CHAPTER 9

Solutions Key

Measurement: Two-Dimensional Figures

ARE YOU READY? PAGE 515

1. trapezoid

2. parallelogram

3. radius; diameter

4. 1,535
Nearest ten: 1,540
Nearest hundred: 1,500

5. 294
Nearest ten: 290
Nearest hundred: 300

6. 30,758
Nearest ten: 30,760
Nearest hundred: 30,800

7. 497
Nearest ten: 500
Nearest hundred: 500

8. 6.18
Nearest whole number: 6
Nearest tenth: 6.2

9. 10.50
Nearest whole number: 11
Nearest tenth: 10.5

10. 513.93
Nearest whole number: 514
Nearest tenth: 513.9

11. 29.06
Nearest whole number: 29
Nearest tenth: 29.1

12. $5.63 \cdot 8 = 45.04$

13. $9.67 \cdot 4.3 = 41.581$

14. $8.34 \cdot 16 = 133.44$

15. $6.08 \cdot 0.56 = 3.4048$

16. $0.82 \cdot 21 = 17.22$

17. $2.74 \cdot 6.6 = 18.084$

18. $40 \cdot 9.54 = 381.60$

19. $0.33 \cdot 0.08 = 0.0264$

20.
$2 \cdot 9 + 2 \cdot 9$
$18 + 12$
30

21.
$2(15 + 8)$
$2(23)$
46

22.
$4 \cdot 6.8 + 7 \cdot 9.3$
$27.2 + 65.1$
92.3

23.
$14(25.9 + 13.6)$
$14(39.5)$
553

24.
$(27.3 + 0.7) \div 2^2$
$28 \div 4$
7

25.
$5 \cdot 3^3 - 8.02$
$5 \cdot 27 - 8.02$
$135 - 8.02$
126.98

26.
$(63 \div 7) \cdot 4^2$
$9 \cdot 16$
144

27.
$1.1 + 3 \cdot 4.3$
$1.1 + 12.9$
14

28.
$66 \cdot [5 + (3 + 3)^2]$
$66 \cdot [5 + 36]$
$66 \cdot [41]$
$2{,}706$

29. trapezoid

30. triangle

31. parallelogram

9-1, PAGES 519–521

Think and Discuss

1. Possible answer: There are 6 significant digits: 4 nonzero digits and 2 zeros between significant digits.

2. Possible answer: 18 oz is more precise because an ounce is smaller than a pound.

Exercises

1. 4 ft, 1 yd
Since a foot is a smaller unit than a yard, 4 ft is more precise.

2. 2 cm, 21 mm
Since a millimeter is a smaller unit than a centimeter, 21 mm is more precise.

3. $5\frac{1}{2}$ in., $5\frac{1}{4}$ in.
5.5 in., 5.25 in.
Since hundredths are smaller than tenths, 5.25 in., or $5\frac{1}{4}$ in., is more precise.

4. 2.703 g
The digits 2, 7, and 3 are nonzero digits, and 0 is between two nonzero digits.
So, 2.703 has 4 significant digits.

5. 0.02 km
The digit 2 is a nonzero digit.
So, 0.02 km has 1 significant digit.

6. 28,000 lb
The digits 2 and 8 are nonzero digits.
So, 28,000 lb has 2 significant digits.

7.
16 — *0 digits to the right of the decimal point*
-3.8 — *1 digit to the right of the decimal point*
$12.2 \approx 12$ — *Round the difference so that it has no digits to the right of the decimal point.*

8.
3.5 — *1 digit to the right of the decimal point*
$+0.66$ — *2 digits to the right of the decimal point*
$4.16 \approx 4.2$ — *Round the sum so that it has 1 digit to the right of the decimal point.*

9.
11.3 — *1 digit to the right of the decimal point*
-4 — *0 digits to the right of the decimal point*
$7.3 \approx 7$ — *Round the difference so that it has no digits to the right of the decimal point.*

10.
47.9 — *3 significant digits*
$\times 3.8$ — *2 significant digits*
$182.02 \approx 180$ — *Round the product so that it has 2 significant digits.*

11.
7.0 — *2 significant digits*
$\times 3.6$ — *2 significant digits*
$25.2 \approx 25$ — *Round the product so that it has 2 significant digits.*

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12. 50.2 (*3 significant digits*) ÷ 8.0 (*2 significant digits*) = 6.275 ≈ 6.3 *Round the quotient so that it has 2 significant digits.*

13. 11 in., 11 ft
Since an inch is a smaller unit than a foot, 11 in. is more precise.

14. 7.2 m, 6.2 cm
Since a centimeter is a smaller unit than a meter, 6.2 cm is more precise.

15. 14.2 km, 14 km
Since tenths are smaller than ones, 14.2 km is more precise.

16. $4\frac{3}{8}$ in., $4\frac{7}{16}$ in.
4.375 in., 4.4375 in.
Since ten thousandths are smaller than thousandths, 4.4375 in., or $4\frac{7}{16}$ in., is more precise.

17. 2.8 m, 3 m
Since tenths are smaller than ones, 2.8 m is more precise.

18. 37 g, 37.0 g
Since tenths are smaller than ones, 37.0 g is more precise.

19. 0.00002 kg
The digit 2 is a nonzero digit.
So, 0.00002 kg has 1 significant digit.

20. 10,000,000 lb
The digit 1 is a nonzero digit.
So, 10,000,000 lb has 1 significant digit.

21. 200.060 m
The digits 2 and 6 are nonzero digits, the first three zeros are between two nonzero digits, and the last zero is to the right of the decimal after the last nonzero digit.
So, 200.060 m has 6 significant digits.

22. 4.003 L
The digits 4 and 3 are nonzero digits, and the 0 is to the right of the decimal after the last nonzero digit.
So, 4.003 L has 4 significant digits.

23. 0.230 cm
The digits 2 and 3 are nonzero digits, and the 0 is to the right of the decimal after the last nonzero digit.
So, 0.230 cm has 3 significant digits.

24. 940.0 ft
The digits 9 and 4 are nonzero digits, the last zero is to the right of the decimal after the last nonzero digit, and the first 0 is between two significant digits.
So, 940.0 ft has 4 significant digits.

25. 6.2 has 1 digit to the right of the decimal point and 8.93 has 2. Round the sum so that it has 1 digit to the right of the decimal point.
6.2 + 8.93 = 15.13 ≈ 15.1

26. 7.02 has 2 digits to the right of the decimal point and 15 has none. Round the sum so that it has no digits to the right of the decimal point.
7.02 + 15 = 22.02 ≈ 22

27. 8 has no digits to the right of the decimal point and 6.6 has 1. Round the difference so that it has no digits to the right of the decimal point.
8 − 6.6 = 1.4 ≈ 1

28. 29.1 has 1 digit to the right of the decimal point and 13.204 has 3. Round the difference so that it has 1 digit to the right of the decimal point.
29.1 − 13.204 = 15.896 ≈ 15.9

29. 8.6 has 1 digit to the right of the decimal point and 9.43 has 2. Round the sum so that it has 1 digit to the right of the decimal point.
8.6 + 9.43 = 18.03 ≈ 18.0

30. 43.5 has 1 digit to the right of the decimal point and 876.23 has 2. Round the sum so that it has 1 digit to the right of the decimal point.
43.5 + 876.23 = 919.73 ≈ 919.7

31. 17 has 2 significant digits and 104 has 3. Round the product so that it has 2 significant digits.
17 · 104 = 1,768 ≈ 1,800

32. 21.8 has 3 significant digits and 10.9 has 3. Round the product so that it has 3 significant digits.
21.8 · 10.9 = 237.62 ≈ 238

33. 7.0 has 2 significant digits and 3.11 has 3 significant digits. Round the quotient so that it has 2 significant digits.
7.0 ÷ 3.11 = 2.2508… ≈ 2.3

34. 1,680 has 3 significant digits and 5.025 has 4. Round the quotient so that it has 3 significant digits.
1,680 ÷ 5.025 = 334.328… ≈ 334

35. 14.2 has 3 significant digits and 0.05 has 1. Round the quotient so that it has 1 significant digit.
14.2 ÷ 0.05 = 284 ≈ 300

36. 5.22 has 3 significant digits and 6.3 has 2. Round the product so that it has 2 significant digits.
5.22 · 6.3 = 32.886 ≈ 33

37. A foot is more precise because it is a smaller unit than a mile.

38. A millimeter is more precise because it is a smaller unit than a centimeter.

39. A milliliter is more precise because it is a smaller unit than a liter.

40. A second is more precise because it is a smaller unit than a minute.

41. 38,000 · 4.8 = 182,400 ≈ 180,000

42. 2.879 + 113.6 = 116.479 ≈ 116.5

43. 290 − 6.1 = 283.9 ≈ 280

44. $5.6 \div 0.6 = 9.\overline{3} \approx 9$

45. 40.29 − 18.5 = 21.79 ≈ 21.8

46. 24 ÷ 6.02 = 3.9867… ≈ 4.0

47. a. No, Jay walks about 1.5 mi in the morning and about 0.5 mi in the afternoon for a total of 2 mi. In a 5-day week, he walks about 10 mi.
b. (1.55 + 0.4) · 5 = 9.75 mi

48. The amount in minestrone is more accurate since 1.5 has the smaller decimal place.

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49. 29% of what number is 690?
$0.29 \cdot n = 690$
$n \approx 2{,}379.31$
The recommended daily value for sodium is about 2,400 mg.

50. 1 kg = 1,000 g
$1{,}000 \div 154 \approx 6.4935 \approx 6$
One kilogram of grapefruit counts as 6 servings of fruit.

51. Find half of one-fourth. Subtract the answer from $19\frac{1}{4}$, and add your answer to $19\frac{1}{4}$.

$\frac{1}{2} \cdot \frac{1}{4} = \frac{1}{8}$

$19\frac{1}{4} - \frac{1}{8} = 19\frac{2}{8} - \frac{1}{8} = 19\frac{1}{8}$

$19\frac{1}{4} + \frac{1}{8} = 19\frac{2}{8} + \frac{1}{8} = 19\frac{3}{8}$

The watermelon may actually weigh between $19\frac{1}{8}$ lb and $19\frac{3}{8}$ lb.

52. D; 63,355 inches
Inches is the smallest unit of the ones given, so 63,355 inches is the most precise.

53. G; 0.08 ft
0.08 ft has only 1 nonzero digit to the right of the decimal point.

54. no correlation; The price of a car is not affected by the number of windows it has.

55. negative correlation; The faster a car travels, the less time it takes to go 100 miles.

56. positive correlation; The more expensive a gallon of gasoline costs directly impacts the cost for a tank of gas.

57. yes

58. no; Its sides are curved.

59. yes

HANDS-ON LAB 9-2, PAGES 522-523

Activity 1

Think and Discuss

1. Possible answer: The points lie on a straight line.

2. Possible answer: For each rectangle, the sum of the length and width is $\frac{1}{2}$ the perimeter.

3. To find the rectangle's perimeter, use $P = 2(\ell + w)$ or $P = 2\ell + 2w$.

Try This

1. $P = 2\ell + 2w$
$P = 2(6) + 2(4)$
$P = 12 + 8$
$P = 20$ in.

2. $P = 2\ell + 2w$
$P = 2(9) + 2(3)$
$P = 18 + 6$
$P = 24$ ft

3. $P = 2\ell + 2w$
$P = 2(5) + 2(5)$
$P = 10 + 10$
$P = 20$ cm

Activity 2

Think and Discuss

1. Possible answer: The points are close to lying on a straight line.

2. Possible answer: $\pi \approx 3.14$

Try This

1. $C = \pi d$

2. Possible answer: $C \approx 12.56$ cm

9-2, PAGES 525-527

Think and Discuss

1. Possible answer: Add the lengths of the four sides. Or multiply twice the length and twice the width, and then find the sum of the products.

2. Possible answer: Multiply the radius by 2 to find the diameter, and then substitute the value for the diameter into the formula.

Exercises

1. $P = 6 + 4 + 8$
$P = 18$
The perimeter of the triangle is 18 m.

2. $P = 7 + 5 + 7 + 5$
$P = 24$
The perimeter of the parallelogram is 24 in.

3. $P = 8 + 8 + 8 + 8$
$P = 32$
The perimeter of the square is 32 ft.

4. $P = 2\ell + 2w$
$P = (2 \cdot 12) + (2 \cdot 6)$
$P = 24 + 12$
$P = 36$
The perimeter of the rectangle is 36 in.

5. $P = 2\ell + 2w$
$P = (2 \cdot 8) + (2 \cdot 2)$
$P = 16 + 4$
$P = 20$
The perimeter of the rectangle is 20 m.

6. $P = 2\ell + 2w$
$P = \left(2 \cdot 4\frac{1}{2}\right) + \left(2 \cdot 1\frac{1}{2}\right)$
$P = 9 + 3$
$P = 12$
The perimeter of the rectangle is 12 ft.

7. $C = \pi d$
$C \approx 3.14 \cdot 12$
$C \approx 37.68$
The circumference of the circle is about 37.7 m.

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8. $C = \pi d$
$C \approx 3.14 \cdot 3$
$C \approx 9.42$
The circumference of the circle is about 9.4 ft.

9. $C = 2\pi r$
$C \approx 2 \cdot 3.14 \cdot 21$
$C \approx 131.88$
The circumference of the circle is about 131.9 in.

10. $C = \pi d$
$440 \approx 3.14 \cdot d$
$440 \div 3.14 \approx 3.14d \div 3.14$
$140.127 \approx d$
The diameter of the Ferris wheel is about 140 ft.

11. $P = 12 + 12 + 12 + 12$
$P = 48$
The perimeter of the rhombus is 48 cm.

12. $P = 7 + 13 + 10$
$P = 30$
The perimeter of the triangle is 30 ft.

13. $P = 8 + 10 + 10 + 16$
$P = 44$
The perimeter of the trapezoid is 44 m.

14. $P = 2\ell + 2w$
$P = (2 \cdot 8) + (2 \cdot 5)$
$P = 16 + 10$
$P = 26$
The perimeter of the rectangle is 26 in.

15. $P = 2\ell + 2w$
$P = (2 \cdot 3) + (2 \cdot 1)$
$P = 6 + 2$
$P = 8$
The perimeter of the rectangle is 8 ft.

16. $P = 2\ell + 2w$
$P = (2 \cdot 10.2) + (2 \cdot 8)$
$P = 20.4 + 16$
$P = 36.4$
The perimeter of the rectangle is 36.4 cm.

17. $C = \pi d$
$C \approx \frac{22}{7} \cdot 35$
$C \approx \frac{770}{7}$
$C \approx 110$
The circumference of the circle is about 110 cm.

18. $C = 2\pi r$
$C \approx 2 \cdot 3.14 \cdot 3$
$C \approx 18.84$
The circumference of the circle is about 18.8 m.

19. $C = 2\pi r$
$C \approx 2 \cdot 3.14 \cdot 5.1$
$C \approx 32.028$
The circumference of the circle is about 32.0 in.

20. $C = \pi d$
$91 \approx 3.14 \cdot d$
$91 \div 3.14 \approx 3.14d \cdot 3.14$
$28.98 \approx d$
The diameter is about 29 in.

21. $C = \pi d$
$17.8 \approx 3.14 \cdot d$
$17.8 \div 3.14 \approx 17.8d \cdot 3.14$
$5.67 \approx d$
$r = d \div 2$
$= 5.67 \div 2$
$= 2.835$
The diameter is about 5.7 m, and the radius is about 2.8 m.

22. $C = 2\pi r$
$C \approx 2 \cdot 3.14 \cdot 6.7$
$C \approx 42.076$
$d = r \cdot 2$
$= 6.7 \cdot 2$
$= 13.4$
The circumference is about 42.1 yd, and the diameter is about 13.4 yd.

23. $C = \pi d$
$C \approx 3.14 \cdot 10.6$
$C \approx 33.284$
$r = d \div 2$
$= 10.6 \div 2$
$= 5.3$
The circumference is about 33.3 in., and the radius is about 5.3 in.

24. $C = \pi d$
$\pi \approx \pi \cdot d$
$\pi \div \pi \approx \pi d \div \pi$
$1 \approx d$
$r = d \div 2$
$= 1 \div 2$
$= \frac{1}{2}$
The diameter is about 1 unit, and the radius is about a $\frac{1}{2}$ unit.

25. $C = \pi d$
$C \approx \pi \cdot 24.2$
$C \approx 75.988$ ft
$\frac{12 \text{ in.}}{1 \text{ ft}} = \frac{x}{76 \text{ ft}}$
$1 \cdot x = 12 \cdot 76$
$x = 912$ in.
$C \approx 912$ in.
912 in. $\div$ 57-in. strands $=$ 16 strands
16 strands of lights are needed to surround the patio edge.

26. $P = 34 + 45 + 62 = 141$
He travels 141 mi roundtrip.

27. $C = \pi d$
$301.5 \approx 3.14 \cdot d$
$301.5 \div 3.14 \approx 3.14d \div 3.14$
$96 \approx d$
The diameter of the rotunda is about 96 ft.

28. Possible answer: How many feet of ribbon would be needed to trim the edge of the bulletin board.

29. Subtract twice the length from the perimeter and divide the result by 2.

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30. $25\frac{1}{2} \div 9 = \frac{51}{2} \cdot \frac{1}{9} = \frac{17}{2} \cdot \frac{1}{3} = \frac{17}{6} = 2\frac{5}{6}$

Each side of the nonagon is $2\frac{5}{6}$ in.

31. D; 47.1 inches

$C = \pi d$

$C \approx 3.14 \cdot 15$

$C \approx 47.1$

The circumference of the circle is about 47.1 in.

32. G; 28 feet

$P = 2\ell + 2w$

$P = 2 \cdot 6 + 2 \cdot 8$

$P = 12 + 16$

$P = 28$

The perimeter is 28 ft.

33. 18 is 20% of what number?

$18 = 0.20 \cdot n$

$18 \div 0.20 = 0.20n \div 0.20$

$90 = n$

18 is 20% of 90.

34. 78% of 65 is what number?

$0.78 \cdot 65 = x$

$50.7 = x$

78% of 65 is 50.7.

35. $5.8 + 3.27 = 9.07$

There are two significant digits in 5.8 and three significant digits in 3.27. The answer needs to be rounded to the lowest number of significant digits, which is two. So, 9.07 becomes 9.1.

$5.8 + 3.27 = 9.1$

36. $6 - 2.5 = 3.5$

There is one significant digit in 6 and two significant digits in 2.5. The answer needs to be rounded to the lowest number of significant digits, which is one. So, 3.5 becomes 4.

$6 - 2.5 = 4$

37. $22.3 \cdot 6.2 = 138.26$

There are three significant digits in 5.8 and two significant digits in 6.2. The answer needs to be rounded to the lowest number of significant digits, which is two. So, 138.26 becomes 140.

$22.3 \cdot 6.2 = 140$

38. $60.6 \div 15 = 4.04$

There are three significant digits in 60.6 and two significant digits in 15. The answer needs to be rounded to the lowest number of significant digits, which is two. So, 4.04 becomes 4.0.

HANDS-ON LAB 9-3, PAGES 528-529

Activity 1

Think and Discuss

1. Possible answer: The length and width of the rectangle are equal to the base and height of the parallelogram.

2. $A = bh$

Try This

1. The formula will work for any parallelogram; $A = 5 \cdot 3 = 15$ in^2.

2. They all have the same area.

Activity 2

Think and Discuss

1. Possible answer: The base and height of the triangle are equal to the base and height of the parallelogram.

2. $A = \frac{1}{2}bh$

Try This

1. $A = \frac{1}{2}bh$

$A = \frac{1}{2} \cdot 10 \cdot 5 = 25$

The area of the triangle is 25 ft^2.

Activity 3

Think and Discuss

1. Possible answer: The length of the base of the parallelogram is $b_1 + b_2$. The area of the trapezoid is $h(b_1 + b_2)$.

2. $A = \frac{1}{2}h(b_1 + b_2)$

Try This

1. $A = \frac{1}{2}h(b_1 + b_2)$

$A = \frac{1}{2}(8)(4 + 6)$

$A = \frac{1}{2} \cdot 8 \cdot 10 = 40$

The area of the trapezoid is 40 in^2.

9-3, PAGES 531-533

Think and Discuss

1. $A = s^2$

2. Possible answer: When a parallelogram is nonrectangular, you have to multiply the height and the base, not the side lengths, to find the area.

Exercises

1. $A = \ell w$

$A = 8 \cdot 4.2$

$A = 33.6$

The area of the rectangle is 33.6 ft^2.

2. $A = \ell w$

$A = 7 \cdot 3$

$A = 21$

The area of the rectangle is 21 m^2.

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3. $A = \ell w$
$A = 16.4 \cdot 9$
$A = 147.6$
The area of the rectangle is 147.6 cm^2.

4. $A = \ell w$
$132 = 12 \cdot w$
$132 \div 12 = 12w \div 12$
$11 = w$
The width of the room is 11 ft.

5. $A = bh$
$A = 8 \cdot 6$
$A = 48$
The area of the parallelogram is 48 in^2.

6. $A = bh$
$A = 2\frac{4}{5} \cdot 4$
$A = \frac{14}{5} \cdot 4$
$A = \frac{56}{5} = 11\frac{1}{5}$
The area of the parallelogram is $11\frac{1}{5}$ cm^2.

7. $A = bh$
$A = 4.4 \cdot 6.5$
$A = 28.6$
The area of the parallelogram is 28.6 m^2.

8. $\frac{1 \text{ yd}}{3 \text{ ft}} = \frac{120 \text{ yd}}{x}$
$1 \cdot x = 120 \cdot 3$
$x = 360$ ft long
$\frac{1 \text{ yd}}{3 \text{ ft}} = \frac{66 \text{ yd}}{x}$
$1 \cdot x = 66 \cdot 3$
$x = 198$ ft wide
$A = \ell w$
$A = 360 \cdot 198$
$A = 71{,}280$
The area of the field is 71,280 ft^2.

9. $A = \ell w$
$A = 12 \cdot 7$
$A = 84$
The area of the rectangle is 84 ft^2.

10. $A = \ell w$
$A = 15\frac{1}{2} \cdot 8\frac{1}{2}$
$A = \frac{31}{2} \cdot \frac{17}{2}$
$A = \frac{527}{4} = 131\frac{3}{4}$
The area of the rectangle is $131\frac{3}{4}$ in^2.

11. $A = \ell w$
$A = 11.2 \cdot 9.6$
$A = 107.52$
The area of the rectangle is 107.52 in^2.

12. $A = \ell w$
$67.5 = \ell \cdot 4.5$
$67.5 \div 4.5 = 4.5\ell \div 4.5$
$15 = \ell$
The length of the dog yard is 15 m.

13. $A = bh$
$A = 4 \cdot 1.5$
$A = 6$
The area of the parallelogram is 6 m^2.

14. $A = bh$
$A = 7\frac{1}{2} \cdot 2\frac{1}{3}$
$A = \frac{15}{2} \cdot \frac{7}{3}$
$A = \frac{5}{2} \cdot \frac{7}{1}$
$A = \frac{35}{2} = 17\frac{1}{2}$
The area of the parallelogram is $17\frac{1}{2}$ ft^2.

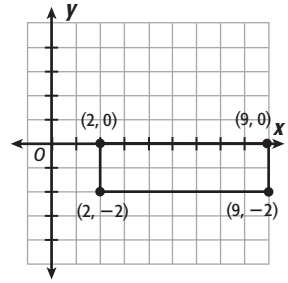
15. $A = bh$
$A = 3.9 \cdot 8.2$
$A = 31.98$
The area of the parallelogram is 31.98 cm^2.

16. $\frac{1 \text{ ft}}{12 \text{ in.}} = \frac{\ell}{15 \text{ in.}}$
$1 \cdot 15 = 12 \cdot \ell$
$15 = 12\ell$
$15 \div 12 = 12\ell \div 12$
$1.25 = \ell$
$\frac{1 \text{ ft}}{12 \text{ in.}} = \frac{w}{18 \text{ in.}}$
$1 \cdot 18 = 12 \cdot w$
$18 = 12w$
$18 \div 12 = 12w \div 12$
$1.5 = w$
$A = \ell w$
$A = 1.25 \cdot 1.5$
$A = 1.875$
The area of one block is 1.875 ft^2.

17. $A = \ell w$
$A = 9 \cdot 8$
$A = 72$
The area of the rectangle is 72 yd^2.

18. $A = bh$
$A = 7 \cdot 4.2$
$A = 29.4$
The area of the parallelogram is 29.4 m^2.

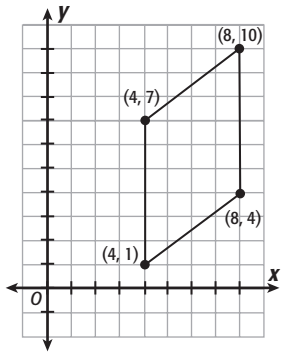
19.



$A = \ell w$
$A = 7 \cdot 2$
$A = 14$
The area of the rectangle is 14 $units^2$.

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20.



$A = \ell w$
$A = 6 \cdot 4$
$A = 24$
The area of the rectangle is 24 units^2.

21. a. $A = \ell w$
$A = 23 \cdot 31$
$A = 713$
The area of the painting is 713 in^2.

b. $P = 2\ell + 2w$
$P = 2 \cdot 23 + 2 \cdot 31$
$P = 46 + 62$
$P = 108$
The perimeter of the painting is 108 in.

c. Add the width of the frame to each side, making the dimensions 29 in. by 37 in.
$A = \ell w$
$A = 29 \cdot 37$
$A = 1{,}073$
The area of the entire painting and frame is 1,073 in^2.

22. $A = bh$
$66 = 11h$
$6 = h$
The height of the parallelogram is 6 inches.

23. C; 12 cm
Guess and Test or Make a Table

	Base	*Height*	*Area*
A:	5	0	0 ✗
B:	7	2	14 ✗
C:	12	7	84 ✓

24. No, the parallelogram could have a height less than 3 m, but the height of the rectangle is 3 m.

25. 1:2, 1:4
If the height is divided in half, the area will be half the original size. If both the height and base are halved, the area will be a quarter of the original size.

26. C; 40 in^2
$A = bh$
$A = 8 \cdot 5 = 40$

27. No, doubling the length of each side will make the deck 4 times as large because $6 \cdot 8 = 48$ and $2(6) \cdot 2(6) = 192 = 4(48)$. Possible answer: double the length of one side of the deck, giving dimensions of either 12 ft by 8 ft or 6 ft by 16 ft. Both of these alternatives will give an area of 96, or $2(48)$, square feet.

28. acute

29. obtuse

30. straight

31. right

32. $P = 2\ell + 2w$
$P = 2(6) + 2(12)$
$P = 12 + 24$
$P = 36$
The perimeter of the rectangle is 36 in.

33. $P = 2\ell + 2w$
$P = 2(2) + 2(8)$
$P = 4 + 16$
$P = 20$
The perimeter of the rectangle is 20 m.

34. $P = 2\ell + 2w$
$P = 2(16) + 2(3)$
$P = 32 + 6$
$P = 38$
The perimeter of the rectangle is 38 cm.

35. $P = 2\ell + 2w$

$P = 2\left(4\frac{4}{5}\right) + 2\left(1\frac{3}{8}\right)$

$P = 2\left(\frac{24}{5}\right) + 2\left(\frac{11}{8}\right)$

$P = \frac{48}{5} + \frac{22}{8}$

$P = \frac{384}{40} + \frac{110}{40}$

$P = \frac{494}{40} = 12\frac{14}{40} = 12\frac{7}{20}$

The perimeter of the rectangle is $12\frac{7}{20}$ ft.

9-4, PAGES 535-537

Think and Discuss

1. Possible answer: Multiply the lengths of the perpendicular sides, and then divide by two.

2. Possible answer: Find the sum of the lengths of the two parallel sides, and then find $\frac{1}{2}$ of the height times that sum.

Exercises

1. $A = \frac{1}{2}bh$

$A = \frac{1}{2}(8 \cdot 7)$

$A = 28$

The area of the triangle is 28 units^2.

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2. $A = \frac{1}{2}bh$

$A = \frac{1}{2}(6 \cdot 4)$

$A = 12$

The area of the triangle is 12 units^2.

3. $A = \frac{1}{2}bh$

$A = \frac{1}{2}(11.2 \cdot 7)$

$A = 39.2$

The area of the triangle is 39.2 units^2.

4. $A = \frac{1}{2}h(b_1 + b_2)$

$A = \frac{1}{2} \cdot 2(4 + 2.5)$

$A = \frac{1}{2} \cdot 2(6.5)$

$A = 6.5$

The area of the trapezoid is 6.5 cm^2.

5. $A = \frac{1}{2}h(b_1 + b_2)$

$A = \frac{1}{2} \cdot 8(6 + 10)$

$A = \frac{1}{2} \cdot 8(16)$

$A = 64$

The area of the trapezoid is 64 m^2.

6. $A = \frac{1}{2}h(b_1 + b_2)$

$A = \frac{1}{2} \cdot 6(12 + 6)$

$A = \frac{1}{2} \cdot 6(18)$

$A = 54$

The area of the trapezoid is 54 ft^2.

7. $A = bh$

$A = 442 \cdot 115$

$A = 50{,}830$

The area of Tennessee is about 50,830 mi^2.

8. $A = \frac{1}{2}bh$

$A = \frac{1}{2}(15 \cdot 6)$

$A = 45$

The area of the triangle is 45 units^2.

9. $A = \frac{1}{2}bh$

$A = \frac{1}{2}(5 \cdot 3)$

$A = 7.5$

The area of the triangle is 7.5 units^2.

10. $A = \frac{1}{2}bh$

$A = \frac{1}{2}(9 \cdot 16)$

$A = 72$

The area of the triangle is 72 units^2.

11. $A = \frac{1}{2}h(b_1 + b_2)$

$A = \frac{1}{2} \cdot 12(15 + 40)$

$A = \frac{1}{2} \cdot 12(55)$

$A = 330$

The area of the trapezoid is 330 yd^2.

12. $A = \frac{1}{2}h(b_1 + b_2)$

$A = \frac{1}{2} \cdot 10(3 + 18)$

$A = \frac{1}{2} \cdot 10(21)$

$A = 105$

The area of the trapezoid is 105 in^2.

13. $A = \frac{1}{2}h(b_1 + b_2)$

$A = \frac{1}{2} \cdot 3(5 + 10)$

$A = \frac{1}{2} \cdot 3(15)$

$A = 22.5$

The area of the trapezoid is 22.5 cm^2.

14. $A = \frac{1}{2}bh$

$A = \frac{1}{2}(160 \cdot 85)$

$A = 6{,}800$

The area of the triangle is 6,800 mi^2.

15. $A = \frac{1}{2}bh$

$18 = \frac{1}{2}(8 \cdot h)$

$18 = 4h$

$4.5 = h$

The height of the triangle is 4.5 cm.

16. $A = \frac{1}{2}bh$

$A = \frac{1}{2}(16 \cdot 0.7)$

$A = 5.6$

The area of the triangle is 5.6 ft^2.

17. $A = \frac{1}{2}bh$

$1{,}045 = \frac{1}{2}(b \cdot 95)$

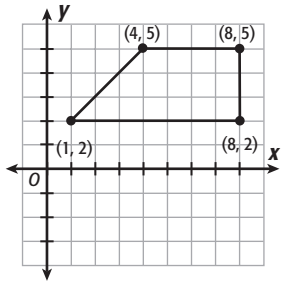
$1{,}045 = 47.5b$

$22 = b$

The base of the triangle is 22 in.

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18.



$A = \frac{1}{2}h(b_1 + b_2)$

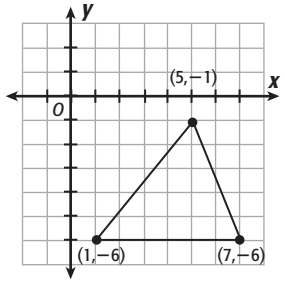
$A = \frac{1}{2} \cdot 3(7 + 4)$

$A = \frac{1}{2} \cdot 3(11)$

$A = 16.5$

The area of the trapezoid is 16.5 units^2.

19.



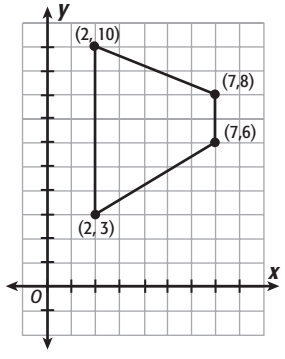
$A = \frac{1}{2}bh$

$A = \frac{1}{2}(6 \cdot 5)$

$A = 15$

The area of the triangle is 15 units^2.

20.



$A = \frac{1}{2}h(b_1 + b_2)$

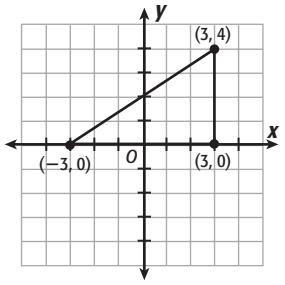
$A = \frac{1}{2} \cdot 5(7 + 2)$

$A = \frac{1}{2} \cdot 5(9)$

$A = 22.5$

The area of the trapezoid is 22.5 units^2.

21.



$A = \frac{1}{2}bh$

$A = \frac{1}{2}(6 \cdot 4)$

$A = 12$

The area of the triangle is 12 units^2.

22. $A = \frac{1}{2}h(b_1 + b_2)$

$9 = \frac{1}{2} \cdot h(2.4 + 3.6)$

$9 = \frac{1}{2} \cdot h(6)$

$9 = 3h$

$3 = h$

The height of the trapezoid is 3 m.

23. $P = 2\ell + 2w$

$P = (2 \cdot 365) + (2 \cdot 276)$

$P = 730 + 550$

$P = 1{,}282$

$A = \ell w$

$A = 365 \cdot 276$

$A = 100{,}740$

The perimeter of Colorado is about 1,282 mi and the area is about 100,740 mi^2.

24. The student multiplied the base and the side length and then multiplied the product by $\frac{1}{2}$ for an area of 33 cm^2. This is not a right triangle, so the length of one side is not the height of the triangle. In order to find the correct area, the height is needed.

25. Think of the state as a rectangle 200 mi by 320 mi and a triangle with height 320 mi and base 275 mi $(475 - 200 = 275)$; area of the rectangle part: $200 \cdot 320 = 64{,}000$; area of triangle part: $\frac{1}{2}(320 \cdot 275) = 44{,}000$; area of the whole state: $64{,}000 + 44{,}000 = 108{,}000$ mi^2.

26. $A = \frac{1}{2}h(b_1 + b_2)$

$70{,}704 = \frac{1}{2} \cdot 210(b_1 + 359)$

$70{,}704 = 105(b_1 + 359)$

$673.371 \approx b_1 + 359$

$314.371 \approx b_1$

The northern border is about 314 miles long.

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27. A, 8 cm^2

$A = \frac{1}{2}h(b_1 + b_2)$

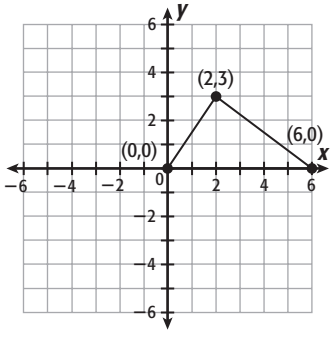
$A = \frac{1}{2} \cdot 2(3 + 5)$

$A = \frac{1}{2} \cdot 2(8)$

$A = 8$

The area of the trapezoid is 8 cm^2.

28.



$A = \frac{1}{2}bh$

$A = \frac{1}{2}(6 \cdot 3)$

$A = 9$

The area of the triangle is 9 $units^2$.

29. $180 = 45 + 45 + x$

$180 = 90 + x$

$90 = x$

The measure of the third angle is 90°.

30. $180 = 71 + 57 + x$

$180 = 128 + x$

$52 = x$

The measure of the third angle is 52°.

31. $180 = 103 + 28 + x$

$180 = 131 + x$

$49 = x$

The measure of the third angle is 49°.

32. $180 = 62 + 19 + x$

$180 = 81 + x$

$99 = x$

The measure of the third angle is 99°.

33. First convert the yards to feet.

$\frac{1 \text{ yd}}{3 \text{ ft}} = \frac{5 \text{ yd}}{\ell}$

$1 \cdot \ell = 5 \cdot 3$

$\ell = 15$ feet

$\frac{1 \text{ yd}}{3 \text{ ft}} = \frac{6 \text{ yd}}{w}$

$1 \cdot w = 6 \cdot 3$

$w = 18$ feet

$A = \ell w$

$A = 15 \cdot 18 = 270$

Justin needs 270 ft^2 of tile.

9-5, PAGES 539-541

Think and Discuss

1. Possible answer: The formula for the area of a circle uses the radius of a circle. If the diameter is given, you must first divide the diameter by 2.

2. Possible answer: a clock; estimate the radius of the clock, square that number, and then multiply by 3.14. $(6 \text{ in.})^2 \cdot 3.14 = 113.04 \text{ in}^2$

Exercises

1. $A = \pi r^2$

$A \approx 3.14 \cdot 5^2$

$A \approx 3.14 \cdot 25$

$A \approx 78.5$

The area of the circle is about 78.5 in^2.

2. $A = \pi r^2$

$A \approx 3.14 \cdot 8^2$

$A \approx 3.14 \cdot 64$

$A \approx 200.96$

The area of the circle is about 201.0 cm^2.

3. $A = \pi r^2$

$A \approx 3.14 \cdot 10^2$

$A \approx 3.14 \cdot 100$

$A \approx 314$

The area of the circle is about 314 yd^2.

4. $A = \pi r^2$

$A \approx 3.14 \cdot 1.1^2$

$A \approx 3.14 \cdot 1.21$

$A \approx 3.7994$

The area of the circle is about 3.8 m^2.

5. $A = \pi r^2$

$A \approx \frac{22}{7} \cdot 7^2$

$A \approx \frac{22}{7} \cdot 49$

$A \approx \frac{22}{1} \cdot 7$

$A \approx 154$

The area of the pizza is about 154 in^2.

6. The diameter of the circle is 1.2 cm.

$A = \pi r^2$

$A \approx 3.14 \cdot 0.6^2$

$A \approx 1.1304$

Half of the circle is shaded, so $1.1304 \div 2 = 0.5652$.

The area of the shaded part of the circle is about 0.6 cm^2.

7. $A = \pi r^2$

$A \approx 3.14 \cdot 3^2$

$A \approx 3.14 \cdot 9$

$A \approx 28.26$

The area of the circle is about 28.3 in^2.

8. $A = \pi r^2$

$A \approx 3.14 \cdot 16^2$

$A \approx 3.14 \cdot 256$

$A \approx 803.84$

The area of the circle is about 803.8 ft^2.

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9. $A = \pi r^2$
$A \approx 3.14 \cdot 3.2^2$
$A \approx 3.14 \cdot 10.24$
$A \approx 32.1536$
The area of the circle is about 32.2 yd^2.

10. $A = \pi r^2$
$A \approx 3.14 \cdot 7.5^2$
$A \approx 3.14 \cdot 56.25$
$A \approx 176.625$
The area of the circle is about 176.6 cm^2.

11. $A = \pi r^2$

$A \approx \frac{22}{7} \cdot 14^2$

$A \approx \frac{22}{7} \cdot 196$

$A \approx \frac{22}{1} \cdot 28$

$A \approx 616$
The area of the pizza is about 616 cm^2.

12. The diameter of the circle measures 3 cm.
$A = \pi r^2$
$A \approx 3.14 \cdot 1.5^2$
$A \approx 7.065$
A quarter of the circle is shaded,
so $7.065 \div 4 = 1.76625$.
The area of the shaded part of the circle is about 1.8 cm^2.

13. $A = \pi r^2$
$A \approx 3.14 \cdot 75^2$
$A \approx 3.14 \cdot 5{,}625$
$A \approx 17{,}662.5$
The area of the circle is about 17,662.5 mi^2.

14. $A = \pi r^2$
$A \approx 3.14 \cdot 4^2$
$A \approx 3.14 \cdot 16$
$A \approx 50.24$
The area of Kay's flower bed is about 50.2 ft^2.

15. $A = \pi r^2$
$A \approx 3.14 \cdot 3^2$
$A \approx 3.14 \cdot 9$
$A \approx 28.26$
The area of one lid is about 28.3 cm^2.

16. $C = 2\pi r$
$C \approx 2 \cdot 3.14 \cdot 7$
$C \approx 43.96$
The circumference is about 44.0 m.
$A = \pi r^2$
$A \approx 3.14 \cdot 7^2$
$A \approx 3.14 \cdot 49$
$A \approx 153.86$
The area is about 153.9 m^2.

17. $C = \pi d$
$C \approx 3.14 \cdot 18$
$C \approx 56.52$
The circumference is about 56.5 in.
$A = \pi r^2$
$A \approx 3.14 \cdot 9^2$
$A \approx 3.14 \cdot 81$
$A \approx 254.34$
The area is about 254.3 in^2.

18. $C = \pi d$
$C \approx 3.14 \cdot 24$
$C \approx 75.36$
The circumference is about 75.4 ft.
$A = \pi r^2$
$A \approx 3.14 \cdot 12^2$
$A \approx 3.14 \cdot 144$
$A \approx 452.16$
The area is about 452.2 ft^2.

19. $C = 2\pi r$
$C \approx 2 \cdot 3.14 \cdot 6.4$
$C \approx 40.192$
The circumference is about 40.2 cm.
$A = \pi r^2$
$A \approx 3.14 \cdot 6.4^2$
$A \approx 3.14 \cdot 40.96$
$A \approx 128.6144$
The area is about 128.6 cm^2.

20. $A = \pi r^2$
$113.04 \approx 3.14r^2$
$36 \approx r^2$
$6 \approx r$
The radius is 6 cm.

21. $A = \pi r^2$
$3.14 \approx 3.14r^2$
$1 \approx r^2$
$1 \approx r$
The radius is 1 ft.

22. $A = \pi r^2$
$28.26 \approx 3.14r^2$
$9 \approx r^2$
$3 \approx r$
The radius is 3 in.

23. a. The hiker walked 6 miles in any direction. This is equivalent to a circle with a radius of 6.
$A = \pi r^2$
$A \approx 3.14 \cdot 6^2$
$A \approx 3.14 \cdot 36$
$A \approx 113.04$
They would have to search about 113 mi^2.

b. The hiker would have walked 9 miles in any direction, which is a circle with a radius of 9.
$A = \pi r^2$
$A \approx 3.14 \cdot 9^2$
$A \approx 3.14 \cdot 81$
$A \approx 254.34$
They would have to search about 254 mi^2.
$254 - 113 = 141$
This is an additional 141 mi^2.

24. The diameter of the turbine is 187 ft.
$A = \pi r^2$
$A \approx 3.14 \cdot 93.5^2$
$A \approx 3.14 \cdot 8{,}742.25$
$A \approx 27{,}450.665$
The area covered by the turbine when it is rotating is about 27,450.7 ft^2.

25. No; the combined area of the two circles of the same radius is $2\pi r^2$, while the area of a circle with twice the radius is $\pi(2r)^2 = 4\pi r^2$.

26. Possible answer: What is the area that Chang painted, using 3.14 for π?

27. Possible answer: First use the formula for the circumference, $C = 2\pi r$, to solve for the radius, r. Then plug the radius into the formula for the area of a circle, $A = \pi r^2$.

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28. The area is multiplied by a factor of n^2. For instance, a circle with a radius of 5 has an area of about 78.5 units^2. If the radius is multiplied by 5, then the area is about 1,962.5 units^2, which is 5^2 times, or 25 times, as large.

29. A, 3.7 square feet

$A = \pi r^2$

$30 \approx 3.14r^2$

$9.55 \approx r^2$

$3.09 \approx r$

$3.09 - 2 = 1.09$

$A = \pi r^2$

$A \approx 3.14 \cdot 1.09^2$

$A \approx 3.73$

The area of the second circle is 3.7 square feet.

30. No, the 24-in. pizza is actually 4 times the size of the 12-in. pizza. When the diameter is doubled, the area becomes 2^2, or 4, times as large.

12-in.diameter pizza:

$A = \pi r^2$

$A \approx 3.14 \cdot 6^2$

$A \approx 113.04$ in^2

24-in.diameter pizza:

$A = \pi r^2$

$A \approx 3.14 \cdot 12^2$

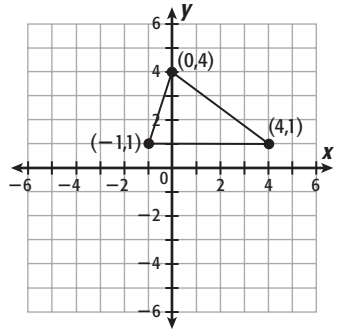
$A \approx 452.16$ in^2

31. 135°; since lines *a* and *b* are parallel, their corresponding angles are equal in measure.

32. 45°; lines *a* and *b* are parallel, so their corresponding angles are equal in measure. Therefore $\angle 1$ is 135°. Since $\angle 1$ and $\angle 2$ are supplementary, $180 - 135 = 45$. The m$\angle 2$ is 45°.

33. 45°; $\angle 2$ and $\angle 3$ are vertical angles, so they are equal in measure.

34.



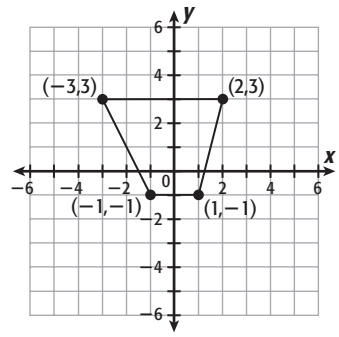
$A = \frac{1}{2}bh$

$A = \frac{1}{2}(5 \cdot 3)$

$A = 7.5$

The area of the triangle is 7.5 units^2.

35.



$A = \frac{1}{2}h(b_1 + b_2)$

$A = \frac{1}{2}4(5 + 2)$

$A = \frac{1}{2}4(7)$

$A = 14$

The area of the trapezoid is 14 units^2.

9-6, PAGES 543-545

Think and Discuss

1. Possible answer: Divide the figure horizontally into two rectangles (with areas 12 in^2 and 16 in^2), or divide the figure vertically into two rectangles (with areas 24 in^2 and 4 in^2).

2. Possible answer: The area of the figure is less than the area of a rectangle with sides of length 4 in. and 8 in., and the area of this rectangle is $4 \cdot 8 = 32$ in^2.

Exercises

1. 27 full squares + 4 partially-filled squares is about 28 ft^2.

2. 8 full squares + 6 half-filled squares + 4 partially-filled squares is about 14 ft^2.

3. Top rectangle:

$A = \ell w$

$A = 8 \cdot 10$

$A = 80$

Bottom rectangle:

$A = \ell w$

$A = 18 \cdot 8$

$A = 144$

$80 + 144 = 224$

The area of the figure is 224 ft^2.

4. Rectangle:

$A = \ell w$

$A = 12 \cdot 26$

$A = 312$

Half circle:

$A = \frac{1}{2}\pi r^2$

$A \approx \frac{1}{2} \cdot 3.14 \cdot 5^2$

$A \approx \frac{1}{2} \cdot 78.5$

$A \approx 39.25$

$312 + 39.25 = 351.25$

The area of the figure is 351.25 m^2.

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5. Rectangle:
$A = \ell w$
$A = 3 \cdot 2$
$A = 6$
Triangle:
$A = \frac{1}{2}bh$
$A = \frac{1}{2} \cdot 8 \cdot 8$
$A = \frac{1}{2} \cdot 64$
$A = 32$
$6 + 32 = 38$
The area of the figure is 38 ft^2.

6. Rectangle:
$A = \ell w$
$A = 4.5 \cdot 2$
$A = 9$
Two half circles:
$A = 2 \cdot \left(\frac{1}{2}\pi r^2\right)$
$A \approx 2 \cdot \left(\frac{1}{2} \cdot 3.14 \cdot 1^2\right)$
$A \approx 2 \cdot (1.57)$
$A \approx 3.14$
$9 + 3.14 = 12.14$
The area of the figure is 12.14 ft^2.

7. 21 full squares + 4 half-filled squares + 3 partially-filled squares is about 25 ft^2.

8. 22 full squares + 6 partially-filled squares is about 26 ft^2.

9. Rectangle:
$A = \ell w$
$A = 12 \cdot 6$
$A = 72$
Two half circles:
$A = 2 \cdot \left(\frac{1}{2}\pi r^2\right)$
$A \approx 2 \cdot \left(\frac{1}{2} \cdot 3.14 \cdot 2^2\right)$
$A \approx 2 \cdot (6.28)$
$A \approx 12.56$
$72 + 12.56 = 84.56$
The area of the figure is 84.56 m^2.

10. Rectangle 1:
$A = \ell w$
$A = 8 \cdot 10$
$A = 80$
Rectangle 2:
$A = \ell w$
$A = 4 \cdot 7$
$A = 28$
Rectangle 3:
$A = \ell w$
$A = 3 \cdot 3$
$A = 9$
$80 + 28 + 9 = 117$
The area of the figure is 117 ft^2.

11. Rectangle:
$A = \ell w$
$A = 9 \cdot 4$
$A = 36$
Triangle 1:
$A = \frac{1}{2}bh$
$A = \frac{1}{2} \cdot 4 \cdot 2$
$A = \frac{1}{2} \cdot 8$
$A = 4$
Triangle 2:
$A = \frac{1}{2}bh$
$A = \frac{1}{2} \cdot 4 \cdot 3$
$A = \frac{1}{2} \cdot 12$
$A = 6$
$36 + 4 + 6 = 46$
The area of the figure is 46 cm^2.

12. Trapezoid:
$A = bh$
$A = 20 \cdot 6$
$A = 120$
Half circle:
$A = \frac{1}{2}\pi r^2$
$A \approx \frac{1}{2} \cdot 3.14 \cdot 10^2$
$A \approx 157$
$120 + 157 = 277$
The area of the figure is 277 m^2.

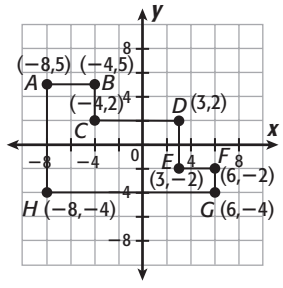
13. Top rectangle:
$A = \ell w$
$A = 3 \cdot 4$
$A = 12$
Bottom rectangle:
$A = \ell w$
$A = 9 \cdot 2$
$A = 18$
$12 + 18 = 30$
The area of the figure is 30 ft^2.
$P = 2 + 3 + 4 + 3 + 4 + 3 + 2 + 9 = 30$
The perimeter of the area is 30 ft.

14. Square:
$A = \ell w$
$A = 5 \cdot 5$
$A = 25$
Triangle:
$A = \frac{1}{2}bh$
$A = \frac{1}{2} \cdot 3 \cdot 4$
$A = \frac{1}{2} \cdot 12$
$A = 6$
$25 + 6 = 31$
The area of the figure is 31 m^2.
$P = 5 + 5 + 4 + 5 + 2 + 5 = 26$
The perimeter of the area is 26 m.

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15. Rectangle:
$A = \ell w$
$A = 18 \cdot 12$
$A = 216$
Half circle:
$A = \frac{1}{2}\pi r^2$
$A \approx \frac{1}{2} \cdot 3.14 \cdot 5^2$
$A \approx \frac{1}{2} \cdot 78.5$
$A \approx 39.25$
$216 + 39.25 = 255.25$
The area of the figure is 255.25 m^2.
$C = \pi d$
$C \approx 3.14 \cdot 10$
$C \approx 31.4$
Half circle:
$C \approx 31.4 \div 2 = 15.7$
$P = 12 + 18 + 12 + 15.7 + 8 = 65.7$
The perimeter of the figure is 65.7 m.

16.



Rectangle 1:
$A = \ell w$
$A = 4 \cdot 9$
$A = 36$
Rectangle 2:
$A = \ell w$
$A = 7 \cdot 6$
$A = 42$
Rectangle 3:
$A = \ell w$
$A = 3 \cdot 2$
$A = 6$
$36 + 42 + 6 = 84$
The area of the figure is 84 $units^2$.
$P = 9 + 4 + 3 + 7 + 4 + 3 + 2 + 14 = 46$
The perimeter of the figure is 46 units.

17.
$P = s + s + s + s + s$
$44 = x + x + x + 7 + 7$
$44 = 3x + 14$
$44 - 14 = 3x + 14 - 14$
$30 = 3x$
$10 \text{ ft} = x$

18. A; 5 m
Draw a Picture and Guess and Check
Area of total figure = 32.5; area of triangle = 7.5
$32.5 - 7.5 = 25$, area of square
$A = s^2$
$25 = s^2$
$5 \text{ m} = s$

19. Draw a vertical line to divide the figure into a rectangle (area 30 in^2) and triangle (area 27 in^2). The total area is $30 + 27 = 57$ in^2.

20. Find the area of the entire rectangle. Then subtract the area of the two half circles.
Rectangle:
$A = \ell w$
$A = 10 \cdot 8$
$A = 80$
Two half circles:
$A = 2 \cdot \left(\frac{1}{2}\pi r^2\right)$
$A \approx 2 \cdot \left(\frac{1}{2} \cdot 3.14 \cdot 4^2\right)$
$A \approx 2 \cdot (25.12)$
$A \approx 50.24$
$80 - 50.24 = 29.76$
The area of the figure is 29.76 cm^2.
$C = \pi d$
$C \approx 3.14 \cdot 8$
$C \approx 25.12$
Half circle:
$C \approx 31.4 \div 2 = 12.56$
$P = 10 + 12.56 + 10 + 12.56 = 45.12$
The perimeter of the figure is 45.12 cm.

21. B; 24 in.
If the area of one triangle is 6 in^2, use the formula for the area of a triangle to find the possible base and height lengths.
$A = \frac{1}{2}bh$
$6 = \frac{1}{2}bh$
$12 = bh$
Possible bh combinations that equal 12:
1×12
2×6
3×4
Try these combinations as perimeters.
1×12 combination: $P = 1 + 12 + 1 + 12 = 26$ in.
2×6 combination: $P = 2 + 6 + 2 + 6 = 16$ in.
3×4 combination: $P = 3 + 4 + 3 + 4 = 14$ in.
24 inches is the only choice that cannot be the perimeter of this rectangle.

22. 18 full squares + 4 half squares = 20 full squares, or patches
20 patches $\times$ 12 carrots per patch = 240 carrots
She can expect to grow 240 carrots in her garden.

23. $90 - 33 = 57°$

24. $90 - 46 = 44°$

25. $90 - 60 = 30°$

26. $90 - 25.5 = 64.5°$

27.
$r = d \div 2$
$= 30 \div 2$
$= 15$
$A = \pi r^2$
$A = 3.14 \cdot 15^2$
$A = 706.5 \text{ m}^2$

28.
$r = d \div 2$
$= 5.5 \div 2$
$= 2.75$
$A = \pi r^2$
$A = 3.14 \cdot 2.75^2$
$A = 23.7 \text{ cm}^2$

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29. $r = d \div 2$
$= 18 \div 2$
$= 9$
$A = \pi r^2$
$A = 3.14 \cdot 9^2$
$A = 254.3 \text{ in}^2$

30. $r = d \div 2$
$= 11 \div 2$
$= 5.5$
$A = \pi r^2$
$A = 3.14 \cdot 5.5^2$
$A = 95.0 \text{ ft}^2$

READY TO GO ON? PAGE 546

1. An inch is a smaller unit than a foot, so 5 in. is more precise.

2. $329 + 640 = 970$

3. $5.6 \cdot 2.59 = 14.504 = 15$
There are two significant digits in 5.6 and three significant digits in 2.59. Round the answer to the lowest number of significant digits, which is two. So, the answer becomes 15.

4. $82.5 \div 16 = 5.15625 = 5.2$
There are three significant digits in 82.5 and two significant digits in 16. Round the answer to the lowest number of significant digits, which is two. So, the answer becomes 5.2.

5. $27.1 - 4 = 23.1 = 23$
There are three significant digits in 27.1 and one significant digit in 4. Round the answer to the lowest number of significant digits, which is one. So, the answer becomes 23.

6. $P = 10.2 + 3.0 + 10.2 + 3.0 = 26.4$
The perimeter is 26.4 m.

7. $C = \pi d$
$94 \approx 3.14 \cdot d$
$29.936 \approx d$
The diameter is about 30 cm.

8. $A = lw$
$1{,}508 = 52 \cdot w$
$1{,}508 \div 52 = 52w \div 52$
$29 \text{ m} = w$

9. $\frac{1 \text{ yd}}{3 \text{ ft}} = \frac{8 \text{ yd}}{\ell}$
$1 \cdot \ell = 3 \cdot 8$
$\ell = 24 \text{ ft}$
$\frac{1 \text{ yd}}{3 \text{ ft}} = \frac{3 \text{ yd}}{w}$
$1 \cdot w = 3 \cdot 3$
$w = 9 \text{ ft}$
$A = \ell w$
$A = 24 \cdot 9 = 216$
The area of the kitchen is 216 ft^2.

10. $A = \frac{1}{2}h(b_1 + b_2)$
$A = \frac{1}{2}(8)(3 + 12)$
$A = \frac{1}{2}(8)(15)$
$A = \frac{1}{2}(120)$
$A = 60$
The area of the trapezoid is 60 in^2.

11. $A = \frac{1}{2}bh$
$45 = \frac{1}{2} \cdot 12.5 \cdot h$
$45 = 6.25h$
$7.2 = h$
The height of the triangle is 7.2 cm.

12. $A = \pi r^2$
$A \approx 3.14 \cdot 14^2$
$A \approx 615.44 \approx 615.4$ OR
$A \approx \frac{22}{7} \cdot 14^2$
$A \approx \frac{22}{7} \cdot \frac{196}{1}$
$A \approx \frac{22}{1} \cdot \frac{28}{1} \approx 616$
The area of the circle is 615.4 ft^2 or 616 ft^2.

13. $A = \pi r^2$
$A \approx \frac{22}{7} \cdot \left(\frac{35}{4}\right)^2$
$A \approx \frac{22}{7} \cdot \frac{1{,}225}{16}$
$A \approx \frac{11}{1} \cdot \frac{175}{8}$
$A \approx \frac{1{,}925}{8} \approx 240\frac{5}{8}$
The area of the clock face is 240 in^2 (if using 3.14 for π) or 241 in^2 (if using $\frac{22}{7}$ for π).

14. Rectangle 1:
$A = \ell w$
$A = 21 \cdot 15$
$A = 315$
Rectangle 2:
$A = \ell w$
$A = 15 \cdot 6$
$A = 90$
$315 + 90 = 405$
The area of the figure is 405 cm^2.

15. Rectangle:
$A = \ell w$
$A = 13 \cdot 7$
$A = 91$
Triangle 1:
$A = \frac{1}{2}bh$
$A = \frac{1}{2} \cdot 4 \cdot 3$
$A = 6$
Triangle 2:
$A = \frac{1}{2}bh$
$A = \frac{1}{2} \cdot 7 \cdot 3$
$A = 11.5$
$91 + 6 + 10.5 = 107.5$
The area of the figure is 107.5 ft^2.

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16. Rectangle:
$A = \ell w$
$A = 9 \cdot 11$
$A = 99$
Two half circles:
$A = 2 \cdot \left(\frac{1}{2}\pi r^2\right)$
$A \approx 2 \cdot \left(\frac{1}{2} \cdot 3.14 \cdot 5.5^2\right)$
$A \approx 2 \cdot (47.4925)$
$A \approx 94.985$
$99 + 94.985 = 193.985$
The area of the figure is 194 yd^2.

FOCUS ON PROBLEM SOLVING, PAGE 547

1. Possible answer: Not enough information; *One side of her garden measures 8 feet. Another side measures 5 feet*; need to know the shape of the garden; need the lengths of all of the garden's sides.

2. Possible answer: Correct amount of information; *Two sides of a triangle measure 17 inches and 13 inches. The perimeter of the triangle is 45 inches.*
$45 - 17 - 13 = 15$
$15 \text{ in.} \cdot \frac{1 \text{ ft}}{12 \text{ in.}} = 1.25 \text{ ft}$
The length of the third side is 1.25 ft.

3. Possible answer: Too much information; *The dimensions of the pool are 25 meters by 50 meters.*
$A = lw$
$A = 25 \cdot 50$
$A = 1{,}250$
The area of the pool is 1,250 m^2.

4. Possible answer: Not enough information; *Each afternoon Curtis walks his dog two times around the park. The park is a rectangle that is 315 yards long*; need to know the width of the park.

5. Possible answer: Not enough information; *A trapezoid has bases that measure 12 meters and 18 meters and one side that measures 9 meters*; need to know the height of the trapezoid.

HANDS-ON LAB 9-7, PAGES 548-549

Activity 1

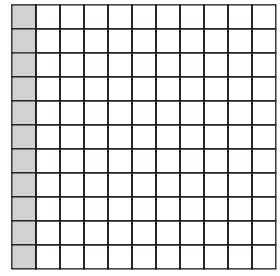
Think and Discuss

1. The square root times itself equals the number of small squares in the arrangement.

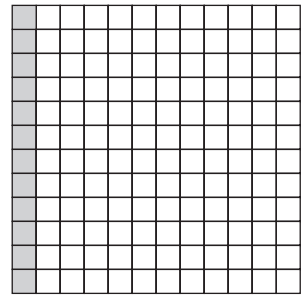
2. The number of shaded squares in each figure equals the square root of the number represented by the arrangement.

Try This

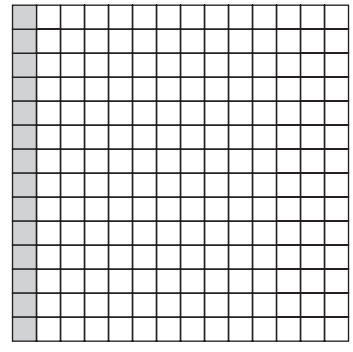
1. 11



2. 12



3. 14



Activity 2

Think and Discuss

1. Use the first perfect square that is greater than the number and the first perfect square that is less than the number to estimate the square root of the number.

2. On graph paper, use one color to draw the smallest possible square arrangement using at least 19 small squares (25 squares). On the same arrangement, draw the largest possible square arrangement using less than 19 small squares (16 squares). Count the number of squares in each arrangement. Notice that 19 is between these numbers. The square root of 19 will be between 4 and 5.

3. Since 5 is the square root of 25 and 6 is the square root of 35, the possible answers are any integers between 25 and 36.

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Try This

1. 4.4 **2.** 3.2

3. 5.3 **4.** 5.9

9-7, PAGES 551-553

Think and Discuss

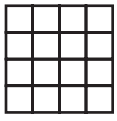
1. Possible answer: 75 lies between the perfect squares 64 and 81. Since 75 is closer to 81 than to 64, $\sqrt{75}$ is closer to $\sqrt{81}$ than to $\sqrt{64}$. $\sqrt{81} = 9$, so $\sqrt{75} \approx 9$.

2. Possible answer: Since squaring and finding a square root are inverse operations, one undoes the other. Undoing 3^2 gives 3.

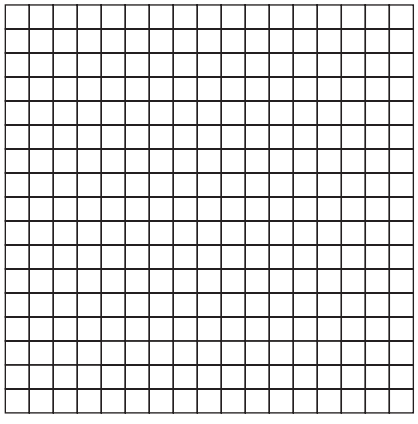
Exercises

1. 4^2

$A = \ell w$
$A = 4 \cdot 4$
$A = 16$
The square of 4 is 16.



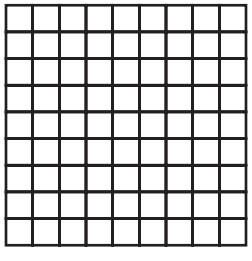
2. 17^2



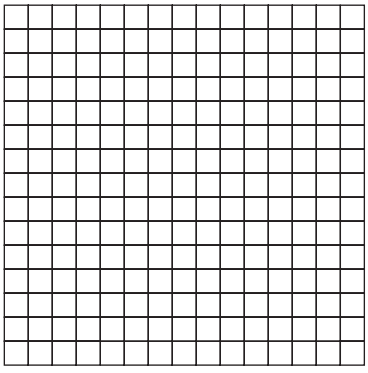
$A = \ell w$
$A = 17 \cdot 17$
$A = 289$
The square of 17 is 289.

3. 9^2

$A = \ell w$
$A = 9 \cdot 9$
$A = 81$
The square of 9 is 81.



4. 15^2



$A = \ell w$
$A = 15 \cdot 15$
$A = 225$
The square of 15 is 225.

5. $\sqrt{400} = 20$ **6.** $\sqrt{9} = 3$

7. $\sqrt{144} = 12$ **8.** $\sqrt{529} = 23$

9. $\sqrt{20}$

$16 < 20 < 25$
$\sqrt{16} < \sqrt{20} < \sqrt{25}$
$4 < \sqrt{20} < 5$
Since 20 is nearer in value to 16 than to 25, $\sqrt{20} \approx 4$.

10. $\sqrt{45}$

$36 < 45 < 49$
$\sqrt{36} < \sqrt{45} < \sqrt{49}$
$6 < \sqrt{45} < 7$
Since 45 is nearer in value to 49 than to 36, $\sqrt{45} \approx 7$.

11. $\sqrt{84}$

$81 < 84 < 100$
$\sqrt{81} < \sqrt{84} < \sqrt{100}$
$9 < \sqrt{84} < 10$
Since 84 is nearer in value to 81 than to 100, $\sqrt{84} \approx 9$.

12. $\sqrt{58}$

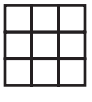
$49 < 58 < 64$
$\sqrt{49} < \sqrt{58} < \sqrt{64}$
$7 < \sqrt{58} < 8$
Since 58 is nearer in value to 64 than to 49, $\sqrt{58} \approx 8$.

13. The length of each side of the patrol square is $\sqrt{125}$ mi.

$121 < 125 < 144$
$\sqrt{121} < \sqrt{125} < \sqrt{144}$
$11 < \sqrt{125} < 12$
Since 125 is nearer to 121 than to 144, $\sqrt{125} \approx 11$.
Each side of the patrol square is about 11 miles long.

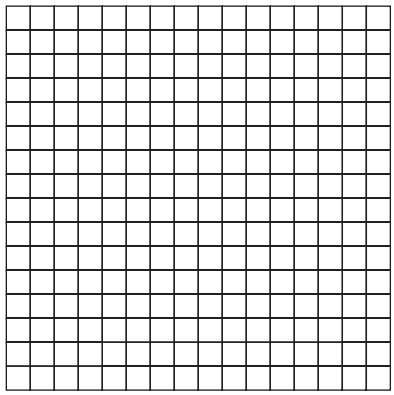
14. 3^2

$A = \ell w$
$A = 3 \cdot 3$
$A = 9$
The square of 3 is 9.



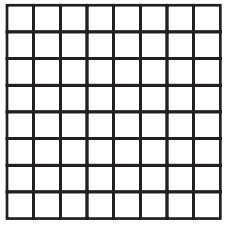
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15. 16^2

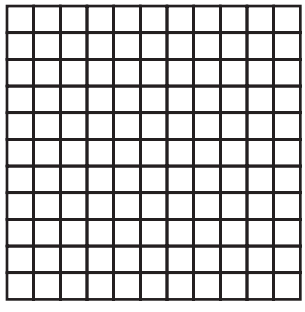


$A = \ell w$
$A = 16 \cdot 16$
$A = 256$
The square of 16 is 256.

16. 8^2
$A = \ell w$
$A = 8 \cdot 8$
$A = 64$
The square of 8 is 64.



17. 11^2
$A = \ell w$
$A = 11 \cdot 11$
$A = 121$
The square of 11 is 121.



18. $\sqrt{361} = 19$

19. $\sqrt{16} = 4$

20. $\sqrt{169} = 13$

21. $\sqrt{441} = 21$

22. $\sqrt{12}$
$9 < 12 < 16$
$\sqrt{9} < \sqrt{12} < \sqrt{16}$
$3 < \sqrt{12} < 4$
Since 12 is nearer in value to 9 than to 16, $\sqrt{12} \approx 3$.

23. $\sqrt{39}$
$36 < 39 < 49$
$\sqrt{36} < \sqrt{39} < \sqrt{49}$
$6 < \sqrt{39} < 7$
Since 39 is nearer in value to 36 than to 49, $\sqrt{39} \approx 6$.

24. $\sqrt{73}$
$64 < 73 < 81$
$\sqrt{64} < \sqrt{73} < \sqrt{81}$
$8 < \sqrt{73} < 9$
Since 73 is nearer in value to 81 than to 64, $\sqrt{73} \approx 9$.

25. $\sqrt{109}$
$100 < 109 < 121$
$\sqrt{100} < \sqrt{109} < \sqrt{121}$
$10 < \sqrt{109} < 11$
Since 109 is nearer in value to 100 than to 121, $\sqrt{109} \approx 10$.

26. The length of each side of the square field is $\sqrt{200}$ ft.
$196 < 200 < 225$
$\sqrt{196} < \sqrt{200} < \sqrt{225}$
$14 < \sqrt{200} < 15$
Since 200 is nearer in value to 196 than to 225, $\sqrt{200} \approx 14$.
Each side of the field is about 14 feet long.

27. $\sqrt{6}$
$4 < 6 < 9$
$\sqrt{4} < \sqrt{6} < \sqrt{9}$
$2 < \sqrt{6} < 3$
Since 6 is nearer in value to 4 than to 9, $\sqrt{6} \approx 2$.

28. $\sqrt{180}$
$169 < 180 < 196$
$\sqrt{169} < \sqrt{180} < \sqrt{196}$
$13 < \sqrt{180} < 14$
Since 180 is nearer in value to 169 than to 196, $\sqrt{180} \approx 13$.

29. $\sqrt{145}$
$144 < 145 < 169$
$\sqrt{144} < \sqrt{145} < \sqrt{169}$
$12 < \sqrt{145} < 13$
Since 145 is nearer in value to 144 than to 169, $\sqrt{145} \approx 12$.

30. $\sqrt{216}$
$196 < 216 < 225$
$\sqrt{196} < \sqrt{216} < \sqrt{225}$
$12 < \sqrt{216} < 15$
Since 216 is nearer in value to 225 than to 196, $\sqrt{216} \approx 15$.

31. $\sqrt{300}$
$\sqrt{289} < \sqrt{300} < \sqrt{324}$
$17 < \sqrt{300} < 18$
$\sqrt{300} \approx 17$

32. $\sqrt{420}$
$\sqrt{400} < \sqrt{420} < \sqrt{441}$
$20 < \sqrt{420} < 21$
$\sqrt{420} \approx 20$

33. $\sqrt{700}$
$\sqrt{676} < \sqrt{700} < \sqrt{729}$
$26 < \sqrt{700} < 27$
$\sqrt{700} \approx 26$

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34. $\sqrt{1{,}500}$
$\sqrt{1{,}444} < \sqrt{1{,}500} < \sqrt{1{,}521}$
$38 < \sqrt{1{,}500} < 39$
$\sqrt{1{,}500} \approx 39$

35. $\sqrt{44} \approx 6.6$

36. $\sqrt{253} \approx 15.9$

37. $\sqrt{87} \approx 9.3$

38. $\sqrt{125} \approx 11.2$

39. $\sqrt{380} \approx 19.5$

40. $\sqrt{94} \approx 9.7$

41. $\sqrt{202} \approx 14.2$

42. $\sqrt{571} \approx 23.9$

43. The window with the perimeter of 48 in. is larger because its sides are 12 in. long and its area is 144 in^2. The sides of the window with the area of 100 in^2 are about $10\frac{1}{2}$ in. long, and the perimeter is about 42 in.

44. $A = \pi r^2$
$706.9 \approx 3.14 \cdot r^2$
$225.127 \approx r^2$
$15 \text{ m} \approx r$

45. $A = \pi r^2$
$615.44 \approx 3.14 \cdot r^2$
$196 \approx r^2$
$14 \text{ yd} \approx r$
$C = \pi d$
$C \approx 3.14 \cdot 28$
$C = 87.92 \text{ yd}$

46. $A = \pi r^2$
$28.26 \approx 3.14 \cdot r^2$
$9 \approx r^2$
$3 \text{ ft} \approx r$
$6 \text{ ft} = d$

47. $A = \pi r^2$
$3.14 \approx 3.14 \cdot r^2$
$1 \approx r^2$
$1 \text{ in.} \approx r$

48. Use a calculator to find the value of each of the numbers.
$\sqrt{49} = 7$
$\frac{17}{3} = 5.\overline{66}$
$6.5 = 6.5$
$8 = 8$
$\frac{25}{4} = 6.25$
Then order the numbers from least to greatest.
$\frac{17}{3}, \frac{25}{4}, 6.5, \sqrt{49}, 8$

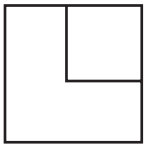
49. Use a calculator to find the value of each of the numbers.
$\frac{52}{3} = 5.\overline{66}$
$\sqrt{25} = 5$
$3^2 = 9$
$7.15 = 7.15$
$\frac{29}{4} = 7.25$
Then order the numbers from least to greatest.
$\sqrt{25}, 5\frac{2}{3}, 7.15, \frac{29}{4}, 9$

50. $\sqrt{49} = 7$
The length of each side is 7 in.
$P = 7 + 7 + 7 + 7 = 28$
The perimeter of the square is 28 in.

51. $D = 3.56 \cdot \sqrt{A}$
$D = 3.56 \cdot \sqrt{1{,}800}$
$D \approx 3.56 \cdot 42.42641$
$D \approx 151.03801$
The horizon is about 151 km away.

52. $\sqrt{324} = 18$
Each square in the quilt is 18 in. by 18 in. There are 4 squares to a side.
$18 \cdot 4 = 72$
Each side of the quilt is 72 in. The dimensions are 72 in. $\times$ 72 in.

53. Draw a Diagram



54. Possible answer: Multiply the number by itself. So, the square of 6 is $6 \times 6 = 36$. To find the square root of a number, you find the number that, when multiplied by itself, equals the first number, So, $\sqrt{81}$ is 9 because $9 \times 9 = 81$.

55. $5^2 + 12^2 = 25 + 144 = 169$
$\sqrt{169} = 13$

56. C; $5^2 = 25$. The model shows 5 rows of 5 squares each, totaling 25.

57. F; 9
$\sqrt{87} = 9.327379$, rounded to the nearest whole number is 9.

58. scalene

59. equilateral

60. isosceles

61. $C = \pi d$
$C \approx 3.14 \cdot 22$
$C \approx 69.1 \text{ in.}$
$A = \pi r^2$
$A \approx 3.14 \cdot 11^2$
$A \approx 379.9 \text{ in}^2$

62. $C = \pi d$
$C \approx 3.14 \cdot 25$
$C \approx 78.5 \text{ cm}$
$A = \pi r^2$
$A \approx 3.14 \cdot 12.5^2$
$A \approx 490.6 \text{ cm}^2$

63. $C = \pi d$
$C \approx 3.14 \cdot 6$
$C \approx 18.8 \text{ ft}$
$A = \pi r^2$
$A \approx 3.14 \cdot 32$
$A \approx 28.3 \text{ ft}^2$

HANDS-ON LAB 9-8, PAGES 554-555

Activity 1

Think and Discuss

1. The area of the two red squares added together is equal to the area of the blue square.

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2. a. Squaring the side length of a square will give you the area of the square.

b. Possible answer: Squaring the length of each side of the triangle will give you the area of the square that shares that side with the triangle.

c. $a^2 + b^2 = c^2$

Try This

1. Yes, the relationship is true for each isosceles right triangle.

Activity 2

Think and Discuss

1. Possible answer: 9, 16, 25; if you add the areas of the two smaller squares, you get the area of the largest square.

2. 5 units

3. Possible answer: $3^2 + 4^2 = 5^2$; $9 + 16 = 25$; the equation seems to be true for right triangles other than just right isosceles triangles.

4. Possible answer: No; for example, the relationship is not true for an equilateral triangle with side length 1. $1^2 + 1^2 \neq 1^2$

Try This

1. No; the total area of the red square is 25; but the area of the blue square is 36.

2. Yes; to find the length of the longest side, square each of the smaller sides and add them together: $9^2 + 12^2 = 81 + 144 = 225$. The length of the longest side is the square root of 225: $\sqrt{225} = 15$.

3. Square both numbers. Subtract the square of the shorter side from the square of the longest side. The length of the third side is the square root of the difference.

9-8, PAGES 557-559

Think and Discuss

1. Possible answer: The Pythagorean Theorem can be used to find the unknown side length of a scalene triangle only if it is a right triangle.

2. Possible answer: A leg can never be greater than the hypotenuse. The hypotenuse of a right triangle is always the longest side since it is always opposite the greatest angle in the triangle, the right angle. Since the square of the hypotenuse is greater than the square of either leg, the hypotenuse must be longer than either leg.

Exercises

1.
$$\begin{aligned} a^2 + b^2 &= c^2 \\ 12^2 + 16^2 &= c^2 \\ 144 + 256 &= c^2 \\ 400 &= c^2 \\ \sqrt{400} &= \sqrt{c^2} \\ 20 &= c \end{aligned}$$
The length of the hypotenuse is 20 m.

2.
$$\begin{aligned} a^2 + b^2 &= c^2 \\ 15^2 + b^2 &= 17^2 \\ 225 + b^2 &= 289 \\ -225 \quad & \quad -225 \\ b^2 &= 64 \\ \sqrt{b^2} &= \sqrt{64} \\ b &= 8 \end{aligned}$$
The length of the leg, b, is 8 ft.

3.
$$\begin{aligned} a^2 + b^2 &= c^2 \\ a^2 + 10^2 &= 26^2 \\ a^2 + 100 &= 676 \\ -100 \quad & \quad -100 \\ a^2 &= 576 \\ \sqrt{a^2} &= \sqrt{576} \\ a &= 24 \end{aligned}$$
The length of the leg, a, is 24 cm.

4.
$$\begin{aligned} a^2 + b^2 &= c^2 \\ a^2 + 5^2 &= 10^2 \\ a^2 + 25 &= 100 \\ -25 \quad & \quad -25 \\ a^2 &= 75 \\ \sqrt{a^2} &= \sqrt{75} \\ a &\approx 8.660 \\ a &\approx 8.7 \end{aligned}$$
The ladder touches the wall about 8.7 ft above the ground.

5.
$$\begin{aligned} a^2 + b^2 &= c^2 \\ 24^2 + 18^2 &= c^2 \\ 576 + 324 &= c^2 \\ 900 &= c^2 \\ \sqrt{900} &= \sqrt{c^2} \\ 30 &= c \end{aligned}$$
The length of the hypotenuse is 30 yd.

6.
$$\begin{aligned} a^2 + b^2 &= c^2 \\ 202 + b^2 &= 25^2 \\ 400 + b^2 &= 625 \\ -400 \quad & \quad -400 \\ b^2 &= 225 \\ \sqrt{b^2} &= \sqrt{225} \\ b &= 15 \end{aligned}$$
The length of the leg, b, is 15 ft.

7.
$$\begin{aligned} a^2 + b^2 &= c^2 \\ a^2 + 30^2 &= 34^2 \\ a^2 + 900 &= 1{,}156 \\ -900 \quad & \quad -900 \\ a^2 &= 256 \\ \sqrt{a^2} &= \sqrt{256} \\ a &= 16 \end{aligned}$$
The length of the leg, a, is 16 in.

8.
$$\begin{aligned} a^2 + b^2 &= c^2 \\ 15^2 + 15^2 &= c^2 \\ 225 + 225 &= c^2 \\ 450 &= c^2 \\ \sqrt{450} &= \sqrt{c^2} \\ 21.213 &\approx c \\ 21.2 &\approx c \end{aligned}$$
He is about 21.2 mi away from his starting point.

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9. $a^2 + b^2 = c^2$
$5^2 + 8^2 = c^2$
$25 + 64 = c^2$
$89 = c^2$
$9.4 \text{ ft} \approx c$

10. $a^2 + b^2 = c^2$
$10^2 + b^2 = 15^2$
$100 + b^2 = 225$
$-100 \quad -100$
$b^2 = 125$
$b \approx 11.2 \text{ mm}$

11. $a^2 + b^2 = c^2$
$19^2 + b^2 = 31^2$
$361 + b^2 = 961$
$-361 \quad -361$
$b^2 = 600$
$b \approx 24.5 \text{ m}$

12. $a^2 + b^2 = c^2$
$21^2 + 20^2 = c^2$
$441 + 400 = c^2$
$841 = c^2$
$29 \text{ yd} = c$

13. $a^2 + b^2 = c^2$
$13.5^2 + 18^2 = c^2$
$182.25 + 324 = c^2$
$506.25 = c^2$
$22.5 \text{ yd} = c$

14. $a^2 + b^2 = c^2$
$a^2 + 13^2 = 18^2$
$a^2 + 169 = 324$
$-169 \quad -169$
$a^2 = 155$
$a \approx 12.4 \text{ cm}$

15. Yes. The lengths become 6 ft and 8 ft and the hypotenuse becomes 10 ft.
$6^2 + 8^2 = 10^2$
$36 + 64 = 100$
Since the Pythagorean Theorem is satisfied, it is a right triangle.

16. a. $\sqrt{12{,}100} = 110$
The length of each side of the base is 110 m.

b. $a^2 + b^2 = c^2$
$110^2 + 110^2 = c^2$
$12{,}100 + 12{,}100 = c^2$
$24{,}200 = c^2$
$155.6 \approx c$
The length of a diagonal of the base is about 155.6 m.

17. $A = \frac{1}{2}bh$
$A = \frac{1}{2}(214 \cdot 179)$
$A = 19{,}153$
The area of one side of the pyramid is 19,153 m^2.

18. $a^2 + b^2 = c^2$
$107^2 + 179^2 = c^2$
$11{,}449 + 32{,}041 = c^2$
$43{,}490 = c^2$
$208.5 \approx \text{c}$
The distance from one corner to the peak is about 208.5 m.

19. $471 \text{ ft} \cdot \frac{12 \text{ in.}}{1 \text{ ft}} \cdot \frac{1 \text{ cubit}}{21 \text{ in.}} \approx 269.1 \text{ cubits}$
The height of the pyramid is about 269.1 cubits.

20. In the equation $a^2 + b^2 = c^2$, a and b are always the two sides that meet at a 90° angle and c is always the hypotenuse.

21. $a^2 + b^2 = c^2$
$55^2 + b^2 = 88.1^2$
$3{,}025 + b^2 = 7{,}761.61$
$-3{,}025 \quad -3{,}025$
$b^2 = 4{,}736.61$
$b \approx 68.8$
The height of the pyramid is 68.8 m.

22. B, 9.2 m
$a^2 + b^2 = c^2$
$6^2 + 7^2 = c^2$
$36 + 49 = c^2$
$85 = c^2$
$9.2 \text{ m} \approx c$

23. $a^2 + b^2 = c^2$
$2^2 + b^2 = 10^2$
$4 + b^2 = 100$
$b^2 = 96$
$b \approx 9.79$
The ladder is about 9.8 feet tall.

24. 180°

25. 90°

26. 150°

27. 60°

28. $\sqrt{140}$
$121 < 140 < 144$
$\sqrt{121} < \sqrt{140} < \sqrt{144}$
$11 < \sqrt{140} < 12$
Since 140 is nearer in value to 144 than to 121, $\sqrt{140} \approx 12$.

29. $\sqrt{60}$
$49 < 60 < 64$
$\sqrt{49} < \sqrt{60} < \sqrt{64}$
$7 < \sqrt{60} < 8$
Since 60 is nearer in value to 64 than to 49, $\sqrt{60} \approx 8$.

30. $\sqrt{200}$
$196 < 200 < 225$
$\sqrt{196} < \sqrt{200} < \sqrt{225}$
$14 < \sqrt{200} < 15$
Since 200 is nearer in value to 196 than to 225, $\sqrt{200} \approx 14$.

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31. $\sqrt{30}$

$25 < 30 < 36$

$\sqrt{25} < \sqrt{30} < \sqrt{36}$

$5 < \sqrt{30} < 6$

Since 30 is nearer in value to 25 than to 36, $\sqrt{30} \approx 5$.

READY TO GO ON? PAGE 560

1. $21^2 = 441$

2. $7^2 = 49$

3. $12^2 = 144$

4. $13^2 = 169$

5. $\sqrt{49} = 7$

6. $\sqrt{36} = 6$

7. $\sqrt{64} = 8$

8. $\sqrt{841} = 29$

9. $\sqrt{1{,}089} = 33$

10. $\sqrt{81} = 9$

11. $\sqrt{576} = 24$

12. $\sqrt{40}$

$36 < 40 < 49$

$\sqrt{36} < \sqrt{40} < \sqrt{49}$

$6 < \sqrt{40} < 7$

Since 40 is nearer in value to 36 than to 49, $\sqrt{40} \approx 6$.

13. $\sqrt{85}$

$81 < 85 < 100$

$\sqrt{81} < \sqrt{85} < \sqrt{100}$

$9 < \sqrt{85} < 10$

Since 85 is nearer in value to 81 than to 100, $\sqrt{85} \approx 9$.

14. $\sqrt{12}$

$9 < 12 < 16$

$\sqrt{9} < \sqrt{12} < \sqrt{16}$

$3 < \sqrt{12} < 4$

Since 12 is nearer in value to 9 than to 16, $\sqrt{12} \approx 3$.

15. $\sqrt{33}$

$25 < 33 < 36$

$\sqrt{25} < \sqrt{33} < \sqrt{36}$

$5 < \sqrt{33} < 6$

Since 33 is nearer in value to 36 than to 25, $\sqrt{33} \approx 6$.

16. $a^2 + b^2 = c^2$

$6^2 + 8^2 = c^2$

$36 + 64 = c^2$

$100 = c^2$

$10 \text{ cm} = c$

17. $a^2 + b^2 = c^2$

$12^2 + b^2 = 37^2$

$144 + b^2 = 1{,}369$

$b^2 = 1{,}225$

$b = 35 \text{ m}$

18. $a^2 + b^2 = c^2$

$40^2 + 9^2 = c^2$

$1{,}600 + 81 = c^2$

$1{,}681 = c^2$

$41 \text{ ft} = c$

19. $a^2 + b^2 = c^2$

$1.8^2 + 3.2^2 = c^2$

$3.24 + 10.24 = c^2$

$13.48 = c^2$

$3.7 \text{ mi} \approx c$

20. $a^2 + b^2 = c^2$

$8^2 + b^2 = 17^2$

$64 + b^2 = 289$

$b^2 = 225$

$b = 15 \text{ ft}$

21. $a^2 + b^2 = c^2$

$a^2 + 14.3^2 = 22^2$

$a^2 + 204.49 = 484$

$a^2 = 279.51$

$a \approx 16.7 \text{ cm}$

22. $a^2 + b^2 = c^2$

$10^2 + 24^2 = c^2$

$100 + 576 = c^2$

$676 = c^2$

$26 \text{ yd} = c$

23. $a^2 + b^2 = c^2$

$12.4^2 + 9.0^2 = c^2$

$153.76 + 81 = c^2$

$234.76 = c^2$

$15.3 \text{ in.} \approx c$

24. $a^2 + b^2 = c^2$

$a^2 + 2.5^2 = 8^2$

$a^2 + 6.25 = 64$

$a^2 = 57.75$

$a \approx 7.6 \text{ cm}$

MULTI-STEP TEST PREP, PAGE 561

1. $\ell = 20 + 5 + 5 = 30$

$w = 30 + 5 + 5 = 40$

$P = 2\ell + 2w$

$P = 2(30) + 2(40)$

$P = 60 + 80 = 140$

She will need 140 ft of fencing.

2. $P = 2\ell + 2w$

$P = 2(20) + 2(30)$

$P = 40 + 60 = 100$

Seedlings are planted every 12 inches, or 1 foot, so 100 seedlings will be planted.

3. $C = \pi d$

$C = 3.14 \cdot 10$

$C = 31.4$

The concrete border around the fountain is 31.4 ft.

4. Area of entire garden:

$A = \ell w$

$A = 20 \cdot 30$

$A = 600 \text{ ft}^2$

Area of fountain

$A = \pi r^2$

$A = 3.14 \cdot 5^2$

$A = 78.5 \text{ ft}^2$

$600 - 78.5 = 521.5$

There is 521.5 ft^2 left for planting.

5. $521.5 \div 18 \approx 28.97222$

She should buy 29 bags of mulch.

6. $a^2 + b^2 = c^2$

$40^2 + 30^2 = c^2$

$1{,}600 + 900 = c^2$

$2{,}500 = c^2$

$50 = c$

50 ft is the hypotenuse of one half of the *X*, so $50 \times 2 = 100$.

100 ft of streamers are needed to make the *X*.

STUDY GUIDE: REVIEW, PAGES 566-568

1. hypotenuse

2. circumference

3. precision

4. square root

5. 0.**450** kg
3 significant digits

6. **6,703.0** ft
5 significant digits

7. **3**0,000 lb
1 significant digit

8. 0.000**78** g
2 significant digits

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9. **900.5** cm
4 significant digits

10. **1,204** gal
4 significant digits

11. $P = 12 + 24 + 15 + 32$
$P = 83$
The perimeter of the trapezoid is 83 m.

12. $P = 2\ell + 2w$
$P = (2 \cdot 24.9) + (2 \cdot 15.8)$
$P = 49.8 + 31.6$
$P = 81.4$
The perimeter of the rectangle is 81.4 cm.

13. $C = \pi d$
$C \approx 3.14 \cdot 13$
$C \approx 40.82$
The circumference of the circle is about 40.8 ft.

14. $C = 2\pi r$
$C \approx 2 \cdot 3.14 \cdot 7.8$
$C \approx 48.984$
The circumference of the circle is about 49.0 in.

15. $A = \ell w$
$A = 8.6 \cdot 5.9$
$A = 50.74$
The area of the rectangle is 50.74 cm^2.

16. $A = bh$
$A = 34 \cdot 24.3$
$A = 826.2$
The area of the parallelogram is 826.2 yd^2.

17. $A = \ell w$
$A = 12 \cdot 6$
$A = 72$
The area of the art paper is 72 in^2.

18. $A = \frac{1}{2}bh$
$A = \frac{1}{2}(28 \cdot 19)$
$A = 266$
The area of the triangle is 266 in^2.

19. $A = \frac{1}{2}h(b_1 + b_2)$
$A = \frac{1}{2}(12.5)(7.6 + 9.8)$
$A = \frac{1}{2}(12.5)(17.4)$
$A = 108.75$
The area of the trapezoid is 108.75 cm^2.

20. $A = \frac{1}{2}bh$
$A = \frac{1}{2}\left(12\frac{1}{2} \cdot 8\right)$
$A = 50$
The area of the triangle is 50 yd^2.

21. $A = \frac{1}{2}h(b_1 + b_2)$
$A = \frac{1}{2}(42)(67 + 36)$
$A = \frac{1}{2}(42)(103)$
$A = 2{,}163$
The area of the trapezoid is 2,163 in^2.

22. $A = \pi r^2$
$A \approx 3.14 \cdot 3.4^2$
$A \approx 3.14 \cdot 11.56$
$A \approx 36.3$
The area of the circle is 36.3 m^2.

23. $A = \pi r^2$
$A \approx 3.14 \cdot 8.5^2$
$A \approx 3.14 \cdot 72.25$
$A \approx 226.865$
The area of the circle is 226.9 ft^2.

24. $A = \pi r^2$
$A \approx 3.14 \cdot 92$
$A \approx 3.14 \cdot 81$
$A \approx 254.34$
The area of the circle is 254.34 in^2.

25. Area of rectangle:
$A = \ell w$
$A = 7 \cdot 3.5$
$A = 24.5$
Area of half circle:
$A = \frac{1}{2}\pi r^2$
$A \approx \frac{1}{2} \cdot 3.14 \cdot 2.5^2$
$A \approx 9.8125$
$24.5 + 9.8125 = 34.3125$
The area of the figure is 34.3125 ft^2.

26. Area of rectangle 1:
$A = \ell w$
$A = 2 \cdot 6$
$A = 12$
Area of rectangle 2:
$A = \ell w$
$A = 3 \cdot 1$
$A = 3$
Area of rectangle 3:
$A = \ell w$
$A = 2 \cdot 3$
$A = 6$
$12 + 3 + 6 = 21$
The area of the figure is 21 m^2.

27. $\sqrt{29}$
$25 < 29 < 36$
$\sqrt{25} < \sqrt{29} < \sqrt{36}$
$5 < \sqrt{29} < 6$
$\sqrt{29} \approx 5$

28. $\sqrt{92}$
$81 < 92 < 100$
$\sqrt{81} < \sqrt{92} < \sqrt{100}$
$9 < \sqrt{92} < 10$
$\sqrt{92} \approx 10$

29. $\sqrt{106}$
$100 < 106 < 121$
$\sqrt{100} < \sqrt{106} < \sqrt{121}$
$10 < \sqrt{106} < 11$
$\sqrt{106} \approx 10$

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30. $\sqrt{150}$

$144 < 150 < 169$

$\sqrt{144} < \sqrt{150} < \sqrt{169}$

$12 < \sqrt{150} < 13$

$\sqrt{150} \approx 12$

31. $A = s^2$

$265 = s^2$

$\sqrt{265} = \sqrt{s^2}$

$16.278821 \approx s$

The length of each side of the garden is about 16 feet.

32. $a^2 + b^2 = c^2$

$30^2 + 16^2 = c^2$

$900 + 256 = c^2$

$1{,}156 = c^2$

$34 = c$

The length of the hypotenuse is 34 cm.

33. $a^2 + b^2 = c^2$

$25^2 + b^2 = 65^2$

$625 + b^2 = 4{,}225$

$-625 \quad -625$

$b^2 = 3{,}600$

$b = 60$

The length of the leg, b, is 60 ft.

34. $a^2 + b^2 = c^2$

$a^2 + 4.8^2 = 5.2^2$

$a^2 + 23.04 = 27.04$

$-23.04 \quad -23.04$

$a^2 = 4$

$a = 2$

The length of the leg, a, is 2 m.

35. $a^2 + b^2 = c^2$

$36^2 + 48^2 = c^2$

$1{,}296 + 2{,}304 = c^2$

$3{,}600 = c^2$

$60 = c$

The length of the hypotenuse is 60 mm.

CHAPTER TEST, PAGE 569

1. 80 m, 7.9 cm
Since a centimeter is a smaller unit than a meter, 7.9 is more precise.

2. 18 yd, 5 mi
Since a yard is a smaller unit than a meter, 18 yd is more precise.

3. 500 lb, 18 oz
Since an ounce is a smaller unit than a pound, 18 oz is more precise.

4. 5.6 has 2 significant digits and 2.59 has 3. Round the quotient so that there are 2 significant digits.
$5.6 \div 2.59 = 2.16216216\ldots$
5.6 lb $\div$ 2.59 $\approx$ 2.2 lb

5. Both 3.14 and 125 have 3 significant digits. Round the products so that there are 3 significant digits.
$3.14 \cdot 125 = 392.5$
3.14 $\cdot$ 125 cm $\approx$ 393 cm

6. 5.882 has 3 digits to the right of the decimal and 5.17 has 2. Round the sum so that there are 2 digits to the right of the decimal.
$5.882 + 5.17 = 11.052$
5.882 in. + 5.17 in. $\approx$ 11.05 in.

7. $P = 10.5 + 6.3 + 17.2 + 9.1$

$P = 43.1$

The perimeter of the trapezoid is 43.1 in.

8. $C = \pi d$

$25 = 3.14 \cdot d$

$7.96178\ldots = d$

$r = d \div 2$

$r = 7.96 \div 2$

$r = 3.98$

The radius of the tunnel opening is about 4 feet.

9. $A = bh$

$A = 13.6 \cdot 8.7$

$A = 118.32$

The area of the parallelogram is 118.32 ft^2.

10. Area of rectangle 1:

$A = \ell w$

$A = 18 \cdot 7$

$A = 126$

Area of rectangle 2:

$A = \ell w$

$A = 6 \cdot 5$

$A = 30$

$126 + 30 = 156$

The area of the figure is 156 m^2.

11. $A = \frac{1}{2}h(b_1 + b_2)$

$A = \frac{1}{2} \cdot 4\frac{1}{4}\left(2\frac{1}{2} + 6\right)$

$A = \frac{1}{2} \cdot 4\frac{1}{4}\left(8\frac{1}{2}\right)$

$A = 18\frac{1}{16}$

The area of the trapezoid is $18\frac{1}{16}$ mi^2 or 18.0625 mi^2.

12. $A = \ell w$

$660 = \ell \cdot 22$

$30 = \ell$

The length of the lab is 30 feet.

13. $A = \pi r^2$

$66 \approx 3.14 \cdot r^2$

$21.019 \approx r^2$

$4.58466 \approx r$

The radius is about 4.6 cm.

14. $C = 2\pi r$

$C \approx 2 \cdot 3.14 \cdot 5\frac{1}{2}$

$C \approx 34.54$

The circumference of the circle is about 34.5 ft.

15. $A = \pi r^2$

$A \approx 3.14 \cdot \left(5\frac{1}{2}\right)^2$

$A \approx 3.14 \cdot 30\frac{1}{4}$

$A \approx 94.985$

The area of the circle is about 95.0 ft^2.

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16. $15^2 = 15 \cdot 15 = 225$

17. $23^2 = 23 \cdot 23 = 529$

18. $\sqrt{1{,}600} = 40$

19. $\sqrt{961} = 31$

20. $a^2 + b^2 = c^2$
$15^2 + b^2 = 16^2$
$225 + b^2 = 256$
$b^2 = 31$
$b \approx 5.56776\ldots$
The missing length, b, is about 5.6 cm.

21. $a^2 + b^2 = c^2$
$2.1^2 + 3.0^2 = c^2$
$4.41 + 9 = c^2$
$13.41 = c^2$
$3.661966\ldots \approx c$
The length of the third side, c, is about 3.7 mi.

22. $a^2 + b^2 = c^2$
$a^2 + 36^2 = 39^2$
$a^2 + 1{,}296 = 1{,}521$
$a^2 = 225$
$a = 15$
The missing leg is 15 cm.

23. $A = \frac{1}{2}bh$
$A = \frac{1}{2}(36 \cdot 15)$
$A = 270$
The area of the triangle is 270 cm^2.

TEST TACKLER, PAGES 570-571

1. Since the side of the square is 4 cm, the diameter of the circle is also 4 cm and the radius is 2 cm. C and D are correct statements about the circle and cannot be correct answers to the question.

2. The area of a square $= \ell^2$. Since the square is 16 cm^2, each side is 4 cm. The length of the side of the square is the same as the diameter of the side.

3. $C = 4\pi$ is the correct formula for finding the circumference of this circle.

4. The correct formula for finding the area of the circle is $A = \pi r^2$. The equation in B is incorrect because the circle has a radius of 2 cm. The correct equation would be $A = 4\pi$ cm^2.

5. An acute triangle is a triangle with all three angles measuring less than 90°.

6. An isosceles triangle is a triangle with two sides of equal length.

7. F is incorrect because one angle is not an acute angle.

8. Choices A and D do not show reflections. Choice A shows a translation and choice D shows a rotation.

9. A reflection across the x-axis is a mirror image occurring on either side of the x-axis.

10. $A = \frac{1}{2}h(b_1 + b_2)$

11. $A = \frac{1}{2}h(b_1 + b_2)$
$30 = \frac{1}{2}h(12 + 8)$
$30 = \frac{1}{2}h(20)$
$30 = 10h$
$3 = h$
The height of the trapezoid is 3 in.

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