

8.1, 8.2 & 8.3 Parabolas, Ellipses & Hyperbolas

Target 4A/4C/4E: Investigate the geometric properties of parabolas/ellipses/hyperbolas

Graphing Conic Sections By Hand

Equation	Type of Conic	Key Features	Graph
$\frac{x^2}{25} + \frac{y^2}{4} = 1$	Ellipse	Center: $(0,0)$ Vertices: $(5,0)$ $a^2=25$ $(-5,0)$ $a=5$ Foci: $(\sqrt{21}, 0)$ $a^2 = b^2 + c^2$ $(-\sqrt{21}, 0)$ $25 = 4 + c^2$ $21 = c^2$ $\sqrt{21} = c$ Semi-major axis: 5 $b^2 = 4$ $b = 2$ Semi-minor axis: 2 Eccentricity: $e = \sqrt{21}/5$ Focal axis: $y = 0$	
$\frac{(x+2)^2}{4} - (y-3)^2 = 1$	Hyperbola	Center: $(-2, 3)$ Vertices: $(0, 3)$ $a^2=4$ $(-4, 3)$ $a=2$ Foci: $(-2+\sqrt{5}, 3)$ $c^2 = a^2 + b^2$ $(-2-\sqrt{5}, 3)$ $c^2 = 4 + 1$ $c^2 = 5$ $c = \sqrt{5}$ Semi-transverse axis: 2 Semi-conjugate axis: 1 $b^2 = 1$ $b = 1$ Asymptotes: $y = \pm \frac{1}{2}(x+2) + 3$ Focal axis: $y = 3$ Eccentricity: $e = \sqrt{5}/2$	
$(x-1)^2 = 8(y+5)$	Parabola	Vertex: $(1, -5)$ opens up $4p=8$ Focus: $(1, -3)$ $p=2$ Directrix: $y = -7$ Focal width: 8 (Latus rectum) Axis of symmetry: $x = 1$	

Equation	Type of Conic	Key Features	Graph
$25x^2 - 16(y - 2)^2 = 400$ $\frac{25x^2}{400} - \frac{16(y - 2)^2}{400} = \frac{400}{400}$ $\frac{x^2}{16} - \frac{(y - 2)^2}{25} = 1$	<p>Hyperbola</p>	<p>Center: $(0, 2)$</p> <p>Vertices: $(4, 2)$ $a^2 = 16$ $(-4, 2)$ $a = 4$</p> <p>Foci: $(\sqrt{41}, 2)$ $c^2 = a^2 + b^2$ $(-\sqrt{41}, 2)$ $c^2 = 16 + 25$ $c^2 = 41$ $c = \sqrt{41}$</p> <p>Semi transverse axis: 4</p> <p>Semi conjugate axis: 5 $b^2 = 25$ $b = 5$</p> <p>Asymptotes: $y = \pm \frac{5}{4}(x) + 2$</p> <p>Focal axis: $y = 2$</p> <p>Eccentricity: $e = \frac{\sqrt{41}}{4}$</p>	
$(y + 2)^2 = -4(x - 3)$	<p>Parabola</p>	<p>Vertex: $(3, -2)$</p> <p>Opens Left $4p = -4$ $p = -1$</p> <p>Focus: $(2, -2)$</p> <p>Directrix: $x = 4$</p> <p>Focal width (Latus rectum): $4p$ 4</p>	
$9x^2 + 4y^2 = 36$ $\frac{9x^2}{36} + \frac{4y^2}{36} = \frac{36}{36}$ $\frac{x^2}{4} + \frac{y^2}{9} = 1$	<p>Ellipse</p>	<p>Center: $(0, 0)$</p> <p>Vertices: $(0, 3)$ $a^2 = 9$ $(0, -3)$ $a = 3$</p> <p>Foci: $(0, \sqrt{5})$ $a^2 = b^2 + c^2$ $(0, -\sqrt{5})$ $9 = 4 + c^2$ $5 = c^2$ $\sqrt{5} = c$</p> <p>Semi major axis: 3</p> <p>Semi minor axis: 2 $b^2 = 4$ $b = 2$</p> <p>Focal axis: $x = 0$</p> <p>Eccentricity: $e = \frac{\sqrt{5}}{3}$</p>	

More Practice

Conics

<http://www.mathguide.com/lessons/ConicSections.html>

<https://www.khanacademy.org/math/precalculus/conics-precac>

<http://math2.org/math/algebra/conics.htm>

<https://www.youtube.com/watch?v=la6jmezAgiw>

<https://youtu.be/5nxT6LQhXLM>

https://youtu.be/Z6cwpsDC_5A

Homework Assignment

p.639 #31,33,35, p.652 #13,15,16, p.663 #11,15,16