# Solving Equations With Variables on Both Sides



# Vocabulary

#### Review

Write the like terms in each expression or equation.

1. 
$$5x + 2x + 6$$

**2.** 
$$1.5y - 1.2 + 1.2z + y$$
 **3.**  $\frac{1}{2}x + \frac{1}{2} = 3x$ 

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## Vocabulary Builder

identity (noun) eye DEN tuh tee

**Main Idea:** Any equation that is always true is an **identity**.

**Examples:** The equation 39 = 39 is an **identity** because it is always true.

The equation y + 3 = y + 3 is an **identity** because it is true for all values of y.

**Nonexample:** The equation x + 5 = 8 is *not* an **identity** because it is *not* always true. It is true only when x = 3.

## Use Your Vocabulary

Write a number or expression to make each equation an *identity*.

**6.** 
$$-5x + 3 =$$
 + 3



**7. Multiple Choice** Which equation is NOT an *identity*?

$$\bigcirc$$
 0 + 7 = 7

$$x + 3 = 3 + x$$
  $x + 1 = x$ 

m = mis an *identity*.

> m = 15is NOT

an identity.

**8.** Draw a line from each equation in Column A to its description in Column B.

Column A

$$x = x - 1$$

always true

$$x + x = 2x$$

sometimes true

$$5x = 15$$

never true

### **Got It?** What is the solution of 7k + 2 = 4k - 10?

**9.** There is a variable on each side of the equation. Are they like terms?

Yes / No

**10.** Use one of the reasons from the box to justify each step. You may use a reason more than once.

Division Property of Equality Simplify. Subtraction Property of Equality Subtract.

$$7k + 2 = 4k - 10$$

Write the original equation.

$$7k + 2 - 4k = 4k - 10 - 4k$$

$$3k + 2 = -10$$

$$3k + 2 - 2 = -10 - 2$$

$$3k = -12$$

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

$$k = -4$$



# Problem 2 Using an Equation With Variables on Both Sides

Got it? An office manager spent \$650 on a new energy-saving copier that will reduce the monthly electric bill for the office from \$112 to \$88. In how many months will the copier pay for itself?

**11.** Complete the model below.

**Define** 

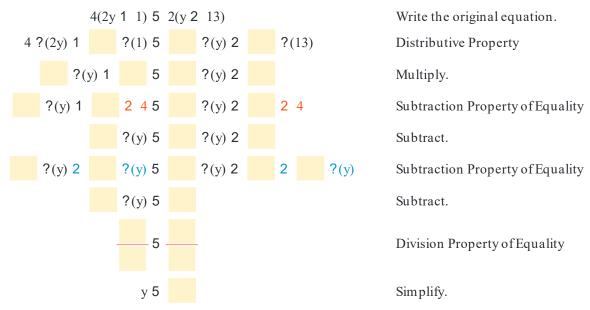
Let m = ? Circle the correct answer.

Write

- **12.** Now write and solve the equation.
- **13.** The copier will pay for itself in about
- months.

#### Got It? What is the solution of 4(2y 1 1) 5 2(y 2 13)?

14. Use the justifications at the right to solve the equation.



15. Check your answer by substituting it for y in the original equation.



# Problem 4 Identities and Equations With No Solution

Got It? What is the solution of 3(4b 2 2) 5 26 1 12b?

16. Circle the first step you would take to isolate the variable. Underline the second step you would take.

Multiply each side by 3. Distribute the 3. Subtract 12b from each side.

17. Solve the equation.

18. Because 265 26 is always true, the original equation has no solution / infinitely many solutions.

Remember to follow these steps when solving equations.

STEP 1 Use the Distributive Property to remove any grouping symbols.
Use properties of equality to clear decimals and fractions.

STEP 2 Combine like terms on each side of the equation.

STEP 3 Use the properties of equality to get the variable terms on one side of the equation and the constants on the other.

STEP 4 Use the properties of equality to solve for the variable.

STEP 5 Check your solution in the original equation.



# Lesson Check • Do you UNDERSTAND?

Vocabulary Tell whether each equation has in itely many solutions, one solution, or no solution.

Write the steps to isolate the variable in each equation.

22. Tell whether each equation has infinitely many solutions, one solution, or no solution.



# Math Success

Check off the vocabulary words that you understand.

like terms



Rate how well you can solve equations with variables on both sides.

