

Write your questions and thoughts here!

Label the Graph:

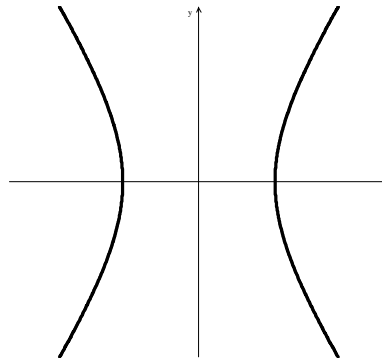
center

foci

vertices

transverse axis

conjugate axis

**Standard Equation of a Hyperbola**

“horizontal” hyperbola: $\frac{(x-h)^2}{a^2} - \frac{(y-k)^2}{b^2} = 1$
 (opens left/right)

“vertical” hyperbola: $\frac{(y-k)^2}{a^2} - \frac{(x-h)^2}{b^2} = 1$
 (opens up/down)

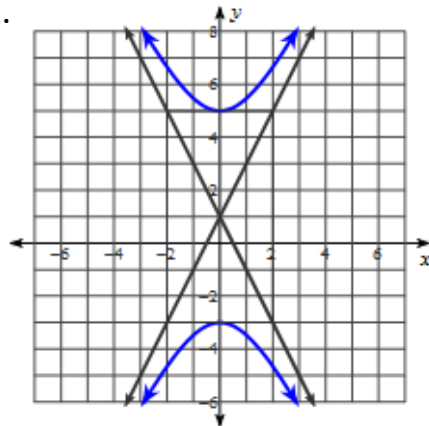
Center at (h, k) Foci are c units away from the center along the transverse axis.

$c^2 =$

$c =$

Use the information provided to write the standard form equation of each hyperbola.

1.

2. Vertices: $(0, 10), (0, -10)$ Endpoints of Conjugate Axis:
 $(6, 0), (-6, 0)$

11.3 Hyperbolas

Write your questions and thoughts here!



Use the information provided to write the standard form equation of each hyperbola.

3. Center: $(2, -4)$
Transverse axis is horizontal;
central rectangle is 8 units wide and
24 units tall.



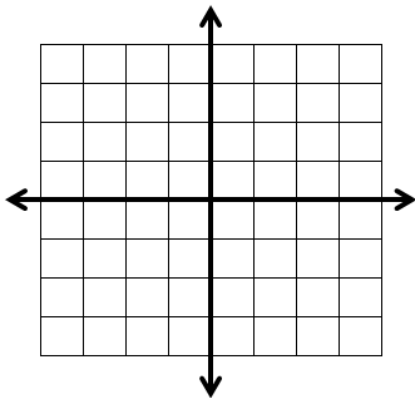
4. Vertices:
 $(-1, -10)$ and $(-17, -10)$
Conjugate Axis is 10 units long

Now summarize what you learned!



Algebra Skills:

1. Graph $f(x) = \sqrt{x+2} - 4$.



Multiply.

2. $(2 - \sqrt{5})(2 - \sqrt{5})$

3. $(2 + \sqrt{x})(\sqrt{x} - 4)$

Solve by factoring.

4. $3x^3 - 27x = 0$

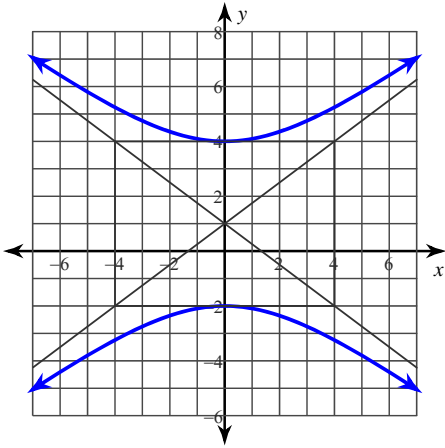
5. $6x^2 - 3x - 9 = 0$

11.3 Practice - Hyperbolas

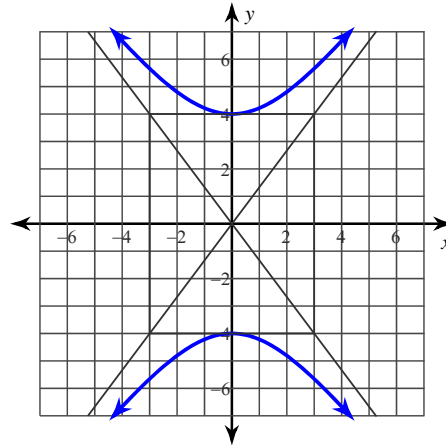
Use the information provided to write the standard form equation of each hyperbola.

- 1) Vertices: $(0, 14), (0, -14)$
Endpoints of Conjugate Axis: $(12, 0)$
 $(-12, 0)$
- 2) Vertices: $(8, 0), (-8, 0)$
Endpoints of Conjugate Axis: $(0, 10)$
 $(0, -10)$
- 3) Vertices: $(-1, -2), (-13, -2)$
Endpoints of Conjugate Axis: $(-7, 2)$
 $(-7, -6)$
- 4) Center at $(0, 0)$
Transverse axis is horizontal; central rectangle
is 10 units wide and 14 units tall
- 5) Center at $(0, 0)$
Transverse axis is vertical; central rectangle
is 16 units wide and 4 units tall
- 6) Center at $(-8, -9)$
Transverse axis is vertical; central rectangle
is 10 units wide and 24 units tall
- 7) Vertices: $(-10, 12), (-10, -14)$
Conjugate Axis is 20 units long
- 8) Vertices: $(0, -4), (-12, -4)$
Conjugate Axis is 10 units long
- 9) Vertices: $(-6, 11), (-6, -9)$
Conjugate Axis is 22 units long

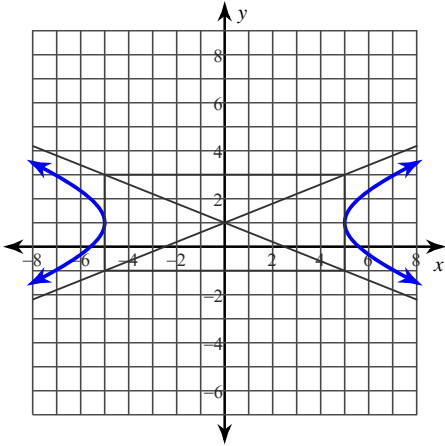
10)



11)



12)



13) Center at $(9, -5)$

Transverse axis is horizontal; central rectangle is 8 units wide and 22 units tall

14) Center at $(-9, 9)$

Transverse axis is horizontal; central rectangle is 24 units wide and 20 units tall

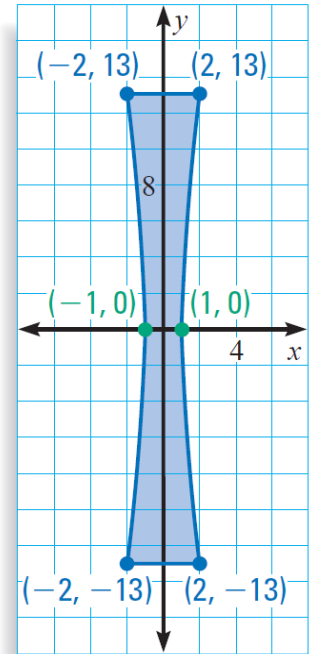
15) Center at $(10, 7)$

Transverse axis is vertical; central rectangle is 18 units wide and 6 units tall

11.3 Application and Extension

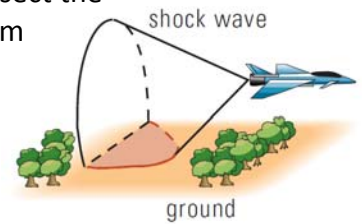
1. The diagram at the right shows the hyperbolic cross section of a sculpture located at the Fermi National Accelerator Laboratory in Batavia, Illinois. The **center** of the sculpture is located at the origin and the **bottom** of the sculpture is on the line $y = -13$.

a) Write an equation that models the curved sides of the sculpture. (*Hint: The top of the sculpture has nothing to do with the rectangle of the hyperbola. You must solve for b by using the given information.*)



b) At a height of 5 feet, how wide is the sculpture? Remember, this means 5 feet from the bottom of the sculpture. (Each unit in the coordinate plane represents 1 foot.)

2. When an airplane travels faster than the speed of sound, the sound waves form a cone behind the airplane. If the airplane is flying parallel to the ground, the sound waves intersect the ground in a hyperbola with the airplane directly above its center. A sonic boom is heard along the hyperbola. If you hear a sonic boom that is audible along a hyperbola with the equation $\frac{x^2}{100} - \frac{y^2}{4} = 1$ where x and y are measured in miles, what is the shortest **horizontal** distance you could be to the airplane? (Don't overthink this; it's much easier than it might first appear!)



SAT Prep:

1.

Which is the equation of a hyperbola with vertices at $(0, -6)$ and $(0, 6)$ and foci at $(0, -8)$ and $(0, 8)$?

- Ⓐ $\frac{x^2}{64} - \frac{y^2}{36} = 1$ Ⓑ $\frac{y^2}{64} - \frac{x^2}{36} = 1$
 Ⓒ $\frac{x^2}{36} - \frac{y^2}{28} = 1$ Ⓓ $\frac{y^2}{36} - \frac{x^2}{28} = 1$

2. The distance between $(1, 1)$ and $(4, y)$ is $\sqrt{13}$. What is a positive value for y ?

	/	/	
.	.	.	.
	0	0	0
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	6	6	6
7	7	7	7
8	8	8	8
9	9	9	9