

Module 6: Solving Quadratic Equations

Topic 1: Solving Quadratic Equations by Factoring

Introduction



Today's Lesson

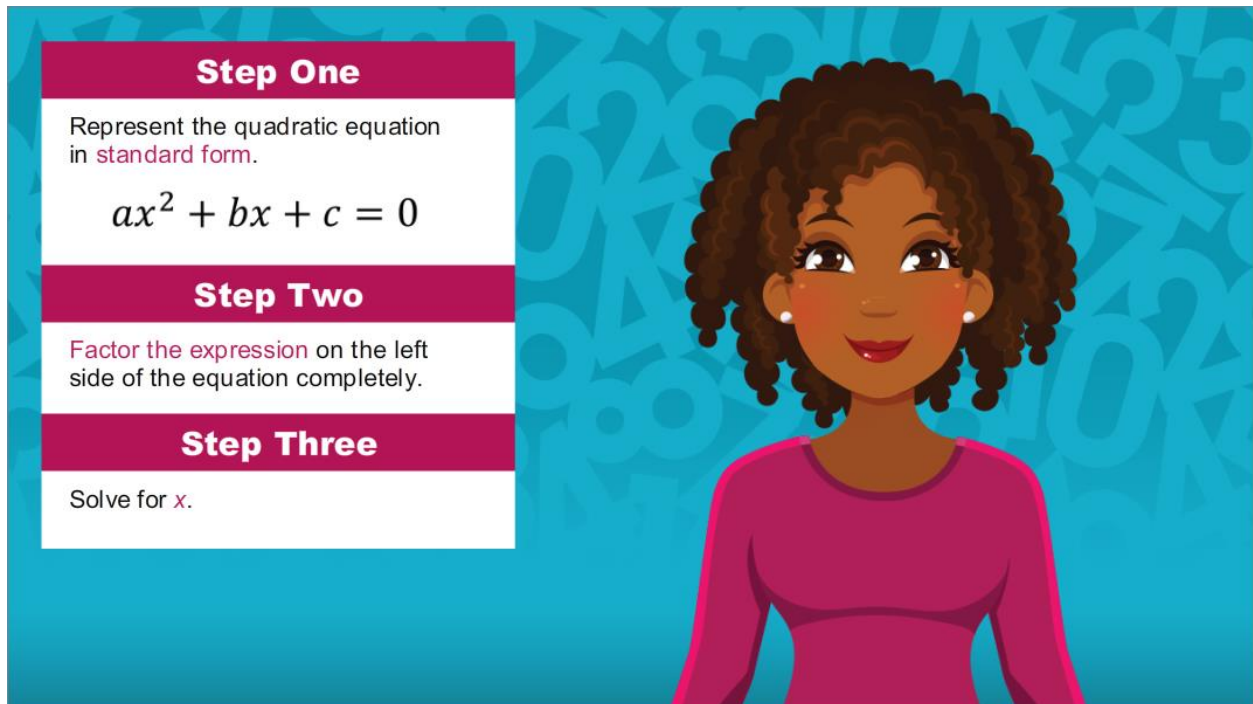
- You will learn how to use factoring to solve quadratic equations.

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.

Module 6: Solving Quadratic Equations

Topic 1: Solving Quadratic Equations by Factoring

Anticipatory Set



Step One

Represent the quadratic equation in **standard form**.

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

Step Two

Factor the expression on the left side of the equation completely.

Step Three

Solve for x .

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.

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Solving Quadratic Equations By Factoring

SOLVING QUADRATIC EQUATIONS BY FACTORING

Click the Examples Below to Learn More

Example 1

Self-Check

Example 2

Click the examples below to learn more

- Example 1
- Example 2
- Self-Check

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Example 1

Solve the quadratic equation below.

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

$$\begin{array}{r} 3x^2 + 21x = -18 \\ \quad + 18 \quad \quad + 18 \\ \hline 3x^2 + 21x + 18 = 0 \end{array}$$

$$\begin{aligned} 3x^2 + 21x + 18 &= 0 \\ 3(x^2 + 7x + 6) &= 0 \end{aligned}$$

$$\begin{aligned} 3(x^2 + 7x + 6) &= 0 \\ 3(x + 1)(x + 6) &= 0 \end{aligned}$$

Zero Product Property

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

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

$$\begin{aligned} 3(x + 1)(x + 6) &= 0 \\ x + 1 = 0 \quad x + 6 &= 0 \end{aligned}$$

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 $3x^2 + 21x + 18 = 0$.

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.

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

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.

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

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Example 1 (continued)

Solve the quadratic equation below.

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

$$x + 1 = 0$$

$$\begin{array}{r} -1 \quad -1 \\ \hline \end{array}$$

$$x = -1$$

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

$$x + 6 = 0$$

$$\begin{array}{r} -6 \quad -6 \\ \hline \end{array}$$

$$x = -6$$

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

If $x = -1$, then...

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

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

$$3(-1)^2 + 21(-1) = -18$$

$$3 - 21 = -18$$

$$-18 = -18$$

If $x = -6$, then...

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

$$3(-6)^2 + 21(-6) = -18$$

$$108 - 126 = -18$$

$$-18 = -18$$

$\{-1, -6\}$

-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.

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Example 2

Example 2

Solve the following quadratic equation: $x^2 - 8x + 16 = 0$

STEP ONE
Represent the quadratic equation in standard form.

STEP TWO
Factor the expression on the left side of the equation.

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

$(x + 8)(x - 4) = 0$

$(x - 4)(x - 4) = 0$

$(x - 1)(x + 16) = 0$

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) $(x - 1)(x + 16) = 0$

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Example 2 (continued)

Example 2

Solve the following quadratic equation: $x^2 - 8x + 16 = 0$

$(x - 4)(x - 4) = 0$

STEP ONE
Represent the quadratic equation in standard form.

The left side of the quadratic equation can be represented as the product $(x - 4)(x - 4)$.

STEP TWO
Factor the expression on the left side of the equation.

$(x - 4)(x - 4) = 0$

Next

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 $(x - 4)(x - 4) = 0$.

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Example 2 (continued)

Example 2

Solve the following quadratic equation: $x^2 - 8x + 16 = 0$

$(x - 4)(x - 4) = 0$

STEP ONE
Represent the quadratic equation in standard form.

STEP TWO
Factor the expression on the left side of the equation.

STEP THREE
Solve for x .

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

{4}

{-4}

{-4, 0, 4}

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}

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Example 2 (continued)

Example 2

Solve the following quadratic equation: $x^2 - 8x + 16 = 0$
 $(x - 4)(x - 4) = 0$

Set each factor to 0 and solve for x .

$$\begin{array}{r} x - 4 = 0 \\ +4 \quad +4 \\ \hline x = 4 \end{array}$$

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

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

Menu

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 .

$$\begin{array}{r} x - 4 = 0 \\ +4 \quad +4 \quad \text{Add 4 to each side.} \\ \hline x = 4 \end{array}$$

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 $\{4\}$.

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Self-Check



Self-Check

Solve the quadratic equation below by factoring. Then, determine which of the following represents the solution set.

$$x^2 = -2x + 15$$

- {-3, 5}
- {-5, 3}
- {3}
- The quadratic equation has no solutions.

SUBMIT

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

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Self-Check: Answer

Self Check

Correct

That's correct! Remember to follow the three steps.

Step 1: Represent the quadratic equation in standard form.

Perform inverse operations to represent the equation in standard form. Add $2x$ to each side of the equation.

$$\begin{array}{r} x^2 = -2x + 15 \\ +2x \quad +2x \\ \hline x^2 + 2x = 15 \end{array}$$

Subtract 15 from each side of the equation.

$$\begin{array}{r} x^2 + 2x = 15 \\ -15 \quad -15 \\ \hline x^2 + 2x = 15 \end{array}$$

The equation is now in standard form.

Part 1
Part 2
Continue

SUBMIT

Self Check

Correct

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

$$\begin{aligned} x^2 + 2x - 15 &= 0 \\ (x + 5)(x - 3) &= 0 \end{aligned}$$

Step 3: Solve for x .

$$\begin{array}{r} x + 5 = 0 \\ -5 \quad -5 \\ \hline x = -5 \end{array}$$

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

The solution set is $\{-5, 3\}$.

Part 1
Part 2
Continue

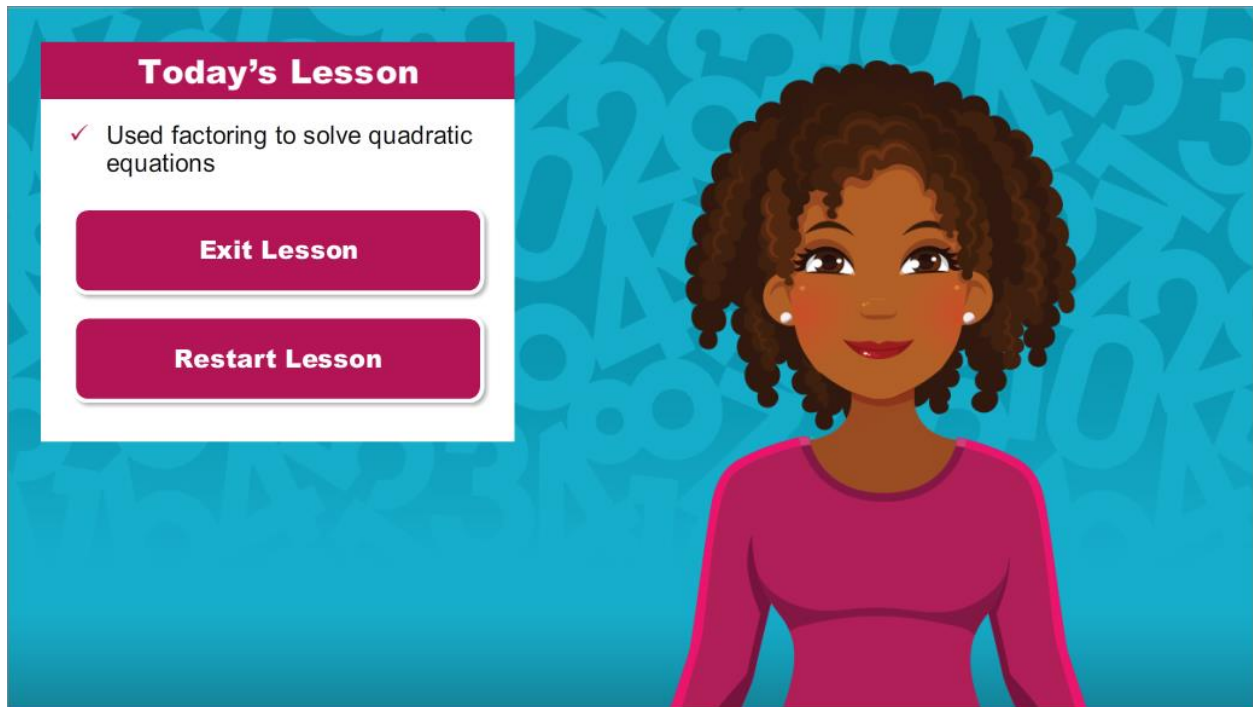
SUBMIT

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

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Conclusion



The image shows a digital interface for a lesson conclusion. On the left, a white panel with a pink header titled "Today's Lesson" contains a checkmark and the text "Used factoring to solve quadratic equations". Below this are two pink buttons: "Exit Lesson" and "Restart Lesson". To the right of the panel is a cartoon illustration of a young woman with dark curly hair, wearing a pink long-sleeved top, set against a blue background with faint mathematical symbols.

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