

Module 6: Solving Quadratic Equations

Topic 3 Content: Practical Problems Involving Quadratic Equations

Introduction



Today's Lesson

- You will learn how to use quadratic equations to model and solve practical problems.

Hi there! I'm so glad to have you here for this lesson in Algebra I, where you will learn how to use quadratic equations to model and solve practical problems.

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Anticipatory Set

Step One
Read through the problem.
Step Two
Highlight the key information.
Step Three
Use the key information to solve the problem.

Use the following steps to guide you in the process of using quadratic equations to solve real-world problems.

Step 1: Read through the problem.

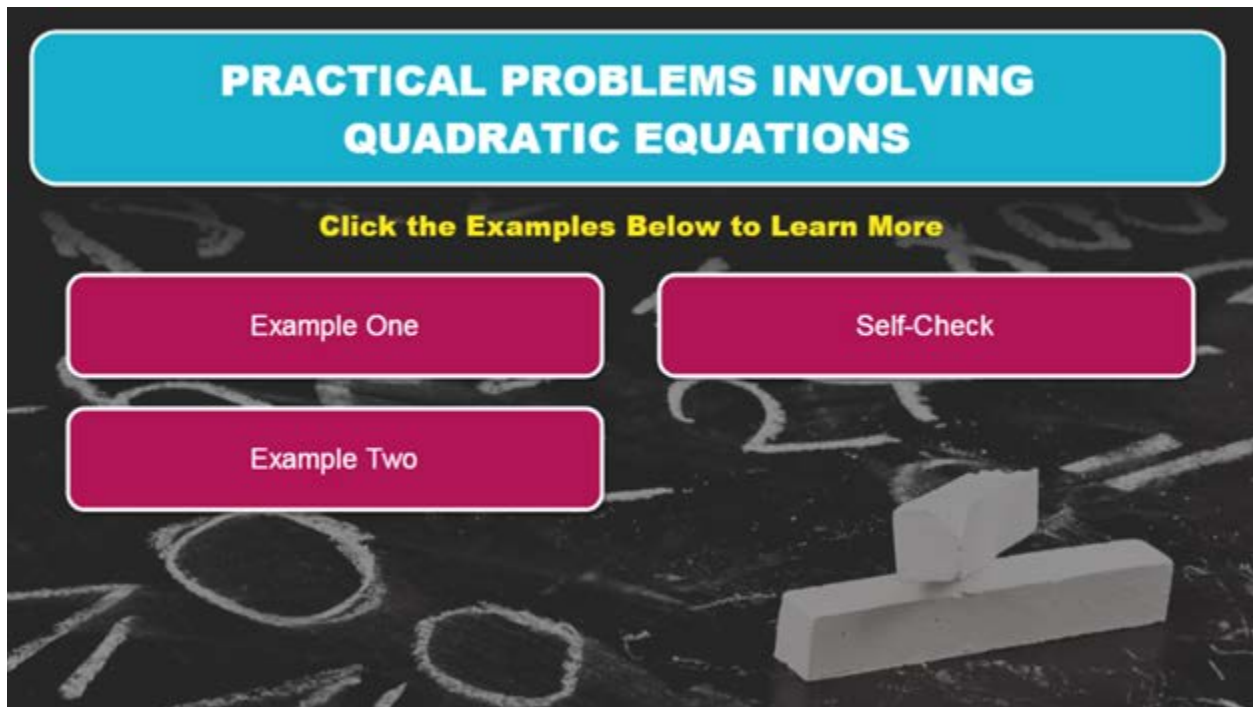
Step 2: Highlight the key information.

Step 3: Use the key information to solve the problem.

Keep these steps in mind while you work through the following examples.

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Practical Problems Involving Quadratic Equations




The image shows a digital interface with a dark background featuring faint chalkboard drawings of circles and arrows. At the top, a blue rounded rectangle contains the text "PRACTICAL PROBLEMS INVOLVING QUADRATIC EQUATIONS" in white. Below this, a yellow text prompt reads "Click the Examples Below to Learn More". Three pink rounded rectangular buttons are arranged in a 2x2 grid: "Example One" (top-left), "Self-Check" (top-right), and "Example Two" (bottom-left). In the bottom right corner, there is a 3D rendering of a white rectangular block with a smaller white cube-like shape on top of it.

Click the examples below to learn more.

- [Example One](#)
- [Example Two](#)
- [Self-Check](#)

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Example One



Example 1

The playground at a local park is in the shape of a rectangle, with an area of 496 ft^2 and a length of 1 foot more than twice its width. Find the dimensions of the playground.

Read through the problem above.
Click to highlight important passages.

Next

The playground at a local park is in the shape of a rectangle, with an area of 496 ft^2 and a length 1 foot more than twice its width. Find the dimensions of the playground.

Take a few moments to read Example 1. Highlight the information you think is necessary to solve the problem.

Read through the problem above. Click to highlight important passages.

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Example One (continued)



Example 1

The playground at a local park is in the shape of a rectangle, with an area of 496 ft^2 and a length of 1 foot more than twice its width. Find the dimensions of the playground.

The playground at a local park is in the shape of a rectangle, with an area of 496 ft^2 and a length 1 foot more than twice its width. Find the dimensions of the playground.

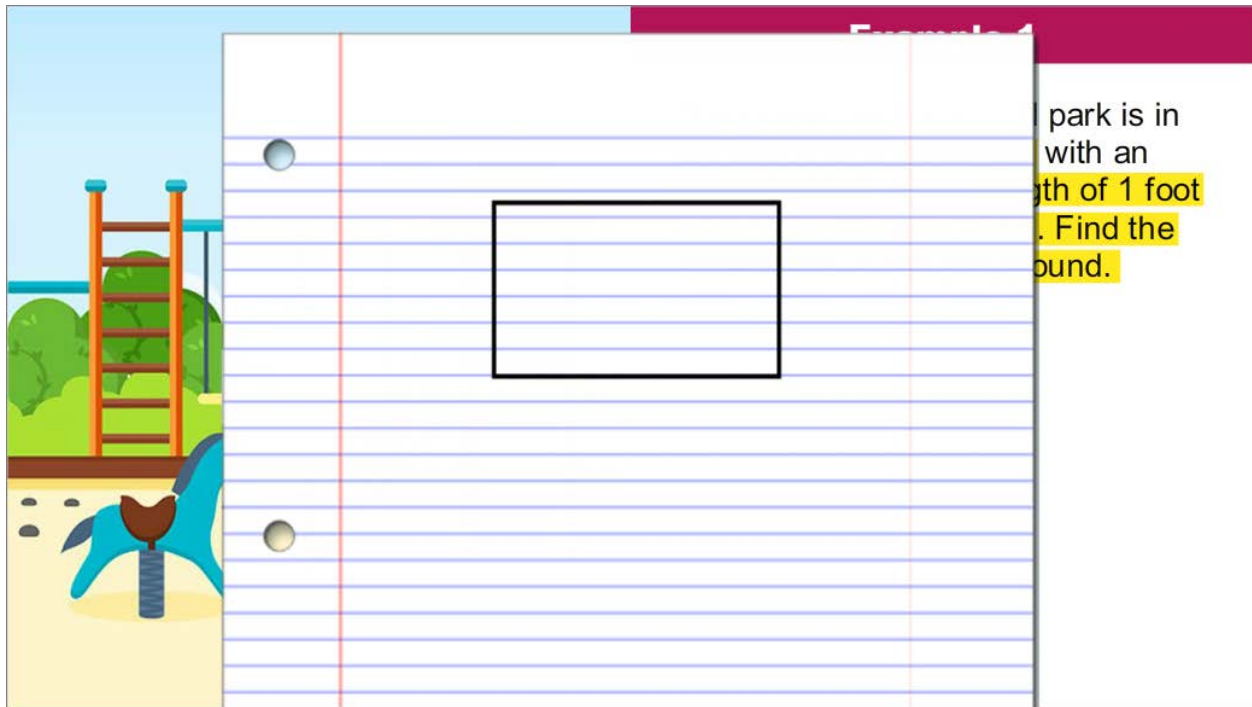
Did you highlight the important facts?

- The playground is in the shape of rectangle
- The area of the playground is 496 ft^2
- The length of the playground is 1 foot more than twice its width
- Find the dimensions of the playground

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Example One (continued)

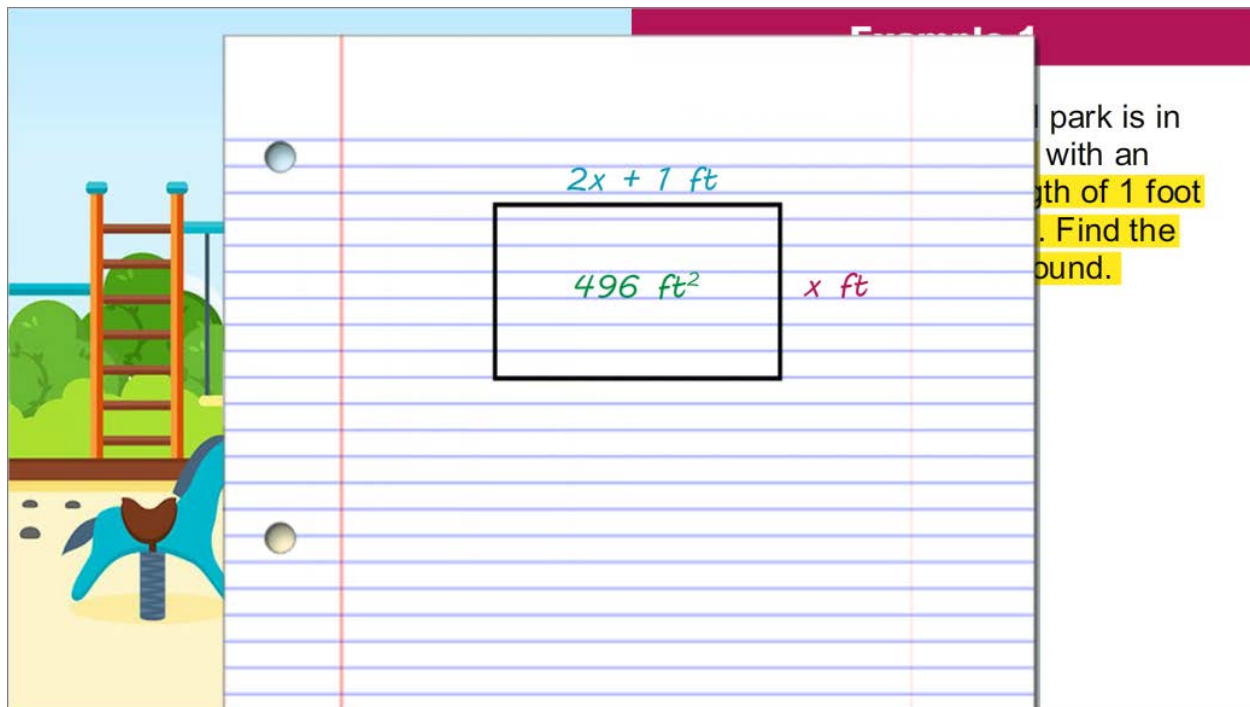


The park is in the shape of a rectangle with a length of 1 foot. Find the width.

To solve this problem, you may find it helpful to start with a rough sketch of the situation. The playground is in the shape of a rectangle. On notebook paper, sketch a rectangle to represent the playground.

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Example One (continued)



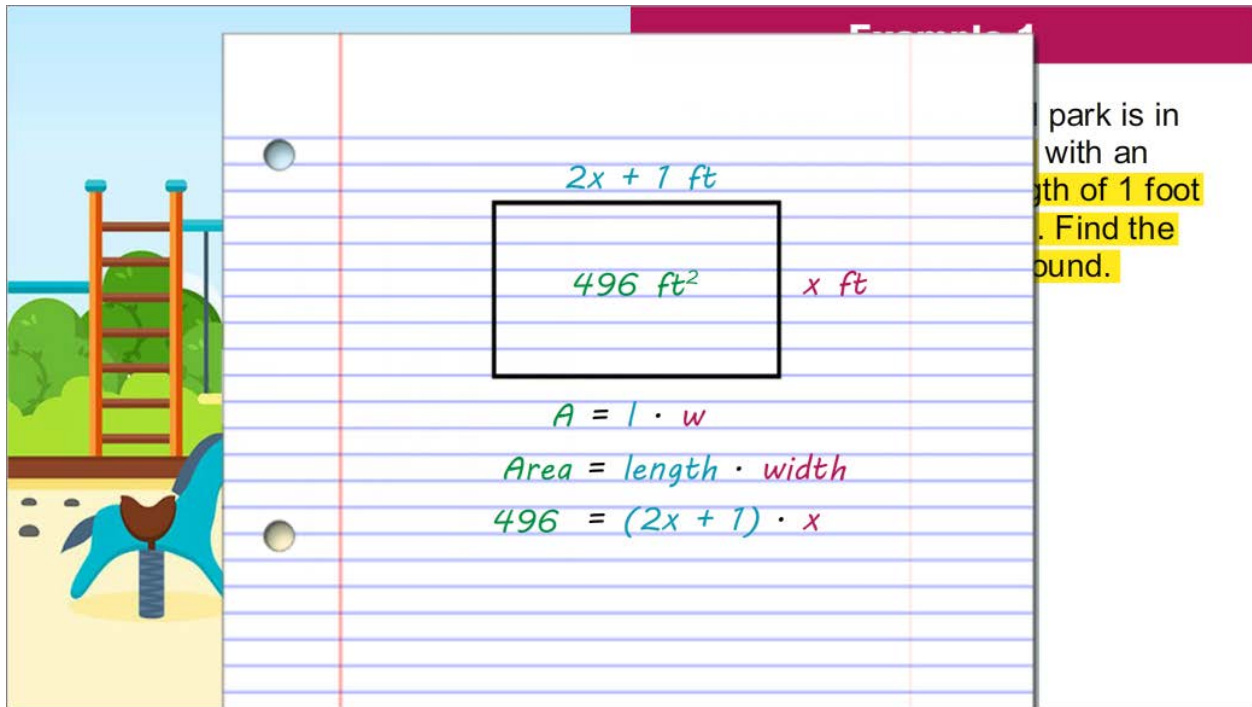
The diagram shows a rectangular area on a sheet of lined paper. The area is labeled with 496 ft^2 and $2x + 1 \text{ ft}$ for the length, and $x \text{ ft}$ for the width. To the left of the paper is an illustration of a playground with a slide and a swing set.

park is in
with an
length of 1 foot
. Find the
bound.

The area of the playground is 496 ft^2 . Its length is 1 foot more than twice its width. Let x represent the width of the rectangle. Because the length is 1 foot more than twice its width, the length can be represented by the expression $2x + 1$.

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Example One (continued)



The image shows a composite scene. On the left is a colorful illustration of a playground with a blue slide, a wooden ladder, and green bushes. On the right is a notebook page with blue horizontal lines and two vertical red margin lines. On the notebook page, a black rectangle is drawn. The top side of the rectangle is labeled $2x + 7 \text{ ft}$ in blue. The right side is labeled $x \text{ ft}$ in red. Inside the rectangle, the area is labeled 496 ft^2 in green. Below the rectangle, the following equations are written in green and red:

$$A = l \cdot w$$
$$\text{Area} = \text{length} \cdot \text{width}$$
$$496 = (2x + 7) \cdot x$$

To the right of the notebook page, a portion of a text problem is visible, with some words highlighted in yellow:

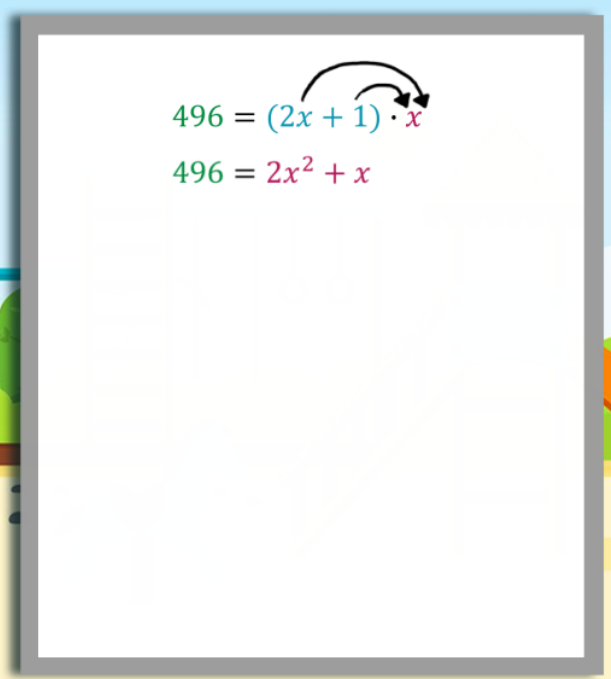
park is in
with an
length of 1 foot
. Find the
bound.

Now it is time to set up the equation. The formula for the area of a rectangle is $A = l \cdot w$. A represents the area of the rectangle, l represents its length and w represents its width. In the equation, substitute 496 for A , the expression $2x + 7$ for l , and x for w .

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Example One (continued)

 $496 = (2x + 1) \cdot x$ $496 = 2x^2 + x$	<h3>Example 1</h3> <p>The playground at a local park is in the shape of a rectangle, with an area of 496 ft^2 and a length of 1 foot more than twice its width. Find the dimensions of the playground.</p> <p>Standard Form</p> $ax^2 + bx + c = 0$
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The playground at a local park is in the shape of a rectangle, with an area of 496 ft^2 and a length 1 foot more than twice its width. Find the dimensions of the playground.

Standard form: $ax^2 + bx + c = 0$

$$496 = (2x^2 + 1) \cdot x$$

$$496 = 2x^2 + x$$

Now that you have written the equation to model the situation, solve for x . Begin by applying the distributive property to the right side of the equation.

Notice that the equation now includes a square term. Therefore, it is a quadratic equation. To solve a quadratic equation begin by representing it in standard form.

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Example One (continued)

$496 = (2x + 1) \cdot x$ $496 = 2x^2 + x$ $\begin{array}{r} -496 \quad -496 \\ \hline 0 = 2x^2 + x - 496 \end{array}$	Example 1
	<p>The playground at a local park is in the shape of a rectangle, with an area of 496 ft² and a length of 1 foot more than twice its width. Find the dimensions of the playground.</p> <p align="center">Standard Form $ax^2 + bx + c = 0$</p>

The playground at a local park is in the shape of a rectangle, with an area of 496 ft² and a length 1 foot more than twice its width. Find the dimensions of the playground.

Standard form: $ax^2 + bx + c = 0$

$$496 = (2x^2 + 1) \cdot x$$

$$496 = 2x^2 + x$$

$$\begin{array}{r} -496 \quad -496 \\ \hline 0 = 2x^2 + x - 496 \end{array}$$

One strategy is to subtract 496 from each side of the equation. The result is $0 = 2x^2 + x - 496$.

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Example One (continued)

Example 1	
$496 = (2x + 1) \cdot x$ $496 = 2x^2 + x$ $\begin{array}{r} -496 \quad -496 \\ \hline 0 = 2x^2 + x - 496 \\ 2x^2 + x - 496 = 0 \end{array}$	<p>The playground at a local park is in the shape of a rectangle, with an area of 496 ft² and a length of 1 foot more than twice its width. Find the dimensions of the playground.</p> <p style="text-align: center;">Standard Form $ax^2 + bx + c = 0$</p> <p style="text-align: center;">Symmetric Property If $a = b$, then $b = a$.</p>

The playground at a local park is in the shape of a rectangle, with an area of 496 ft² and a length 1 foot more than twice its width. Find the dimensions of the playground.

Standard form: $a^2 + bx + c = 0$

Symmetric Property: If $a = b$, then $b = a$.

$$496 = (2x^2 + 1) \cdot x$$

$$496 = 2x^2 + x$$

$$\begin{array}{r} -496 \quad -496 \\ \hline 0 = 2x^2 + x - 496 \\ 2x^2 + x - 496 = 0 \end{array}$$

The Symmetric Property states that the order of equality does not affect an equation. Therefore, you can represent the equation as $2x^2 + x - 496 = 0$.

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Example One (continued)

$$ax^2 + bx + c = 0$$
$$2x^2 + x - 496 = 0$$

Enter the appropriate values for a , b , and c . Then, click submit.

$a =$ $b =$ $c =$

Example 1

The playground at a local park is in the shape of a rectangle, with an area of 496 ft^2 and a length of 1 foot more than twice its width. Find the dimensions of the playground.

Submit

The playground at a local park is in the shape of a rectangle, with an area of 496 ft^2 and a length 1 foot more than twice its width. Find the dimensions of the playground.

Standard form: $a^2 + bx + c = 0$

Symmetric Property: If $a = b$, then $b = a$.

$$ax^2 + bx + c = 0$$
$$2x^2 + x - 496 = 0$$

You have learned two methods of solving a quadratic equation, factoring and the quadratic formula. You may find it more efficient to use the quadratic formula for this example.

Start by identifying a , b , and c .

$$a = ? \quad b = ? \quad c = ?$$

Enter the appropriate values for a , b , and c . Then, click submit.

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Example One (continued)

Example 1

$$ax^2 + bx + c = 0$$
$$2x^2 + 1x + (-496) = 0$$

The appropriate values for a , b , and c are as follows:

$$a = 2 \quad b = 1 \quad c = -496$$

Next

The playground at a local park is in the shape of a rectangle, with an area of 496 ft^2 and a length 1 foot more than twice its width. Find the dimensions of the playground.

$$ax^2 + bx + c = 0$$
$$2x^2 + 1x - 496 = 0$$

The appropriate values for a , b , and c are as follows:

$$a = 2 \quad b = 1 \quad c = -496$$

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Example One (continued)

$$ax^2 + bx + c = 0$$

$$2x^2 + 1x + (-496) = 0$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Substitute the appropriate values into the quadratic formula.

$$x = \frac{-(\quad) \pm \sqrt{(\quad)^2 - 4(\quad)(\quad)}}{2(\quad)}$$

Example 1

The playground at a local park is in the shape of a rectangle, with an area of 496 ft² and a length of 1 foot more than twice its width. Find the dimensions of the playground.

Submit

The playground at a local park is in the shape of a rectangle, with an area of 496 ft² and a length 1 foot more than twice its width. Find the dimensions of the playground.

$$ax^2 + bx + c = 0$$

$$2x^2 + 1x - 496 = 0$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Now that you have found that $a = 2, b = 1, c = -496$, substitute the values into the quadratic formula.

$$x = \frac{-(?) \pm \sqrt{(?)^2 - 4(?)(?)}}{2(?)}$$

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Example One (continued)

Example 1

$$ax^2 + bx + c = 0$$
$$2x^2 + 1x + (-496) = 0$$
$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

If $a = 2$, $b = 1$, and $c = -496$, then...

$$x = \frac{-(1) \pm \sqrt{(1)^2 - 4(2)(-496)}}{2(2)}$$

Next

The playground at a local park is in the shape of a rectangle, with an area of 496 ft^2 and a length 1 foot more than twice its width. Find the dimensions of the playground.

$$ax^2 + bx + c = 0$$
$$2x^2 + 1x - 496 = 0$$
$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

If $a = 2$, $b = 1$, $c = -496$, then...

$$x = \frac{-(1) \pm \sqrt{(1)^2 - 4(2)(-496)}}{2(2)}$$

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Example One (continued)

Example 1	
$x = \frac{-(1) \pm \sqrt{(1)^2 - 4(2)(-496)}}{2(2)}$ $x = \frac{-1 \pm \sqrt{1}}{2}$	<p>The playground at a local park is in the shape of a rectangle, with an area of 496 ft² and a length 1 foot more than twice its width. Find the dimensions of the playground.</p>

The playground at a local park is in the shape of a rectangle, with an area of 496 ft² and a length 1 foot more than twice its width. Find the dimensions of the playground.

$$x = \frac{-(1) \pm \sqrt{(1)^2 - 4(2)(-496)}}{2(2)}$$

$$x = \frac{-1 \pm \sqrt{1}}{2}$$

Now, begin to simplify the expression to the right of the equals sign. Start with the numerator.

The opposite of 1 is -1.

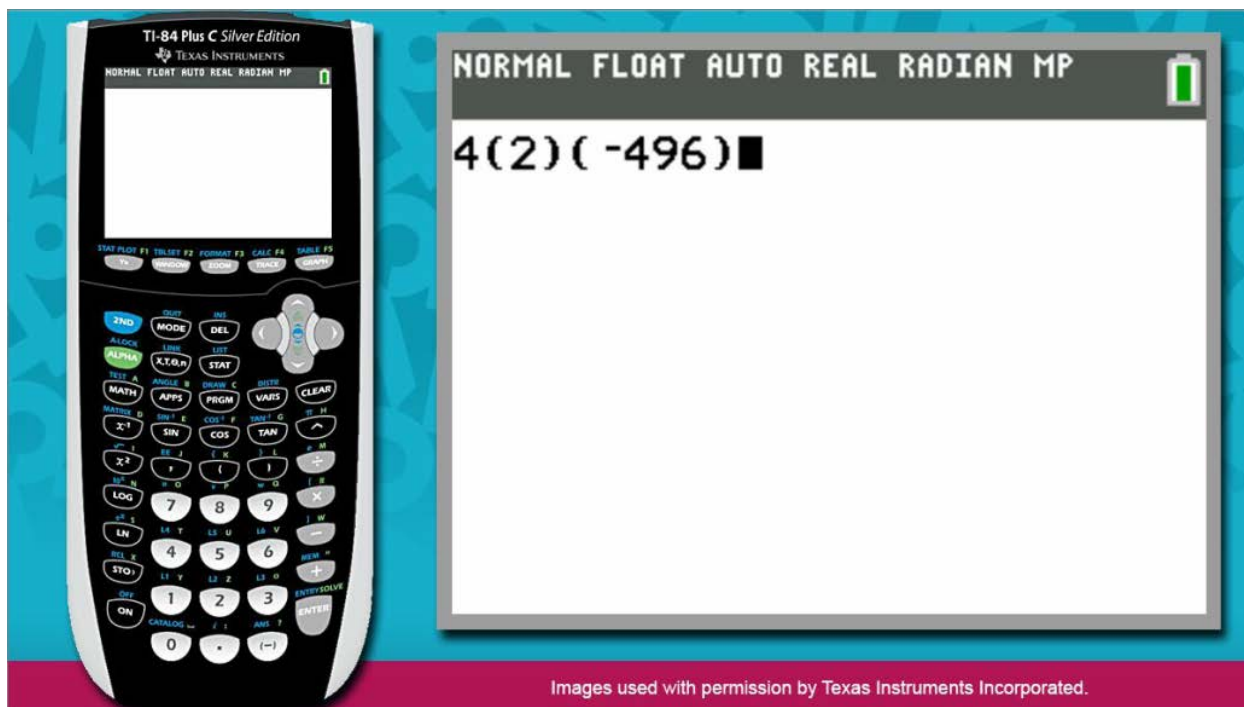
$$1^2 = 1$$

To find the product of 4, 2, and -496, you may want to use the calculator.

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Example One (continued)

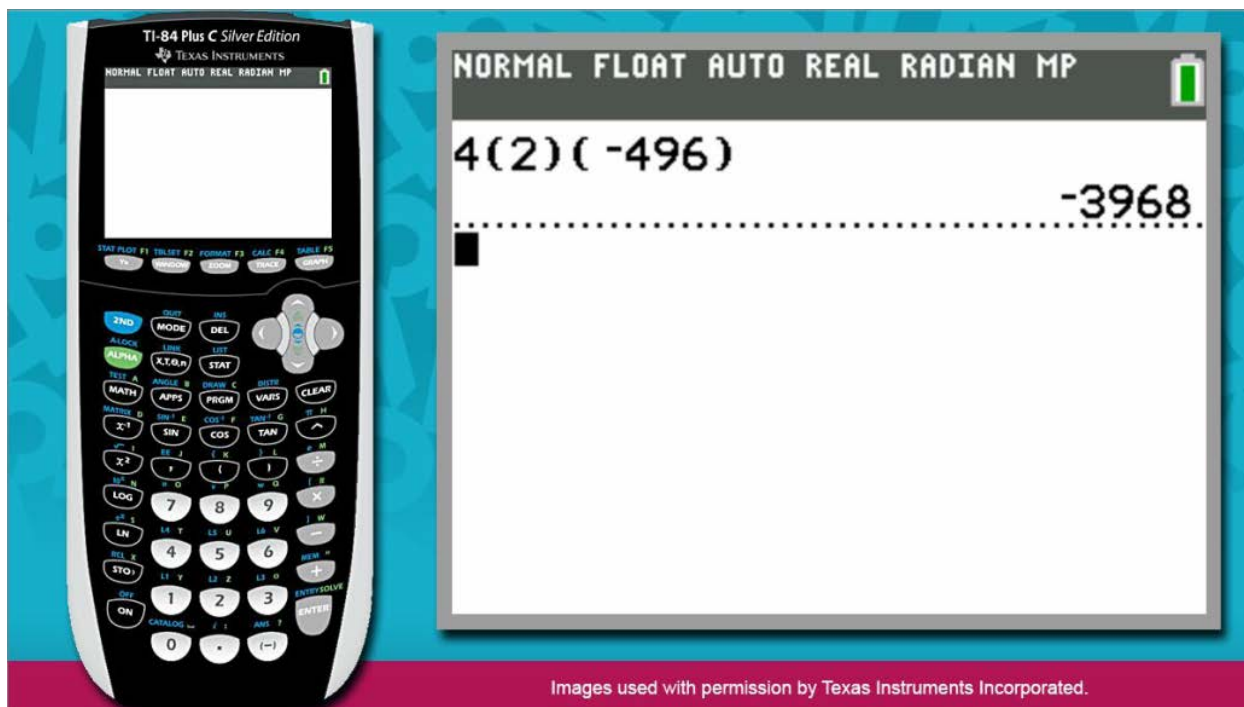


Input the product into the calculator.

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Example One (continued)



After pressing enter you find that the product is -3968 .

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Example One (continued)

Example 1	
$x = \frac{-(1) \pm \sqrt{(1)^2 - 4(2)(-496)}}{2(2)}$ $x = \frac{-1 \pm \sqrt{1 - (-3968)}}{4}$	<p>The playground at a local park is in the shape of a rectangle, with an area of 496 ft² and a length of 1 foot more than twice its width. Find the dimensions of the playground.</p>

The playground at a local park is in the shape of a rectangle, with an area of 496 ft² and a length 1 foot more than twice its width. Find the dimensions of the playground.

$$x = \frac{-(1) \pm \sqrt{(1)^2 - 4(2)(-496)}}{2(2)}$$

Next, simplify the product in the denominator.

$$2(2) = 4$$

$$x = \frac{-1 \pm \sqrt{1 - (-3968)}}{4}$$

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Example One (continued)

Example 1	
$x = \frac{- (1) \pm \sqrt{ (1)^2 - 4 (2) (-496) }}{2 (2)}$ $x = \frac{-1 \pm \sqrt{3969}}{4}$	<p>The playground at a local park is in the shape of a rectangle, with an area of 496 ft² and a length of 1 foot more than twice its width. Find the dimensions of the playground.</p>

The playground at a local park is in the shape of a rectangle, with an area of 496 ft² and a length 1 foot more than twice its width. Find the dimensions of the playground.

$$x = \frac{- (1) \pm \sqrt{ (1)^2 - 4 (2) (-496) }}{2 (2)}$$

Now, simplify the expression underneath the radical symbol.

$$x = \frac{-1 \pm \sqrt{3968}}{4}$$

1 - (-3968) can be represented as 1 + 3968.

This sum equals 3969.

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Example One (continued)

$x = \frac{-(-1) \pm \sqrt{(-1)^2 - 4(2)(-496)}}{2(2)}$ $x = \frac{-1 \pm \sqrt{3969}}{4}$ $x = \frac{-1 + \sqrt{3969}}{4}$	<p align="center">Example 1</p> <p>The playground at a local park is in the shape of a rectangle, with an area of 496 ft² and a length of 1 foot more than twice its width. Find the dimensions of the playground.</p>
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The playground at a local park is in the shape of a rectangle, with an area of 496 ft² and a length 1 foot more than twice its width. Find the dimensions of the playground.

$$x = \frac{-(-1) \pm \sqrt{(-1)^2 - 4(2)(-496)}}{2(2)}$$

$$x = \frac{-1 \pm \sqrt{3969}}{4}$$

$$x = \frac{-1 + \sqrt{3969}}{4}$$

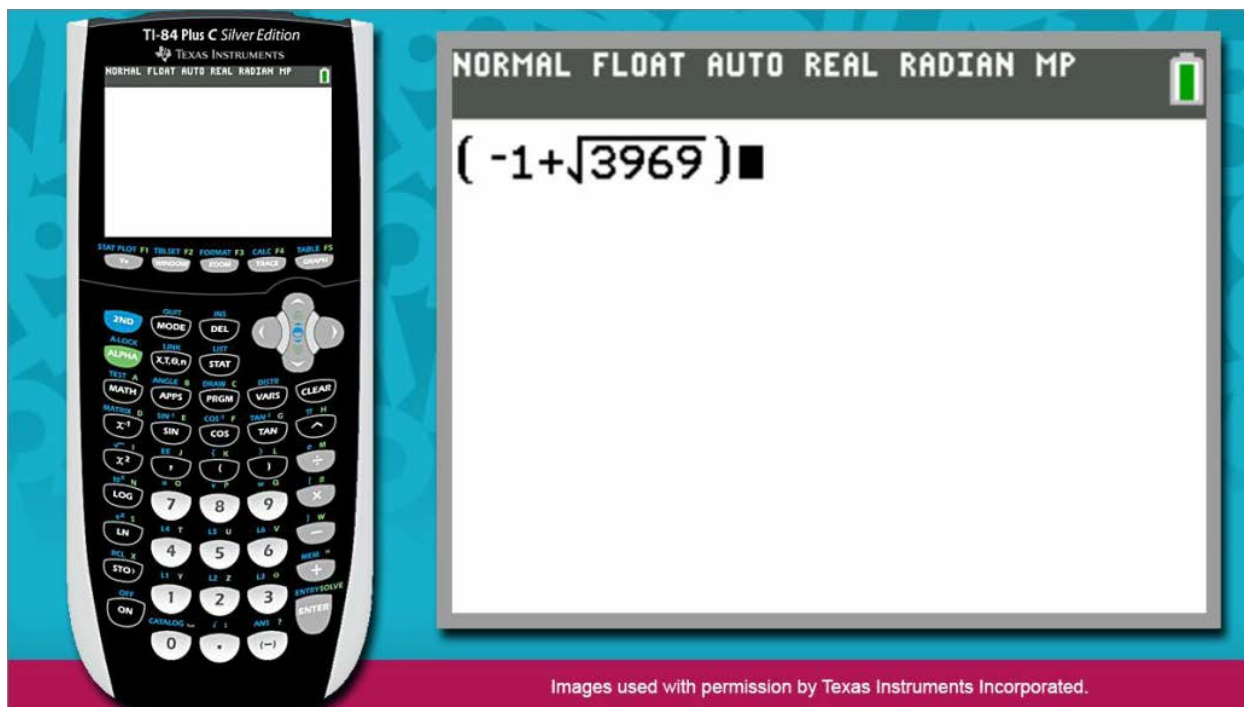
There are two solutions to the quadratic equation. One of the solutions is $x = \frac{-1 + \sqrt{3969}}{4}$.

You may want to use the calculator to simplify the expression to the right of equals sign.

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Example One (continued)

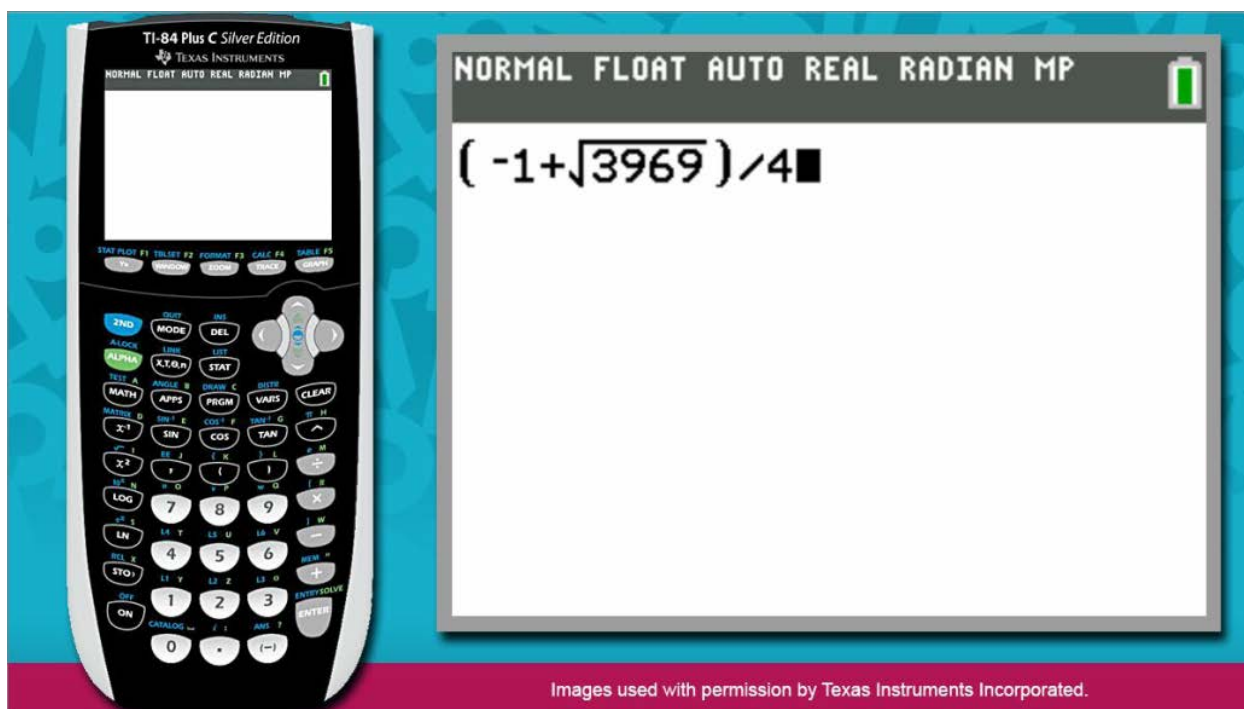


Remember to place parentheses around the expression in the numerator.

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Example One (continued)

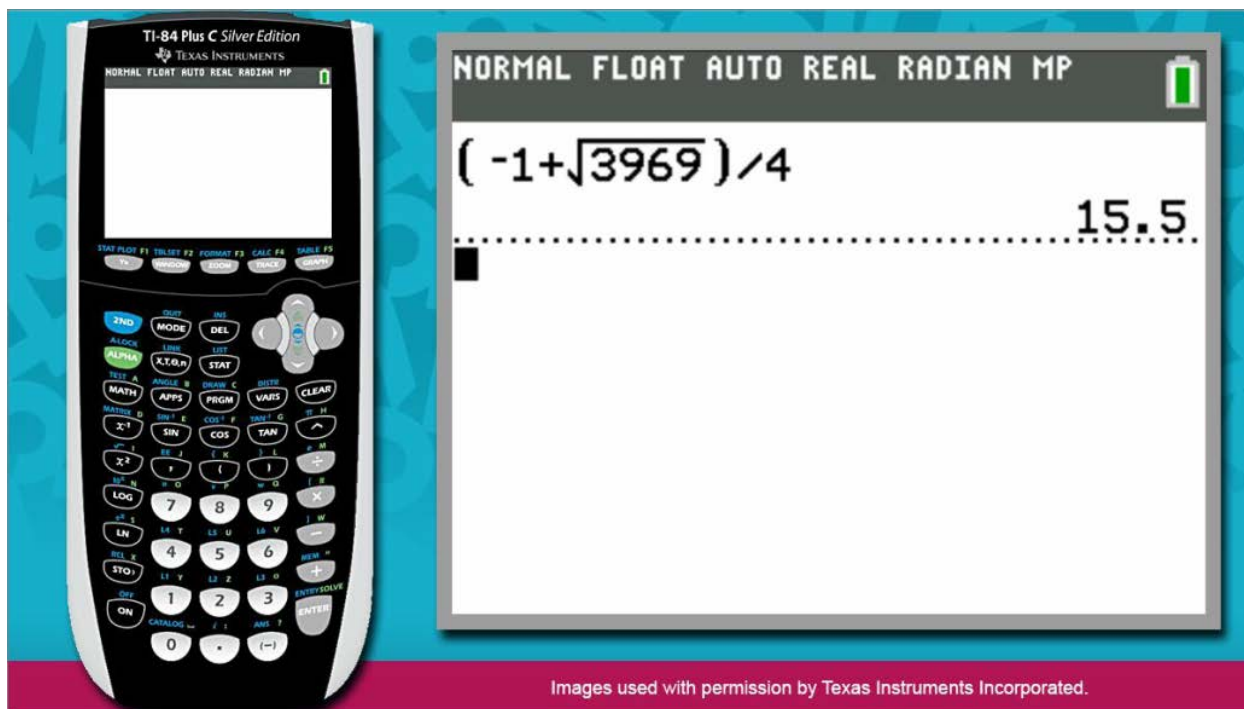


Then, divide by 4.

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Example One (continued)



After pressing ENTER, you find that the result is 15.5.

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Example One (continued)

	Example 1
$x = \frac{-(1) \pm \sqrt{(1)^2 - 4(2)(-496)}}{2(2)}$ $x = \frac{-1 \pm \sqrt{3969}}{4}$ $x = \frac{-1 + \sqrt{3969}}{4} \approx 15.5$ $x = \frac{-1 - \sqrt{3969}}{4}$	The playground at a local park is in the shape of a rectangle, with an area of 496 ft ² and a length of 1 foot more than twice its width. Find the dimensions of the playground.

The playground at a local park is in the shape of a rectangle, with an area of 496 ft² and a length 1 foot more than twice its width. Find the dimensions of the playground.

$$x = \frac{-(1) \pm \sqrt{(1)^2 - 4(2)(-496)}}{2(2)}$$

$$x = \frac{-1 \pm \sqrt{3968}}{4}$$

$$x = \frac{-1 - \sqrt{3969}}{4}$$

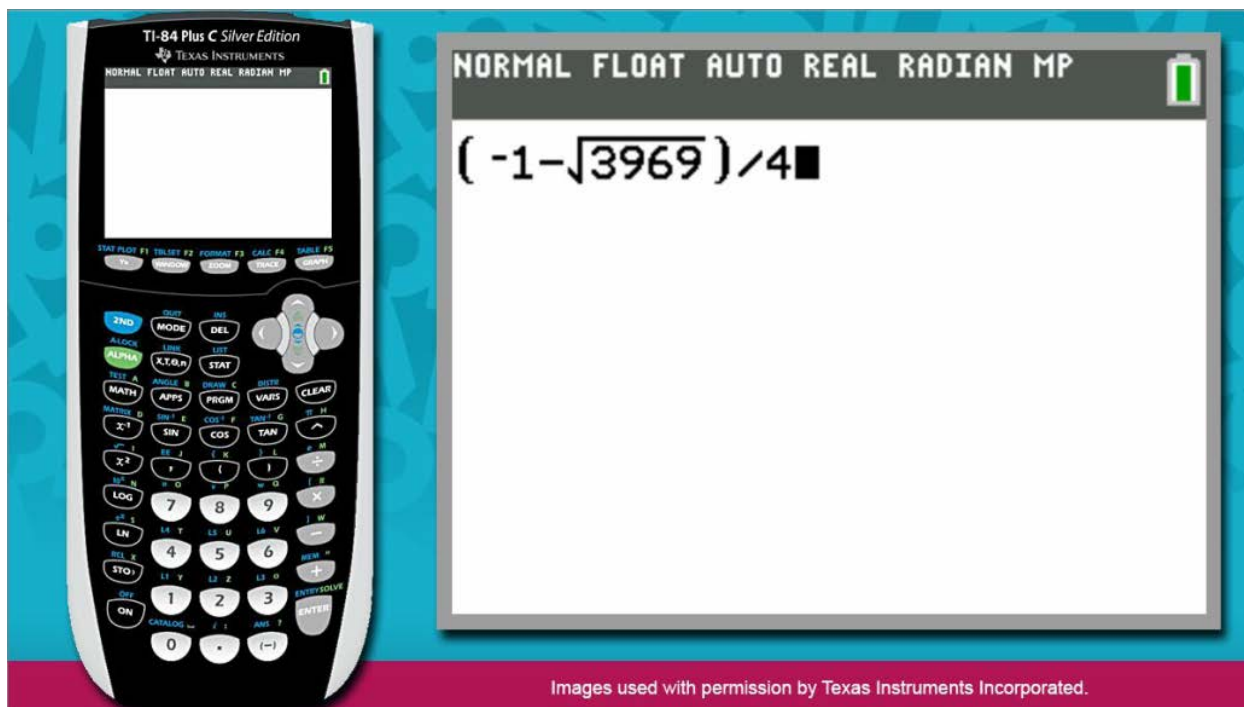
Now that you know that one of the solutions is 15.5, you can move on to determine the second solution, where $x = \frac{-1 - \sqrt{3969}}{4}$.

Again, you may want to use the calculator to determine this value.

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Example One (continued)

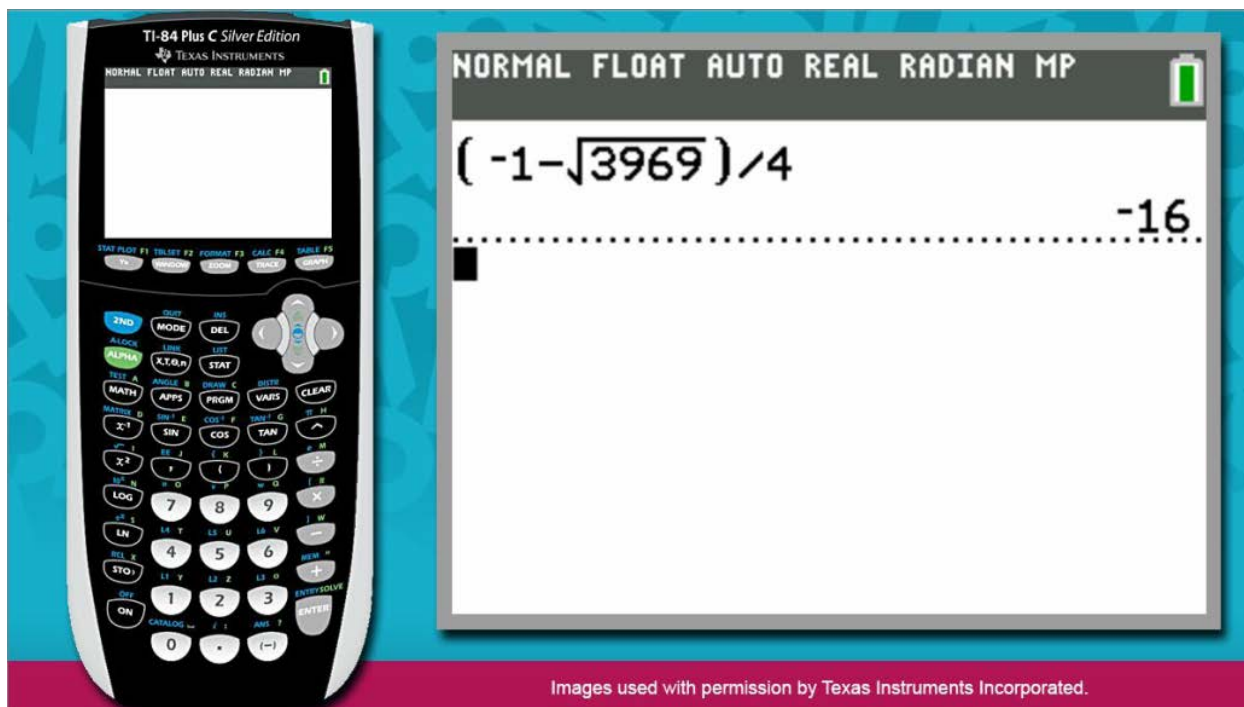


Remember to place parentheses around the expression in the numerator before dividing by 4.

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Example One (continued)



After pressing ENTER, you find that the result is -16 .

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Example One (continued)

$$x = \frac{- (1) \pm \sqrt{(1)^2 - 4 (2) (-496)}}{2 (2)}$$
$$x = \frac{-1 \pm \sqrt{3969}}{4}$$
$$x = \frac{-1 + \sqrt{3969}}{4} = 15.5$$
$$x = \frac{-1 - \sqrt{3969}}{4} = -16$$

Example 1

The playground at a local park is in the shape of a rectangle, with an area of 496 ft^2 and a length of 1 foot more than twice its width. Find the dimensions of the playground.

The playground at a local park is in the shape of a rectangle, with an area of 496 ft^2 and a length 1 foot more than twice its width. Find the dimensions of the playground.

$$x = \frac{- (1) \pm \sqrt{(1)^2 - 4 (2) (-496)}}{2 (2)}$$

$$x = \frac{-1 \pm \sqrt{3968}}{4}$$

$$x = \frac{-1 + \sqrt{3969}}{4} = 15.5$$

$$x = \frac{-1 - \sqrt{3969}}{4} = -16$$

You have determined both solutions to the quadratic equation: $x = 15.5$ or $x = -16$.

Because x represents the width of the rectangle, -16 is not a reasonable solution. -16 is referred to as an extraneous solution, as it is a valid solution to the equation, but not a reasonable solution to the problem.

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Example One (continued)

$x = \frac{-(1)}{2}$
 $x =$
 $x =$

$2x + 1 \text{ ft}$
 496 ft^2
 $x \text{ ft}$

width: $x = 15.5 \text{ ft}$
length: $2x + 1$
 $2(15.5) + 1$
 $31 + 1$
 32 ft


park is in with an th of 1 foot. Find the ound.
 tion quation, lution to em.

width: $x = 15.5$
length: $2x + 1$
 $2(15.5) + 1$
 $31 + 1$
 32 ft

Therefore, the rectangular-shaped playground has a width 15.5 ft . After substituting 15.5 for x in the expression $2x + 1$, you find that the length of the playground is 32 ft .

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Example Two



Example 2

The top surface of a desk is modeled by the rectangle below.

$(x + 10) \text{ ft}$



$(x + 1) \text{ ft}$

If the area of the surface is 52 square feet, find its dimensions.

Read through the problem above.
Click to highlight important passages.

Next

The top surface of a desk is modeled by the rectangle below.

$(x + 10) \text{ ft}$



$(x + 1) \text{ ft}$


If the area of the surface is 52 square feet, find its dimensions.

Take a few moments to read Example 2. Highlight the information you think is necessary to solve the problem.

Read through the problem above. Click to highlight the important passages.

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Example Two (continued)



Example 2

The top surface of a desk is modeled by the rectangle below.

$(x + 10) \text{ ft}$



$(x + 1) \text{ ft}$

If the area of the surface is 52 square feet, find its dimensions.

The top surface of a desk is modeled by the rectangle below.

$(x + 10) \text{ ft}$



$(x + 1) \text{ ft}$

If the area of the surface is 52 square feet, find its dimensions.

Did you highlight the important facts?

- The top surface of the desk is a rectangle
- The length of the rectangle is represented by $x + 10$
- The width of the rectangle is represented by $x + 1$
- The area of the surface is 52 square feet
- Find the dimensions of the rectangle.

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Example Two (continued)

Example 2

Which equation correctly models the area of the rectangular surface?

$(x + 1)(x + 1) = 52$

$(x + 10)(x + 10) = 52$

$(x + 10)(x + 1) = 52$

The top surface of a desk is modeled by the rectangle below.

$(x + 10) \text{ ft}$

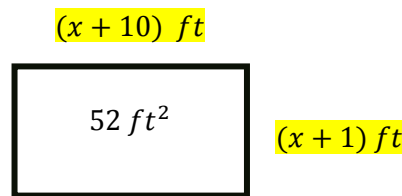
52 ft^2

$(x + 1) \text{ ft}$

If the area of the surface is 52 square feet, find its dimensions.

$A = l \cdot w$

The top surface of a desk is modeled by the rectangle below.



If the area of the surface is 52 square feet, find its dimensions.

$$A = l \cdot w$$

The formula for the area of a rectangle is $A = l \cdot w$.

The area of the rectangular surface is 52 square feet.

Which of the following equations correctly models the area of the rectangular surface?

- A) $(x + 1)(x + 1) = 52$
- B) $(x + 10)(x + 10) = 52$
- C) $(x + 10)(x + 1) = 52$

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Example Two (continued)

The equation $(x + 10)(x + 1) = 52$ correctly models the area of the rectangular surface.

$(x + 10)(x + 1) = 52$

Example 2

The top surface of a desk is modeled by the rectangle below.

$(x + 10) \text{ ft}$

52 ft^2

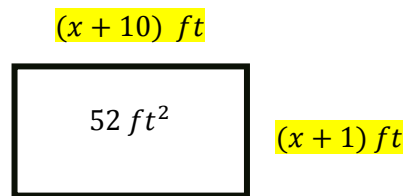
$(x + 1) \text{ ft}$

If the area of the surface is 52 square feet, find its dimensions.

$A = l \cdot w$

[View Work](#) [Next](#)

The top surface of a desk is modeled by the rectangle below.



If the area of the surface is 52 square feet, find its dimensions.

$$A = l \cdot w$$

The equation $(x + 10)(x + 1) = 52$ correctly models the area of the rectangular surface.

Module 6: Solving Quadratic Equations

Topic 3 Content: Practical Problems Involving Quadratic Equations

Example Two (continued)

The area of a rectangle is equal to the product of its length and width: $A = l \cdot w$.

The area of the surface is 52 square feet.

The length of the surface is $(x + 10)$.

The width of the surface is $(x + 1)$.

$$A = l \cdot w$$

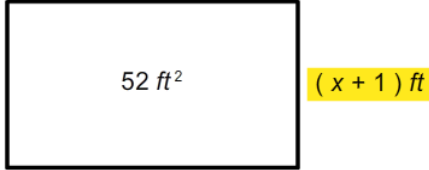
$$52 = (x + 10) \cdot (x + 1)$$

The Symmetric Property states that the order of equality does not affect the equation. Therefore...

$$(x + 10)(x + 1) = 52$$

Example 2

The top surface of a desk is modeled by the rectangle below.

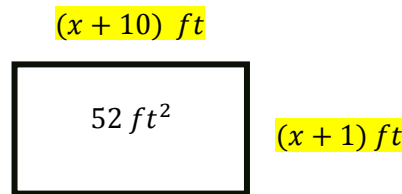
$(x + 10) \text{ ft}$


If the area of the surface is 52 square feet, find its dimensions.

$$A = l \cdot w$$

Next

The top surface of a desk is modeled by the rectangle below.



If the area of the surface is 52 square feet, find its dimensions.

$$A = l \cdot w$$

The area of a rectangle is equal to the product of its length and width: $A = l \cdot w$.

The area of the surface is 52 square feet.

The length of the surface is $(x + 10)$.

The width of the surface is $(x + 1)$.

$$A = l \cdot w$$

$$52 = (x + 10) \cdot (x + 1)$$

The Symmetric Property states that the order of equality does not affect the equation.

Therefore, $(x + 10)(x + 1) = 52$.

Module 6: Solving Quadratic Equations
Topic 3 Content: Practical Problems Involving Quadratic Equations

Example Two (continued)

$(x + 10)(x + 1) = 52$

Which of the following equations correctly models the area of the rectangular surface?

$x^2 + 11x - 42 = 0$

$x^2 + 11x - 52 = 0$

$x^2 + 11x = 62$

Example 2

The top surface of a desk is modeled by the rectangle below.

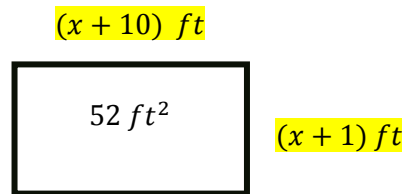
$(x + 10) \text{ ft}$

52 ft^2 $(x + 1) \text{ ft}$

If the area of the surface is 52 square feet, find its dimensions.

$A = l \cdot w$

The top surface of a desk is modeled by the rectangle below.



If the area of the surface is 52 square feet, find its dimensions.

$$A = l \cdot w$$

$$(x + 10)(x + 1) = 52$$

Now that you have written an equation to model the situation, solve for x . Begin by representing the quadratic equation in standard form.

Which of the following equations correctly models the area of the rectangular surface?

- A) $x^2 + 11x - 42 = 0$
- B) $x^2 + 11x - 52 = 0$
- C) $x^2 + 11x = 62$

Module 6: Solving Quadratic Equations
Topic 3 Content: Practical Problems Involving Quadratic Equations

Example Two (continued)

$$(x + 10)(x + 1) = 52$$

The equation $x^2 + 11x - 42 = 0$ correctly represents the area in standard form.

$x^2 + 11x - 42 = 0$

Example 2

The top surface of a desk is modeled by the rectangle below.

$(x + 10) \text{ ft}$

 $(x + 1) \text{ ft}$

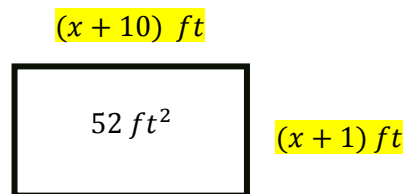
If the area of the surface is 52 square feet, find its dimensions.

$$A = l \cdot w$$

View Work

Next

The top surface of a desk is modeled by the rectangle below.



If the area of the surface is 52 square feet, find its dimensions.

$$A = l \cdot w$$

$$(x + 10)(x + 1) = 52$$

The equation $x^2 + 11x - 42 = 0$ correctly represents the area in standard form.

Module 6: Solving Quadratic Equations

Topic 3 Content: Practical Problems Involving Quadratic Equations

Example Two (continued)

Simplify the left side of the equation. Use the distributive property (or the FOIL method) to find the product of the binomials.

$$(x + 10)(x + 1) = 52$$

$$x^2 + x + 10x + 10 = 52$$

$$x^2 + 11x + 10 = 52$$

The standard form of a quadratic equation is $ax^2 + bx + c = 0$. To represent the equation in standard form, subtract 52 from each side.

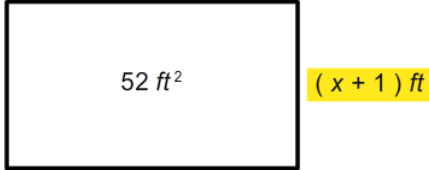
$$x^2 + 11x + 10 = 52$$

$$ - 52 \quad - 52$$

$$x^2 + 11x - 42 = 0$$

Example 2

The top surface of a desk is modeled by the rectangle below.

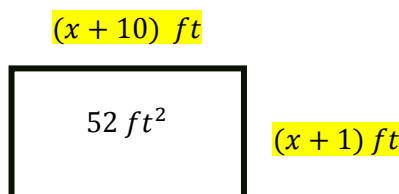
$(x + 10) \text{ ft}$


If the area of the surface is 52 square feet, find its dimensions.

$$A = l \cdot w$$

Next

The top surface of a desk is modeled by the rectangle below.



If the area of the surface is 52 square feet, find its dimensions.

$$A = l \cdot w$$

$$(x + 10)(x + 1) = 52$$

$$x^2 + x + 10x = 52$$

$$x^2 + 11x + 10 = 52$$

$$x^2 + 11x + 10 = 52$$

$$ - 52 \quad - 52$$

$$x^2 + 11x - 42 = 0$$

Simplify the left side of the equation. Use the distributive property (or the FOIL method) to find the product of the binomials.

The standard form of a quadratic equation is $ax^2 + bx + c = 0$. To represent the equation in standard form, subtract 52 from each side.

Module 6: Solving Quadratic Equations

Topic 3 Content: Practical Problems Involving Quadratic Equations

Example Two (continued)

Now that the quadratic equation is in standard form, you can determine the solution. The left side of the equation can be factored completely.

$$x^2 + 11x - 42 = 0$$

Which of the following equations is equivalent to the given equation?

$(x + 14)(x - 3) = 0$

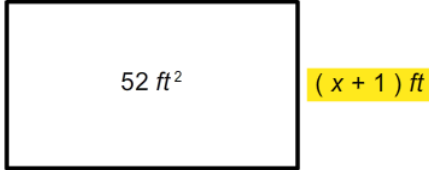
$(x + 10)(x + 1) = 0$

$(x + 3)(x - 14) = 0$

Example 2

The top surface of a desk is modeled by the rectangle below.

$(x + 10) \text{ ft}$

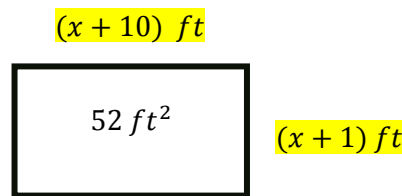


52 ft^2 $(x + 1) \text{ ft}$

If the area of the surface is 52 square feet, find its dimensions.

$$A = l \cdot w$$

The top surface of a desk is modeled by the rectangle below.



If the area of the surface is 52 square feet, find its dimensions.

$$A = l \cdot w$$

Now that the quadratic equation is in standard form you can determine the solution. The left side of the equation can be factored completely.

$$x^2 + 11x - 42 = 0$$

Which of the following equations is equivalent to the given equation?

- A) $(x + 14)(x - 3) = 0$
- B) $(x + 10)(x + 1) = 0$
- C) $(x + 3)(x - 14) = 0$

Module 6: Solving Quadratic Equations

Topic 3 Content: Practical Problems Involving Quadratic Equations

Example Two (continued)

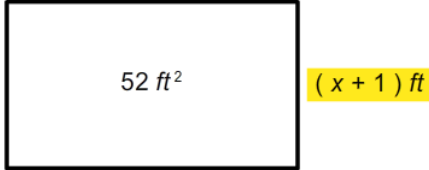
The factors of the trinomial on the left side of the equation are $x + 14$ and $x - 3$.

$$x^2 + 11x - 42 = 0$$
$$(x + 14)(x - 3) = 0$$

$(x + 14)(x - 3) = 0$

Example 2

The top surface of a desk is modeled by the rectangle below.

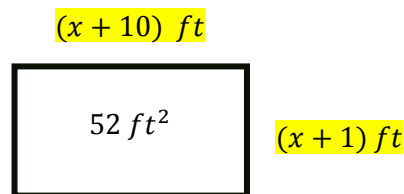
$(x + 10) \text{ ft}$

 $(x + 1) \text{ ft}$

If the area of the surface is 52 square feet, find its dimensions.

$$A = l \cdot w$$

Next

The top surface of a desk is modeled by the rectangle below.



If the area of the surface is 52 square feet, find its dimensions.

$$A = l \cdot w$$

The factors of the trinomial on the left side of the equation are $x + 14$ and $x - 3$.

$$x^2 + 11x - 42 = 0$$

$$(x + 14)(x - 3) = 0$$

Module 6: Solving Quadratic Equations
Topic 3 Content: Practical Problems Involving Quadratic Equations

Example Two (continued)

$(x + 14)(x - 3) = 0$

What are the solutions to the equation?

$x =$ $x =$

Enter the correct values and click submit.

Example 2

The top surface of a desk is modeled by the rectangle below.

$(x + 10) \text{ ft}$

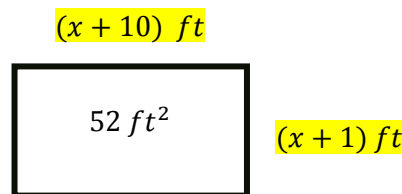
52 ft^2 $(x + 1) \text{ ft}$

If the area of the surface is 52 square feet, find its dimensions.

$A = l \cdot w$

Submit

The top surface of a desk is modeled by the rectangle below.



If the area of the surface is 52 square feet, find its dimensions.

$$A = l \cdot w$$

Continue to solve the quadratic equation by factoring, by now applying the Zero Product Property. Set each factor equal to 0. Then, solve for x .

$$(x + 14)(x - 3) = 0$$

What are the solutions to the equation? $x = ?$ and $x = ?$

Enter the correct values and then click submit.

Module 6: Solving Quadratic Equations

Topic 3 Content: Practical Problems Involving Quadratic Equations

Example Two (continued)

$(x + 14)(x - 3) = 0$

The correct solutions are as follows.

$x = -14$ $x = 3$


Set each factor equal to zero and solve for x .

$(x + 14)(x - 3) = 0$

$x + 14 = 0$	$x - 3 = 0$
$\frac{-14 \quad -14}{x = -14}$	$\frac{+3 \quad +3}{x = 3}$

Example 2

The top surface of a desk is modeled by the rectangle below.

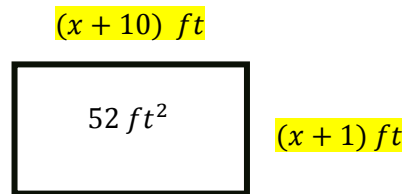
$(x + 10) \text{ ft}$


If the area of the surface is 52 square feet, find its dimensions.

$A = l \cdot w$

Next

The top surface of a desk is modeled by the rectangle below.



If the area of the surface is 52 square feet, find its dimensions.

$$A = l \cdot w$$

$$(x + 14)(x - 3) = 0$$

The correct solutions are as follows: $x = -14, x = 3$

Set each factor equal to zero and solve for x .

$$(x + 14)(x - 3) = 0$$

$$\begin{array}{r} x + 14 = 0 \\ -14 \quad -14 \\ \hline x = -14 \end{array}$$

$$\begin{array}{r} x - 3 = 0 \\ +3 \quad +3 \\ \hline x = 3 \end{array}$$

Module 6: Solving Quadratic Equations
Topic 3 Content: Practical Problems Involving Quadratic Equations

Example Two (continued)

$(x + 14)(x - 3) = 0$

$x = -14$ $x = 3$

Which solution is an extraneous solution?

$x = -14$


$x = 3$

There are no extraneous solutions

Example 2

The top surface of a desk is modeled by the rectangle below.

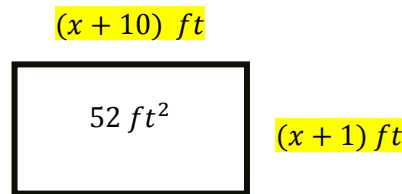
$(x + 10) \text{ ft}$



If the area of the surface is 52 square feet, find its dimensions.

$A = l \cdot w$

The top surface of a desk is modeled by the rectangle below.



If the area of the surface is 52 square feet, find its dimensions.

$$A = l \cdot w$$

$$(x + 14)(x - 3) = 0$$

Which of the solutions is an extraneous solution?

- A) $x = 3$
- B) $x = -14$
- C) There are no extraneous solutions to the equation.

Module 6: Solving Quadratic Equations
Topic 3 Content: Practical Problems Involving Quadratic Equations

Example Two (continued)

$(x + 14)(x - 3) = 0$

$x = -14 \quad x = 3$


-14 is an extraneous solution.

$x = -14$

Example 2

The top surface of a desk is modeled by the rectangle below.

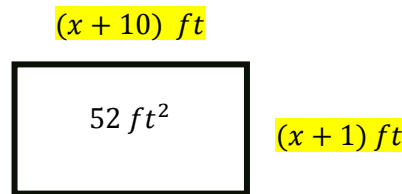
$(x + 10) \text{ ft}$



If the area of the surface is 52 square feet, find its dimensions.

$A = l \cdot w$

The top surface of a desk is modeled by the rectangle below.



If the area of the surface is 52 square feet, find its dimensions.

$$A = l \cdot w$$

$$(x + 14)(x - 3) = 0$$

$$x = -14 \quad x = 3$$

-14 is an extraneous solution.

Module 6: Solving Quadratic Equations

Topic 3 Content: Practical Problems Involving Quadratic Equations

Example Two (continued)


If $x = -14$, then the length of the surface is -4 ft and the width is -13 ft .

Length:	Width:
$(x + 10) \text{ ft}$	$(x + 1) \text{ ft}$
$x + 10$	$x + 1$
$-14 + 10$	$-14 + 1$
-4 ft	-13 ft

It is not possible for a rectangle to have dimensions that are negative values. Therefore, $x = -14$ is an extraneous solution.

Example 2

The top surface of a desk is modeled by the rectangle below.

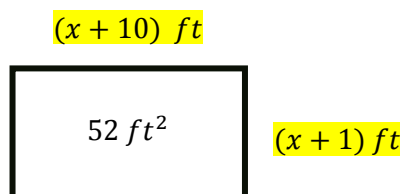
$(x + 10) \text{ ft}$


If the area of the surface is 52 square feet, find its dimensions.

$A = l \cdot w$

Next

The top surface of a desk is modeled by the rectangle below.



If the area of the surface is 52 square feet, find its dimensions.

$$A = l \cdot w$$

$$(x + 14)(x - 3) = 0$$

If $x = -14$, then the length of the surface is -4 ft and the width is -13 ft .

Length: $(x + 10) \text{ ft}$	Width: $(x + 1) \text{ ft}$
$x + 10$	$x + 1$
$-14 + 10$	$-14 + 1$
-4 ft	-13 ft

It is not possible for a rectangle to have dimensions that are negative values. Therefore, $x = -14$ is an extraneous solution.

Module 6: Solving Quadratic Equations
Topic 3 Content: Practical Problems Involving Quadratic Equations

Example Two (continued)

$(x + 14)(x - 3) = 0$

$x = -14$ $x = 3$

What are the dimensions of the top surface of the desk?

Length: Width:

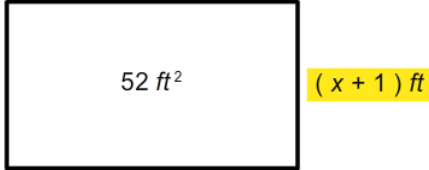
ft

ft

Enter the correct values and click submit.

Example 2

The top surface of a desk is modeled by the rectangle below.

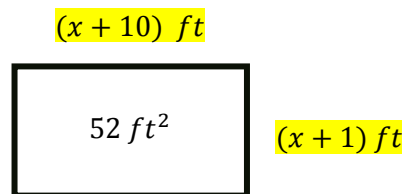
$(x + 10) \text{ ft}$


If the area of the surface is 52 square feet, find its dimensions.

$A = l \cdot w$

Submit

The top surface of a desk is modeled by the rectangle below.



If the area of the surface is 52 square feet, find its dimensions.

$$A = l \cdot w$$

$$(x + 14)(x - 3) = 0$$

$$x = -14 \quad x = 3$$

What are the dimensions of the top surface of the desk?

Length = ? *ft* Width = ? *ft*

Enter the correct dimensions and click submit.

Module 6: Solving Quadratic Equations
Topic 3 Content: Practical Problems Involving Quadratic Equations

Example Two (continued)

Example 2

$$(x + 14)(x - 3) = 0$$

$x = -14$ $x = 3$

If $x = 3$, then the length of the surface is 13 ft and the width is 4 ft .

Length:	Width:
13 ft	4 ft
$(x + 10) \text{ ft}$	$(x + 1) \text{ ft}$
$x + 10$	$x + 1$
$3 + 10$	$3 + 1$
13 ft	4 ft

The top surface of a desk is modeled by the rectangle below.

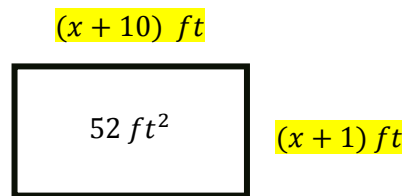
$(x + 10) \text{ ft}$

If the area of the surface is 52 square feet, find its dimensions.

$A = l \cdot w$

Menu

he top surface of a desk is modeled by the rectangle below.



If the area of the surface is 52 square feet, find its dimensions.

$$A = l \cdot w$$

$$(x + 14)(x - 3) = 0$$

$$x = -14 \quad x = 3$$

If $x = 3$, then the length of the surface is 13 ft and the width is 4 ft .

Length: $(x + 10) \text{ ft}$

$$x + 10$$

$$3 + 10$$

$$13 \text{ ft}$$

Width: $(x + 1) \text{ ft}$


$$x + 1$$

$$3 + 1$$

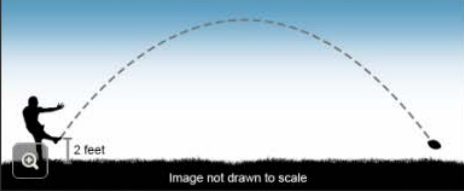
$$4 \text{ ft}$$

Module 6: Solving Quadratic Equations
Topic 3 Content: Practical Problems Involving Quadratic Equations

Self-Check

 **Self-Check**

A football is punted from a height 2 feet above the ground, with an initial velocity of 50 feet per second. The motion of the football can be modeled by the equation $h = -16t^2 + 50t + 2$ where h represents the height of the object, in feet, at any given time, and t represents the time in seconds.



If no one catches the football, how long will it remain in the air?
Hint: If $h = 0$, what is the value of t ?

Give your answer to the nearest hundredth of a second. Type your answer into the box below and then click submit.

seconds

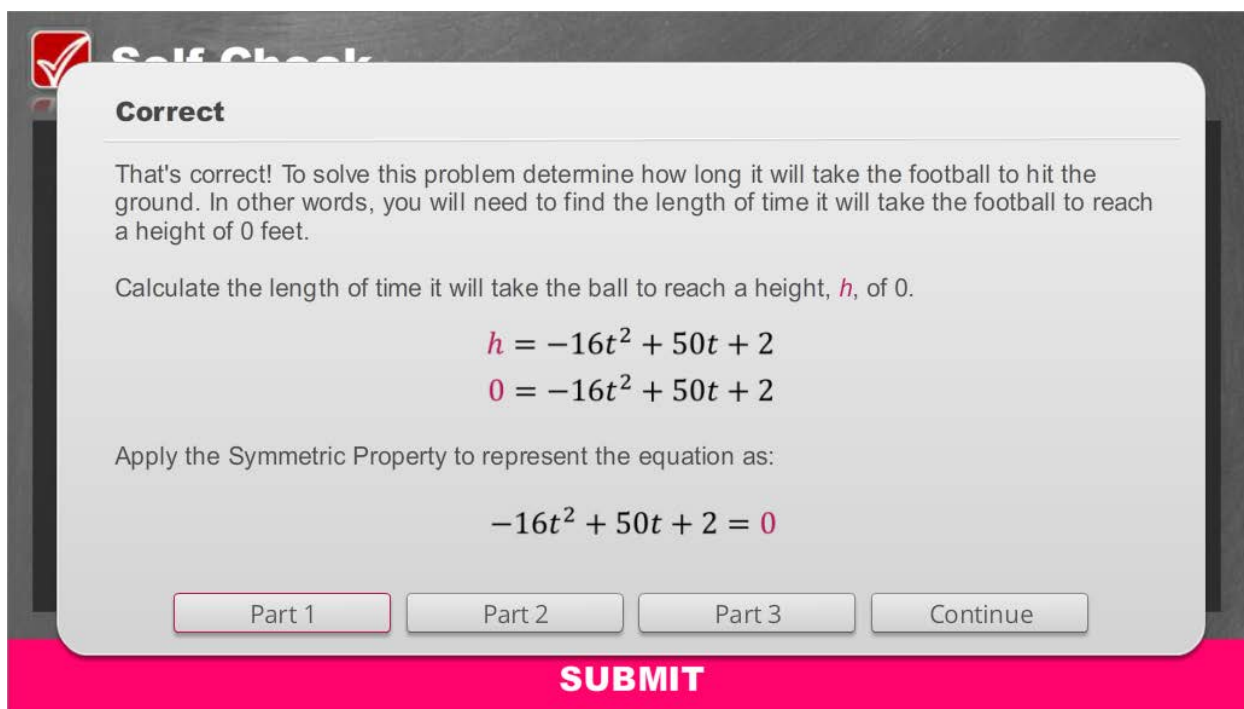
SUBMIT

Solve the problem in the image above to check your understanding of the content.

Module 6: Solving Quadratic Equations

Topic 3 Content: Practical Problems Involving Quadratic Equations

Self-Check: Answer



Correct

That's correct! To solve this problem determine how long it will take the football to hit the ground. In other words, you will need to find the length of time it will take the football to reach a height of 0 feet.

Calculate the length of time it will take the ball to reach a height, h , of 0.

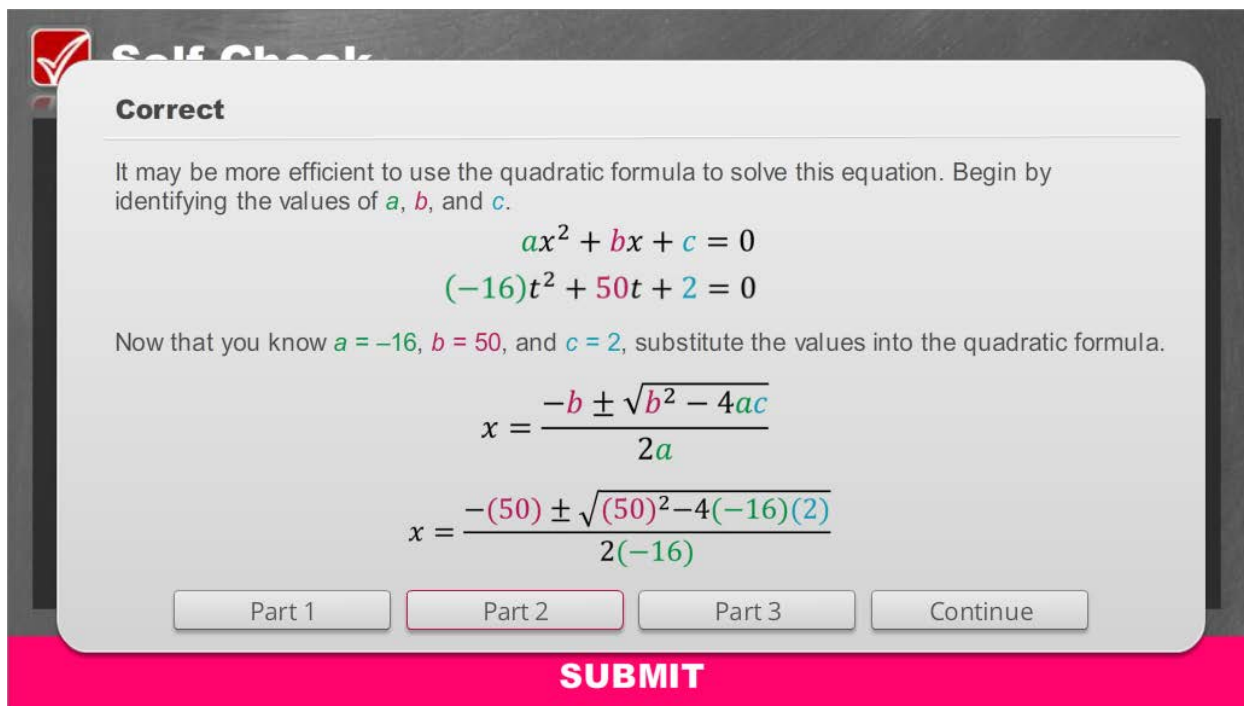
$$h = -16t^2 + 50t + 2$$
$$0 = -16t^2 + 50t + 2$$

Apply the Symmetric Property to represent the equation as:

$$-16t^2 + 50t + 2 = 0$$

Part 1 Part 2 Part 3 Continue

SUBMIT



Correct

It may be more efficient to use the quadratic formula to solve this equation. Begin by identifying the values of a , b , and c .

$$ax^2 + bx + c = 0$$
$$(-16)t^2 + 50t + 2 = 0$$

Now that you know $a = -16$, $b = 50$, and $c = 2$, substitute the values into the quadratic formula.

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$
$$x = \frac{-50 \pm \sqrt{(50)^2 - 4(-16)(2)}}{2(-16)}$$

Part 1 Part 2 Part 3 Continue

SUBMIT

For your reference, the images above show the correct solution to the self-check problem.

Module 6: Solving Quadratic Equations
Topic 3 Content: Practical Problems Involving Quadratic Equations

Self-Check: Answer (continued)

Correct

Next, begin simplifying the expression.

$$x = \frac{-(50) \pm \sqrt{(50)^2 - 4(-16)(2)}}{2(-16)}$$
$$x = \frac{-50 \pm \sqrt{2500 - (-128)}}{-32}$$
$$x = \frac{-50 \pm \sqrt{2628}}{-32}$$

Finally, solve each equation.

$$x = \frac{-50 + \sqrt{2628}}{-32} \quad x = \frac{-50 - \sqrt{2628}}{-32}$$
$$x \approx -0.04 \quad x \approx 3.16$$

Because x represents the amount of time the football is in the air, only positive x values are acceptable. Therefore $x \approx 3.16$ is a reasonable solution. If no one catches the football it will remain in the air for approximately 3.16 seconds.

Part 1 Part 2 **Part 3** Continue

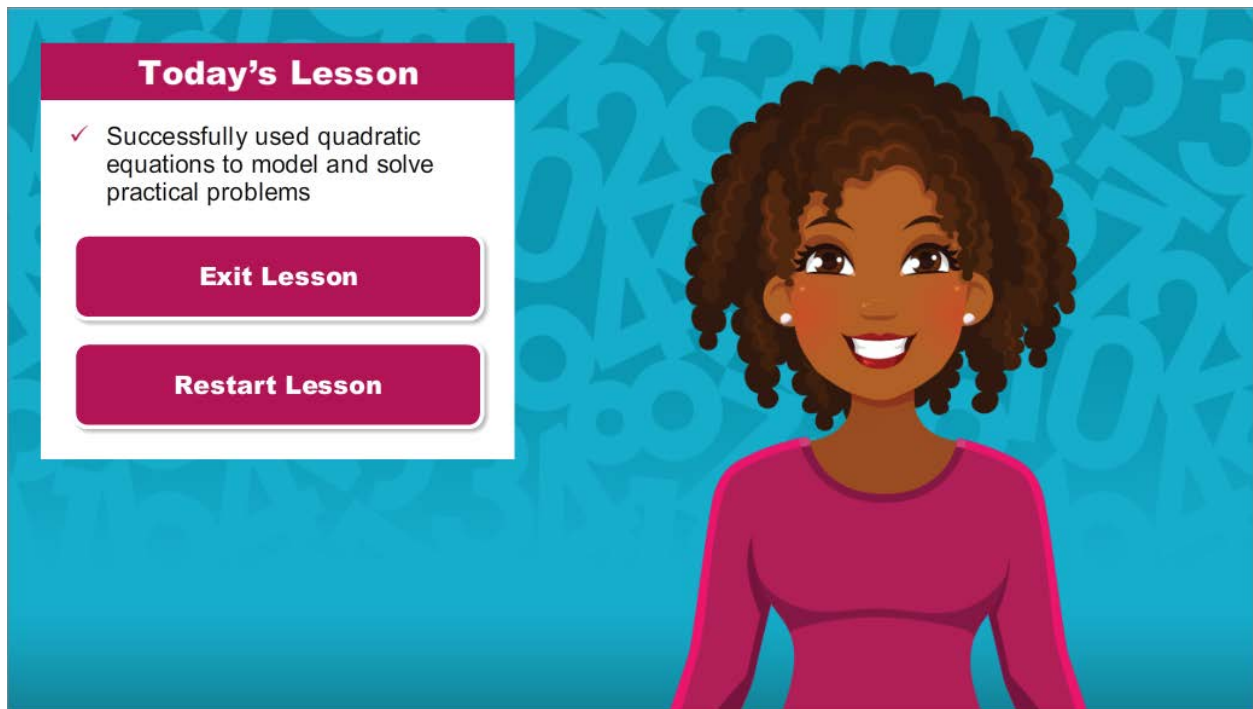
SUBMIT

For your reference, the image above shows the correct solution to the self-check problem.

Module 6: Solving Quadratic Equations

Topic 3 Content: Practical Problems Involving Quadratic Equations

Conclusion



The image shows a digital interface for a lesson conclusion. On the right side, there is a cartoon illustration of a young woman with dark skin and curly hair, wearing a pink long-sleeved top, smiling. The background is a light blue with a pattern of faint mathematical symbols like pi, infinity, and numbers. On the left side, there is a white rectangular box with a pink header that says "Today's Lesson". Below the header, there is a checkmark icon followed by the text "Successfully used quadratic equations to model and solve practical problems". At the bottom of the box, there are two pink buttons with white text: "Exit Lesson" and "Restart Lesson".

You have reached the conclusion of this lesson where you learned how to use quadratic equations to model and solve practical problems.