

## ? Topic Essential Question

What procedures can be used to write and solve equations and inequalities?

## Vocabulary Review

Complete each definition with a vocabulary word.

**Vocabulary**   dependent variable   independent variable   inequality   equation

1. In the equation  $y = x + 9$ , the variable  $x$  is the \_\_\_\_\_.
2. A(n) \_\_\_\_\_ has an infinite number of solutions.
3. In the equation  $y = x - 9$ , the variable  $y$  is the \_\_\_\_\_.

Draw a line from each equation to the property of equality it illustrates.

4.  $(6 + 3) - 3 = 9 - 3$                       Addition Property of Equality
5.  $(6 + 3) \times 3 = 9 \times 3$                       Division Property of Equality
6.  $(6 + 3) + 3 = 9 + 3$                       Multiplication Property of Equality
7.  $(6 + 3) \div 3 = 9 \div 3$                       Subtraction Property of Equality

### Use Vocabulary in Writing

Describe how to solve  $\frac{3}{7}n = 27$ . Use vocabulary words in your explanation.

# Concepts and Skills Review

## LESSON 4-1 Understand Equations and Solutions

### Quick Review

The **solution of an equation** makes the equation true. Substitute each of the given values into the equation for the variable to determine which value, if any, is a solution of the equation.

### Example

Which value of  $x$  is a solution of the equation?

$$x + 4.8 = 19$$

$$x = 13, 14.2, 15.8$$

Try  $x = 13$ :

$$13 + 4.8 \neq 17.8 \quad \times$$

Try  $x = 14.2$ :

$$14.2 + 4.8 = 19 \quad \checkmark$$

Try  $x = 15.8$ :

$$15.8 + 4.8 \neq 20.6 \quad \times$$

### Practice

Tell which value of the variable, if any, is a solution of the equation.

1.  $d + 9 = 25$        $d = 6, 14, 16, 21$

2.  $c - 8 = 25$        $c = 17, 28, 33, 35$

3.  $2y = 30$        $y = 10, 12, 24, 36$

4.  $150 \div h = 50$        $h = 2, 3, 4, 5$

5.  $f - 13.2 = 28.9$        $f = 38.7, 42.2, 45.8, 51.4$

## LESSON 4-2 Apply Properties of Equality

### Quick Review

The **properties of equality** allow you to apply the same operation with the same amount to both sides of an equation.

### Example

The properties of equality are illustrated in the table.

#### Properties of Equality

Addition Property of Equality	$4 + 3 = 7$ So, $4 + 3 + 2 = 7 + 2$
Subtraction Property of Equality	$9 + 8 = 17$ So, $9 + 8 - 5 = 17 - 5$
Multiplication Property of Equality	$3 \times 5 = 15$ So, $3 \times 5 \times 2 = 15 \times 2$
Division Property of Equality	$16 \div 2 = 8$ So, $(16 \div 2) \div 2 = 8 \div 2$

### Practice

- If  $6 + 2 = 8$ , does  $6 + 2 + 3 = 8 + 3$ ? Why or why not?
- If  $8 - 1 = 7$ , does  $8 - 1 - 2 = 7 - 3$ ? Why or why not?
- If  $4 + 6 = 10$ , does  $(4 + 6) \times 3 = 10 \times 3$ ? Why or why not?
- If  $5 + 4 = 9$ , does  $(5 + 4) \div 3 = 9 \div 4$ ? Why or why not?



Quick Review

Use the **inverse relationship** of addition and subtraction or multiplication and division to solve equations. To check, substitute your answer back into the original equation.

Example

$$23 + y = 57$$

$$23 + y - 23 = 57 - 23$$

$$y = 34$$

$$9z = 63$$

$$9z \div 9 = 63 \div 9$$

$$z = 7$$

$$a - 12 = 16$$

$$a - 12 + 12 = 16 + 12$$

$$a = 28$$

$$c \div 4 = 24$$

$$c \div 4 \times 4 = 24 \times 4$$

$$c = 96$$

Practice

Solve for  $x$ .

1.  $8x = 64$

2.  $x + 2 = 11$

3.  $x \div 20 = 120$

4.  $x - 17 = 13$

5.  $x \div 12 = 2$

6.  $8 + x = 25$

7.  $7x = 77$

8.  $x - 236 = 450$

9.  $26 = 13x$

10.  $x + 21.9 = 27.1$

11.  $2,448 \div 48 = x$

12.  $x + 15 = 31$

LESSON 4-5

Write and Solve Equations with Rational Numbers

Quick Review

You can use inverse relationships and properties of equality to solve each equation.

Example

Solve  $w + 4\frac{1}{3} = 7$ .

Subtract  $4\frac{1}{3}$  from both sides.

$$w + 4\frac{1}{3} - 4\frac{1}{3} = 7 - 4\frac{1}{3}$$

$$w = 2\frac{2}{3}$$

Solve  $\frac{3}{5}n = \frac{2}{3}$ .

Multiply both sides by the reciprocal of  $\frac{3}{5}$ .

$$\frac{5}{3} \times \frac{3}{5}n = \frac{5}{3} \times \frac{2}{3}$$

$$n = \frac{10}{9} \text{ or } 1\frac{1}{9}$$

Practice

In 1–8, solve for  $x$ .

1.  $x + 3\frac{5}{8} = 7\frac{1}{4}$

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

3.  $x \div 15 = 8\frac{1}{3}$

4.  $\frac{4}{2}x = 6$

5.  $\frac{x}{3} = 9$

6.  $14x = 73.5$

7.  $12x = 19.2$

8.  $17.9 - x = 12.8$

9. Tomas buys a bag of 5 peaches for \$3.55. Write and solve an equation to find how much money,  $m$ , Tomas paid for each peach.

10. Krys has \$1.54 and spends \$0.76. Write and solve an equation to find how much money,  $m$ , Krys has left.



Quick Review

An **inequality** is a mathematical sentence that contains  $<$  (less than),  $>$  (greater than),  $\leq$  (less than or equal to),  $\geq$  (greater than or equal to), or  $\neq$  (not equal to).

Example

Situation	Inequality
The age of the house, $a$ , is greater than 3 years.	$a > 3$
The cost of the house, $c$ , is at least \$50,000.	$c \geq 50,000$
The number of windows, $w$ , is fewer than 10.	$w < 10$
The number of people, $n$ , living in the house is at most 5.	$n \leq 5$
The number of trucks, $t$ , in the garage is not 2.	$t \neq 2$

Practice

Write an inequality for each situation.

- Up to 5 people,  $p$ , visited Mary today.
- The value,  $v$ , of the hat is less than \$9.
- The number of guests,  $g$ , coming for dinner is not 8.
- The distance of the race,  $d$ , is at least 6 miles.
- The time it takes to get to Grandma's house,  $t$ , is longer than 2 hours.

Quick Review

To graph the solutions of an inequality on a number line, use an open circle for  $<$  or  $>$  and a closed circle for  $\leq$  or  $\geq$ . If the values of the variable are less than the given number, shade to the left on the number line. If the values of the variable are greater than the given number, shade to the right on the number line.

Example

"Molly is less than 15 years old" is represented by the inequality  $x < 15$ . Write three ages that could represent Molly's age.

To graph the inequality on a number line, draw an open circle at 15 and shade to the left of 15 because  $x$  is less than 15. Draw an arrow to show all numbers less than 15.



There are many solutions. Molly could be 10, 12, 14, or any age less than 15 years.

Practice

Write the inequality that each graph represents.



## LESSON 4-8

## Understand Dependent and Independent Variables

### Quick Review

Think about how the values of variables affect each other.

To identify the **dependent variable**, ask yourself which variable depends on the other.

To identify the **independent variable**, ask yourself which variable causes the change.

### Example

The spirit squad is washing cars. The equation  $m = 2c$  represents the money they make,  $m$ , for washing  $c$  cars. Identify the dependent variable and the independent variable.

The amount of money the spirit squad makes **depends** on the number of cars they wash. The dependent variable is  $m$ .

The number of cars washed changes the amount of money made. The independent variable is  $c$ .

### Practice

Identify the dependent variable and the independent variable in each situation.

- The distance traveled,  $d$ , and the speed,  $s$
- The calories,  $c$ , in a snack and the amount of the snack,  $a$
- The amount of money you have spent,  $s$ , and how much money you have left,  $m$
- The number of apple slices remaining,  $r$ , and the number of apple slices eaten,  $e$

## LESSON 4-9

## Use Patterns to Write and Solve Equations

### Quick Review

Look for patterns between two related variables to find rules and write equations.

### Example

Write a rule and an equation that represents the pattern. Then complete the table.

$x$	3	4	5	6	7
$y$	12	16	20	24	28

Find the rule and write an equation.

$$12 \text{ is } 3 \times 4$$

$$16 \text{ is } 4 \times 4$$

$$20 \text{ is } 5 \times 4$$

Rule: The value of  $y$  is 4 times the value of  $x$ .

$$\text{Equation: } y = 4x$$

Evaluate the equation for  $x = 6$  and  $x = 7$ .

$$y = 4 \times 6 = 24$$

$$y = 4 \times 7 = 28$$

### Practice

- Find the pattern and then write a rule and an equation that represents the pattern. Then complete the table.

$x$	0	2	10	16	20
$y$	0	1	5	<input type="text"/>	<input type="text"/>

- Use the equation to complete the table.

$$y = 6x + 1$$

$x$	1	2	3	4	5
$y$	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>



Quick Review

A table, equation, or graph can be used to analyze the relationship between dependent and independent variables. Ordered pairs that make an equation true can be used to graph the equation.

Example

Complete the table and graph to show the relationship between the variables in the equation  $t = s + 1$ .

A restaurant has a special that when you buy one sandwich you get a second sandwich for \$1.

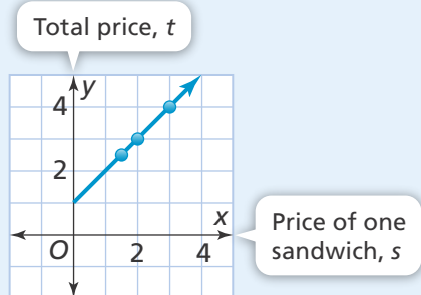
Let  $s$  = price of one sandwich.

Let  $t$  = total price of two sandwiches.

**Step 1** Make a table. Include at least three values.

$t = s + 1$	
$s$	$t$
\$1.50	\$2.50
\$2	\$3
\$3	\$4

**Step 2** Graph each ordered pair on a coordinate plane. Then draw a line through the points.



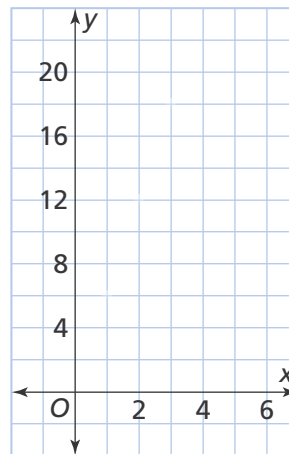
Practice

1. The cross country team practices by jogging on the town's streets. The average jogging rate is 6 miles per hour. One member jogged for 3.5 hours one weekend. How many miles did the team member jog?

a. Complete the table to relate the number of miles to the number of hours jogged.

$x$	$y$
1	<input type="text"/>
2	<input type="text"/>
3	<input type="text"/>

b. Graph the ordered pairs on the coordinate plane.



c. Write an equation that describes the relationship. Then solve the problem.

2. Alex is making puppets for a show. He bought all the string needed for \$125. It costs \$18 for the remaining materials to make each puppet. What is the total cost to make 50 puppets?