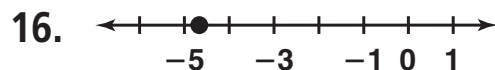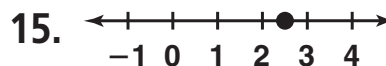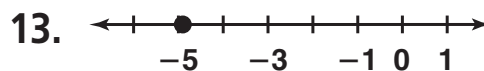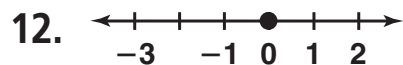# Answers for Lesson 1-1 Exercises

1. natural numbers, whole numbers, integers, rational numbers, real numbers

2. irrational numbers, real numbers

3. irrational numbers, real numbers

4. integers, rational numbers, real numbers

5. whole numbers, integers, rational numbers, real numbers

6. rational numbers, real numbers

7. rational numbers, real numbers

8. irrational numbers, real numbers

9. whole numbers, rational numbers

10. natural numbers, rational numbers

11. real numbers

12.

13.

14.

15.

16.

17. $>$ 18. $=$ 19. $>$

20. $<$ 21. $<$ 22. $=$

23. $>$ 24. $<$

25. $-\frac{1}{4} > -\frac{1}{3}, -\frac{1}{3} < -\frac{1}{4}$ 26. $0.075 < 0.39, 0.39 > 0.075$

27. $-2.\overline{3} < 2.\overline{1}, 2.\overline{1} > -2.\overline{3}$ 28. $-5.2 < -4.8, -4.8 > -5.2$

29. $3.0\overline{4} < 3.4, 3.4 > 3.0\overline{4}$ 30. $0.4 < \sqrt{0.4}, \sqrt{0.4} > 0.4$

31. $-4 < -\sqrt{4}, -\sqrt{4} > -4$ 32. $\sqrt{5} < \sqrt{7}, \sqrt{7} > \sqrt{5}$

33. $-\sqrt{3} > -\sqrt{5}, -\sqrt{5} < -\sqrt{3}$

Answers for Lesson 1-1   Exercises (cont.)

34. $-200, \frac{1}{200}$ **35.** $-3\frac{3}{5}, \frac{5}{18}$ **36.** $0.01, -100$

37. $\frac{7}{2}, -\frac{2}{7}$ **38.** $-\sqrt{3}, \frac{1}{\sqrt{3}} \left(\text{or } \frac{\sqrt{3}}{3}\right)$

39. $-2\pi, \frac{1}{2\pi}$ **40.** $2.34, -\frac{50}{117}$ **41.** $3 - \pi, \frac{1}{\pi - 3}$

42. Dist. Prop.   **43.** Comm. Prop. of Add.

44. Assoc. Prop. of Mult.   **45.** Comm. Prop. of Mult.

46. Identity Prop. of Add.   **47.** Inverse Prop. of Mult.

48. 10.3   **49.** 0.06   **50.** -25

51. 1.6   **52.** $\frac{1}{3}$ **53.** 3

54. 3   **55.** -2

56–63. Answers may vary. Samples are given.

56. -5 **57.** $-3\frac{1}{2}$ **58.** $-1\frac{1}{4}$

59. $\frac{1}{2}$ **60.** $1\frac{2}{3}$ **61.** $3\frac{1}{3}$

62. 4   **63.** 4.8   **64.** D

65. natural numbers, whole numbers, integers, rational numbers, real numbers

66. irrational numbers, real numbers

67. irrational numbers, real numbers

68. rational numbers, real numbers

69. irrational numbers, real numbers

70. irrational numbers, real numbers

Answers for Lesson 1-1   Exercises (cont.)

71. $>$ **72.** $>$ **73.** $<$

74. $>$ **75.** $<$ **76.** $<$

77. $<$ **78.** $<$

79. Answers may vary. Sample: 4 is a whole number, but $\frac{1}{4}$ is not a whole number.

80. Answers may vary. Sample: 7 is a natural number, but -7 is not a natural number.

81. 0 is a whole number, and since $-0 = 0$, the opposite of 0 is a whole number.

82. Answers may vary. Sample: The integer -1 has -1 as its reciprocal, so -1 is an integer whose reciprocal is an integer.

83. Answers may vary. Sample: $\sqrt{2}$ and $\sqrt{2}$ are irrational numbers, but their product (2) is a rational number.

84. Check students' work.

85. all except the Identity Prop. of Add. (since 0 is not in the set of natural numbers) and the inverse properties

86. all except the Inverse Prop. of Mult. and the Inverse Prop. of Add.

87. all except the Inverse Prop. of Mult.

88. all the properties

89. Comm., Assoc., and Distr. Prop.

90. No; explanations may vary. Sample: The only pairs of integers that have a product of -12 are -1 and 12, -2 and 6, -3 and 4, -4 and 3, -6 and 2, and -12 and 1. None of these pairs has a sum of -3.

Answers for Lesson 1-2   Exercises

1. -30

2. 26

3. 368

4. -16

5. -16

6. 28

7. -70

8. -12

9. 1 ft

10. 4 ft

11. 64 ft

12. 1600 ft

13. 0.013 mm

14. 0.032 mm

15. 0.4 mm

16. 1.4 mm

17. $\$1210$

18. $\$1331$

19. $\$1464.10$

20. $\$1610.51$

21. $4a$

22. $2s + 5$

23. $-9a + b$

24. $6a + 3b$

25. $10r + 5s$

26. $6w + 5z$

27. $2x^2 + x$

28. $xy + 3x$

29. $-0.5x$

30. $6x - 5$

31. $10y + x - 4$

32. $-y - 6x$

33. $-3a + 15b$

34. $4g - 2$

35. $-3x + 4y - z$

36. $4a$

37. $4a$

38. 5

39. 17

40. 41

41. 66

42. -1

43. $\frac{41}{4}$

44. 10

45. -765

46. **a.** about 180 million voters

b. about 242 million voters; about 263 million voters

c. $-0.0078y^2 + 1.265y + 65.27$

d. about 87 million

47. $-\frac{3}{4}a^2 + 2b^2$

48. $\frac{5x^2}{2}$

49. $\frac{7y^2}{12} + \frac{2y}{15}$

50. y

51. $3x + 6y$

52. $4x + 2y$

53. $-2x^2 + 2y^2$

54. F

55. C

Answers for Lesson 1-2   Exercises (cont.)

56. A   **57.** G   **58.** B

59. H   **60.** E   **61.** I

62. D

63. Assoc. Prop. of Add., Comm. Prop. of Add., Assoc. Prop. of Add., Identity Prop. of Mult., Distr. Prop. of Add., Simplify.

64. Distr. Prop.; Simplify; Distr. Prop.

65. Answers may vary. Sample: $x^3 + x^2 + x - x^3 - 2x$, $-x^2 + 2x^2 + 3x - 3x - x$, $x^2 - 5x + 4x - x^5 + x^5$, $3x^2 - x^2 - x^2 + 7x - 8x$

66. Answers may vary.

Sample: $2(b - a) + 5(b - a) = (2 + 5)(b - a)$ Dist. Prop.
$$= 7(b - a) \qquad \text{Addition}$$
$$= 7b - 7a \qquad \text{Dist. Prop.}$$

67. a. 18

b. $2x^2, 18$

c. Properties of operations were used to simplify the original expression. Those properties convert one expression into an equivalent expression, and equivalent expressions have equal values for all replacements of their variables.

d. No; explanations may vary. Sample: Students should check each step in the simplification; they also should substitute more than one value for x in the original and simplified expressions.

Answers for Lesson 1-3   Exercises

1. 23

2. 8

3. $\frac{17}{2}$

4. -5

5. $\frac{7}{2}$

6. $-\frac{1}{9}$

7. $\frac{17}{7}$

8. $\frac{3}{2}$

9. 8

10. -6

11. 2

12. 0

13. $-\frac{2}{3}$

14. -6

15. 2

16. $\frac{1}{2}$

17. $h = \frac{2A}{b}$

18. $g = \frac{2s}{t^2}$

19. $w = \frac{V}{lh}$

20. $r = \frac{I}{pt}$

21. $r = \frac{S}{2\pi h}$

22. $h = \frac{V}{\pi r^2}$

23. $x = \frac{c}{a + b}, a \neq -b$

24. $x = \frac{c}{c - b}, b \neq c$

25. $x = a(c - b)$ or $ac - ab, a \neq 0$

26. $x = a(b + 5)$ or $ab + 5a, a \neq 0$

27. $x = 2(m + n) + 2$ or $2m + 2n + 2$

28. $x = \frac{5g}{2} - 1$

29. 4 h

30. 300 mi/h, 600 mi/h

31. width $= 4.5$ cm, length $= 7.5$ cm

32. $4\frac{2}{3}$ in., $5\frac{2}{3}$ in., $6\frac{2}{3}$ in.

33. 11 cm, 11 cm, 16.5 cm, 16.5 cm

34. 7.5 cm, 10 cm, 12.5 cm

35. a. $x + (x + 1) + (x + 2) = 90; 29, 30, 31$
   b. $(x - 1) + x + (x + 1) = 90; 29, 30, 31$

Answers for Lesson 1-3   Exercises (cont.)

36. $\frac{46}{39}$, or $1\frac{7}{39}$ **37.** 3   **38.** $\frac{27}{5}$, or $5\frac{2}{5}$

39. $\frac{3}{2}$ **40.** 30   **41.** $\frac{79}{80}$, or 0.9875

42. $R = \frac{r_1 r_2}{r_1 + r_2}$ **43.** $r_2 = \frac{Rr_1}{r_1 - R}$ **44.** $h = \frac{S - 2\pi r^2}{2\pi r}$

45. $v = \frac{h + 5t^2}{t}$ **46.** $h = \frac{2(v - s^2)}{s}$ **47.** $b_2 = \frac{2A}{h} - b_1$

48. $40°, 140°$ **49.** $34°, 56°$ **50.** about 169.4 mi

51. ≈ 4.03 m   **52.** \$360; \$746.40   **53.** 43, 45, 47, 49

54. 34, 36, 38, 40   **55.** $x = ab - b^2 - a, b \neq 0$

56. $x = \frac{c - a}{b - d}, b \neq d$ **57.** $x = \frac{b + d}{c - a}, a \neq c$

58. $x = \frac{3a - b - 8}{a - b}, a \neq b$ **59.** $x = \frac{3b + 2c - 5}{b - c}, b \neq c$

60. $x = \frac{2ab - 2c}{3at - cd}, 3at \neq cd$ **61.** $x = \frac{4a - 3bc}{aq - 5bp}, 5bp \neq aq$

62. $x = \frac{cb}{2da} + 6, a, b, d \neq 0$ **63.** $x = \frac{10c}{a}, a \neq 0$

64. $x = \frac{a - c}{m} + a, m \neq 0, x \neq a$

65. a. $t = \frac{s - 1055}{1.1}$

  b. about 40.9°F

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

  d. about 4.9°C

66. a. 10 cows, 30 chickens; Sample equation:
      $4c + 2(40 - c) = 100$, where c is the number of cows.

  b. 80 legs; 20 legs; 2 legs; 10 cows

  c. Answers may vary. Sample: In all, a repair shop has 11
      bicycles and tricycles to repair. These have a total of 26
      wheels. How many bicycles and how many tricycles are
      there? 7 bicycles, 4 tricycles

Answers for Lesson 1-3   Exercises (cont.)

67. a. If you solve $ax - b = c$ for x, you get $x = \frac{b + c}{a}$. Since b and c are integers, $b + c$ is an integer. But a is a nonzero integer. So $\frac{b + c}{a}$ is the quotient of two integers and hence, by the definition of a rational number, $\frac{b + c}{a}$ is a rational number.

b. Solutions are rational when $\frac{c - b}{a} \geq 0$, $a \neq 0$, and $\frac{c - b}{a}$ is a perfect square (a whole number perfect square or, in simplest form, a fraction whose numerator and denominator are whole number perfect squares). Since $x^2 = \frac{c - b}{a}$ $(a \neq 0)$, $x = \frac{\sqrt{c - b}}{a}$ or $x = \frac{-\sqrt{c - b}}{a}$. For $\frac{\sqrt{c - b}}{a}$ and $\frac{-\sqrt{c - b}}{a}$ to be rational, $\frac{c - b}{a}$ must be nonnegative and also $\frac{c - b}{a}$ must be a perfect square.

68. about 269.4 ft

Answers for Lesson 1-4   Exercises

1. $x \leq -\frac{1}{2}$

$$\xleftarrow{\hspace{1cm}}\bullet\!\!\longrightarrow$$
−3   −1 0 1 2 3 4 5

2. $k > -9$

$$\xleftarrow{\hspace{1cm}}\oplus\!\!\!\longrightarrow$$
−11   −9   −7   −5   −3

3. $a > 11$

$$\xleftarrow{\hspace{1cm}}\oplus\!\!\!\longrightarrow$$
8 9 10 11 12 13 14 15 16

4. $t \leq 11$

$$\xleftarrow{\hspace{1cm}}\bullet\!\!\longrightarrow$$
8 9 10 11 12 13 14 15 16

5. $y \leq -14$

$$\xleftarrow{\hspace{1cm}}\bullet\!\!\longrightarrow$$
−17   −15   −13   −11   −9

6. $y \leq -6$

$$\xleftarrow{\hspace{1cm}}\bullet\!\!\longrightarrow$$
−10   −8   −6   −4   −2

7. $x \leq 8$

$$\xleftarrow{\hspace{1cm}}\bullet\!\!\longrightarrow$$
5 6 7 8 9 10 11 12 13

8. $m < 10$

$$\xleftarrow{\hspace{1cm}}\oplus\!\!\!\longrightarrow$$
7 8 9 10 11 12 13 14 15

9. $n > 8$

$$\xleftarrow{\hspace{1cm}}\oplus\!\!\!\longrightarrow$$
4 5 6 7 8 9 10 11 12

10. All real numbers are solutions.

$$\xleftarrow{\hspace{1cm}}\longrightarrow$$
−3   −1 0 1 2 3 4
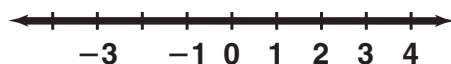
11. All real numbers are solutions.

12. All real numbers are solutions.
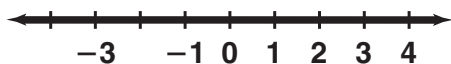
13. no solutions

14. The width is less than 11.5 in., and the length is 3 in. greater than the width.

15. The longest side is less than 21 cm.

16. The smaller number is an integer greater than or equal to 8.

17. 40 students

18. $-5 < x < 2$

19. $-4 \leq x \leq 2$
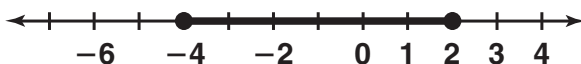
20. $-4 \leq x < 6$

21. $-5 < x \leq 6$
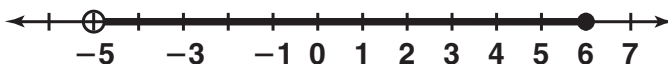
22. $x < 4$ or $x > 12$
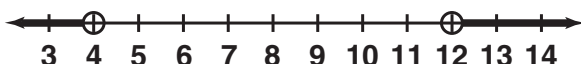
Answers for Lesson 1-4 Exercises (cont.)

23. All real numbers are solutions.
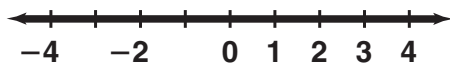
24. $x \geq -8$
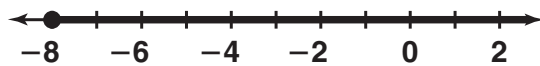
25. $x \leq -3$ or $x \geq 9$
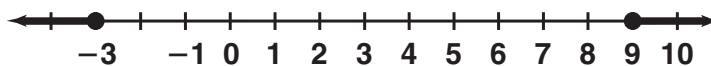
26. between about 36.4 lb and 45.5 lb flour

27. between $4\frac{1}{2}$ and $5\frac{1}{2}$ days

28. between 0.26 cm and 0.30 cm

29. $z \geq 6$
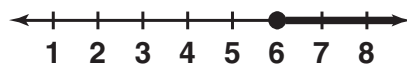
30. $y \leq \frac{3}{13}$
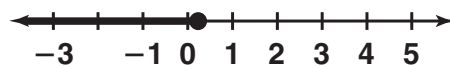
31. $x \geq -48$
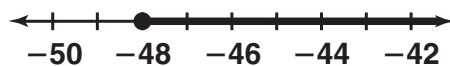
32. $x < 42$
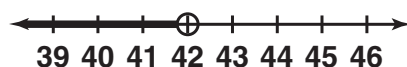
33. no solutions

34. All real numbers are solutions.
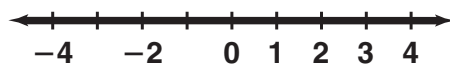
Answers for Lesson 1-4   Exercises (cont.)

35. Answers may vary. Sample: Mario has a coin collection that consists of dimes and nickels. There are half as many dimes as nickels. There are no more than 60 coins in the collection. Describe the collection.

36. $2 < AB < 6$

37. between $204,000 and $254,000

38. a. 0 makes $y \leq 20$ true, but it does not make $\frac{1}{2}(y - 16) \geq y + 2$ true.

    b. $y \leq -20$

39. Dist. Prop.; arithmetic; Sub. Prop. of Inequality; Mult. Prop. of Inequality

40. Mult. Prop. of Inequality; Dist. Prop.; Add. Prop. of Inequality; Subt. Prop. of Inequality; Div. Prop. of Inequality

41. $-1 < x < 8$
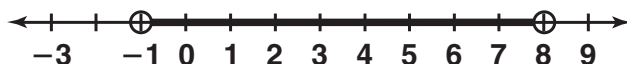
42. $3 < y < 6$

43. no solutions

44. $-7 \leq z < 4\frac{2}{5}$
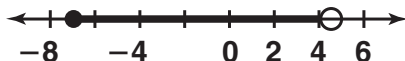
45. All real numbers are solutions.
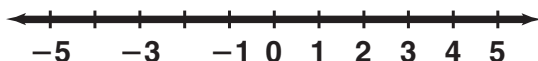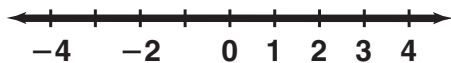

46. $b < 2$ or $b > 5$
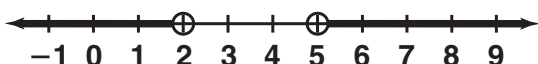
Answers for Lesson 1-4　Exercises (cont.)

47. All real numbers are solutions.
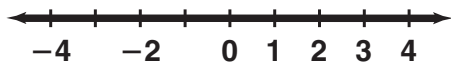
48. no solutions

49. All real numbers are solutions.

50. no solutions

51. Answers may vary. Sample: $2x - 7 \geq -11$

52. Answers may vary. Sample: $-3x + 1 > 4$

53. Answers may vary. Sample: $-9 < 5x + 1 < 6$

54. Answers may vary. Sample: $2x + 4 \leq 0$ or $-3x - 3 \leq 0$

55. a. no

　　 b. yes; values of a that are 8 or greater

　　 c. (a) yes; values of a that are less than 8, (b) no

Answers for Lesson 1-5   Exercises

1. $-6, 6$

2. $-8, 8$

3. $-6, 12$

4. $3, -\frac{5}{3}$

5. no solution

6. no solution

7. $-18, 10$

8. $-7, 17$

9. $-7, 15$

10. $-\frac{3}{2}$

11. $\frac{2}{3}$

12. $\frac{3}{2}$

13. $-4, 8$

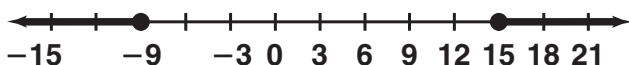**14.** $-1, \frac{3}{2}$
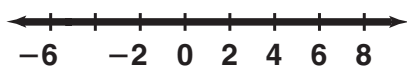
15. 1

16. $x < -12$ or $x > 6$
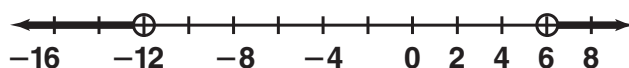
17. $x \leq -3$ or $x \geq 13$
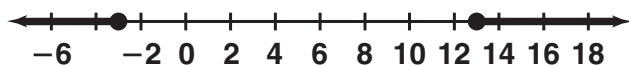
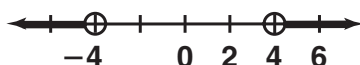**18.** $y \leq -9$ or $y \geq 15$

19. All real numbers are solutions.

20. $x \leq -3$ or $x \geq 4$
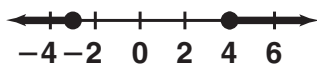
21. $z < -4$ or $z > 4$

22. $0 < y < 18$
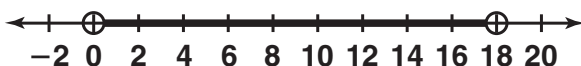
23. $-2\frac{2}{3} < y < 3\frac{1}{3}$
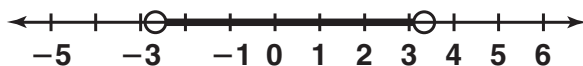
24. $-2 < x < 6$
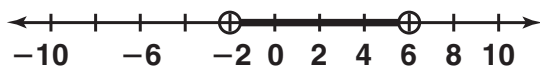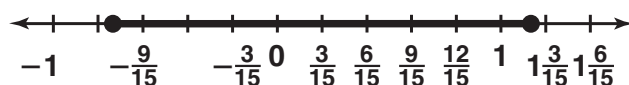

25. no solution

26. $-3\frac{1}{2} \leq w \leq \frac{1}{2}$

27. $-\frac{11}{15} \leq t \leq \frac{17}{15}$

28. $|h - 1.4| \leq 0.1$

29. $|k - 50.5| \leq 0.5$

30. $|C - 27.5| \leq 0.25$

31. $|b - 52.5| \leq 2.5$

32. $|m - 1250| \leq 50$

33. $|d - 0.11885| \leq 0.00015$

34. no solutions

35. $-\frac{3}{2}, -1$

36. $-\frac{14}{3}, \frac{16}{3}$

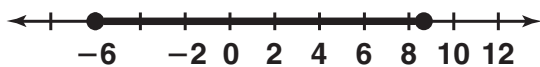**37.** $-\frac{1}{3}$

38. no solutions

39. $\frac{5}{2}$

40. $\frac{11}{8}$

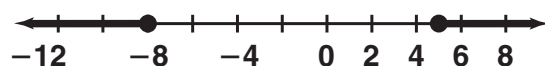**41.** $-1, -3$

42. $-\frac{71}{36}$

43. 2

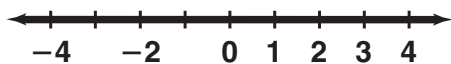**44.** $-6 \leq x \leq 8\frac{2}{3}$
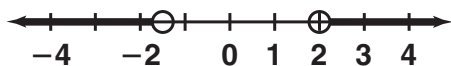

45. $x \leq -8$ or $x \geq 5$

Answers for Lesson 1-5   Exercises (cont.)

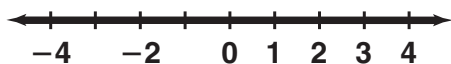**46.** All real numbers are solutions.
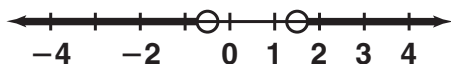

47. $t < -\frac{3}{2}$ or $t > 2$

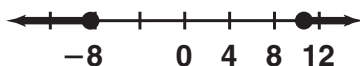**48.** All real numbers are solutions.

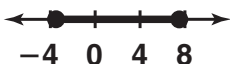**49.** $x < -\frac{1}{2}$ or $x > \frac{3}{2}$

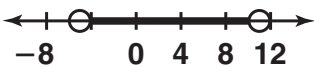**50.** $x \leq -8.4$ or $x \geq 9.6$
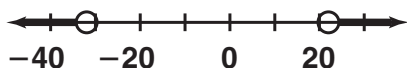

51. $-3.5 \leq x \leq 7.5$

52. $-5 < x < 11$

53. $x < -32$ or $x > 22$

Answers for Lesson 1-5   Exercises (cont.)

54. Region 1

$0 \leq s \leq 0.1, |s - 0.05| \leq 0.05;$

Region 2

$0.1 \leq s \leq 1, |s - 0.55| \leq 0.45;$

Region 3

$1 \leq s \leq 3, |s - 2| \leq 1;$

Region 4

$3 \leq s \leq 6, |s - 4.5| \leq 1.5;$

55. C

56. The graph of $|x| < a$ (where $a > 0$) is the set of all points on the number line that lie between the points for a and $-a$. The graph of $|x| > a$ has two parts: the left part consists of the points to the left of the point for $-a$, and the right part consists of the points to the right of the point for a.

57. Answers may vary. Sample: $|x - 1| \geq 0; |x| < -5$

58. $|x - 36.8| \leq 0.05, 36.75 \leq x \leq 36.85$
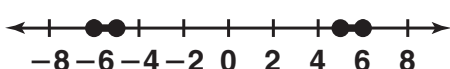
59. $|x - 9.55| \leq 0.02, 9.53 \leq x \leq 9.57$
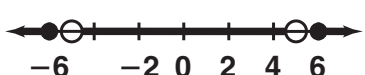
60. x is in inches: $|x - 3600| \leq 4, 3596 \leq x \leq 3604.$

61. $-\frac{b + c}{a}, \frac{b + c}{a}, a \neq 0;$ no solution, $b + c < 0$

62. $\frac{ab + d}{c}, \frac{-ab + d}{c}, c \neq 0;$ no solution, $ab < 0$

63. $\frac{ac + d}{ab}, \frac{ac - d}{ab}, ab \neq 0;$ no solution, $\frac{d}{a} < 0$

64. $(-6 \leq x \leq -5)$ or $(5 \leq x \leq 6)$

65. $(x \leq -6)$ or $(-5 < x < 5)$ or $(x \geq 6)$

66. $x \geq \frac{5}{2}$

Answers for Lesson 1-6   Exercises

1. $\frac{161}{340}$ or about 47%; $\frac{179}{340}$ or about 53%

2. the number 1: $\frac{21}{134}$, or about 15.7%; the number 2: $\frac{11}{67}$ or about 16.4%; the number 3: $\frac{45}{268}$ or out 16.8%; the number 4: $\frac{11}{67}$ or about 16.4%; the number 5: $\frac{47}{268}$ or about 17.5%; the number 6: $\frac{23}{134}$ or about 17.2%

3. Answers may vary. Sample: Generate random numbers between 0 and 1 using a graphing calculator. In each random number, examine the first five digits. Let even digits represent correct answers and odd digits incorrect answers. If there are two or more even digits, make a tally mark for that number. Do this 100 times. Find the total number of tally marks. This, as a percent, gives the experimental probability. The simulated probability should be about 80%.

4. Answers may vary. Sample: Toss 5 coins. Keep a tally of the times 3 or more heads are tossed. (A head represents a correct answer.) Do this 100 times. The total number of tally marks, as a percent, gives the experimental probability. The simulated probability should be about 50%.

5. Answers may vary. Sample: Generate 100 random numbers with a calculator. Record the first five digits of each number. Let 0 and 1 represent correct answers and the other digits incorrect answers. Tally the recorded numbers with exactly one digit that represents a correct answer. Tally the recorded numbers with exactly two digits that represent correct answers. Tally the recorded numbers with exactly three digits that represent correct answers. The tally totals, as a percent, give the experimental probabilities. They should be about 40%, 20%, and 5%, respectively.

Answers for Lesson 1-6   Exercises (cont.)

6. $\frac{3}{10}$, or 30% **7.** $\frac{1}{2}$, or 50% **8.** $\frac{4}{5}$, or 80%

9. $\frac{4}{5}$, or 80% **10.** $\frac{48}{125}$, or 38.4% **11.** $\frac{19}{125}$, or 15.2%

12. $\frac{103}{125}$, or 82.4% **13.** $\frac{14}{25}$, or 56% **14.** $\frac{77}{125}$, or 61.6%

15. $\{Gg, Gg, gg, gg\}$; $\frac{1}{2}$, or 50%

16. $\{Gg, Gg, Gg, Gg\}$; 1, or 100%

17. $\frac{1}{16}$, or 6.25% **18.** $\frac{3}{8}$, or 37.5%

19. $\frac{1}{4}$, or 25% **20.** $\frac{3}{4}$, or 75%

21. a. 1

b. 0

22. C

23. Answers may vary. Sample: Let odd digits represent heads and even digits represent tails. Use the first 50 digits of the table. The experimental probability of heads is $\frac{1}{2}$.

24. $\frac{116}{147}$, or 78.9% **25.** $\frac{52}{147}$, or 35.4% **26.** $\frac{43}{147}$, or 29.3%

27. $\frac{31}{147}$, or 21.1% **28.** $\frac{1}{6}$ **29.** $\frac{1}{2}$

30. $\frac{2}{3}$ **31.** 0 **32.** $\frac{1}{6}$

33. 1 **34.** $\frac{1}{3}$ **35.** $\frac{4}{9}$

36. $\frac{4}{9}$ **37.** $\frac{4}{9}$

38. a. $(1, 1), (1, 2), (1, 3), (1, 4), (1, 5), (1, 6), (2, 1), (2, 2), (2, 3),$
$(2, 4), (2, 5), (2, 6), (3, 1), (3, 2), (3, 3), (3, 4), (3, 5), (3, 6),$
$(4, 1), (4, 2), (4, 3), (4, 4), (4, 5), (4, 6), (5, 1), (5, 2), (5, 3),$
$(5, 4), (5, 5), (5, 6), (6, 1), (6, 2), (6, 3), (6, 4), (6, 5), (6, 6)$

b. 36 outcomes

c. $\frac{1}{36}$

d. $\frac{1}{6}$

Answers for Lesson 1-6　Exercises (cont.)

39. $\approx 6.4\%$

40. a. $\frac{1}{4}; \frac{3}{4}$

　　b. Answers may vary. Sample: Variables such as injuries make probability a poor predictor.

41. if there are any restrictions on the last digit of a ZIP code

42. $\frac{1}{15}$ or 6.7%

43. a. $\frac{a}{a+b}$

　　b. a to $b - a$ or $\frac{a}{b-a}$

　　c. A game where the probability of winning is $\frac{1}{2}$; when the odds of winning are $\frac{1}{2}$, the probability of winning is only $\frac{1}{3}$.

44. Check students' work.

45. a. about $\frac{1}{3}$

　　b. about $\frac{2}{3}$