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## Solving Equations with Variables on Both Sides

Unit 2 Lesson 4

# SOLVING EQUATIONS WITH VARIABLES ON BOTH SIDES

**Students will be able to:**

Solve Equations with Variables on Both Sides

**Key Vocabulary:**

- Equation with One Solution
- Identity Equation
- Equation with No Solution

## SOLVING EQUATIONS WITH VARIABLES ON BOTH SIDES

An equation with variable on both sides means the variable is on both sides of the equality.

Mathematically, it is of the form:

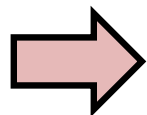
$$ax \pm b = cx \pm d$$

# SOLVING EQUATIONS WITH VARIABLES ON BOTH SIDES

## Equations with One Solution

In this case, exactly one solution exists for the equation.

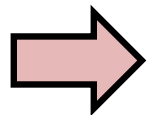
**Example 1: Solve  $5x - 2 = 2x - 14$ .**



$$5x - 2x - 2 = 2x - 2x - 14$$

**Subtraction Property of Equality**

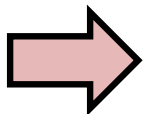
$$3x - 2 = -14$$



$$3x - 2 + 2 = -14 + 2$$

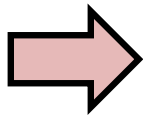
**Addition Property of Equality**

$$3x = -12$$



$$\frac{3x}{3} = \frac{-12}{3}$$

**Division Property of Equality**



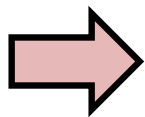
$$x = -4$$

# SOLVING EQUATIONS WITH VARIABLES ON BOTH SIDES

## Identity Equation

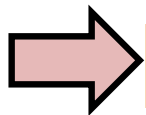
An identity equation is an equation that is true for every value of the variable.

**Example 2: Solve  $5(2x - 2) = 2(5x - 5)$ .**



$$10x - 10 = 10x - 10$$

**Distributive Property**



$$10x - 10 + 10 = 10x - 10 + 10$$

**Addition Property of Equality**

$$10x = 10x$$

**Identity**

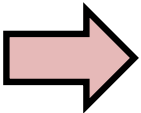
This equation is an identity equation since all the values of  $x$  are the solutions to this equation.

# SOLVING EQUATIONS WITH VARIABLES ON BOTH SIDES

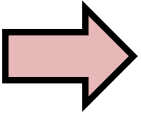
## Equation with No Solution

An equation in which the variable on both sides gets cancelled out but the remaining sides are not equal is an equation with no solution.

**Example 3: Solve  $9x - 4 = -3x + 5 + 12x$ .**


$$9x - 4 = 9x + 5$$

Combining Like Terms


$$9x - 4 - 9x = 9x + 5 - 9x$$

Subtraction Property of Equality

$$-4 = 5$$

No Solution

This equation has no solution since the variable terms cancelled out and the remaining sides are not equal.