GUIDED PRACTICE for Examples 1 and 2

Graph the equation. Identify the vertices, foci, and asymptotes of the hyperbola.

1. $\frac{x^2}{16} - \frac{y^2}{49} = 1$ **2.** $\frac{y^2}{36} - x^2 = 1$ **3.** $4y^2 - 9x^2 = 36$

Write an equation of the hyperbola with the given foci and vertices.

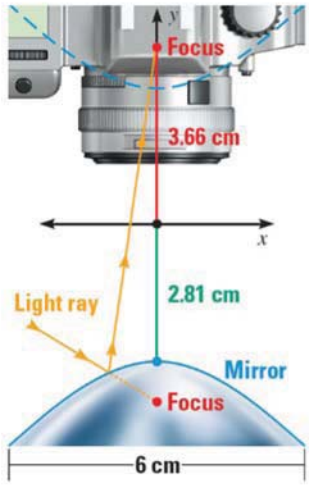
4. Foci: $(-3, 0)$, $(3, 0)$
Vertices: $(-1, 0)$, $(1, 0)$

5. Foci: $(0, -10)$, $(0, 10)$
Vertices: $(0, -6)$, $(0, 6)$

EXAMPLE 3 TAKS REASONING: Multi-Step Problem

PHOTOGRAPHY You can take panoramic photographs using a hyperbolic mirror. Light rays heading toward the focus behind the mirror are reflected to a camera positioned at the other focus as shown. After a photograph is taken, computers can "unwarp" the distorted image into a 360° view.

- Write an equation for the cross section of the mirror.
- The mirror is 6 centimeters wide. How tall is it?



Solution

STEP 1 From the diagram, $a = 2.81$ and $c = 3.66$.

To write an equation, find b^2.

$$b^2 = c^2 - a^2 = 3.66^2 - 2.81^2 \approx 5.50$$

▸ Because the transverse axis is vertical, the standard form of the equation for the cross section of the mirror is as follows:

$$\frac{y^2}{2.81^2} - \frac{x^2}{5.50} = 1, \quad \text{or} \quad \frac{y^2}{7.90} - \frac{x^2}{5.50} = 1$$

STEP 2 Find the y-coordinate at the mirror's bottom edge. Because the mirror is 6 centimeters wide, substitute $x = 3$ into the equation and solve.

$$\frac{y^2}{7.90} - \frac{3^2}{5.52} = 1 \qquad \text{Substitute 3 for } x.$$

$$y^2 \approx 20.78 \qquad \text{Solve for } y^2.$$

$$y \approx -4.56 \qquad \text{Solve for } y.$$

▸ So, the mirror has a height of $-2.81 - (-4.56) = 1.75$ centimeters.

AVOID ERRORS
The mirror is below the x-axis, so choose the negative square root.

GUIDED PRACTICE for Example 3

6. WHAT IF? In Example 3, suppose that the mirror remains 6 centimeters wide, but that $a = 3$ centimeters and $c = 5$ centimeters. How tall is the mirror?