LESSON 9.3

GOAL
Solve quadratic equations by graphing.

Vocabulary
A quadratic equation is an equation that can be written in the **standard form**
$ax^2 + bx + c = 0$ where $a \neq 0$ and a is called the **leading coefficient.**

Common Student Errors

• Thinking the y-intercept is also a solution

Tip Stress that only the x-intercepts of a graph of
a quadratic function are solutions to the related
quadratic equation. Have students check their
solutions by substituting into the original equation
or using factoring to solve the equation.

Example: Solve $x^2 + x - 30 = 0$.

Student solution: –6, 5, –30

EXAMPLE 1
Solve a quadratic equation having two solutions
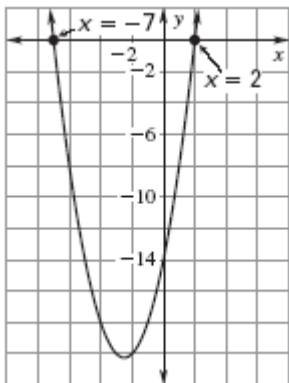
Solve $x^2 + 5x = 14$ by graphing.

Solution

STEP 1 **Write** the equation in standard form.
$$x^2 + 5x = 14 \qquad \text{Write original equation.}$$
$$x^2 + 5x - 14 = 0 \qquad \text{Subtract 14 from each side.}$$

STEP 2 **Graph** the function $y = x^2 + 5x - 14$.
The x-intercepts are –7 and 2.
The solutions of the equation $x^2 + 5x = 14$ are –7 and 2.

CHECK You can check -7 and 2 in the original equation.

$$x^2 + 5x = 14 \qquad x^2 + 5x = 14 \qquad \text{Write original equation.}$$
$$(-7)^2 + 5(-7) \overset{?}{=} 14 \qquad (2)^2 + 5(2) \overset{?}{=} 14 \qquad \text{Substitute for } x.$$
$$14 = 14 \checkmark \qquad 14 = 14 \checkmark \qquad \text{Simplify. Each solution checks.}$$

EXAMPLE 2
Solve a quadratic equation having one solution
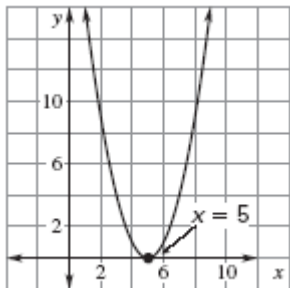
Solve $x^2 + 25 = 10x$ by graphing.

Solution

STEP 1 Write the equation in standard form.
$$x^2 + 25 = 10x \qquad \text{Write original equation.}$$
$$x^2 - 10x + 25 = 0 \qquad \text{Subtract } 10x \text{ from each side.}$$

STEP 2 Graph the function $y = x^2 - 10x + 25$.
The x-intercept is 5.
The solution of the equation $x^2 + 25 = 10x$ is 5.

EXAMPLE 3
Solve a quadratic equation having no solution
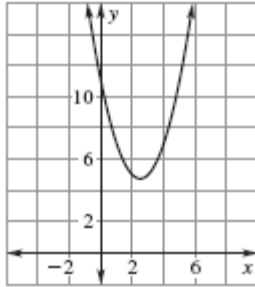
Solve $x^2 + 11 = 5x$ by graphing.

Solution

STEP 1 Write the equation in standard form.
$$x^2 + 11 = 5x \qquad \text{Write original equation.}$$
$$x^2 - 5x + 11 = 0 \qquad \text{Subtract } 5x \text{ from each side.}$$

STEP 2 Graph the function $y = x^2 - 5x + 11$.
The graph has no x-intercepts.
The equation $x^2 + 11 = 5x$ has no solution.

Exercises for Examples 1, 2, and 3

Solve the equation by graphing.

1. $x^2 = 2x + 15$
2. $x^2 + 4 = -4x$
3. $x^2 + 6x = -4$

EXAMPLE 4
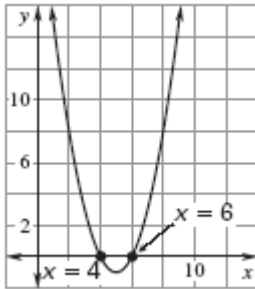**Find the zeros of a quadratic function**

Find the zeros of $f(x) = x^2 - 10x + 24$.

Solution

Graph the function $f(x) = x^2 - 10x + 24$.
The x-intercepts are 4 and 6.
The zeros of the function are 4 and 6.

Exercises for Example 4

Find the zeros of the function.
   4. $f(x) = x^2 - 4$
   5. $f(x) = x^2 + 5x - 14$