: $x^2/a^2 + y^2/b^2 = 1$ (a > b)
Vertices	$(\pm a, 0)$
Foci	$(\pm c, 0)$, where $c^2 = a^2 - b^2$
Major axis length	2a (along x-axis)
Minor axis length	2b (along y-axis)
Eccentricity	$e = c/a = \sqrt{(1 - b^2/a^2)}$; $0 < e < 1$
Latus rectum length	$= 2b^2/a$
Directrices	$x = \pm a/e$
Sum of focal distances	= 2a (constant, the defining property)
Vertical ellipse (b > a)	$x^2/a^2 + y^2/b^2 = 1$ with foci on y-axis, $c^2 = b^2 - a^2$

10.4 Hyperbola

Concept	Horizontal: $x^2/a^2 - y^2/b^2 = 1$
Vertices	$(\pm a, 0)$
Foci	$(\pm c, 0)$, where $c^2 = a^2 + b^2$
Transverse axis length	2a
Conjugate axis length	2b
Eccentricity	$e = c/a = \sqrt{(1 + b^2/a^2)}$; $e > 1$
Latus rectum length	$= 2b^2/a$
Directrices	$x = \pm a/e$
Asymptotes	$y = \pm(b/a)x$
Difference of focal distances	= 2a (constant, defining property)
Conjugate hyperbola	$y^2/b^2 - x^2/a^2 = 1$ (foci on y-axis)

10.5 Eccentricity & Comparison

Conic	Eccentricity (e)	Defining Property
Circle	$e = 0$	All points equidistant from centre
Ellipse	$0 < e < 1$	Sum of distances from 2 foci constant
Parabola	$e = 1$	Equidistant from focus & directrix
Hyperbola	$e > 1$	Difference of distances from 2 foci constant
Relation (ellipse)	$c^2 = a^2 - b^2$	$c = ae$
Relation (hyperbola)	$c^2 = a^2 + b^2$	$c = ae$

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Circle radius	From $x^2+y^2+2gx+2fy+c=0$: centre $(-g,-f)$, radius $\sqrt{(g^2+f^2-c)}$.
Parabola LR	Latus rectum = 4a ; focus at distance a from vertex along the axis.
y^2 vs x^2	$y^2 = 4ax$ opens sideways (along x) ; $x^2 = 4ay$ opens up/down (along y).
Ellipse c	$c^2 = a^2 - b^2$ (subtract). Foci INSIDE. Sum of focal distances = 2a.
Hyperbola c	$c^2 = a^2 + b^2$ (add). Difference of focal distances = 2a.
Eccentricity ladder	Circle 0 < Ellipse <1 = Parabola 1 < Hyperbola. e tells the shape.
Latus rectum (ellipse/hyperbola)	Both = $2b^2/a$ — same formula.
Asymptotes	Only the hyperbola has them: $y = \pm(b/a)x$.