

**EXAMPLE 6 TAKS REASONING: Multi-Step Problem**

**TERRARIUM** A terrarium in the shape of a rectangular prism has a volume of 4608 cubic inches. Its length is more than 10 inches. The dimensions of the terrarium are shown. Find the length, width, and height of the terrarium.

**Solution**

**STEP 1** Write a verbal model. Then write an equation.

Volume (cubic inches)	=	Length (inches)	·	Width (inches)	·	Height (inches)
↓		↓		↓		↓
4608	=	$(36 - w)$	·	$w$	·	$(w + 4)$

**STEP 2** Solve the equation for  $w$ .

$4608 = (36 - w)(w)(w + 4)$	<b>Write equation.</b>
$0 = 32w^2 + 144w - w^3 - 4608$	<b>Multiply. Subtract 4608 from each side.</b>
$0 = (-w^3 + 32w^2) + (144w - 4608)$	<b>Group terms.</b>
$0 = -w^2(w - 32) + 144(w - 32)$	<b>Factor each group.</b>
$0 = (w - 32)(-w^2 + 144)$	<b>Distributive property</b>
$0 = -1(w - 32)(w^2 - 144)$	<b>Factor <math>-1</math> from <math>-w^2 + 144</math>.</b>
$0 = -1(w - 32)(w - 12)(w + 12)$	<b>Difference of two squares pattern</b>
$w - 32 = 0$ or $w - 12 = 0$ or $w + 12 = 0$	<b>Zero-product property</b>
$w = 32$ $w = 12$ $w = -12$	<b>Solve for <math>w</math>.</b>

**STEP 3** Choose the solution of the equation that is the correct value of  $w$ . Disregard  $w = -12$ , because the width cannot be negative.

You know that the length is more than 10 inches. Test the solutions 12 and 32 in the expression for the length.

Length =  $36 - 12 = 24$  ✓ or      Length =  $36 - 32 = 4$  ✗

The solution 12 gives a length of 24 inches, so 12 is the correct value of  $w$ .

**STEP 4** Find the height.

Height =  $w + 4 = 12 + 4 = 16$

► The width is 12 inches, the length is 24 inches, and the height is 16 inches.

**GUIDED PRACTICE for Example 6**

**10. DIMENSIONS OF A BOX** A box in the shape of a rectangular prism has a volume of 72 cubic feet. The box has a length of  $x$  feet, a width of  $(x - 1)$  feet, and a height of  $(x + 9)$  feet. Find the dimensions of the box.