

MATHEMATICS • CLASS 11

CHAPTER 10

Conic Sections

CHAPTER NOTES



CONIC SECTIONS: THE DOUBLE CONE

A conic section is the curve formed when a plane intersects a right circular cone.

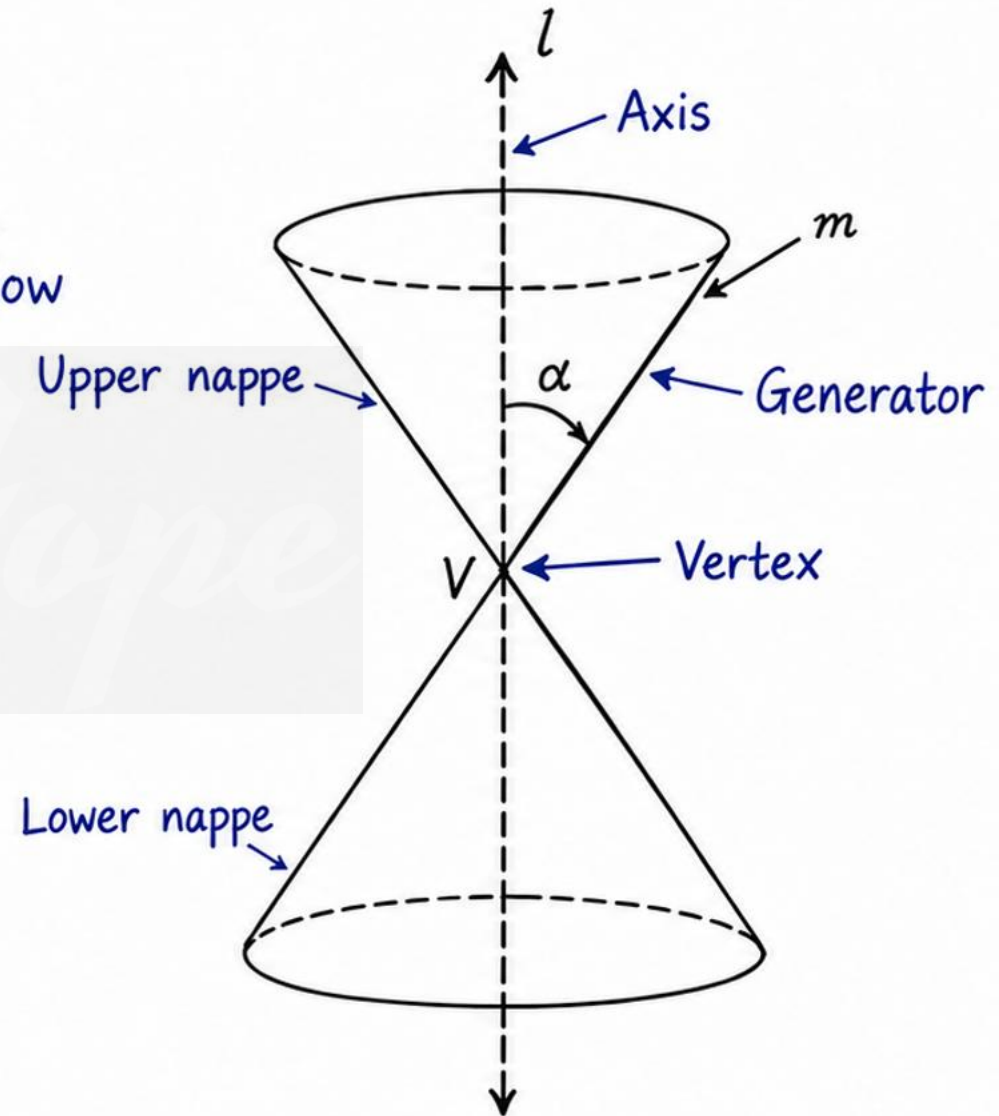
Rotate a slanting line about a fixed axis at a constant angle. The surface is a double-napped right circular hollow cone, extending indefinitely in both directions.

- Vertex: the fixed meeting point of the generator and axis.
- Axis: the fixed line around which the generator rotates.
- Generator: the rotating slanting line.
- Nappes: the two parts separated by the vertex.

α = angle between generator and axis

β = angle between cutting plane and axis

Conics are used in planetary motion, telescopes, antennas, flashlights and vehicle headlights.



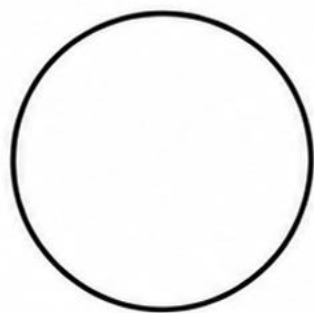
HOW A PLANE PRODUCES DIFFERENT CONICS

The plane must not pass through the vertex in these cases.

Circle

$$\beta = 90^\circ$$

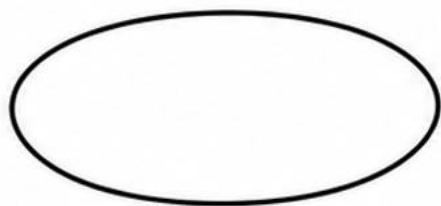
The plane cuts one nappe and is perpendicular to the axis.



Ellipse

$$\alpha < \beta < 90^\circ$$

The plane cuts completely across one nappe.



Parabola

$$\beta = \alpha$$

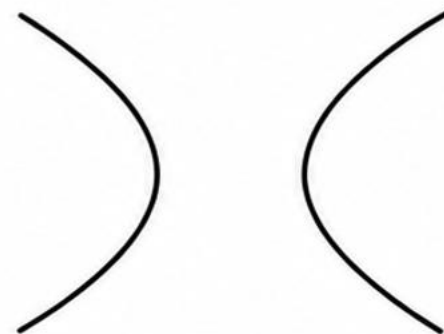
The plane is parallel to a generator and cuts one nappe.



Hyperbola

$$0^\circ \leq \beta < \alpha$$

The plane cuts both nappes.



DEGENERATE CONIC SECTIONS

A degenerate conic is formed when the cutting plane passes through the vertex.

Point

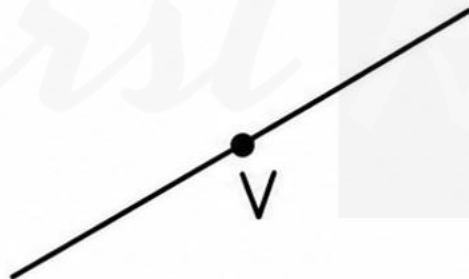
$$\alpha < \beta \leq 90^\circ$$



The plane meets the cone only at its vertex.

Straight line

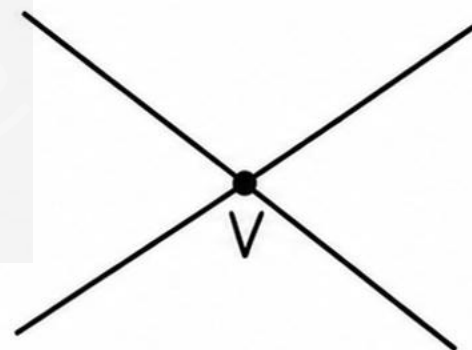
$$\beta = \alpha$$



The plane contains a generator. This is the degenerate case of a parabola.

Pair of intersecting straight lines

$$0^\circ \leq \beta < \alpha$$



The plane cuts through both nappes. This is the degenerate case of a hyperbola.

CIRCLE: DEFINITION AND EQUATION

A circle is the set of all points in a plane at the same distance from a fixed point.

The fixed point is the centre. The constant distance is the radius.

Centre: $C(h, k)$, radius: $r > 0$

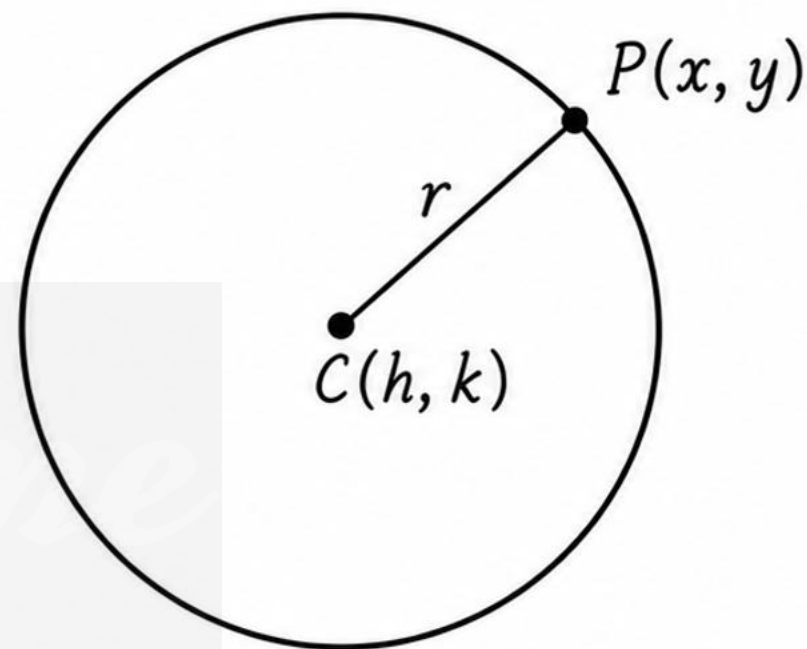
For any point on the circle

$$P(x, y), \quad CP = r$$

Use the distance formula and square both sides.

$$\sqrt{(x-h)^2 + (y-k)^2} = r$$

$$(x-h)^2 + (y-k)^2 = r^2$$



Circle centred at the origin

$$h = 0, \quad k = 0$$

$$x^2 + y^2 = r^2$$

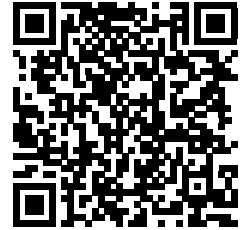


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