Module 6: Solving Quadratic Equations
Topic 1: Solving Quadratic Equations by Factoring

Introduction

Hello and welcome! I'm so glad you could join me for this lesson in Algebra I, where you will learn how to use factoring to solve quadratic equations.

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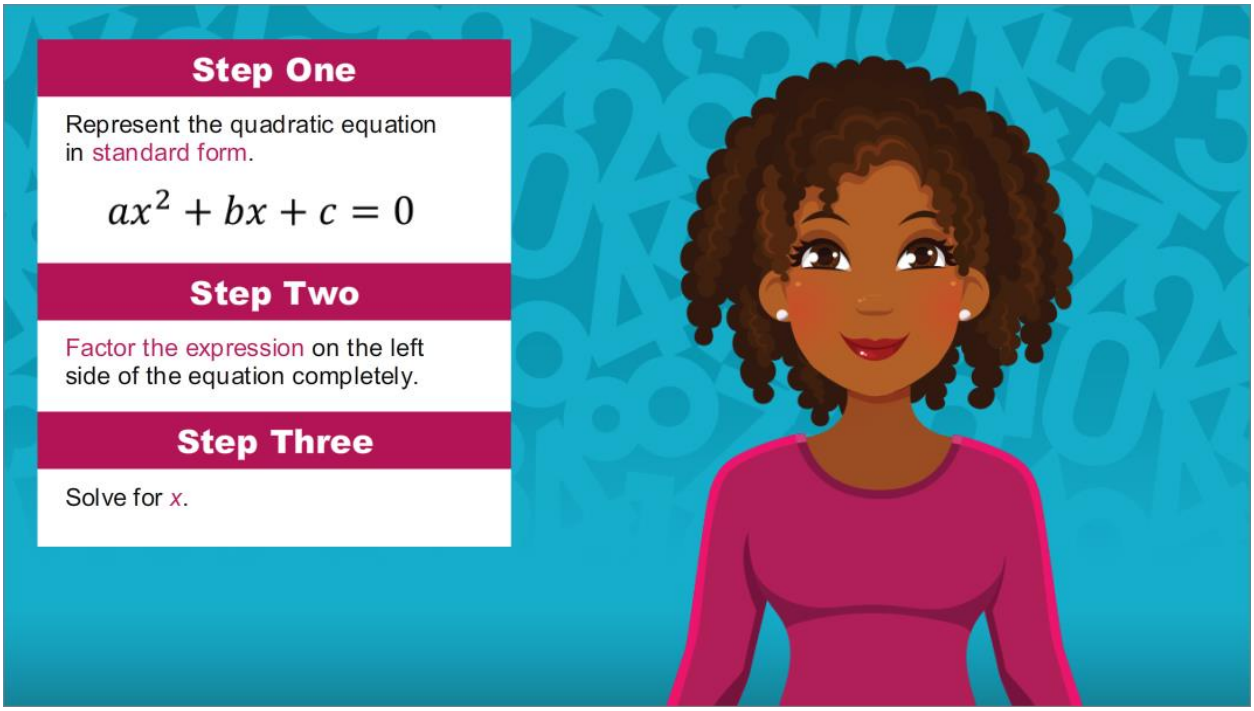
Anticipatory Set



Use the following steps to guide you in the process of using factoring to solve quadratic equations.

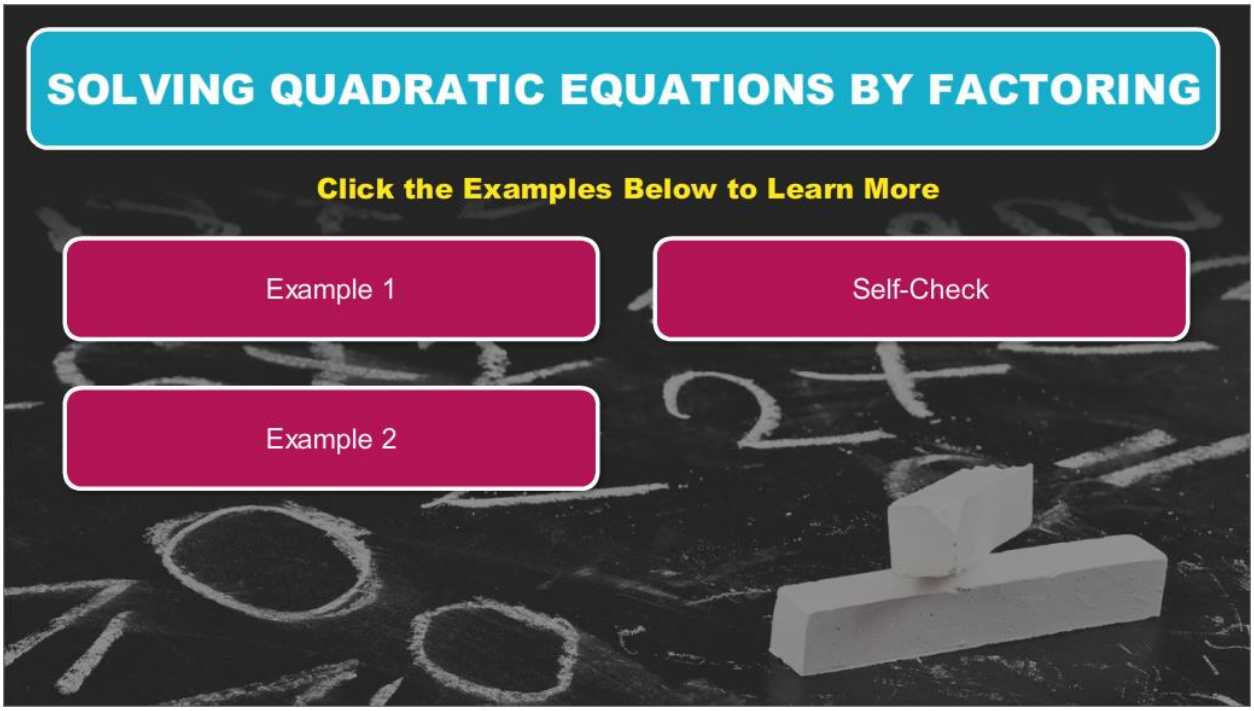
Step 1: Represent the quadratic equation in standard form.

Step 2: Factor the expression on the left side of the equation completely.

Step 3: Solve for x.

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

Solving Quadratic Equations By Factoring



Click the examples below to learn more

- Example 1
- Example 2
- Self-Check

Module 6: Solving Quadratic Equations
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Example 1

Solve the quadratic equation below.

$$3x^2 + 21x = -18$$

$$3x^2 + 21x = -18$$
$$+18 \qquad +18$$
$$3x^2 + 21x + 18 = 0$$

Step 1: Represent the quadratic equation in standard form.

To represent the given equation in standard form, you must add 18 to both sides of the equation. The result is $3x^2 + 21x + 18 = 0$.

$$3x^2 + 21x + 18 = 0$$
$$3(x^2 + 7x + 6) = 0$$

Step 2: Factor the expression on the left side of the equation completely.

The terms of the trinomial expression share a greatest common factor of 3. So begin by factoring 3 out of the expression.

$$3(x^2 + 7x + 6) = 0$$
$$3(x + 1)(x + 6) = 0$$

Now, factor the trinomial expression included within the parentheses. The trinomial can be represented as the product of the binomials $x + 1$ and $x + 6$.

Zero Product Property

If $a \cdot b = 0$, then $a = 0$ or $b = 0$.

$$3(x + 1)(x + 6) = 0$$

Step 3: Solve for x.

Recall that the Zero Product Property states that if a product equals 0 then one of the factors must equal 0. The trinomial expression is represented as the product of 3, and the binomials $x + 1$ and $x + 6$. You can immediately determine that $3 \neq 0$. You must find the values of x that will result in one of the remaining factors having a value of 0.

$$3(x + 1)(x + 6) = 0$$
$$x + 1 = 0 \qquad x + 6 = 0$$

Set each binomial factor equal to 0 and solve for x.

Example 1 (continued)

Solve the quadratic equation below.

$$3x^2 + 21x = -18$$

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

In the first equation, subtract 1 from each side. The result is $x = -1$.

$$\begin{array}{r} x + 6 = 0 \\ -6 \quad -6 \\ \hline x = -6 \end{array}$$

In the second equation, subtract 6 from each side. The result is $x = -6$.

If $x = -1$, then…

$$\begin{aligned} 3x^2 + 21x &= -18 \\ 3(-1)^2 + 21(-1) &= -18 \\ 3 - 21 &= -18 \\ -18 &= -18 \end{aligned}$$

You can conclude that if $x = -1$, or if $x = -6$, the quadratic equation will be satisfied.

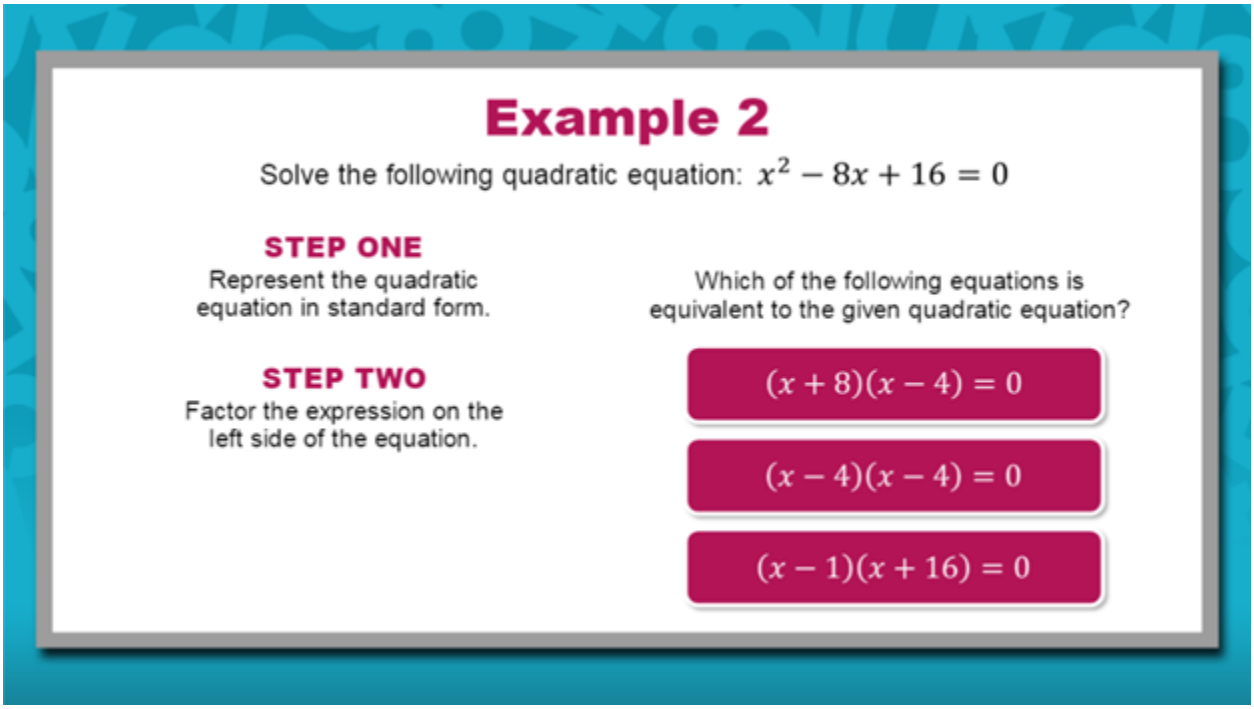
If $x = -6$, then…

$$\begin{aligned} 3x^2 + 21x &= -18 \\ 3(-6)^2 + 21(-6) &= -18 \\ 108 - 126 &= -18 \\ -18 &= -18 \end{aligned}$$

$\{-1, -6\}$

-1 and -6 are solutions to the equation. You can use set notation to show that these values make up the solution set to the quadratic equation.

Example 2



Solve the following quadratic equation:

$$x^2 - 8x + 16 = 0$$

Step 1: Represent the quadratic equation in standard form.

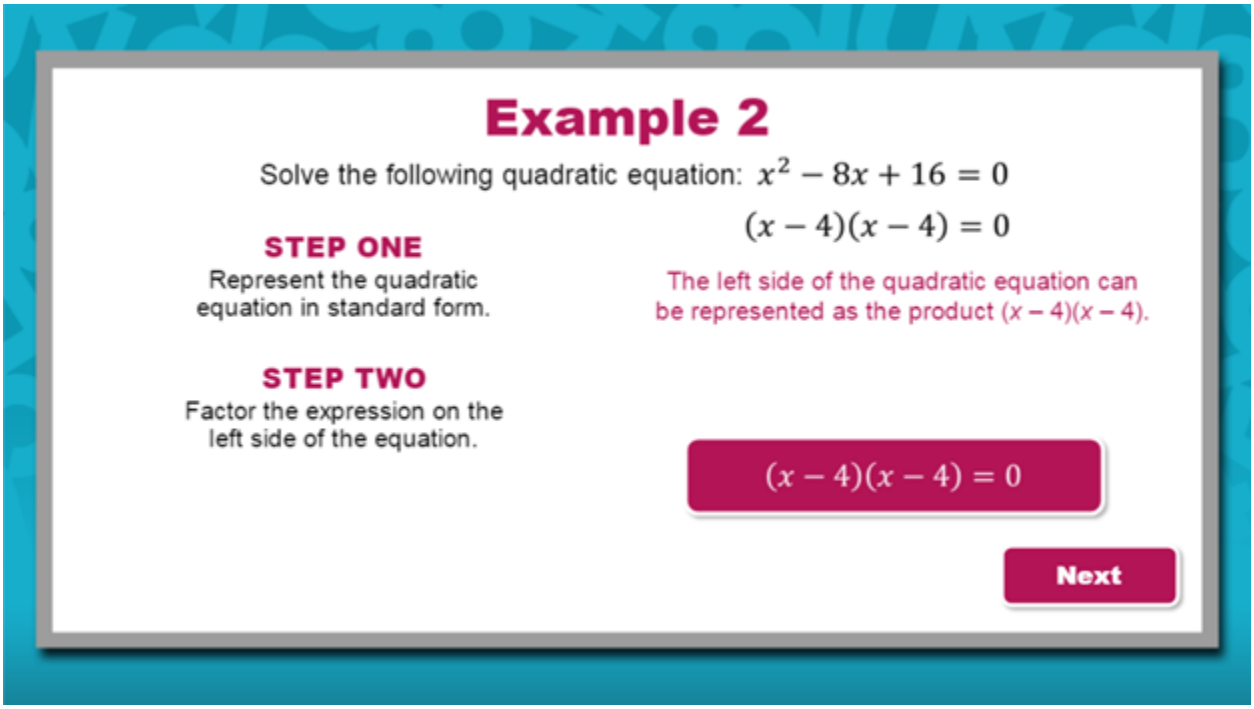
This quadratic equation is already in standard form. So, you can move on to Step 2.

Step 2: Factor the expression on the left side of the equation completely.

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

A) $(x + 8)(x - 4) = 0$
B) $(x - 4)(x - 4) = 0$
C) $(x - 1)(x + 16) = 0$

Example 2 (continued)



Solve the following quadratic equation:

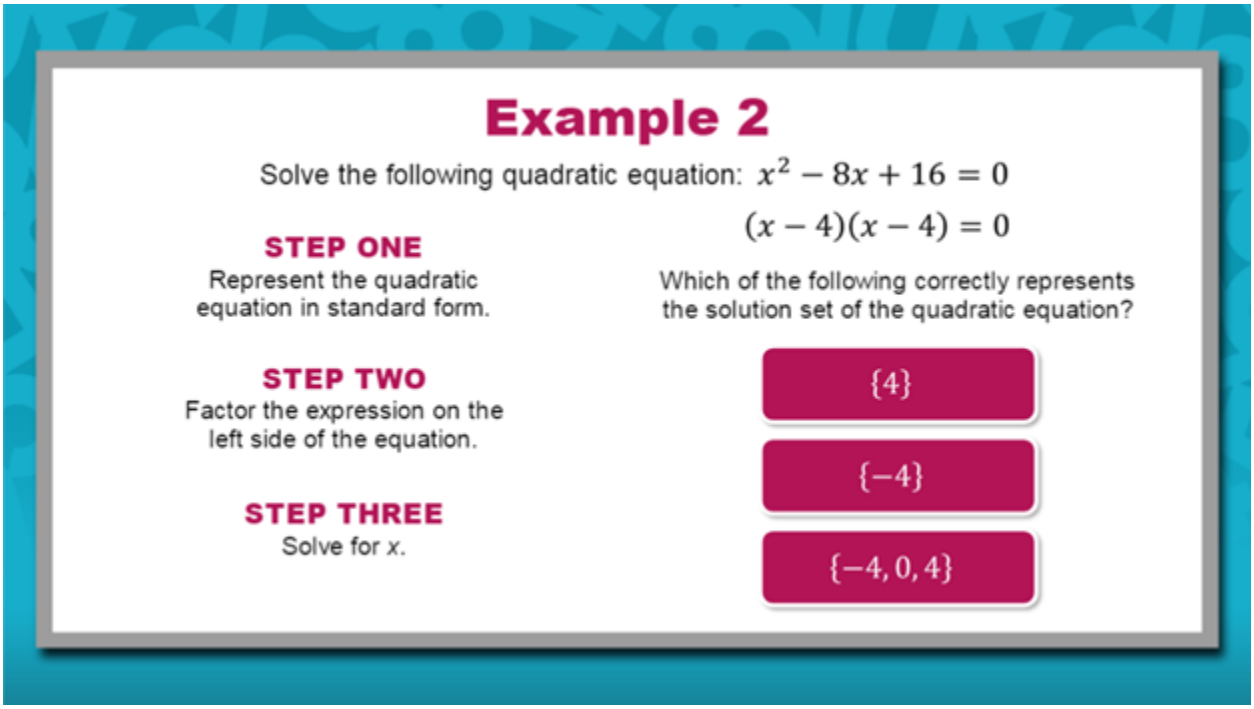
$$x^2 - 8x + 16 = 0$$
$$(x - 4)(x - 4) = 0$$

Step 1: Represent the quadratic equation in standard form.

Step 2: Factor the expression on the left side of the equation completely.

The left side of the quadratic equation can be represented as the product $(x - 4)(x - 4)$. Therefore, the correct answer is $(x - 4)(x - 4) = 0$.

Example 2 (continued)



Solve the following quadratic equation:

$$x^2 - 8x + 16 = 0$$
$$(x - 4)(x - 4) = 0$$

Step 1: Represent the quadratic equation in standard form.

Step 2: Factor the expression on the left side of the equation completely.

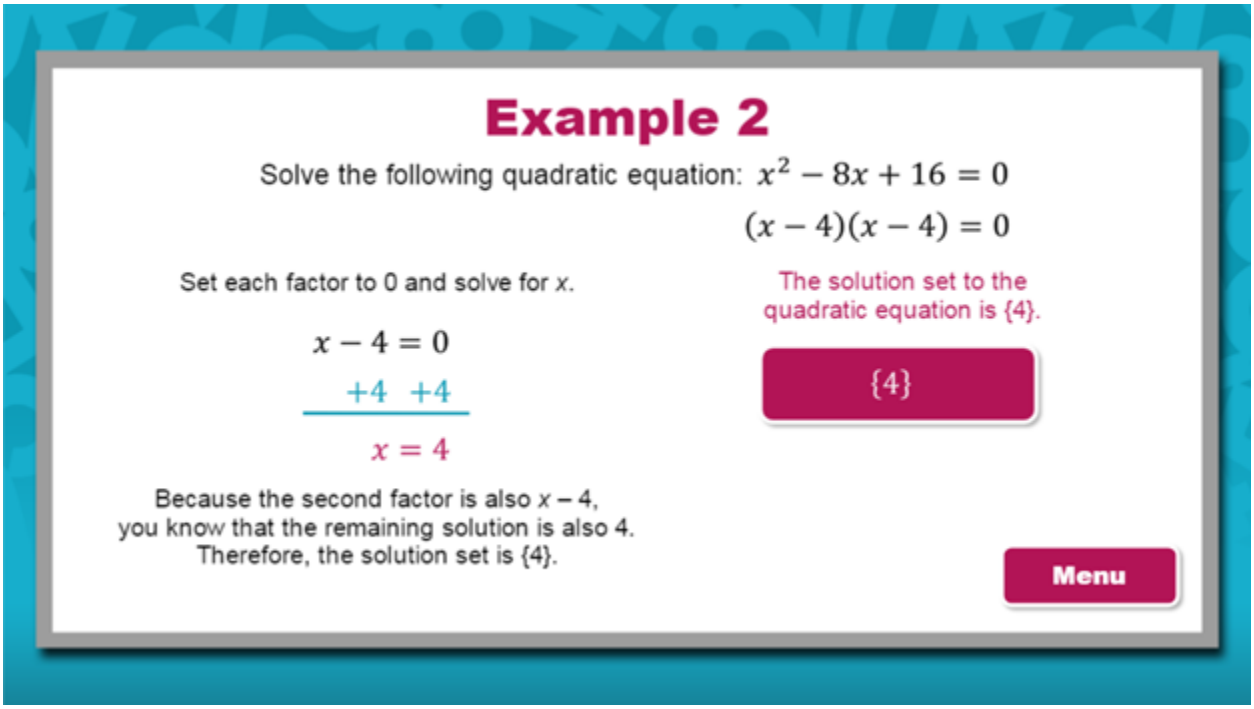
Step 3: Solve for x.

Now that you have factored the trinomial completely, solve for x.

Which of the following correctly represents the solution set of the quadratic equation?

A) $\{4\}$
B) $\{-4\}$
C) $\{-4, 0, 4\}$

Example 2 (continued)



Solve the following quadratic equation:

$$x^2 - 8x + 16 = 0$$
$$(x - 4)(x - 4) = 0$$

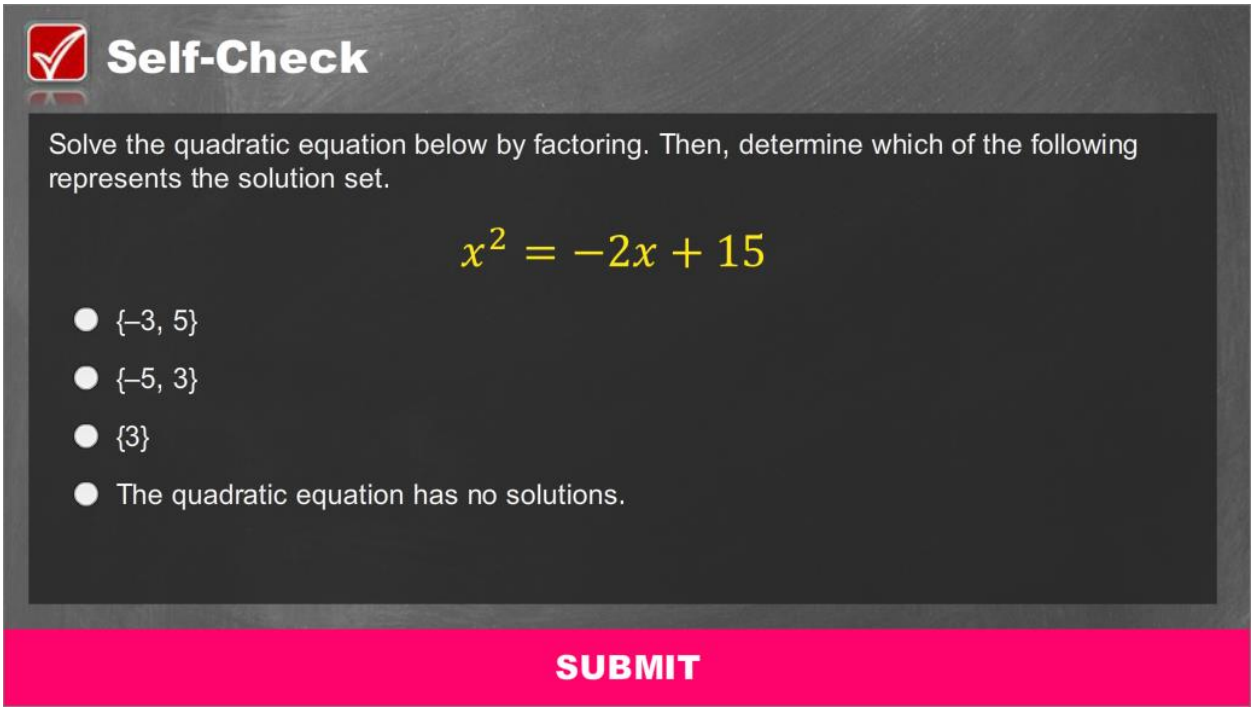
Set each factor equal to 0 and solve for x.

$$x - 4 = 0$$
$$+4 \quad +4 \qquad \text{Add 4 to each side.}$$
$$x = 4$$

Because the second factor is also $x - 4$, you know that the remaining solution is also 4. Therefore, the solution set is {4}.

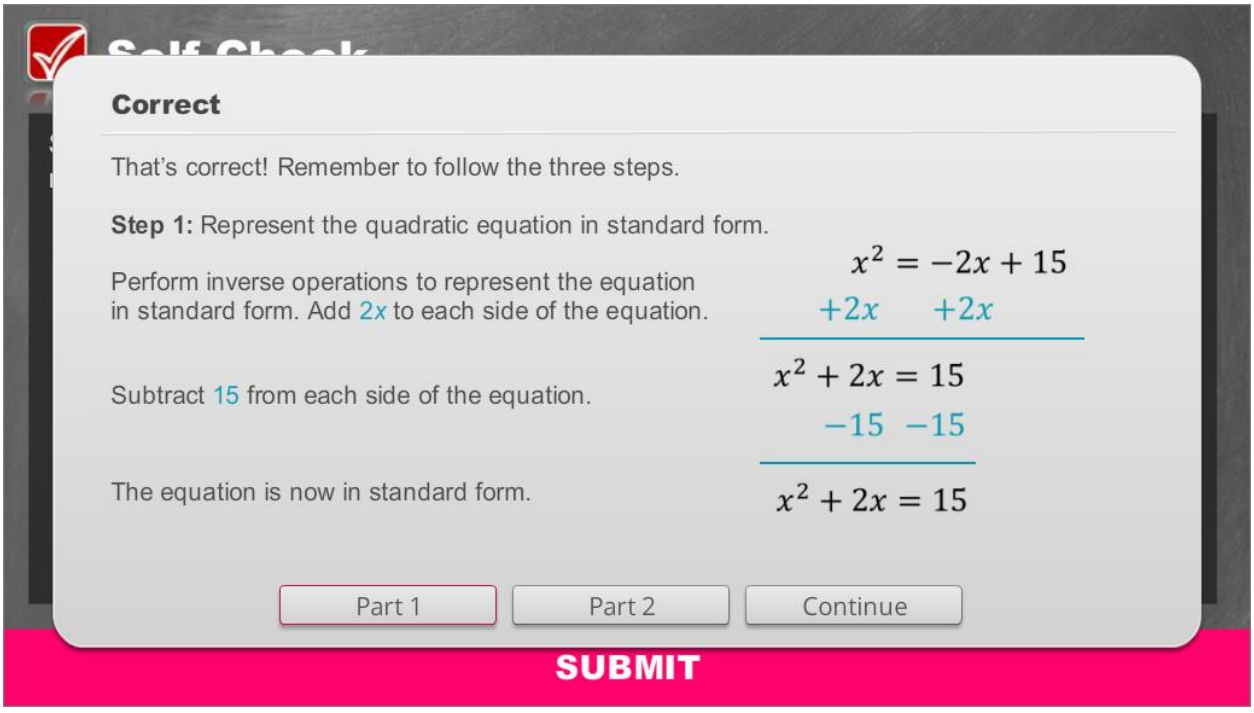
The solution set to the quadratic equation is {4}.

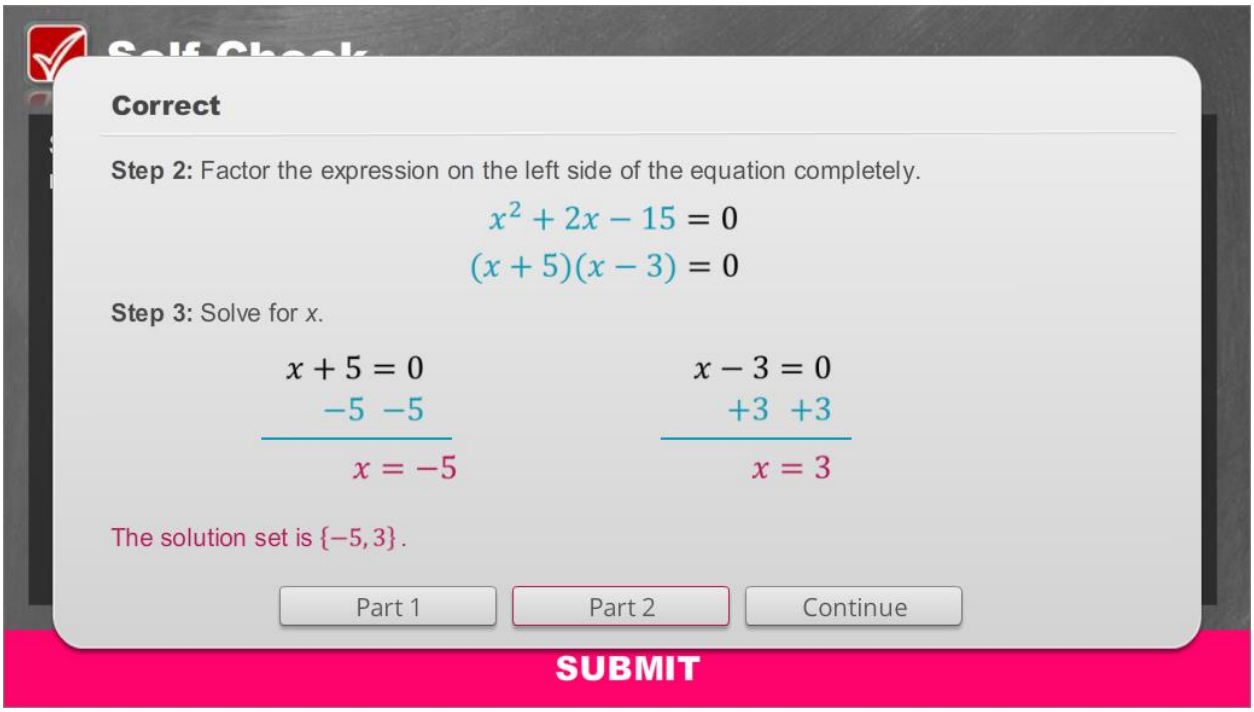
Self-Check



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

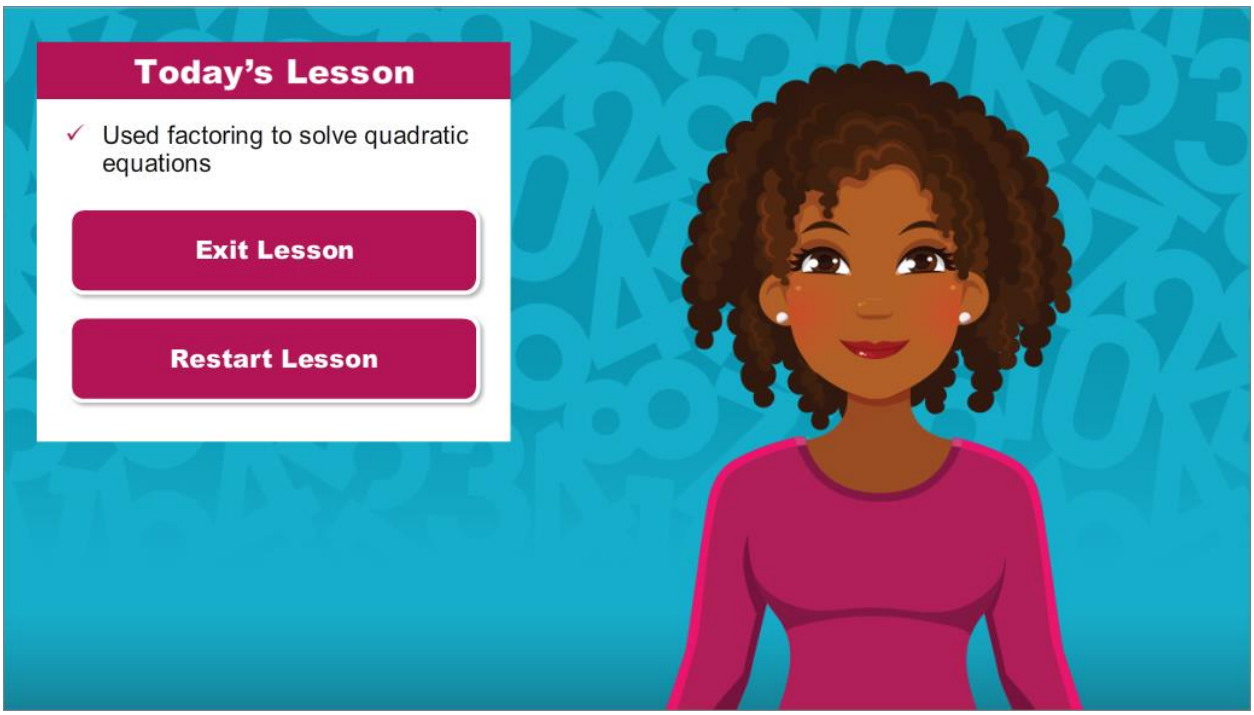
Self-Check: Answer





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 factoring to solve quadratic equations.