

? 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 inequality equation solution of an equation inverse relationship

1. The operations addition and subtraction have a(n) _____.
2. A(n) _____ has an infinite number of solutions.
3. For the equation $-3x = 15$, -5 is a(n) _____.

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?

$$x + 21 = 19$$

$$x = 2, -2, -4$$

Try $x = 2$:

$$2 + 21 = 23 \text{ ✗}$$

Try $x = -2$:

$$-2 + 21 = 19 \text{ ✓}$$

Try $x = -4$:

$$-4 + 21 = 17 \text{ ✗}$$

Practice

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

1. $d + 9 = -25$ $d = 6, 3, -16, -34$

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

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

4. $150 \div h + h = 53$ $h = 2, 3, 4, 5$

5. $f - 13 = 28$ $f = 38, 42, 45, 51$

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	$-9 + 8 = -1$ So, $-9 + 8 - 5 = -1 - 5$
Multiplication Property of Equality	$3 \times 5 = 15$ So, $3 \times 5 \times 2 = 15 \times 2$
Division Property of Equality	$16 + (-2) = 14$ So, $(16 + (-2)) \div 2 = 14 \div 2$

Practice

1. If $6 + 2 = 8$, does $6 + 2 + 3 = 8 + 3$? Why or why not?

2. If $-8 - 1 = -9$, does $-8 - 1 - 2 = -9 - 3$? Why or why not?

3. If $4 + 6 = 10$, does $(4 + 6) \times (-3) = 10 \times (-3)$? Why or why not?

4. 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

$$23 + y = 57$$

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

$$y = 34$$

$$9z = 63$$

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

$$z = 7$$

$$a - 12 = -16$$

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

$$a = -4$$

$$c \div (-4) = 24$$

$$c \div (-4) \times (-4) = 24 \times (-4)$$

$$c = -96$$

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.	$w < 10$
A number, n , 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.
- A value, v , is at least -6 .
- 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 $x < 15$. Graph the inequality. Write three numbers that could represent Molly's age.

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.

