

# Equation Challenge: Variables on Both Sides

QC

Target audience: 8th Grade Math learners

## Learning goal

Students will be able to solve linear equations with variables on both sides, including those requiring distribution and combining like terms.

### Visual model: Balance Scale of Equations

#### Initial Setup

An equation like  $3x + 2 = x + 8$  is shown with 'x' blocks and number weights on each

#### Moving Variables

To move 'x' blocks from one side, you 'subtract' them from both sides. Visually,

This model uses a digital balance scale to represent equations. Each side of the scale represents an expression, and the goal is to keep the scale balanced while isolating the

#### Part 1: Identify and Simplify

- Identify the variable terms in:  $5x + 7 = 2x + 13$
- Identify the constant terms in:  $4y - 3 = 9y + 12$
- Combine like terms on the left side:  $3x + 5 - x = 2x + 10$
- Combine like terms on the right side:  $7 + 2y - 4 = 5y - 1$

#### Part 2: Isolate the Variable Term

- What is the first step to solve:  $6x + 5 = 2x + 17$ ?
- Subtract  $3x$  from both sides:  $8x - 4 = 3x + 11$
- Add  $2y$  to both sides:  $10 - 2y = 5y + 3$
- Move the smallest variable term:  $7z + 1 = 2z + 16$

#### Part 3: Solve for the Variable

- Solve for x:  $4x + 9 = x + 21$
- Solve for y:  $10y - 3 = 6y + 13$
- Solve for z:  $2z + 15 = 7z - 5$
- Solve for m:  $3m - 8 = 5m + 4$

# Answer Key, Assessment Snapshot, and Differentiation Paths

## Answer key

- Part 1:  $5x$ ,  $2x$ ;  $7$ ,  $13$ ;  $2x + 5 = 2x + 10$ ;  $3 + 2y = 5y - 1$
- Part 2: Subtract  $2x$  from both sides;  $5x - 4 = 11$ ;  $10 = 7y + 3$ ;  $5z + 1 = 16$
- Part 3:  $x = 4$ ;  $y = 4$ ;  $z = 4$ ;  $m = -6$
- Part 4:  $a = 5$ ;  $b = 7$ ;  $c = 4$ ;  $d = 13$
- Part 5: No solution; Infinitely many solutions; Infinitely many solutions; No solution
- A strong reflection names a specific change in thinking and connects it to evidence from the task.

## Assessment snapshot

### 1. Solve for x: $7x - 12 = 3x + 8$

Answer:  $x = 5$

### 2. Solve for y: $2(y + 5) = 4y - 6$

Answer:  $y = 8$

### 3. Solve for z: $5z - 1 = 5z + 3$

Answer: No solution

## Differentiation paths

### Support

- Provide pre-solved examples with missing steps for students to fill in.
- Use algebra tiles or balance scales for concrete representation of equations.
- Focus on equations with only positive integers and no distribution.

### Core

- Solve multi-step equations with variables on both sides, including rational coefficients.
- Practice equations involving the distributive property.
- Identify and solve equations with one solution, no solution, or infinitely many solutions.

### Stretch

- Create and solve complex equations with multiple distributive properties and fractions/decimals.
- Analyze and explain why certain equations have no solution or infinite solutions.
- Design real-world problems that can be modeled and solved using linear equations with variables on both sides.