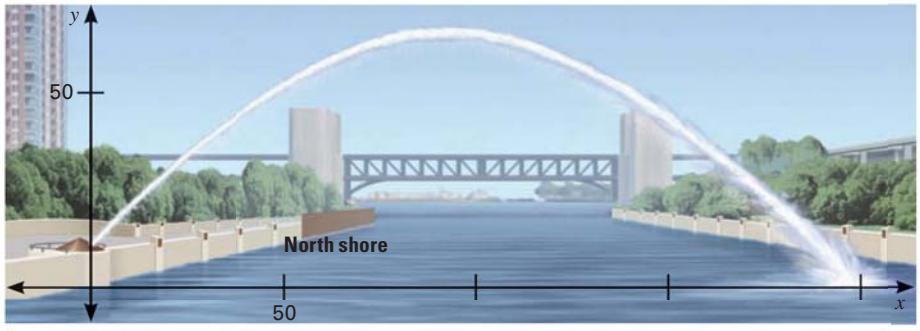
EXAMPLE 4 TAKS REASONING: Multi-Step Problem

FOUNTAINS The Centennial Fountain in Chicago shoots a water arc that can be modeled by the graph of the equation $y = -0.006x^2 + 1.2x + 10$ where x is the horizontal distance (in feet) from the river's north shore and y is the height (in feet) above the river. Does the water arc reach a height of 50 feet? If so, about how far from the north shore is the water arc 50 feet above the water?



Solution

STEP 1 **Write** a quadratic equation. You want to know whether the water arc reaches a height of 50 feet, so let $y = 50$. Then write the quadratic equation in standard form.

$y = -0.006x^2 + 1.2x + 10$ **Write given equation.**

$50 = -0.006x^2 + 1.2x + 10$ **Substitute 50 for y.**

$0 = -0.006x^2 + 1.2x - 40$ **Subtract 50 from each side.**

STEP 2 **Find** the value of the discriminant of $0 = -0.006x^2 + 1.2x - 40$.

$b^2 - 4ac = (1.2)^2 - 4(-0.006)(-40)$ **$a = -0.006$, $b = 1.2$, $c = -40$**

$= 0.48$ **Simplify.**

STEP 3 **Interpret** the discriminant. Because the discriminant is positive, the equation has two solutions. So, the water arc reaches a height of 50 feet at two points on the water arc.

STEP 4 **Solve** the equation $0 = -0.006x^2 + 1.2x - 40$ to find the distance from the north shore where the water arc is 50 feet above the water.

$x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ **Quadratic formula**

$= \dfrac{-1.2 \pm \sqrt{0.48}}{2(-0.006)}$ **Substitute values in the quadratic formula.**

$x \approx 42$ *or* $x \approx 158$ **Use a calculator.**

▶ The water arc is 50 feet above the water about 42 feet from the north shore and about 158 feet from the north shore.

USE A SHORTCUT
Because the value of $b^2 - 4ac$ was calculated in Step 2, you can substitute 0.48 for $b^2 - 4ac$.

GUIDED PRACTICE for Example 4

7. **WHAT IF?** In Example 4, does the water arc reach a height of 70 feet? If so, about how far from the north shore is the water arc 70 feet above the water?