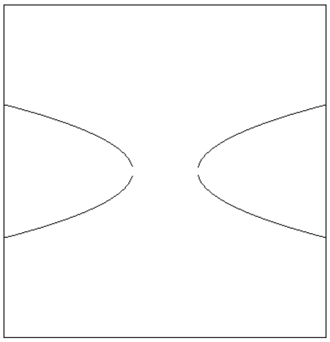
Conic Sections - Hyperbolas and Classifying Conics

Standard Form for the Equation of a Hyperbola

Horizontal Hyperbola

$$\frac{(x-h)^2}{a^2}-\frac{(y-k)^2}{b^2}=1$$

Asymptotes: $y-k=\pm\frac{b}{a}(x-h)$



a is always in the denominator of the positive fraction

Center $=(h,k)$

Vertices: a units from the center

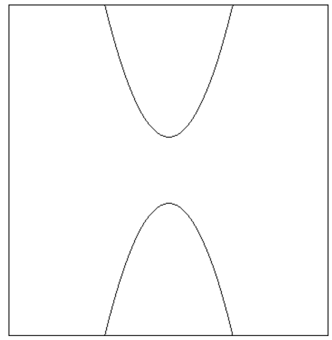
Foci: $c^2=a^2+b^2$

Eccentricity: $e=\frac{c}{a}$

Vertical Hyperbola

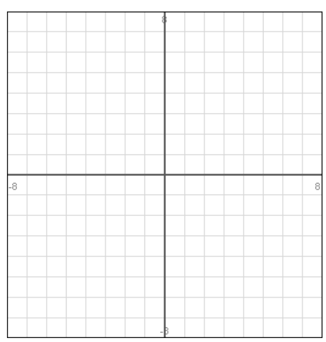
$$\frac{(y-k)^2}{a^2}-\frac{(x-h)^2}{b^2}=1$$

Asymptotes: $y-k=\pm\frac{a}{b}(x-h)$

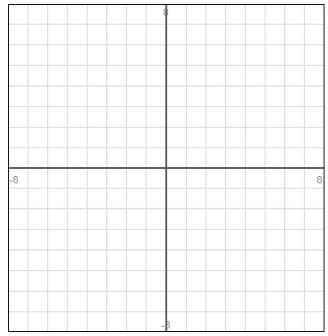


1. Find the center, vertices, foci, eccentricity and equations of the asymptotes of the hyperbola and sketch its graph.

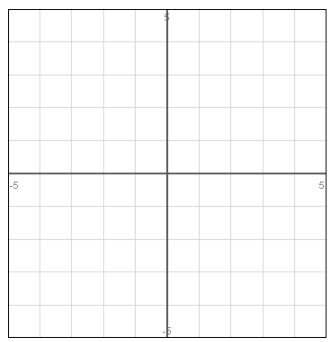
a) $\frac{(x-1)^2}{9}-\frac{y^2}{25}=1$



b) $-4x^2+24x+y^2+4y-41=0$

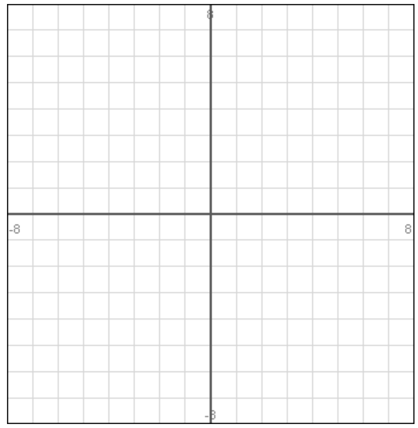


c) $16y^2-x^2+2x+64y+63=0$

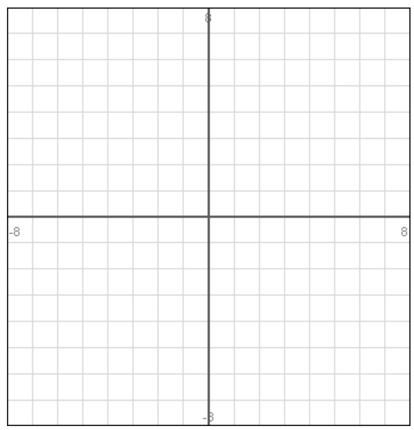


2. Find the standard form of the equation of the hyperbola.

a) Vertices: $(2,3)$ and $(2,-3)$
Foci: $(2,5)$ and $(2,-5)$

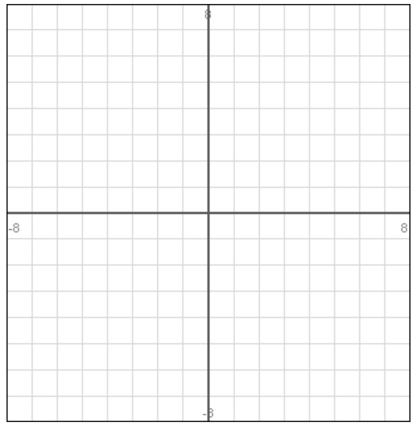


b) Vertices: $(3,-5)$ and $(3,1)$
Asymptotes: $y = 2x - 8$ and $y = -2x + 4$



c) Vertices: $(-2,1)$ and $(2,1)$

Passes through the point: $(8,4)$



Classifying Conics from General Equations

Circle - x^2 and y^2 have the same coefficients

Parabola - only x^2 or y^2

Ellipse - x^2 and y^2 have different coefficients but are the same sign

Hyperbola - x^2 and y^2 have different signs

3. Classify each of the following conic sections.

a) $4x^2 - y^2 - 4x + 3 = 0$

b) $4x^2 + 3y^2 - 14x + 3y = -7$

c) $-2x^2 - 2y^2 - 16x + 15 = 0$

d) $y^2 - 4y + x = 0$