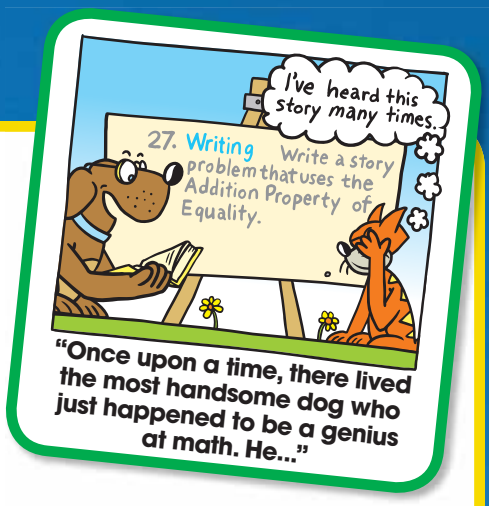
1 Equations

What You Learned Before



Simplifying Algebraic Expressions

Example 1 **Simplify $10b + 13 - 6b + 4$.**

$10b + 13 - 6b + 4 = 10b - 6b + 13 + 4$ Commutative Property of Addition

$= (10 - 6)b + 13 + 4$ Distributive Property

$= 4b + 17$ Simplify.

Example 2 **Simplify $5(x + 4) + 2x$.**

$5(x + 4) + 2x = 5(x) + 5(4) + 2x$ Distributive Property

$= 5x + 20 + 2x$ Multiply.

$= 5x + 2x + 20$ Commutative Property of Addition

$= 7x + 20$ Combine like terms.

Try It Yourself

Simplify the expression.

1. $9m - 7m + 2m$ **2.** $3g - 9 + 11g - 21$ **3.** $6(3 - y)$

4. $12(a - 4)$ **5.** $22.5 + 7(n - 3.4)$ **6.** $15k + 8(11 - k)$

Adding and Subtracting Integers

Example 3 **Find $4 + (-12)$.**

$4 + (-12) = -8$

$|-12| > |4|$. So, subtract $|4|$ from $|-12|$.

Use the sign of -12.

Example 4 **Find $-7 - (-16)$.**

$-7 - (-16) = -7 + 16$ Add the opposite of –16.

$= 9$ Add.

Try It Yourself

Add or subtract.

7. $-5 + (-2)$ **8.** $0 + (-13)$

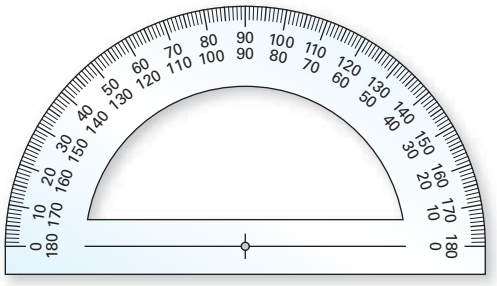
9. $-6 + 14$ **10.** $19 - (-13)$

1.1 Solving Simple Equations

Essential Question How can you use inductive reasoning to discover rules in mathematics? How can you test a rule?

1 ACTIVITY: Sum of the Angles of a Triangle

Work with a partner. Use a protractor to measure the angles of each triangle. Copy and complete the table to organize your results.



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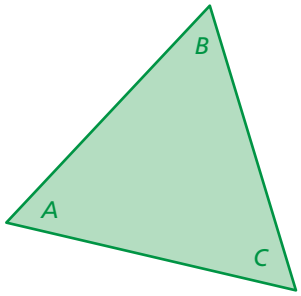

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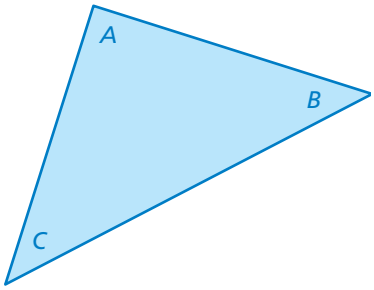

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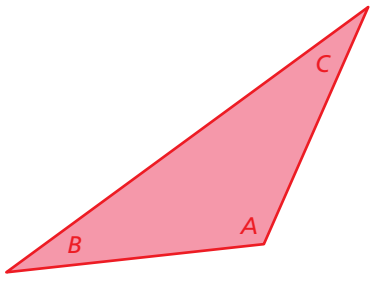

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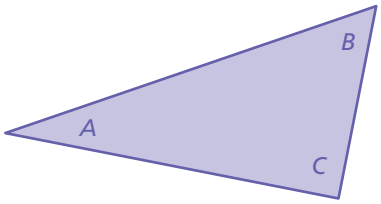


Solving Equations

In this lesson, you will

- solve simple equations using addition, subtraction, multiplication, or division.

Triangle	Angle *A* (degrees)	Angle *B* (degrees)	Angle *C* (degrees)	*A* + *B* + *C*
a.				
b.				
c.				
d.				

2 ACTIVITY: Writing a Rule

Work with a partner. Use inductive reasoning to write and test a rule.

a. **STRUCTURE** Use the completed table in Activity 1 to write a rule about the sum of the angle measures of a triangle.

b. **TEST YOUR RULE** Draw four triangles that are different from those in Activity 1. Measure the angles of each triangle. Organize your results in a table. Find the sum of the angle measures of each triangle.

3 ACTIVITY: Applying Your Rule

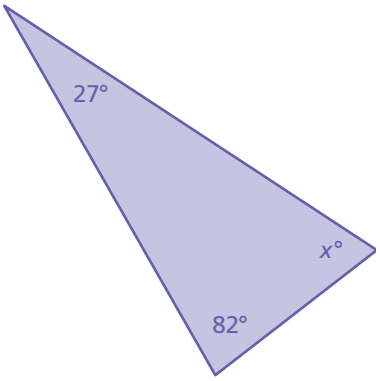
Work with a partner. Use the rule you wrote in Activity 2 to write an equation for each triangle. Then solve the equation to find the value of x. Use a protractor to check the reasonableness of your answer.

Math Practice

Analyze Conjectures

Do your results support the rule you wrote in Activity 2? Explain.

a.



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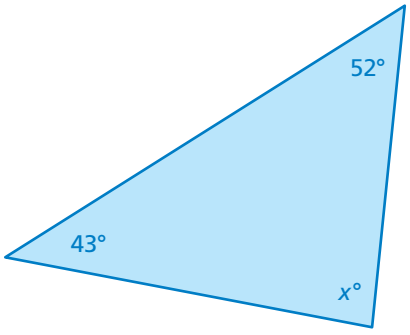

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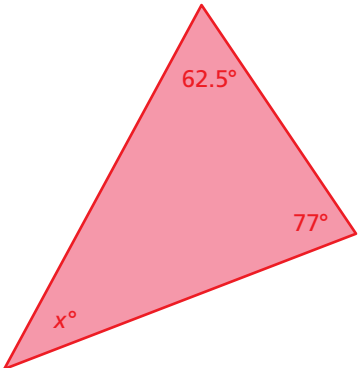

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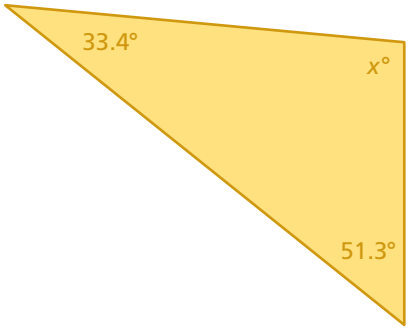

What Is Your Answer?

4. **IN YOUR OWN WORDS** How can you use inductive reasoning to discover rules in mathematics? How can you test a rule? How can you use a rule to solve problems in mathematics?

Practice Use what you learned about solving simple equations to complete Exercises 4–6 on page 7.

1.1 Lesson

Check It Out
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Remember

Addition and subtraction are inverse operations.

Key Ideas

Addition Property of Equality

Words Adding the same number to each side of an equation produces an equivalent equation.

Algebra If $a = b$, then $a + c = b + c$.

Subtraction Property of Equality

Words Subtracting the same number from each side of an equation produces an equivalent equation.

Algebra If $a = b$, then $a - c = b - c$.

EXAMPLE 1 Solving Equations Using Addition or Subtraction

a. Solve $x - 7 = -6$.

$x - 7 = -6$ Write the equation.

Undo the subtraction. → $+7 \quad +7$ Addition Property of Equality

$x = 1$ Simplify.

∴ The solution is $x = 1$.

Check

$x - 7 = -6$

$1 - 7 \stackrel{?}{=} -6$

$-6 = -6$ ✓

b. Solve $y + 3.4 = 0.5$.

$y + 3.4 = 0.5$ Write the equation.

Undo the addition. → $-3.4 \quad -3.4$ Subtraction Property of Equality

$y = -2.9$ Simplify.

∴ The solution is $y = -2.9$.

Check

$y + 3.4 = 0.5$

$-2.9 + 3.4 \stackrel{?}{=} 0.5$

$0.5 = 0.5$ ✓

c. Solve $h + 2\pi = 3\pi$.

$h + 2\pi = 3\pi$ Write the equation.

Undo the addition. → $-2\pi \quad -2\pi$ Subtraction Property of Equality

$h = \pi$ Simplify.

∴ The solution is $h = \pi$.

On Your Own

Now You're Ready
Exercises 7–15

Solve the equation. Check your solution.

1. $b + 2 = -5$ **2.** $g - 1.7 = -0.9$ **3.** $-3 = k + 3$

4. $r - \pi = \pi$ **5.** $t - \frac{1}{4} = -\frac{3}{4}$ **6.** $5.6 + z = -8$

Remember

Multiplication and division are inverse operations.

Key Ideas

Multiplication Property of Equality

Words Multiplying each side of an equation by the same number produces an equivalent equation.

Algebra If $a = b$, then $a \cdot c = b \cdot c$.

Division Property of Equality

Words Dividing each side of an equation by the same number produces an equivalent equation.

Algebra If $a = b$, then $a \div c = b \div c$, $c \neq 0$.

EXAMPLE 2 Solving Equations Using Multiplication or Division

a. Solve $-\frac{3}{4}n = -2$.

$-\frac{3}{4}n = -2$ Write the equation.

Use the reciprocal. → $-\frac{4}{3} \cdot \left(-\frac{3}{4}n\right) = -\frac{4}{3} \cdot (-2)$ Multiplication Property of Equality

$n = \frac{8}{3}$ Simplify.

∴ The solution is $n = \frac{8}{3}$.

b. Solve $\pi x = 3\pi$.

$\pi x = 3\pi$ Write the equation.

Undo the multiplication. → $\frac{\pi x}{\pi} = \frac{3\pi}{\pi}$ Division Property of Equality

$x = 3$ Simplify.

∴ The solution is $x = 3$.

Check

$\pi x = 3\pi$

$\pi(3) \stackrel{?}{=} 3\pi$

$3\pi = 3\pi$ ✓

On Your Own

Now You're Ready
Exercises 18–26

Solve the equation. Check your solution.

7. $\frac{y}{4} = -7$ **8.** $6\pi = \pi x$ **9.** $0.09w = 1.8$

EXAMPLE 3 Identifying the Solution of an Equation

What value of k makes the equation $k + 4 \div 0.2 = 5$ true?

Ⓐ -15 Ⓑ -5 Ⓒ -3 Ⓓ 1.5

$$k + 4 \div 0.2 = 5 \quad \text{Write the equation.}$$
$$k + 20 = 5 \quad \text{Divide 4 by 0.2.}$$
$$-20 \quad -20 \quad \text{Subtraction Property of Equality}$$
$$k = -15 \quad \text{Simplify.}$$

∴ The correct answer is Ⓐ.

EXAMPLE 4 Real-Life Application

The melting point of bromine is -7°C.

The *melting point* of a solid is the temperature at which the solid becomes a liquid. The melting point of bromine is $\frac{1}{30}$ of the melting point of nitrogen. Write and solve an equation to find the melting point of nitrogen.

Words The melting point of bromine is $\frac{1}{30}$ of the melting point of nitrogen.

Variable Let n be the melting point of nitrogen.

Equation $-7 = \frac{1}{30} \cdot n$

$$-7 = \frac{1}{30}n \quad \text{Write the equation.}$$
$$30 \cdot (-7) = 30 \cdot \left(\frac{1}{30}n\right) \quad \text{Multiplication Property of Equality}$$
$$-210 = n \quad \text{Simplify.}$$

∴ So, the melting point of nitrogen is -210°C.

On Your Own

Now You're Ready
Exercises 33–38

10. Solve $p - 8 \div \frac{1}{2} = -3$.

11. Solve $q + |-10| = 2$.

12. The melting point of mercury is about $\frac{1}{4}$ of the melting point of krypton. The melting point of mercury is -39°C. Write and solve an equation to find the melting point of krypton.

1.1 Exercises

Check It Out
Help with Homework
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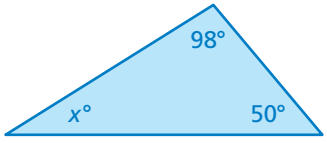
Vocabulary and Concept Check

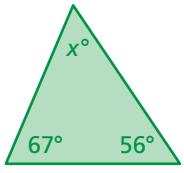
1. **VOCABULARY** Which of the operations $+$, $-$, $\times$, and $\div$ are inverses of each other?
2. **VOCABULARY** Are the equations $3x = -9$ and $4x = -12$ equivalent? Explain.
3. **WHICH ONE DOESN'T BELONG?** Which equation does *not* belong with the other three? Explain your reasoning.

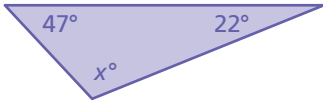
$x - 2 = 4$ $\quad$ $x - 3 = 6$ $\quad$ $x - 5 = 1$ $\quad$ $x - 6 = 0$

Practice and Problem Solving

CHOOSE TOOLS **Find the value of x. Check the reasonableness of your answer.**

4. 

5. 

6. 

Solve the equation. Check your solution.

7. $x + 12 = 7$
8. $g - 16 = 8$
9. $-9 + p = 12$
10. $0.7 + y = -1.34$
11. $x - 8\pi = \pi$
12. $4\pi = w - 6\pi$
13. $\frac{5}{6} = \frac{1}{3} + d$
14. $\frac{3}{8} = r + \frac{2}{3}$
15. $n - 1.4 = -6.3$

16. **CONCERT** A discounted concert ticket costs \$14.50 less than the original price p. You pay \$53 for a discounted ticket. Write and solve an equation to find the original price.

17. **BOWLING** Your friend's final bowling score is 105. Your final bowling score is 14 pins less than your friend's final score.

9	10	FINAL SCORE
8 –	7 / 6	105
89	105	
6 3	9	?
82		

a. Write and solve an equation to find your final score.

b. Your friend made a spare in the 10th frame. Did you? Explain.

Solve the equation. Check your solution.

18. $7x = 35$

19. $4 = -0.8n$

20. $6 = -\frac{w}{8}$

21. $\frac{m}{\pi} = 7.3$

22. $-4.3g = 25.8$

23. $\frac{3}{2} = \frac{9}{10}k$

24. $-7.8x = -1.56$

25. $-2 = \frac{6}{7}p$

26. $3\pi d = 12\pi$

27. ERROR ANALYSIS Describe and correct the error in solving the equation.

$$-1.5 + k = 8.2$$
$$k = 8.2 + (-1.5)$$
$$k = 6.7$$

28. TENNIS A gym teacher orders 42 tennis balls. Each package contains 3 tennis balls. Which of the following equations represents the number x of packages?

$x + 3 = 42$ $\quad$ $3x = 42$ $\quad$ $\frac{x}{3} = 42$ $\quad$ $x = \frac{3}{42}$

MODELING In Exercises 29–32, write and solve an equation to answer the question.

29. PARK You clean a community park for 6.5 hours. You earn \$42.25. How much do you earn per hour?

30. ROCKET LAUNCH A rocket is scheduled to launch from a command center in 3.75 hours. What time is it now?

31. BANKING After earning interest, the balance of an account is \$420. The new balance is $\frac{7}{6}$ of the original balance. How much interest did it earn?

Roller Coasters at Cedar Point	
Coaster	**Height (feet)**
Top Thrill Dragster	420
Millennium Force	310
Magnum XL-200	205
Mantis	?

32. ROLLER COASTER Cedar Point amusement park has some of the tallest roller coasters in the United States. The Mantis is 165 feet shorter than the Millennium Force. What is the height of the Mantis?

Solve the equation. Check your solution.

33. $-3 = h + 8 \div 2$

34. $12 = w - |-7|$

35. $q + |6.4| = 9.6$

36. $d - 2.8 \div 0.2 = -14$

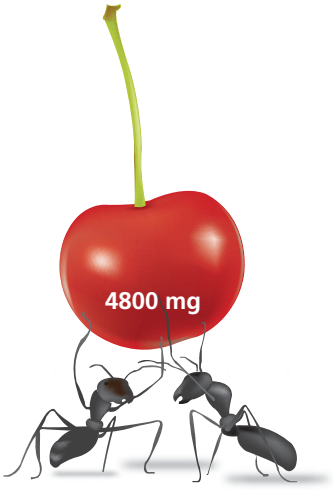
37. $\frac{8}{9} = x + \frac{1}{3}(7)$

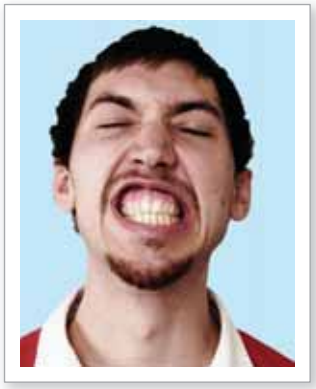
38. $p - \frac{1}{4} \cdot 3 = -\frac{5}{6}$

39. **LOGIC** Without solving, determine whether the solution of $-2x = -15$ is *greater than* or *less than* -15. Explain.

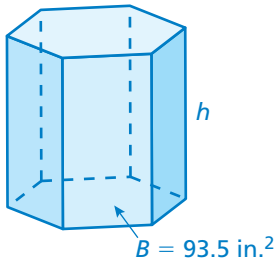
40. **OPEN-ENDED** Write a subtraction equation and a division equation so that each has a solution of -2.

41. **ANTS** Some ant species can carry 50 times their body weight. It takes 32 ants to carry the cherry. About how much does each ant weigh?





42. **REASONING** One-fourth of the girls and one-eighth of the boys in a class retake their school pictures. The photographer retakes pictures for 16 girls and 7 boys. How many students are in the class?



43. **VOLUME** The volume V of the prism is 1122 cubic inches. Use the formula $V = Bh$ to find the height h of the prism.

44. Critical Thinking A neighbor pays you and two friends \$90 to paint her garage. You divide the money three ways in the ratio 2 : 3 : 5.

a. How much does each person receive?

b. What is one possible reason the money is not divided evenly?

Fair Game Review What you learned in previous grades & lessons

Simplify the expression. *(Skills Review Handbook)*

45. $2(x - 2) + 5x$

46. $0.4b - 3.2 + 1.2b$

47. $\frac{1}{4}g + 6g - \frac{2}{3}$

48. **MULTIPLE CHOICE** The temperature at 4:00 P.M. was -12 °C. By 11:00 P.M., the temperature had dropped 14 °C. What was the temperature at 11:00 P.M.? *(Skills Review Handbook)*

A -26 °C **B** -2 °C **C** 2 °C **D** 26 °C

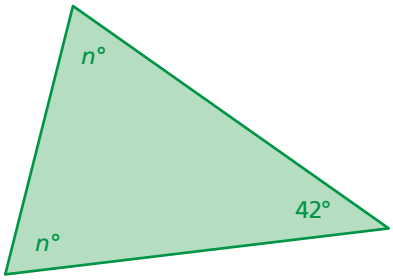
1.2 Solving Multi-Step Equations

Essential Question How can you solve a multi-step equation? How can you check the reasonableness of your solution?

1 ACTIVITY: Solving for the Angles of a Triangle

Work with a partner. Write an equation for each triangle. Solve the equation to find the value of the variable. Then find the angle measures of each triangle. Use a protractor to check the reasonableness of your answer.

a.



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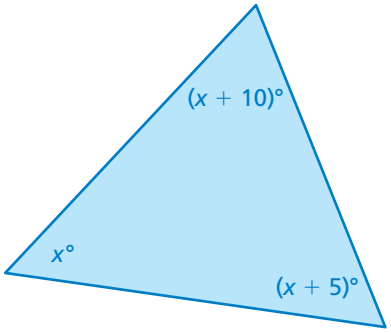

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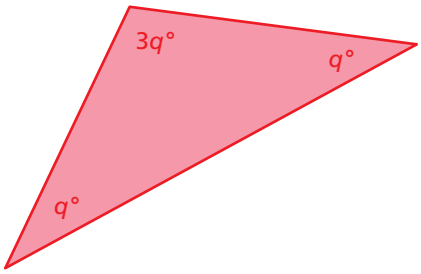

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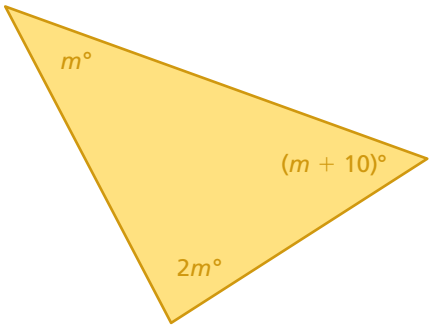
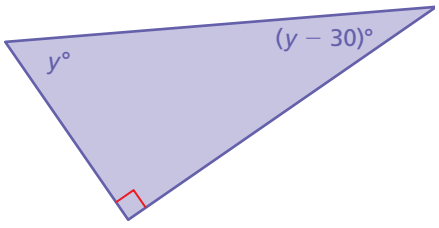


Solving Equations

In this lesson, you will

- use inverse operations to solve multi-step equations.
- use the Distributive Property to solve multi-step equations.

e.



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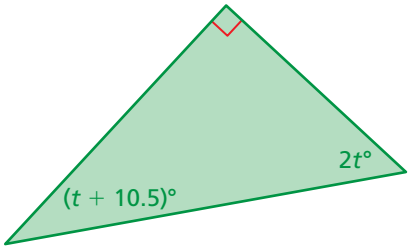


2 ACTIVITY: Problem-Solving Strategy

Math Practice

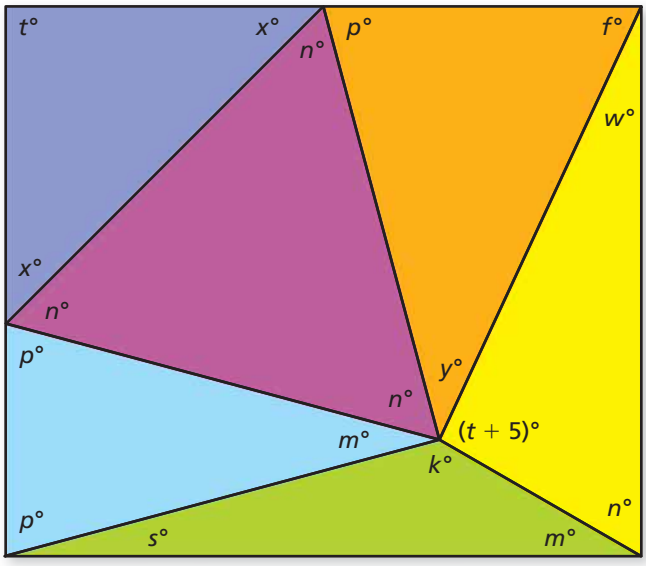
Find Entry Points

How do you decide which triangle to solve first? Explain.

Work with a partner.

The six triangles form a rectangle.

Find the angle measures of each triangle. Use a protractor to check the reasonableness of your answers.



3 ACTIVITY: Puzzle

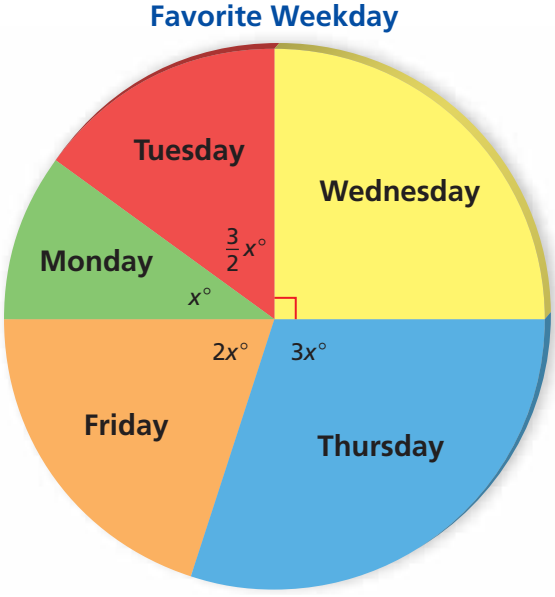
Work with a partner. A survey asked 200 people to name their favorite weekday. The results are shown in the circle graph.

a. How many degrees are in each part of the circle graph?

b. What percent of the people chose each day?

c. How many people chose each day?

d. Organize your results in a table.



What Is Your Answer?

4. IN YOUR OWN WORDS How can you solve a multi-step equation? How can you check the reasonableness of your solution?

Practice Use what you learned about solving multi-step equations to complete Exercises 3–5 on page 14.

1.2 Lesson

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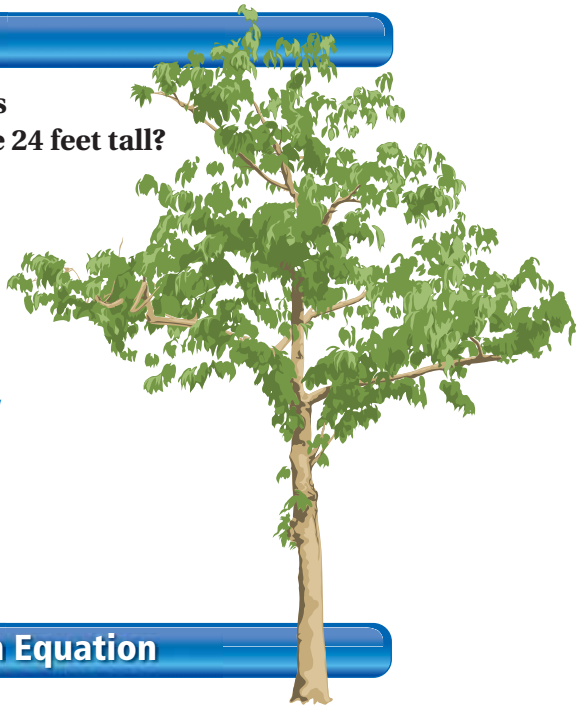
Key Idea

Solving Multi-Step Equations

To solve multi-step equations, use inverse operations to isolate the variable.

EXAMPLE 1 Solving a Two-Step Equation



The height (in feet) of a tree after x years is $1.5x + 15$. After how many years is the tree 24 feet tall?

$1.5x + 15 = 24$ Write an equation.

Undo the addition. → $-15 \quad -15$ Subtraction Property of Equality

$1.5x = 9$ Simplify.

Undo the multiplication. → $\frac{1.5x}{1.5} = \frac{9}{1.5}$ Division Property of Equality

$x = 6$ Simplify.

∴ So, the tree is 24 feet tall after 6 years.

EXAMPLE 2 Combining Like Terms to Solve an Equation

Solve $8x - 6x - 25 = -35$.

$8x - 6x - 25 = -35$ Write the equation.

$2x - 25 = -35$ Combine like terms.

Undo the subtraction. → $+25 \quad +25$ Addition Property of Equality

$2x = -10$ Simplify.

Undo the multiplication. → $\frac{2x}{2} = \frac{-10}{2}$ Division Property of Equality

$x = -5$ Simplify.

∴ The solution is $x = -5$.

On Your Own

Now You're Ready
Exercises 6–9

Solve the equation. Check your solution.

1. $-3z + 1 = 7$
2. $\frac{1}{2}x - 9 = -25$
3. $-4n - 8n + 17 = 23$

EXAMPLE 3 Using the Distributive Property to Solve an Equation

Solve $2(1 - 5x) + 4 = -8$.

$2(1 - 5x) + 4 = -8$ Write the equation.

$2(1) - 2(5x) + 4 = -8$ Distributive Property

$2 - 10x + 4 = -8$ Multiply.

$-10x + 6 = -8$ Combine like terms.

$-6 \quad -6$ Subtraction Property of Equality

$-10x = -14$ Simplify.

$\frac{-10x}{-10} = \frac{-14}{-10}$ Division Property of Equality

$x = 1.4$ Simplify.

Study Tip

Here is another way to solve the equation in Example 3.

$2(1 - 5x) + 4 = -8$

$2(1 - 5x) = -12$

$1 - 5x = -6$

$-5x = -7$

$x = 1.4$

EXAMPLE 4 Real-Life Application

STEM VIDEO

Use the table to find the number of miles x you need to run on Friday so that the mean number of miles run per day is 1.5.

Day	Miles
Monday	2
Tuesday	0
Wednesday	1.5
Thursday	0
Friday	x

Write an equation using the definition of *mean*.

sum of the data → $\frac{2 + 0 + 1.5 + 0 + x}{5} = 1.5$ Write the equation.

number of values →

$\frac{3.5 + x}{5} = 1.5$ Combine like terms.

Undo the division. → $5 \cdot \frac{3.5 + x}{5} = 5 \cdot 1.5$ Multiplication Property of Equality

$3.5 + x = 7.5$ Simplify.

Undo the addition. → $-3.5 \quad -3.5$ Subtraction Property of Equality

$x = 4$ Simplify.

∴ So, you need to run 4 miles on Friday.

On Your Own

Now You're Ready
Exercises 10 and 11

Solve the equation. Check your solution.

4. $-3(x + 2) + 5x = -9$ **5.** $5 + 1.5(2d - 1) = 0.5$

6. You scored 88, 92, and 87 on three tests. Write and solve an equation to find the score you need on the fourth test so that your mean test score is 90.

1.2 Exercises

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Vocabulary and Concept Check

1. **WRITING** Write the verbal statement as an equation. Then solve.

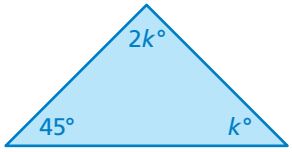
   2 more than 3 times a number is 17.

2. **OPEN-ENDED** Explain how to solve the equation $2(4x - 11) + 9 = 19$.

Practice and Problem Solving

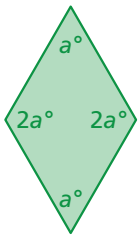
CHOOSE TOOLS **Find the value of the variable. Then find the angle measures of the polygon. Use a protractor to check the reasonableness of your answer.**

3.



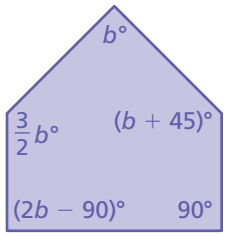
Sum of angle measures: 180°

4.



Sum of angle measures: 360°

5.



Sum of angle measures: 540°

Solve the equation. Check your solution.

1 2 6. $10x + 2 = 32$

7. $19 - 4c = 17$

8. $1.1x + 1.2x - 5.4 = -10$

9. $\frac{2}{3}h - \frac{1}{3}h + 11 = 8$

3 10. $6(5 - 8v) + 12 = -54$

11. $21(2 - x) + 12x = 44$

12. **ERROR ANALYSIS** Describe and correct the error in solving the equation.

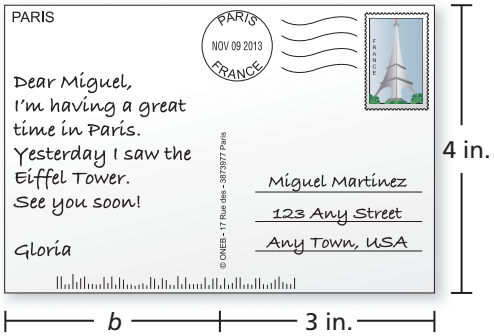
$$\begin{aligned} -2(7 - y) + 4 &= -4 \\ -14 - 2y + 4 &= -4 \\ -10 - 2y &= -4 \\ -2y &= 6 \\ y &= -3 \end{aligned}$$

13. **WATCHES** The cost C (in dollars) of making n watches is represented by $C = 15n + 85$. How many watches are made when the cost is \$385?

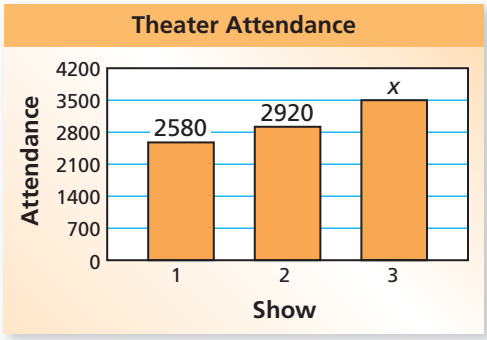
14. **HOUSE** The height of the house is 26 feet. What is the height x of each story?

In Exercises 15–17, write and solve an equation to answer the question.

15. **POSTCARD** The area of the postcard is 24 square inches. What is the width b of the message (in inches)?



16. **BREAKFAST** You order two servings of pancakes and a fruit cup. The cost of the fruit cup is $1.50. You leave a 15% tip. Your total bill is $11.50. How much does one serving of pancakes cost?



17. **THEATER** How many people must attend the third show so that the average attendance per show is 3000?

18. **DIVING** Divers in a competition are scored by an international panel of judges. The highest and the lowest scores are dropped. The total of the remaining scores is multiplied by the degree of difficulty of the dive. This product is multiplied by 0.6 to determine the final score.

a. A diver's final score is 77.7. What is the degree of difficulty of the dive?

Judge	Russia	China	Mexico	Germany	Italy	Japan	Brazil
Score	7.5	8.0	6.5	8.5	7.0	7.5	7.0

b. Critical Thinking The degree of difficulty of a dive is 4.0. The diver's final score is 97.2. Judges award half or whole points from 0 to 10. What scores could the judges have given the diver?

Fair Game Review What you learned in previous grades & lessons

Let $a = 3$ and $b = -2$. Copy and complete the statement using <, >, or =. *(Skills Review Handbook)*

19. $-5a$ ☐ 4 **20.** 5 ☐ $b + 7$ **21.** $a - 4$ ☐ $10b + 8$

22. **MULTIPLE CHOICE** What value of x makes the equation $x + 5 = 2x$ true? *(Skills Review Handbook)*

(A) -1 (B) 0 (C) 3 (D) 5

1 Study Help

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You can use a **Y chart** to compare two topics. List differences in the branches and similarities in the base of the Y. Here is an example of a Y chart that compares solving simple equations using addition to solving simple equations using subtraction.

Solving Simple Equations Using Addition

- Add the same number to each side of the equation.

Solving Simple Equations Using Subtraction

- Subtract the same number from each side of the equation.

- You can solve the equation in one step.
- You produce an equivalent equation.
- The variable can be on either side of the equation.
- It is always a good idea to check your solution.

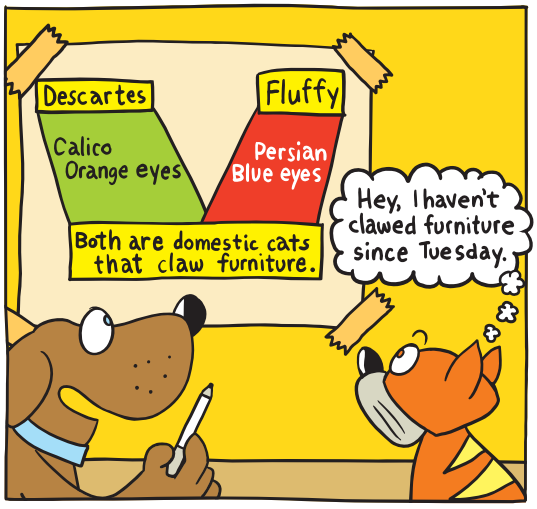
On Your Own

Make Y charts to help you study and compare these topics.

1. solving simple equations using multiplication and solving simple equations using division
2. solving simple equations and solving multi-step equations

After you complete this chapter, make Y charts for the following topics.

3. solving equations with the variable on one side and solving equations with variables on both sides
4. solving multi-step equations and solving equations with variables on both sides
5. solving multi-step equations and rewriting literal equations



"I made a Y chart to compare and contrast Fluffy's characteristics with yours."

1.1–1.2 Quiz

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Progress Check
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Solve the equation. Check your solution. *(Section 1.1)*

1. $-\frac{1}{2} = y - 1$

2. $-3\pi + w = 2\pi$

3. $1.2m = 0.6$

4. $q + 2.7 = -0.9$

Solve the equation. Check your solution. *(Section 1.2)*

5. $-4k + 17 = 1$

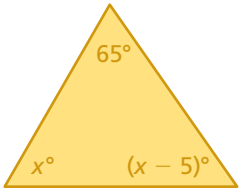
6. $\frac{1}{4}z + 8 = 12$

7. $-3(2n + 1) + 7 = -5$

8. $2.5(t - 2) - 6 = 9$

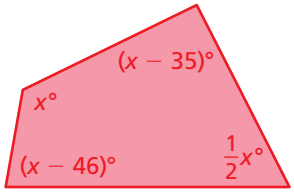
Find the value of x. Then find the angle measures of the polygon. *(Section 1.2)*

9.



Sum of angle measures: 180°

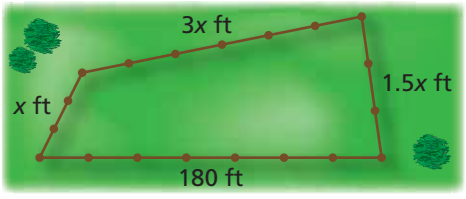
10.



Sum of angle measures: 360°

11. JEWELER The equation $P = 2.5m + 35$ represents the price P (in dollars) of a bracelet, where m is the cost of the materials (in dollars). The price of a bracelet is \$115. What is the cost of the materials? *(Section 1.2)*

12. PASTURE A 455-foot fence encloses a pasture. What is the length of each side of the pasture? *(Section 1.2)*



13. POSTERS A machine prints 230 movie posters each hour. Write and solve an equation to find the number of hours it takes the machine to print 1265 posters. *(Section 1.1)*

14. BASKETBALL Use the table to write and solve an equation to find the number of points p you need to score in the fourth game so that the mean number of points is 20. *(Section 1.2)*

Game	Points
1	25
2	15
3	18
4	p

1.3 Solving Equations with Variables on Both Sides

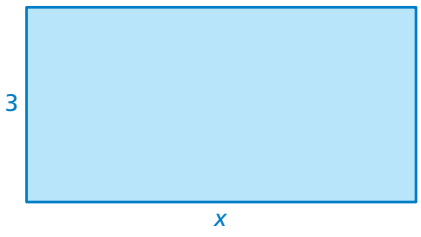
Essential Question How can you solve an equation that has variables on both sides?

1 ACTIVITY: Perimeter and Area

Work with a partner.

- **Each figure has the unusual property that the value of its perimeter (in feet) is equal to the value of its area (in square feet). Write an equation for each figure.**
- **Solve each equation for x.**
- **Use the value of x to find the perimeter and the area of each figure.**
- **Describe how you can check your solution.**

a.



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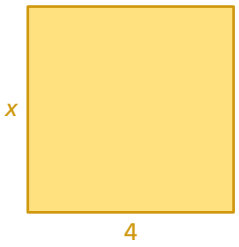
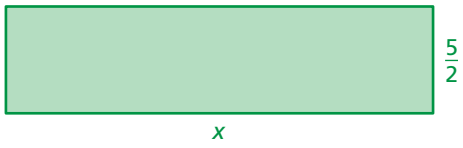
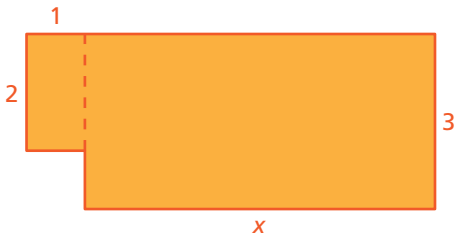


c.

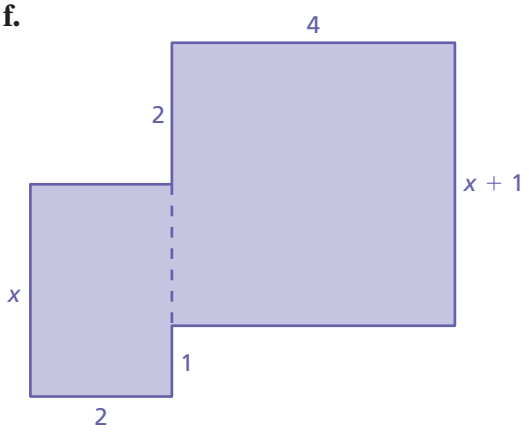
d.



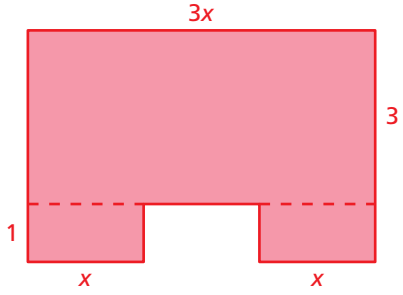
e.



f.



g.



Solving Equations

In this lesson, you will

- solve equations with variables on both sides.
- determine whether equations have no solution or infinitely many solutions.

2 ACTIVITY: Surface Area and Volume

Math Practice

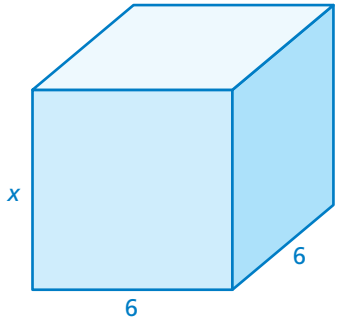
Use Operations

What properties of operations do you need to use in order to find the value of x?

Work with a partner.

- **Each solid has the unusual property that the value of its surface area (in square inches) is equal to the value of its volume (in cubic inches). Write an equation for each solid.**
- **Solve each equation for x.**
- **Use the value of x to find the surface area and the volume of each solid.**
- **Describe how you can check your solution.**

a.



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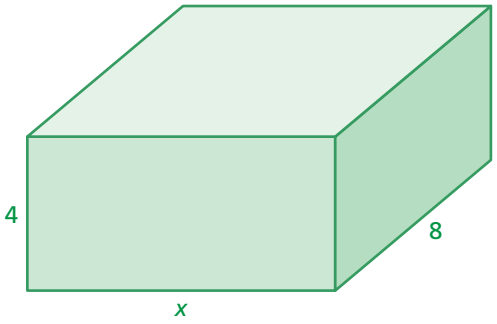
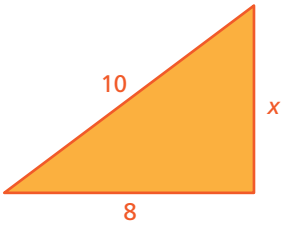
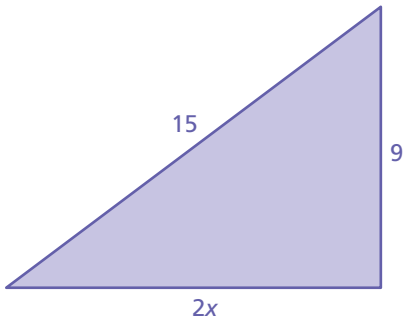


3 ACTIVITY: Puzzle

Work with a partner. The perimeter of the larger triangle is 150% of the perimeter of the smaller triangle. Find the dimensions of each triangle.





What Is Your Answer?

4. **IN YOUR OWN WORDS** How can you solve an equation that has variables on both sides? How do you move a variable term from one side of the equation to the other?

5. Write an equation that has variables on both sides. Solve the equation.

Practice

Use what you learned about solving equations with variables on both sides to complete Exercises 3–5 on page 23.

1.3 Lesson

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Key Idea

Solving Equations with Variables on Both Sides

To solve equations with variables on both sides, collect the variable terms on one side and the constant terms on the other side.

EXAMPLE 1 Solving an Equation with Variables on Both Sides

Solve $15 - 2x = -7x$. Check your solution.

	$15 - 2x = -7x$	Write the equation.
Undo the subtraction. →	$+ 2x \quad + 2x$	Addition Property of Equality
	$15 = -5x$	Simplify.
Undo the multiplication. →	$\frac{15}{-5} = \frac{-5x}{-5}$	Division Property of Equality
	$-3 = x$	Simplify.

∴ The solution is $x = -3$.

Check

$15 - 2x = -7x$

$15 - 2(-3) \stackrel{?}{=} -7(-3)$

$21 = 21$ ✓

EXAMPLE 2 Using the Distributive Property to Solve an Equation

Solve $-2(x - 5) = 6\left(2 - \frac{1}{2}x\right)$.

	$-2(x - 5) = 6\left(2 - \frac{1}{2}x\right)$	Write the equation.
	$-2x + 10 = 12 - 3x$	Distributive Property
Undo the subtraction. →	$+ 3x \quad + 3x$	Addition Property of Equality
	$x + 10 = 12$	Simplify.
Undo the addition. →	$- 10 \quad - 10$	Subtraction Property of Equality
	$x = 2$	Simplify.

∴ The solution is $x = 2$.

On Your Own

Now You're Ready
Exercises 6–14

Solve the equation. Check your solution.

1. $-3x = 2x + 19$
2. $2.5y + 6 = 4.5y - 1$
3. $6(4 - z) = 2z$

Some equations do not have one solution. Equations can also have no solution or infinitely many solutions.

When solving an equation that has no solution, you will obtain an equivalent equation that is not true for any value of the variable, such as $0 = 2$.

EXAMPLE 3 Solving Equations with No Solution

Solve $3 - 4x = -7 - 4x$.

$3 - 4x = -7 - 4x$ Write the equation.

Undo the subtraction. → $+ 4x \quad + 4x$ Addition Property of Equality

$3 = -7$ ✗ Simplify.

∴ The equation $3 = -7$ is never true. So, the equation has no solution.

When solving an equation that has infinitely many solutions, you will obtain an equivalent equation that is true for all values of the variable, such as $-5 = -5$.

EXAMPLE 4 Solving Equations with Infinitely Many Solutions

Solve $6x + 4 = 4\left(\frac{3}{2}x + 1\right)$.

$6x + 4 = 4\left(\frac{3}{2}x + 1\right)$ Write the equation.

$6x + 4 = 6x + 4$ Distributive Property

Undo the addition. → $- 6x \quad - 6x$ Subtraction Property of Equality

$4 = 4$ Simplify.

∴ The equation $4 = 4$ is always true. So, the equation has infinitely many solutions.

On Your Own

Now You're Ready
Exercises 18–29

Solve the equation.

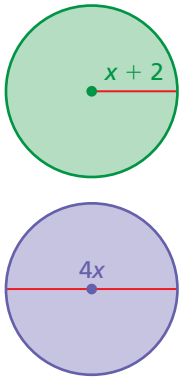
4. $2x + 1 = 2x - 1$

5. $\frac{1}{2}(6t - 4) = 3t - 2$

6. $\frac{1}{3}(2b + 9) = \frac{2}{3}\left(b + \frac{9}{2}\right)$

7. $6(5 - 2v) = -4(3v + 1)$

EXAMPLE 5 Writing and Solving an Equation



The circles are identical. What is the area of each circle?

Ⓐ 2 Ⓑ 4 Ⓒ 16π Ⓓ 64π

The circles are identical, so the radius of each circle is the same.

$x + 2 = 2x$ Write an equation. The radius of the purple circle is $\frac{4x}{2} = 2x$.

$-x \quad -x$ Subtraction Property of Equality

$2 = x$ Simplify.

Because the radius of each circle is 4, the area of each circle is $\pi r^2 = \pi(4)^2 = 16\pi$.

∴ So, the correct answer is Ⓒ.

EXAMPLE 6 Real-Life Application

A boat travels x miles per hour upstream on the Mississippi River. On the return trip, the boat travels 2 miles per hour faster. How far does the boat travel upstream?

The speed of the boat on the return trip is $(x + 2)$ miles per hour.

Distance upstream = Distance of return trip

$3x = 2.5(x + 2)$ Write an equation.

$3x = 2.5x + 5$ Distributive Property

$-2.5x \quad -2.5x$ Subtraction Property of Equality

$0.5x = 5$ Simplify.

$\frac{0.5x}{0.5} = \frac{5}{0.5}$ Division Property of Equality

$x = 10$ Simplify.

∴ The boat travels 10 miles per hour for 3 hours upstream. So, it travels 30 miles upstream.

On Your Own

8. **WHAT IF?** In Example 5, the diameter of the purple circle is $3x$. What is the area of each circle?

9. A boat travels x miles per hour from one island to another island in 2.5 hours. The boat travels 5 miles per hour faster on the return trip of 2 hours. What is the distance between the islands?

1.3 Exercises

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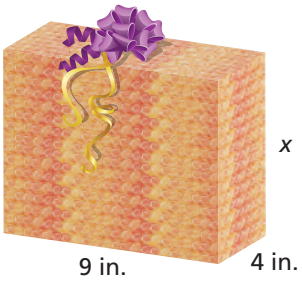
Vocabulary and Concept Check

1. **WRITING** Is $x = 3$ a solution of the equation $3x - 5 = 4x - 9$? Explain.
2. **OPEN-ENDED** Write an equation that has variables on both sides and has a solution of -3.

Practice and Problem Solving

The value of the solid's surface area is equal to the value of the solid's volume. Find the value of x.

3.


4.


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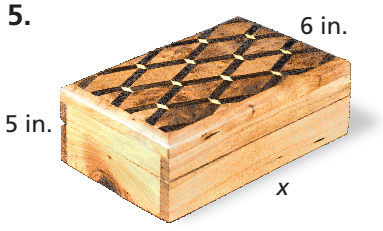


Solve the equation. Check your solution.

6. $m - 4 = 2m$
7. $3k - 1 = 7k + 2$
8. $6.7x = 5.2x + 12.3$
9. $-24 - \frac{1}{8}p = \frac{3}{8}p$
10. $12(2w - 3) = 6w$
11. $2(n - 3) = 4n + 1$
12. $2(4z - 1) = 3(z + 2)$
13. $0.1x = 0.2(x + 2)$
14. $\frac{1}{6}d + \frac{2}{3} = \frac{1}{4}(d - 2)$

15. **ERROR ANALYSIS** Describe and correct the error in solving the equation.

$$
\begin{aligned}
3x - 4 &= 2x + 1 \\
3x - 4 - 2x &= 2x + 1 - 2x \\
x - 4 &= 1 \\
x - 4 + 4 &= 1 - 4 \\
x &= -3
\end{aligned}
$$

16. **TRAIL MIX** The equation $4.05p + 14.40 = 4.50(p + 3)$ represents the number p of pounds of peanuts you need to make trail mix. How many pounds of peanuts do you need for the trail mix?

17. **CARS** Write and solve an equation to find the number of miles you must drive to have the same cost for each of the car rentals.


$15 plus $0.50 per mile


$25 plus $0.25 per mile

Solve the equation. Check your solution, if possible.

3 4 **18.** $x + 6 = x$

19. $3x - 1 = 1 - 3x$

20. $4x - 9 = 3.5x - 9$

21. $\frac{1}{2}x + \frac{1}{2}x = x + 1$

22. $3x + 15 = 3(x + 5)$

23. $\frac{1}{3}(9x + 3) = 3x + 1$

24. $5x - 7 = 4x - 1$

25. $2x + 4 = -(-7x + 6)$

26. $5.5 - x = -4.5 - x$

27. $10x - \frac{8}{3} - 4x = 6x$

28. $-3(2x - 3) = -6x + 9$

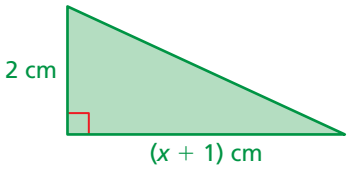
29. $6(7x + 7) = 7(6x + 6)$

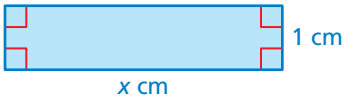
30. ERROR ANALYSIS Describe and correct the error in solving the equation.

$$-4(2n - 3) = 12 - 8n$$
$$-8n + 12 = 12 - 8n$$
$$-8n = -8n$$
$$0 = 0$$
The solution is $n = 0$.

31. OPEN-ENDED Write an equation with variables on both sides that has no solution. Explain why it has no solution.

32. GEOMETRY Are there any values of x for which the areas of the figures are the same? Explain.

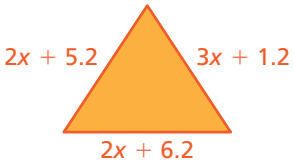




33. SATELLITE TV Provider A charges $75 for installation and charges $39.95 per month for the basic package. Provider B offers free installation and charges $39.95 per month for the basic package. Your neighbor subscribes to Provider A the same month you subscribe to Provider B. After how many months is your neighbor's total cost the same as your total cost for satellite TV?

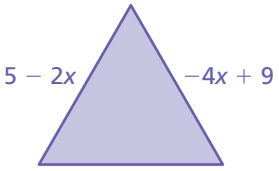
34. PIZZA CRUST Pepe's Pizza makes 52 pizza crusts the first week and 180 pizza crusts each subsequent week. Dianne's Delicatessen makes 26 pizza crusts the first week and 90 pizza crusts each subsequent week. In how many weeks will the total number of pizza crusts made by Pepe's Pizza equal twice the total number of pizza crusts made by Dianne's Delicatessen?

35. PRECISION Is the triangle an equilateral triangle? Explain.



A polygon is *regular* if each of its sides has the same length. Find the perimeter of the regular polygon.

36.



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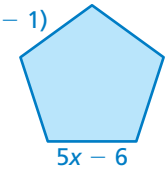

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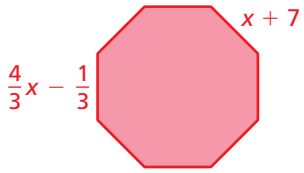
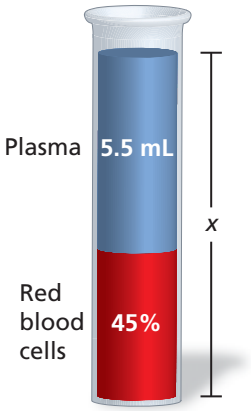


39. PRECISION The cost of mailing a DVD in an envelope by Express Mail® is equal to the cost of mailing a DVD in a box by Priority Mail®. What is the weight of the DVD with its packing material? Round your answer to the nearest hundredth.

	Packing Material	Priority Mail®	Express Mail®
Box	$2.25	$2.50 per lb	$8.50 per lb
Envelope	$1.10	$2.50 per lb	$8.50 per lb

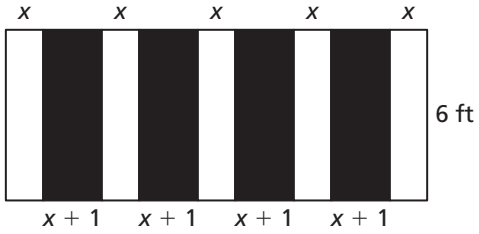


40. PROBLEM SOLVING Would you solve the equation $0.25x + 7 = \frac{1}{3}x - 8$ using fractions or decimals? Explain.

41. BLOOD SAMPLE The amount of red blood cells in a blood sample is equal to the total amount in the sample minus the amount of plasma. What is the total amount x of blood drawn?

42. NUTRITION One serving of oatmeal provides 16% of the fiber you need daily. You must get the remaining 21 grams of fiber from other sources. How many grams of fiber should you consume daily?

43. Geometry A 6-foot-wide hallway is painted as shown, using equal amounts of white and black paint.



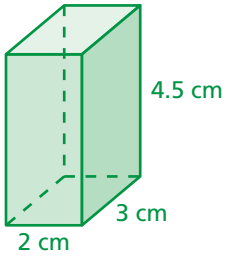
a. How long is the hallway?

b. Can this same hallway be painted with the same pattern, but using twice as much black paint as white paint? Explain.

Fair Game Review What you learned in previous grades & lessons

Find the volume of the solid. *(Skills Review Handbook)*

44.



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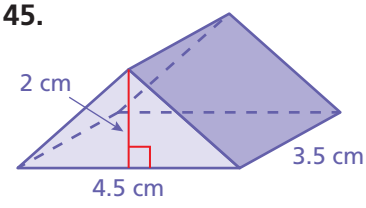

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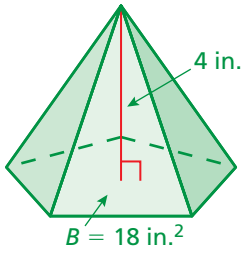


47. MULTIPLE CHOICE A car travels 480 miles on 15 gallons of gasoline. How many miles does the car travel per gallon? *(Skills Review Handbook)*

(A) 28 mi/gal (B) 30 mi/gal (C) 32 mi/gal (D) 35 mi/gal

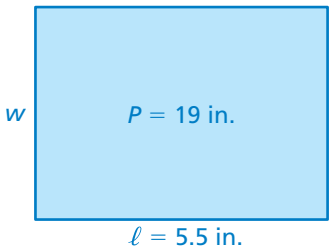
1.4 Rewriting Equations and Formulas

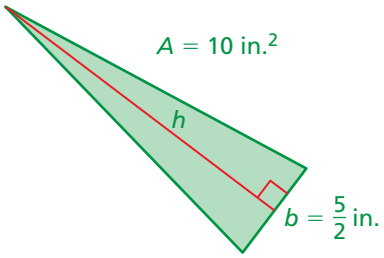
Essential Question How can you use a formula for one measurement to write a formula for a different measurement?

1 ACTIVITY: Using Perimeter and Area Formulas

Work with a partner.

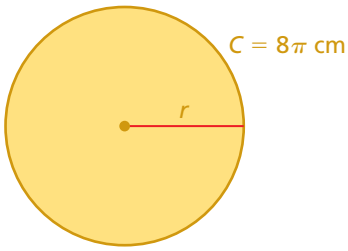
a.
- Write a formula for the perimeter P of a rectangle.
- Solve the formula for w.
- Use the new formula to find the width of the rectangle.

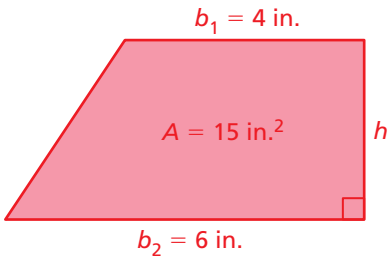




b.
- Write a formula for the area A of a triangle.
- Solve the formula for h.
- Use the new formula to find the height of the triangle.

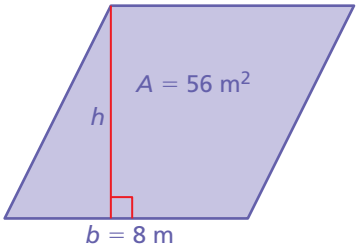
c.
- Write a formula for the circumference C of a circle.
- Solve the formula for r.
- Use the new formula to find the radius of the circle.





d.
- Write a formula for the area A of a trapezoid.
- Solve the formula for h.
- Use the new formula to find the height of the trapezoid.

e.
- Write a formula for the area A of a parallelogram.
- Solve the formula for h.
- Use the new formula to find the height of the parallelogram.



Solving Equations

In this lesson, you will

- rewrite equations to solve for one variable in terms of the other variable(s).

2 ACTIVITY: Using Volume and Surface Area Formulas

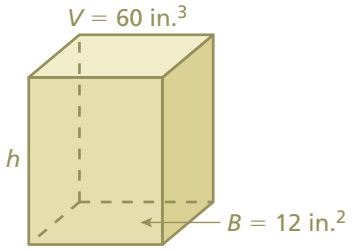
Math Practice

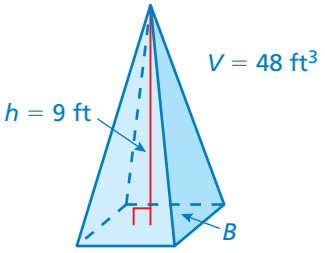
Find General Methods

What do you have to do each time to solve for the given variable? Why does this process result in a new formula?

Work with a partner.

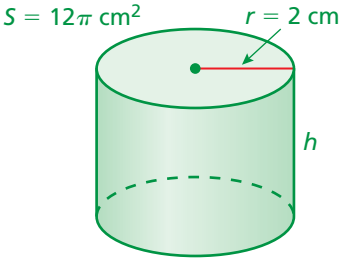
a.
- Write a formula for the volume V of a prism.
- Solve the formula for h.
- Use the new formula to find the height of the prism.

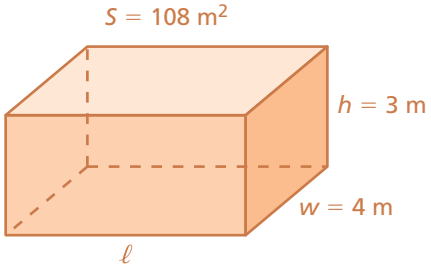




b.
- Write a formula for the volume V of a pyramid.
- Solve the formula for B.
- Use the new formula to find the area of the base of the pyramid.

c.
- Write a formula for the lateral surface area S of a cylinder.
- Solve the formula for h.
- Use the new formula to find the height of the cylinder.





d.
- Write a formula for the surface area S of a rectangular prism.
- Solve the formula for ℓ.
- Use the new formula to find the length of the rectangular prism.

What Is Your Answer?

3. IN YOUR OWN WORDS How can you use a formula for one measurement to write a formula for a different measurement? Give an example that is different from the examples on these two pages.

Practice Use what you learned about rewriting equations and formulas to complete Exercises 3 and 4 on page 30.

1.4 Lesson

Check It Out
Lesson Tutorials
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Key Vocabulary
literal equation, *p. 28*

An equation that has two or more variables is called a **literal equation**. To rewrite a literal equation, solve for one variable in terms of the other variable(s).

EXAMPLE 1 Rewriting an Equation

Solve the equation $2y + 5x = 6$ for y.

$2y + 5x = 6$ — Write the equation.

Undo the addition. → $2y + 5x - 5x = 6 - 5x$ — Subtraction Property of Equality

$2y = 6 - 5x$ — Simplify.

Undo the multiplication. → $\frac{2y}{2} = \frac{6 - 5x}{2}$ — Division Property of Equality

$y = 3 - \frac{5}{2}x$ — Simplify.

On Your Own

Now You're Ready
Exercises 5–10

Solve the equation for y.

1. $5y - x = 10$ **2.** $4x - 4y = 1$ **3.** $12 = 6x + 3y$

EXAMPLE 2 Rewriting a Formula

The formula for the surface area S of a cone is $S = \pi r^2 + \pi r\ell$. Solve the formula for the slant height ℓ.

Remember
A *formula* shows how one variable is related to one or more other variables. A formula is a type of literal equation.

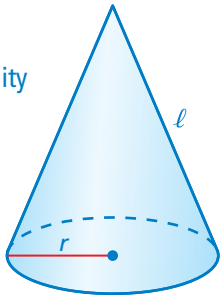
$S = \pi r^2 + \pi r\ell$ — Write the formula.

$S - \pi r^2 = \pi r^2 - \pi r^2 + \pi r\ell$ — Subtraction Property of Equality

$S - \pi r^2 = \pi r\ell$ — Simplify.

$\frac{S - \pi r^2}{\pi r} = \frac{\pi r\ell}{\pi r}$ — Division Property of Equality

$\frac{S - \pi r^2}{\pi r} = \ell$ — Simplify.



On Your Own

Now You're Ready
Exercises 14–19

Solve the formula for the red variable.

4. Area of rectangle: $A = bh$ **5.** Simple interest: $I = Prt$

6. Surface area of cylinder: $S = 2\pi r^2 + 2\pi rh$

Key Idea

Temperature Conversion

A formula for converting from degrees Fahrenheit F to degrees Celsius C is

$$C = \frac{5}{9}(F - 32).$$

EXAMPLE 3 Rewriting the Temperature Formula

Solve the temperature formula for F.

$$C = \frac{5}{9}(F - 32)$$ Write the temperature formula.

Use the reciprocal. → $\frac{9}{5} \cdot C = \frac{9}{5} \cdot \frac{5}{9}(F - 32)$ Multiplication Property of Equality

$$\frac{9}{5}C = F - 32$$ Simplify.

Undo the subtraction. → $\frac{9}{5}C + 32 = F - 32 + 32$ Addition Property of Equality

$$\frac{9}{5}C + 32 = F$$ Simplify.

∴ The rewritten formula is $F = \frac{9}{5}C + 32$.

EXAMPLE 4 Real-Life Application

Which has the greater temperature?

Convert the Celsius temperature of lightning to Fahrenheit.

$$F = \frac{9}{5}C + 32$$ Write the rewritten formula from Example 3.

$$= \frac{9}{5}(30{,}000) + 32$$ Substitute 30,000 for C.

$$= 54{,}032$$ Simplify.

∴ Because 54,032 °F is greater than 11,000 °F, lightning has the greater temperature.

On Your Own

7. Room temperature is considered to be 70 °F. Suppose the temperature is 23 °C. Is this greater than or less than room temperature?

1.4 Exercises

Check It Out
Help with Homework
BigIdeasMath.com

Vocabulary and Concept Check

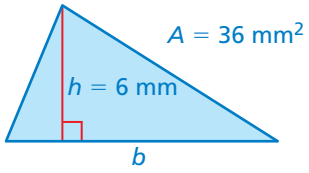
1. **VOCABULARY** Is $-2x = \frac{3}{8}$ a literal equation? Explain.

2. **DIFFERENT WORDS, SAME QUESTION** Which is different? Find "both" answers.

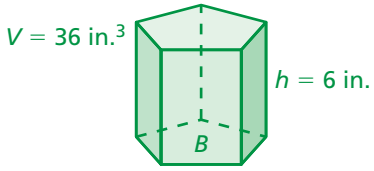
Solve $4x - 2y = 6$ for y.	Solve $6 = 4x - 2y$ for y.
Solve $4x - 2y = 6$ for y in terms of x.	Solve $4x - 2y = 6$ for x in terms of y.

Practice and Problem Solving

3. **a.** Write a formula for the area A of a triangle.
   b. Solve the formula for b.
   c. Use the new formula to find the base of the triangle.



4. **a.** Write a formula for the volume V of a prism.
   b. Solve the formula for B.
   c. Use the new formula to find the area of the base of the prism.



Solve the equation for y.

1 **5.** $\frac{1}{3}x + y = 4$ **6.** $3x + \frac{1}{5}y = 7$ **7.** $6 = 4x + 9y$

8. $\pi = 7x - 2y$ **9.** $4.2x - 1.4y = 2.1$ **10.** $6y - 1.5x = 8$

11. ERROR ANALYSIS Describe and correct the error in rewriting the equation.

✗ $2x - y = 5$
$y = -2x + 5$

12. TEMPERATURE The formula $K = C + 273.15$ converts temperatures from Celsius C to Kelvin K.

   a. Solve the formula for C.
   b. Convert 300 Kelvin to Celsius.

13. INTEREST The formula for simple interest is $I = Prt$.

   a. Solve the formula for t.
   b. Use the new formula to find the value of t in the table.

I	\$75
P	\$500
r	5%
t	

Solve the equation for the red variable.

14. $d = rt$

15. $e = mc^2$

16. $R - C = P$

17. $A = \frac{1}{2}\pi w^2 + 2\ell w$

18. $B = 3\frac{V}{h}$

19. $g = \frac{1}{6}(w + 40)$

20. LOGIC Why is it useful to rewrite a formula in terms of another variable?

21. REASONING The formula $K = \frac{5}{9}(F - 32) + 273.15$ converts temperatures from Fahrenheit F to Kelvin K.

a. Solve the formula for F.

b. The freezing point of water is 273.15 Kelvin. What is this temperature in Fahrenheit?

c. The temperature of dry ice is -78.5 °C. Which is colder, dry ice or liquid nitrogen?

Navy Pier Ferris Wheel

22. FERRIS WHEEL The Navy Pier Ferris Wheel in Chicago has a circumference that is 56% of the circumference of the first Ferris wheel built in 1893.

a. What is the radius of the Navy Pier Ferris Wheel?

b. What was the radius of the first Ferris wheel?

c. The first Ferris wheel took 9 minutes to make a complete revolution. How fast was the wheel moving?

23. Repeated Reasoning The formula for the volume of a sphere is $V = \frac{4}{3}\pi r^3$. Solve the formula for r^3. Use Guess, Check, and Revise to find the radius of the sphere.

Fair Game Review What you learned in previous grades & lessons

Multiply. *(Skills Review Handbook)*

24. $5 \times \frac{3}{4}$

25. $-2 \times \frac{8}{3}$

26. $\frac{1}{4} \times \frac{3}{2} \times \frac{8}{9}$

27. $25 \times \frac{3}{5} \times \frac{1}{12}$

28. MULTIPLE CHOICE Which of the following is not equivalent to $\frac{3}{4}$? *(Skills Review Handbook)*

(A) 0.75 (B) 3:4 (C) 75% (D) 4:3

1.3–1.4 Quiz

Check It Out
Progress Check
BigIdeasMath.com

Solve the equation. Check your solution, if possible. *(Section 1.3)*

1. $2(x + 4) = -5x + 1$

2. $\frac{1}{2}s = 4s - 21$

3. $8.3z = 4.1z + 10.5$

4. $3(b + 5) = 4(2b - 5)$

5. $n + 7 - n = 4$

6. $\frac{1}{4}(4r - 8) = r - 2$

Solve the equation for y. *(Section 1.4)*

7. $6x - 3y = 9$

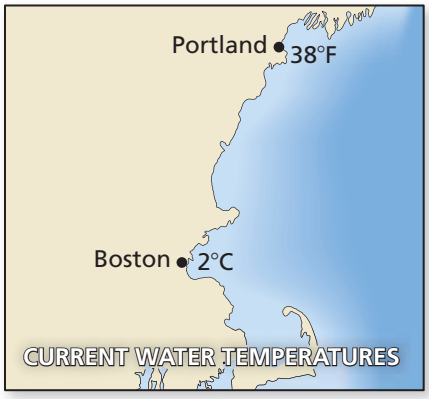
8. $8 = 2y - 10x$

Solve the formula for the red variable. *(Section 1.4)*

9. Volume of a cylinder: $V = \pi r^2 h$

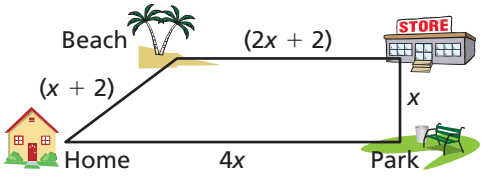
10. Area of a trapezoid: $A = \frac{1}{2}h(b_1 + b_2)$

11. TEMPERATURE In which city is the water temperature higher? *(Section 1.4)*



12. SAVINGS ACCOUNT You begin with \$25 in a savings account and \$50 in a checking account. Each week you deposit \$5 into savings and \$10 into checking. After how many weeks is the amount in checking twice the amount in savings? *(Section 1.3)*

13. INTEREST The formula for simple interest I is $I = Prt$. Solve the formula for the interest rate r. What is the interest rate r if the principal P is \$1500, the time t is 2 years, and the interest earned I is \$90? *(Section 1.4)*



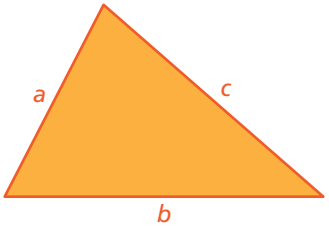
14. ROUTES From your home, the route to the store that passes the beach is 2 miles shorter than the route to the store that passes the park. What is the length of each route? *(Section 1.3)*

15. PERIMETER Use the triangle shown. *(Section 1.4)*

a. Write a formula for the perimeter P of the triangle.

b. Solve the formula for b.

c. Use the new formula to find b when a is 10 feet and c is 17 feet.



Perimeter = 42 feet

1 Chapter Review

Check It Out
Vocabulary Help
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Review Key Vocabulary

literal equation, *p. 28*

Review Examples and Exercises

1.1 Solving Simple Equations *(pp. 2–9)*

The *boiling point* of a liquid is the temperature at which the liquid becomes a gas. The boiling point of mercury is about $\frac{41}{200}$ of the boiling point of lead. Write and solve an equation to find the boiling point of lead.

Mercury
357°C

Let x be the boiling point of lead.

$\frac{41}{200}x = 357$ — Write the equation.

$\frac{200}{41} \cdot \left(\frac{41}{200}x\right) = \frac{200}{41} \cdot 357$ — Multiplication Property of Equality

$x \approx 1741$ — Simplify.

∴ The boiling point of lead is about 1741°C.

Exercises

Solve the equation. Check your solution.

1. $y + 8 = -11$ **2.** $3.2 = -0.4n$ **3.** $-\frac{t}{4} = -3\pi$

1.2 Solving Multi-Step Equations *(pp. 10–15)*

Solve $-14x + 28 + 6x = -44$.

$-14x + 28 + 6x = -44$ — Write the equation.

$-8x + 28 = -44$ — Combine like terms.

$-28 \quad -28$ — Subtraction Property of Equality

$-8x = -72$ — Simplify.

$\frac{-8x}{-8} = \frac{-72}{-8}$ — Division Property of Equality

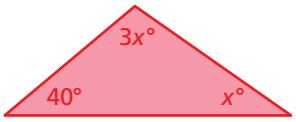
$x = 9$ — Simplify.

∴ The solution is $x = 9$.

Exercises

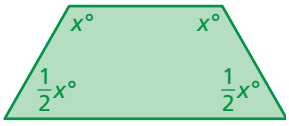
Find the value of x. Then find the angle measures of the polygon.

4.



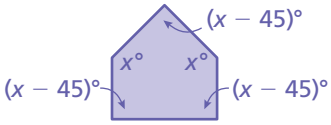
Sum of angle measures: 180°

5.



Sum of angle measures: 360°

6.



Sum of angle measures: 540°

1.3 Solving Equations with Variables on Both Sides *(pp. 18–25)*

a. Solve $3(x - 4) = -2(4 - x)$.

$3(x - 4) = -2(4 - x)$	Write the equation.
$3x - 12 = -8 + 2x$	Distributive Property
$-2x \quad -2x$	Subtraction Property of Equality
$x - 12 = -8$	Simplify.
$+12 \quad +12$	Addition Property of Equality
$x = 4$	Simplify.

∴ The solution is $x = 4$.

b. Solve $4 - 5k = -8 - 5k$.

$4 - 5k = -8 - 5k$	Write the equation.
$+5k \quad +5k$	Addition Property of Equality
$4 = -8$ ✗	Simplify.

∴ The equation $4 = -8$ is never true. So, the equation has no solution.

c. Solve $2\left(7g + \frac{2}{3}\right) = 14g + \frac{4}{3}$.

$2\left(7g + \frac{2}{3}\right) = 14g + \frac{4}{3}$	Write the equation.
$14g + \frac{4}{3} = 14g + \frac{4}{3}$	Distributive Property
$-14g \quad -14g$	Subtraction Property of Equality
$\frac{4}{3} = \frac{4}{3}$	Simplify.

∴ The equation $\frac{4}{3} = \frac{4}{3}$ is always true. So, the equation has infinitely many solutions.

Exercises

Solve the equation. Check your solution, if possible.

7. $5m - 1 = 4m + 5$ **8.** $3(5p - 3) = 5(p - 1)$ **9.** $\frac{2}{5}n + \frac{1}{10} = \frac{1}{2}(n + 4)$

10. $7t + 3 = 8 + 7t$ **11.** $\frac{1}{5}(15b - 7) = 3b - 9$ **12.** $\frac{1}{6}(12z - 18) = 2z - 3$

1.4 Rewriting Equations and Formulas *(pp. 26–31)*

a. Solve $7y + 6x = 4$ for y.

$7y + 6x = 4$	Write the equation.
$7y + 6x - 6x = 4 - 6x$	Subtraction Property of Equality
$7y = 4 - 6x$	Simplify.
$\frac{7y}{7} = \frac{4 - 6x}{7}$	Division Property of Equality
$y = \frac{4}{7} - \frac{6}{7}x$	Simplify.

b. The equation for a line in slope-intercept form is $y = mx + b$. Solve the equation for x.

$y = mx + b$	Write the equation.
$y - b = mx + b - b$	Subtraction Property of Equality
$y - b = mx$	Simplify.
$\frac{y - b}{m} = \frac{mx}{m}$	Division Property of Equality
$\frac{y - b}{m} = x$	Simplify.

Exercises

Solve the equation for y.

13. $6y + x = 8$ **14.** $10x - 5y = 15$ **15.** $20 = 5x + 10y$

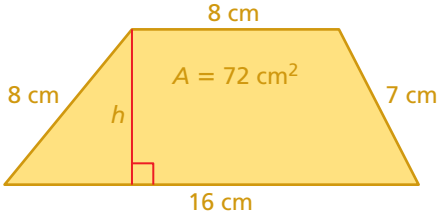
16. a. The formula $F = \frac{9}{5}(K - 273.15) + 32$ converts a temperature from Kelvin K to Fahrenheit F. Solve the formula for K.

b. Convert 240 °F to Kelvin K. Round your answer to the nearest hundredth.

17. a. Write the formula for the area A of a trapezoid.

b. Solve the formula for h.

c. Use the new formula to find the height h of the trapezoid.



1 Chapter Test

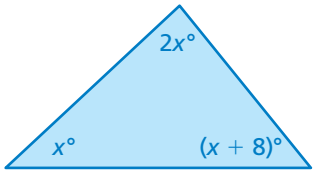
Check It Out
Test Practice
BigIdeasMath.com

Solve the equation. Check your solution, if possible.

1. $4 + y = 9.5$
2. $-\frac{x}{9} = -8$
3. $z - \frac{2}{3} = \frac{1}{8}$
4. $3.8n - 13 = 1.4n + 5$
5. $9(8d - 5) + 13 = 12d - 2$
6. $9j - 8 = 8 + 9j$
7. $2.5(2p + 5) = 5p + 12.5$
8. $\frac{3}{4}t + \frac{1}{8} = \frac{3}{4}(t + 8)$
9. $\frac{1}{7}(14r + 28) = 2(r + 2)$

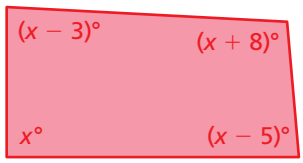
Find the value of x. Then find the angle measures of the polygon.

10.



Sum of angle measures: 180°

11.



Sum of angle measures: 360°

Solve the equation for y.

12. $1.2x - 4y = 28$
13. $0.5 = 0.4y - 0.25x$

Solve the formula for the red variable.

14. Perimeter of a rectangle: $P = 2\ell + 2w$
15. Distance formula: $d = rt$

16. **BASKETBALL** Your basketball team wins a game by 13 points. The opposing team scores 72 points. Explain how to find your team's score.

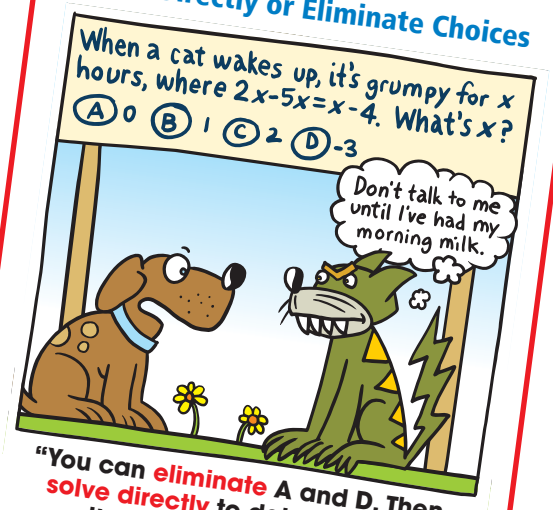
17. **CYCLING** You are biking at a speed of 18 miles per hour. You are 3 miles behind your friend, who is biking at a speed of 12 miles per hour. Write and solve an equation to find the amount of time it takes for you to catch up to your friend.

18. **VOLCANOES** Two scientists are measuring lava temperatures. One scientist records a temperature of 1725°F. The other scientist records a temperature of 950°C. Which is the greater temperature? $\left(\text{Use } C = \frac{5}{9}(F - 32).\right)$

19. **JOBS** Your profit for mowing lawns this week is \$24. You are paid \$8 per hour and you paid \$40 for gas for the lawn mower. How many hours did you work this week?

1 Cumulative Assessment

Test-Taking Strategy
Solve Directly or Eliminate Choices



"You can **eliminate** A and D. Then, **solve directly** to determine that the correct answer is B."

1. Which value of x makes the equation true?

$$4x = 32$$

A. 8 **C.** 36

B. 28 **D.** 128

2. A taxi ride costs \$3 plus \$2 for each mile driven. When you rode in a taxi, the total cost was \$39. This can be modeled by the equation below, where m represents the number of miles driven.

$$2m + 3 = 39$$

How long was your taxi ride?

F. 72 mi **H.** 21 mi

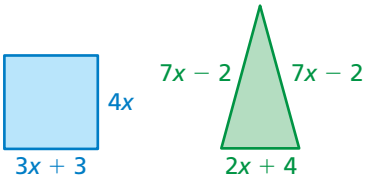
G. 34 mi **I.** 18 mi

3. Which of the following equations has exactly one solution?

A. $\frac{2}{3}(x + 6) = \frac{2}{3}x + 4$ **C.** $\frac{4}{5}\left(n + \frac{1}{3}\right) = \frac{4}{5}n + \frac{1}{3}$

B. $\frac{3}{7}y + 13 = 13 - \frac{3}{7}y$ **D.** $\frac{7}{8}\left(2t + \frac{1}{8}\right) = \frac{7}{4}t$

4. The perimeter of the square is equal to the perimeter of the triangle. What are the side lengths of the square?



5. The formula below relates distance, rate, and time.

$$d = rt$$

Solve this formula for t.

F. $t = dr$ **H.** $t = d - r$

G. $t = \frac{d}{r}$ **I.** $t = \frac{r}{d}$

6. What could be the first step to solve the equation shown below?

$$3x + 5 = 2(x + 7)$$

A. Combine $3x$ and 5.

B. Multiply x by 2 and 7 by 2.

C. Subtract x from $3x$.

D. Subtract 5 from 7.

7. You work as a sales representative. You earn \$400 per week plus 5% of your total sales for the week.

Think
Solve
Explain

Part A Last week, you had total sales of \$5000. Find your total earnings. Show your work.

Part B One week, you earned \$1350. Let s represent your total sales that week. Write an equation that you could use to find s.

Part C Using your equation from Part B, find s. Show all steps clearly.

8. In 10 years, Maria will be 39 years old. Let m represent Maria's age today. Which equation can you use to find m?

F. $m = 39 + 10$

G. $m - 10 = 39$

H. $m + 10 = 39$

I. $10m = 39$

9. Which value of y makes the equation below true?

$$3y + 8 = 7y + 11$$

A. -4.75

B. -0.75

C. 0.75

D. 4.75

10. The equation below is used to convert a Fahrenheit temperature F to its equivalent Celsius temperature C.

$$C = \frac{5}{9}(F - 32)$$

Which formula can be used to convert a Celsius temperature to its equivalent Fahrenheit temperature?

F. $F = \frac{5}{9}(C - 32)$

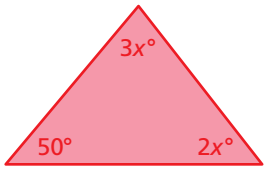
G. $F = \frac{9}{5}(C + 32)$

H. $F = \frac{9}{5}C + \frac{32}{5}$

I. $F = \frac{9}{5}C + 32$

11. You have already saved $35 for a new cell phone. You need $175 in all. You think you can save $10 per week. At this rate, how many more weeks will you need to save money before you can buy the new cell phone?

12. What is the greatest angle measure in the triangle below?



Sum of angle measures: 180°

A. 26°

B. 78°

C. 108°

D. 138°

13. Which value of x makes the equation below true?

$$6(x - 3) = 4x - 7$$

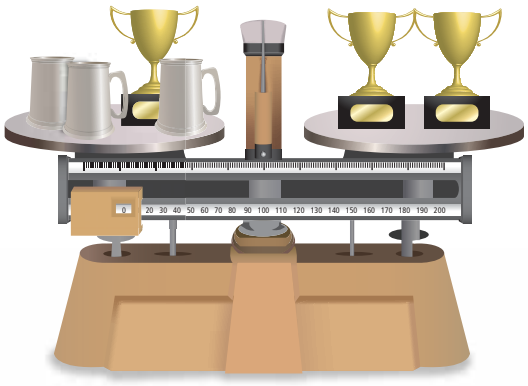
F. −5.5

G. −2

H. 1.1

I. 5.5

14. The drawing below shows equal weights on two sides of a balance scale.



What can you conclude from the drawing?

A. A mug weighs one-third as much as a trophy.

B. A mug weighs one-half as much as a trophy.

C. A mug weighs twice as much as a trophy.

D. A mug weighs three times as much as a trophy.