LESSON 5.1

NAME ______________________________ DATE __________

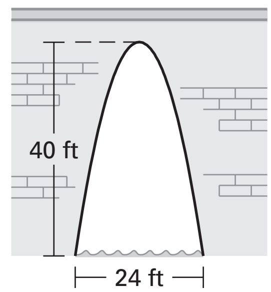
Challenge: Skills and Applications

For use with pages 249–255

1. Find a, b, and c so that the parabola whose equation is $y = ax^2 + bx + c$ has its vertex at $(3, 2)$ and passes through the point $(-1, 10)$.

2. Find b and c so that the parabola $y = -3x^2 + bx + c$ has x-intercepts 1 and -4.

3. A stone bridge has a parabolic arch where a river flows under it. At the water level the arch is 24 ft wide. The peak of the arch is 40 ft above the water.

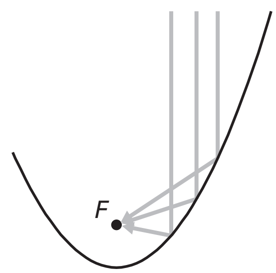


a. Using the left end of the arch (where it meets the water) as the origin, find an equation for the arch. That is, find an equation that gives the height y (in feet) above the water of a point on the arch as a function the point's position x (in feet) in relation to the left endpoint.

b. A town along the river wants to place red warning lights on the arch at points 6 ft to the right of its left end and 6 ft to the left of its right end. At what height will the lights need to be placed?

4. Suppose a parabola has a vertical axis and vertex (h, k). Show that the point $(h + t, q)$ is on the parabola if and only if the point $(h - t, q)$ is also on the parabola. What does this fact tell you about the geometry of a parabola?

5. With each parabola is associated a point F (not on the graph itself) with the following property: Any incoming vertical ray (of light, sound, etc.) that strikes the "inside" of the parabola is reflected directly toward F. This property accounts for the parabolic shape of satellite dishes and directional microphones. The point F is called the *focus* of the parabola.



The focus of a parabola is on the axis of the parabola and is always "inside" the graph. If p represents the distance from the focus to the vertex, then

$$a = \frac{1}{4p},$$

where a is the coefficient of the x^2-term in vertex (or standard) form. Use this fact to find the focus of the parabola whose equation is $y = x^2 - 2x + 3$.

Lesson 5.1