Module 5: Solving Linear Equations

Topic 1 Content: Properties of Equality

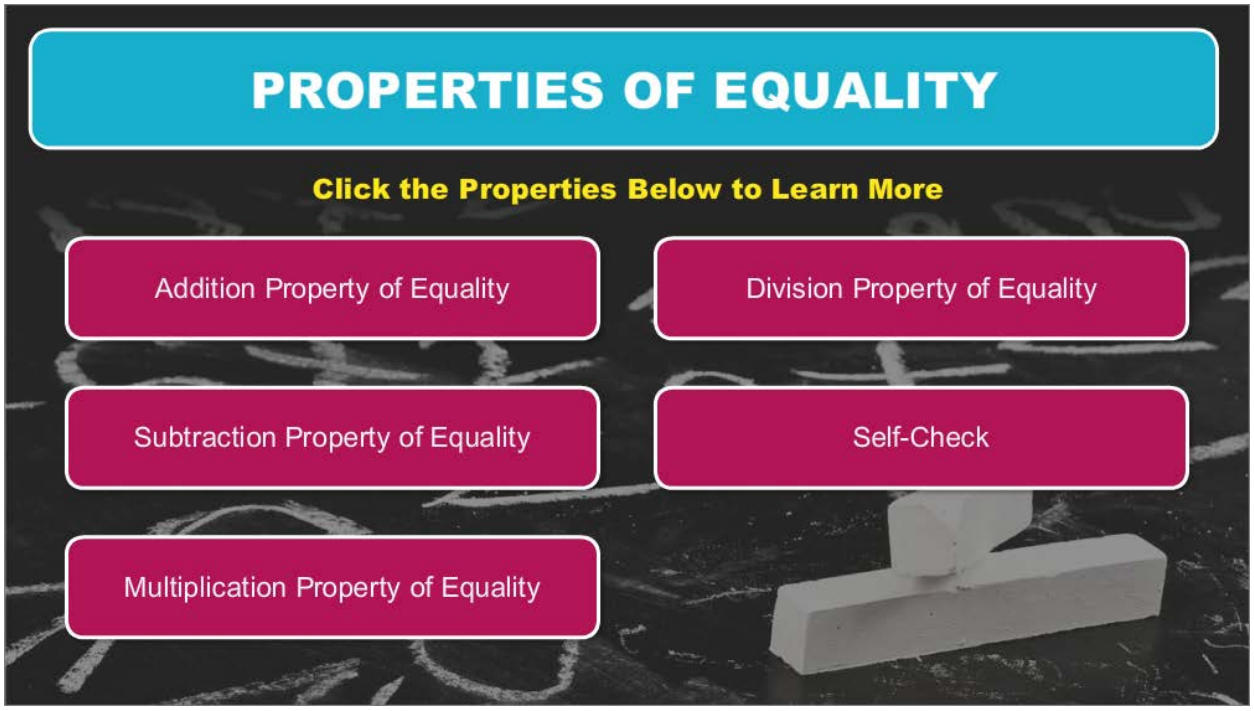
Introduction

I'm so glad to have you here for this lesson in Algebra I. In this lesson, you will explore how the properties of equality help you determine the solution to a linear equation.

Module 5: Solving Linear Equations

Topic 1 Content: Properties of Equality

Properties of Equality



Click the examples below to learn more.

- Addition Property of Equality
- Subtraction Property of Equality
- Multiplication Property of Equality
- Division Property of Equality
- Self-Check

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Topic 1 Content: Properties of Equality

Addition Property of Equality

The Addition Property of Equality states that for all real numbers, if $a = b$, then $a + c = b + c$. In other words, when the same value is added to each side of an equation, the equation will remain true.

For a simple application of this property, consider the equation, $3 = 3$. If 4, for example, was added to each side of the equation, the equation would remain true.

The Addition Property of Equality can be applied to determine the solution to an equation.

Consider the equation, $x - 9 = 2$. Recall that when solving an equation, the goal is to isolate the variable. In this equation, apply the Addition Property of Equality by adding 9 to both sides of the equation. The solution is $x = 11$.

If $a = b$, then $a + c = b + c$.

$$\begin{aligned} 3 &= 3 \\ 3 + 4 &= 3 + 4 \\ 7 &= 7 \end{aligned}$$

$$\begin{array}{r} x - 9 = 2 \\ +\ 9 \quad +9 \\ \hline x = 11 \end{array}$$

Subtraction Property of Equality

The Subtraction Property of Equality states that for all real numbers, if $a = b$, then $a - c = b - c$. In other words, when the same value is subtracted from each side of an equation, the equation will remain true.

Consider the equation, $3 = 3$. If 4 was subtracted from each side of the equation, the equation would remain true.

The Subtraction Property of Equality can be applied to determine the solution to an equation.

Consider the equation, $x + 6 = 8$. Apply the Subtraction Property of Equality by subtracting 6 from both sides of the equation. The solution is $x = 2$.

If $a = b$, then $a - c = b - c$.

$$3 = 3$$
$$3 - 4 = 3 - 4$$
$$-1 = -1$$

$$\begin{array}{r} x + 6 = 8 \\ -6 \quad -6 \\ \hline x = 2 \end{array}$$

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Multiplication Property of Equality

The Multiplication Property of Equality states that for all real numbers, if $a = b$, then $a \cdot c = b \cdot c$. In other words, if both sides of an equation are multiplied by the same value, the equation will remain true.

Consider the equation, $3 = 3$. If both sides were multiplied by 4, the equation would remain true.

The Multiplication Property of Equality can be applied to determine the solution to an equation.

Consider the equation, $\frac{1}{3}x = 5$. Apply the Multiplication Property of Equality by multiplying each side by 3. The result is $1x = 15$ or more simply, $x = 15$.

If $a = b$, then $a \cdot c = b \cdot c$.

$$3 = 3$$
$$3 \cdot 4 = 3 \cdot 4$$
$$12 = 12$$

$$\frac{1}{3}x = 5$$
$$3 \cdot \frac{1}{3}x = 5 \cdot 3$$
$$1x = 15$$
$$x = 15$$

Division Property of Equality

The Division Property of Equality states that for all real numbers, if $a = b$, and $c \neq 0$, then $\frac{a}{c} = \frac{b}{c}$. In other words, if both sides of an equation are divided by the same value, the equation will remain true.

Consider the equation, $18 = 18$. If both sides of the equation were divided by 2, the equation would remain true.

The Division Property of Equality can be applied to determine the solution to an equation.

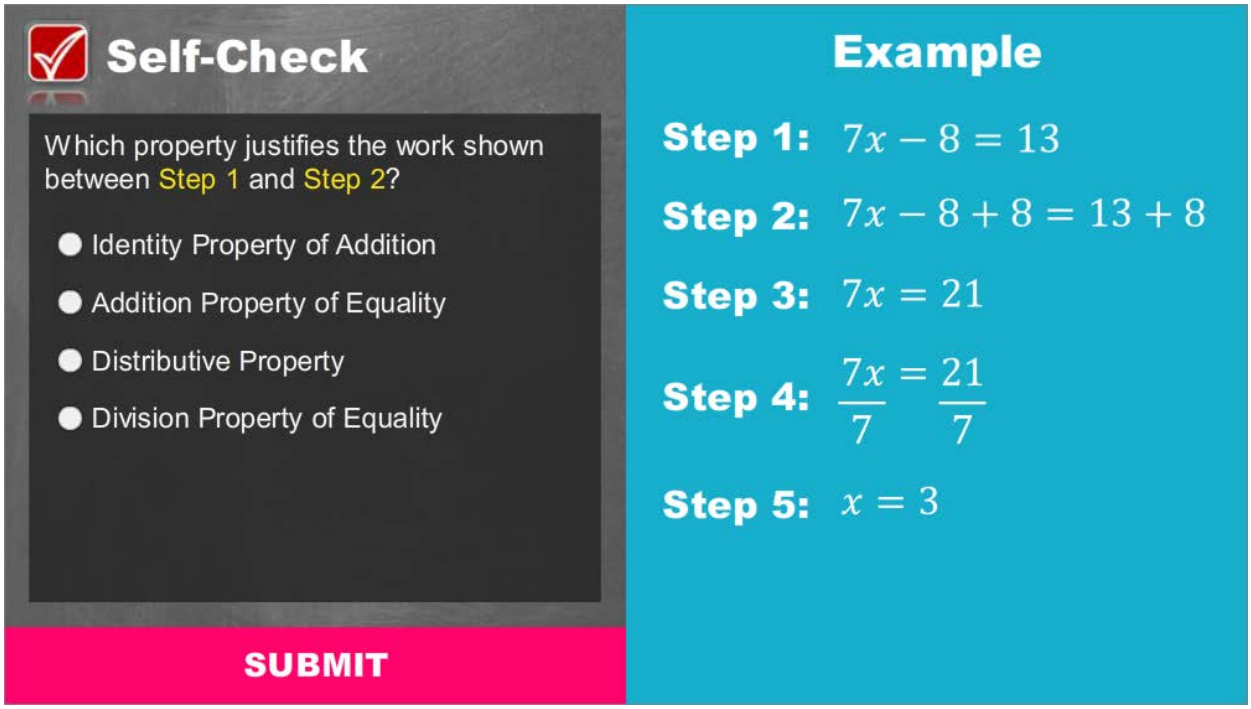
Consider the equation, $5x = 30$. Apply the Division Property of Equality by dividing each side by 5. The solution is $x = 6$.

If $a = b$, and $c \neq 0$, then $\frac{a}{c} = \frac{b}{c}$.

$$18 = 18$$
$$\frac{18}{2} = \frac{18}{2}$$
$$9 = 9$$

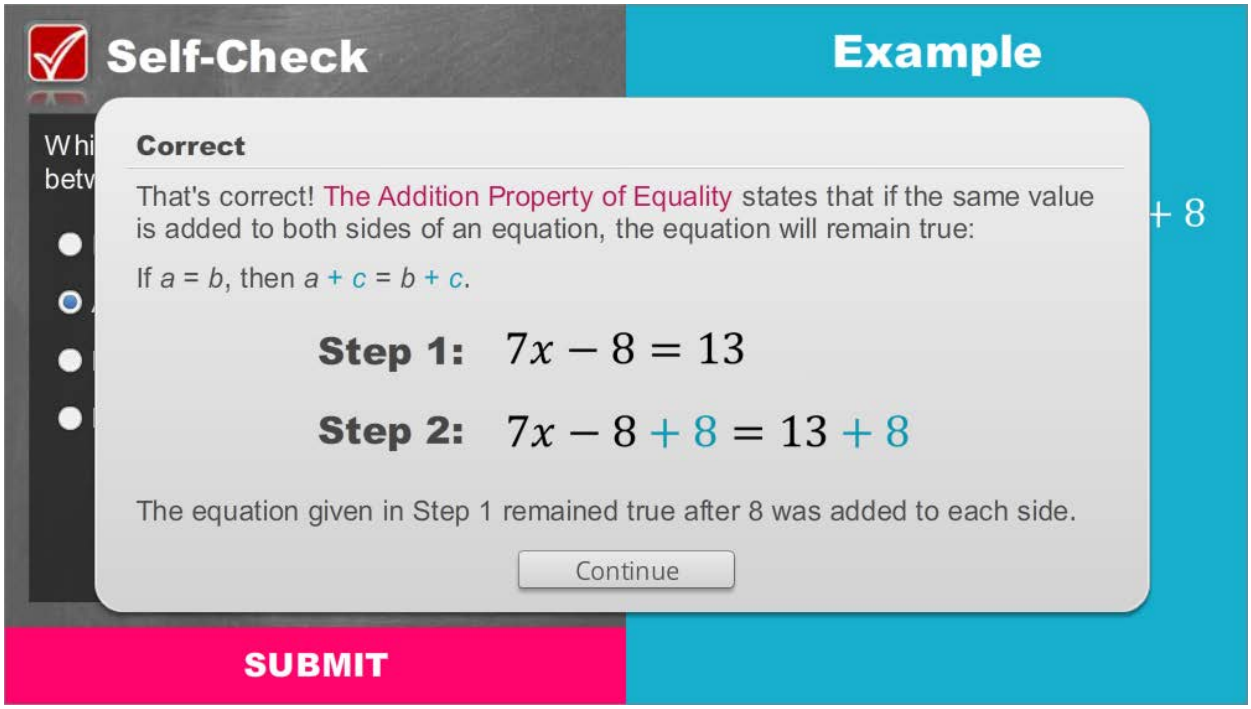
$$5x = 30$$
$$\frac{5x}{5} = \frac{30}{5}$$
$$x = 6$$

Self-Check



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

Self-Check: 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 equality to help you determine the solution to a linear equation.