11th Standard - Mathematics

Conic Sections

Circle

A circle is the set of all points in a plane, which are at a fixed distance from a fixed point in the plane. The fixed point is called the centre of the circle and the distance from centre to any point on the circle is called the radius of the circle.

The equation of a circle with radius r having centre (h, k) is given by $(x - h)^2 + (y - k)^2 = r^2$.

The general equation of the circle is given by $x^2 + y^2 + 2gx + 2fy + c = 0$, where, g, f and c are constants.

- The centre of the circle is (-g, -f).
- The radius of the circle is $r = g2+f2-c-------\sqrt{}$

The general equation of the circle passing through origin is $x^2 + y^2 + 2gx + 2fy = 0$.

The parametric equation of the circle $x^2 + y^2 = r^2$ are given by $x = r \cos \theta$, $y = r \sin \theta$, where θ is the parametre and the parametric equation of the circle $(x - h)^2 + (y - k)^2 = r^2$ are given by $x = h + r \cos \theta$, $y = k + r \sin \theta$.

Note: The general equation of the circle involves three constants which implies that at least three conditions are required to determine a circle uniquely.

Parabola

A parabola is the set of points P whose distances from a fixed point F in the plane are equal to their distance from a fixed line l in the plane. The fixed point F is called focus and the fixed line l is the directrix of the parabola.

Main Facts About the Parabola

Forms of parabola	$y^2 = 4ax$	$y^2 = -4ax$	$x^2 = 4ay$	$x^2 = -4ay$
Axis of parabola	y = 0	y = 0	x = 0	x = 0
Directrix of parabola	x = -a	x = a	y = -a	y = a
Vertex	(0, 0)	(0, 0)	(0, 0)	(0, 0)
Focus	(a, 0)	(-a, 0)	(0, a)	(0, -a)
Length of latus rectum	4a	4a	4a	4a
Focal length	|x + a|	|x – a|	|y + a|	|y – a|

Ellipse

An ellipse is the set of all points in a plane such that the sum of whose distances from two fixed points is constant.

or

An ellipse is the set of all points in the plane whose distances from a fixed point in the plane bears a constant ratio, less than to their distance from a fixed point in the plane. The fixed point is called focus, the fixed line a directrix and the constant ratio(e) the eccentricity of the ellipse. We have two standard forms of ellipse i.e.

Main Facts about the Ellipse

Forms of the ellipse	$\frac{x^2}{a^2}+\frac{y^2}{b^2}=1, a>b$	$\frac{x^2}{b^2}+\frac{y^2}{a^2}=1, a>b$
Equation of major axis	$y=0$	$x=0$
Length of major axis	$2a$	$2a$
Equation of minor axis	$x=0$	$y=0$
Length of minor axis	$2b$	$2b$
Equation of directrices	$x=\pm a/e$	$y=\pm a/e$
Vertex of ellipse	$(\pm a, 0)$	$(0, \pm a)$
Focus of ellipse	$(\pm ae, 0)$	$(0, \pm ae)$
Length of latusrectum	$2b^2/a$	$2b^2/a$

Hyperbola

A hyperbola is the locus of a point in a plane which moves in such a way that the ratio of its distance from a fixed point in the same plane to its distance from a fixed line is always constant which is always greater than unity.

The fixed point is called the focus, the fixed line is called the directrix and the constant ratio, generally denoted bye, is known as the eccentricity of the hyperbola.

We have two standard forms of hyperbola i.e.

(i) $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ and (ii) $\frac{y^2}{a^2} - \frac{x^2}{b^2} = 1$

Main Facts About Hyperbola

Forms of the hyperbola	$\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$	$\frac{y^2}{a^2} - \frac{x^2}{b^2} = 1$
Coordinates of centre	(0, 0)	(0, 0)
Coordinates of vertices	$(\pm a, 0)$	$(0 \pm a)$
Coordinates of foci	$(\pm ae, 0)$	$(0, \pm ae)$
Length of transverse axis	$2a$	$2a$
Length of conjugate axis	$2b$	$2b$
Equation of directrices	$x = \pm a/e$	$y = \pm a/e$
Eccentricity	$e = \sqrt{\frac{a^2 + b^2}{a^2}}$	$e = \sqrt{\frac{a^2 + b^2}{a^2}}$
Length of latusrectum	$2b^2/a$	$2b^2/a$
Equation of transverse axis	$y = 0$	$x = 0$
Equation of conjugate axis	$x = 0$	$y = 0$