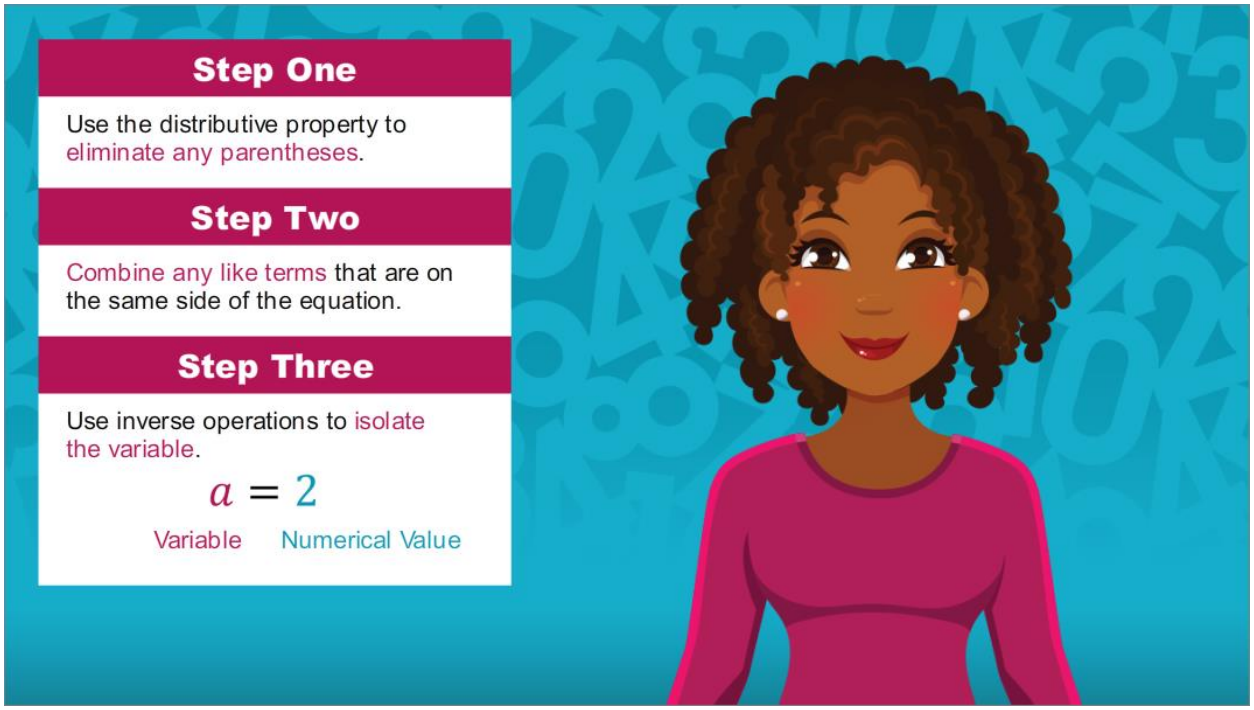
Module 5: Solving Linear Equations

Topic 2 Content: Solving Multi-Step Equations – Part 1

Introduction

Hello and welcome! I'm so glad you could join me for this lesson in Algebra I, where you learn how to apply the properties of real numbers and the properties of equality to solve multi-step linear equations.

Steps



Use the following steps to guide you in the process of solving equations:

Step 1: Are there any ***parentheses?***

If so, use the distributive property to eliminate them.

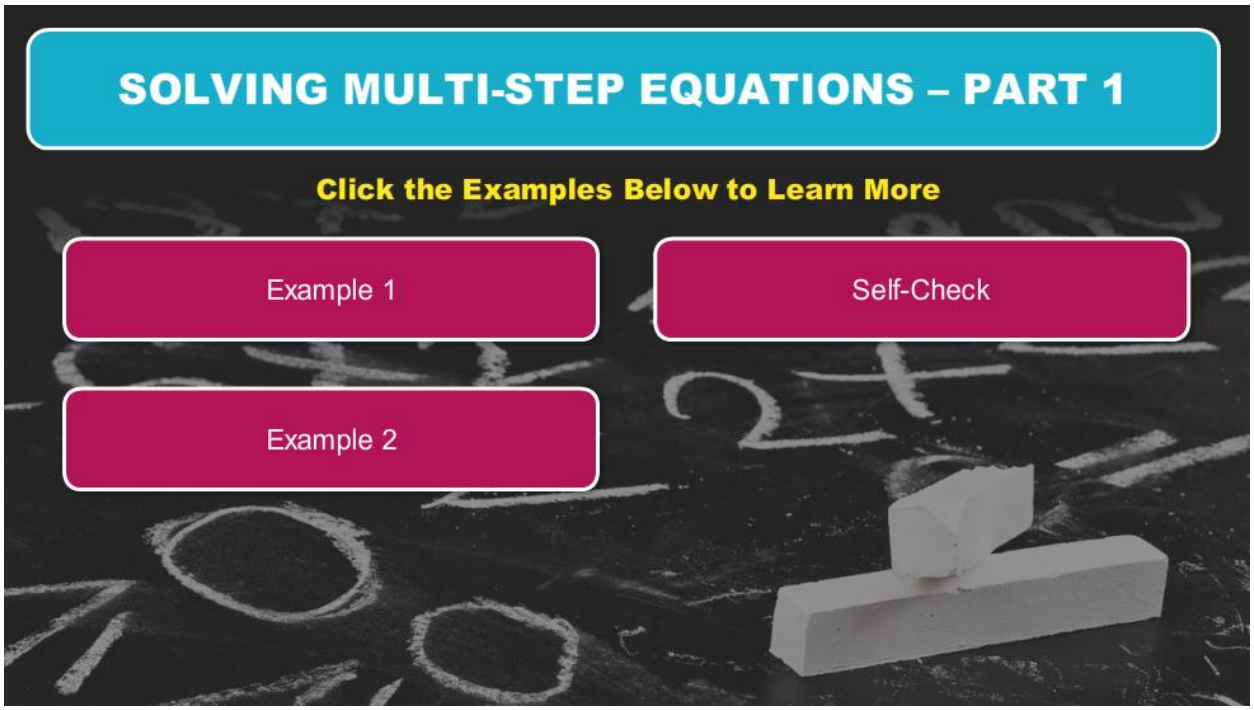
Step 2: Are there any ***like terms to combine?***

Remember to only combine like terms that are on the same side of the equation.

Step 3: Now, it's time to ***isolate the variable.***

When solving an equation, the goal is typically to end with your variable on the left side of the equation and your numerical value on the right side.

Solving Multi-Step Equations – Part 1



Click the examples below to learn more.

- Example One
- Example Two
- Self-Check

Example 1

Solve for x: $6(2-x)+3=9$

$6(2-x)+3=9$

Step 1: Are there any ***parentheses?***

$6(2-x)+3=9$

This equation does have parentheses, so you will need to use the distributive property.

$12-6x+3=9$

$6 \cdot 2 = 12$ and $6 \cdot -x = -6x$

Bring down the addition sign and 3, along with the equals sign and 9.

$12-6x+3=9$

Step 2: Do you have any ***like terms to combine?***

$15-6x=9$

In this case you do have like terms to combine. Remember to only combine like terms that are on the same side of the equation.

$12+3=15$

Bring down the subtraction sign and $6x$, along with the equals sign and 9.

$15 - 6x = 9$

Step 3: Now, it's time to ***isolate the variable.***

$-15 \quad -15$

$-6x = -6$

You can begin using inverse operations to isolate the variable.

Recall that the Subtraction Property of Equality states that you can subtract the same value from each side of an equation and the equation will remain true. So, begin isolating the variable by subtracting 15 from each side of the equation.

$15-15=0$. So these terms are canceled out. Bring down the subtraction sign, $6x$, and the equals sign.

$9-15=-6$.

Example 1 (continued)

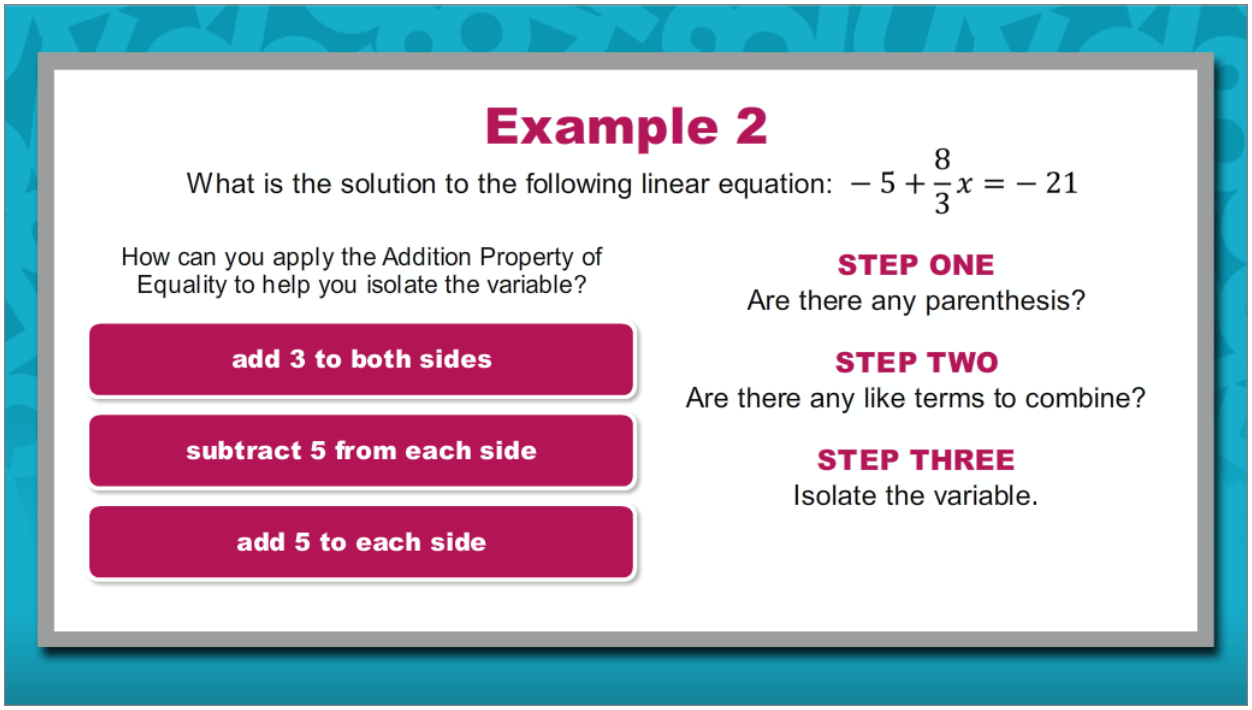
$$\frac{-6x}{-6} = \frac{-6}{-6}$$

$$x = 1$$

There is one more step to isolating the variable. Recall that the Division Property of Equality states that you can divide each side of an equation by the same value and the equation will remain true. To isolate the variable, divide each side of the equation by -6.

The solution is $x = 1$.

Example 2



What is the solution to the linear equation below?

$$-5+\frac{8}{3}x=-21$$

Step 1: Are there any ***parentheses?***

This equation does not have any parentheses, so you will not need to use the distributive property. You can move on to Step 2.

Step 2: Do you have any ***like terms to combine?***

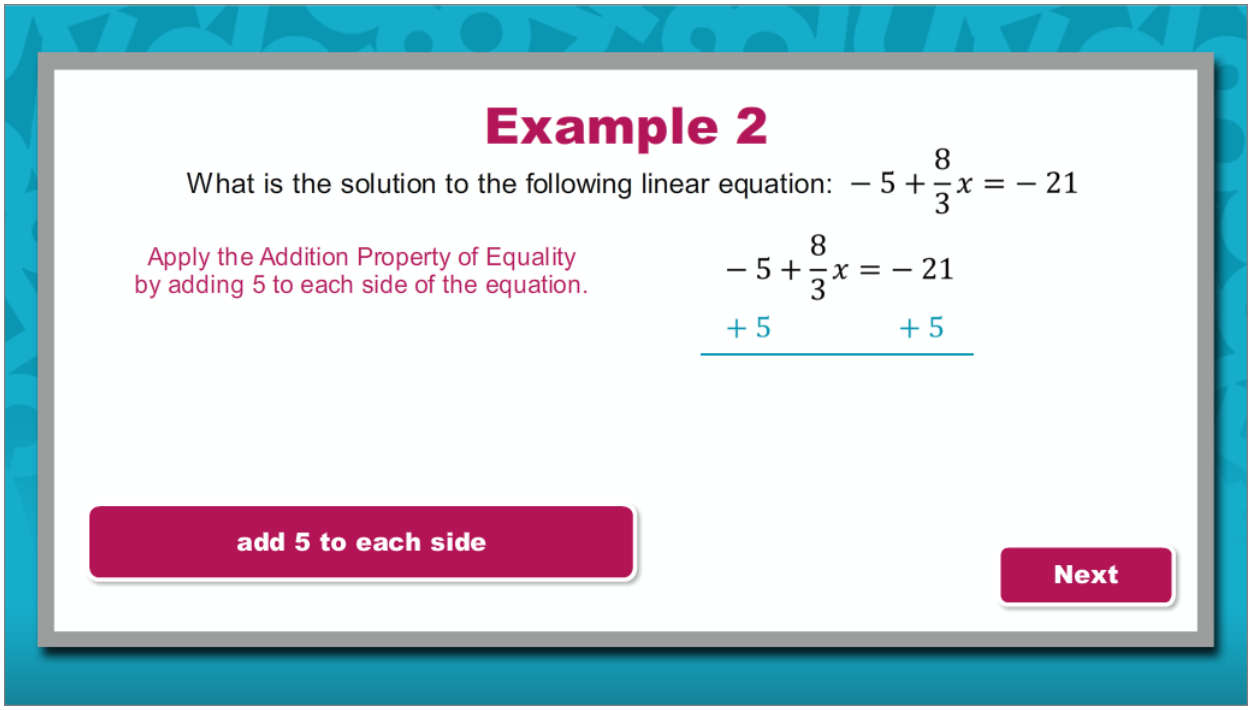
In this case, you have no like terms to combine. So, move on to Step 3.

Step 3: Now, it's time to ***isolate the variable.***

How can you apply the Addition Property of Equality to help you isolate the variable?

A) add 3 to both sides of the equation
B) subtract 5 from each side of the equation
C) add 5 to each side of the equation

Example 2 (continued)



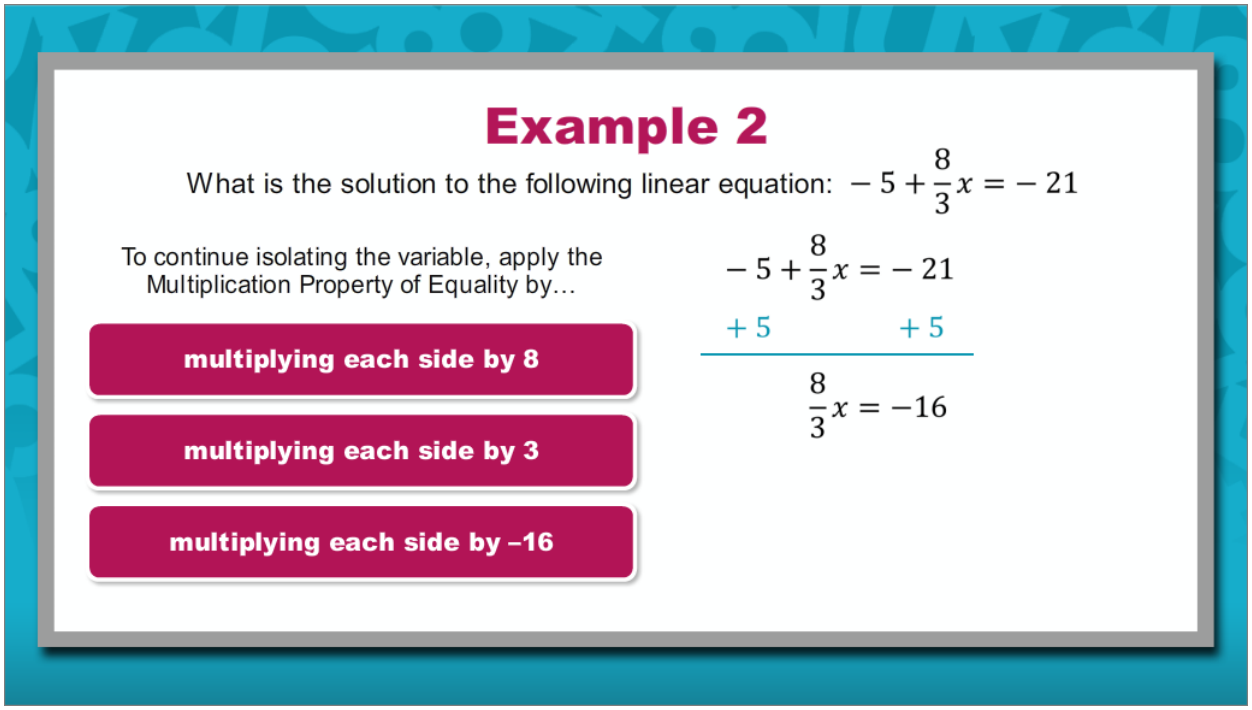
What is the solution to the linear equation below?

$$-5+\frac{8}{3}x=-21$$

Apply the Addition Property of Equality by adding 5 to each side of the equation.

$$-5+\frac{8}{3}x=-21$$
$$+5 \qquad +5$$

Example 2 (continued)



What is the solution to the linear equation below?

$$-5+\frac{8}{3}x=-21$$

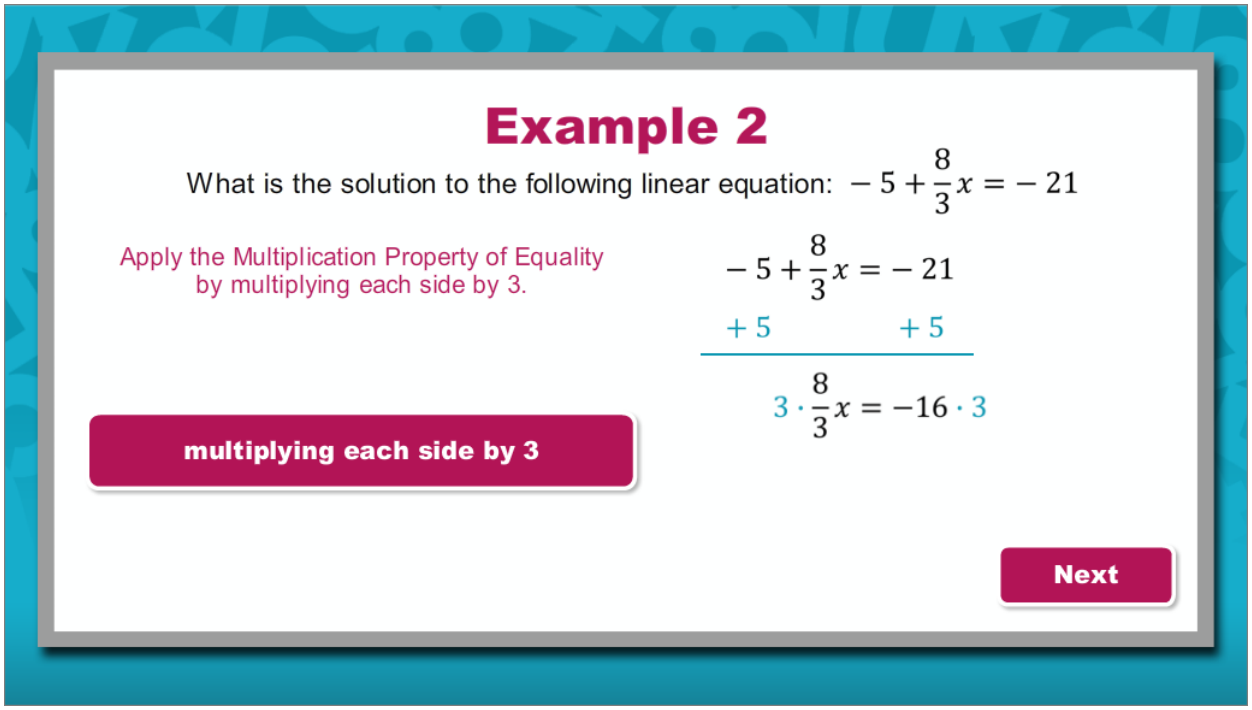
After 5 is added to each side of the equation, the result is $\frac{8}{3}x=-16$.

To continue isolating the variable, apply the Multiplication Property of Equality by…

$$-5+\frac{8}{3}x=-21$$
$$+5 \quad +5$$
$$\frac{8}{3}x=-16$$

A) multiplying each side by 8
B) multiplying each side by 3
C) multiplying each side by -16

Example 2 (continued)



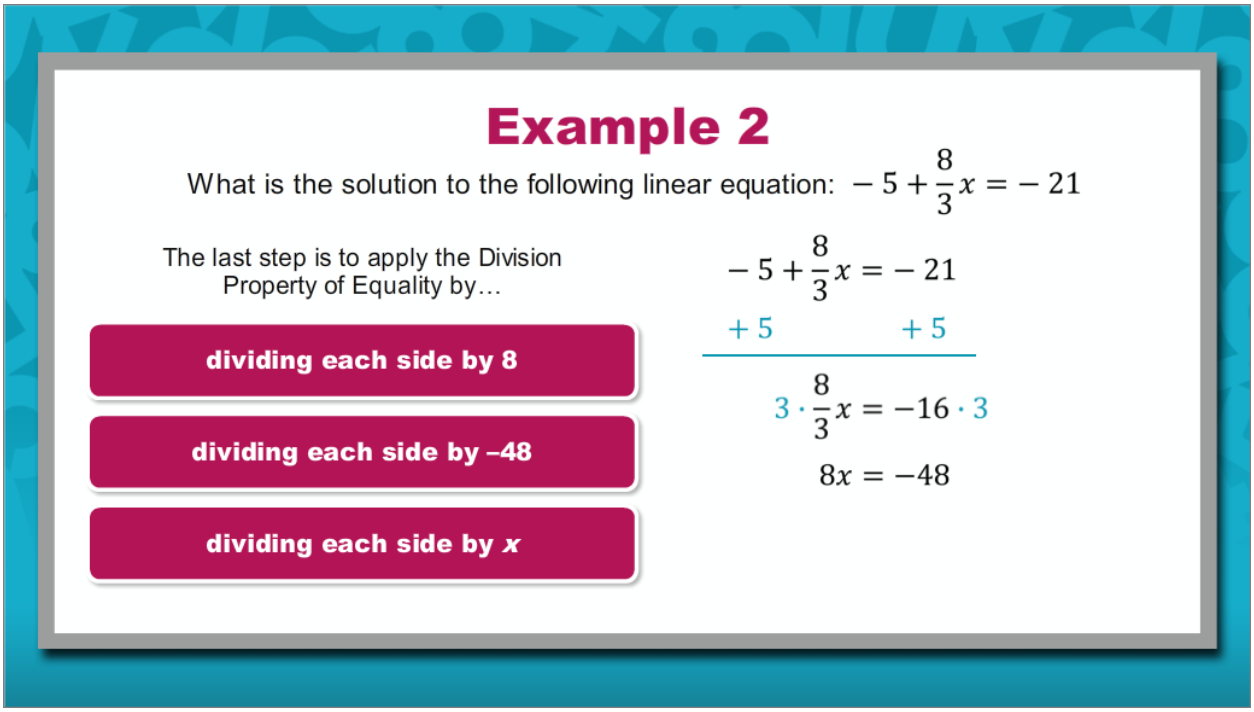
What is the solution to the linear equation below?

$$-5+\frac{8}{3}x=-21$$

Apply the Multiplication Property of Equality by multiplying each side by 3.

$$-5+\frac{8}{3}x=-21$$
$$+5 \qquad +5$$
$$3\cdot\frac{8}{3}x=-16\cdot3$$

Example 2 (continued)



What is the solution to the linear equation below?

$$-5+\frac{8}{3}x=-21$$

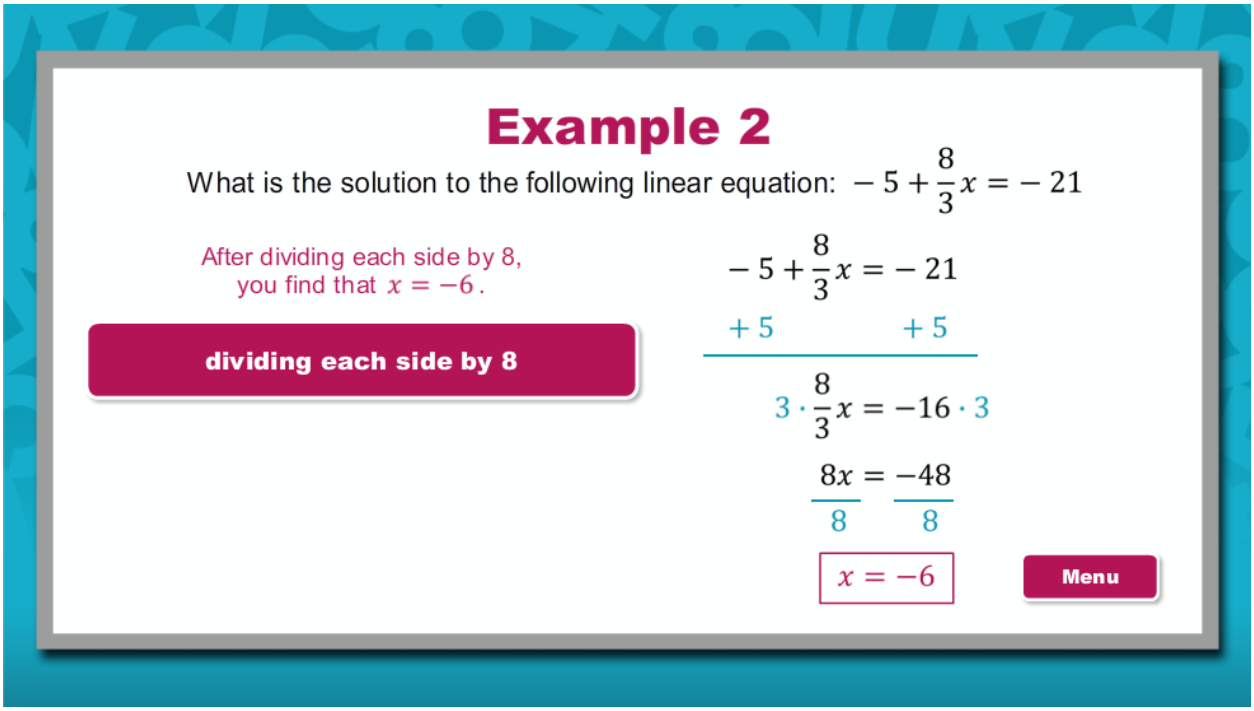
After each side of the equation is multiplied by 3, the result is $8x=-48$.

The last step is to apply the Division Property of Equality by…

$$-5+\frac{8}{3}x=-21$$
$$+5 \quad +5$$
$$3\cdot\frac{8}{3}x=-16\cdot 3$$
$$8x=-48$$

A) dividing each side by 8
B) dividing each side by -48
C) dividing each side by x

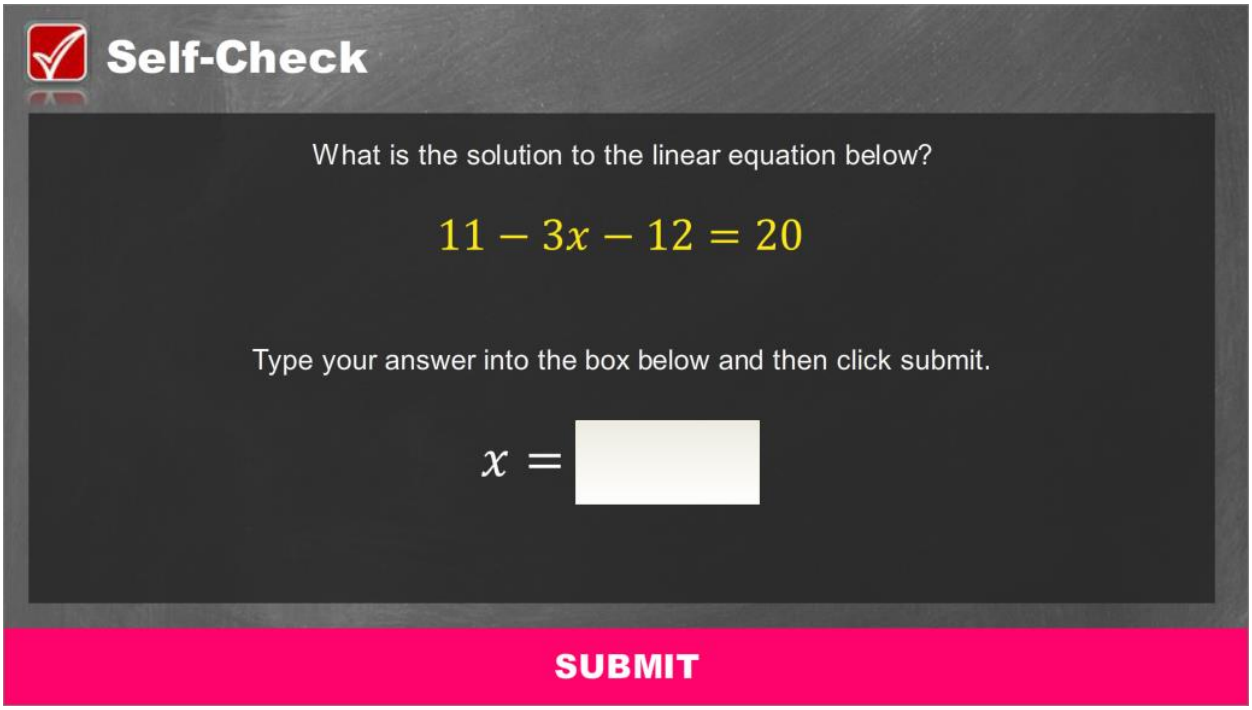
Example 2 (continued)



After dividing each side by 8, you find that $x = -6$.

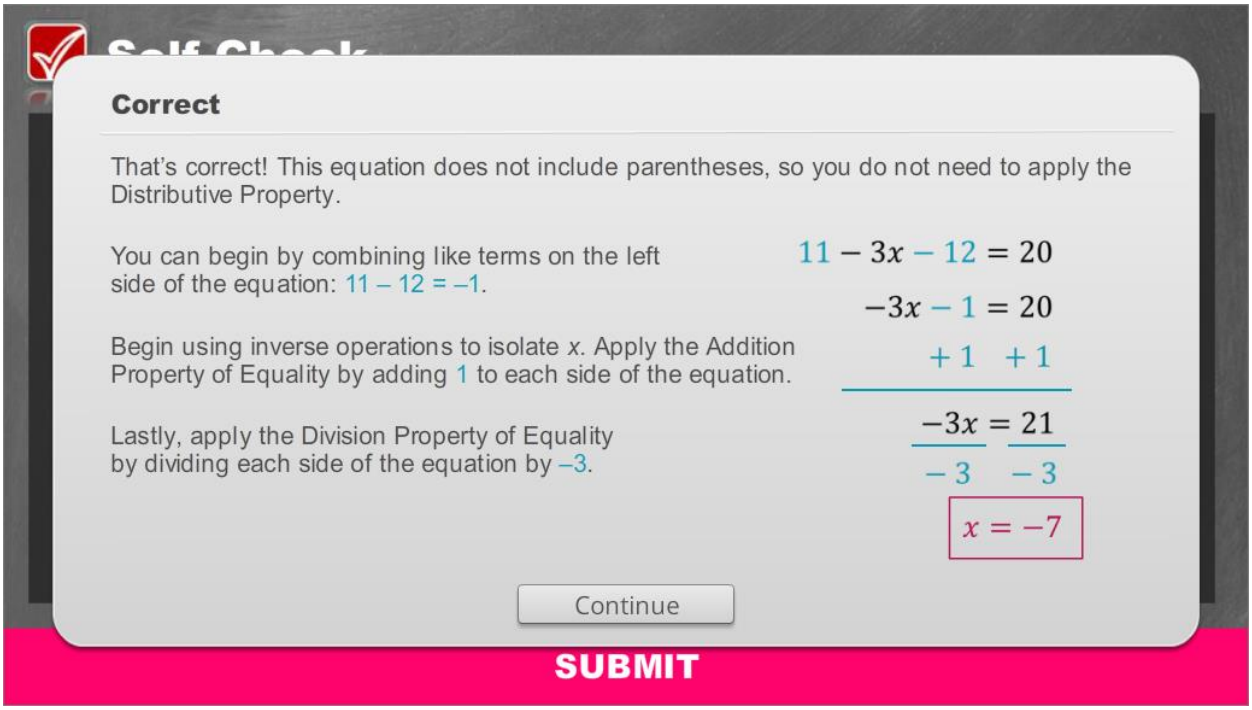
$$-5+\frac{8}{3}x=-21$$
$$+5 \qquad +5$$
$$3\cdot\frac{8}{3}x=-16\cdot 3$$
$$\frac{8x}{8}=\frac{-48}{8}$$
$$x=-6$$

Self-Check 1



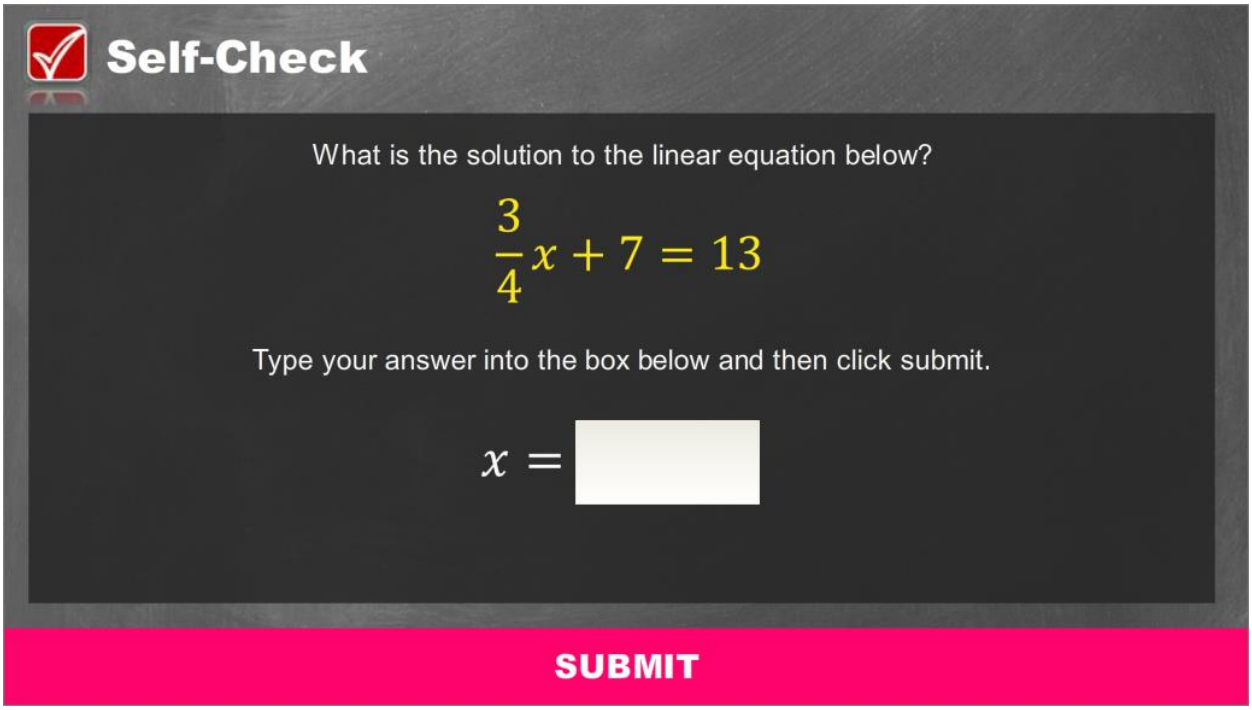
Solve the problem in the image above to check your understanding of the content.

Self-Check 1: Answer



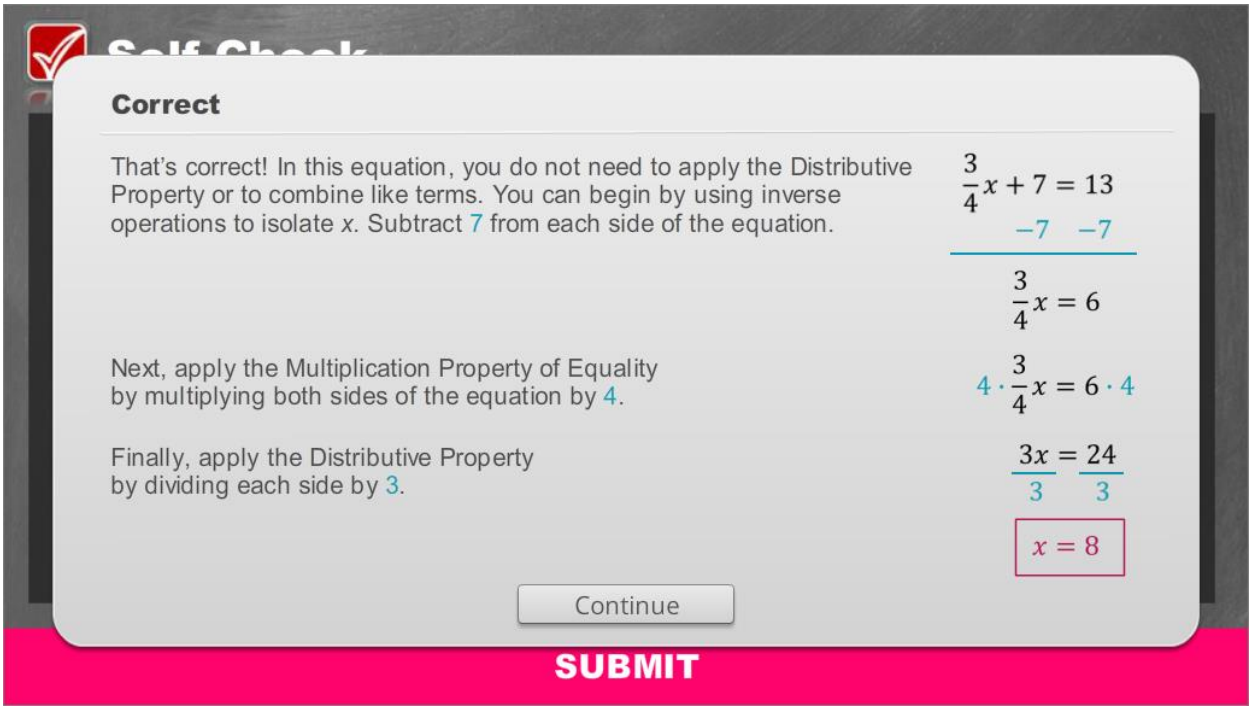
For your reference, the image above shows the correct solution to the self-check problem.

Self-Check 2



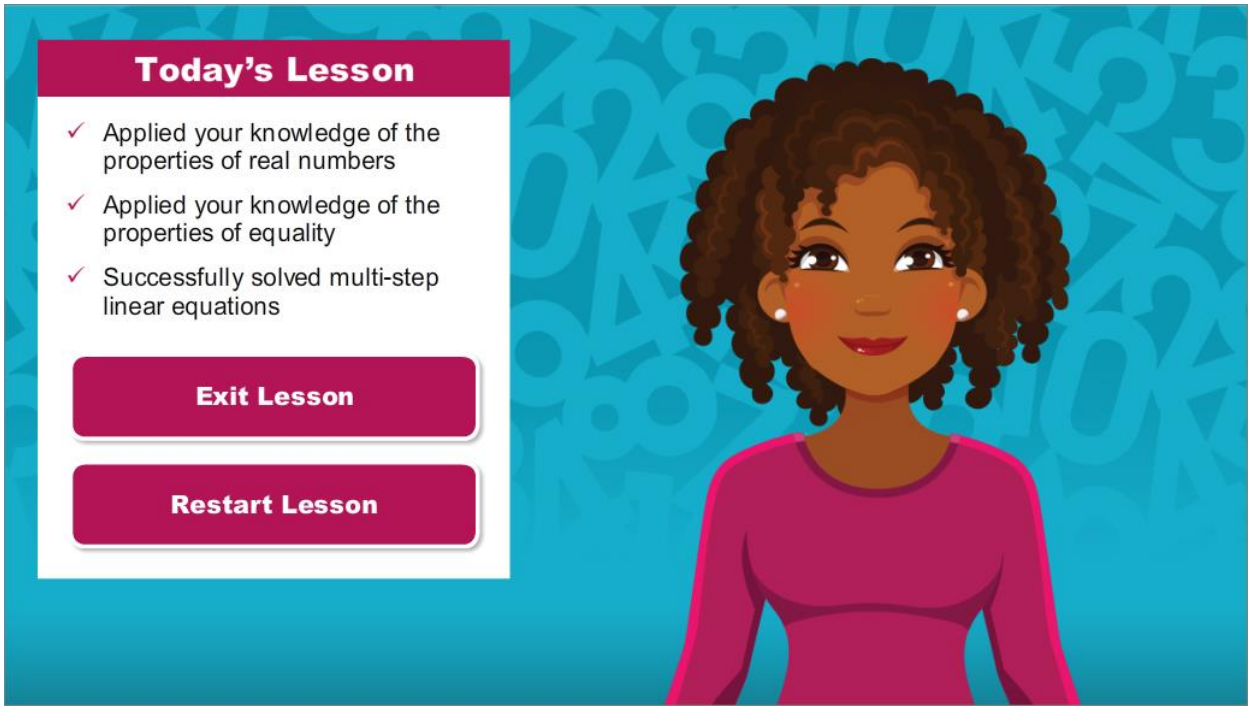
Solve the problem in the image above to check your understanding of the content.

Self-Check 2: Answer



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

Conclusion



You have reached the conclusion of this lesson where you learned how to apply the properties of real numbers and the properties of equality to solve multi-step linear equations.