9.6 Factor $ax^2 + bx + c$

EXAMPLE

THROWN BALL You throw a ball up into the air. At 4 feet above the ground, the ball leaves your hand with an initial vertical velocity of 30 feet per second.

a. Write an equation that gives the height (in feet) of the ball as a function of the time (in seconds) since it left your hand.

b. After how many seconds does the ball land on the ground?

Solution

a. Use the vertical motion model $h = -16t^2 + vt + s$ to write an equation for the height h (in feet) of the ball as a function of the time t (in seconds). In this case, $v = 30$ and $s = 4$.

$h = -16t^2 + vt + s$	**Vertical motion model**
$h = -16t^2 + 30t + 4$	**Substitute 30 for v and 4 for s.**

b. When the ball lands on the ground, its height is 0 feet. Substitute 0 for h and solve the equation for t.

$0 = -16t^2 + 30t + 4$	**Substitute 0 for h.**
$0 = -2(8t^2 - 15t - 2)$	**Factor out -2.**
$0 = -2(8t + 1)(t - 2)$	**Factor the trinomial. Find factors of 8 and -2 that produce a middle term with a coefficient of -15.**
$8t + 1 = 0 \quad or \quad t - 2 = 0$	**Zero-product property**
$t = -\dfrac{1}{8} \ or \qquad t = 2$	**Solve for t.**

The solutions of the equation are $-\dfrac{1}{8}$ and 2. A negative solution does not make sense in this situation, so disregard $-\dfrac{1}{8}$.

▶ The ball lands on the ground after 2 seconds.

EXERCISES

**EXAMPLES
1, 2, 3, and 4**
on pp. 593–595
for Exs. 43–50

Solve the equation.

43. $7x^2 - 8x = -1$ **44.** $4n^2 + 3 = 7n$ **45.** $3s^2 + 4s + 4 = 8$

46. $6z^2 + 13z = 5$ **47.** $-4r^2 = 18r + 18$ **48.** $9a^2 = 6a + 24$

49. THROWN BALL You throw a ball up into the air with an initial vertical velocity of 46 feet per second. The ball leaves your hand when it is 6 feet above the ground. After how many seconds does the ball land on the ground?

50. GEOMETRY The length of a rectangle is 1 inch less than twice the width. The area of the rectangle is 21 square inches. What is the length of the rectangle?