

Module 5: Solving Linear Equations

Topic 1 Content: Properties of Equality

Introduction



Today's Lesson

- You will explore the properties of equality and use them to solve linear equations.

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

PROPERTIES OF EQUALITY

Click the Properties Below to Learn More

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

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

Module 5: Solving Linear Equations

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 $x = 11$.

$$\text{If } a = b, \text{ then } a + c = b + c.$$

$$3 = 3$$

$$3 + 4 = 3 + 4$$

$$7 = 7$$

$$x - 9 = 2$$

$$+ 9 \quad + 9$$

$$x = 11$$

Module 5: Solving Linear Equations

Topic 1 Content: Properties of Equality

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 $x = 2$.

$$\text{If } a = b, \text{ then } a - c = b - c.$$

$$3 = 3$$

$$3 - 4 = 3 - 4$$

$$-1 = -1$$

$$x + 6 = 8$$

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

Module 5: Solving Linear Equations

Topic 1 Content: Properties of Equality

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, $x = 15$.

$$\text{If } a = b, \text{ then } a \cdot c = b \cdot c.$$

$$3 = 3$$

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

$$12 = 12$$

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

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

$$1x = 15$$

$$x = 15$$

Module 5: Solving Linear Equations

Topic 1 Content: Properties of Equality

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 $x = 6$.

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


$$\begin{array}{r} 18 = 18 \\ 18 = 18 \\ \hline 2 \quad 2 \\ 9 = 9 \end{array}$$

$$\begin{array}{r} 5x = 30 \\ 5x = 30 \\ \hline 5 \quad 5 \\ x = 6 \end{array}$$

Module 5: Solving Linear Equations

Topic 1 Content: Properties of Equality

Self-Check

**Self-Check**

Which property justifies the work shown between **Step 1** and **Step 2**?

- Identity Property of Addition
- Addition Property of Equality
- Distributive Property
- Division Property of Equality

SUBMIT

Example
Step 1: $7x - 8 = 13$
Step 2: $7x - 8 + 8 = 13 + 8$
Step 3: $7x = 21$
Step 4: $\frac{7x}{7} = \frac{21}{7}$
Step 5: $x = 3$

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

Module 5: Solving Linear Equations

Topic 1 Content: Properties of Equality

Self-Check: Answer

The screenshot shows a digital learning interface. On the left, a dark grey sidebar contains a red checkmark icon and the text 'Self-Check'. Below this, a vertical list of four white circles is visible, with the second one from the top being filled with blue. To the right of the sidebar, a light grey rounded rectangle contains the following text: 'Correct', 'That's correct! The Addition Property of Equality states that if the same value is added to both sides of an equation, the equation will remain true:', and 'If $a = b$, then $a + c = b + c$.' Below this, two steps are shown: 'Step 1: $7x - 8 = 13$ ' and 'Step 2: $7x - 8 + 8 = 13 + 8$ '. A 'Continue' button is at the bottom of the grey box. The background is split into a dark grey top-left section and a teal top-right section. A pink bar at the bottom left contains the word 'SUBMIT' in white. On the far right, a '+ 8' is partially visible.

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

Module 5: Solving Linear Equations

Topic 1 Content: Properties of Equality

Conclusion



The image shows a digital interface for a lesson conclusion. On the left, a white box with a pink header titled "Today's Lesson" contains a checklist of four items, each with a checkmark: "Addition Property of Equality", "Subtraction Property of Equality", "Multiplication Property of Equality", and "Division Property of Equality". Below the list are two pink buttons: "Exit Lesson" and "Restart Lesson". To the right of the box is a cartoon illustration of a smiling woman with dark curly hair, wearing a pink long-sleeved top. The background is a blue pattern of mathematical symbols like plus, minus, multiplication, and division signs.

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.