

**LESSON**  
**8-3**

# Using Special Factors to Solve Equations

## Reteach

Use the difference of squares method or the perfect-square method to solve many projectile-motion word problems. The height of a projectile is often represented by one of these equations (where  $h$  is height in feet and  $t$  is time in seconds, and  $-16t^2$  represents the force of gravity for all projectiles on Earth).

$h = -16t^2 + h_0$ <p>Use when the initial velocity = 0 (the projectile is <i>dropped</i> from a height, <math>h_0</math>).</p>	$h = -16t^2 + v_0t + h_0$ <p>Use when the initial velocity <math>\neq 0</math> (the projectile is launched from a height, <math>h_0</math>, with an initial upward velocity of <math>v_0</math>).</p>
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Problem 1: $h = -16t^2 + 64$	Problem 2: $h = -16t^2 + 24t - 9$
<ul style="list-style-type: none"> <li>✓ 64 represents the initial height of the projectile.</li> <li>✓ To find when the projectile hits the ground set <math>h = 0</math> and use the difference of squares to solve for <math>t</math>.</li> </ul>	<ul style="list-style-type: none"> <li>✓ 24 represents the initial velocity of the launched projectile.</li> <li>✓ The <math>-9</math> represents the initial height, in this case 9 feet under ground.</li> <li>✓ Set <math>h = 0</math> and use perfect-squares to solve for <math>t</math>.</li> </ul>
<ol style="list-style-type: none"> <li>1. Set <math>h = 0</math>. <math>h = -16t^2 + 64 = 0</math></li> <li>2. Factor. <math>h = -16(t^2 - 4) = 0</math></li> <li>3. <math>a = \sqrt{t^2} = t</math> and <math>b = \sqrt{4} = 2</math></li> <li>4. Use difference of squares to solve for <math>t</math>.  <math>h = -16(t + 2)(t - 2) = 0</math>  <math>t = -2</math> or <math>2</math>            Pick positive <math>t</math>, so <math>t = 2</math>.</li> </ol>	<ol style="list-style-type: none"> <li>1. Set <math>h = 0</math>. <math>h = -16t^2 + 24t - 9 = 0</math></li> <li>2. Factor. <math>h = -1(16t^2 - 24t + 9) = 0</math></li> <li>3. <math>a = \sqrt{16t^2} = 4t</math> and <math>b = \sqrt{9} = 3</math></li> <li>4. Check middle term. <math>2ab = 24t</math></li> <li>5. Use perfect-squares to solve for <math>t</math>.  <math>h = -1(4t - 3)^2 = 0</math>, so  <math>t = \frac{3}{4}</math> seconds.</li> </ol>

Find when each projectile below hits the ground.

1.  $h = -16t^2 + 128$

a. 128 represents \_\_\_\_\_.

b. Set  $h = 0$  and solve for  $t$ .

$t =$  \_\_\_\_\_

2.  $h = -16t^2 + 40t - 25$

a. 40 represents \_\_\_\_\_.

b.  $-25$  represents \_\_\_\_\_.

c. Set  $h = 0$  and solve for  $t$ .

$t =$  \_\_\_\_\_