Subject: Geometry
Created by: Alex Penaflor
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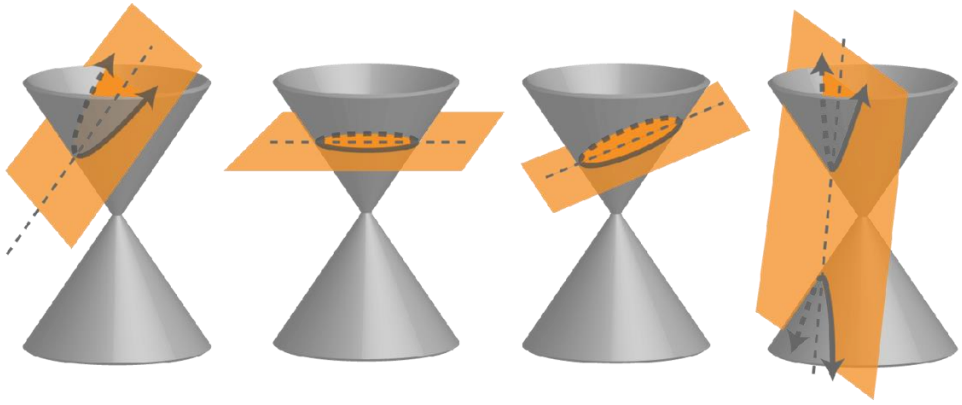
Conic Sections

How Conic Sections Are Made:



Parabola Circle Ellipse Hyperbola

Each conic section is made by intersecting a plane with two cones as shown.

Summary of Conic Sections:

Parabola

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

If $a > 0$, opens towards the right
If $a < 0$, opens towards the left
$p = \frac{1}{4a}$
$a = \frac{1}{4p}$
Vertex: (h, k)
Focus: $(h + p, k)$
Directrix: $x = h - p$
Axis of Symmetry: $y = k$

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

If $a > 0$, opens upward
If $a < 0$, opens downward
$p = \frac{1}{4a}$
$a = \frac{1}{4p}$
Vertex: (h, k)
Focus: $(h, k + p)$
Directrix: $y = k - p$
Axis of Symmetry: $x = h$

Ellipse

$$\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$$
$$c^2 = a^2 - b^2, a > b > 0$$

Center: (0,0)
Foci: $(c, 0), (-c, 0)$
Vertices: $(a, 0), (-a, 0)$
y-intercepts: $(0, b), (0, -b)$
Major axis: x axis
Minor axis: y axis
Length of major axis: $2a$
Length of minor axis: $2b$

$$\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$$
$$c^2 = a^2 - b^2, a > b > 0$$

Center: (0,0)
Foci: $(0, c), (0, -c)$
Vertices: $(0, a), (0, -a)$
y-intercepts: $(b, 0), (-b, 0)$
Major axis: y axis
Minor axis: x axis
Length of major axis: $2a$
Length of minor axis: $2b$

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Conic Sections

Hyperbola

Transverse axis: Horizontal

$$\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$$

Center: $(0,0)$
Foci: $(c, 0), (-c, 0)$
Vertices: $(a, 0), (-a, 0)$
Asymptotes: $y = \pm\frac{b}{a}x$

Transverse axis: Vertical

$$\frac{y^2}{b^2} - \frac{x^2}{a^2} = 1$$

Center: $(0,0)$
Foci: $(0, c), (0, -c)$
Vertices: $(0, a), (0, -a)$
Asymptotes: $y = \pm\frac{a}{b}x$

Circle

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

Center: (h, k)
Radius: r