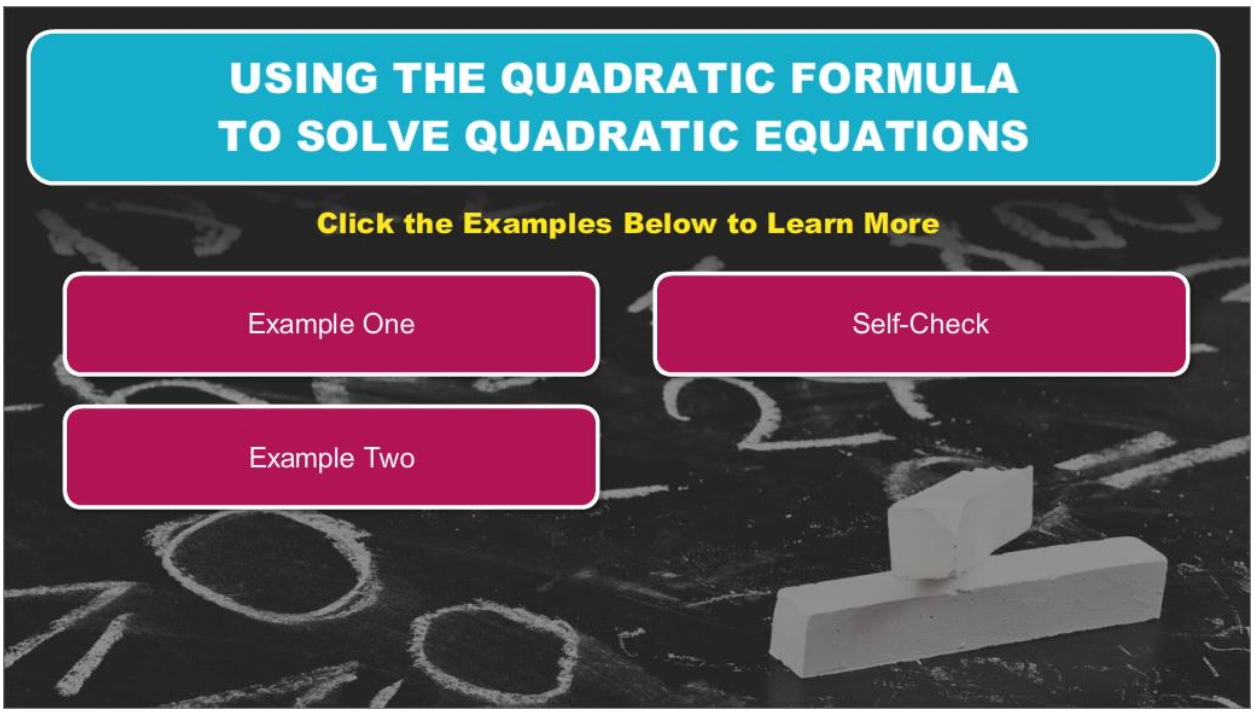
# Module 6: Solving Quadratic Equations
## Topic 2: Using the Quadratic Formula to Solve Quadratic Equations

### Introduction


Hi there! I'm so glad you could join me for this lesson in Algebra I, where you will learn how to use the quadratic formula to solve quadratic equations.

## Using the Quadratic Formula to Solve Quadratic Equations



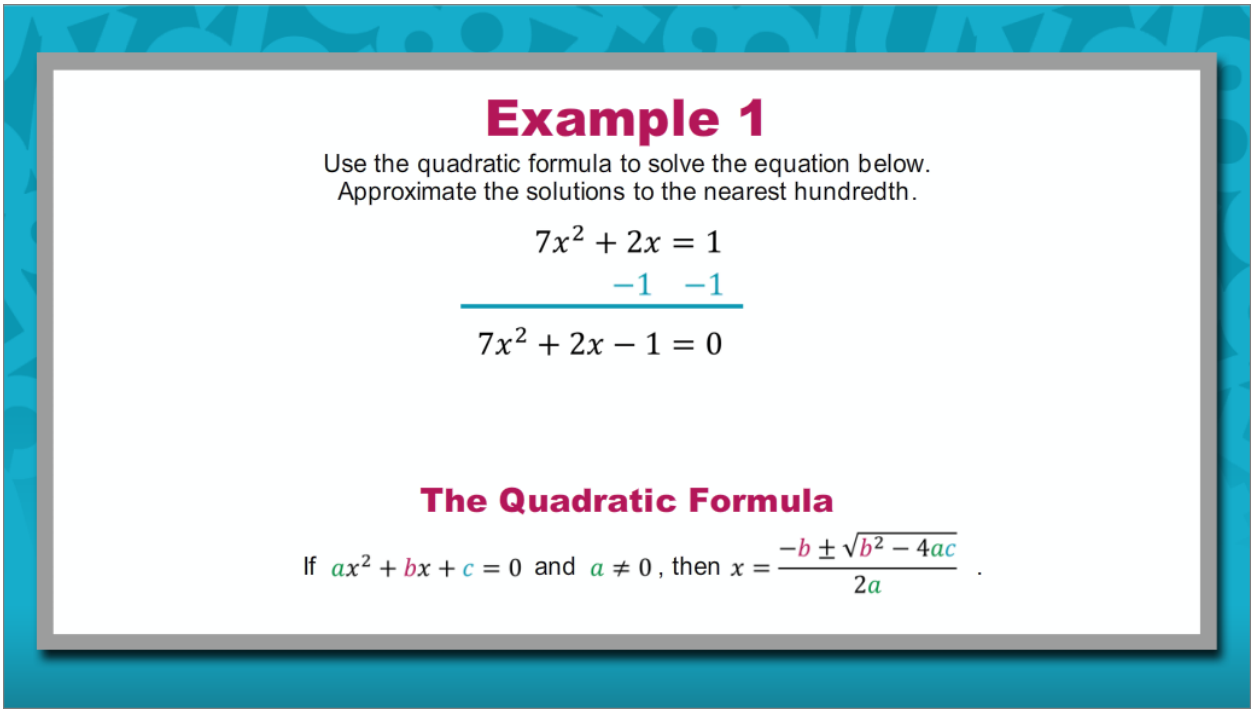

Click the examples below to learn more.

- Example One
- Example Two
- Self-Check

# Module 6: Solving Quadratic Equations

## Topic 2: Using the Quadratic Formula to Solve Quadratic Equations

**Example 1**




Use the quadratic formula to solve the equation below. Approximate the solutions to the nearest hundredth.

$$7x^2 + 2x = 1$$

$$\begin{array}{r} 7x^2 + 2x = 1 \\ -1 \quad -1 \\ \hline 7x^2 + 2x - 1 = 0 \end{array}$$

Before you are able to use the quadratic formula, you must represent the given equation in standard form. In this case, you will need to subtract 1 from each side of the equation. The result is $7x^2 + 2x - 1 = 0$.

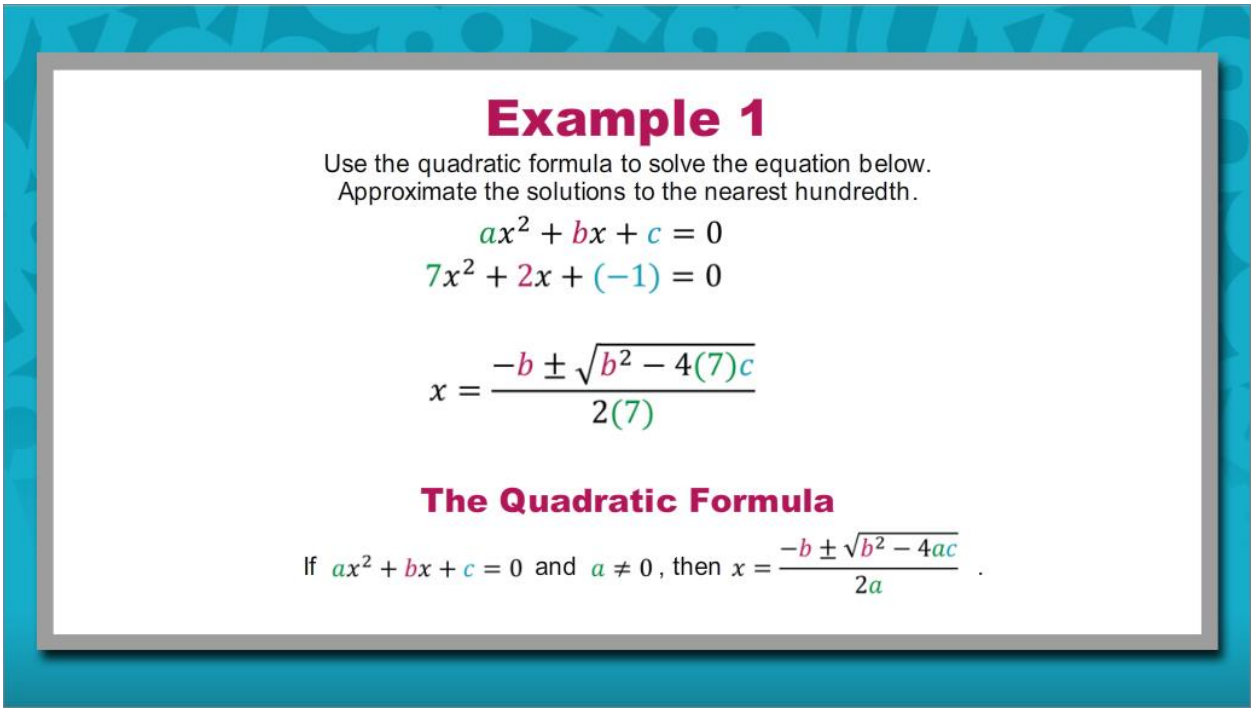
**The Quadratic Formula**

If $ax^2 + bx + c = 0$ and $a \neq 0$, then

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

Now that the quadratic equation is in standard form, you can begin to use the quadratic formula to determine the solutions. The quadratic formula states that if $ax^2 + bx + c = 0$ and $a \neq 0$, then $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$.

Example 1 (continued)




Use the quadratic formula to solve the equation below. Approximate the solutions to the nearest hundredth.

$$7x^2 + 2x = 1$$

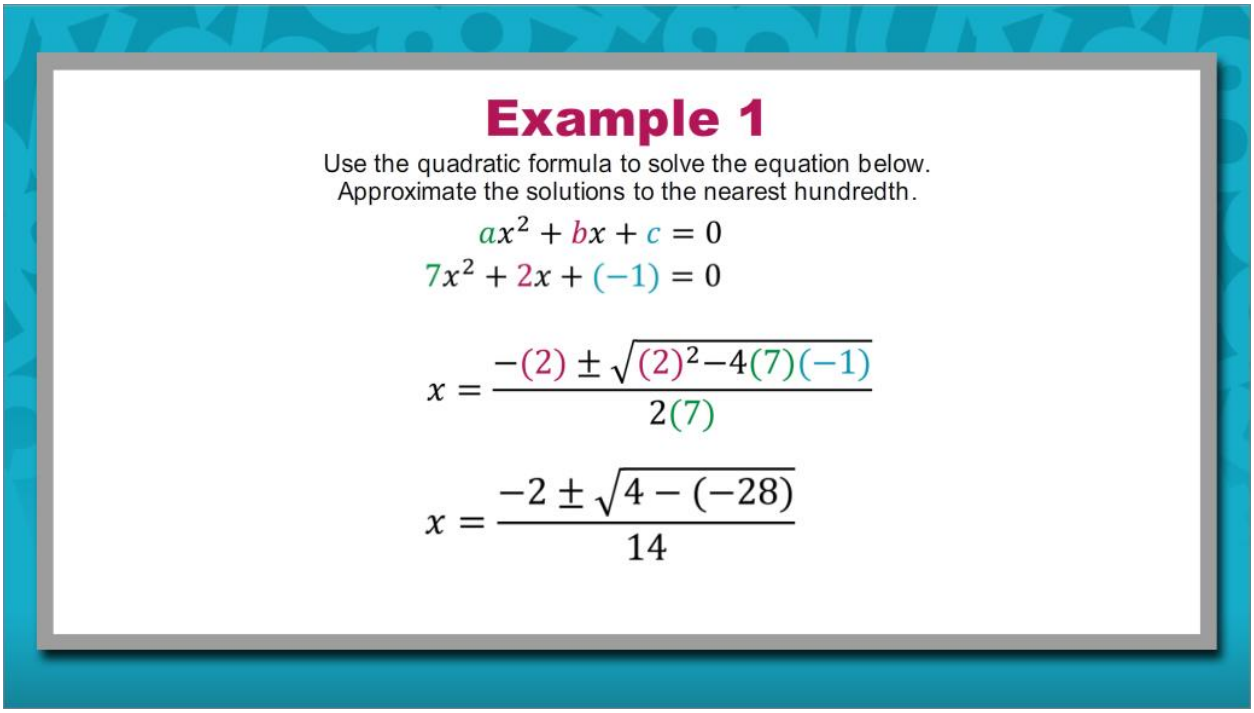
$ax^2 + bx + c = 0$
$7x^2 + 2x + (-1) = 0$

In the given equation, $a = 7$, $b = 2$, and $c = -1$. Substitute these values in the quadratic formula.

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

$$x = \frac{-(2) \pm \sqrt{(2)^2 - 4(7)(-1)}}{2(7)}$$

Example 1 (continued)




Use the quadratic formula to solve the equation below. Approximate the solutions to the nearest hundredth.

$$7x^2 + 2x = 1$$

$$x = \frac{-(2) \pm \sqrt{(2)^2 - 4(7)(-1)}}{2(7)}$$

Now, begin to simplify the expression to the right of the equals sign. Start with the numerator. The opposite of 2 is $-2$.

$$x = \frac{-2 \pm \sqrt{4 - (-28)}}{14}$$

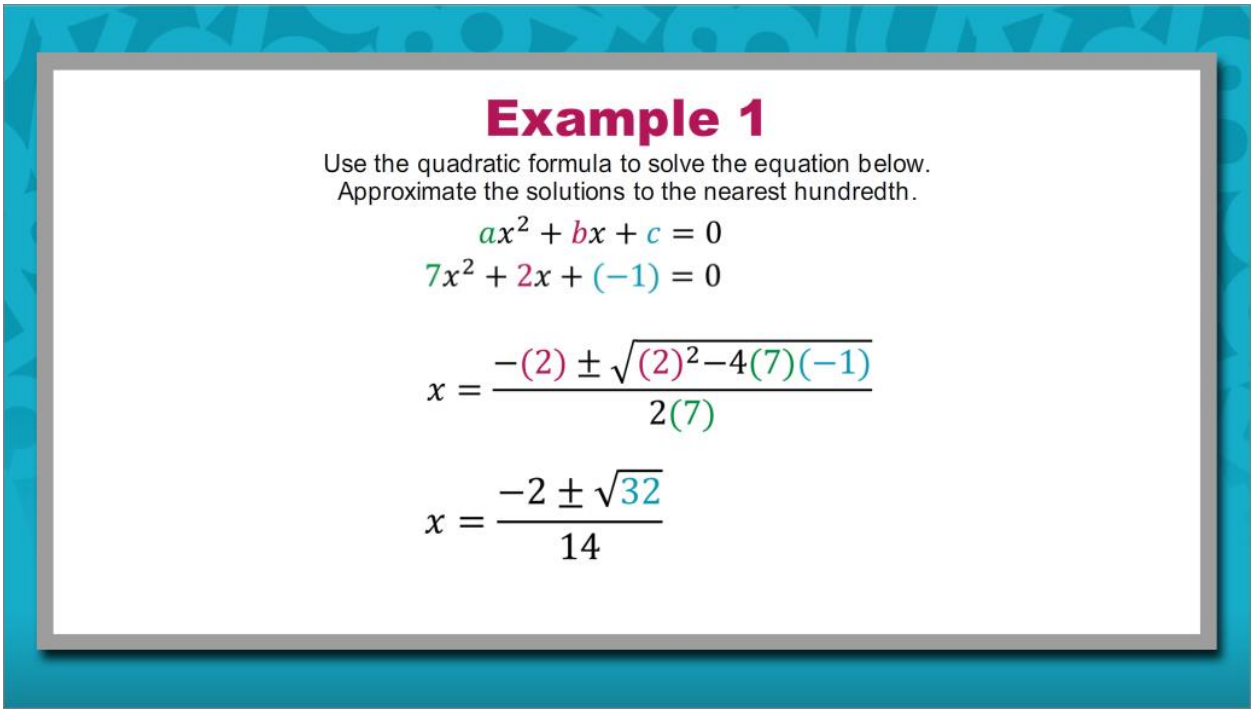
$2^2 = 4$

$4(7)(-1) = -28$

Next, simplify the product in the denominator.

$2(7) = 14$

Example 1 (continued)




Use the quadratic formula to solve the equation below. Approximate the solutions to the nearest hundredth.

$$7x^2 + 2x = 1$$

$$x = \frac{-2 \pm \sqrt{4 - (-28)}}{14}$$

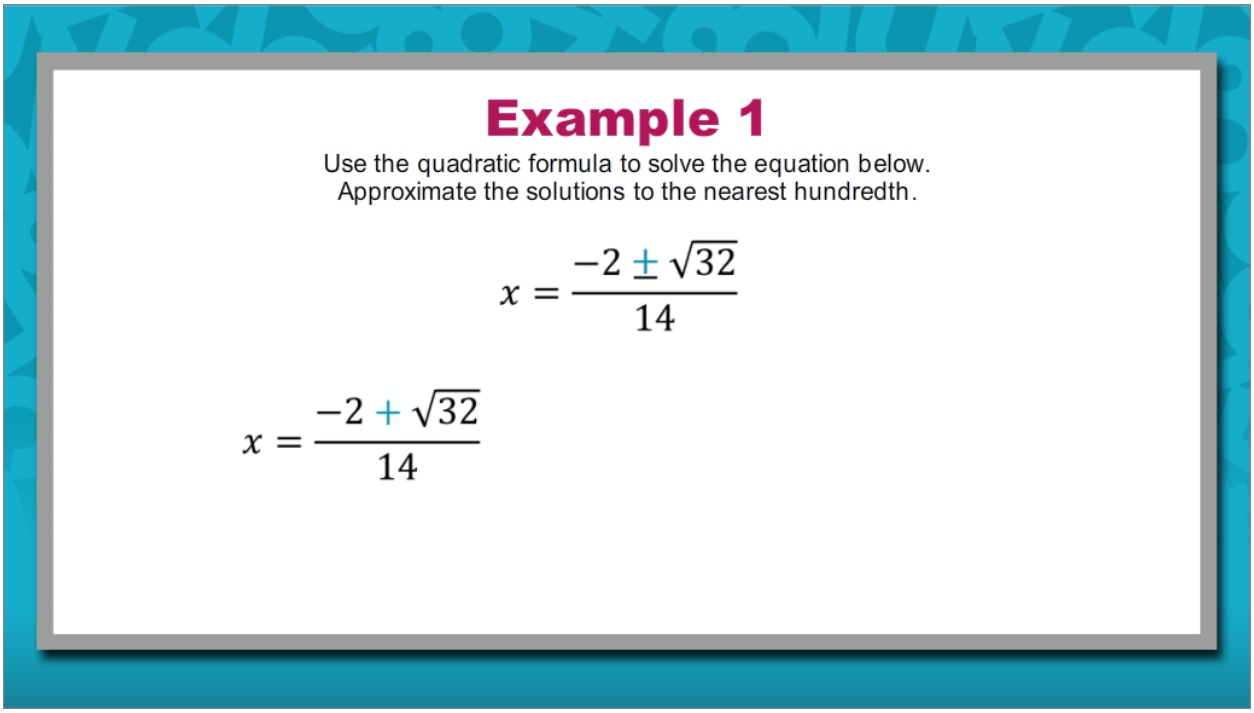
Now, simplify the expression underneath the radical symbol.

$$x = \frac{-2 \pm \sqrt{32}}{14}$$

$$4 - (-28) = 32$$

You are one step closer to determining the solutions.

Example 1 (continued)




Use the quadratic formula to solve the equation below. Approximate the solutions to the nearest hundredth.

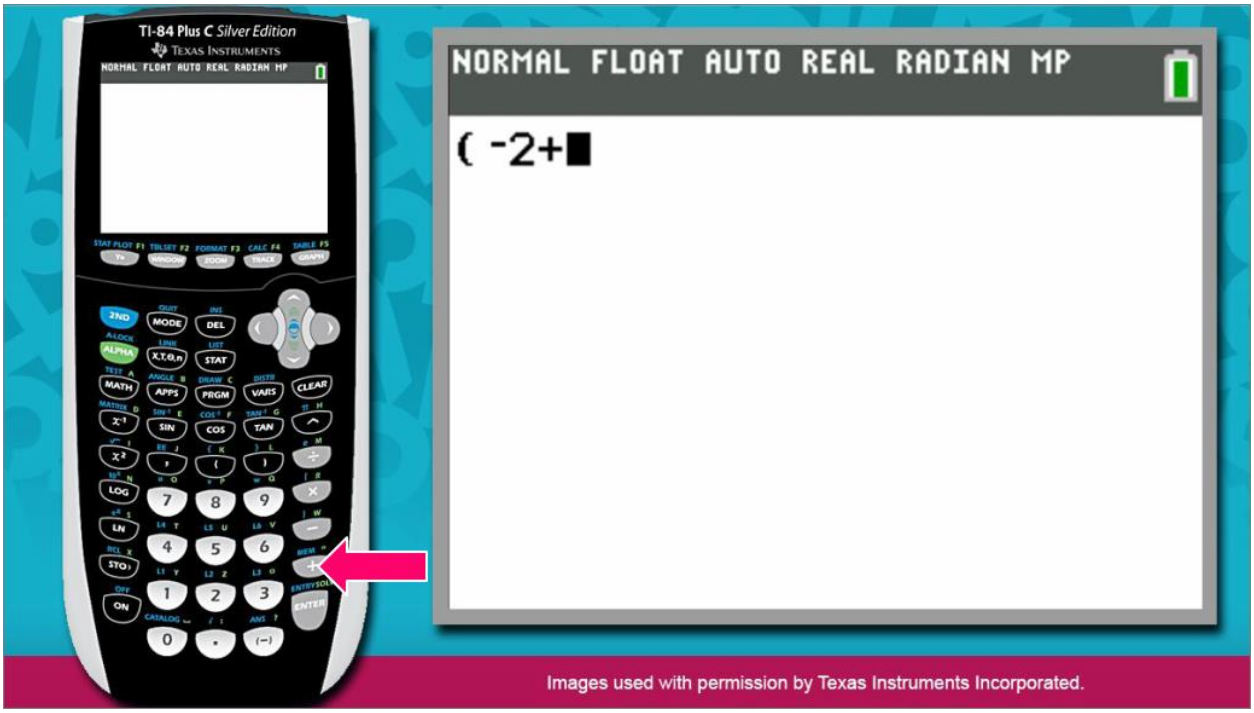
$$7x^2 + 2x = 1$$

$$x = \frac{-2 \pm \sqrt{32}}{14}$$

$$x = \frac{-2 + \sqrt{32}}{14}$$

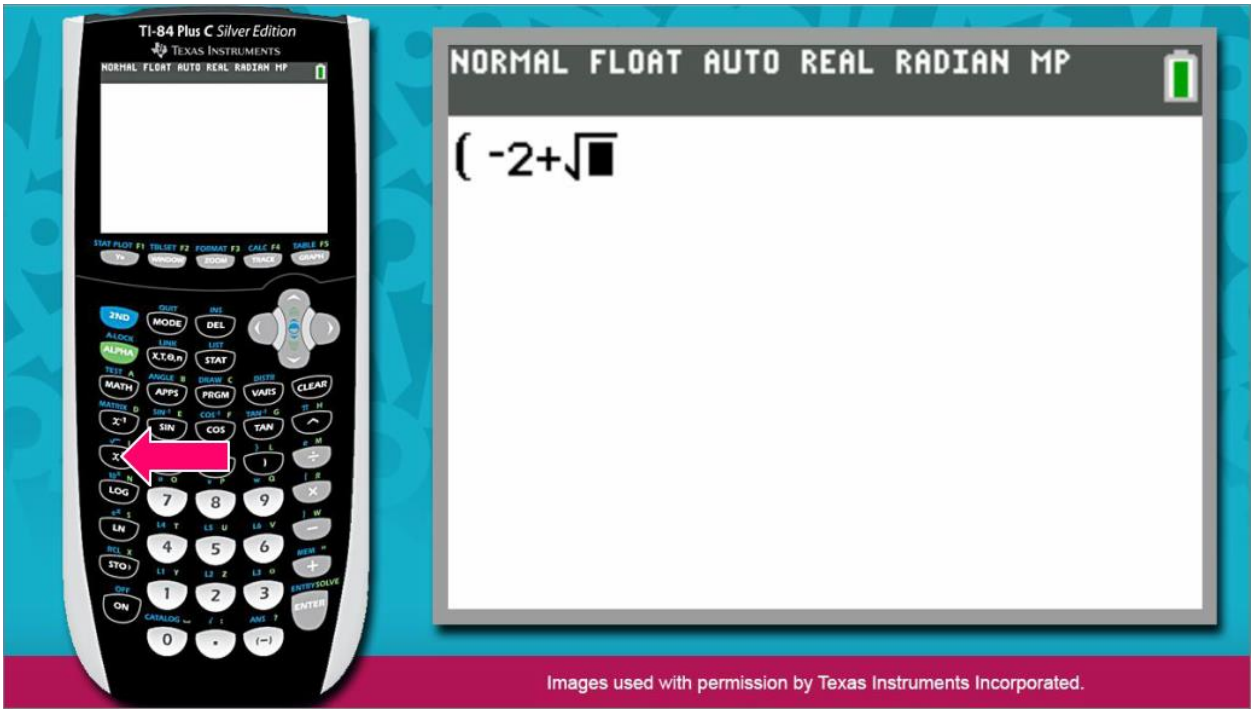
There are two solutions to the quadratic equation. One of the solutions is $x = \frac{-2+\sqrt{32}}{14}$. Because 32 is not a perfect square, you may want to use the calculator to simplify the expression to the right of equals sign.

Example 1 (continued)




Recall the order of operations. You must simplify the expression in numerator before dividing by 14. To guarantee that the order of operations is followed, include parentheses around the expression in the numerator. Press the left parenthesis key, located above the 8 key. Press the negative key, then press the 2 key, and then the addition key.

Example 1 (continued)



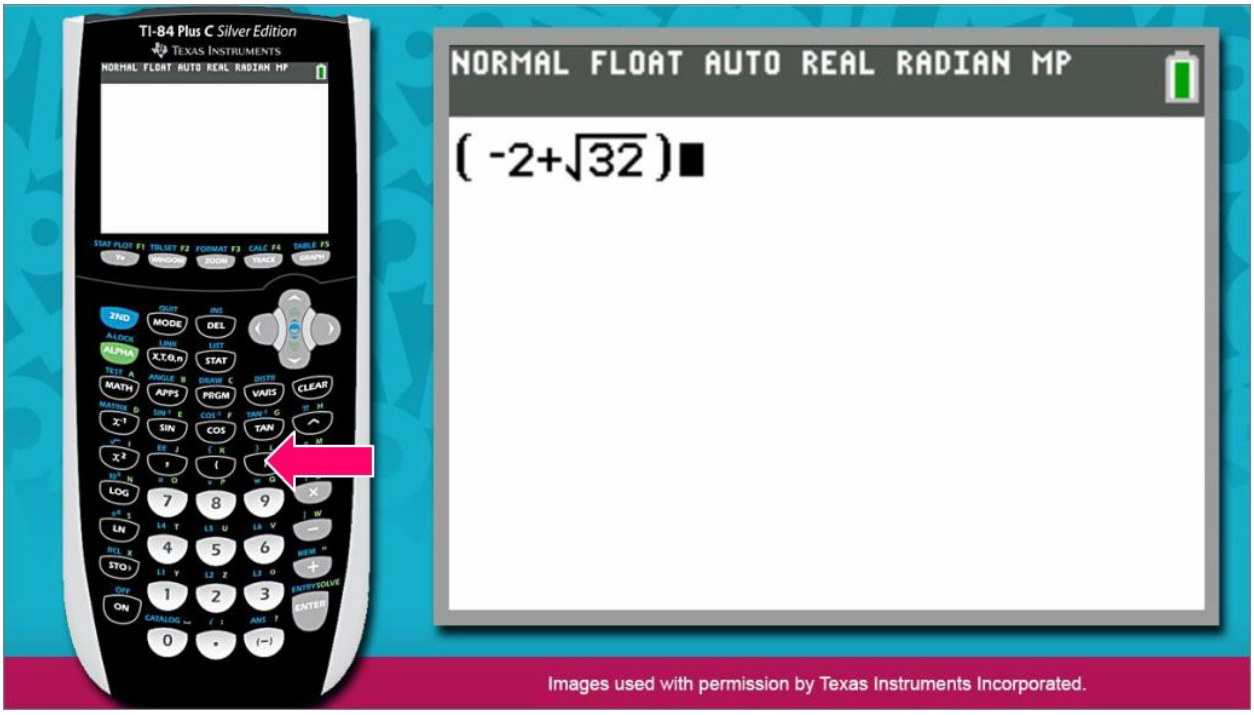

To access the square root function, press the 2nd key, the blue key located near the top left corner of the keys. Pressing this key informs the calculator that you want to perform one of the functions stamped above a calculator key.

Now, press the $x^2$ key, located above and to the left of the 7 key.

Example 1 (continued)

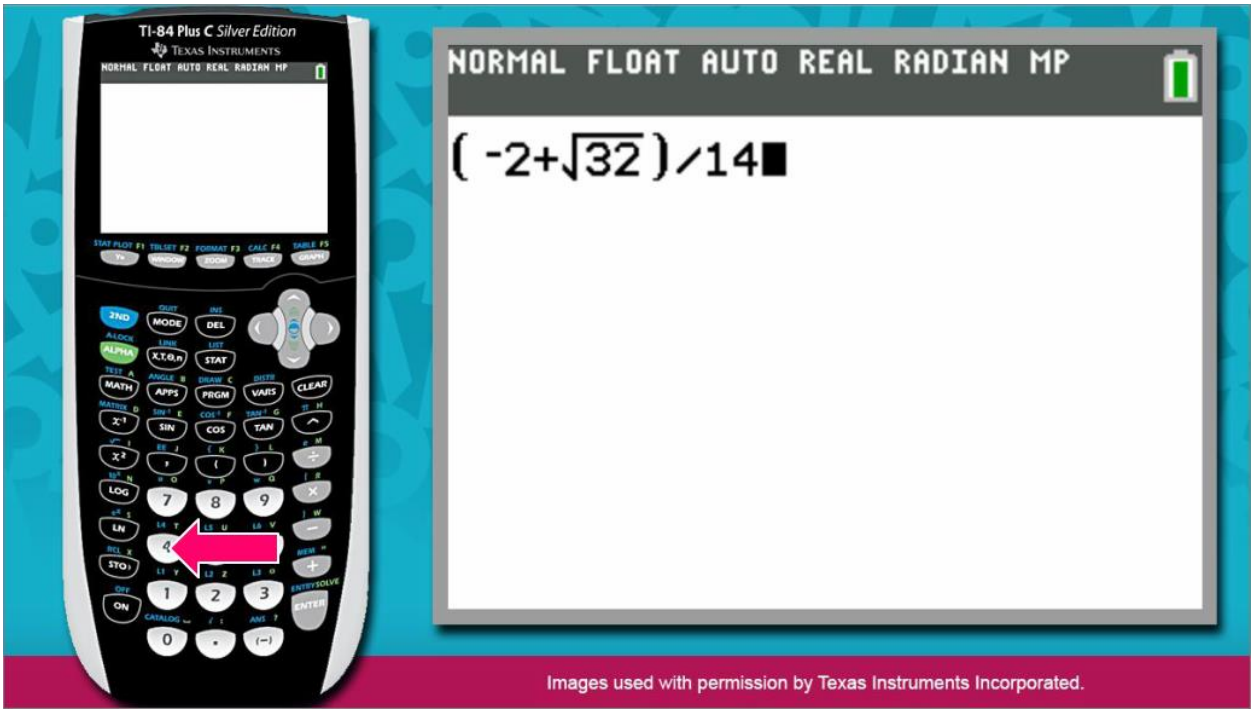

Next press the 3 key and then the 2 key. Notice that the cursor changes to a right arrow. This is the calculator's way of alerting you to press the right arrow key if you have finished entering the value to be included within the square root symbol.

Example 1 (continued)



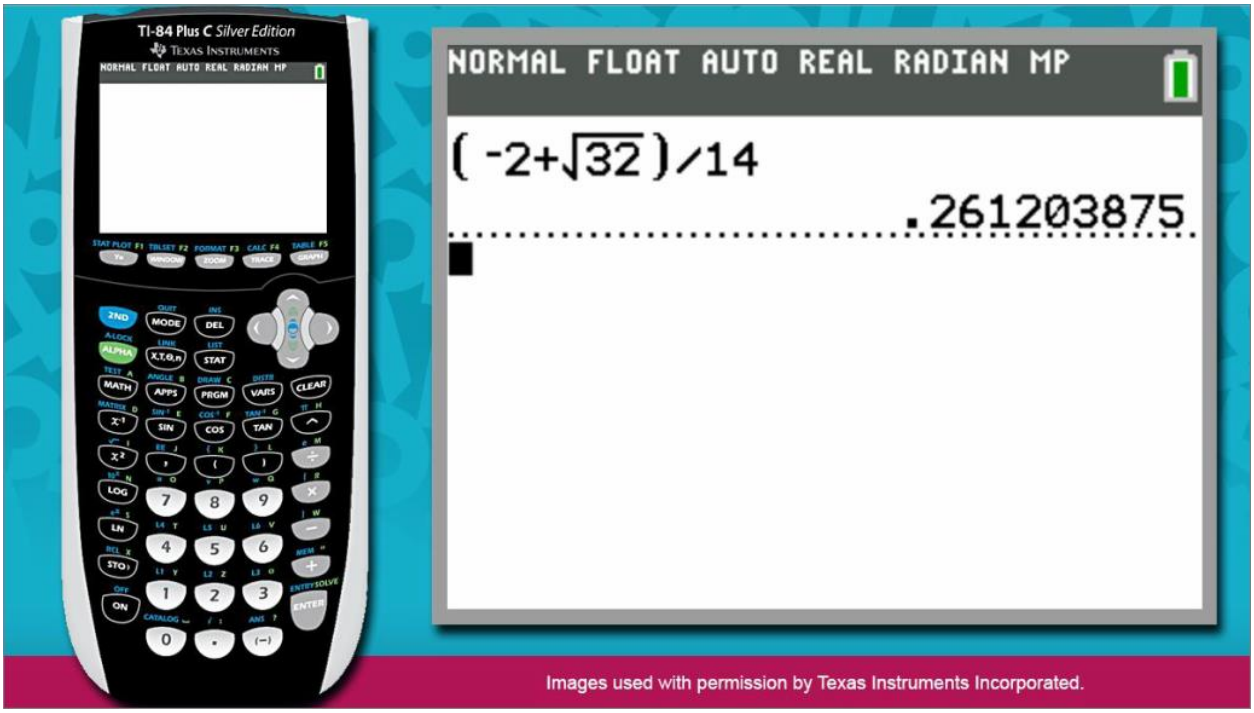

Because you have finished entering the value, press the right arrow key. You will notice the cursor move to the right of the expression. Next, press the right parenthesis key, located above the 9 key.

Example 1 (continued)



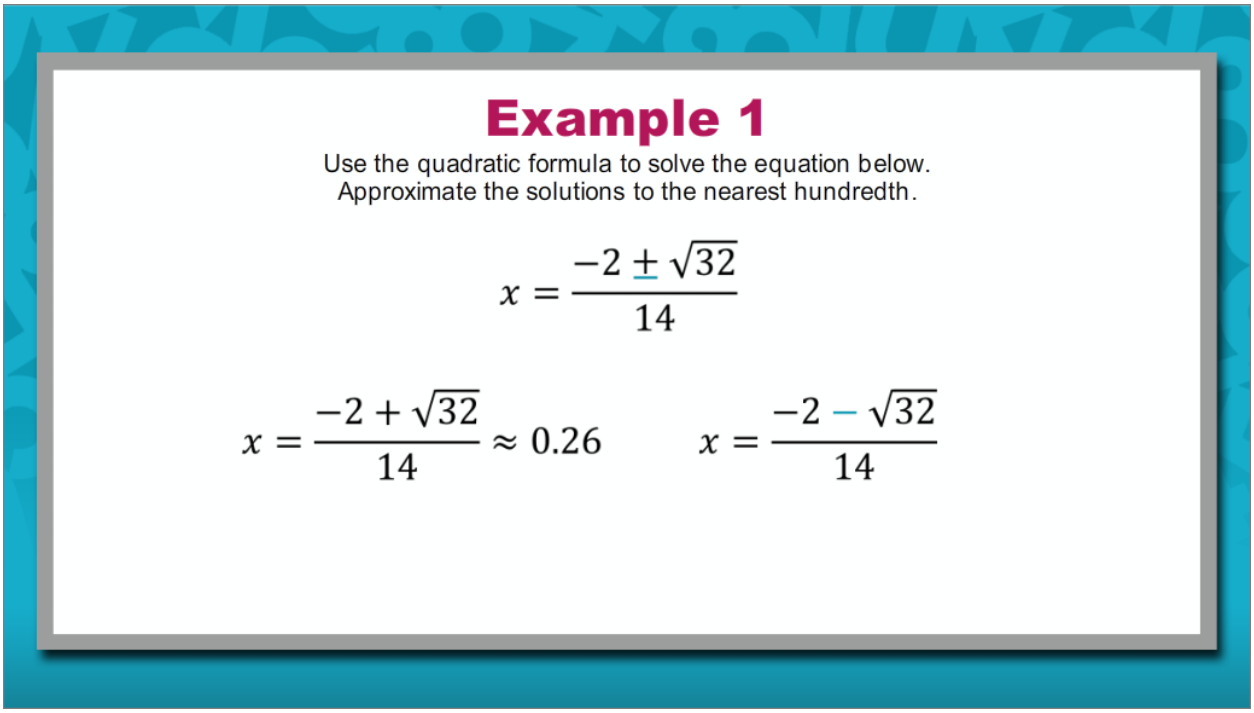

Now, press the division key. Then press the 1 key, and then the 4 key.

Example 1 (continued)




Now, press enter. In this example, you were asked to approximate the solutions to the nearest hundredth. So, this solution can be represented as 0.26.

Example 1 (continued)




Use the quadratic formula to solve the equation below. Approximate the solutions to the nearest hundredth.

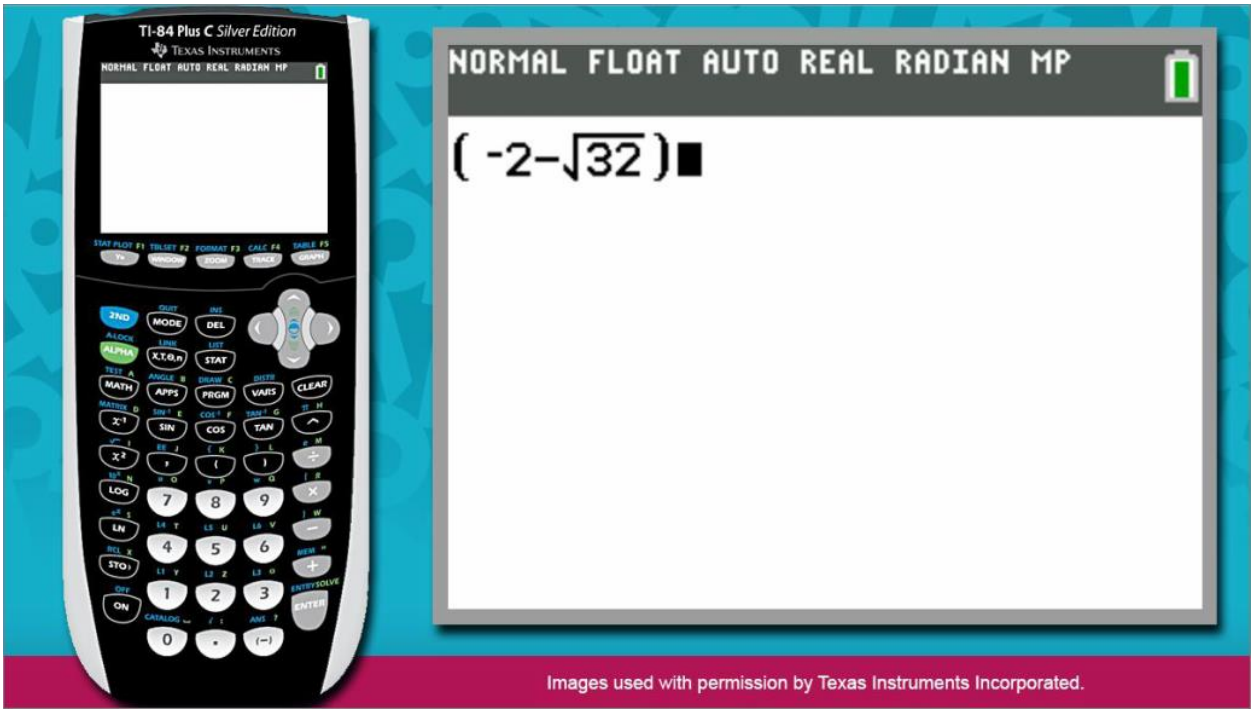
$$7x^2 + 2x = 1$$

$$x = \frac{-2 \pm \sqrt{32}}{14}$$

$$x = \frac{-2+\sqrt{32}}{14} \approx 0.26 \qquad x = \frac{-2-\sqrt{32}}{14}$$

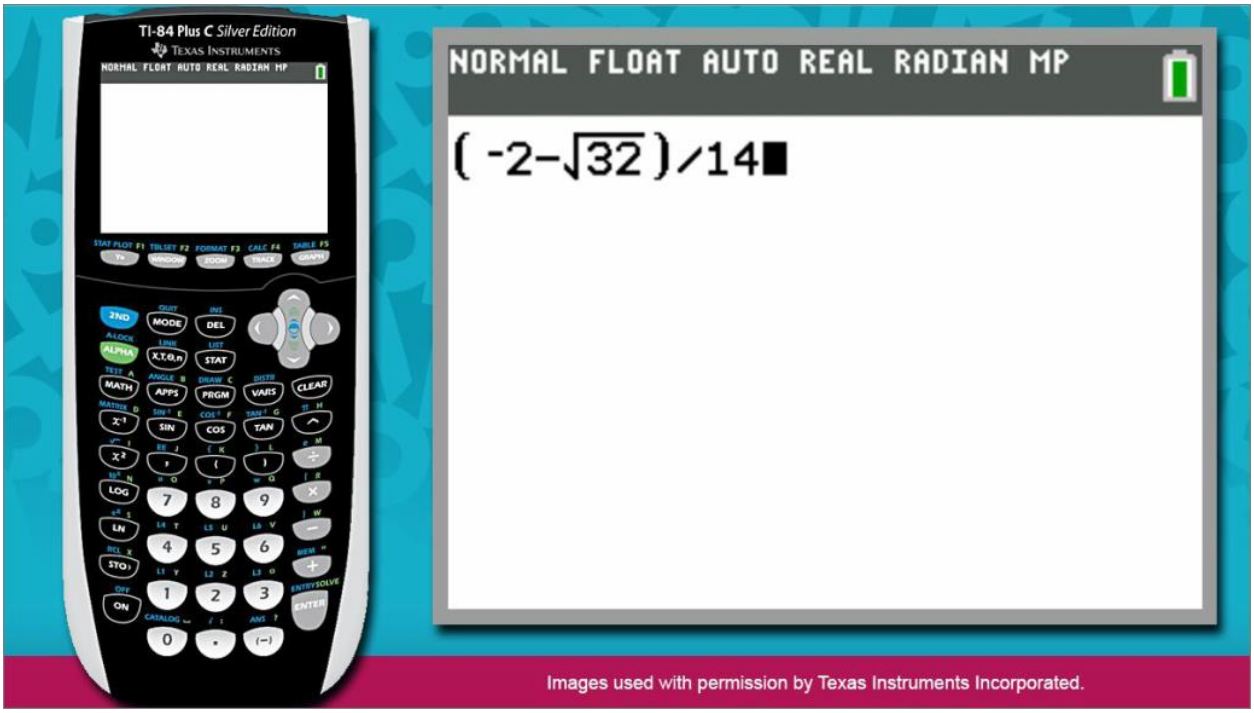
Now that you know one of the solutions is approximately 0.26, you can move on to determine the second solution, where $x = \frac{-2-\sqrt{32}}{14}$. Again, you may want to use the calculator to determine this value.

Example 1 (continued)



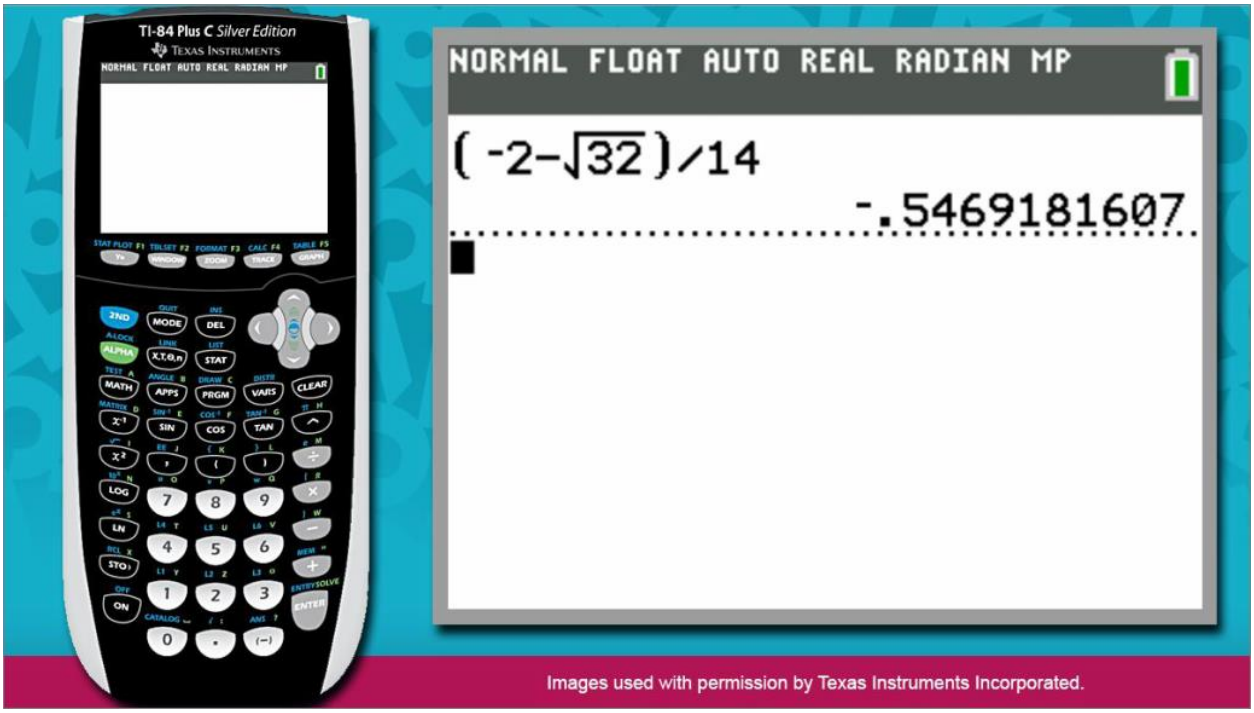

Remember to place parentheses around the expression in the numerator.

Example 1 (continued)



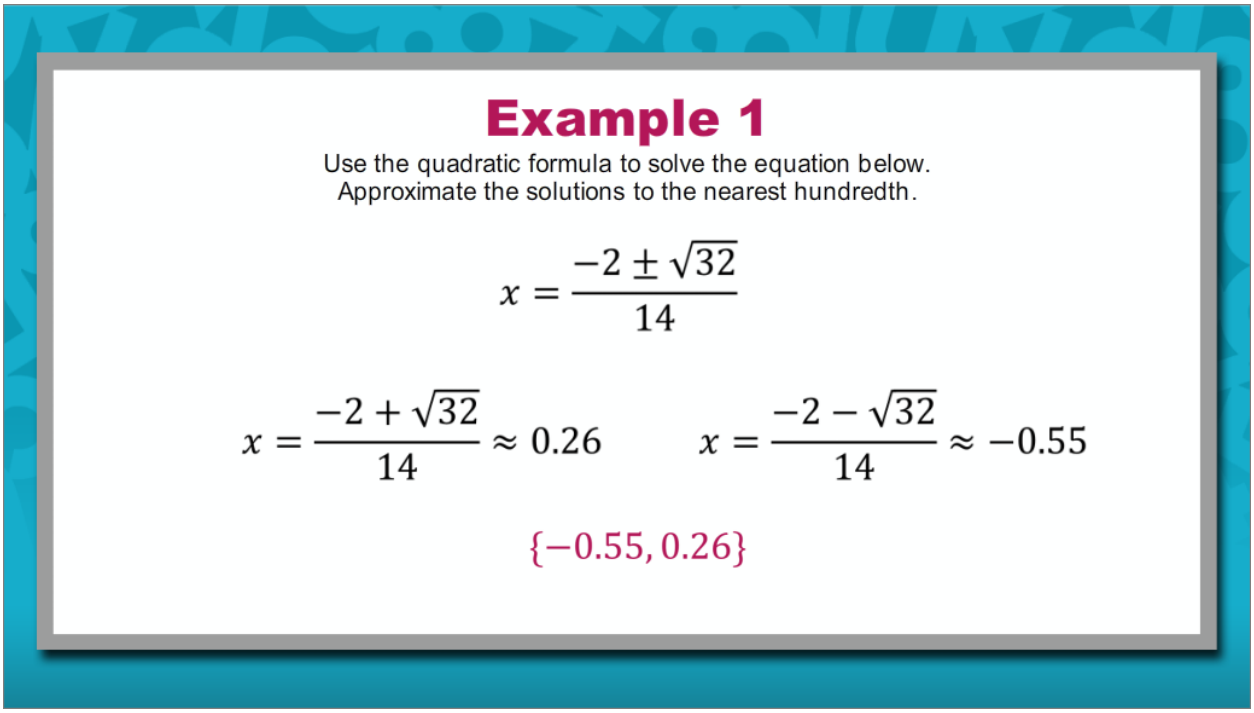

Then, divide the expression by 14.

Example 1 (continued)




After pressing ENTER, you are able to determine the solution. Remember that in this example you were asked to approximate the solutions to the nearest hundredth. So, this solution can be represented as $-0.55$.

Example 1 (continued)




Use the quadratic formula to solve the equation below. Approximate the solutions to the nearest hundredth.

$$7x^2 + 2x = 1$$

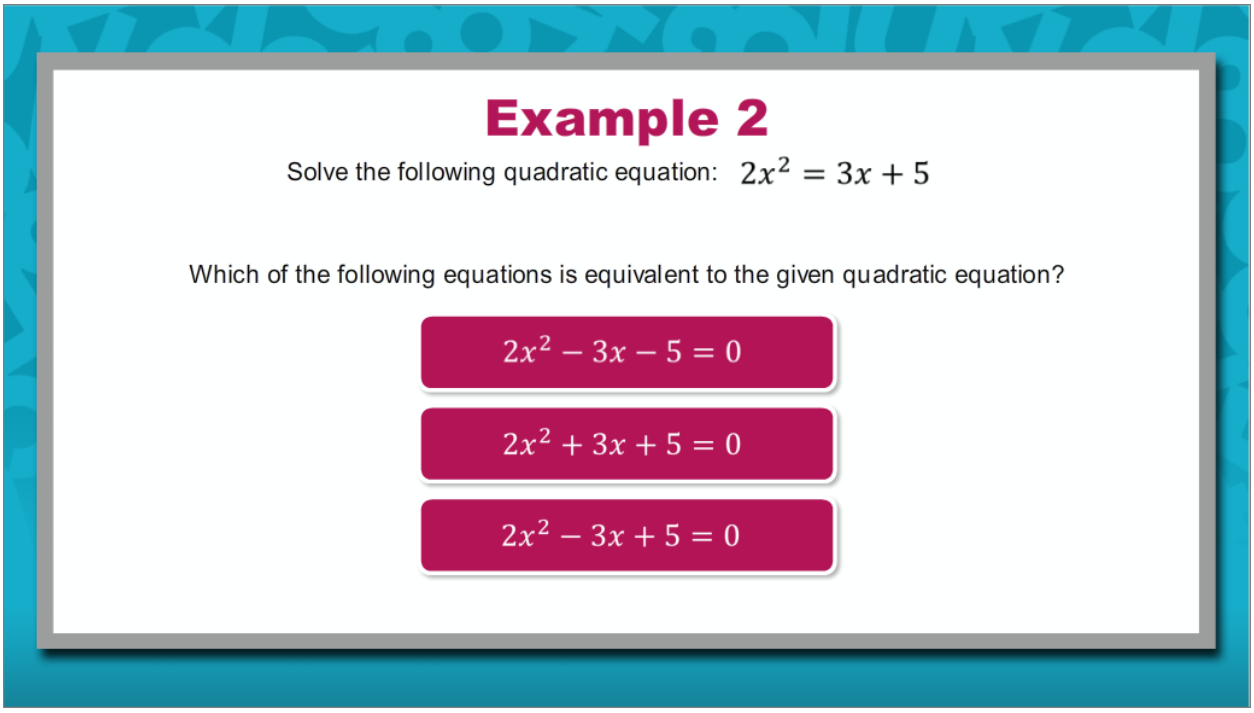
$$x = \frac{-2 \pm \sqrt{32}}{14}$$

You have determined both solutions to the quadratic equation. The solutions can be represented using set notation.

$x = \frac{-2+\sqrt{32}}{14} \approx 0.26$ $x = \frac{-2-\sqrt{32}}{14} \approx -0.55$

$\{-0.55, 0.26\}$

**Example 2**




Solve the following quadratic equation:

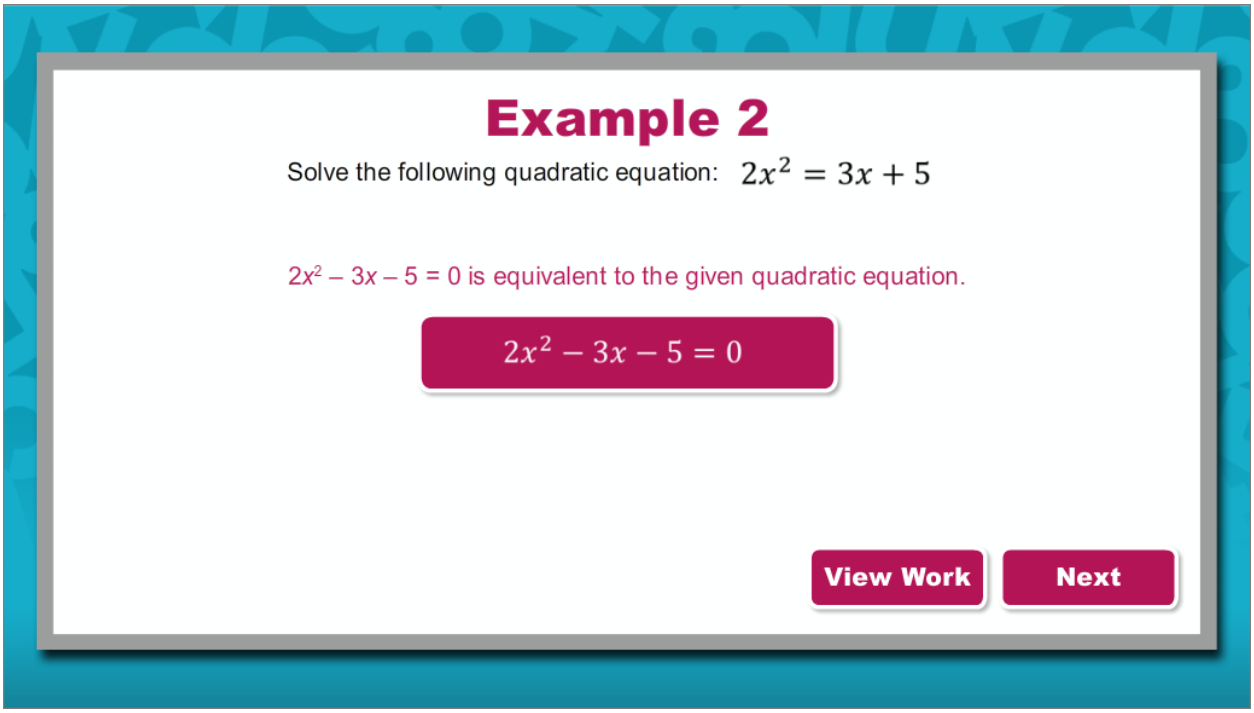
$$2x^2 = 3x + 5$$

Before you are able to use the quadratic formula you must represent the given equation in standard form.

Which of the following correctly models the given quadratic equation in standard form?

A) $2x^2 - 3x - 5 = 0$
B) $2x^2 + 3x + 5 = 0$
C) $2x^2 - 3x + 5 = 0$

**Example 2 (continued)**

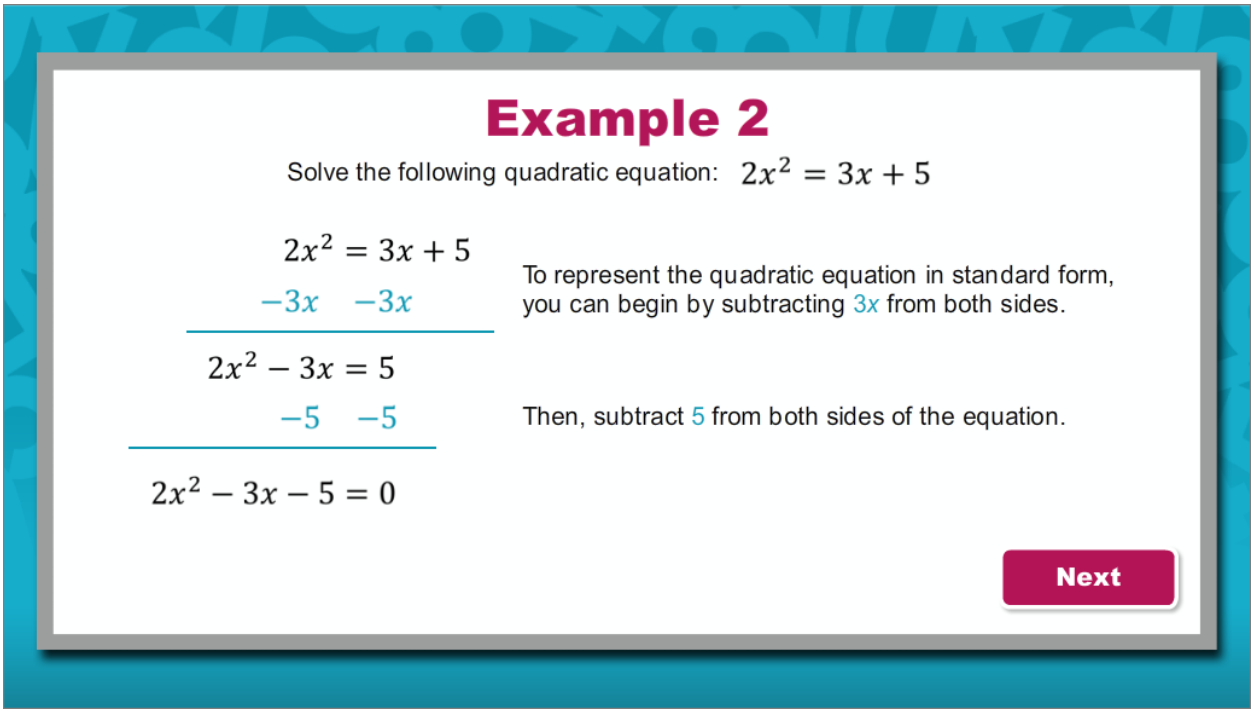



Solve the following quadratic equation:

$$2x^2 = 3x + 5$$

$2x^2 - 3x - 5 = 0$ is equivalent to the given quadratic equation.

**Example 2 (continued)**




Solve the following quadratic equation:

$$2x^2 = 3x + 5$$

$$\begin{array}{r} 2x^2 = 3x + 5 \\ -3x \quad -3x \\ \hline 2x^2 - 3x = 5 \end{array}$$

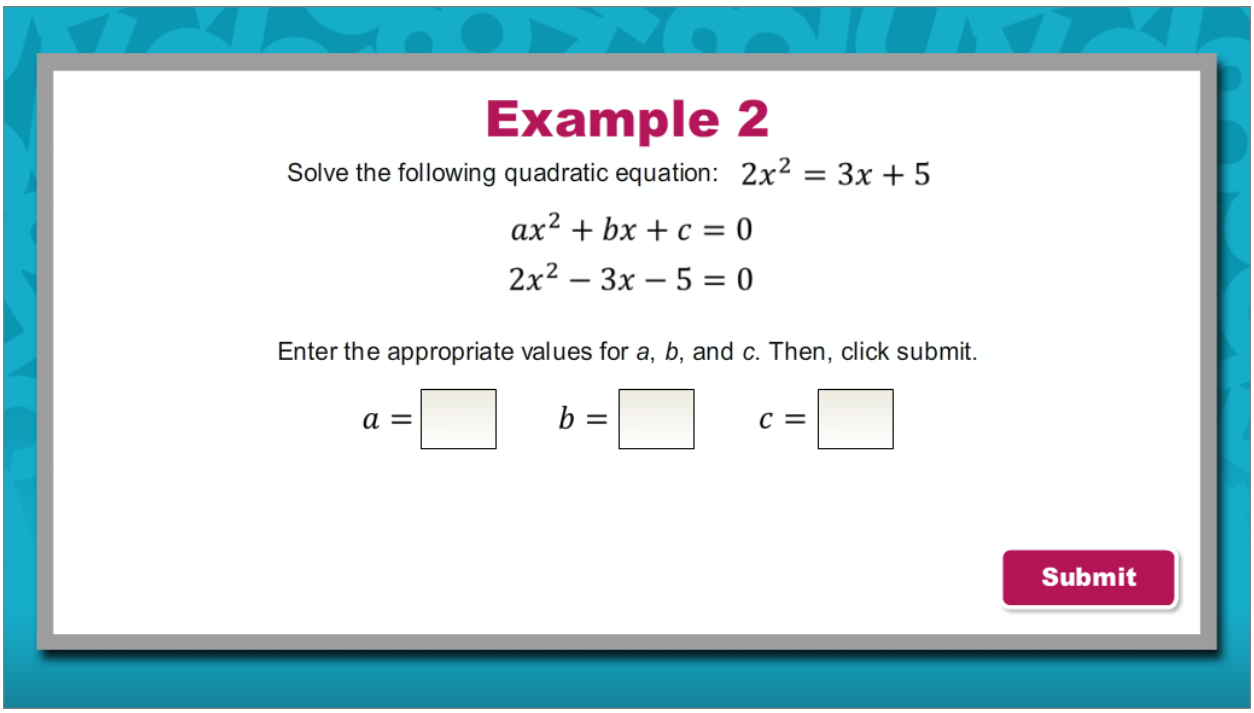
To represent the quadratic equation in standard form, you can begin by subtracting $3x$ from both sides.

$$\begin{array}{r} 2x^2 - 3x = 5 \\ -5 \quad -5 \\ \hline 2x^2 - 3x - 5 = 0 \end{array}$$

Then, subtract 5 from both sides of the equation.

The correct answer is B.

**Example 2 (continued)**




Solve the following quadratic equation:

$$2x^2 = 3x + 5$$

$$ax^2 + bx + c = 0$$
$$2x^2 - 3x - 5 = 0$$

Now that the quadratic equation is in standard form, you can begin to use the quadratic formula.

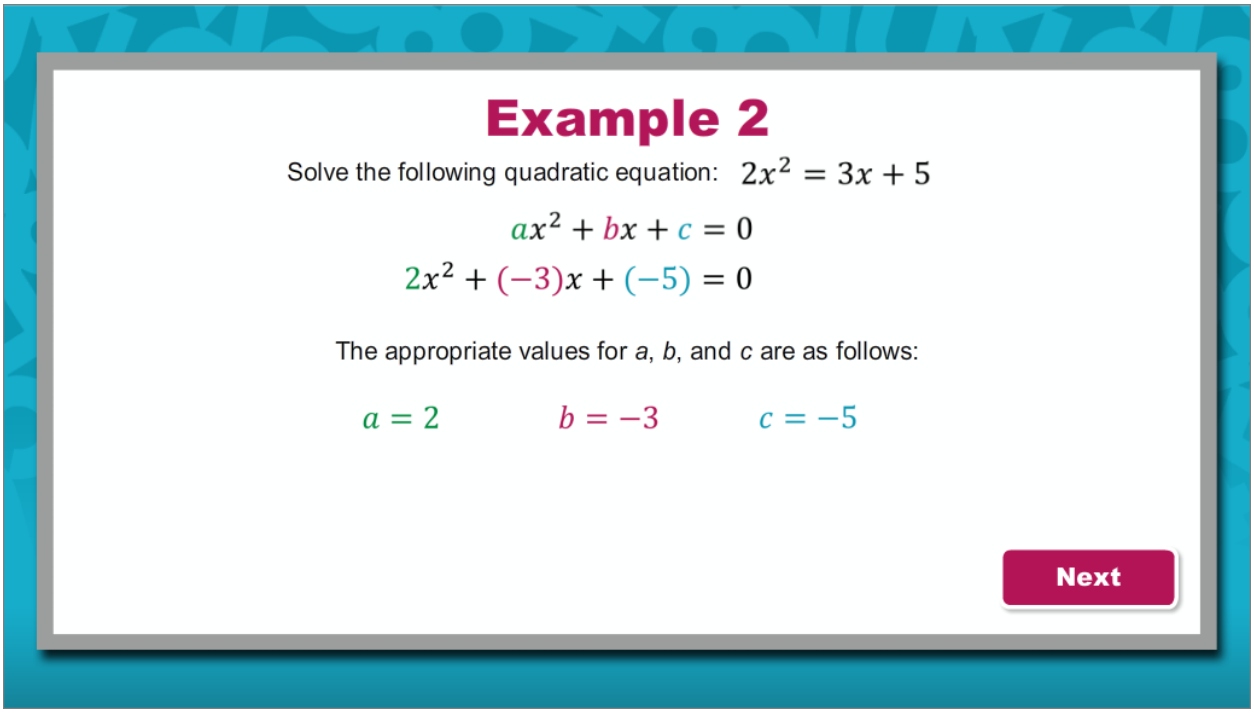
$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Start by identifying $a$, $b$, and $c$.

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

$a =$ __?__ $b =$ __?__ $c =$ __?__

**Example 2 (continued)**




Solve the following quadratic equation:

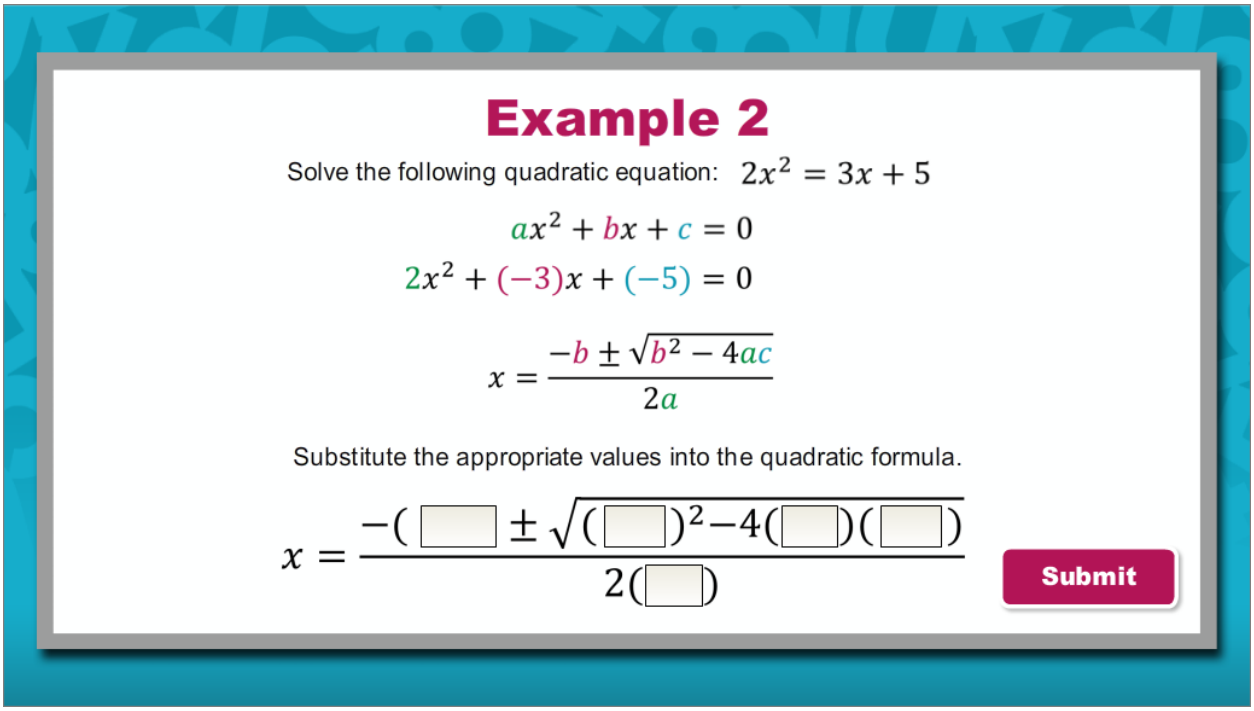
$$2x^2 = 3x + 5$$

$$ax^2 + bx + c = 0$$
$$2x^2 + (-3)x + (-5) = 0$$

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

$$a = 2 \qquad b = -3 \qquad c = -5$$

**Example 2 (continued)**




Solve the following quadratic equation:

$$2x^2 = 3x + 5$$

$$ax^2 + bx + c = 0$$
$$2x^2 + (-3)x + (-5) = 0$$

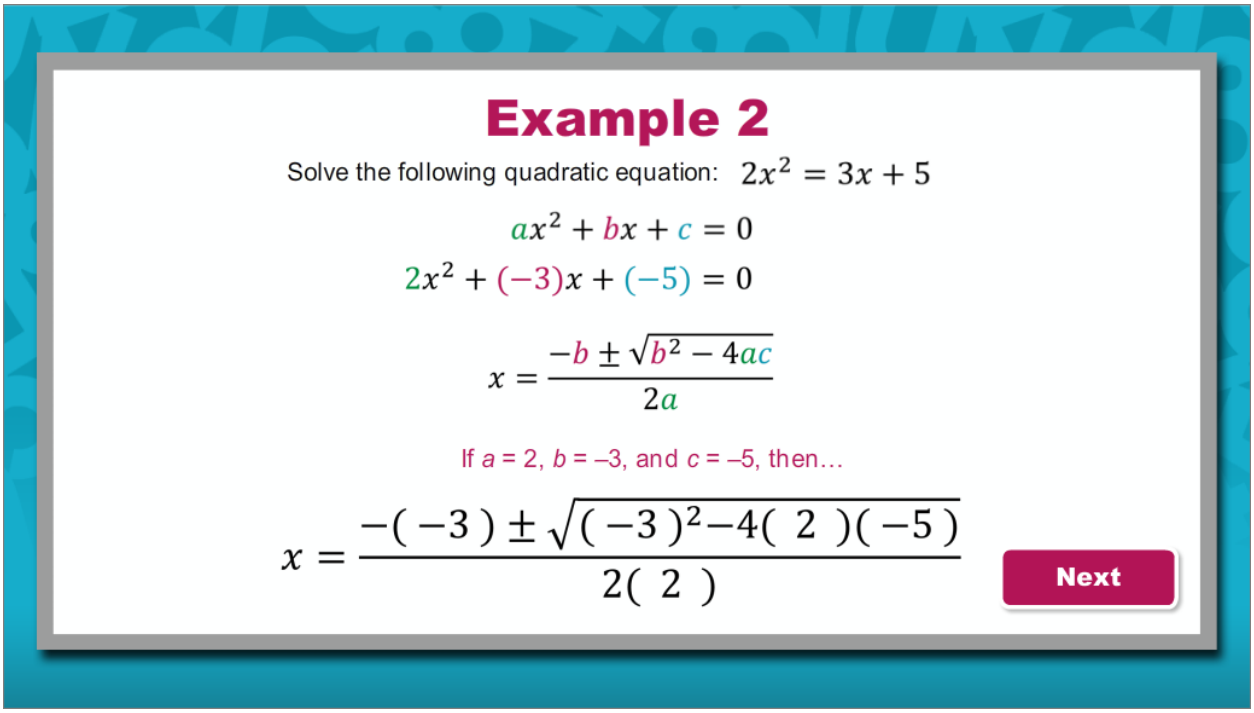
Now that you have found that $a = 2, b = -3, c = -5$, substitute the values into the quadratic formula.

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

Substitute the appropriate values into the quadratic formula.

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

**Example 2 (continued)**




Solve the following quadratic equation:

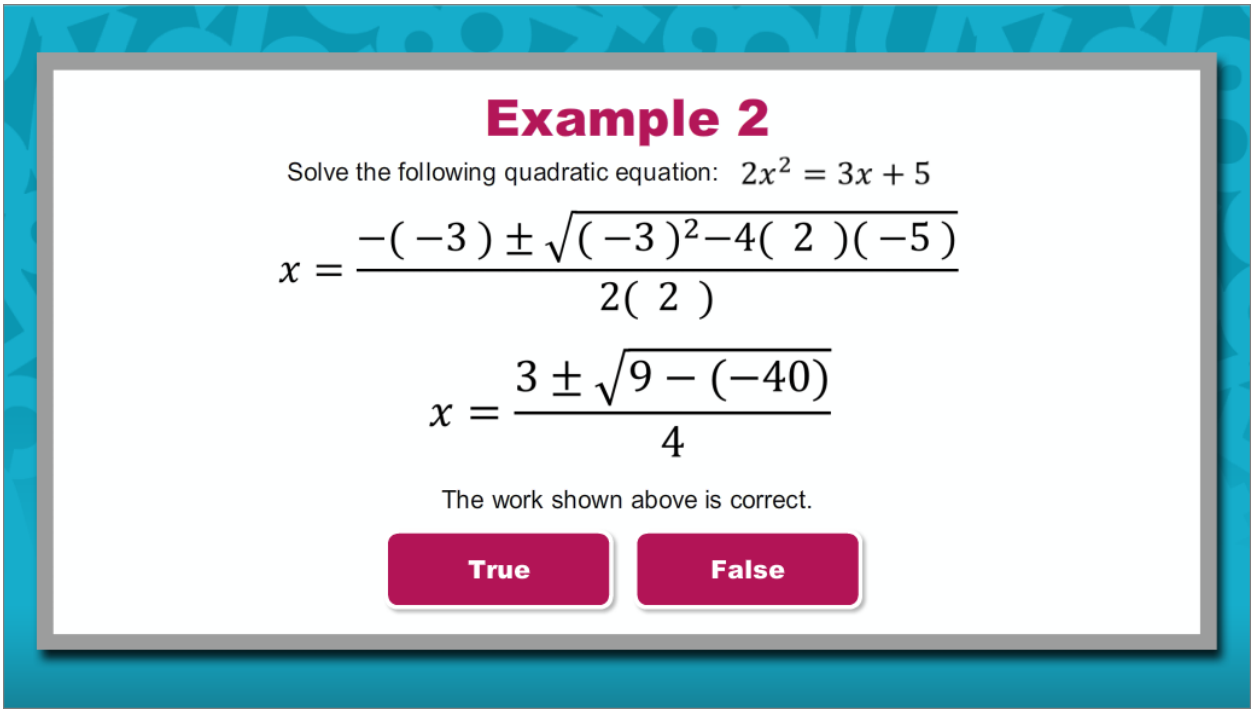
$$2x^2 = 3x + 5$$

$$ax^2 + bx + c = 0$$
$$2x^2 + (-3)x + (-5) = 0$$

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

If $a = 2, b = -3, c = -5$, then $x = \frac{-(-3) \pm \sqrt{(-3)^2 - 4(2)(-5)}}{2(2)}$

**Example 2 (continued)**




Solve the following quadratic equation:

$$2x^2 = 3x + 5$$

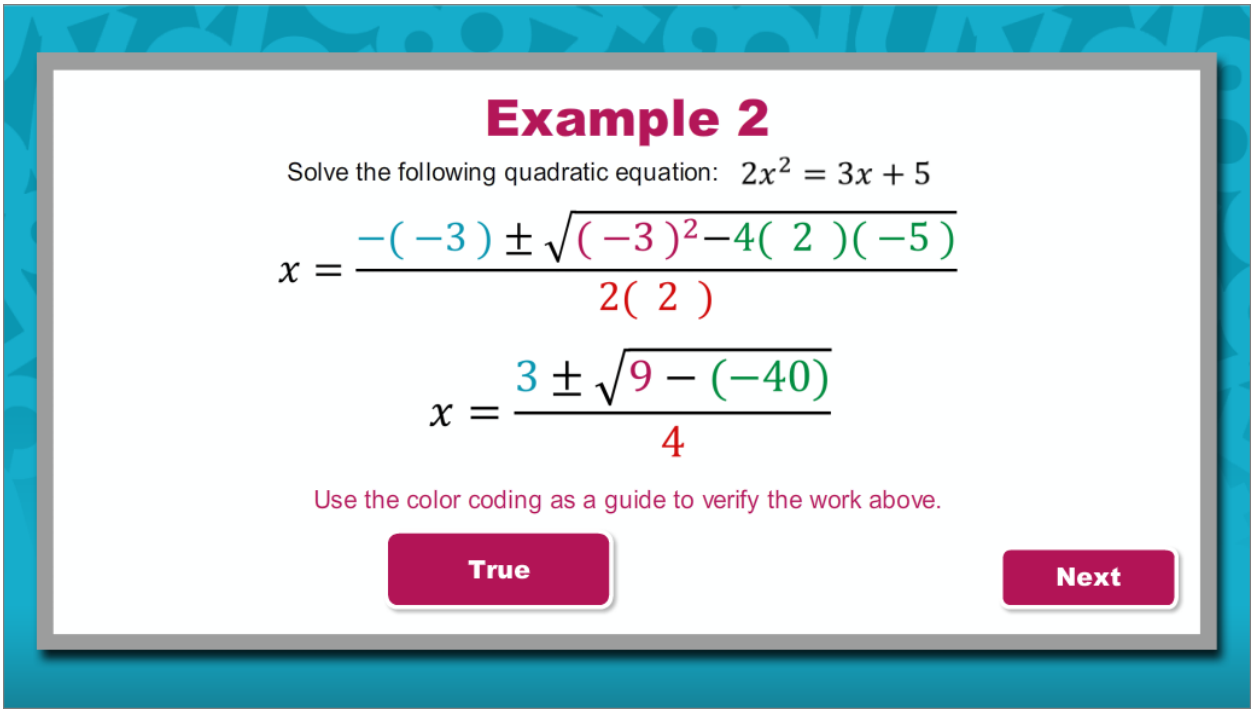
$$x = \frac{-(-3) \pm \sqrt{(-3)^2 - 4(2)(-5)}}{2(2)}$$

$$x = \frac{3 \pm \sqrt{9-(-40)}}{4}$$

The work shown above is correct.

A) True
B) False

**Example 2 (continued)**




Solve the following quadratic equation:

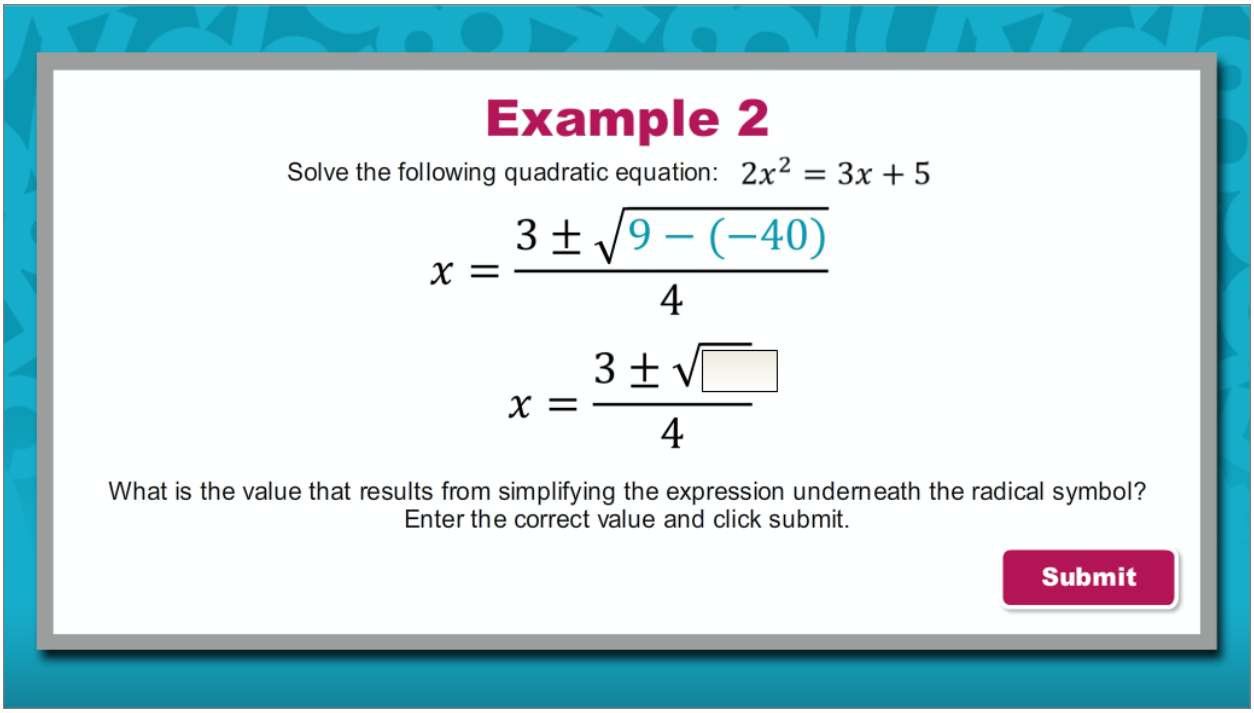
$$2x^2 = 3x + 5$$

$$x = \frac{-(-3) \pm \sqrt{(-3)^2 - 4(2)(-5)}}{2(2)}$$

$$x = \frac{3 \pm \sqrt{9 - (-40)}}{4}$$

Use the color coding as a guide to verify the work above.

**Example 2 (continued)**




Solve the following quadratic equation:

$$2x^2 = 3x + 5$$

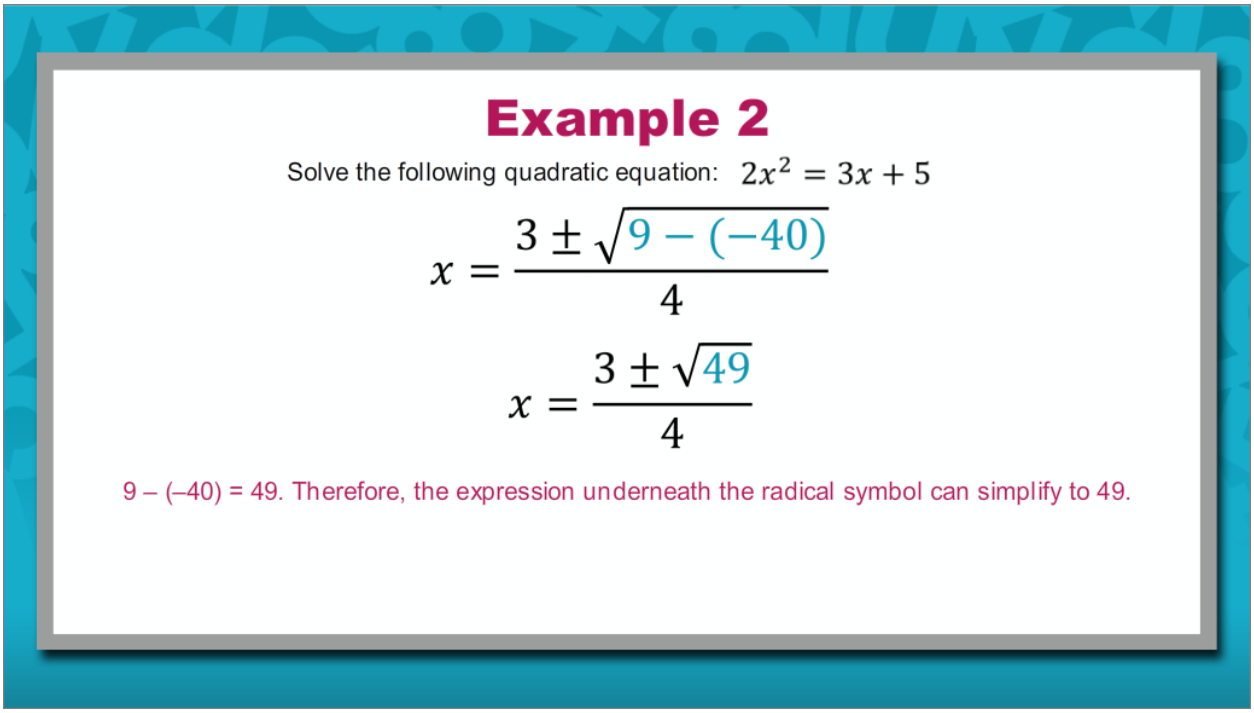
Simplify the expression underneath the radical symbol.

$$x = \frac{3 \pm \sqrt{9 - (-40)}}{4}$$

$$x = \frac{3 \pm \sqrt{?}}{4}$$

What is the value that results from simplifying the expression underneath the radical symbol? Enter the correct value and click submit.

**Example 2 (continued)**




Solve the following quadratic equation:

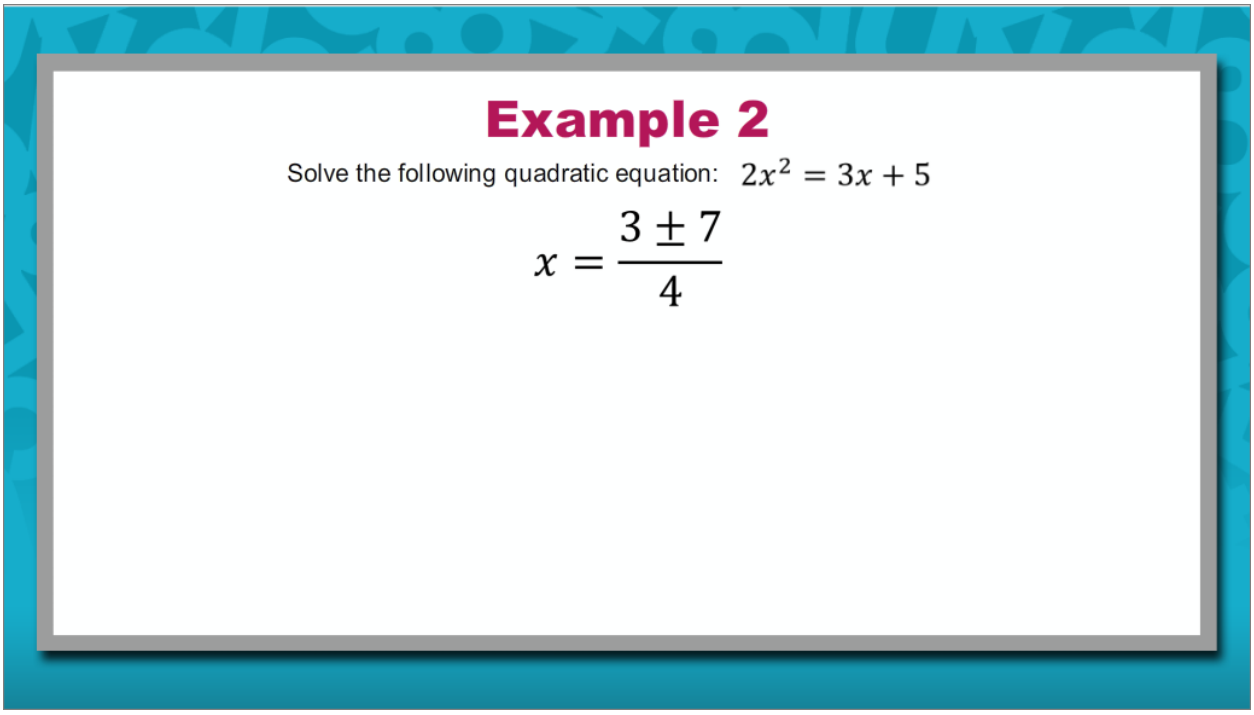
$$2x^2 = 3x + 5$$

$$x = \frac{3 \pm \sqrt{9 - (-40)}}{4}$$

$$x = \frac{3 \pm \sqrt{49}}{4}$$

$9 - (-40) = 49$. Therefore, the expression underneath the radical symbol can simplify to 49.

**Example 2 (continued)**




Solve the following quadratic equation:

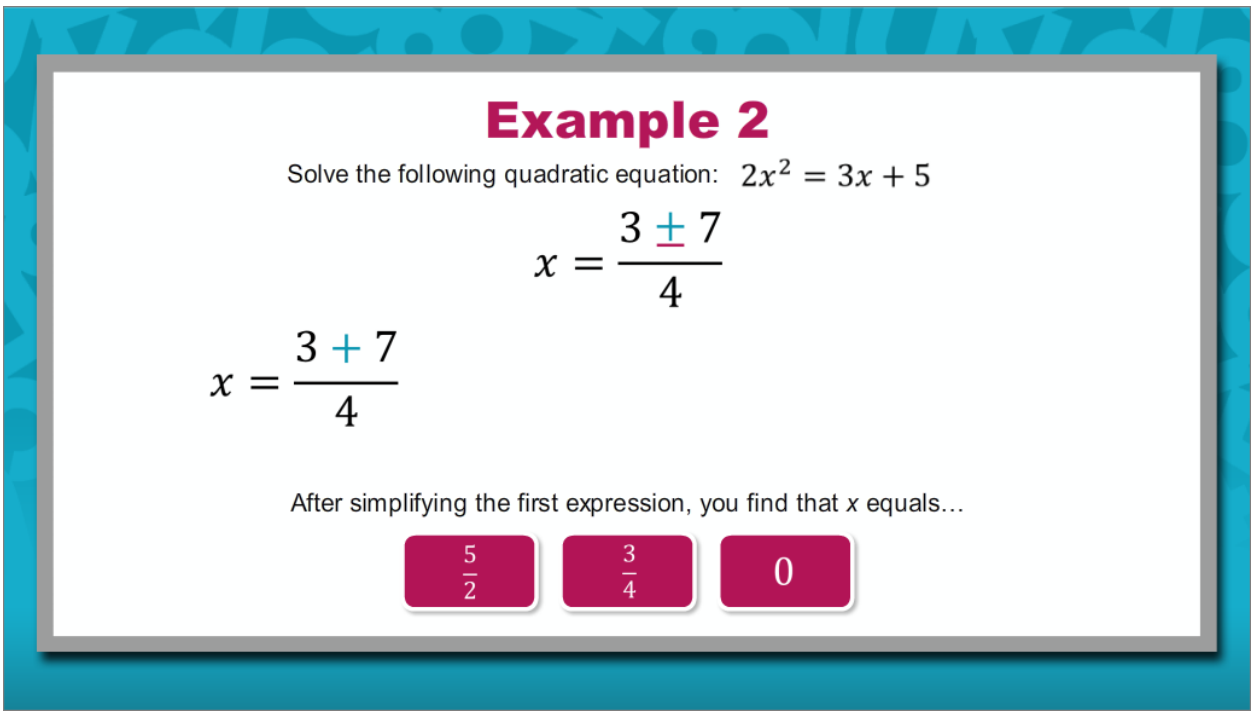
$$2x^2 = 3x + 5$$

$$x = \frac{3 \pm \sqrt{49}}{4}$$

$$x = \frac{3 \pm 7}{4}$$

49 is a perfect square. So continue to simplify the expression by replacing the $\sqrt{49}$ with 7.

**Example 2 (continued)**




Solve the following quadratic equation:

$$2x^2 = 3x + 5$$

$$x = \frac{3 \pm \sqrt{7}}{4}$$

The final step is to determine each solution.

$$x = \frac{3 + 7}{4}$$

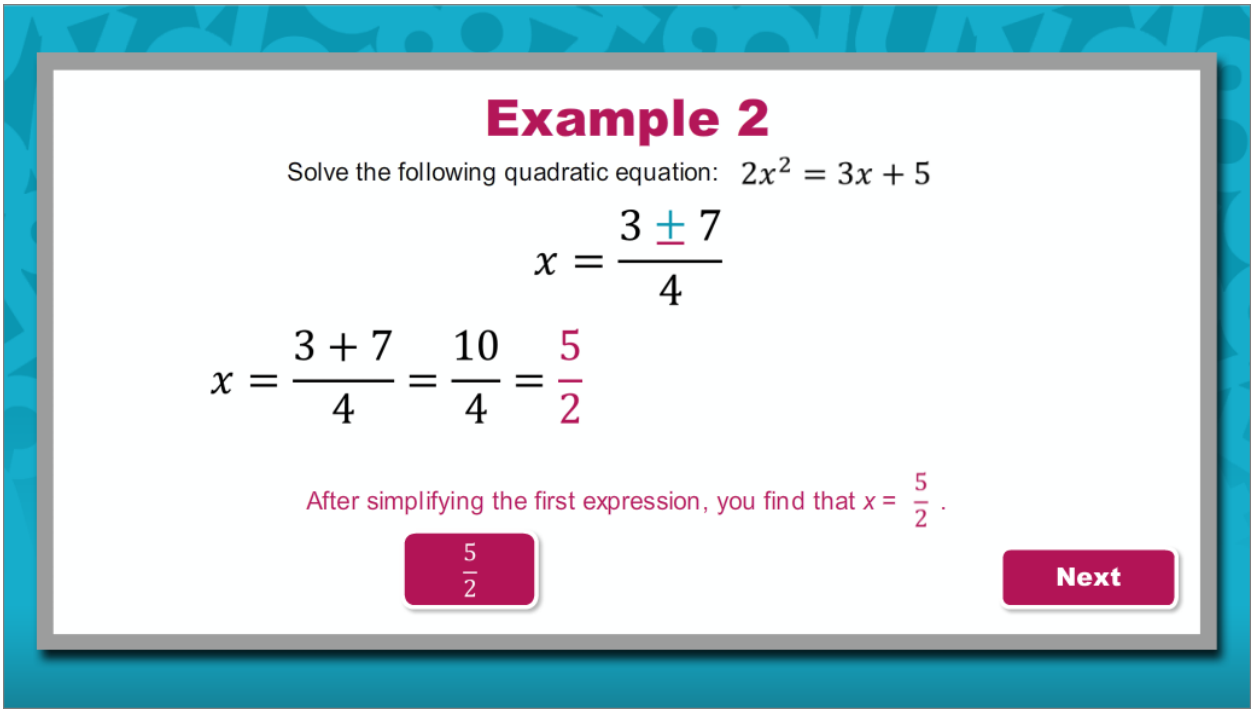
After simplifying the first expression, you find that…

A) $\frac{5}{2}$

B) $\frac{3}{4}$

C) 0

**Example 2 (continued)**




Solve the following quadratic equation:

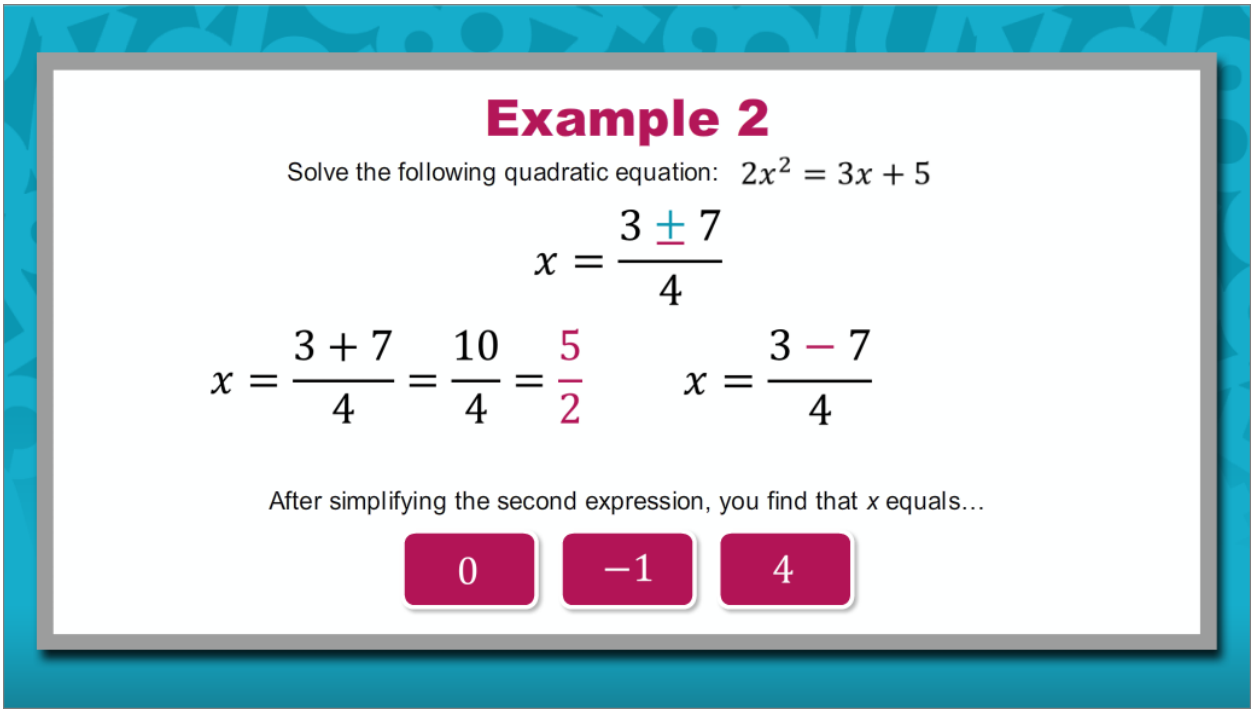
$$2x^2 = 3x + 5$$

$$x = \frac{3 \pm \sqrt{7}}{4}$$

$x = \frac{3+7}{4} = \frac{10}{4} = \frac{5}{2}$

After simplifying the first expression, you find that $x = \frac{5}{2}$.

**Example 2 (continued)**




Solve the following quadratic equation:

$$2x^2 = 3x + 5$$

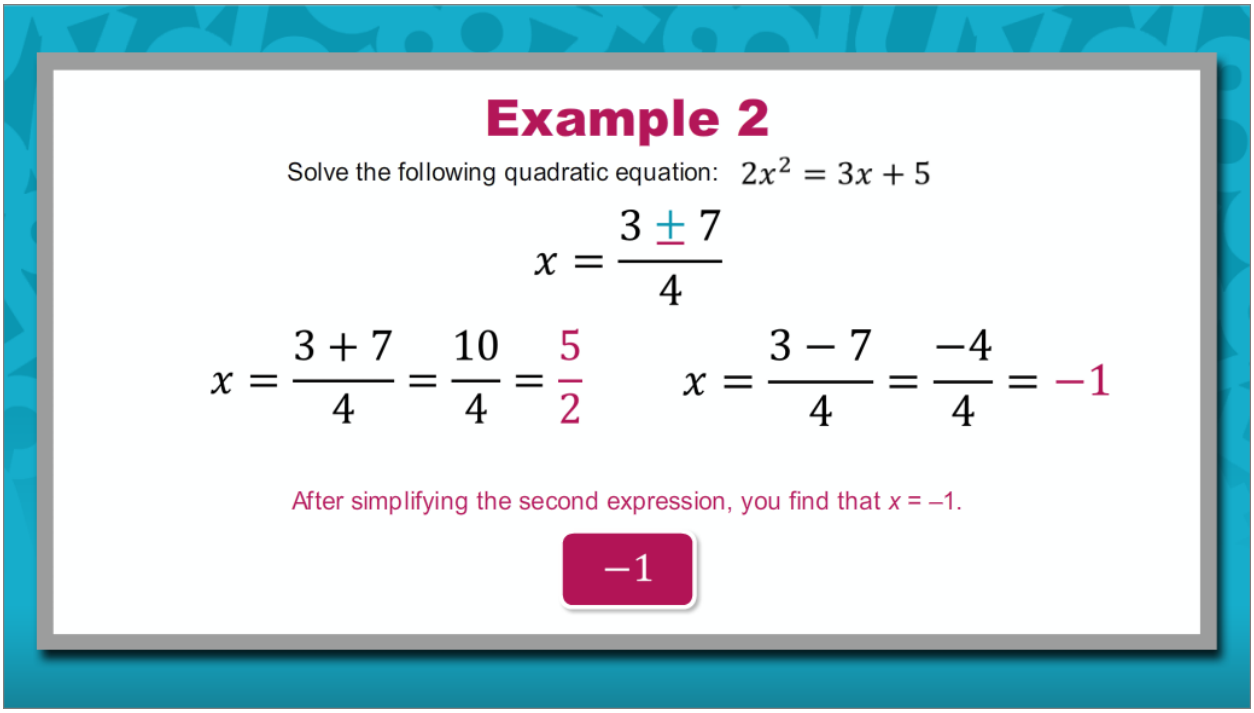
$$x = \frac{3 \pm \sqrt{7}}{4}$$

$$x = \frac{3+7}{4} = \frac{10}{4} = \frac{5}{2} \qquad x = \frac{3-7}{4}$$

After simplifying the second expression, you find that…

A) 0
B) −1
C) 4

**Example 2 (continued)**




Solve the following quadratic equation:

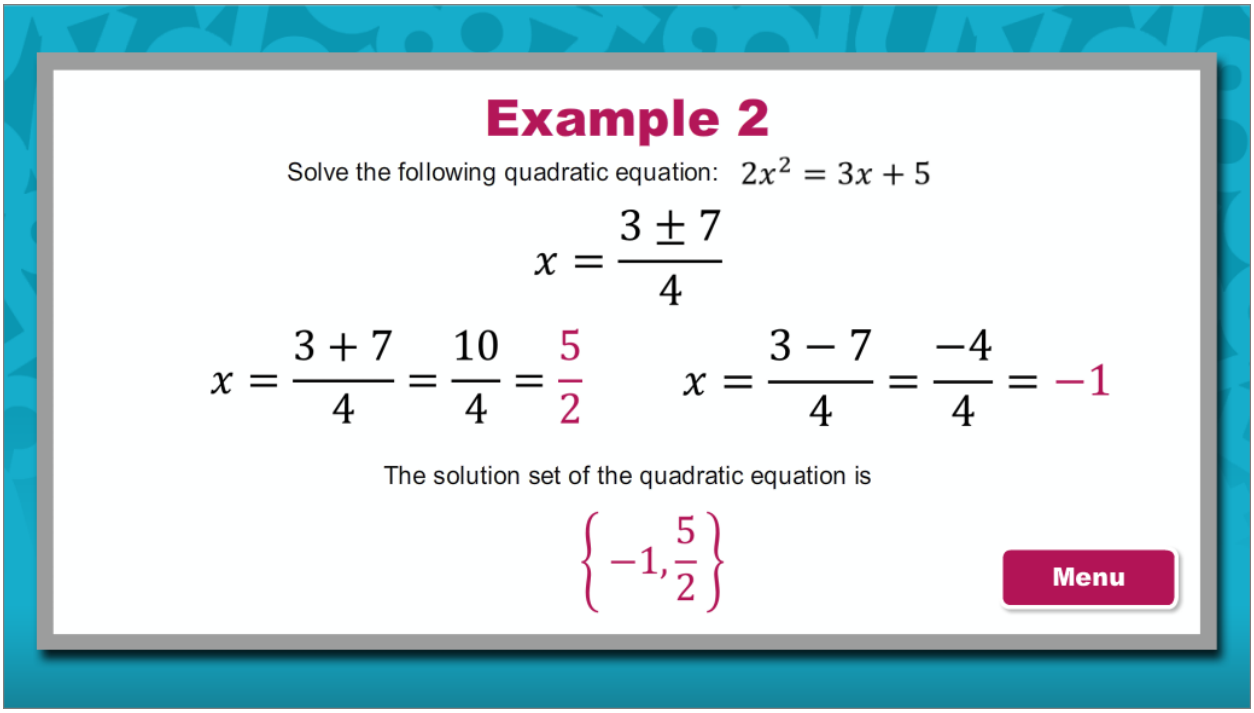
$$2x^2 = 3x + 5$$

$$x = \frac{3 \pm \sqrt{7}}{4}$$

$$x = \frac{3+7}{4} = \frac{10}{4} = \frac{5}{2} \qquad x = \frac{3-7}{4} = \frac{-4}{4} = -1$$

After simplifying the second expression, you find that $x = -1$.

**Example 2 (continued)**




Solve the following quadratic equation:

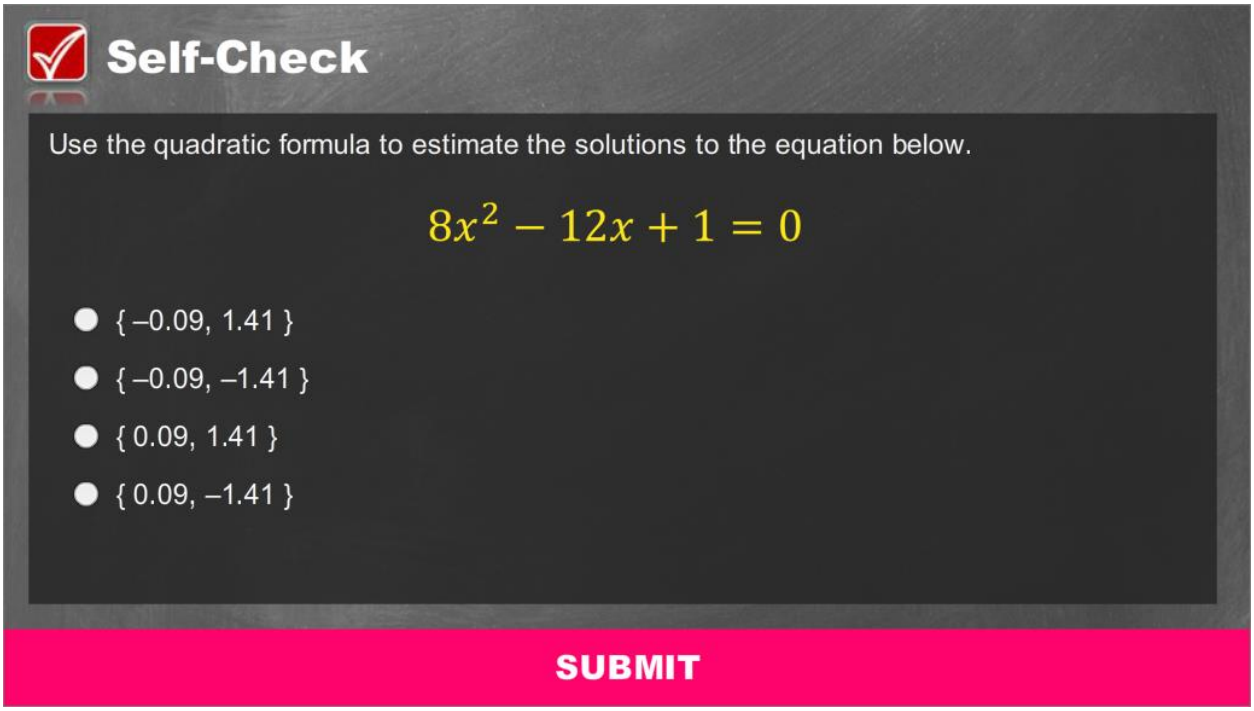
$$2x^2 = 3x + 5$$

$$x = \frac{3 \pm \sqrt{7}}{4}$$

$$x = \frac{3+7}{4} = \frac{10}{4} = \frac{5}{2} \qquad x = \frac{3-7}{4} = \frac{-4}{4} = -1$$

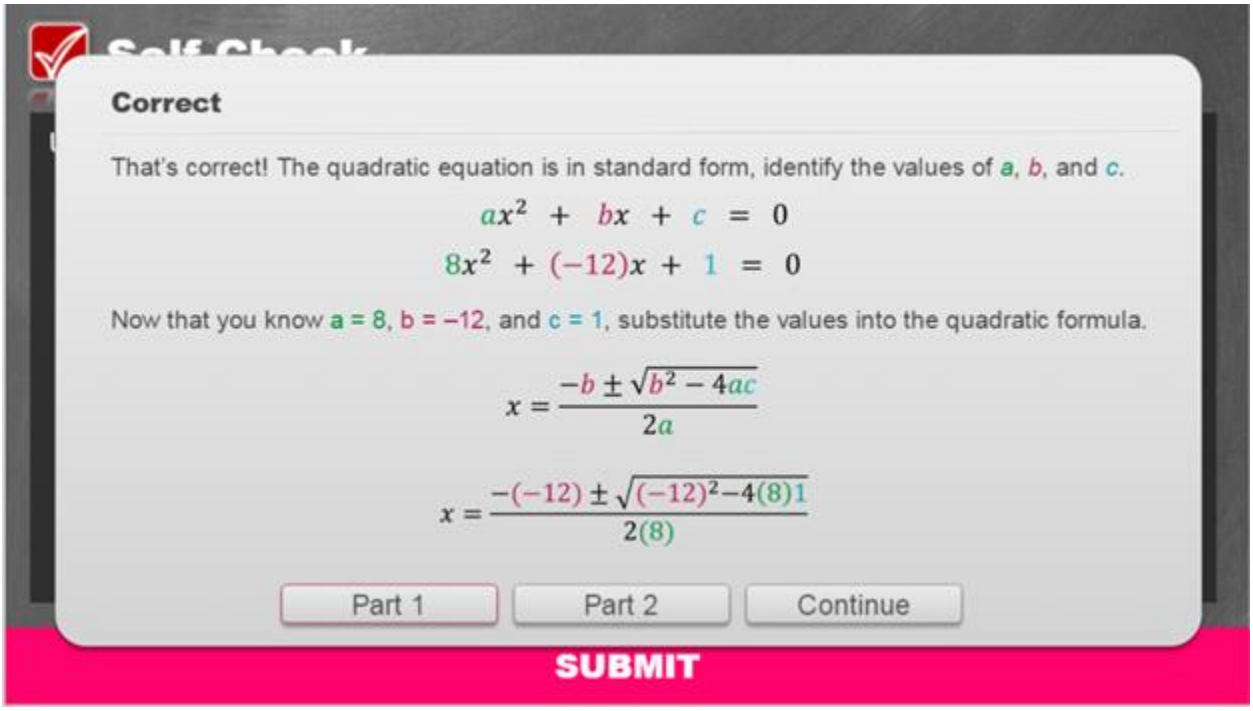
The solution set of the quadratic equation is $\left\{-1, \frac{5}{2}\right\}$.

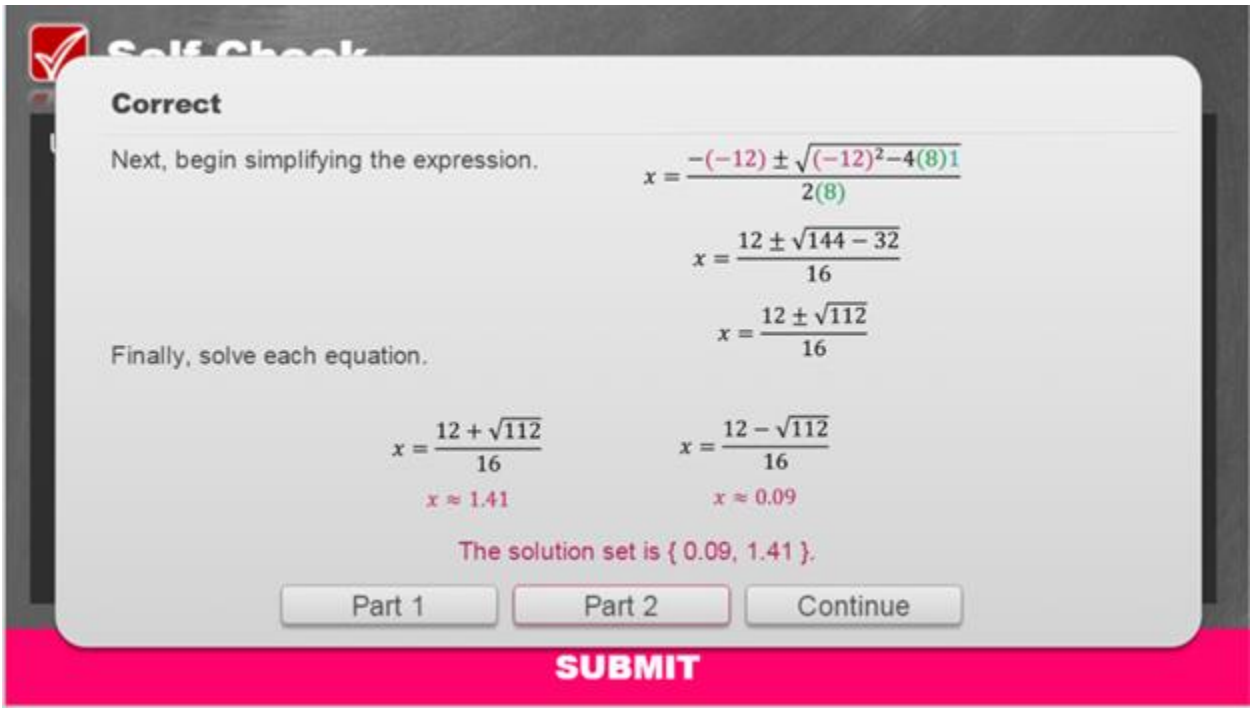
Self-Check




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

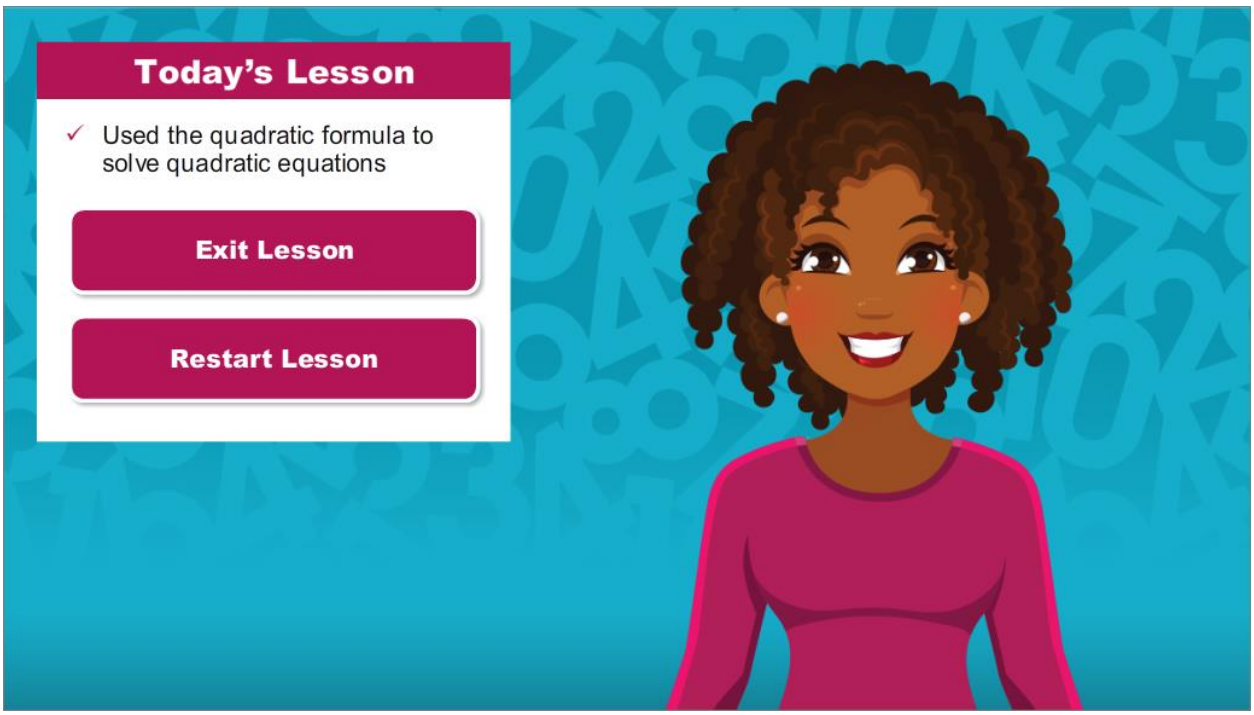
Self-Check: Answer




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

## Conclusion




You have reached the conclusion of this lesson, where you learned how to use the quadratic formula to solve quadratic equations.