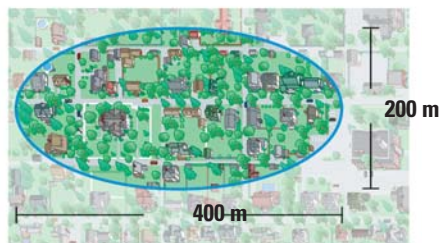




EXAMPLE 3 TAKS REASONING: Multi-Step Problem

LIGHTNING When lightning strikes, an elliptical region where the strike most likely hit can often be identified. Suppose it is determined that there is a 50% chance that a lightning strike hit within the elliptical region shown in the diagram.



- Write an equation of the ellipse.
- The area A of an ellipse is $A = \pi ab$. Find the area of the elliptical region.

Solution

STEP 1 The major axis is horizontal, with $a = \frac{400}{2} = 200$ and $b = \frac{200}{2} = 100$.

$$\text{An equation is } \frac{x^2}{200^2} + \frac{y^2}{100^2} = 1, \text{ or } \frac{x^2}{40,000} + \frac{y^2}{10,000} = 1.$$

STEP 2 The area is $A = \pi(200)(100) \approx 62,800$ square meters.

ANOTHER WAY

For an alternative method for solving the problem in Example 3, turn to page 640 for the **Problem Solving Workshop**.



EXAMPLE 4 Write an equation given a vertex and a focus

Write an equation of the ellipse that has a vertex at $(-8, 0)$, a focus at $(4, 0)$, and center at $(0, 0)$.

Solution

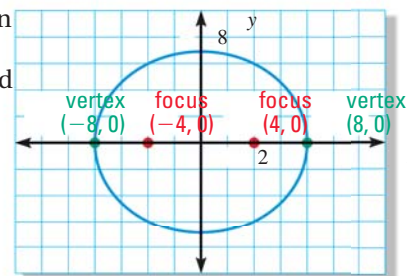
Make a sketch of the ellipse. Because the given vertex and focus lie on the x -axis, the major axis is horizontal, with $a = 8$ and $c = 4$. To find b , use the equation $c^2 = a^2 - b^2$.

$$4^2 = 8^2 - b^2$$

$$b^2 = 8^2 - 4^2 = 48$$

$$b = \sqrt{48}, \text{ or } 4\sqrt{3}$$

► An equation is $\frac{x^2}{8^2} + \frac{y^2}{(4\sqrt{3})^2} = 1$, or $\frac{x^2}{64} + \frac{y^2}{48} = 1$.



GUIDED PRACTICE for Examples 2, 3, and 4

Write an equation of the ellipse with the given characteristics and center at $(0, 0)$.

- | | |
|---|--|
| 4. Vertex: $(7, 0)$; co-vertex: $(0, 2)$ | 5. Vertex: $(0, 6)$; co-vertex: $(-5, 0)$ |
| 6. Vertex: $(0, 8)$; focus: $(0, -3)$ | 7. Vertex: $(-5, 0)$; focus: $(3, 0)$ |

8. **WHAT IF?** In Example 3, suppose that the elliptical region is 250 meters from east to west and 350 meters from north to south. Write an equation of the elliptical boundary and find the area of the region.