

**FINDING A COMMON FACTOR** In Lesson 9.4, you learned to factor out the greatest common monomial factor from the terms of a polynomial. Sometimes you may need to do this before finding two binomial factors of a trinomial.

**EXAMPLE 4** Write and solve a polynomial equation

**DISCUS** An athlete throws a discus from an initial height of 6 feet and with an initial vertical velocity of 46 feet per second.



- Write an equation that gives the height (in feet) of the discus as a function of the time (in seconds) since it left the athlete's hand.
- After how many seconds does the discus hit the ground?

**Solution**

- Use the vertical motion model to write an equation for the height  $h$  (in feet) of the discus. In this case,  $v = 46$  and  $s = 6$ .

$$h = -16t^2 + vt + s \quad \text{Vertical motion model}$$

$$h = -16t^2 + 46t + 6 \quad \text{Substitute 46 for } v \text{ and 6 for } s.$$

- To find the number of seconds that pass before the discus lands, find the value of  $t$  for which the height of the discus is 0. Substitute 0 for  $h$  and solve the equation for  $t$ .

$$0 = -16t^2 + 46t + 6 \quad \text{Substitute 0 for } h.$$

$$0 = -2(8t^2 - 23t - 3) \quad \text{Factor out } -2.$$

$$0 = -2(8t + 1)(t - 3) \quad \text{Factor the trinomial. Find factors of 8 and } -3 \text{ that produce a middle term with a coefficient of } -23.$$

$$8t + 1 = 0 \quad \text{or} \quad t - 3 = 0 \quad \text{Zero-product property}$$

$$t = -\frac{1}{8} \quad \text{or} \quad t = 3 \quad \text{Solve for } t.$$

The solutions of the equation are  $-\frac{1}{8}$  and 3. A negative solution does not make sense in this situation, so disregard  $-\frac{1}{8}$ .

- The discus hits the ground after 3 seconds.

**USE VERTICAL MOTION MODEL**  
For help with using the vertical motion model, see p. 575.

**GUIDED PRACTICE** for Example 4

- WHAT IF?** In Example 4, suppose another athlete throws the discus with an initial vertical velocity of 38 feet per second and releases it from a height of 5 feet. After how many seconds does the discus hit the ground?
- SHOT PUT** In a shot put event, an athlete throws the shot put from an initial height of 6 feet and with an initial vertical velocity of 29 feet per second. After how many seconds does the shot put hit the ground?