NAME ______________________ CLASS ____________ DATE ____________

Reteaching
9.5 Hyperbolas

◆ **Skill A** Writing an equation for a graphed hyperbola

Recall Hyperbola with a horizontal transverse axis: $\frac{(x-h)^2}{a^2} - \frac{(y-k)^2}{b^2} = 1$

Hyperbola with a vertical transverse axis: $\frac{(y-k)^2}{a^2} - \frac{(x-h)^2}{b^2} = 1$

◆ **Example**

For the graph at right, write an equation for
a. the hyperbola. **b.** each asymptote.

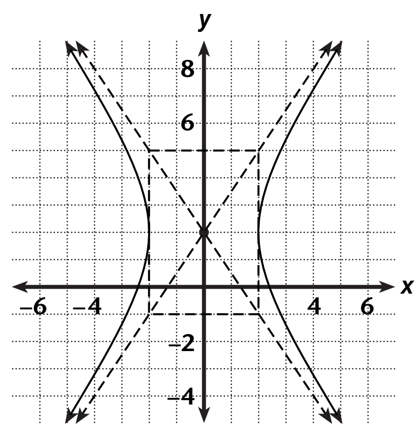
◆ **Solution**

a. The center is at $(h, k) = (0, 2)$.
Since the transverse axis is **horizontal,**

$$\frac{(x-0)^2}{a^2} - \frac{(y-2)^2}{b^2} = 1.$$

This implies that a is the **horizontal** distance from the center to the vertices, so $a = 2$.
This leaves $b = 3$ as the **vertical** distance from the center to the edge of the "rectangle."
The equation of the hyperbola is

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

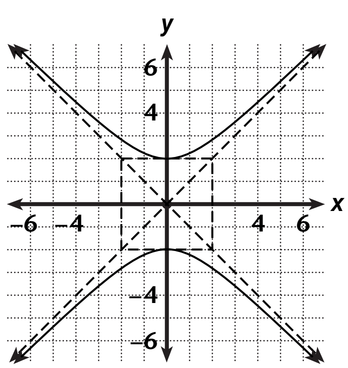


b. The asymptotes both have a y-intercept of 2 and slopes of $\frac{b}{a} = \frac{3}{2}$ and $-\frac{b}{a} = -\frac{3}{2}$.

The equations of the asymptotes are $y = \frac{3}{2}x + 2$ and $y = -\frac{3}{2}x + 2$.

Write the standard equation for each hyperbola and give the equations for the asymptotes.

1.



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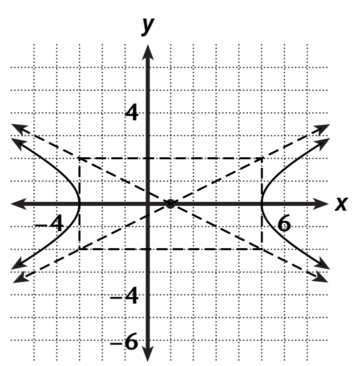
2.



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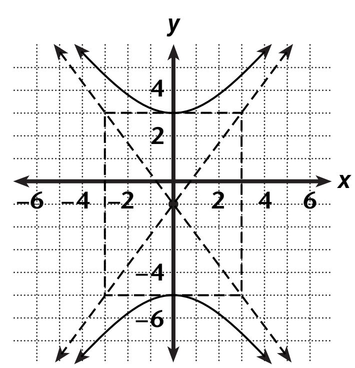
3.



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◆ Skill B Graphing a hyperbola from its equation

Recall Drawing a rectangle and asymptotes can help you draw a hyperbola, but they are really not part of the graph of the hyperbola.

◆ **Example**

Sketch a graph of $\frac{(y-1)^2}{16} - \frac{(x+2)^2}{9} = 1$.

◆ **Solution**

Use one of the standard forms to identify h, k, a, and b.
Since the y-term is **positive,** the form is

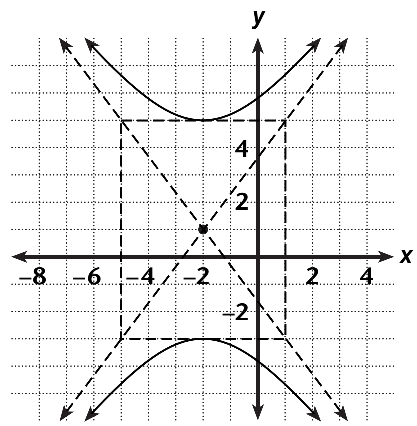
$$\frac{(y-k)^2}{a^2} - \frac{(x-h)^2}{b^2} = 1$$

where $h = -2$, $k = 1$, $a = 4$, and $b = 3$.

Mark the center $(-2, 1)$ and sketch a rectangle by moving 4 units above and below the center and 3 units to the left and to the right of the center.

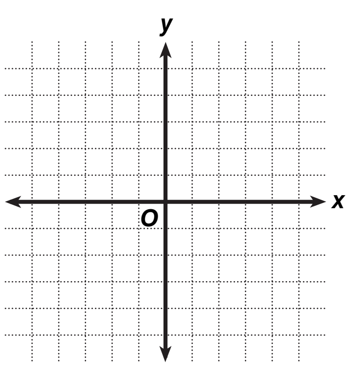
Draw the diagonals of the rectangle and extend them to form the asymptotes.

Since the ***y*-term** is positive, sketch the two branches above and below the center.

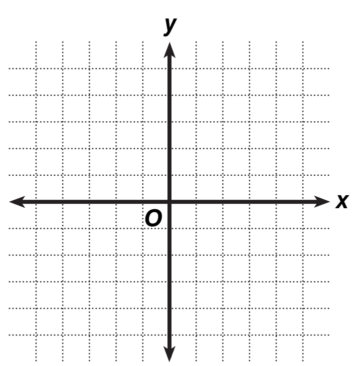


Graph each hyperbola.

4. $\frac{y^2}{25} - \frac{x^2}{4} = 1$



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



6. $x^2 - y^2 + 6x + 10y - 17 = 0$