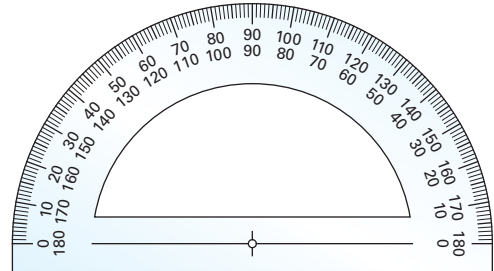


1.1 Solving Simple Equations

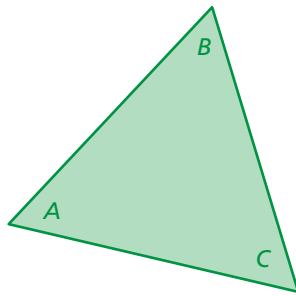
Essential Question How can you use inductive reasoning to discover rules in mathematics? How can you test a rule?

1 ACTIVITY: Sum of the Angles of a Triangle

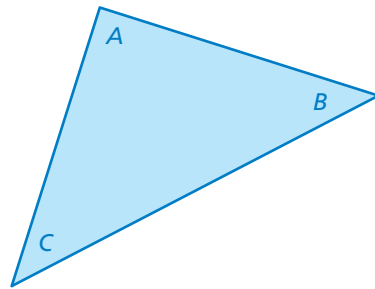
Work with a partner. Copy the triangles. Use a protractor to measure the angles of each triangle. Copy and complete the table to organize your results.



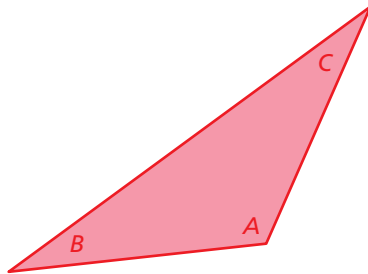
a.



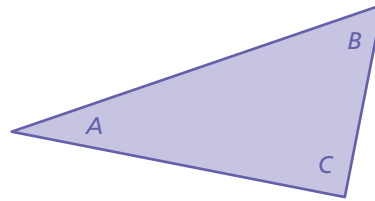
b.



c.



d.



Solving Equations

In this lesson, you will

- write and solve simple equations.
- solve real-life problems.

Learning Standards

A.CED.1

A.REI.1

A.REI.3

| Triangle | Angle A (degrees) | Angle B (degrees) | Angle C (degrees) | $A + B + C$ |
|----------|-------------------|-------------------|-------------------|-------------|
| a. | | | | |
| b. | | | | |
| c. | | | | |
| d. | | | | |

Math Practice 3

Construct Arguments

How can you use results from the previous activity to write a rule?

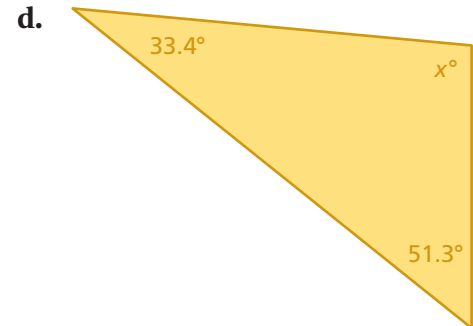
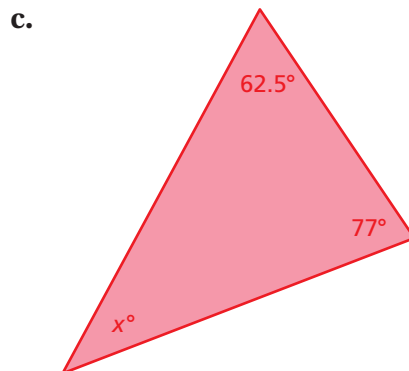
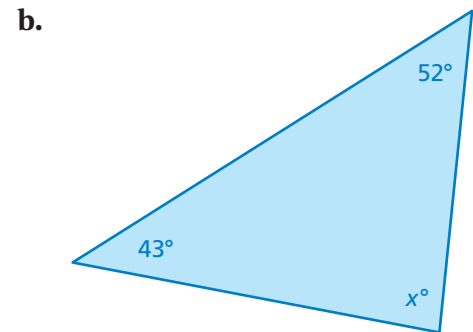
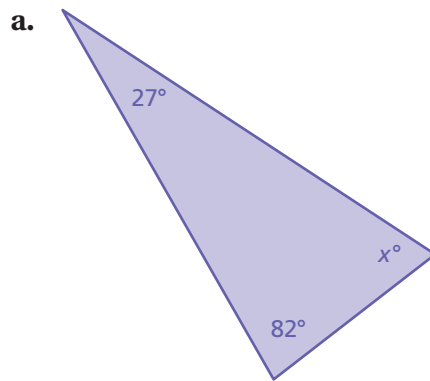
2 ACTIVITY: Writing a Rule

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

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



What Is Your Answer?

- 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.

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.

$$\xrightarrow{+7 \quad +7}$$

Add 7 to each side.

$$x = 1$$

Simplify.

∴ The solution is $x = 1$.

Check

$$x - 7 = -6$$

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

$$-6 = -6 \quad \checkmark$$

b. Solve $y + 3.4 = 0.5$.

$$y + 3.4 = 0.5$$

Write the equation.

Undo the addition.

$$\xrightarrow{-3.4 \quad -3.4}$$

Subtract 3.4 from each side.

$$y = -2.9$$

Simplify.

∴ The solution is $y = -2.9$.

Check

$$y + 3.4 = 0.5$$

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

$$0.5 = 0.5 \quad \checkmark$$

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

$$h + 2\pi = 3\pi$$

Write the equation.

Undo the addition.

$$\xrightarrow{-2\pi \quad -2\pi}$$

Subtract 2π from each side.

$$h = \pi$$

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. $\rightarrow -\frac{4}{3} \cdot \left(-\frac{3}{4}n\right) = -\frac{4}{3} \cdot (-2)$

Multiply each side by $-\frac{4}{3}$, the reciprocal of $-\frac{3}{4}$.

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

Simplify.

∴ The solution is $n = \frac{8}{3}$.

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

$$\pi x = 3\pi$$

Write the equation.

Undo the multiplication. \rightarrow

$$\frac{\pi x}{\pi} = \frac{3\pi}{\pi}$$

Divide each side by π .

$$x = 3$$

Simplify.

∴ The solution is $x = 3$.

Check

$$\pi x = 3\pi$$

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

$$3\pi = 3\pi \quad \checkmark$$

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 Solving an Equation

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

- (A) -15 (B) -5 (C) -3 (D) 1.5

$$k + 4 \div 0.2 = 5 \quad \text{Write the equation.}$$

$$k + 20 = 5 \quad \text{Divide 4 by 0.2.}$$

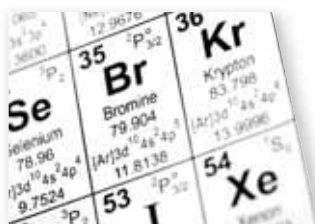
$$\underline{-20} \quad \underline{-20} \quad \text{Subtract 20 from each side.}$$

$$k = -15 \quad \text{Simplify.}$$

∴ The correct answer is (A).

EXAMPLE 4 Real-Life Application

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.



The melting point of bromine is -7°C .

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

$$-7 = \frac{1}{30}n \quad \text{Write the equation.}$$

$$30 \cdot (-7) = 30 \cdot \left(\frac{1}{30}n\right) \quad \text{Multiply each side by 30.}$$

$$-210 = n \quad \text{Simplify.}$$

∴ 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



Vocabulary and Concept Check

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

$$x - 2 = 4$$

$$x - 3 = 6$$

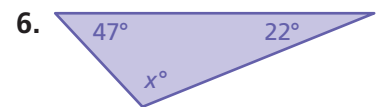
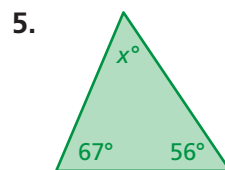
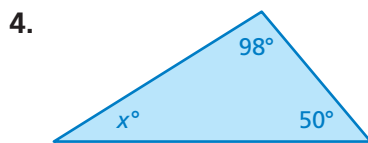
$$x - 5 = 1$$

$$x - 6 = 0$$



Practice and Problem Solving

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



Solve the equation. Check your solution.

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

16. **CONCERT** A discounted concert ticket is \$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.

- Write and solve an equation to find your final score.
- Your friend made a spare in the tenth frame. Did you? Explain.

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



Solve the equation. Check your solution.

2 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?

$$x + 3 = 42$$

$$3x = 42$$

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

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

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 was earned?



| Tallest Coasters at Cedar Point | |
|---------------------------------|---------------|
| Roller 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. $d - 2.8 \div 0.2 = -14$

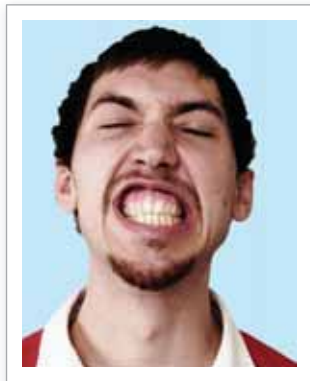
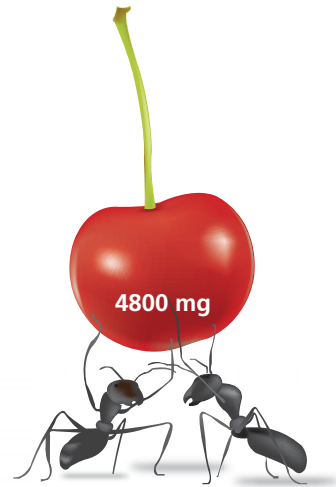
37. $\frac{8}{9} = x + \frac{1}{3}(7)$

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

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

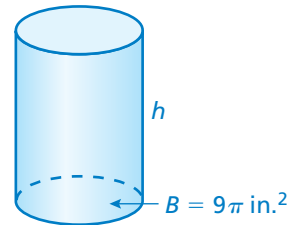
40. **OPEN-ENDED** Write a subtraction equation and a division equation that each has a solution of -2 .

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 cylinder is 72π cubic inches. Use the formula $V = Bh$ to find the height h of the cylinder.



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

- How much does each person receive?
- 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 P.M. was -12°C . By 11 P.M. the temperature had dropped 14 degrees. What was the temperature at 11 P.M.? *(Skills Review Handbook)*

(A) -26°C

(B) -2°C

(C) 2°C

(D) 26°C