

TOPIC
6

GET READY!

Review What You Know!

Vocabulary
Choose the best term from the box to complete each definition.

1. A statement that contains the symbols $<$, $>$, \geq , \leq , or \neq is called a(n) _____.

2. Properties that state that performing the same operation on both sides of an equation will keep the equation true are called _____.

3. Addition and subtraction have a(n) _____ because they can "undo" each other.

4. Terms that have the same variable are called _____.

inverse relationship
like terms
inequality
properties of equality

Properties of Equality

Use properties to solve each equation for x .

5. $x + 9.8 = 14.2$ 6. $14x = 91$ 7. $\frac{1}{3}x = 24$

Like Terms

Combine like terms in each expression.

8. $\frac{1}{4}k + \frac{1}{4}m - \frac{2}{3}k + \frac{2}{9}m$ 9. $-4b + 2w + (-4b) + 8w$ 10. $6 - 5z + 8 - 4z + 1$

Inequalities

11. Write an inequality that represents the situation: *A large box of golf balls has more than 12 balls.* Describe how your inequality represents the situation.

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Topic 6 Solve Problems Using Equations and Inequalities **329**

Prepare for Reading Success

As you work through Topic 6, complete the graphic organizer with details that you learn comparing equations and inequalities.

Item 1 _____ Equations

Item 2 _____ Inequalities

How are they alike?

How are they different?

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Explore It!

Marley collects golf balls. His neighbor Tucker collects 3 more than twice as many golf balls as Marley.

Lesson 6-1

Write Two-Step Equations

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I can...
represent a problem with a two-step equation.

A. How can you use a table to represent the number of golf balls in Marley's collection, m , and the number of golf balls in Tucker's collection?

B. How can you use an algebraic expression to represent the number of golf balls in Tucker's collection?

Focus on math practices

Look for Relationships How do the terms of the expression you wrote in Part B relate to the values in the table?

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Essential Question

How does an equation show the relationship between variables and other quantities in a situation?

INTERACTIVE RESOURCE

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EXAMPLE 1

Write a Two-Step Equation to Represent a Situation

What equation can be used to represent the numbers of golf balls in Marley's and Tucker's collections?

Model with Math

How can an equation represent a given situation?

159 golf balls

Marley's Collection

Tucker's Collection

Tucker has 3 more than twice Marley's golf ball collection.

Use a bar diagram to represent the situation.

Tucker's collection → 159 golf balls

↑ m ↑ m ↑ 3

↑ golf balls in Marley's collection ↑ more golf balls

Use the bar diagram to write an equation.

Tucker's collection = twice Marley's collection + more golf balls

$159 = 2m + 3$

The equation $159 = 2m + 3$ can be used to represent Marley's and Tucker's golf ball collections.

Try It!

Cole buys a new laptop for \$335. He makes a down payment of \$50 and pays the rest in 6 equal monthly payments, p . What equation represents the relationship between the cost of the laptop and Cole's payments?

Cost of laptop → 335

Down payment → 50

↑ p ↑ p ↑ p ↑ p ↑ p ↑ p

cost = + × monthly payment

= + ×

=

Convince Me! Why are both multiplication and addition used in the equation that represents Cole's monthly payments?

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EXAMPLE 2 Write More Two-Step Equations

A baseball weighs 25.75 ounces less than a bat. Write an equation that represents the relationship between the weights of a baseball and a bat in terms of the weight of the box, w .

weight of one baseball	=	weight of one bat	-	difference in weight
5.25	=	$\frac{\text{weight of box}}{\text{number of bats in box}}$	-	25.75
5.25	=	$\frac{w}{50}$	-	25.75



The equation $5.25 = \frac{w}{50} - 25.75$ can be used to represent the relationship between the weights of a baseball and a bat.

Try It!

Marcia and Tamara are running a race. Marcia has run 4 kilometers. Tamara has completed $\frac{3}{4}$ of the race and is 2.5 kilometers ahead of Marcia. Write an equation that represents the relationship between the distances each girl has run. Let k represent the total length of the race in kilometers.

EXAMPLE 3 Interpret Quantities and Operations in Equations

Claire bought 8 tickets for a total cost of \$104. She had used a coupon code to get \$3 off each ticket. Let x be the original cost of each ticket. Which of the following equations correctly represents the situation?

$3(x - 8) = 104$ Total cost	$8x - 3 = 104$ Total cost	$8(x - 3) = 104$ Total cost
\$3 discount times the difference of 8 tickets and the cost per ticket	8 tickets times the cost per ticket minus a total discount of \$3	8 tickets times the difference of the cost per ticket and \$3.

The equation $8(x - 3) = 104$ represents this situation.

Try It!

At the mall, Claire buys a hat that is 60% off and socks that are reduced to \$5.49. She spends a total of \$9.49. Let x represent the cost of the hat. Which of the following equations correctly represents Claire's shopping trip?

$0.4x + 5.49 = 5.09$ $0.4x + 5.49 = 9.49$ $0.6x + 9.49 = 5.49$

KEY CONCEPT "is" → "="
"was" → "="

You can write an equation with more than one operation to represent a situation.

$3(x + 5) = 24$ This two-step equation uses multiplication and addition.	$\frac{1}{2} - 15 = 18$ This two-step equation uses division and subtraction.
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Do You Understand?

- Essential Question** How does an equation show the relationship between variables and other quantities in a situation?
- Use Structure** Do the equations $\frac{1}{2}x + 2 = 6$ and $\frac{1}{2}(x + 2) = 6$ represent the same situation? Explain.
- How do you decide which operations to use when writing an equation?

Do You Know How?

- Rita started the day with r apps. Then she deleted 3 apps and still had twice as many apps as Cora has. Write an equation that represents the number of apps each girl has.
- Write a problem that could be represented by the equation $5n = 6 + 19$.
make up your own
- Kayleigh babysat for 11 hours this week. That was 5 fewer than $\frac{3}{2}$ as many hours as the babysat last week. Write an equation to represent the number of hours the babysat each week.
"fewer than" less than subtraction (reverse order)
" $\frac{3}{2}$ of h "

Handwritten work for problem 6:

$$\frac{3}{2}h + 5 = 11$$

$$\frac{3}{2}h = 11 - 5$$

$$\frac{3}{2}h = 6$$

$$h = \frac{6 \cdot 2}{3}$$

$$h = \frac{12}{3}$$

$$h = 4$$

Final conclusion: Kayleigh babysat 24 hours last week.

Vertical notes on the right: End P, D, M, E, A, S, Start

Name: _____

Practice & Problem Solving

7. A farmer ships oranges in wooden crates. Suppose each orange weighs the same amount. The total weight of a crate filled with oranges is 24.5 pounds. Write an equation that represents the relationship between the weight of the crate and the number of oranges it contains.

$24.5 = 15 + 0.38g = 24.5$

empty crate: 15 lb



8. Jordan wrote the following description: Three fewer than one fourth of x is 12. Write an equation to represent the description.

9. At a graduation dinner, an equal number of guests were seated at each of 3 large tables, and 7 late-arriving guests were seated at a smaller table. There were 37 guests in all. If n represents the number of people seated at each of the large tables, what equation represents the situation?

$3 \cdot n + 7 = 37$

10. Last night, 4 friends went out to dinner at a restaurant. They split the bill evenly. Each friend paid \$12.75 for his or her meal and each left the same amount for a tip, t . The total dinner bill including the tip was \$61. What equation could you use to describe the situation?

$4(12.75 + t) = 61$

For 12 and 13, use the equation shown at the right.

12. Describe a situation that the equation could represent.

$\frac{g + 3}{6} = 15$

13. Reasoning Would the situation you wrote for Problem 12 work if the denominator in the equation were doubled? Explain why or why not.

14. You want to buy a pet iguana. You already have \$12 and plan to save \$9 per week.

a. Model with Math If w represents the number of weeks until you have enough money to buy the iguana, what equation represents your plan to afford the iguana?

b. Explain how you could set up an equation to find the amount of money you should save each week to buy the iguana in 6 weeks.



1995 → 2000 → 2005

15. In a certain country, the life expectancy of a woman born in 1995 was 80.2 years. Between 1995 and 2005, the life expectancy increased 0.4 year every 5 years.

a. If L represents the life expectancy of a woman born in 2005, what equation could you use to represent the situation?

b. Reasoning Could two different equations be used to find the value of L ? Explain.

$L = 80.2 + 2(0.4)$
 $L = 2(0.4) + 80.2$

16. Higher Order Thinking Use the equation $5x - 13 = 12$.

a. Write a description that represents the equation.

b. Of the numbers 1, 2, 3, 4, and 5, which are solutions to the equation?

$5x + 13 = 12$
 $+13 = +13$
 $5x = 25$
 $\frac{5x}{5} = \frac{25}{5}$
 $x = 5$

P
E
M
D
A
S
Start

Assessment Practice

17. A garden contains 135 flowers, each of which is either red or yellow. There are 3 beds of yellow flowers and 3 beds of red flowers. There are 30 yellow flowers in each yellow flower bed.

PART A

If r represents the number of red flowers in each red flower bed, what equation could you use to represent the number of red and yellow flowers?

$Y + R = \text{Total}$
 $3(30) + 3r = 135$
 $90 + 3r = 135$
 $-90 = -90$
 $3r = 45$
 $\frac{3r}{3} = \frac{45}{3}$
 $r = 15$

PART B

Write another real-world situation that your equation from Part A could represent.

$90 + 3r = 135$

There are 15 red flowers in each bed of red.

