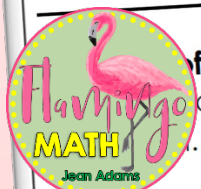


Algebra 2 Honors

Hyperbolas

Verbal Vocabulary



Center of the hyperbola – the midpoint between the vertices which is also the midpoint between the foci.

Foci – the fixed points equidistant from the center and located on the focal axis (major axis).

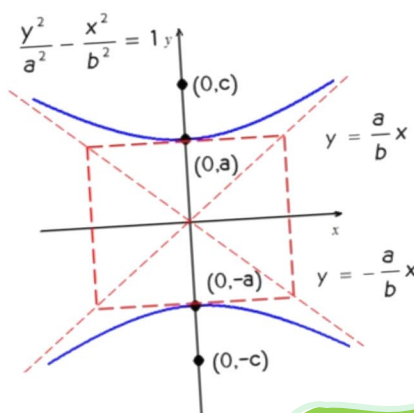
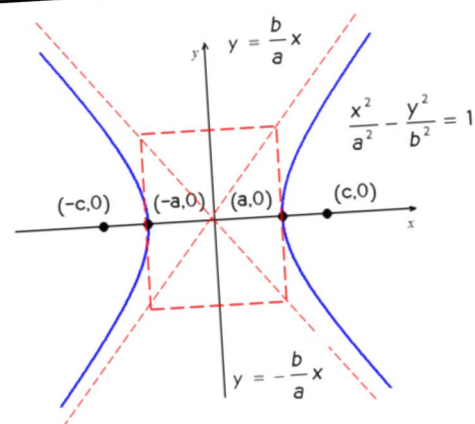
Vertices – the endpoints of the transverse axis.

Axis of symmetry – the line that divides a figure into two parts that are mirror images.

Conjugate axis – the line segment of length $2b$ that is perpendicular to the focal axis, with the center of the hyperbola as its midpoint.

Transverse axis – the segment connecting the two vertices which lie on the axis of symmetry.

Semi-transverse axis – the number a



Completely Editable

10.3

Lesson 4: Hyperbolas

DEFINITION OF A HYPERBOLA

A **hyperbola** is the set of all points P in a plane such that the difference between the distances from P to the foci F_1 and F_2 is a given constant k .

$$|PF_1 - PF_2| = k$$

Verbal Vocabulary

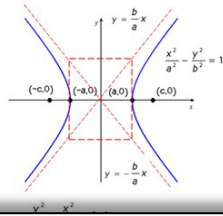
Center of the hyperbola – the midpoint between the two vertices which is also the midpoint between the two foci.

Foci – the fixed points equidistant from the center and located on the focal axis (major axis).

Vertices – the endpoints of the transverse axis.

Axis of symmetry – the line that divides a figure into two parts that are mirror images.

Visual Vocabulary



Graphing Basic Hyperbolas

EX #1: Find the vertices, foci, and asymptotes of the hyperbola. Then sketch.

$$\frac{x^2}{9} - \frac{y^2}{16} = 1$$

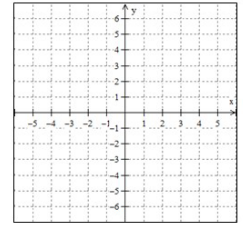
$$a = \quad b = \quad c = \quad$$

Major vertices: _____

Minor vertices: _____

Foci: _____

Asymptotes: _____



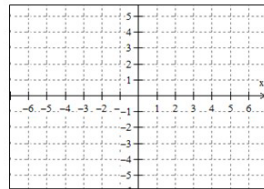
Standard Form of a Hyperbola

EX #3: Find the standard form for the equation, the vertices, foci and asymptotes. Draw the hyperbola.

$$9x^2 - 16y^2 = 144$$

Standard Form: _____

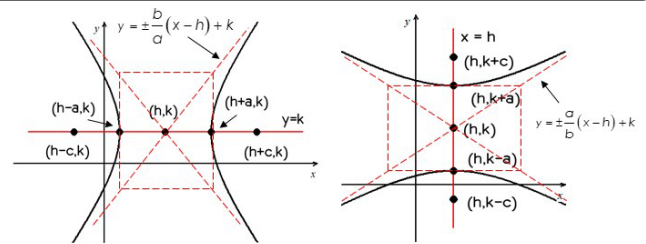
Major axis	
Major Vertices	
Minor Vertices	
Foci	
Asymptotes	



EX #4: Write an equation for a hyperbola in standard form whose center is at the origin

A. Transverse axis is vertical and is 4 units, central rectangle perimeter is 16 units.

Hyperbolas with Center (h, k)



Equation	$\frac{(x-h)^2}{a^2} - \frac{(y-k)^2}{b^2} = 1$	$\frac{(y-k)^2}{a^2} - \frac{(x-h)^2}{b^2} = 1$
Transverse Axis		
Foci		
Vertices		
Pythagorean Relation		

Working Backwards from a Graph

EX #6: Write an equation for the hyperbola. Then sketch the location for each focal point.

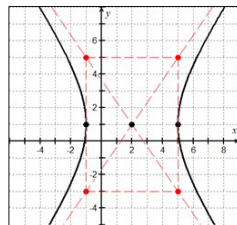
$$a = \quad b = \quad c = \quad$$

Equation: _____

(h, k) : _____

Foci: _____

Asymptotes: _____

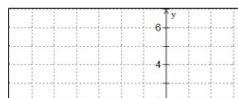


Finding an Equation of a Hyperbola

EX #7: Find the equation in standard form for a hyperbola with a major vertex point at $(-2, 4)$ and asymptotes at $y = \frac{3}{2}x + 4$ and $y = -\frac{3}{2}x - 2$.

$$a = \quad b = \quad c = \quad$$

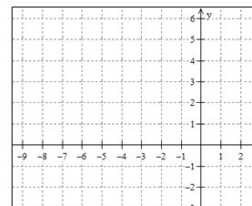
STANDARD FORM: _____



Completing the Square

EX #8: Complete the square to find the center, vertices, foci and asymptotes. Draw a graph.

$$9x^2 - 4y^2 + 54x + 8y + 41 = 0$$



Center:	
Major Vertices:	
Minor Vertices:	
Foci:	

NOTES

Name _____ Date _____

10.4

Hyperbolas Practice

Problems 1 – 4, write an equation of a hyperbola with the given values, foci, or vertices.
Assume that the transverse axis is horizontal.

1. $a = 12, b = 7$

2. $b = 9, c = 12$

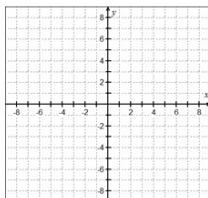
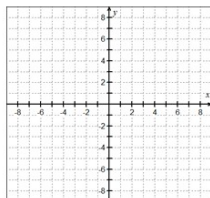
3. $a = 7, c = 9$

4. foci $(\pm 8, 0)$ vertices $(\pm 2, 0)$

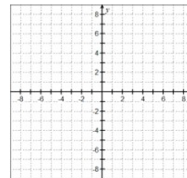
Problems 5 – 10, find the center, transverse axis, vertices, foci, and asymptotes. Graph each equation.

5. $\frac{x^2}{25} - \frac{y^2}{25} = 1$

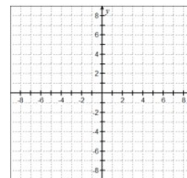
6. $\frac{y^2}{9} - \frac{x^2}{16} = 1$



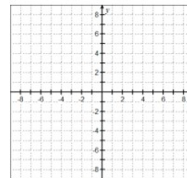
7. $y^2 - \frac{x^2}{9} = 1$



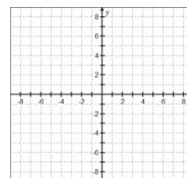
8. $\frac{x^2}{36} - \frac{y^2}{25} = 1$



9. $9x^2 - 25y^2 = 225$



10. $25y^2 - 16x^2 = 400$



Problems 11 – 14, write the equation of a hyperbola with the given foci and vertices.

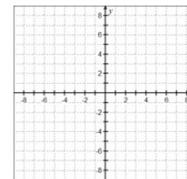
11. Foci $(\pm 2\sqrt{5}, 0)$, Vertices $(\pm 4, 0)$

12. Asymptotes $y = \pm \frac{2}{3}x$, Vertices $(0, \pm 2)$

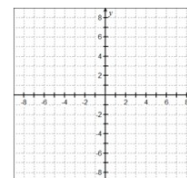
13. Vertices $(\pm 7, 0)$, Foci $(\pm 9, 0)$

Problems 15 – 17, find the center, transverse axis, vertices, foci, and asymptotes. Graph each equation.

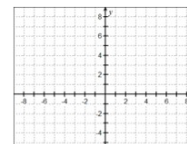
15. $\frac{(x+3)^2}{16} - \frac{(y-2)^2}{25} = 1$



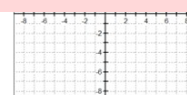
16. $\frac{(y-4)^2}{9} - \frac{(x-4)^2}{9} = 1$



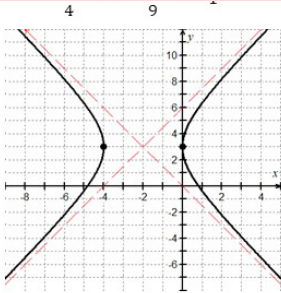
17. $x^2 - y^2 + 6x + 4y - 4 = 0$



Practice Sets



Lesson Warm-Ups



3. Write the equation for the asymptotes shown as dotted lines in the graph.

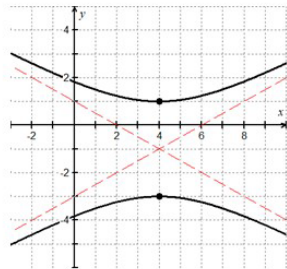
Name _____ Date _____ Period _____

Lesson 10.4: Hyperbolas

Warm-Up #2

1. Use the graph of the ellipse to answer the following questions.

$$\frac{(y+1)^2}{4} - \frac{(x-4)^2}{16} = 1$$



2. Identify the center and the two major vertices.

3. Write the equation for the asymptotes shown as dotted lines in the graph.

Form A

10.4 Hyperbolas

Form B

Name _____

Date _____ Period _____

1. Write an equation of a hyperbola in standard form with center at the origin, horizontal transverse axis and $a = 5$, $b = 6$.

Questions 2-3: Find the vertices, foci and asymptotes of the hyperbola, and sketch the graph in the grid below.

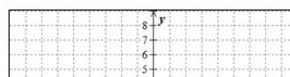
$$2. \frac{y^2}{16} - \frac{x^2}{25} = 1$$

Major vertices: _____

Foci: _____

Asymptotes: _____

3. Graph:



Questions 2-3: Find the vertices, foci and asymptotes of the hyperbola, and sketch the graph in the grid below.

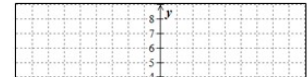
$$2. \frac{y^2}{36} - \frac{x^2}{9} = 1$$

Major vertices: _____

Foci: _____

Asymptotes: _____

3. Graph:



Daily Lesson Quiz

Grade: _____

Grade: _____