Edgenuity

# Warm-Up | Solving with Variables on Both Sides

## Lesson Question

## Lesson Goals

**Solve** equations with variables on both sides.

**Isolate** the variable term on one side and the _____ on the other.

**Use** the properties of _____ to solve.

## Words to Know

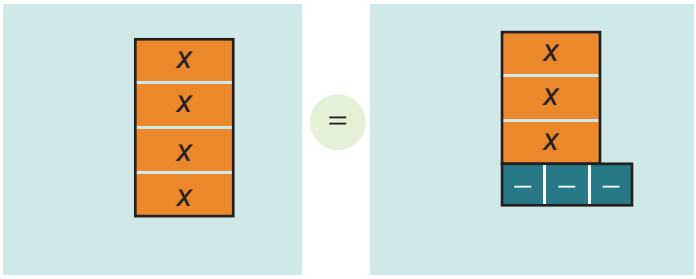
*Write the letter of the definition next to the matching word as you work through the lesson. You may use the glossary to help you.*

| | | | |
|---|---|---|---|
| _____ | properties of equality | A. | to separate from other substances; to place apart |
| _____ | variable | B. | a letter or symbol used to represent an unknown quantity |
| _____ | coefficient | C. | the rules that allow you to balance, manipulate, and solve equations |
| _____ | isolate | D. | the number value in a monomial |

# Warm-Up | Solving with Variables on Both Sides

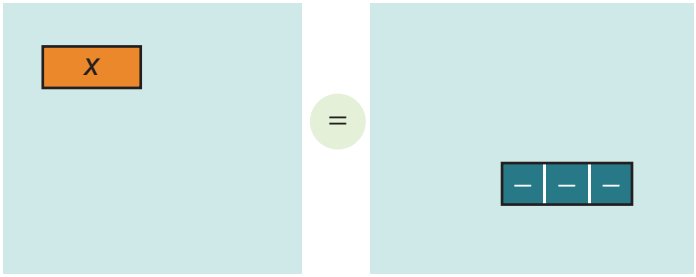
## Using Algebra Tiles to Solve an Equation

Use algebra tiles to solve $4x = 3x - 3$.




1. Isolate the *x*-term on the left side of the equation.

   - Drag 3 blue rectangular *x*-tiles to the right side. This makes 3 zero pairs and leaves no *x*-tiles on the right side.
   - Drag 3 blue rectangular *x*-tiles to the left side to keep the equation balanced. This makes 3 zero pairs and leaves 1 orange positive *x*-tile on the left side.




$$4x = 3x - 3$$

$$x = \square$$

# Instruction | Solving with Variables on Both Sides

Slide 2

## Isolating the Variable

**PROCEDURE**

Steps for Solving

1. Use the addition or subtraction **property of equality** to **isolate** the **variable** term.

2. Use the multiplication or division property of equality to solve for the [ ].

Solve the equation.

$2x - 7 = 4x$

$2x - 7 = 4x$

$-2x \quad -2x$

$-7 =$ [ ]

$\frac{-7}{2} = \frac{2x}{2}$

$x =$ [ ]

## Verifying a Solution

Verify that $x = \frac{-7}{2}$ is the solution for the equation $2x - 7 = 4x$.

$2\left(\frac{-7}{2}\right) - 7 = 4\left(\boxed{\phantom{00}}\right)$

$-\frac{14}{2} - 7 = -\frac{28}{2}$

$\boxed{\phantom{00}} - 7 = -14$

$\boxed{\phantom{00}} = -14$

So, our solution is correct.

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Slide 4

## Solving for a Variable with Decimals on Both Sides

**EXAMPLE**

Steps for Solving

1. Isolate the variable term to one side of the equals sign.

Solve the equation.

$$5.3x = 4.1x + 5.76$$

$$5.3x = 4.1x + 5.76$$
$$-4.1x \quad -4.1x$$

$$\square = 5.76$$

2. Use the inverse operation to remove the **coefficient**.

$$\frac{1.2x}{\square} = \frac{5.76}{1.2}$$

$$x = \frac{5.76}{1.2} \times \frac{10}{10}$$

$$x = \frac{\square}{12}$$

$$x = \square$$

# Instruction | Solving with Variables on Both Sides

Slide 6

## A One-Variable Equation with Fractions

Steps for Solving

1. Use the addition or subtraction property of equality to isolate the ☐ term.

2. Use the multiplication or division property of equality to solve for the variable.

Solve the equation.

$$8 - \frac{3}{4}x = \frac{1}{2}x$$

$$8 - \frac{3}{4}x = \frac{1}{2}x$$

$$+\frac{3}{4}x \quad +\frac{3}{4}x$$

$$8 = \square$$

$$\frac{4}{5} \cdot 8 = \frac{4}{5} \cdot \frac{5}{4}x$$

$$\square = x$$

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Slide 10

## Solving More than One Way

Solve the equation.

$$3x + 4 = 5x + 9$$

Isolate the variable term on the right.

$3x + 4 = 5x + 9$

$-3x \quad -3x$

$4 = \square + 9$

$-9 \quad -9$

$\square = 2x$

$\frac{-5}{2} = \frac{2x}{2}$

$x = \square$

Isolate the variable term on the left.

$3x + 4 = 5x + 9$

$-5x \quad -5x$

$\square + 4 = 9$

$-4 \quad -4$

$-2x = \square$

$\frac{-2x}{-2} = \frac{5}{-2}$

$x = -\frac{5}{2}$

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Slide 12

## Solving an Equation with Fractions

Solve the riddle.

9 minus three-fourths of a number is the same as seven less than half the number.

$$9 - \frac{3}{4}x = \frac{1}{2}x - 7$$

$$9 - \frac{3}{4}x = \frac{1}{2}x - 7$$

$$+\frac{3}{4}x \quad + \frac{3}{4}x$$

$$9 = \square - 7$$

$$+7 \qquad\qquad 7$$

$$\square = \frac{5}{4}x$$

$$16 \cdot \frac{4}{5} = \frac{4}{5} \cdot \frac{5}{4}x$$

$$\square = x$$

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Slide 12

## Verifying a Solution

Verify that $x = \frac{64}{5}$ is the solution for the equation.

$$9 - \frac{3}{4}x = \frac{1}{2}x - 7$$

$$9 - \frac{3}{4}\left(\frac{64}{5}\right) = \frac{1}{2}\left(\frac{\square}{5}\right) - 7$$

$$9 - \frac{\square}{5} = \frac{32}{5} - 7$$

$$\frac{\square}{5} - \frac{48}{5} = \frac{32}{5} - \square$$

$$-\frac{3}{5} = -\frac{3}{5}$$

Therefore, our solution is correct.

# Summary | Solving with Variables on Both Sides

**Lesson Question**

How can you solve equations with variables on both sides of the equals sign?

## Answer

## 2 Review: Key Concepts

Steps to Solve

1. Use the addition or subtraction properties of equality to isolate the variable term and the [ ] on opposite sides of the equation.
2. Use the multiplication or division property of equality to solve for the variable.

# Summary | Solving with Variables on Both Sides

*Use this space to write any questions or thoughts about this lesson.*