

Aim: Introduction to the Hyperbola

I. Do Now:

1. Convert to standard form:

$$4x^2 + 9y^2 - 48x + 72y + 144 = 0$$

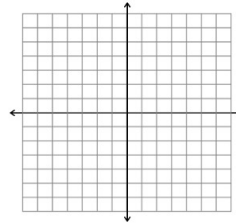
Vertices: _____

Foci: _____

Eccentricity: _____

Length of Major Axis: _____

Length of Minor Axis: _____



2. Identify the conic section by its equation.

(a) $\frac{x^2}{3} + \frac{y^2}{5} = 1$ _____

(b) $3x^2 + 3y^2 = 27$ _____

(c) $\frac{x^2}{3} - \frac{y^2}{5} = 1$ _____

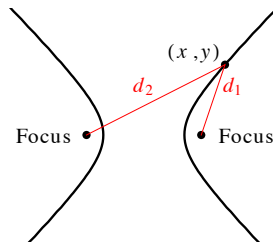
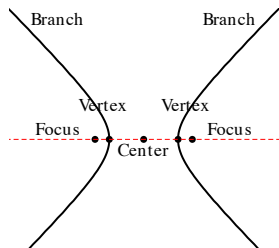
(d) $y = x^2 - 3$ _____

II. Definitions:

Ellipse: the set of all points whose **sum** of distances from two fixed points called the foci is constant.

Hyperbola: the set of all points whose _____ of distances from two fixed points called the foci is constant.

III. Development:



- Each hyperbola has two distinct *branches*.
- The line passing through the two *foci* intersects the hyperbola at its *vertices*.
- The segment connecting the vertices is called the *transverse axis*; the midpoint of the transverse axis is the hyperbola's *center*.
- The axis perpendicular to the transverse axis passing through the center is called the *conjugate axis*.

Standard Form of Equations of Hyperbolas

$$\frac{(x-h)^2}{a^2} - \frac{(y-k)^2}{b^2} = 1 \quad \text{Horizontal Transverse Axis}$$

$$\frac{(y-k)^2}{a^2} - \frac{(x-h)^2}{b^2} = 1 \quad \text{Vertical Transverse Axis}$$

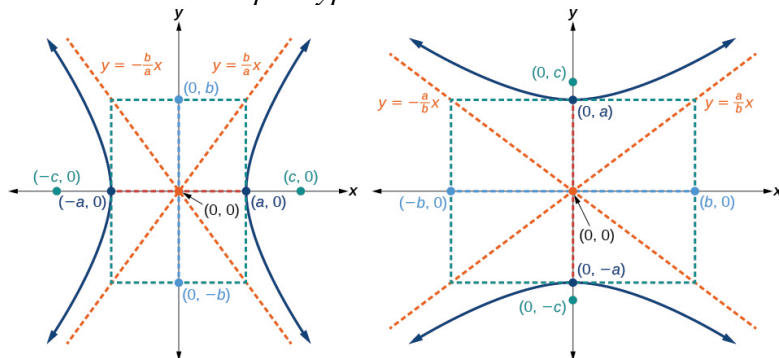
If the center is (0, 0), these equations are:

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

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

For hyperbolas, the relationship between a , b , and c is $c^2 = a^2 + b^2$.

The Box Method to Graph Hyperbolas



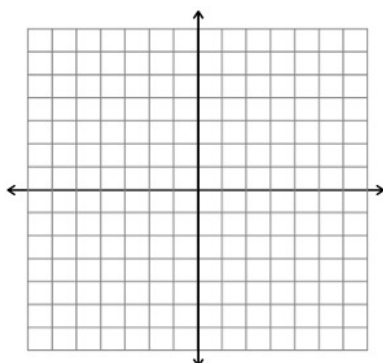
The eccentricity of a hyperbola is $e = c/a$ (same as for the ellipse).

Since $c > a$, $e > 1$.

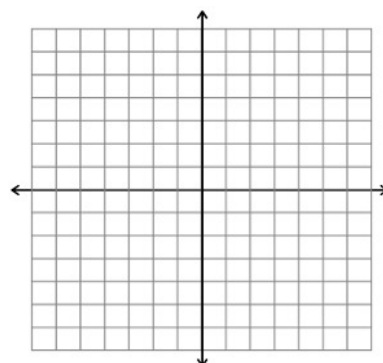
As e approaches 1, the hyperbola becomes flatter. As e increases, the hyperbola becomes rounder at its vertices.

IV. Examples

3. Graph the hyperbola $4x^2 - y^2 = 16$.



4. Graph the hyperbola $4y^2 - x^2 = 16$.



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- p. 644: 85
- p. 665: 7, 8, 11, 14
- p. 654: 34, 46