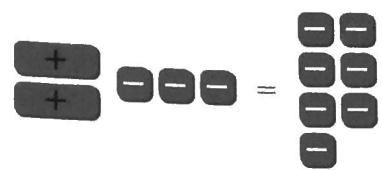


algebra tiles. Then solve the equation.



c. $9m = 18$

d. $\frac{3}{2}n = 11$

13. **Checking a Solution** Check whether the given value is a solution of the equation.

a. $x + 9 = 17; x = 8$

b. $6x - 7 = 29; x = 5$

c. $18 - 4y = 6; y = 3$

d. $2.5y + 10 = 16; y = 4$

e. $\frac{1}{2}z - 1 = 5; z = 12$

f. $4z - 5 = 12; z = 1$

14. **Checking a Solution** Check whether the given value is a solution of the equation.

a. $4 - x = 8; x = 4$

b. $x + 1 = 7; x = -7$

c. $-2y + 9 = 7; y = 1$

d. $-5 + 2.2y = 18; y = 4$

e. $-1 + \frac{1}{4}z = -2; z = -4$

f. $-z + 4 = -3; z = 1$

15. **Solving One-Step Equations** Solve each equation. Show your work and justify each step.

a. $14 + x = 31$

b. $a - \frac{3}{4} = \frac{1}{8}$

c. $9 = \frac{y}{12}$

d. $91 = 13b$

e. $y - 0.5 = 2.80$

f. $\frac{u}{3} = 4.5$

16. **Solving One-Step Equations** Solve each equation. Show your work and justify each step.

a. $s - 13 = 19$

b. $\frac{2}{3} + x = \frac{5}{6}$

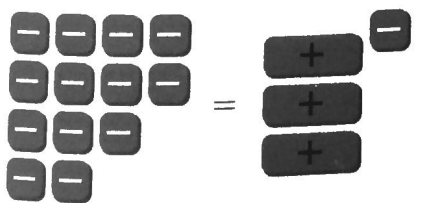
c. $-\frac{y}{7} = 12$

d. $-8z = 104$

e. $6.25 = -3.4 + t$

f. $12.46 = 9.7 + h$

17. **Algebra Tiles** Write the equation modeled by the algebra tiles. Then solve the equation.



19. **Using Algebra Tiles** Use algebra tiles to model and solve each equation.

a. $6x + 1 = -11$

b. $8x - 16 = 0$

c. $3y - 15 = 15$

d. $-10 = 3 + 13y$

20. **Using Algebra Tiles** Use algebra tiles to model and solve each equation.

a. $2x + 5 = -15$

b. $3x + 21 = 0$

c. $4y - 10 = 6$

d. $1 = -1 + 2y$

21. **Solving Two-Step Equations** Solve each equation. Show your work and justify each step.

a. $4x + 3 = 11$

b. $7d - 1 = 13$

c. $10 = 7 - m$

d. $\frac{a}{3} + 4 = 6$

e. $16 - 2.4d = -8$

f. $\frac{c}{5.3} + 8.3 = 11.3$

g. $\frac{4}{5} - 2g = \frac{1}{10}$

h. $7 = \frac{5}{6}c - 8$

22. **Solving Two-Step Equations** Solve each equation. Show your work and justify each step.

a. $7y - 3 = 25$

b. $3x + 7 = 19$

c. $11 = 12 - q$

d. $17 = \frac{w}{5} + 13$

e. $14.4m - 5.1 = 2.1$

f. $3.2 + \frac{x}{2.5} = 4.6$

g. $-4j + \frac{1}{2} = \frac{7}{8}$

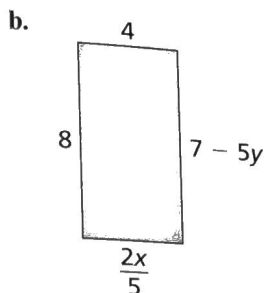
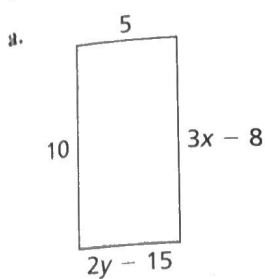
h. $10 = \frac{2}{7}n + 4$

23. **Modeling** Write and solve an equation to model each statement.
- The sum of a number n and fourteen is twenty-four.
 - Three less than a number n is negative fifteen.
 - The quotient of a number n and four is negative two.
 - Twelve times a number n is thirty-six.
 - Nine less than the product of three and a number n is fifteen.
24. **Modeling** Write and solve an equation to model each statement.
- Six more than a number n is two.
 - The difference between a number n and negative five is zero.
 - A number n divided by five is twenty.
 - The product of a number n and five-sixths is negative fifteen.
 - Fourteen more than the quotient of a number n and seven is twenty-five.
25. **Cliff** A cliff has a height of 1500 feet. You climb to a height of 675 feet. Write and solve an equation to find how much farther you have to climb to reach the top.
26. **School Supplies** You are buying school supplies that cost \$48.95. After sales tax is added, the total cost is \$51.89. Write and solve an equation to determine how much you pay in sales tax.
27. **Bowling** Your friend's bowling score is 105 pins. Your bowling score is 14 pins less than your friend's score. Write and solve an equation to find your score.
28. **Tickets** A discounted concert ticket is \$14.75 less than the original price. You pay \$54 for a discounted ticket. Write and solve an equation to find the original price of the ticket.
29. **Park** You clean a community park for 5.5 hours. You earn \$45.65. Write and solve an equation to find your hourly pay rate.
30. **Theater** A movie theater has 1960 seats. Each row has 40 seats. Write and solve an equation to find how many rows of seats are in the theater.
31. **Dance** A dance studio charges a one-time registration fee of \$15 and \$11 per class. A student has paid the studio \$92. How many classes has the student taken?
32. **Party** You need 124 plastic spoons for a party. A store has 1 box of 60 spoons and several boxes of 8 spoons available. How many boxes of 8 spoons should you buy along with the box of 60 spoons?
33. **Activity: In Your Classroom** Design a classroom activity in which students write and represent real-life situations involving one-step equations. Specify the steps that the students are to use to write an equation representing each real-life situation.
34. **Activity: In Your Classroom** Design a classroom activity in which students write and represent real-life situations involving two-step equations. Specify the steps that the students are to use to write an equation representing each real-life situation.
35. **Grading Student Work** On a diagnostic test, one of your students does the following work. Explain what the student did wrong. Which topics would you encourage the student to review?
- a.
- $$\begin{aligned} -1.5 + k &= 8.2 \\ k &= 8.2 + (-1.5) \\ k &= 6.7 \end{aligned}$$
- b.
- $$\begin{aligned} 7 - 3x &= 12 \\ 4x &= 12 \\ \frac{4x}{4} &= \frac{12}{4} \\ x &= 3 \end{aligned}$$
36. **Grading Student Work** On a diagnostic test, one of your students does the following work. Explain what the student did wrong. Which topics would you encourage the student to review?
- a.
- $$\begin{aligned} s + \frac{3}{5} &= -\frac{2}{5} \\ s + \frac{3}{5} + \frac{3}{5} &= -\frac{2}{5} + \frac{3}{5} \\ s &= \frac{1}{5} \end{aligned}$$
- b.
- $$\begin{aligned} -6 + 2x &= -10 \\ -6 + \frac{2x}{2} &= \frac{-10}{2} \\ -6 + x &= -5 \\ x &= 1 \end{aligned}$$
37. **Writing** Write a real-life problem that can be modeled by the equation $5x - 6 = 9$. Interpret the solution.

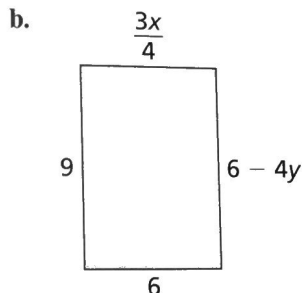
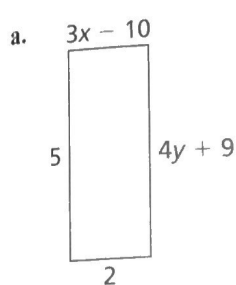
38. **Writing** Explain how you can use the Distributive Property to solve the equation below.

$$3x + 4x = 21$$

39. **Geometry** Write and solve equations to find the values of the variables in each rectangle.



40. **Geometry** Write and solve equations to find the values of the variables in each rectangle.



41. **Missing Information** The following real-life problem is missing information. Determine what information you need to solve the problem.

One day, you jog for 7 minutes and then run for 15 minutes. Each day after the first day, you jog for 7 minutes, but increase the time that you run. After how many days will you be exercising for a total of 90 minutes per day?

42. **Missing Information** The following real-life problem is missing information. Determine what information you need to solve the problem.

You have a job in which you earn \$7 per hour plus tips. You earned a total of \$34 yesterday. How much did you earn in tips?

43. **Rentals** The table shows costs to rent x videos and buy \$4 worth of snacks. Write a verbal model for the situation. Then translate the verbal model into an algebraic equation. Use the equation to find the cost to rent 9 videos and buy \$4 worth of snacks.

Videos, x	1	3	5
Cost	\$7	\$13	\$19

44. **Rentals** The table shows hourly costs to rent a boat including \$20 for gasoline. Write a verbal model for the situation. Then translate the verbal model into an algebraic equation. Use the equation to find the cost to rent the boat for 8 hours including \$20 for gasoline.

Hours, x	Cost
1	\$38.99
3	\$76.97
5	\$114.95
7	\$152.93

45. **School Pictures** One-fourth of the girls and one-eighth of the boys in a grade retake their school pictures. The photographer retakes pictures for 16 girls and 7 boys. How many students are in the grade?
46. **Sick Day** One-sixth of the fourth graders and one-third of the fifth graders miss school on Friday. The absentee sheet for Friday shows the names of 8 fourth graders and 18 fifth graders. How many fourth and fifth graders are enrolled in the school?
47. **Clothing Sale** At a sale, you buy 2 pairs of pants for \$24.95 each, 3 belts for \$12.99 each, and 3 shirts for the same price at a 20% discount. Your total cost (before sales tax) is \$132.07.
- Write and solve an equation to find the discounted price of each shirt.
 - Write and solve an equation to find the original price of each shirt.
48. **Study Time** You have 28 hours available to study for 5 exams. You spend $6\frac{1}{2}$ hours, $5\frac{3}{4}$ hours, and $4\frac{3}{4}$ hours studying for 3 of the exams. Write and solve an equation to find equal amounts of time available to study for the 2 remaining exams.
49. **Reasoning** You have twice as many bus tokens as your colleague. You give your colleague several of your tokens. Each of you now has 120 bus tokens. How many bus tokens did you give your colleague? Explain your reasoning.
50. **Reasoning** You are 10 years older than your cousin. Two years ago, you were 3 times as old as your cousin is now. How old are you and your cousin now?

9.3 Exercises

1. **Writing a Solution Key** Write a solution key for the activity on page 348. Describe a rubric for grading a student's work.

2. **Grading the Activity** In the activity on page 348, a student gave the answers below. Each question is worth 10 points. Assign a grade to each answer. For those that are incorrect, why do you think the student erred?

Sample Student Work

5. $\sqrt{3} \approx 1.73205$

$(1.73205)^2$ is approximately 3.

6. $\sqrt{100} = 10.0000$

$(10)^2$ is exactly 100.

7. $\sqrt{10} = 3.16227$

$(3.16227)^2$ is exactly 10.

8. $\sqrt{0.36} \approx 0.60000$

$(0.6)^2$ is approximately 0.36.

3. **Classifying Numbers** Place check marks to indicate the sets of numbers to which each number belongs.

	Natural	Integer	Rational	Irrational	Real
a. 5.4					
b. -7					
c. $\sqrt{11}$					
d. $\frac{2}{5}$					
e. 71					

4. **Classifying Numbers** Place check marks to indicate the sets of numbers to which each number belongs.

	Natural	Integer	Rational	Irrational	Real
a. $-4\bar{5}$					
b. $\sqrt{10}$					
c. $\sqrt{16}$					
d. $2\frac{8}{9}$					
e. $\frac{6}{11}$					

5. **True or False?** Tell whether each statement is *true* or *false*. Explain your reasoning.

- The set of terminating decimals is a subset of the real numbers.
- The set of rational numbers is a subset of the irrational numbers.

6. **True or False?** Tell whether each statement is *true* or *false*. Explain your reasoning.

- The set of irrational numbers is a subset of the real numbers.
- The set of fractions is a subset of the irrational numbers.

7. **Rational and Irrational Numbers** Simplify each expression if possible. Then decide whether the number is rational or irrational.

- | | |
|-----------------------|-------------------|
| a. $\frac{1}{2}$ | b. 0.4 |
| c. $\sqrt{5}$ | d. $\sqrt{64}$ |
| e. $2 \cdot \sqrt{5}$ | f. $5 + \sqrt{4}$ |

8. **Rational and Irrational Numbers** Simplify each expression if possible. Then decide whether the number is rational or irrational.

- | | |
|----------------------|--------------------|
| a. $-\frac{2}{7}$ | b. 0.9 |
| c. $\sqrt{3}$ | d. $\sqrt{36}$ |
| e. $7 \div \sqrt{6}$ | f. $11 - \sqrt{9}$ |

9. **Ordering Real Numbers** Order the real numbers from least to greatest.

a. $\frac{1}{2}, 0.\overline{5}, 0.\overline{54}, 0.\overline{554}, 0.\overline{54}, 0.\overline{454}, \sqrt{0.54}$

b. $\frac{3}{4}, 0.\overline{75}, 0.\overline{75}, 0.\overline{755}, 0.7, \sqrt{0.75}, \sqrt{0.7}$

10. **Ordering Real Numbers** Order the real numbers from least to greatest.

a. $\frac{1}{4}, 0.\overline{2}, 0.\overline{25}, 0.\overline{225}, 0.\overline{25}, 0.\overline{225}, \sqrt{0.25}$

b. $\frac{4}{7}, 0.4, 0.\overline{47}, 0.\overline{477}, 0.47, \sqrt{0.47}, \sqrt{0.4}$

11. **Finding Irrational Numbers** Find two irrational numbers between each pair of real numbers.

a. 2, 3

b. $\frac{3}{5}, \frac{9}{10}$

c. 0.1, $0.\overline{6}$

d. $\sqrt{2}, \sqrt{10}$

12. **Finding Irrational Numbers** Find two irrational numbers between each pair of real numbers.

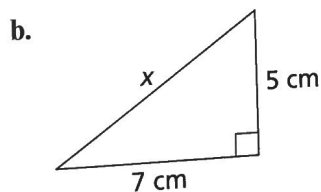
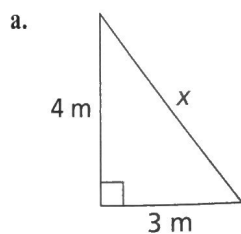
a. 1, 6

b. $\frac{3}{10}, \frac{4}{5}$

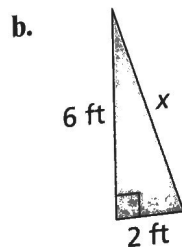
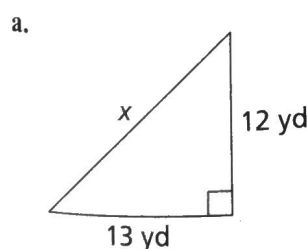
c. $0.\overline{12}, 0.\overline{8}$

d. $\sqrt{1}, \sqrt{8}$

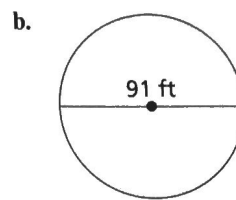
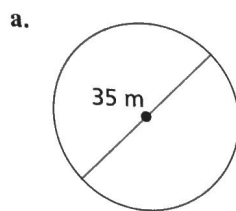
13. **Using the Pythagorean Theorem** Use the Pythagorean Theorem to find or approximate the missing length of each triangle.



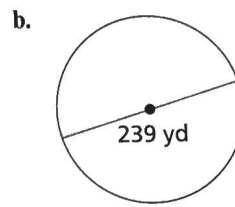
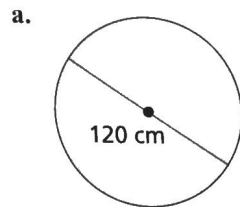
14. **Using the Pythagorean Theorem** Use the Pythagorean Theorem to approximate the missing length of each triangle.



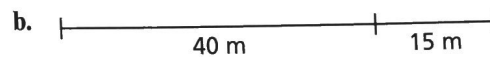
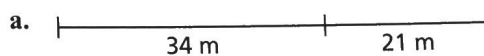
15. **Finding the Circumference of a Circle** Approximate the circumference of each circle. Use $\frac{22}{7}$ for π .



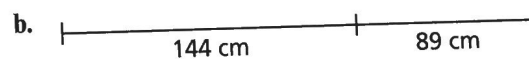
16. **Finding the Circumference of a Circle** Approximate the circumference of each circle. Use 3.14 for π .



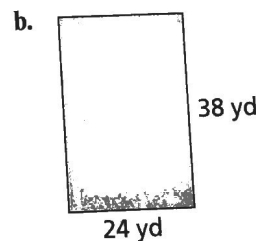
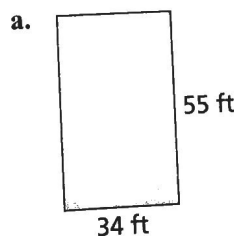
17. **The Golden Ratio** Determine whether the two parts of the line approximate the Golden Ratio.



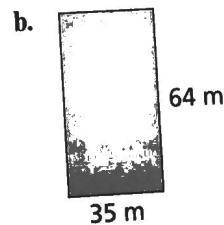
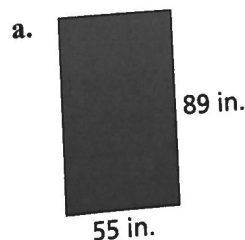
18. **The Golden Ratio** Determine whether the two parts of the line approximate the Golden Ratio.



19. **The Golden Rectangle** Determine whether each rectangle approximates a Golden Rectangle.



20. **The Golden Rectangle** Determine whether each rectangle approximates a Golden Rectangle.



21. **Using Properties of Squares and Square Roots**
 Let n be a positive real number. Use the fact that $\sqrt{n^2} = (\sqrt{n})^2 = n$ to find each value of n .
- $(\sqrt{n})^2 = 9$
 - $n^2 = 16$
 - $\sqrt{n^2} = 256$
 - $\sqrt{n} = \frac{1}{4}$

22. **Using Properties of Squares and Square Roots**
 Let n be a positive real number. Use the fact that $\sqrt{n^2} = (\sqrt{n})^2 = n$ to find each value of n .
- $(\sqrt{n})^2 = 36$
 - $n^2 = 49$
 - $\sqrt{n^2} = 64$
 - $\sqrt{n} = \frac{4}{9}$

23. **Euler's Number** Evaluate each expression for the given value of x . Use 2.72 for e .
- $e^{2x}, x = 4$
 - $e^{-4x}, x = 0.5$

24. **Euler's Number** Evaluate each expression for the given value of x . Use 2.72 for e .
- $4e^x, x = -2$
 - $e^{-5x}, x = 0.6$

25. **Bank Account** You deposit \$8000 into an account that earns 5% annual interest compounded continuously. What will the account balance be in 40 years? Use 2.72 for e .

26. **Bacteria Culture** The number N of bacteria in a culture is represented by

$$N = 100e^{0.25t}$$

where t is the time in hours. Find the number of bacteria in the culture after 4 hours. Use 2.72 for e .

27. **Grading Student Work** On a diagnostic test, one of your students does the following work. Explain what the student did wrong. Which topics would you encourage the student to review?

Approximate the circumference of a circle with a diameter of 145 inches. Use 3.14 for π .

$$\begin{aligned} \pi &= C \cdot d \\ 3.14 &\approx C \cdot 145 \\ 3.14 &\approx 145C \\ \frac{3.14}{145} &\approx \frac{145C}{145} \\ 0.02 &= C \end{aligned}$$

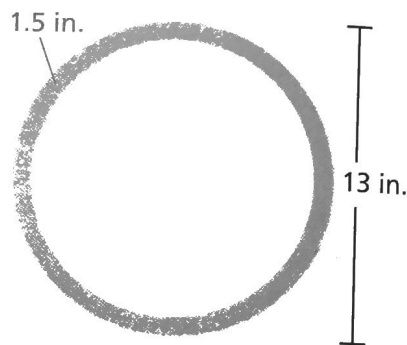
28. **Grading Student Work** On a diagnostic test, one of your students does the following work. Explain what the student did wrong. Which topics would you encourage the student to review?

You deposit \$5000 into an account that earns 4% annual interest compounded continuously. What will the account balance be in 5 years?

$$\begin{aligned} A &= Pe^{rt} \\ &\approx 5000(2.72)^{0.4(5)} \\ &= 5000(2.72)^2 \\ &= 36,992 \end{aligned}$$

The account balance will be about \$36,992.

29. **Flying Disc** A plastic flying disc has a circular hole in the middle as shown below. The diameter of the outer edge of the disc is 13 inches and the width of the disc is 1.5 inches. How much greater is the circumference of the outer edge than the circumference of the inner edge of the disc?



30. **Bicycle** Each tire on a bicycle has a diameter of 20 inches.
- What is the circumference of each tire?
 - How many times does each tire rotate when the bicycle travels 340 inches?

31. **writing** Is it true that

$$\sqrt{x + y} = \sqrt{x} + \sqrt{y}$$

for all x and y ? Explain your reasoning.

32. **writing** You can write $\sqrt{5}$ as

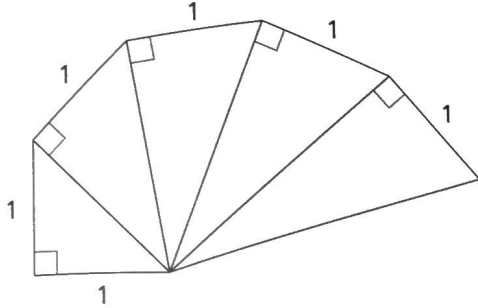
$$\frac{\sqrt{5}}{1}$$

Is $\frac{\sqrt{5}}{1}$ a rational number? Explain your reasoning.

33. **writing** Describe a pair of irrational numbers whose sum is a rational number. Explain your reasoning. (*Hint:* Many of the Properties of Rational Numbers on page 332 apply to irrational numbers.)

34. **Writing** Describe a pair of irrational numbers whose product is a rational number. Explain your reasoning. (*Hint:* Consider how the square root of a number is defined.)

35. **The Wheel of Theodorus** The *Wheel of Theodorus* is a figure formed by a chain of right triangles, with consecutive triangles sharing a common side. The hypotenuse of one triangle becomes a leg of the next, as shown below.

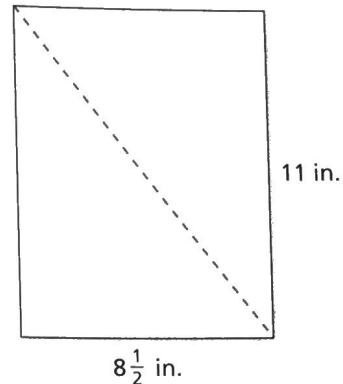


- Find the length of the longest hypotenuse in the figure. Use only exact answers in your calculations.
 - Add two more triangles to the figure. Find the length of the longest hypotenuse. Use only exact answers in your calculations.
36. **Pythagorean Triple** A *Pythagorean triple* is a group of positive integers a , b , and c that represent the side lengths of a right triangle. For example, the integers 3, 4, and 5 form a Pythagorean triple because $3^2 + 4^2 = 5^2$.
- Choose any two positive integers m and n such that $m < n$.
 - Find a , b , and c as follows: $a = n^2 - m^2$, $b = 2mn$, and $c = n^2 + m^2$.
 - Show that the numbers you generated in part (b) form a Pythagorean triple.

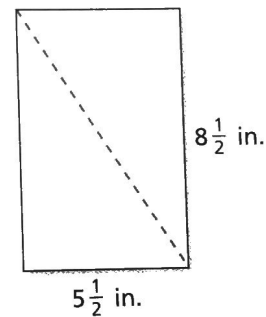
37. **Activity: In Your Classroom** Design a classroom activity that your students can use to discover the Pythagorean Theorem by working with several Pythagorean triples which you will give them. Describe the steps you will have your students perform. Some students may notice that some right triangles have side lengths that *do not* form Pythagorean triples. What will you tell your students about these triangles?

38. **Activity: In Your Classroom** Design a classroom activity that your students can use to discover the value of π . Describe the steps that students will perform to find several approximations of π . Include a description of any items or tools they will use, figures they will draw, or measurements they will make.

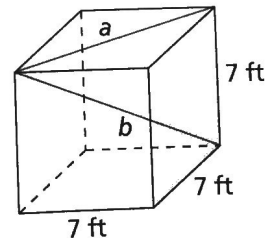
39. **Problem Solving** Fold an $8\frac{1}{2}$ -inch by 11-inch sheet of paper along a diagonal as shown below. Use a ruler to measure the length of the diagonal in inches. Then use the Pythagorean Theorem to find the length of the diagonal. Compare your results.



40. **Problem Solving** Cut an $8\frac{1}{2}$ -inch by 11-inch sheet of paper in half, and then fold it along a diagonal as shown below. Use a ruler to measure the length of the diagonal in inches. Then use the Pythagorean Theorem to find the length of the diagonal. Compare your results.



41. **Reasoning** The edge length of the cube shown below is 7 feet.



- Find diagonal length a .
 - Find diagonal length b .
42. **Problem Solving** An events coordinator plans to use a square section of a park for a small outdoor concert. The section will have an area of 1500 square feet. There is 150 feet of rope available. Is there enough rope to surround the section? Explain your reasoning.