Answer Key

Chapter R: Review of Foundational Math Skills

R.1 Exercises

Concept Check

1. Cubed

3. Base, exponent

5. 1

7. False; nine squared equals 81.

9. False; 70° is 1.

Practice

1. 11^3

3. 7^4

5. $2^3 \cdot 3^2$

7. $5^3 \cdot 7^2$

9. $2 \cdot 3^2 \cdot 11^2$

11. **a.** 4 **b.** 2 **c.** 16

13. **a.** 2 **b.** 3 **c.** 8

15. **a.** 1 **b.** 6 **c.** 1

17. **a.** 5 **b.** 3 **c.** 125

19. **a.** 2 **b.** 4 **c.** 16

21. **a.** 9 **b.** 2 **c.** 81

23. **a.** 7 **b.** 2 **c.** 49

25. **a.** 3 **b.** 5 **c.** 243

27. **a.** 30 **b.** 2 **c.** 900

29. **a.** 20 **b.** 3 **c.** 8000

31. **a.** 1 **b.** 57 **c.** 1

33. **a.** 4 **b.** 0 **c.** 1

35. **a.** 13 **b.** 1 **c.** 13

37. **a.** 22 **b.** 0 **c.** 1

39. 13, 17

41. 2

43. 8, 9

45. 4, 17

47. 2, 251

49. 10, 17

51. 4, 111

53. $2^2 \cdot 13$

55. $2^3 \cdot 7 \cdot 11$

57. $2^2 \cdot 7 \cdot 11$

59. 79 is prime.

61. 17^2

63. 5^3

65. $2^4 \cdot 5^2$

67. $2^3 \cdot 3 \cdot 5$

69. $3 \cdot 7 \cdot 11$

71. $2^2 \cdot 3^2 \cdot 47$

73. **a.** 5, 10, 15, 20, 25, 30, 35, 40, 45, 50

b. 6, 12, 18, 24, 30, 36, 42, 48, 54, 60

c. 10, 20, 30, 40, 50, 60, 70, 80, 90, 100

d. 15, 30, 45, 60, 75, 90, 105, 120, 135, 150

75. 105

77. 40

79. 66

81. 140

83. 150

85. 180

87. 196

89. 210

91. 90

93. 100

95. 150

97. 364

99. 2520

101. 924

103. 7623

105. 2880

107. 7840

Applications

109. **a.** No. Here it shows that we are only dividing the old trading cards by 6 friends versus both the old and new trading cards by 6 friends.

b. 522; $\dfrac{15 \cdot 10 \cdot 20 + 132}{6}$

111. **a.** No. The formula shows that we are using $\dfrac{126}{4}$ yards of fabric to make only skirts, not full dresses. Adding 2 yards of silk after will only be enough for 1 bodice.

b. 20; $\dfrac{126}{4+2}$

113. **a.** Every 70 days

b. 14, 10, and 7 times, respectively

115. **a.** 360 pieces

b. 15 boxes, 10 boxes, and 8 boxes, respectively

117. **a.** 660 minutes

b. 11 hours

Writing & Thinking

119. If addition is within parentheses (or other grouping symbols), addition would be performed first.

121. 53, 59, 61, 67, 71; answers will vary.

123. **a.** To be prime, a number has to have exactly two different factors. The number 1 only has one unique factor, itself.

b. A composite number has more than two different factors. The number 1 only has one unique factor, itself.

R.2 Exercises

Concept Check

1. improper

3. 1

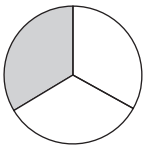
5. 1

7. False; The numerator is 11.

9. True

Practice

1.



3.

5. $\dfrac{5}{4}$

7. $\dfrac{10}{4}$

9. $\dfrac{1}{49}$

11. 0

13. $\dfrac{12}{35}$

15. $\dfrac{15}{32}$

17. $\dfrac{27}{28}$

19. $\dfrac{343}{216}$

21. $\dfrac{4}{45}$

23. $\dfrac{2}{9}$

25. $\dfrac{3}{4} = \dfrac{3}{4} \cdot \dfrac{3}{3} = \dfrac{9}{12}$

27. $\dfrac{6}{7} = \dfrac{6}{7} \cdot \dfrac{2}{2} = \dfrac{12}{14}$

29. $\dfrac{3}{16} = \dfrac{3}{16} \cdot \dfrac{5}{5} = \dfrac{15}{80}$

31. $\dfrac{7}{26} = \dfrac{7}{26} \cdot \dfrac{2}{2} = \dfrac{14}{52}$

33. $\dfrac{18}{1} = \dfrac{18}{1} \cdot \dfrac{3}{3} = \dfrac{54}{3}$

35. $\dfrac{1}{3}$

37. $\frac{3}{4}$

39. $\frac{5}{11}$

41. 0

43. $\frac{12}{35}$

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

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

49. 4

51. $\frac{6}{25}$

53. $\frac{10}{9}$

55. $\frac{1}{4}$

57. $\frac{8}{9}$

59. $\frac{1}{3}$

61. $\frac{9}{16}$

63. $\frac{5}{77}$

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

67. $\frac{10}{3}$ or $3\frac{1}{3}$

69. $\frac{28}{45}$

71. $\frac{21}{16}$ or $1\frac{5}{16}$

73. $\frac{9}{4}$ or $2\frac{1}{4}$

75. $\frac{25}{24}$

77. $\frac{10}{3}$

79. 1

81. $\frac{9}{16}$

83. $\frac{1}{4}$

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

87. Undefined

89. 0

91. $\frac{8}{5}$

93. $\frac{9}{20}$

Applications

95. $\frac{9}{20}$; $\frac{11}{20}$

97. $\frac{23}{45}$

99. $\frac{43}{60}$

101. **a.** $\frac{2}{5}$

b. $\frac{12}{25}$

103. **a.** more than 90

b. less than 90

c. 100 passengers

105. **a.** Yes, it would pass

b. Pass by 5 votes.

107. **a.** $\frac{1}{8}$ **b.** $\frac{1}{512}$ **c.** $\frac{159}{512}$

109. **a.** $\frac{35}{12}$ **b.** $2\frac{11}{12}$

Writing & Thinking

111. The two parts are the numerator and the denominator. The denominator represents the number of pieces in a whole and the numerator represents the number of these pieces being considered.

R.3 Exercises

Concept Check

1. denominators

3. denominators

5. equivalent

7. True

9. False; When subtracting fractions, subtract the numerators and keep the common denominator.

Practice

1. $\frac{5}{14}$

3. 2

5. $\frac{1}{5}$

7. $\frac{3}{4}$

9. $\frac{7}{9}$

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

13. $\frac{62}{45}$

15. $\frac{13}{12}$

17. $\frac{3}{4}$

19. $\frac{7}{10}$

21. 1

23. $\frac{17}{20}$

25. $\frac{5}{6}$

27. $\frac{11}{20}$

29. $\frac{17}{20}$

31. $\frac{317}{1000}$

33. $\frac{631}{100}$

35. $\frac{3}{5}$

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

39. $\frac{8}{13}$

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

43. $\frac{11}{36}$

45. $\frac{3}{5}$

47. $\frac{3}{5}$

49. $\frac{5}{16}$

51. $\frac{13}{20}$

53. $\frac{11}{18}$

55. $\frac{1}{10}$

57. $\frac{23}{16}$

59. 0

61. $\frac{3}{50}$

63. $\frac{1}{50}$

Applications

65. 1 ounce

67. $\frac{23}{20}$ inches

69. $\frac{5}{8}$ inch

71. **a.** $\frac{5}{18}$ **b.** \$6000

73. $\frac{7}{24}$

75. $\frac{11}{36}$

77. **a.** $\frac{3}{4}$

b. 0 (the pie is totally consumed)

79. $\frac{23}{45}$ of the assignment

Writing & Thinking

81. The LCM finds the least common multiple of a set of numbers. The LCD does the same thing for the set of numbers determined by the denominators.

83. Answers will vary. Adding with fractions may be used when cooking or when measuring sewing or construction materials. Subtracting with fractions may be used when cooking or when measuring sewing or construction materials.

R.4 Exercises

Concept Check

1. place value

3. and

5. zeros

7. False; on a number line, any number to the right of another number is larger than that other number.

9. False; the decimal points do not need to be aligned vertically when multiplying decimal numbers.

Practice

1. Nine tenths

3. Twenty and seven tenths

5. One and fifty-three hundredths

7. Nineteen and one hundred two thousandths

9. Eight hundred and nine thousandths

11. 0.3

13. 17.9

15. 0.23

17. 6.028

19. 0.4502

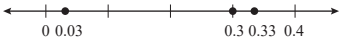
21. 0.27

23. 0.163

25. 24.295

27. 0.01

29.



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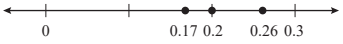

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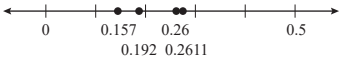


35. 1.4

37. 5.76

39. 1.64

41. 25.89

43. 147.385

45. 19.464

47. 0.04

49. 0.01096

51. 5

53. 2.03

55. 3%

57. 300%

59. 108%

61. 0.06

63. 0.032

65. 1.2

Applications

67. One hundred fourteen and eight tenths

69. Nine hundred fourteen thousandths; One and nine hundredths; Thirty-nine and thirty-seven hundredths; Three and thirty-seven hundredths

71. Two and eight hundred twenty-five ten-thousandths

73. Two and seventy-one thousand eight hundred twenty-eight hundred-thousandths

75. Nine and fifty-eight hundredths; Nineteen and nineteen hundredths; Forty-three and eighteen hundredths

77. Thirty-five and eight tenths; Twenty-six and nine tenths; Eighteen and nine tenths; Twelve and three tenths; Seven and two tenths

Writing & Thinking

79. Numbers in word form are often used for official documents and/or on checks.

R.5 Exercises

Concept Check

1. graphs

3. circle

5. True

7. True

Applications

1. **a.** Social Science

b. Chemistry & Physics, Humanities

c. About 3300

d. About 21.2%

3. **a.** Sue **b.** Bob and Sue

c. 85.7%

d. Bob and Sue; Bob and Sue; Yes, in most cases

e. No, the vertical scales represent two different types of quantities

5. **a.** Italy; **b.** Bulgaria;

c. 35%;

d. Austria, Slovenia, and France

7. **a.** Faculty salaries: $15,525,000; Administration salaries: $6,900,000; Student programs: $1,725,000; Savings: $1,380,000; Non-teacher salaries: $4,485,000; Maintenance: $3,450,000; Supplies: $1,035,000

b. 22% **c.** $4,485,000

d. $8,625,000

9. **a.** Rent: $7200; Food: $4800; Insurance and Health: $3600; Clothing: $2400; Utilities: $1200; Fun: $2400; Savings: $2400

b. Utilities **c.** $14,400

11. **a.** $530

b. Repairs: 15.1%; Gas: 15.1%; Insurance 13.2%; Loan Payment: 56.6%

c. 7:8

13. **a.** Dec ’13 **b.** Jun ’16

15. **a.** Wheat **b.** $1500

c. Steel **d.** $1000

e. Steel **f.** $2000

Writing & Thinking

17. All graphs should be
1. clearly labeled,
2. easy to read, and
3. have appropriate titles.

19. Examples will vary. Pie charts/circle graphs are used when indicating what percent of the population uses public transportation versus driving a car or walking. Bar graphs are used to indicate how many people polled intend to vote for a particular political candidate. Line graphs are used to show the change in a person’s financial portfolio. Histograms can show numbers of people making a particular range of income.

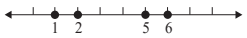
Chapter 1: Algebraic Pathways: Real Numbers and Algebraic Expressions

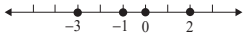
1.1 Exercises

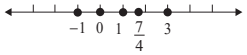
Concept Check

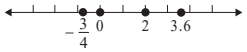
1. integers
3. irrational
5. graph
7. True
9. True

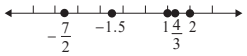
Practice

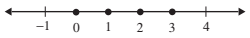
1. 3
3. 0
5. –2
7. 

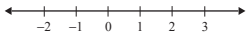
9. 

11. 

13. 

15. 

17. 

19. 

21. 4, 8
23. –7, –2, 0, 4, 8
25. $-7, -2, -\frac{5}{3}, -1.4, 0, \frac{3}{5}, 4, 5.9, 8$
27. <
29. >
31. <
33. =
35. >
37. <
39. =
41. >
43. True
45. False; $-9 < -8.5$
47. True
49. True
51. False; $-|-3| > -|4|$
53. $x = -5, 5$
55. $x = -2, 2$
57. No solution
59. $x = -23, 23$
61. Sometimes. Examples will vary.
63. Always. Examples will vary.

Applications

65. –4500 meters
67. +8844 meters
69. **a.** $|x| \le 3$

    b. 

71. **a.** 

    b. $-\frac{5}{2}$ has the furthest distance from zero.
73. **a.** $x = -5$ millimeters, 5 millimeters

    b. The length of the board can be 5 mm longer or 5 mm shorter than 1 meter.

    c. 1.05 m or 0.95 m

Writing & Thinking

75. If y is a negative number then $-y$ represents a positive number. For example, if $y = -2$, then $-y = -(-2) = 2$.

1.2 Exercises

Concept Check

1. positive
3. perimeter
5. area
7. False; The sum of a positive and negative number can be positive, negative, or zero.
9. True
11. False; The mean of a set of numbers can be positive, negative, or zero.

Practice

1. 4
3. –9
5. –3
7. 0
9. $-\frac{7}{13}$
11. –6.9
13. 1
15. 0
17. $-\frac{13}{6}$
19. $\frac{7}{8}$
21. $\frac{-41}{24}$
23. –51
25. –10
27. $-\frac{15}{64}$
29. $-\frac{1}{28}$
31. –31.3326
33. 3
35. 4
37. –4
39. –4.1
41. 11.08
43. 39
45. –31
47. 20
49. –16
51. –3
53. 5
55. 4
57. –11
59. –7
61. 0
63. $-\frac{5}{3}$
65. 45 cm
67. 108 ft
69. 31 m
71. 25 square yards
73. 63 square meters
75. 216 square yards
77. $2101.61
79. 2016 points
81. 2820 ft
83. 250 yards
85. 648 square feet
87. 10,080 square feet

1.3 Exercises

Concept Check

1. multiplication
3. read
5. check, reasonable
7. True
9. False; Quotient indicates division.

Applications

1. 1103 calories
3. 420 syringes
5. 648 miles
7. 64 people
9. 300 pens
11. 768 beads
13. 26 cans
15. $1175
17. $691
19. $384
21. $160
23. $255
25. $85
27. $150
29. Blue car for $9112; $33 cheaper
31. 54
33. 485
35. 6

37. $321

39. 7 hours

41. $125

43. 21 points

45. $76.60/share; $100 profit

47. **a.** 12 pairs of shoes

b. 254 pairs of shoes

49. 3873 miles

Writing & Thinking

51. **1.** Read the problem carefully. **2.** Draw any type of figure or diagram that might be helpful and decide what operations are needed. **3.** Perform the operations to solve the problem. **4.** Check your work.

53. Answers will vary. Averages may be used when looking at attendance, money made per month, commute time, etc.

1.4 Exercises

Concept Check

1. grouping symbols

3. left, right

5. -1

7. True

9. True

Practice

1. 144

3. 400

5. 6

7. 15

9. 14

11. 30

13. **a.** 36 **b.** 16

15. -25

17. -10

19. -45

21. -137

23. 9

25. 50

27. 152

29. -189

31. 143

33. -36

35. -10

37. $\frac{11}{30}$

39. $\frac{1}{24}$

41. $\frac{31}{24}$

43. $\frac{10}{3}$

45. $\frac{41}{32}$

47. 49

49. 12

51. $\frac{3}{5}$

53. -5.7

55. -3.5

57. 24

59. -5

61. 1

63. $-\frac{13}{64}$

65. 42.45

67. 67.77

69. 15.41

Applications

71. **a.** $\$11\cdot\left(1\frac{1}{4}\right)+\$8.50$

b. $22.25

c. $31

73. **a.** $-\$42-\$35-(3\cdot\$5)$

b. $-$92

75. **a.** $\left(12\frac{1}{2}+15\frac{3}{4}+11\frac{3}{4}-1\frac{1}{4}\right)\div 6$

b. $6\frac{11}{24}$ pounds of potatoes

Writing & Thinking

77. Smaller; When any positive number is multiplied by a fraction (or decimal) between 0 and 1, the result will be smaller. This is what is happening when a number between 0 and 1 is squared. Answers will vary.

1.5 Exercises

Concept Check

1. reciprocal

3. zero, factor

5. opposite

7. False; The commutative property of addition allows the order to change.

9. False; The additive identity of all numbers is 0.

Practice

1. $3 + 7$

3. $4 \cdot 19$

5. $30 + 48$

7. $(2 \cdot 3) \cdot x$

9. $(3 + x) + 7$

11. 0

13. $x + 7$

15. $2x - 24$

17. 0

19. Commutative property of addition

21. Multiplicative identity

23. Associative property of addition

25. Commutative property of multiplication

27. Commutative property of multiplication

29. Multiplicative inverse

31. Additive inverse

33. Multiplicative identity

35. Zero-factor law

37. Associative property of addition

39. $6(11) = 66$ and $6\cdot 3 + 6\cdot 8 = 66$

41. $10(-7) = -70$ and $10\cdot 2 - 10\cdot 9 = -70$

43. Commutative property of multiplication; $6\cdot 4 = 4\cdot 6 = 24$

45. Associative property of addition; $8+(5+(-2))$ $=(8+5)+(-2)=11$

47. Distributive property; $5(4+18)=5(4)+90$ $=110$

49. Associative property of multiplication; $(6\cdot(-2))\cdot 9 = 6\cdot(-2\cdot 9)$ $=-108$

51. Commutative property of addition; $3+(-34)=(-34)+3$ $=-31$

53. Commutative property of addition; $2(3+4)=2(4+3)=14$

55. Commutative property of addition; $5+(4-15)=(4-15)+5$ $=-6$

57. Associative property of multiplication; $(3\cdot 4)\cdot 5 = 3\cdot(4\cdot 5) = 60$

Applications

59. **a.** $118.25

b. $\$11\cdot\left(6\frac{1}{2}\right)+\$11\cdot\left(4\frac{1}{4}\right)$

c. Distributive property

61. **a.** $85.04 – $28.79 – $50.00 – $12.16 or $85.04 – ($28.79 + $50.0 + $12.16)

b. $-$5.91

c. $-\$5.91 + \$5.91 = 0$

d. The additive inverse property

1.6 Exercises

Concept Check

1. 1

3. constant

5. coefficients

7. True

9. False; In the term "$12a$," 12 is the coefficient.

Practice

1. -5, 3, and 8 are like terms; $7x$ and $9x$ are like terms.

3. $-x^2$ and $2x^2$ are like terms; $-6xy$ and $5xy$ are like terms; $3x^2y$ and $5x^2y$ are like terms.

5. 24, -6, and 8.3 are like terms; $1.5xyz$, $-1.4xyz$, and xyz are like terms.

7. $15x$

9. $3x$

11. $5y^2$

13. $10x$

15. $-2c$

17. $7x + 2$

19. $2x^2 + 2x$

21. $3x^2 + 20$

23. $13x^2 - 2y$

25. $7x - 1$

27. $-2n^2 + 2n - 3$

29. $-x^2 + 3x + 45$

31. $4n + 3$

33. $7a - 8b$

35. $8x + y$

37. $-2y$

39. $\frac{8x}{3}$

41. -4

43. 4

45. -2

47. $3x + 4$; 13

49. $5y + 1$; 16

51. $-3.1a^2 + 4a$; -20.4

53. $3.7x + 1.1$; 15.9

55. $8a$; -16

57. $3b$; -3

59. $-x^2 + 5x - 7$; -21

61. $3y^2 - y$; 4

63. $4y^3 - 4y^2 + 5y + 1$; -12

65. $5x^2 + 9x - 22$; -20

67. $2a^2 - 2a$; 4

69. $9ab - 7a + 2b$; 21

71. $14a - 15b + 2c + 2$; 24

73. $10a + 10b + 10c$; 0

Applications

75. \$50,000

77. **a.** $47s + 143m$

b. 6170 boxes

79. $C = 4.39$

Writing & Thinking

81. Like terms have the same variables with the same exponents. For example, $4a^2bc^3$ and $-3a^2bc^3$ are like terms. Unlike terms either have different variables or possibly the same variables with different exponents. For example $6ab$ and $-9a^2b$ are unlike terms and $5xy$ and $13ax$ are unlike terms.

83. -13^2 is the square of 13 multiplied by -1 while $(-13)^2$ is the square of -13. This means that $-13^2 = -169$ and $(-13)^2 = 169$.

1.7 Exercises

Concept Check

1. ambiguous

3. subtraction

5. multiplication

7. True

9. False; Subtraction is indicated by the phrase "five less than a number."

Practice

1. $x + 6$

3. $y - 4$

5. $\frac{2m}{10}$

7. $6y - 4$

9. $4x + 2x$

11. $15 - 2y$

13. $3x - 5x$

15. $9(x+2)$

17. $4(x+1)-13$

19. $3(x+6)+8$

21. $3(7-x)-4$

23. $\frac{x}{2}-18$

25. **a.** $x - 6$

b. $6 - x$

27. **a.** $3x - 5$

b. $5 - 3x$

29. $24d$

31. $3.15x$

33. $365y$

35. $7t + 3$

37. $7t + 3$

39. $20 + 0.15m$

41. $2w + 2(2w - 3) = 6w - 6$

43. Four times a number

45. A number increased by five

47. Four times a number decreased by seven

49. Seven times the sum of a number and one

51. Negative two times the difference between a number and eight

53. Five times the sum of twice a number and three

55. The quotient of six and the difference between a number and one

57. Six times a number plus the number minus one

59. Eight increased by twice the difference between a number and one

61. The sum of three times a number and seven; three times the sum of a number and seven

63. The product of seven and a number minus three; seven times the difference between a number and three

Writing & Thinking

65. The Commutative Property of Addition and Multiplication permits the order of items being added or multiplied to change and still have the same result. This property does not hold true for subtraction or division. Therefore, order is important for subtraction and division problems or the answer will change or be incorrect.

67. Answers will vary.

Chapter 2: Algebraic Pathways: Linear Equations and Inequalities

2.1 Exercises

Concept Check

1. equation

3. addition, equality

5. dividing

7. True

9. True

Practice

1. $x = -2$ is a solution

3. $x = 4$ is not a solution

5. $x = -4$ is a solution

7. $x = -18$ is a solution

9. $x = -28$ is a solution

11. $x = 7$

13. $y = 4$

15. $x = -19$

17. $n = 37$

19. $z = -6$

21. $x = 5$

23. $y = -5.9$

25. $x = -1.2$

27. $x = \frac{11}{20}$

29. $x = 9$

31. $y = 8$

33. $x = 20$

35. $y = 10$

37. $x = -8$

39. $x = 12$

41. $n = 8$

43. $y = 2.1$

45. $x =$

47. $x = -13.3$

49. $y = -12$

51. $x =$

53. $x = -4$

55. $x =$

57. $n = 9.7$

59. $x = -4$

Applications

61. 1945 kanji characters

63. **a.** Answers will vary.

b. $x = 12.5$

c. The garden should be 12.5 feet wide.

65. 4.24 light years

67. 11,500 words

69. 2250 students

71. **a.** Answers will vary.

b. $x = 11{,}550$

c. Clara will need a loan for $11,550.

73. $y = -50.753$

75. $x = -17.214$

77. $x = 246$

79. $x = -153.17$Writing & Thinking

81. **a.** Yes. It is stating that $6 + 3$ is equal to 9.

b. No. If we substitute 4 for x, we get the statement $9 = 10$, which is not true.

2.2 Exercises

Concept Check

1. like

3. multiplication

5. substituting

7. False; subtract 3 from both sides.

9. False, it is called a contradiction.

Practice

1. $x = -3$

3. $x = 2$

5. $y = -1$

7. $x = -0.12$

9. $x = 4$

11. $y = 0$

13. $y = 2$

15. $n = 6$

17. $n = -4$

19. $x = 0$

21. $x = -\frac{11}{3}$

23. $x = \frac{23}{8}$

25. $x = -\frac{4}{7}$

27. $x = 2$

29. $x = -\frac{1}{4}$

31. $y = -10$

33. $x = 2.2$

35. $x = 6$

37. $x = -5$

39. $n = 3$

41. $x = 3$

43. $x = 0$

45. $z = -1$

47. $y = \frac{1}{5}$

49. $x = -4$

51. $x = -21$

53. $y = 0$

55. $y = 1$

57. $x = \frac{1}{4}$

59. $x = \frac{3}{17}$

61. $x = \frac{8}{5}$

63. $x = -11$

65. $x = \frac{1}{2}$

67. $n = -1.5$

69. $x = 0$

71. Conditional

73. Conditional

75. Identity

77. Contradiction

Applications

79. 14,000 tickets per hour

81. 5 snacks

83. 10 courses

85. 379.7 feet

87. **a.** Lowest temperature; Change in temperature per hour; Current temperature

b. $x = 4$

c. The low temperature occurred 4 hours ago.

89. 20 months

91. **a.** The number of items packaged with Option A

b. The number of items that each box in Option B can hold

c. $x = 16$

d. Solution should be correct if Part **c.** is correct.

e. The boxes used in Option A can hold 16 items.

93. **a.** The cost of the special before tax

b. $x = 2.25$

c. The coffee cake or bagel will be cost effective. Answers will vary.

95. 240 sundaes

Writing & Thinking

97. **a.** $x + 6 = 20$; conditional, since there is one age that will make the statement true

b. $x + 6 = x + 8$; contradiction, since he can't be both 6 years older and 8 years older

c. $x + 6 = (x + 3) + 3$; identity, since the statement will be true regardless of Ryan's current age

2.3 Exercises

Concept Check

1. mathematically

3. time

5. substitute

7. False; Case matters in formulas.

9. True

Applications

1. $120

3. $10,000

5. **a.** $183.75 **b.** $3683.75

7. 2 seconds

9. 4 milliliters

11. $1030

13. 14 rafters

15. 336 in. or 28 ft

17. $1030

19. 230 calculators

21. $3.46

23. $8.9 million

25. 5%

27. 0.32 miles per minute

29. 3.5 hours

31. $s = \frac{P}{3}$

33. $d = \frac{C}{\pi}$

35. $C = R - P$

37. $k = v - gt$

39. $h = \frac{L}{2\pi r}$

41. $a = P - 2b$

43. $E = RI$

45. $b^2 = c^2 - a^2$

47. $x = \frac{y - b}{m}$

49. $t = \frac{v_0 - v}{g}$

51. $I = \frac{E}{R}$

53. $L = \frac{R}{2A}$

55. $y = \frac{4 - x}{4}$

57. $y = 3x - 14$

59. $x = \frac{2y - 5}{2}$

61. $r = \frac{A - P}{Pt}$

63. $x = 5 - 3y$

65. $h = \frac{3V}{\pi r^2}$

67. $C = 0.75x + 25$

69. $P = 358n - 5400$

71. **a.** $F = ma$
b. $F = 12.75$ kg · m/s^2; $m = 1.5$
c. a **d.** $a = 8.5$ m/s^2

Writing & Thinking

73. **a.** 0; No, because the numerator will be zero and thus the whole fraction will be equal to zero for all values of s.
b. $x < 70$
c. Answers will vary.

2.4 Exercises

Concept Check

1. read, think

3. answer

5. rate, time

7. True

9. False; the first step is to read the problem carefully

Practice

1. $x - 5 = 13 - x$; 9

3. $36 = 2x + 4$; 16

5. $7x = 2x + 35$; 7

7. $3x + 14 = 6 - x$; -2

9. $\frac{2x}{5} = x + 6$; -10

11. $4(x - 5) = x + 4$; 8

13. $\frac{2x + 5}{11} = 4 - x$; 3

15. $2x + 3x = 4(x + 3)$; 12

Applications

17. $c + (c + 67.51) = 329.49$; calculator: \$130.99, textbook: \$198.50

19. $2x + 90{,}000 = 310{,}000$; \$110,000

21. $3x + 1500 = 12{,}000$; \$3500

23. $(x + 56) + x = 542$; 243 boys

25. $(x + 68) + x = 158$; \$45 million on electric guitars

27. $3x + 15(20) = 330$; \$30

29. **a.** Original price
b. x, $0.20x$
c. \$95.96 – \$95.96(0.20) = \$119.95

Cyclist	Rate	Time	Distance
Chantelle	x	0.5	$0.5x$
Taylor	$x + 6$	0.5	$0.5(x + 6)$

31. 375 mph; 450 mph

33. 4.8 hours

35. 54 mph

37. 12 miles

39. 4.5 miles

41. **a.**

	Rate (mph)	·	Time (min)	=	Distance (miles)
Tortoise	10		t		$10t$
Achilles	25		$t - 2$		$25(t - 2)$

b. $10t = 25(t - 2)$

c. $3\frac{1}{3}$ hours

d. $1\frac{1}{3}$ hours

e. Yes

43. 94

45. 4 phone calls

47. \$20

49. **a.** Not possible
b. 192

Writing & Thinking

51. He would not be able to paddle faster than the current, so he would not be able to return upriver at all;
Correct answer: $\frac{2}{3}$ mph

2.5 Exercises

Concept Check

1. ratio

3. numerator

5. identify

7. True

9. False; a proportion is a statement that two ratios are equal.

Practice

1. $\frac{9}{14}$

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

5. $\frac{11}{16}$

7. $\frac{7}{24}$

9. $\frac{\$2 \text{ profit}}{\$5 \text{ invested}}$

11. $\frac{1 \text{ teacher}}{12 \text{ students}}$

13. $\frac{10 \text{ children}}{3 \text{ families}}$

15. $\frac{5 \text{ scholarships}}{42 \text{ students}}$

17. 60 miles per hour

19. 25 miles per gallon

21. 42 words per minute

23. \$12.75 per hour

25. 113.7¢/oz; 66.6¢/oz; 12 oz at \$7.99

27. \$2.50/pair; \$2.75/pair; 5 pairs at \$12.50

29. 33.3¢/oz; 36.1¢/oz; 12 oz at \$3.99

31. 19.9¢/oz; 16.8¢/oz; 12.2¢/oz; 10.6¢/oz; 64 oz at \$6.79

33. True

35. True

37. False

39. True

41. True

43. True

45. $x = 10$

47. $x = 50$

49. $D = 100$

51. $x = \frac{1}{4}$ or 0.25

53. $R = 50$

55. $B = 6.75$

Applications

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

59. $\frac{1}{12}$

61. $\frac{4}{5}$

63. $\frac{4}{15}$

65. **a.** $\frac{7}{3}$ **b.** $\frac{3}{7}$

67. 25 miles per gallon

69. 50 trash bags for \$25.98

71. \$0.33 per egg

73. **a.** 6.4 memberships per day
b. No; 6.4 memberships per day is higher than the quota.

75. 150 milliliters per hour matches the prescribed rate.

77. They are different.

79. They are different.

81. 3360 miles

83. 2100 minutes or 35 hours

85. $400

87. 200 feet

Writing & Thinking

89. Numerator

2.6 Exercises

Concept Check

1. decrease

3. increase

5. joint

7. False; Varies directly

9. True

Practice

1. $\frac{7}{3}$

3. 2

5. $-\frac{32}{9}$

7. 36

9. 120

11. $\frac{56}{3}$

13. 40

15. 54

17. $\frac{48}{5}$

19. 27

Applications

21. 400 feet

23. $35.10

25. 4.71 feet

27. 6 m

29. 0.0073 cm

31. 16,000 lb

33. 9×10^{-11} N

35. $59.70

37. **a.** $SL=\frac{kwd}{l^2}$ **b.** 200 **c.** 4320 pounds

39. 25,200 lb

41. 18,000 lb

43. 200 cm^3

45. 330 bar

47. 5.2 ohms

49. 10 ohms

51. $10\frac{2}{3}$ ft from the 120 lb weight or, $1\frac{1}{3}$ ft from the 960 lb weight.

53. 216 kilograms

2.7 Exercises

Concept Check

1. interval

3. closed

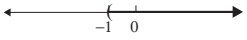
5. addition

7. True

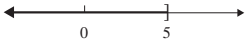
9. False; Only one value in the solution set needs to be checked.

Practice

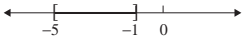
1. $(-1,\infty)$



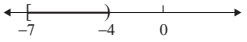
3. $(-\infty,5]$



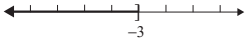
5. $[-5,-1]$



7. $[-7,-4)$

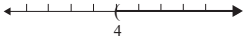


9.



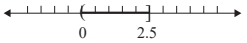
Half-open interval

11.



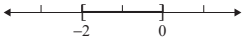
Open interval

13.



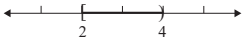
Half-open interval

15.



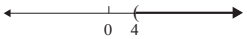
Closed interval

17.

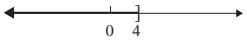


Half-open interval

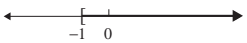
19. $(4,\infty)$



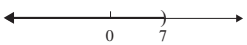
21. $(-\infty,4]$



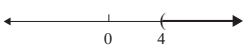
23. $(-1,\infty)$



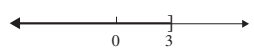
25. $(-\infty,7]$



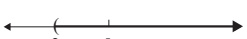
27. $(4,\infty)$



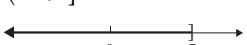
29. $(-\infty,3]$



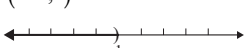
31. $(-2,\infty)$



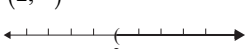
33. $(-\infty,7]$



35. $(-\infty,1)$

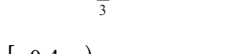


37. $(2,\infty)$



39. $\left(\frac{8}{3},\infty\right)$

41. $[-0.4,\infty)$



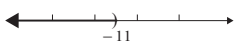
43. $(-\infty,2)$

45. $[3,\infty)$

47. $(-\infty,2]$

49. $\left(-\frac{1}{3},\infty\right)$

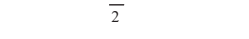
51. $\left(-\infty,-\frac{11}{2}\right)$



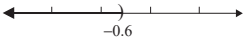
53. $[1,\infty)$

55. $\left(\frac{9}{2},\infty\right)$

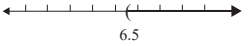
57. $(-\infty,-0.6)$



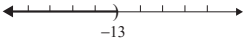
59. $(6.5,\infty)$



61. $(-\infty,-13)$



63. $\left(-\infty,-\frac{10}{9}\right]$



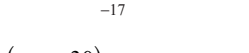
65. $[-4,\infty)$

67. $(-\infty,1]$

69. $(-17,\infty)$

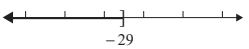
71. $(-\infty,-30)$

73. $\left(-\infty,-\frac{29}{2}\right]$



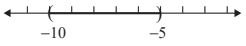
75. $(-9,1)$

77. $\left[\frac{1}{2},\frac{3}{2}\right]$

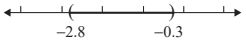


79. $[3, 15]$

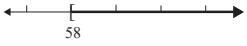
81. $(-10, -5)$



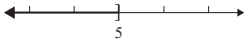
83. $(-2.8, -0.3)$



85. $x \geq 58$



87. $x \leq 5$



Applications

89. **a.** The student would need a score higher than 102 points, which is not possible. Thus he cannot earn an A in the course.

b. The student must score at least 192 points to earn an A in the course.

91. He must sell at least 10 cars.

93. **a.** $15 - x$

b. $8x + 5(15 - x)$

c. 8 large arrangements

95. $100 - 5(x - 3) \geq 70$; 9 unexcused absences

97. 22,500 tickets

99. 8 times

101. **a.** $150 + 60 + 12.50c \leq 400$

b. If you solve the inequality you get $c \leq 15.2$, but you can't buy 0.2 ink cartridges, so $c \leq 15$.

c. Jeph can buy at most 15 ink cartridges.

103. **a.** $\dfrac{92 + 74 + 80 + 72 + E}{5} \geq 80$

b. $E \geq 82$

c. Andrew needs to earn at least an 82 on the fifth exam.

Chapter 3: Algebraic Pathways: Graphing Linear Equations and Inequalities

3.1 Exercises

Concept Check

1. four quadrants

3. pattern

5. equation

7. True

9. False; horizontal lines have y-intercepts.

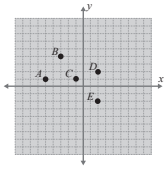
Practice

1. {A(−4, 0), B(0, 0), C(5, −1), D(−3, −3), E(2, −4)}

3. {A(4, 0), B(−2, 3), C(−1, 0), D(4, 4), E(5, −3)}

5. {A(1, 1), B(0, −4), C(−2, −3), D(4, 3), E(3, −2)}

7.



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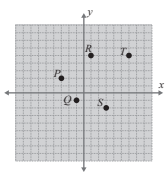

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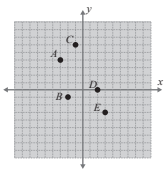


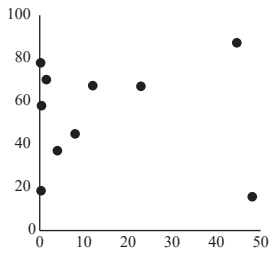
13. (0, 0), (−2, 3), (2, −3); Answers may vary.

15. (0, −2), (1, 1), (2, 4); Answers may vary.

17. (−2, 0), (1, −2), (4, −4); Answers may vary.

19. **a.** (67.3, 12.0), (87.2, 44.6), (70.1, 1.5), (77.9, 0.2), (44.9, 8.0), (67.0, 22.9), (18.5, 0.3), (58.0, 0.4), (15.7, 48.1), (37.1, 4.0)

b.



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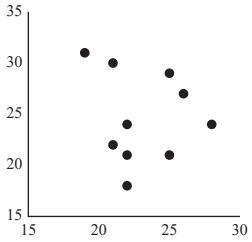


23.

x	y
0	5
$\frac{5}{2}$	0
−2	9
1	3

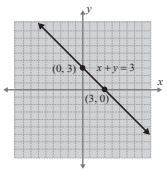
25.

x	y
0	−4
$\frac{4}{3}$	0
2	2
3	5

27. **a.** (0, 5) **b.** $\left(\frac{5}{2}, 0\right)$ **c.** (2, 1) **d.** (−1, 7)

29. **a.** (0, −3) **b.** (2, 0) **c.** (−2, −6) **d.** (4, 3)

31.



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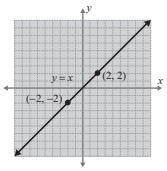

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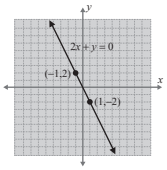

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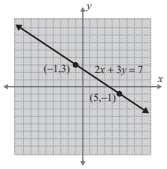

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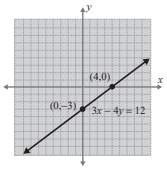

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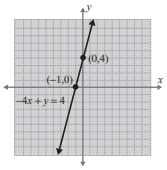

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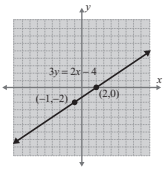

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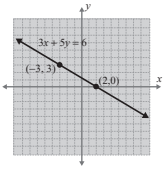

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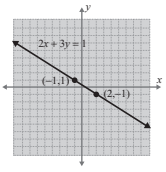

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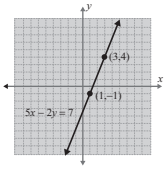

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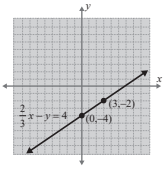

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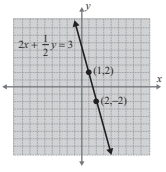

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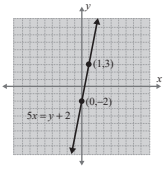

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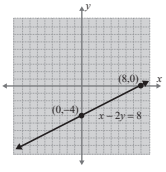

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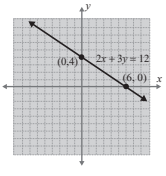

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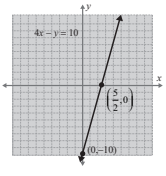

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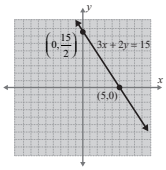
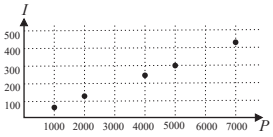


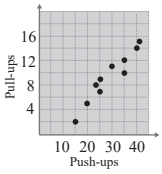
65. a. 60, 120, 240, 300, 420

b.



Writing & Thinking

67. a.



b. Yes, the more push-ups a person can do, it appears the more pull-ups he/she can do.

c. 8 pull-ups, 11 pull-ups, 12 pull-ups, 16 pull-ups; Answers may vary.

69. Plug the x and y values into the equation. Then evaluate both sides to see if the equation is true.

3.2 Exercises

Concept Check

1. run

3. positive

5. 0

7. True

9. True

Practice

1. $m = 5$

3. $m = -\frac{1}{7}$

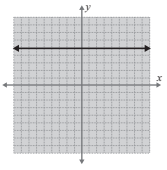
5. $m = 0$

7. $m = \frac{1}{2}$

9. $m = 2$

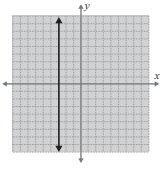
11. $m = \frac{1}{5}$

13.



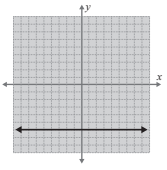
Horizontal line; $m = 0$

15.



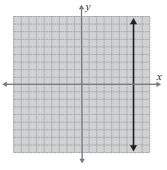
Vertical line; m is undefined

17.



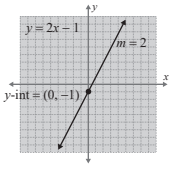
Horizontal line; $m = 0$

19.



Vertical line; m is undefined

21.



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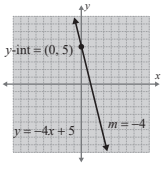

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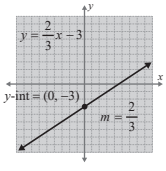

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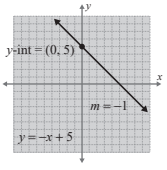

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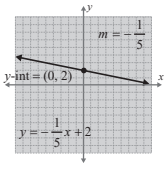

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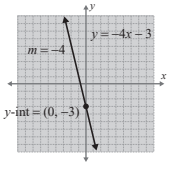

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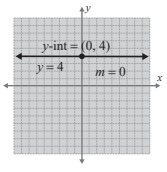

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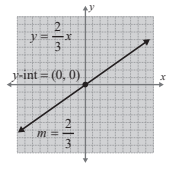

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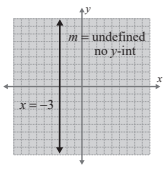

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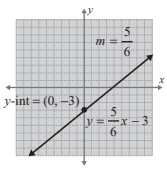

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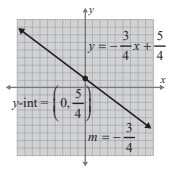

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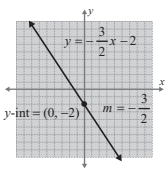

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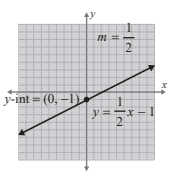

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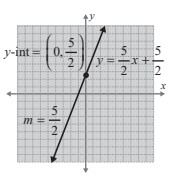
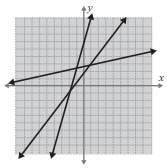
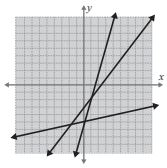


49. Answers will vary.



51. Answers will vary.



53. $y = -\frac{1}{2}x + 3$

55. $y = \frac{2}{5}x - 3$

57. $y = 4x - 5$

59. $y = x - 4$

61. $y = -\frac{5}{6}x - 3$

63. **a.** $m = \frac{3}{2}$ **b.** $(0, 7)$

c. $y = \frac{3}{2}x + 7$

65. **a.** $m = 0$ **b.** $(0, -6)$

c. $y = -6$

67. **a.** $m = \frac{1}{2}$ **b.** $(0, -3)$

c. $y = \frac{1}{2}x - 3$

69. **a.** $m = -\frac{1}{3}$ **b.** $(0, 2)$

c. $y = -\frac{1}{3}x + 2$

71. Yes

73. No

75. Yes

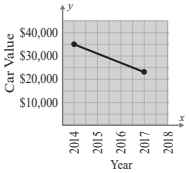
Applications

77. $\frac{3}{4}$

79. $\frac{11}{10}$

81. 54 mph

83. \$4000/year



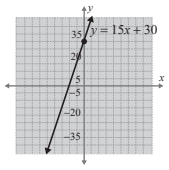
85. –5.66

87. **a.** Slope is \$15; Units are dollars and paintings

b. $(0, 30)$

c. $y = 15x + 30$

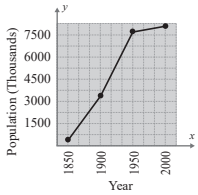
d.



e. Answers will vary. x cannot be negative since you can't sell a negative number of paintings.

f. \$90

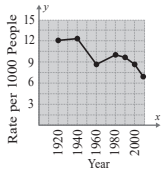
89. **a.** and **b.**



c. 58,433.1; 89,095.1; 2326.42

d. The population of New York increased by 58,433 people/year from 1850-1900; 89,095 ppy from 1900-1950; and 2326 ppy from 1950-2000.

91. **a.** and **b.**



c. –0.18, 0.075, –0.02, –0.13, –0.175, –0.025

d. # of marriages decreased 0.18 marriages/1000 people from '40-'60, increased 0.075 marriages/1000 people from '60-'80, decreased 0.02 marriages/1000 people from '80-'90, decreased 0.13 marriages/1000 people from '90-'00, decreased 0.175 marriages/1000 people from '00-'08, and decreased 0.025 marriages/1000 people per year from '08-'16.

3.3 Exercises

Concept Check

1. negative reciprocals

3. same

5. slope

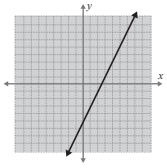
7. True

9. True

Practice

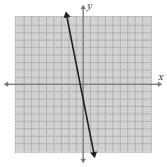
1. **a.** $m = 2$ **b.** $(3,1)$

c.



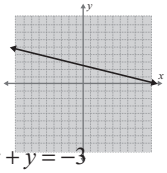
3. **a.** $m = -5$ **b.** $(0,-2)$

c.

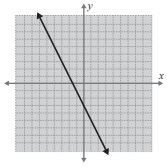


5. **a.** $m = -\frac{1}{4}$ **b.** $(-2,3)$

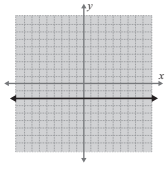
c.



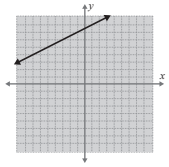
7. $2x + y = -3$



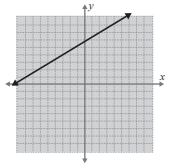
9. $y = -2$



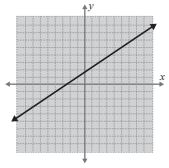
11. $x - 2y = -15$



13. $3x - 5y = -29$



15. $2x - 3y = -5$



17. $y = \frac{1}{2}x + \frac{9}{2}$

19. $y = -\frac{1}{7}x + \frac{2}{7}$

21. $y = -\frac{5}{4}x + 2$

23. $y = -5$

25. $y = -x + 4$

27. $x - y = 1$

29. $3x + y = 2$

31. $3x - 4y = -14$

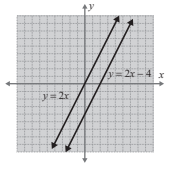
33. $7x + 3y = -5$

35. $y = 6$

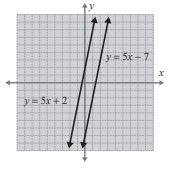
37. $y = 7$

39. $y = 7$

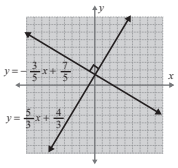
41. $y = 2x$



43. $y = 5x + 2$



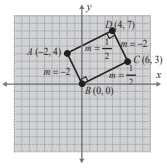
45. $y = -\frac{3}{5}x + \frac{7}{5}$



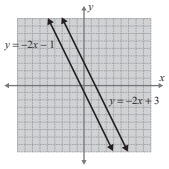
47. $y = -\frac{1}{3}x$

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

51.

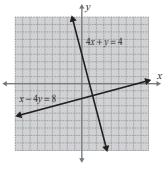


53.



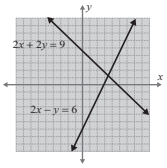
Parallel

55.



Perpendicular

57.



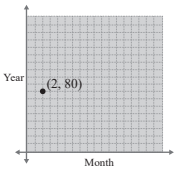
Neither

Applications

59. **a.** $P = 100t - 5000$

b. 50 tickets

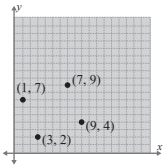
61. **a.**



b. $y - 80 = 10(x - 2)$

63. **a.** $f = 5 + 2m$ **b.** \$35

65. **a.**



b. Top: $m = \frac{1}{3}$;

Bottom: $m = \frac{1}{3}$;

Left: $m = -\frac{5}{2}$

Right: $m = -\frac{5}{2}$

c. Top is parallel with bottom, left is parallel with right.

d. No

e. Parallelogram

3.4 Exercises

Concept Check

1. function

3. domain

5. domain

7. True

9. True

Practice

1. $\{(-4, 0), (-1, 4), (1, 2), (2, 5), (6, -3)\}$;

$D = \{-4, -1, 1, 2, 6\}$;

$R = \{-3, 0, 2, 4, 5\}$;

Function

3. $\{(-5, -4), (-4, -2), (-2, -2), (1, -2), (2, 1)\}$;

$D = \{-5, -4, -2, 1, 2\}$;

$R = \{-4, -2, 1\}$;

Function

5. $\{(-4, -3), (-4, 1), (-1, -1), (-1, 3), (3, -4)\}$;

$D = \{-4, -1, 3\}$;

$R = \{-4, -3, -1, 1, 3\}$;

Not a function

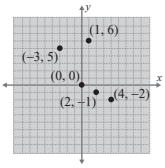
7. $\{(-5, -5), (-5, 3), (0, 5), (1, -2), (1, 2)\}$;

$D = \{-5, 0, 1\}$;

$R = \{-5, -2, 2, 3, 5\}$;

Not a function

9.

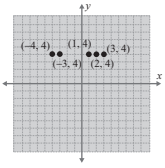


$D = \{-3, 0, 1, 2, 4\}$;

$R = \{-2, -1, 0, 5, 6\}$;

Function

11.

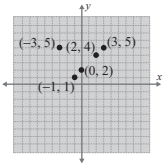


$D = \{-4, -3, 1, 2, 3\}$;

$R = \{4\}$;

Function

13.

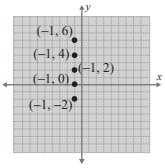


$D = \{-3, -1, 0, 2, 3\}$;

$R = \{1, 2, 4, 5\}$;

Function

15.



$D = \{-1\}$;

$R = \{-2, 0, 2, 4, 6\}$;

Not a function

17. Function;

$D = (-\infty, \infty)$;

$R = [0, \infty)$

19. Function;

$D = (-\infty, \infty)$;

$R = (-\infty, \infty)$

21. Not a function;

$D = (-\infty, \infty)$;

$R = (-\infty, \infty)$

23. Not a function;

$D = (-\infty, \infty)$;

$R = (-\infty, \infty)$

25. Function;

$D = [-5, 5]$;

$R = [-2, 2]$

27. Not a function;

$D = \{-3\}$;

$R = (-\infty, \infty)$

29. $\{(-9, -26), \left(-\frac{1}{3}, 0\right), (0, 1), \left(\frac{4}{3}, 5\right), (2, 7)\}$

31. $\{(-2, -11), (-1, -2), (0, 1), (1, -2), (2, -11)\}$

33. $D = (-\infty, \infty)$

35. $D = (-\infty, 0) \cup (0, \infty)$ or $x \neq 0$

37. $D = (-\infty, 3) \cup (3, \infty)$ or $x \neq 3$

39. **a.** -4 **b.** -16 **c.** -10

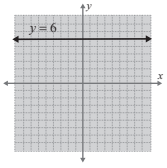
41. **a.** 0 **b.** 12 **c.** 56

43. **a.** -3 **b.** 0 **c.** 3

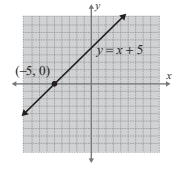
45. $f(1) = 3$

47. $f(4) = 0$

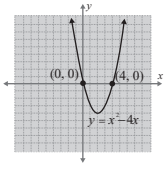
49.



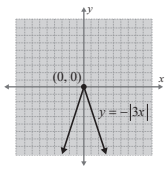
51.



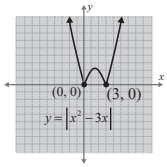
53.



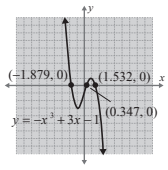
55.



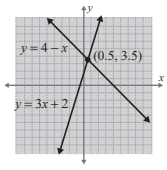
57.



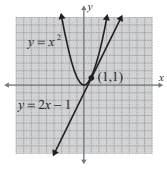
59.



61.



63.



65. y-intercept = $(0,-5)$ (should be $(0,5)$)

67. y-intercept = $(0,-8)$ (should be $(0,-2)$)

69. Slope = -3 (should be the reciprocal, $-\frac{1}{3}$) and y-intercept = $(0,2)$ (should be $(0,0)$)

Applications

71. **a.** $(0, 250)$, represents Ariella's base weekly salary

b. 0.15; Represents the commission rate

c. $y = 0.15x + 250$

d. $f(x) = 0.15x + 250$

e. Domain is all real numbers; Range is all real numbers

f. Answers will vary. Some students may say sales cannot be negative, some will allow negative sales due to returns.

g. \$1000

3.5 Answers

Concept Check

1. correlation

3. zero

5. predict

7. True

9. False; if $r = 1$ or -1, the variables are perfectly correlated.

Practice

1. Positive

3. Positive

5. No correlation

7. Negative

9. Perfectly positive

11. Strong negative

13. Perfectly negative

15. Weak negative

17. Weak positive

19. **a.** $y = 1.6x + 43$

b. $y = 3.3x + 18.5$

21. **a.** $y = -0.5x + 17.8$

b. $y = -2x + 52.2$

23. **a.** $y = 1.65x + 20.1$

b. $y = -1.125x + 38.475$

25. **a.** $y = -3x + 39$

b. $y = -0.5x + 27$

27. $y = 1.11x + 84.66$

29. $y = -147.47x + 1318.80$

31. **a.** 35.7; **b.** 83.3;

c. 130.9

33. **a.** 4.97; **b.** 2.52;

c. 0.07

35. **a.** 18.07; **b.** 15.37;

c. 9.97

3.6 Exercises

Concept Check

1. system

3. inconsistent

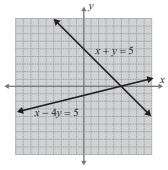
5. independent

7. False; graphs that are parallel indicate no solutions.

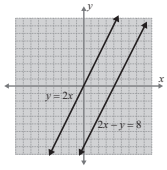
9. True

Practice

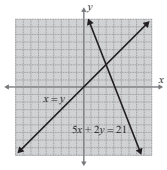
1. (5, 0)



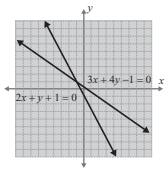
3. No solution



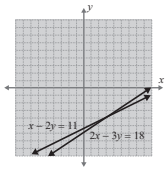
5. (3, 3)

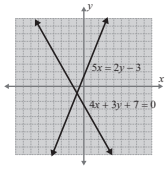


7. (–1, 1)



9. (3, –4)





11. (2, 1), consistent

13. (–1, –3), consistent

15. No solution, inconsistent

17. Infinite number of solutions: $(x, 8 - 3x)$, dependent

19. (1, 6), consistent

21. $\left(\frac{3}{2}, 1\right)$, consistent

23. $\left(3, -\frac{3}{4}\right)$, consistent

25. No solution, inconsistent

27. $\left(\frac{1}{2}, \frac{1}{4}\right)$, consistent

29. (5, 2), consistent

31. Infinite number of solutions: $(x, 6x - 15)$, dependent

33. (7, 5), consistent

35. (4, 7), consistent

Applications

37. 40 liters of 12%, 50 liters of 30%

39. 240 gal of 5%, 120 gal of 2%

41. \$87,000 in bonds, \$37,000 in certificates

43. 325 at \$3.50/share, 175 at \$6.00/share

45. 40 lb at \$3.90/lb, 30 lb at \$2.50/lb

47. 16 lb at \$0.70/lb, 4 lb at \$1.30/lb

49. \$5.50 for paperback, \$9.00 for hardback

51. 205 legislators voted in favor of the bill

53. Commercial jet: 300 mph, Private jet: 125 mph

55. 78 chairs using Method I, 44 chairs using Method II

57. Sue: 12 years old; Pat: 22 years old

59. (2.6667, –2.3333)

61. (0.6667, –1.3333)

63. (–0.6, –2.2)

65. (13, –8)

67. The solution to a consistent system of linear equations is a single point,

which is easily written as an ordered pair.

3.7 Exercises

Concept Check

1. test

3. open

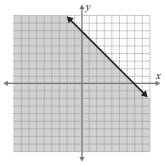
5. three

7. True

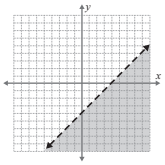
9. False; the solution is the intersection of the graphs

Practice

1.



3.



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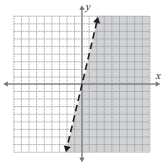

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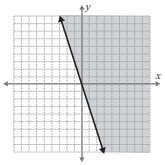

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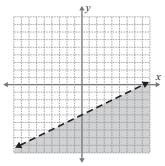

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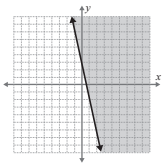

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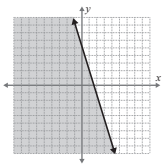

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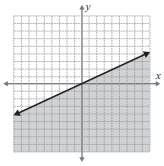

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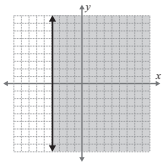

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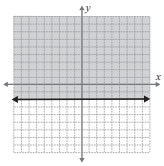

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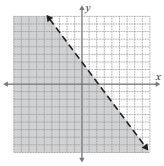

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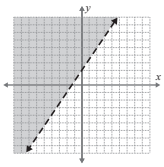

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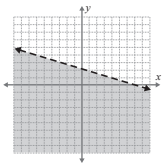

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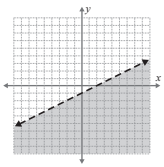

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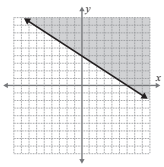

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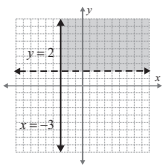

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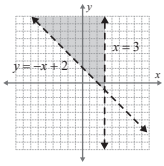

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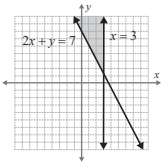

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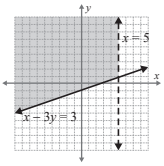

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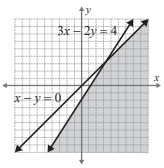

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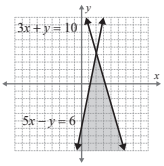

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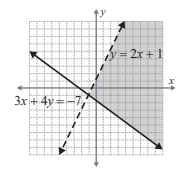

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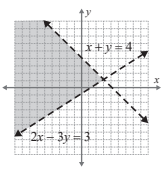

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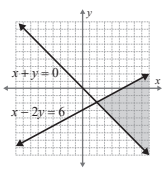

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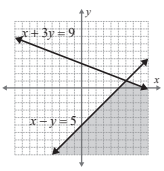
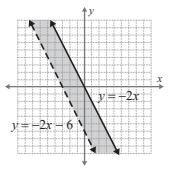


51. No solution

53.



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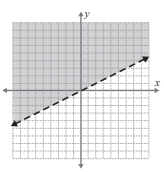

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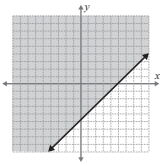

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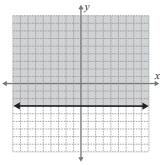

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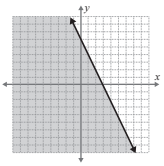

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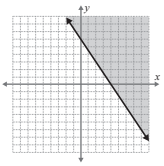

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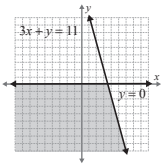

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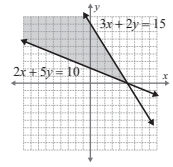

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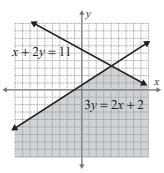

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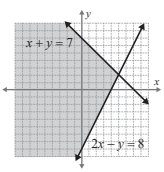
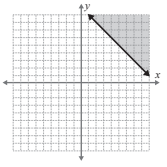


Applications

73. **a.** $x + y \geq 75$

b.

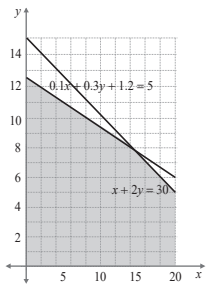


c. No; $67 < 75$

d. Answers will vary; Any points with x or $y < 0$ or > 50.

75. a. $\begin{cases} 0.1x + 0.3y + 1.2 < 5 \\ x + 2y < 30 \end{cases}$

b.



c. Answers will vary.

d. Answers will vary. For example, any negative values of x and y since you cannot have a negative number of cookies.

Writing & Thinking

77. Test any point not on the line. If the test point satisfies the inequality, shade the half-plane on that side of the line. Otherwise, shade the other half-plane.

Chapter 4: Algebraic Pathways: Exponents and Polynomials

4.1 Exercises

Concept Check

1. multiplication

3. product

5. once, positive

7. False; if there is no exponent written, the exponent is assumed to be 1.

9. True

Practice

1. 49

3. 12

5. $\frac{1}{64}$

7. x

9. $\frac{1}{y^5}$

11. x^3

13. x^4

15. $\frac{1}{x}$

17. 1

19. x^8

21. 1

23. $\frac{1}{y^5}$

25. y^5

27. x^3

29. 1

31. y^{11}

33. x^3

35. x^{10}

37. x^{k+3}

39. x^{3k+4}

41. x^k

43. x^{2k}

45. x^{2k+1}

47. x^{k-5}

49. $-\frac{x^2y^3}{3}$

51. $\frac{3y^4}{x^3}$

53. $x^{5n}y^{3-k}$

55. $\frac{b^7}{a^2}$

57. $\frac{x^{10}}{4y}$

59. $\frac{3y^7}{4x^2}$

61. $\frac{80x^{10}}{y^9}$

63. x^4y^5

65. Answers will vary..

4.2 Exercises

Concept Check

1. 1, 10

3. decimal point

5. False; The decimal point should be moved 3 places to the left.

7. False; 4000 written in scientific notation is 4.0×10^3.

Practice

1. 8.6×10^4

3. 3.62×10^{-2}

5. 1.83×10^7

7. 2.368×10^{-10}

9. 9×10^{-7}

11. 3.28×10^{-11}

13. 0.042

15. 7,560,000

17. 0.00006132

19. 30,670,000,000

21. 7,205,000,000

23. 0.00000691

25. $(3 \times 10^2)(1.5 \times 10^{-4})$; 4.5×10^{-2}

27. $(3 \times 10^{-4})(2.5 \times 10^{-6})$; 7.5×10^{-10}

29. $(2.34 \times 10^{10})(5.5 \times 10^9)$; 1.287×10^{20}

31. $\frac{3.9 \times 10^3}{3 \times 10^{-3}}$; 1.3×10^6

33. $\frac{1.25 \times 10^2}{5 \times 10^4}$; 2.5×10^{-3}

35. $\frac{1.3 \times 10^{-12}}{2.6 \times 10^{-8}}$; 5×10^{-5}

37. $\frac{(8.4 \times 10^{-3})(3 \times 10^{-3})}{(2.1 \times 10^{-1})(6 \times 10)}$; 2×10^{-6}

39. $\frac{(5.4 \times 10^0)(3 \times 10^{-3})(5 \times 10)}{(1.5 \times 10)(2.7 \times 10^{-3})(2 \times 10^2)}$; 1×10^{-1}

41. $\frac{(1.4 \times 10^{-2})(9.22 \times 10^2)}{(3.5 \times 10^3)(2.0 \times 10^6)}$; 1.844×10^{-9}

43. $\frac{(2.5 \times 10)(3.75 \times 10^{-5})}{(4 \times 10^{10})(7.5 \times 10^{-6})}$; 3.125×10^{-9}

45. $\frac{(1.4 \times 10^{-7})(7 \times 10^{13})}{4 \times 10}$; 2.45×10^5

47. $\frac{(1.95 \times 10^{-5})(2.65 \times 10^3)(7.56 \times 10^{10})}{(1.5 \times 10^7)(1.3 \times 10^{-13})}$; 2.0034×10^{15}

Applications

49. 1.67×10^{-24} grams

51. 60,000,000,000,000 cells

53. 5.98×10^{27} grams

55. 4.0678×10^{16} m

57. 6.5×10^{-19} grams

59. No. Should be 5.2×10^5

61. 3E8

63. 8.5E7

65. 3E22

67. 1.6051E15

69. 1E2

71. 1.02E22

4.3 Exercises

Concept Check

1. constant

3. base

5. decreases, increases

7. False; they increase slowly at first and then grow very rapidly.

9. True

Practice

1. Since the population triples every hour, we

have a exponential model: $f(t) = 100(3^t)$.

3. Since the balance in the account increases the same amount every week, we have a linear model: $f(t) = 4t + 100$.

5. The number of people doubles every year, so the model is exponential: $f(t) = 100{,}000(2^t)$.

7.

x	–3	–2	–1	0	1	2
$f(x)$	$\frac{1}{27}$	$\frac{1}{9}$	$\frac{1}{3}$	1	3	9

9.

x	–0.5	–0.25	0	0.25	0.5	0.75
$f(x)$	0.25	0.5	1	2	4	8

11.

x	–3	–2	–1	0	1	2
$f(x)$	8	4	2	1	0.5	0.25

13.

x	–1	0	1	2	3	4
$f(x)$	0.25	0.5	1	2	4	8

15.

x	–3	–2	–1	0	1	2
$f(x)$	7	3	1	0	–0.5	–0.75

15.

x	0.25	0.5	0.75	1	1.25	1.5
$f(x)$	0.25	0.5	1	2	4	8

For 17 through 22, the regression values might vary slightly depending on calculator model and rounding.

17. $f(t) = 10e^{0.01t}(t)$

19. $f(t) = 10000(1.01)^t$

21. $f(t) = 8(1.25)^t$

Applications

23. 14,762,250 bacteria

25. $P(6) = 1000(1.005)^6$
≈ 1030.38 dollars

27. $P_0 \approx 1000$ bacteria

29. $V(4) = 10{,}000(0.8)^4$
$= 4096$ dollars

31. $V(8) = 95(0.5)^{\frac{8}{6}}$
≈ 37.7 milligrams

33. $M(50{,}000) = 200 \cdot 0.5^{\frac{50000}{5730}}$
$= 0.47$ milligrams

35. \$2909.98

37. \$3504.60

39. **a.** $f(x) = 2.1(0.63)^x$

b. 0.53 million salmon

4.4 Answers

Concept Check

1. whole, real

3. polynomial

5. sum

7. True

9. False; they are like terms because they have the same variable raised to the same exponent.

Practice

1. Degree 3, binomial, leading coefficient 1

3. Not a polynomial

5. Degree 3, trinomial, leading coefficient $\frac{5}{4}$

7. No degree, monomial, leading coefficient 0

9. Not a polynomial

11. Not a polynomial

13. $4x^2 - 3x - 6$

15. $-7x - 6$

17. $3x^2 - 4y^2$

19. $x^2 - x + 10$

21. $2x^4 - 5x^3 - x - 3$

23. $x^4 + 2x^2 + 8x - 1$

25. $6x^3 - 7x^2 + 8x + 3$

27. $9x^2 + 13xy - 6y^2$

29. $12x^3 - 21x^2 - 2x + 12$

31. $5x^3 - 2x^2$

33. $-2x^2 - 4xy + y^2$

35. $-3xy + 8x$

37. $2x^3 - 2x - 3$

39. $10x^4 + 2x^3 - 4x^2 + 2x + 1$

41. $5x^2 - 7x + 5$

43. $4x^3 + 4x^2 - 7x + 24$

45. $x^4 - 5x^3 - 8x^2 + 3x - 3$

47. 13

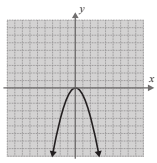
49. 1

51. –289

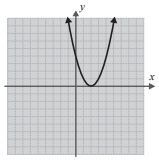
53. 7

55. –20

57. **a.**



b.



Writing & Thinking

59. Any monomial or algebraic sum of monomials.

61. The largest of the degrees of its terms after like terms have been combined.

4.5 Exercises

Concept Check

1. distributive

3. binomials

5. difference

7. False; the distributive property can be used when multiplying any types of polynomials.

9. False; the product will be a binomial.

Practice

1. $5x^3 - 10x^2 + 15x$

3. $x^3y^2 + 4xy^3$

5. $x^2 - 3x - 18$

7. $x^2 - 9x + 8$

9. $2y^2 - 11y - 6$

11. $3x^2 - 19x + 20$

13. $6y^2 + 13y + 6$

15. $8x^2 - 37x - 15$

17. $27x^2 - 15x - 2$

19. $9x^2 + 6x + 1$

21. $25x^2 - 20xy + 4y^2$

23. $16x^2 - 49$

25. $4x^2 - 9y^2$

27. $9x^5 - 16x$

29. $x^3 - 1$

31. $x^3 + 9x^2 + 27x + 27$

33. $x^6 + 4x^3 + 4$

35. $4x^6 - 49$

37. $x^3 - 27y^3$

39. $x^4 - 36y^4$

41. $10x^4 - 13x^2y^2 - 3y^4$

43. $x^2 + 2xy + y^2 - 4$

45. $25x^2 - 10xy + y^2 + 30x - 6y + 9$

47. $x^2 - 4xy + 4y^2 + 8x - 16y + 16$

49. $x^{k+2} + 3x^2$

51. $x^{2k} - 2x^k - 15$

53. $x^{2k} + 5x^k + 4$

55. $3x^{2k} + 17x^k + 10$

57. $x^2 - \frac{25}{64}$

59. $y^2 - \frac{2}{5}y + \frac{1}{25}$

61. $x^2 - 6.25$

63. $6x^3 - 13x^2 - 23x - 6$

65. $2x^4 - 3x^3 - 6x^2 + 17x - 12$

67. $4x^4 - 6x^3 - 28x^2 + 26x + 24$

Applications

69. **a.** $10x^5 - 20x^4 + 10x^3$

b. $\frac{5}{16}$

c. 0.2048

71. **a.** $A(x) = 4x^2 + 150x + 1250$

b. $A(x) = 4x^2 + 150x$

Writing & Thinking

73. As indicated in the diagram, $(x+5)^2 = x^2 + 2(5x) + 5^2$. Answers may vary.

Chapter 5: Algebraic Pathways: Factoring and Solving Quadratic Equations

5.1 Exercises

Concept Check

1. product, factors

3. greatest common factor, largest

5. negative / opposite

7. True

9. False; Binomials can be common factors.

Practice

1. 5

3. 8

5. 1

7. $10x^3$

9. $4a^2$

11. $13ab$

13. $15xy^2z^2$

15. x^4

17. $-4y$

19. $3x^3$

21. $2x^2y$

23. $y^2 - 2y + 3$

25. $2x^2 - 3x + 1$

27. $10x^3 - 11x^2 + x$

29. $-4x^2 + 7x - \frac{5}{2}$

31. $y^3 - \frac{7}{2}y^2 - \frac{15}{2}y + 4$

33. $m + 9$

35. $x - 6$

37. $b + 1$

39. $3y + 4x + 1$

41. $11(x - 11)$

43. $4y(4y^2 + 3)$

45. $-3a(2x - 3y)$

47. $5xy(2x - 5)$

49. $-2yz(9yz - 1)$

51. $8(y^2 - 4y + 1)$

53. $x(2y^2 - 3y - 1)$

55. $4m^2(2x^3 - 3y + z)$

57. $-7x^2z^3(8x^2 + 14xz + 5z^2)$

59. $x^4y^2(15 + 24x^2y^4 - 32x^3y)$

61. $(y + 3)(7y^2 + 2)$

63. $(x - 4)(3x + 1)$

65. $(x - 2)(4x^3 - 1)$

67. $(2y + 3)(10y - 7)$

69. $(x - 2)(a - b)$

71. $(b + c)(x + 1)$

73. $(x^2 + 6)(x + 3)$

75. Not factorable

77. $(3 - b)(x + y)$

79. $(y - 4)(5x + z)$

81. $(z^2 + 3)(a + 1)$

83. $(6x + 1)(a + 2)$

85. $(x + 1)(y + 1)$

87. $(2y - 7z)(5x - y)$

89. $(3x - 4u)(y - 2v)$

91. Not factorable

93. $(2c - 3d)(3a + b)$

Applications

95. She can make 30 identical treat bags, each containing 5 pieces of candy A, 6 pieces of candy B, and 11 pieces of candy C.

97. **a.** 32 feet **b.** $16x(3 - x)$

c. 32 feet

d. Yes. They are equivalent expressions.

5.2 Exercises

Concept Check

1. factorable

3. trial-and-error

5. grouping

7. True

9. False; the first step is to multiply a and c.

Practice

1. $(x + 3)(x + 6)$

3. $(x - 9)(x + 3)$

5. $(x - 25)(x - 2)$

7. $(x + 8)(2x - 1)$

9. $(2x + 3)(3x + 2)$

11. Not factorable

13. $(x - 4)(2x + 1)$

15. $(2x - 1)(9x + 1)$

17. $2x(2x + 5)(3x + 2)$

19. Not factorable

21. $(2x^3 + y^2)(x^3 + 4y^2)$

23. $-2(9x^2 - 36x + 4)$ or $2(-9x^2 + 36x - 4)$

25. $-5(y - 6)(y - 2)$

27. $x^2(3x - 4)(7x + 8)$

29. $(5x^2 + 2y^2)(x^2 + 3y^2)$

31. $(x - 5)(x - 3)(x + 7)$

33. $(x - 6)(2x + 1)(2x + 3)$

35. $(2x + y - 5)(2x + y - 4)$

37. $(x + 3y - 16)(x + 3y + 2)$

39. $(6x - y + 7)(6x - y + 1)$

40. $5(3x - y + 4)(3x - y - 1)$

41. $4(2a + b + 3)(2a + b - 2)$

Applications

43. $l = 2x + 5$ inches

45. **a.** $x(36 - 2x)(12 - 2x)$

b. $V(2) = 512$ in.^{3}

c. $V(4) = 448$ in.^{3}

47. $(5x + 20)$ can have a five factored out.

5.3 Exercises

Concept Check

1. binomial

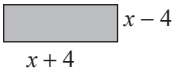
3. $2ax$, $-2ax$

5. $(x + a)(x^2 - ax + a^2)$

7. True
9. False; The sum of two squares is not factorable.

Practice

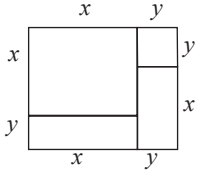
1. $(x-5)(x+5)$
3. $(9-y)(9+y)$
5. $2(x-8)(x+8)$
7. $4(x-2)(x+2)(x^2+4)$
9. $(y-8)^2$
11. $-4(x-5)(x+5)$
13. $(3x-5)(3x+5)$
15. $(y-5)^2$
17. $(2x-1)^2$
19. $(5x+3)^2$
21. $(4x-5)^2$
23. $2xy(x+8)^2$
25. $(x-10)^2$
27. $(x^2+5y)^2$
29. $(x-5)(x^2+5x+25)$
31. $(y+6)(y^2-6y+36)$
33. $(x+3y)(x^2-3xy+9y^2)$
35. Not factorable
37. $4(x-2)(x^2+2x+4)$
39. $y(x+y)(x^2-xy+y^2)$
41. $x^2y^2(1-y)(1+y+y^2)$
43. $3xy(2x+3y)(4x^2-6xy+9y^2)$
45. $(x^2-y^3)(x^4+x^2y^3+y^6)$
47. $(3x+y^2)(9x^2-3xy^2+y^4)$
49. $(2x+y)(4x^2-2xy+y^2)$
51. $8(y-1)(y^2+y+1)$
53. $(3x-y)(3x+y)$
55. $(x-2y)(x+2y)(x^2+4y^2)$
57. $(m+6)(m+1)$
59. $(x+9)(x+2)$
61. $(n-6)(n-2)$
63. Not factorable
65. $(x+5)(x-2)$
67. $3(a+6)(a-2)$
69. $-5(x-6)(x-8)$
71. Not factorable
73. $x(x-6)(x+2)$
75. $-2a(a+8)(a-7)$
77. $-(x-5)(3x-2)$
79. $(2x-1)(3x-4)$
81. $(4m+3)(3m-2)$
83. $2(2x-1)(x-3)$
85. $(4x-7)(2x+5)$
87. $(5x+6)(4x-9)$
89. $-(5x-7)(3x+2)$
91. $(4y+5)(5y-4)$
93. $(6x-1)(3x-2)$
95. $3(4n^2-20n-25)$
97. $3x(3x-2)(4x+5)$
99. $2x(2x-1)(4x-11)$
101. a. x^2-16

b. 

Writing & Thinking

103. a. $xy+xy+x^2+y^2$
$=x^2+2xy+y^2$
$=(x+y)^2$

b. $(x+y)(x+y)$
$=(x+y)^2$



5.4 Exercises

Concept Check

1. zero
3. factor
5. substituting
7. True
9. True

Practice

1. $x=2, 3$
3. $x=-2, \frac{9}{2}$
5. $x=-3$
7. $x=-5$
9. $x=0, 2$
11. $x=-6$
13. $x=-1, 4$
15. $x=-3, 4$
17. $x=-3, 0$
19. $x=2, 4$
21. $x=-4, 3$
23. $x=-\frac{1}{2}, 3$
25. $x=-\frac{2}{3}, 2$
27. $x=-\frac{1}{2}, 4$
29. $x=-2, \frac{4}{3}$
31. $x=\frac{3}{2}$
33. $x=0, \frac{8}{5}$
35. $x=-2, 2$
37. $x=1$
39. $x=2$
41. $x=-3, 3$
43. $x=-5, 10$
45. $x=-6, -2$
47. $x=\frac{1}{2}$
49. $x=0, 2, 4$
51. $x=-\frac{2}{3}, -\frac{1}{2}, 0$
53. $x=-10, 10$
55. $x=-5, 5$
57. $x=-4$
59. $x=3$
61. $x=-1, 3$
63. $x=-8, -2$
65. $x=-5, 2$
67. $x=-5, 7$
69. $x=-6, 2$
71. $x=-1, \frac{2}{3}$
73. $x=-\frac{3}{2}, 4$

Applications

75. a. 640 ft; 384 ft

b. 144 ft; 400 ft

c. 7 seconds; $0=-16(t+7)(t-7)$

77. a. The ball will hit the ground.

b. $0=-16t^2+16t+96$

c. $t=-2, 3$

d. The ball will hit the ground after –2 seconds and after 3 seconds.

e. No, time cannot be negative.

79. a. π in.^{2}

b. 4π in.^{2}

c. 16π in.^{2}

d. 64π in.^{2}

e. The area gets 4 times larger.

Writing & Thinking

81. This allows for use of the zero factor property which says that for the product to equal zero one of the factors must equal zero. Answers will vary.

5.5 Exercises

Concept Check

1. (perfect) square
3. principal
5. terminate, repeat

7. False; If the original number is negative, the principal square root will not be the same as the original number.
9. True

Practice

1. 3
3. 9
5. 17
7. 13
9. $\frac{1}{2}$
11. 0.2
13. –10
15. –0.04
17. $\frac{3}{5}$
19. $\sqrt{64} < \sqrt{74} < \sqrt{81}$ and $8 < \sqrt{74} < 9$ because $64 < 74 < 81$ or $(8.6023)^2 = 73.99956529$
21. $\sqrt{25} < \sqrt{32} < \sqrt{36}$ and $5 < \sqrt{32} < 6$ because $25 < 32 < 36$ or $(5.6569)^2 = 32.00051761$
23. Rational
25. Rational
27. Irrational
29. Not a real number
31. $-3\sqrt{5}$
33. $-3\sqrt{7}$
35. $7\sqrt{2}$
37. $9\sqrt{2}$
39. –11
41. $\frac{4\sqrt{2}}{7}$
43. $-\frac{\sqrt{5}}{2}$
45. $\frac{7\sqrt{3}}{10}$
47. $5\sqrt{3}$
49. $7\sqrt{5}$
51. $5\sqrt{7}$
53. $8-\sqrt{5}$
55. $\sqrt{2}$
57. $12\sqrt{7}$
59. $11\sqrt{3}-3\sqrt{6}$
61. $8\sqrt{2}-4\sqrt{3}$
63. $\sqrt{5}+7\sqrt{2}$
65. $14+6\sqrt{14}$
67. $10\sqrt{2}$
69. $30\sqrt{10}$
71. $\sqrt{6}-2\sqrt{3}$
73. 2
75. $44-39\sqrt{3}$
77. $38+12\sqrt{10}$
79. $6+\sqrt{30}-2\sqrt{3}-\sqrt{10}$
81. 58
83. $\frac{7\sqrt{5}}{5}$
85. $-5\sqrt{2}$
87. $4\sqrt{2}$
89. $\frac{5\sqrt{3}}{3}$
91. $\frac{2\sqrt{3}}{3}$
93. $\frac{3\sqrt{2}}{2}$
95. $-\frac{2\sqrt{5}}{3}$

Applications

97. **a.** 0.64 seconds
    b. 1.01 seconds
    c. 1.09 seconds
99. $\sqrt{3} \approx 1.73$ amperes
101. $50\sqrt{5} \approx 111.80$ volts
103. $5\sqrt{6}+\sqrt{170} \approx 25.29$ ft

Writing & Thinking

105. There is no real number that results in a negative number when squared.

5.6 Exercises

Concept Check

1. square root
3. always
5. two
7. True
9. False; there are two real solutions.

Practice

1. $x = \pm 11$
3. $x = \pm 6$
5. $x = \pm\sqrt{35}$
7. $x = \pm\sqrt{62}$
9. $x = \pm 3\sqrt{5}$
11. $x = \pm 3\sqrt{2}$
13. $x = \pm\frac{2}{3}$
15. $x = -1, 3$
17. no real solution
19. $x = -\frac{3}{2}, -\frac{1}{2}$
21. $x = \frac{7}{3}, \frac{11}{3}$
23. $x = 6 \pm 3\sqrt{2}$
25. $x = 7 \pm 2\sqrt{3}$
27. $x = \frac{-4 \pm 3\sqrt{3}}{3}$
29. $x = \frac{2 \pm 3\sqrt{7}}{5}$
31. no real solution
33. $x^2 - 3x - 2 = 0$; $a = 1, b = -3, c = -2$
35. $2x^2 - x + 6 = 0$; $a = 2, b = -1, c = 6$
37. $7x^2 - 4x - 3 = 0$; $a = 7, b = -4, c = -3$
39. $3x^2 - 9x - 4 = 0$; $a = 3, b = -9, c = -4$
41. $2x^2 - 5x - 3 = 0$; $a = 2, b = 5, c = -3$
43. $x = 2 \pm \sqrt{5}$
45. $x = -1, 4$
47. $x = -\frac{1}{2}, 1$
49. $x = -1, \frac{2}{5}$
51. $x = 0, \frac{1}{3}$
53. $x = \pm\sqrt{7}$
55. $x = -1, 0$
57. $x = -\frac{4}{3}, 0$
59. $x = \frac{-5 \pm \sqrt{65}}{4}$
61. $x = \frac{-6 \pm \sqrt{42}}{3}$
63. $x = \frac{1}{2}, -3$
65. $x = \frac{4 \pm \sqrt{22}}{3}$
67. $x = 1, \frac{3}{4}$
69. $x = -3, -\frac{1}{2}$
71. $x = \frac{7 \pm \sqrt{37}}{6}$
73. $x = -\frac{3}{2}, \frac{8}{5}$
75. $x = 4, -\frac{1}{3}$
77. $x = \frac{11 \pm \sqrt{41}}{8}$
79. $x = -\frac{3}{2}, -2$
81. $x = \pm\frac{4}{5}$
83. $x = \frac{8 \pm \sqrt{58}}{6}$
85. $x = \frac{7 \pm \sqrt{385}}{12}$

5.7 Exercises

Concept Check

1. variable, unknown
3. $c^2 = a^2 + b^2$
5. False: Only with right triangles

Applications

1. $x(x+8) = -16$; $x = -4$, so the numbers are –4 and 4.
3. $x^2 = 7x$; $x = 0, 7$
5. $x^2 + 3x = 28$; $x = 4$
7. $x(x+3) = 40$; $x = -8, 5$, so the numbers are –8 and –5 or 5 and 8.

9. $(x+5)^2 + x^2 = 53$; $x = 2$, so the numbers are 2 and 7.

11. $x + (x+4)^2 = 38$; $x = 2$, so the integers are 2 and 6.

13. $x(2x-5) = x + 56$; $x = -4$

15. $w(2w) = 72$; $w = 6$, so width is 6 in. and length is 12 in.

17. $w(4w) = 64$; $w = 4$, so width is 4 ft and length is 16 ft.

19. $l(l-4) = 45$; $l = 9$, so width is 5 ft and length is 9 ft.

21. $\frac{1}{2}b(b-4) = 16$; $b = 8$, so base is 8 ft and height is 4 ft.

23. $\frac{1}{2}(h+6)h = 20$; $h = 4$, so the base is 10 in.

25. $w(16-w) = 48$; $w = 4$, 12, so the rectangle is 4 in. by 12 in.

27. $w(2w-5) = 63$; $w = 7$, the rectangle is 7 m by 9 m

29. $(x+10)^2 = 9x^2$; $x = 5$, the side of the original square is 5 cm

31. $w^2 + (2w+2)^2 = 169$; $w = 5$, the rectangle is 5 m by 12 m

33. $r(r+13) = 140$; $r = 7$, so there are 7 trees in each row.

35. $r(r+7) = 144$; $r = 9$, so there are 9 rows.

37. $b(b-18) = 175$; $b = 25$, so there are 25 books on each shelf.

39. $2w + \frac{300}{w} = 50$; $w = 10$, 15, so width is 10 ft and length is 30 ft or width is 15 ft and length is 20 ft.

41. $h^2 + (h-34)^2 = (h+2)^2$; $h = 48$, so the height of the pole is 48 ft.

43. $x^2 + (x-49)^2 = (x+1)^2$; $x = 60$, so height is 60 ft.

45. $l^2 + (l-28)^2 = (l+8)^2$; $l = 60$, so the length of the mat is 60 inches.

47. $(w+12)(w+22) = 1344$; $w = 20$, the pool is 20 ft by 30 ft

49. $8(w)(3w+4) = 1590$; $w = 7.5$, the dimensions are length = 26.5 ft; width = 7.5 ft; height = 8 ft

51. $(9+2x)(12+2x) - (9)(12) = 162$; $x = 3$, the frame is 3 in. thick

53. $40I - 4I^2 = 100$; $I = 5$. It needs a current of 5 amperes

55. $x(40-x) = 336$; $x = 12$, 28; he must sell 12 signs

57. $\frac{900}{x} - 10 = \frac{900}{x+15}$; $x = 30$, there are 30 people in the club

59. 34.6 ft

Writing & Thinking

61. 128 in.^{2}; We can use the Pythagorean Theorem to find the length and the width (by finding the diagonals of the interior square) instead.

5.8 Exercises

Concept Check

1. slope, y-intercept

3. symmetry

5. minimum

7. False; the vertex is either the highest or lowest point on the parabola.

9. False; quadratic functions of the form $y = ax^2 + bx + c$, have a line of symmetry at $x = -\frac{b}{2a}$.

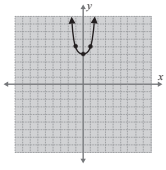
Practice

1. **a.** $(0,4)$

b. $x = 0$

c. none

d.

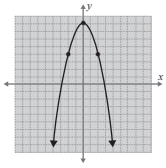


3. **a.** $(0,8)$

b. $x = 0$

c. $\left(2\sqrt{2},0\right), \left(-2\sqrt{2},0\right)$

d.

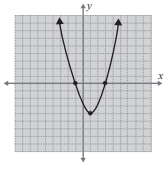


5. **a.** $(1,-4)$

b. $x = 1$

c. (–1, 0), (3,0)

d.

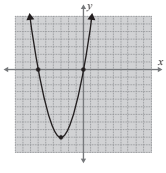


7. **a.** $(-3,-9)$

b. $x = -3$

c. (–6, 0), (0, 0)

d.

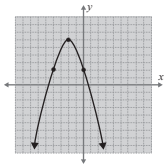


9. **a.** $(-2,6)$

b. $x = -2$

c. $\left(-2+\sqrt{6},0\right), \left(-2-\sqrt{6},0\right)$

d.

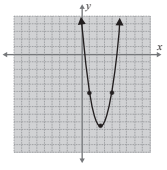


11. **a.** $\left(\frac{5}{2}, -\frac{19}{2}\right)$

b. $x = \frac{5}{2}$

c. $\left(\frac{5+\sqrt{19}}{2},0\right), \left(\frac{5-\sqrt{19}}{2},0\right)$

d.

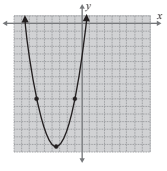


13. **a.** $\left(-\frac{7}{2}, -\frac{65}{4}\right)$

b. $x = -\frac{7}{2}$

c. $\left(\frac{-7+\sqrt{65}}{2},0\right), \left(\frac{-7-\sqrt{65}}{2},0\right)$

d.

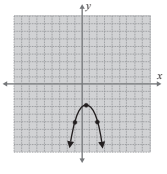


15. **a.** $\left(\frac{1}{2}, -\frac{11}{4}\right)$

b. $x = \frac{1}{2}$

c. none

d.

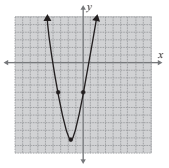


17. **a.** $\left(-\frac{7}{4}, -\frac{81}{8}\right)$

b. $x = -\frac{7}{4}$

c. $(-4,0), \left(\frac{1}{2},0\right)$

d.

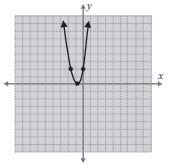


19. a. $\left(-\frac{5}{6},-\frac{1}{12}\right)$

b. $x=-\frac{5}{6}$

c. $\left(-\frac{2}{3},0\right),(-1,0)$

d.

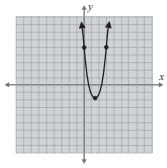


20. a. $\left(\frac{3}{2},-\frac{7}{4}\right)$

b. $x=\frac{3}{2}$

c. $\left(\frac{9+\sqrt{21}}{6},0\right)$, $\left(\frac{9-\sqrt{21}}{6},0\right)$

d.



Applications

21. $A=x(30-x)$; $x=15$, so the dimensions of the rectangle are 15 yd by 15 yd

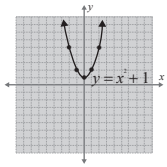
23. a. 3.5 sec **b.** 196 ft

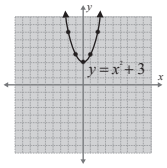
25. a. 4 sec **b.** 288 ft

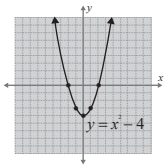
27. a. $R(x)=x(40-x)$ **b.** \$20

29. a. $R(x)=x(80-2x)$ **b.** \$20 **c.** \$800

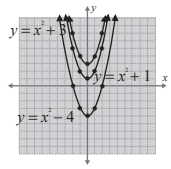
31. a.





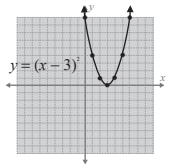


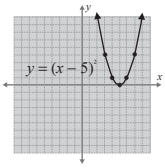
b.

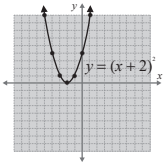


32. Changing k shifts the graph vertically.

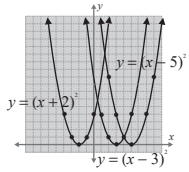
33. a.







b.



34. Changing h will shift the graph horizontally.

35. The graph $y=(x-h)^2+k$ is the graph $y=x^2$ shifted k units vertically and h units horizontally.

Chapter 6: Geometric Pathways: Measurement & Geometry

6.1 Exercises

Concept Check

1. pint, 16

3. yard

5. converted

7. True

9. True

Practice

1. 12

3. 1

5. 1

7. 5280

9. 1

11. 8

13. 36

15. 300

17. 2

19. 21

21. 2

23. 1.5

25. $\frac{3\text{ ft}}{1\text{ yd}}$; 21

27. $\frac{1\text{ qt}}{2\text{ pt}}$; 3

29. $\frac{1\text{ gal}}{4\text{ qt}}$; 3.25

31. $\frac{1\text{ ft}}{12\text{ in.}}$; 1.5

33. $\frac{5280\text{ ft}}{1\text{ mi}}$; 15,840

35. $\frac{1\text{ mi}}{5280\text{ ft}}$; 1.5

37. 8

39. 32,000

41. 4

43. 88

45. 1.5

47. 150

Applications

49. $\frac{7}{8}$ or 0.875 square feet

51. \$93.22

53. $\frac{1}{2}$ or 0.5 miles

55. 15 miles per hour

57. The small bag; \$0.005¢

Writing & Thinking

59. Colby would need to know that there are 3 feet in a yard and 5280 feet in a mile.

61. A unit fraction is a fraction with different units that is equivalent to 1. It can be used to convert between units. When used, the numerator should contain the same units as the desired outcome and the denominator should have the same unit as the unit being converted.

6.2 Exercises

Concept Check

1. threes

3. meter

5. multiply

7. True

Practice

Answers for 1-10 will vary

11. Meters

13. Meters

15. Millimeters

17. 300

19. 80

21. 1500

23. 3.6

25. 0.82

27. 0.0525
29. 0.75
31. 0.245 m
33. 0.23 m
35. 10 km
37. 200 m
39. 0.00679 km
41. 150.3
43. 30 000 000
45. 960
47. 5
49. 500 000
51. 1300; 130 000
53. 115 000; 11 500 000
55. 400; 40 000
57. 670
59. 20 000
61. 575 ha
63. 956; 95 600
65. 0.0625; 0.000625

Applications

67. 3.2 cm^2
69. 50 mm
71. 44 000 square meters
73. 6 gigahertz
75. 500 gigabytes
77. 75 hectares
79. 70,000 square meters

Writing & Thinking

81. Converting among the U.S. customary systems requires knowledge of the equivalencies and there is no consistency among them so they must be memorized. Within the metric system, typically all that is required for conversions is to simply move the decimal point the desired number of places according to the prefixes.

83. Each category of metric units has a base unit. The prefixes determine how many or what fraction of the base unit is being used. For example, the basic unit of length is meter and a millimeter is 1/1000 of a meter, a centimeter is 1/100 of a meter, and a kilometer is 1000 meters.

6.3 Exercises

Concept Check

1. cubic
3. weight
5. kilogram
7. False; Volume is measured in cubic units.
9. False; A metric ton and a US customary ton are not equal (a metric weighs about 2200 US pounds).

Practice

1. Milliliters
3. Liters
5. Milliliters
7. 2000
9. 0.019
11. 13 000
13. 0.5
15. 6300
17. 0.0764
19. 0.95
21. 1250
23. 5300 mL
25. Kilograms
27. Grams
29. Milligrams
31. 2000
33. 7580
35. 540
37. 2
39. 0.0345
41. 0.091
43. 4 600 000
45. 2.963
47. 5000 kg
49. 96 000 mg
51. 75 kg
53. 0.016 g **55.** 0.000 34 kg
57. 7 000 000 g
59. m
61. L
63. km
65. L
67. g

Applications

69. 60 doses
71. Yes. The total amount of solution to be disposed is 3.7 L.
73. 60 000 000 000 grains

Writing & Thinking

75. You could change to milliliters by multiplying by 1000 or by using a unit fraction where the numerator is 1000 mL and the denominator is the given measure in liters.
77. You would probably use kilograms because a gram is approximately the weight of a paperclip and a kilogram is about 2.2 pounds.

6.4 Exercises

Concept Check

1. Fahrenheit
3. 2.54
5. 0.946
7. False; Water freezes at 32 degrees Fahrenheit.
9. False; A 5k (km) run is shorter than a 5 mile run.

Practice

1. 77
3. 50
5. 45
7. 122
9. 0 °C
11. 59 °F
13. 2.74
15. 11.99
17. 83.82
19. 27.88
21. 32.19
23. 2.74 m
25. 96.6 km
27. 124.22 mi
29. 19.69 in.
31. 35.56 cm
33. 19.35
35. 55.74
37. 83.61
39. 405
41. 741.32 acres
43. 53.82 ft^2
45. 4.65 $in.^2$
47. 3.79
49. 1.06
51. 9.46
53. 78
55. 11.10
57. 10.57 qt
59. 189.25 L
61. 72.75
63. 992.23
65. 4.56
67. 3.53
69. 453.59 g
71. 264.55 lb

Applications

73. 177 °C
75. 9.7 miles per hour
77. 226.3 km
79. 3035.14 m^2
81. **a.** 11 145.6 cm^2
b. 1.116 m^2
83. 7 cans
85. Answers will vary.
Small: 5.4 ounces;
Medium: 10.8 ounces or 10.9 ounces;
Large: 1 pound 5 ounces or (21 ounces)

Writing & Thinking

87. One meter is equivalent to 1.09 yards so they are close in length.

89. Because conversions between the metric system and the US system require rounding, it is possible that two answers could be right although they might be slightly different. If Kai used the US to Metric equivalent and Kristen used the Metric to US equivalent, they would both have a correct answer but their answers will be slightly different answers because they used different approximations.

6.5 Exercises

Concept Check

1. line

3. acute

5. supplementary

7. True

9. True

Practice

1. 35°

3. 80°

5. Acute

7. Obtuse

9. Acute

11. **a.** Obtuse **b.** Acute **c.** Right

13. **a.** 180° **b.** 90° **c.** 30° **d.** 150°

15. **a.** 135° **b.** 90° **c.** 70° **d.** 45°

17. **a.** 150°

b. Yes; $\angle 2$ and $\angle 3$ are supplementary.

c. $\angle 1$ and $\angle 3$; $\angle 2$ and $\angle 4$

d. $\angle 1$ and $\angle 2$; $\angle 2$ and $\angle 3$; $\angle 3$ and $\angle 4$; $\angle 1$ and $\angle 4$

19. $m\angle 2 = 138°$; $m\angle 3 = 42°$ $m\angle 4 = 138°$

21. **a.** $m\angle 2 = 70°$; $m\angle 3 = 90°$; $m\angle 4 = 20°$; $m\angle 5 = 70°$

b. $\angle 3$

c. $\angle 2$ and $\angle 5$

23. **a.** 125°; $\angle 1$ and $\angle 3$ are vertical angles.

b. 55°; $\angle 8$ and $\angle 6$ are vertical angles.

c. $m\angle 7 = 125°$; $\angle 6$ and $\angle 7$ are supplementary angles.

d. Yes; $\angle 2$ and $\angle 6$ are corresponding angles.

Writing & Thinking

25. A ray is similar to a line in that it has at least one end that continues infinitely. An angle is formed by two rays that have a common endpoint, called a vertex. A line has no endpoint and continues indefinitely in opposite directions in the same plane.

27. **a.** A right angle

b. An acute angle

c. An obtuse angle

6.6 Exercises

Concept Check

1. line segment

3. corresponding

5. shape, size

7. False; a isosceles triangle has at least two sides of equal length.

9. False; in similar triangles, the lengths of coreesponding sides are proportional.

Practice

1. Scalene

3. Right

5. Isosceles

7. Acute

9. Yes, since $25 < 12 + 15$.

11. **a.** $m\angle Z = 80°$

b. Acute

c. $\overline{YZ}$

d. $\overline{XZ}$ and $\overline{XY}$

e. No, no angle is 90°

13. The triangles are not similar. The corresponding sides are not proportional.

15. $\Delta PQR \sim \Delta SUT$. All pairs of corresponding sides are proportional to the ratio 1:2.

17. $\Delta ABC \sim \Delta EDC$. The corresponding angles have the same measure.

19. $x = 3$; $y = 3$

21. $x = 7$; $y = 5$

23. $x = 2.5$; $y = 2$

25. $x = 8$; $y = 2$

27. Congruent by ASA

29. Congruent by ASA

31. Congruent by SAS

33. Not congruent

35. Yes, $21^2 + 20^2 = 29^2$

37. No, $11^2 + 6^2 \neq 14^2$

39. No, $2^2 + 3^2 \neq 4^2$

41. $c = 4.24$

43. $c = 10.77$

45. $c = 5.66$ cm

47. $c = 20$ mm

Applications

49. 0.1 in.

51. 1 ft

53. 160 ft

55. 2.24 miles

57. 58.31 ft

59. 44.9 inches

61. 14.2 km

Writing & Thinking

63.

m	n	$a = 2nm$	$b = m^2 - n^2$	$c = m^2 + n^2$	Pythagorean Triple?
5	1	10	24	26	Yes: $10^2 + 24^2 = 26^2$
7	1	14	48	50	Yes: $14^2 + 48^2 = 50^2$
3	2	12	5	13	Yes: $12^2 + 5^2 = 13^2$
7	2	28	45	53	Yes: $28^2 + 45^2 = 53^2$
5	3	30	16	34	Yes: $30^2 + 16^2 = 34^2$
11	3	66	112	130	Yes: $66^2 + 112^2 = 130^2$
13	7	182	120	218	Yes: $182^2 + 120^2 = 218^2$

6.7 Exercises

Concept Check

1. polygon

3. circumference

5. area

7. **a.** True

b. False; not all rectangles have four equal sides.

9. True

Practice

1. 44 cm

3. 116 cm

5. 18 km

7. 143 in.

9. 48.1 yd

11. 3.14 m

13. 40 cm

15. 34 cm

17. 200 yd

19. 35 ft

21. 43 cm

23. 40 ft

25. 50 in.

27. 25.12 m

29. 35.98 in.

31. 21.42 m

33. 19.42 cm

35. 81 ft^2

37. 525 km^2

39. 27.37 ft^2

41. $\frac{5}{27}$ in.^{2}

43. 165 cm^2

45. 1.76625 ft^2

47. 48 in.^{2}

49. 162 yd^2

51. 25 yd^2

53. 48 cm^2

55. 160 in.^{2}

57. 75.3914 m^2

59. 60 in.^{2}

61. 9.72 yd^2

63. 52.56 km^2

65. 67.5 cm^2

67. 86 yd^2

Applications

69. 96 in.; Stop signs

71. **a.** 4180 ft **b.** 4180 ft

c. They are identical.

73. 27 feet

75. 204 square feet

77. **a.** 30 ft^2

b. 30 ft

79. **a.** 75 cm

b. 336 cm^2

81. 108 square inches

83. approximately 2.4 gallons

Writing & Thinking

85. The area of the interior triangle is equal to half of the area of the rectangle no matter where the point is chosen.

6.8 Exercises

Concept Check

1. volume

3. surface area

5. right circular cylinder

7. True

9. True

11. **a.** C **b.** E **c.** D **d.** B **e.** A

Practice

1. 70 in.^{3}

3. 381.51 cm^3

5. 12.56 mm^3

7. 60 in.^{3}

9. 14.13 ft^3

11. 401.92 m^3

13. 376.8 ft^3

15. 2289.06 cm^3

17. 224 cm^3

19. 113.04 in.^{3}

21. 9106 dm^3

23. 56.52 ft^3

25. 1017.36 mm^2

27. 122 in.^{2}

29. 226.08 m^2

31. $V = 70$ in.^{3}; $V = 1147.09$ cm^3

33. $V = 12.56$ dm^3; $V = 0.012\,56$ m^3

Applications

35. 2,596,902 m^3

37. 10.39 in.^{3}

39. 800 ft^3

41. 13 cm

43. **a.** 3.375 ft^3 **b.** 13.5 ft^2

45. 1536 square inches

Writing & Thinking

47. Volume is measured in cubic units. Volume takes up a three-dimensional space and the units can be thought of as small cubes which leads to the concept of cubic units.

49. Volume is more important because it determines how many packages or what sized packages the driver can fit into the truck. Three-dimensional space (volume) is more important for this job.

6.9 Answers

Concept Check

1. 0°, 90°

3. Six

5. acute

7. True

9. False; if θ is an acute angle of a right triangle, then $\cos\theta = \frac{adj}{hyp} = \frac{12}{13}$

Practice

1. **a.** The side labeled as 3 is opposite angle θ.

b. The side labeled as 4 is adjacent to angle θ.

c. $\tan\theta = \frac{opp}{adj} = \frac{5}{12}$

$\cos\theta = \frac{4}{5}$, $\tan\theta = \frac{3}{4}$

3. **a.** The side labeled as 6 is opposite angle θ.

b. The side labeled as 8 is adjacent to angle θ.

c. $\tan\theta = \frac{opp}{adj} = \frac{7}{12}$

$\cos\theta = \frac{8}{10} = \frac{4}{5}$,

$\tan\theta = \frac{6}{8} = \frac{3}{4}$

5. 0.768

7. 0.910

9. 0.587

11. 54.0°

13. 43.6°

15. $a = 10.9$, $b = 13.0$

17. $a = 2.1$, $b = 10.2$

Applications

19. **a.** 22.6°

b. 67.4°

c. 24 ft

b. 56.3°

21. 31.0°

23. $x = \frac{2}{\tan(4.8^\circ)} \approx 23.8$ feet

25. $x = 100 \cdot \tan(30°) \approx 57.7$ feet

27. $\frac{4.3}{7.8} \approx 0.55$, So $\theta = \tan^{-1}(1.5) \approx 56.31°$.

29. $\cos(x) = \frac{240{,}000}{93{,}000{,}000} \approx 0.002581$, so $x = \cos^{-1}(0.002581) \approx 89.85°$

31. Recall that the cosine of an angle is given by $\cos(x) = \frac{A}{H}$, so if we could have a cosine with a value of 2, we would get that $2H = A$, that is, the adjacent side to the angle would have to be twice as long as the hypotenuse. But this can't happen as the hypotenuse is the longest side of a right triangle.

33. For any positive number x, it is always possible to choose legs that have a ratio equal to x.

Chapter 7: Pathways to Personal Finance

7.1 Exercises

Concept Check

1. two; right
3. discount; sale
5. commission
7. False; to change a decimal number to a percent, move the decimal point two places to the right and add the % sign.
9. True

Practice

1. 2%
3. 10%
5. 36%
7. 12.8%
9. 112%
11. 200%
13. 0.02
15. 0.18
17. 0.6
19. 1.25
21. 0.173
23. 0.0026
25. 7%
27. 50%
29. 55%
31. 12.5% or $12\frac{1}{2}\%$
33. 125%
35. 206.7% or $206\frac{2}{3}\%$
37. $\frac{1}{25}$
39. $\frac{1}{4}$
41. 3
43. $\frac{3}{400}$
45. $\frac{1}{200}$
47. $\frac{1}{8}$
49. 7
51. 9
53. 42
55. 150
57. 20%
59. 150
61. 50
63. 36
65. 33.3%
67. 41
69. 180%
71. 614
73. 38
75. 80
77. 200%

Applications

79. **a.** \$82.50 **b.** \$192.50
81. \$16.88; \$5.63
83. \$61.25
85. **a.** \$1.81 **b.** \$32.01
87. \$8.12
89. \$875
91. \$28,000
93. \$770
95. 5.9%
97. 100.3%
99. 1.0%
101. 49.3%
103. **a.** \$50 **b.** 20%
c. $16\frac{2}{3}\%$ or $16.\overline{6}\%$
105. **a.** \$500 **b.** 25% **c.** 20%

Writing & Thinking

107. Sales tax and tips are percentages of some item or service. The percent is the rate, while the cost of the item being purchased is the base. The amount is then the sales tax itself, which is being compared to the base. A sales tax might be 8%, as in "what is 8% of the cost of the item purchased?"
109. For both types of percent of profit, the profit (the difference between selling price and cost) must be determined first. The profit is then used as a numerator. In profit based on cost, the denominator is the cost. In profit based on selling price, the selling price is the denominator. The fraction is then divided and the result is a percent of profit, either based on cost or selling price.

7.2 Exercises

Concept Check

1. interest
3. simple
5. quarterly
7. True
9. False; Compound interest is earned on the principal and interest earned.

Applications

1. \$30
3. \$32
5. \$200
7. \$100
9. \$37.50
11. \$2500
13. \$3000
15. 1 year
17. 72 days
19. \$9
21. \$3.33
23. 10%
24. \$520
25. \$1030
27. \$730
29. \$337,500
31. **a.** \$1000
b. 9 months or $\frac{3}{4}$ year
33. \$1030
35. 240 days or $\frac{2}{3}$ year
37. **a.** \$16 **b.** \$100
c. 30 days or $\frac{1}{12}$ year
d. 8.5%
39. **a.** \$100 **b.** \$2100, \$105
c. \$2205, \$110.25
d. \$315.25
41. **a.** \$30
b. \$9030, \$30.10
c. \$9060.10, \$30.20
d. \$9090.30, \$30.30
e. \$120.60
f. \$9120.60
43. \$509.58
45. \$9090.30
47. \$189.24
49. **a.** \$1051.56 **b.** \$51.56
51. **a.** \$28,051.03
b. \$329.40
53. **a.** \$634.13 **b.** No
c. Monthly compounding allows interest earned the previous month to gain interest the following month, but semiannual compounding waits six months for this process to begin.
55. **a.** \$1493.42 **b.** \$93.42
57. **a.** \$67,952.39 **b.** More
c. \$184,675.81
59. **a.** \$1645.31 **b.** 645.31
61. **a.** \$10,560.33
b. \$5560.33
63. **a.** \$275,470.73
b. \$250,470.73
65. Milk: \$4.01; Bread: \$3.35
67. \$12,665.57
69. 11.4%
71. \$8541.94

Writing & Thinking

73. The simple interest formula is $I = P \cdot r \cdot t$ where I is interest, P is principal, r is rate, and t is time. Interest is the amount of money paid for the use of money. The principal is the starting amount invested. Rate is the interest rate and should be written as a decimal or fraction. Time is the amount of time, in years, that interest is being earned on the principal. Time can be written as a decimal or fraction. When a decimal is used, it should only be when it is a terminating decimal so that no rounding is required, which could change the value calculated.

75. Answers will vary.

a. $13,498.03

b. About 7 years.

Collaborative Learning

77. a.

Monthly Income	4%	6%	8%
$2000	$2433.31	$2676.45	$2938.66
$2500	$3041.63	$3345.56	$3673.32
$4000	$4866.61	$5352.90	$5877.31

b. Answers will vary. The total increase in income after 5 years is similar for the lower income with an 8% yearly pay raise and the higher income with the 4% yearly pay raise.

c. Answers will vary.

7.3 Exercises

Concept Check

1. Purchase price

3. fixed installment

5. Principal

7. False; the down payment is the amount the buyer pays upfront to purchase a car.

9. True

Practice

1. Down payment: $1845; Amount financed: $16,605

3. Down payment: $3690; Amount financed: $20,910

5. Down payment: $5450; Amount financed: $21,800

7. $456.33

9. $337.34

11. $349.56

13. $1569.92

15. $1351.64

17. $4143.92

19. 6.5%

21. 7%

23. 5%

Applications

25. $567.93 per month

27. $535.94 per month; Yes, this will fit into Stephen's budget

29. 8%

31. **a.** $362.46 **b.** $1503.08

33. Down payment: $6225; Amount financed: $18,675

7.4 Exercises

Concept Check

1. Purchase price

3. principal, interest

5. closing costs

7. False; private mortgage insurance is required on mortgages with less than a 20% down payment.

9. True

Practice

1. down payment: $24,000; amount financed: $136,000

3. down payment: $39,000; amount financed: $156,000

5. down payment: $77,180; amount financed: $308,720

7. $785.36

9. $1316.49

11. $1908.73

13.

Payment Number	Interest Payment	Principal Payment	Mortgage Balance
1	$666.67	$288.16	$199,711.84
2	$665.71	$289.12	$199,422.72
3	$664.74	$290.09	$199,132.63

15.

Payment Number	Interest Payment	Principal Payment	Mortgage Balance
1	$937.50	$329.21	$249,670.79
2	$936.27	$330.44	$249,340.35
3	$935.03	$331.68	$249,008.67

Applications

17. **a.** $104,000 **b.** $29,980

19. **a.** $838.76 **b.** $1109.59

21. **a.** $1490.01

b. This will not fit into the $1440 per month budget.

23. **a.** $1441.83 per month; total finance cost: $519,058.80

b. 2 points: $5528; $1359.72 per month; total finance cost: $489,499.20 + $5528 = $495,027.20

c. Paying points for a lower interest rate can save approximately $24,000, so this is a good option if you can afford to add it to the closing costs.

Chapter 8: Pathways to Critical Thinking: Sets and Logic

8.1 Answers

Concept Check

1. set

3. Set-builder notation

5. subset

7. False; the three ways to write sets are word descriptions, set-builder notation, and roster notation.

9. False; a set cannot be considered a proper subset of itself.

Practice

1. The set of months of the year.

3. The set of positive even numbers less than or equal to 10.

5. The set of books written by J.R.R. Tolkien.

7. $\{\text{February}\}$

9. $\{\text{Mercury, Mars}\}$

11. $\{5, 6, 7, 8\}$

13. $\{x \mid x \text{ is a season of the year}\}$

15. $\{x \mid x \text{ is a letter in the word "July"}\}$

17. $\{x \mid x \text{ is a natural number less than } 6\}$

19. $\in$

21. $\notin$

23. Empty

25. Empty

27. $2^3 - 1 = 7$

29. $2^2 - 1 = 3$

31. $\varnothing, \{\text{Jack}\}, \{\text{Jill}\}, \{\text{Jack, Jill}\}$

33. $\varnothing$

35. $\subset, \subseteq$

37. $\subseteq$

Applications

39. $\{\text{Communications, Education, Business}\}$

41. $\{\text{English, Business, Education}\}$

43. $\{\text{Business, Education}\}$

45. $\{\text{Monday, Wednesday, Friday}\}$

47. $\{\text{Monday, Wednesday, Friday}\}$

Writing and Thinking

49. No. The set $\{\varnothing\}$ contains one element, the empty set. The symbol $\varnothing$ represents the empty set, which has no elements.

8.2 Answers

Concept Check

1. universal set

3. disjoint

5. union

7. True

9. False; a set and its complement have no elements in common

Practice

1. {2, 4}

3. {5, 6, 7, 8, 9, 10}

5. {6, 8, 10}

7. $\varnothing$

9. {1,3,5}

11. {13}

13. {15, 16, 17, 18}

15. {16, 17}

17. $\varnothing$

19. {15, 18}

21. {3, 5, 7, 11, 13, 17, 19}

23. {1, 4, 6, 8, 9, 10, 12, 14, 15, 16, 18, 20}

25. {1, 9, 15}

27. $\varnothing$

29. {4, 6, 8, 10, 12, 14, 16, 18, 20}

31. {Maine, Vermont, New Hampshire, Massachusetts, Connecticut, Rhode Island}

33. {Vermont, New Hampshire, Maine}

35. {Maine}

37. {Massachusetts, Connecticut, Rhode Island}

39. {Ann, David}

41. {Ben, Emily, Frank, George}

43. {Frank, George}

45. {Carol, Frank, George, Harry, Ian, Joe}

47. {Ben, Carol, Emily, Frank, George, Harry, Ian, Joe}

49. $\varnothing$

51. {Lily, Peter, Steve, Tyler}

53. {Neil, Quincy}

55. {Neil, Oliver, Quincy, Robert}

56. {Kathy, Lily, Michael, Neil, Oliver, Peter, Quincy, Robert, Steve, Tyler}

Writing and Thinking

57. {cookies}

8.3 Exercises

Concept Check

1. Inductive Reasoning

3. counterexample

5. Inductive Reasoning

7. True

9. False; it is an example of inductive reasoning

Practice

1. 9 has factors 1, 3, 9; therefore, it is not prime

3. The word "Tuesday" contains 3 vowels: *u*, *e*, *a*

5. May only has 3 letters

7. $10 \div 5 = 2$, so it is divisible by 5

9. Alaska and Hawaii do not touch another state in the United States

11. Whole numbers are positive, so any negative integer such as -1, -2, or -3 is not a whole number.

13. Earth and Uranus both start with vowels

15. Pattern is adding 5; next entry is 23

17. Pattern is subtracting 2; next entry is 4

19. Pattern is adding 1, then adding 2, then adding 3, etc.; next entry is 17

21. Pattern is dividing by 5; next entry is

23. Pattern is every third letter of the alphabet; next entry is *y*

25. Pattern is to move the first letter of the letter sequence to the end; the next entry is eabcd

27. Pattern is the days of the week, in order; next entry is Thursday

29. In each figure, the circles move one region in a counterclockwise direction and increase by four circles with each movement.

31. In each figure, the minute hand is shifted clockwise by 15 minutes.

33. In each figure, the number of filled circles increases by two and the first filled circle is shifted by one position to the right.

35. New York has a capital city.

37. Harry must attend mandatory study halls every weekday night.

39. Today is 2-for-1 burger nights at Bobby's Burger Joint.

41. Today is December 25.

43. Neil's Christmas present has a red bow.

45. Deductive

47. Inductive

49. Inductive

51. Inductive

53. Deductive

Writing & Thinking

55. 37, 111, 333

8.4 Answers

Concept Check

1. Statement

3. Quantifier

5. negation

7. True

9. True

Practice

1. Not a statement; it is an opinion and therefore can be both true and false depending on who you ask.

3. Statement

5. Statement

7. A penny is not a coin.

9. The course was not easy.

11. There are not 100 pennies in a dollar.

13. I like math.

15. I will receive change.

17. $\sim p$: You are finished eating dinner.

19. $\sim p$: You will cook dinner.

21. $\sim p$: You did not think the course was easy.

23. p: The soup is hot.

25. p: Avocados are green.

27. p: The number is not prime.

29. Quantified statement; some

31. Quantified statement; all

33. Quantified statement; at least one

35. Not all even numbers are divisible by two.

37. All of the animals are restless.

39. None of the art is for sale.

41. Some of the sodas are not cold.

Writing & Thinking

43. Because an opinion is not exact and can change from person to person. Therefore, you cannot determine whether the statement is universally true or false.

8.5 Exercises

Concept Check

1. logical connectives

3. conjunction, and

5. conditional statement

7. False; this is an example of a conditional statement.

9. True

Practice

1. Simple

3. Compound

5. Simple

7. You are finished eating dinner and you didn't cook dinner.

9. Your stomach is not full and you are finished eating dinner and you didn't cook dinner.

11. Your stomach is full and you cooked dinner and you aren't finished eating dinner.

13. p: jets are flying east; p: ships are going south; $p \wedge \sim q$

15. p: shows are funny; q: movies are free; $\sim p \wedge \sim q$

17. p: I like to swim; q: I like jumping rope; $p \wedge \sim q$

19. Hills are not steep or lakes are not deep.

21. Bears are not big or hills are not steep.

23. Bears are big or lakes are deep.

25. p: I will go to the museum; q: I will go to the zoo; $\sim p \vee \sim q$

27. p: The winter is cold; q: the winter is rainy; $p \vee \sim q$

29. If the earth is white, then the sky is dark.

31. If the night has come, then the wind is blowing.

33. If the snow is falling, then the earth is white.

35. p: We will go to the beach; q: Liam finishes his work on time; $q \Rightarrow p$

37. p: A storm begins; q: Jane is afraid to leave the house; $p \Rightarrow q$

39. p: Mary skips her classes; q: I want to help Mary prepare for the tests; $\sim q$: I don't want to help Mary prepare for the tests; $p \Rightarrow \sim q$

41. Zoe will buy a house if and only if the house has a backyard.

43. James will buy a car if and only if the house is in the countryside.

45. Zoe will buy a house if and only if James will buy a car.

47. $t \Leftrightarrow \sim p$

49. $\sim w \Leftrightarrow l$

51. p: The workers will receive a bonus; q: The workers finish their work ahead of time; $p \Leftrightarrow q$

53. p: Dominic will get this job; q: Neil comes to compete with Dominic; $\sim q$: Neil does not come to compete with Dominic; $p \Leftrightarrow \sim q$

55. p: Matthew will get to work on time; q: Matthew is late for the train; $\sim q$: Matthew is not late for the train; $p \Leftrightarrow \sim q$

57. A conditional statement only goes one direction while a biconditional statement goes both ways. The conditional statement is written: $p \Rightarrow q$. While the biconditional statement is written $p \Leftrightarrow q$ which means two things: $p \Rightarrow q$ and $q \Rightarrow p$.

8.6 Exercsies

Concept Check

1. compound statement

3. rows

4. columns

5. true

7. True

9. True

Practice

1. p: He went to the store.

p	$\sim p$
T	F
F	T

3. p: The teacher said this test isn't hard.

p	$\sim p$
T	F
F	T

5. p: She did not want her favorite team to lose.

p	$\sim p$
T	F
F	T

7. p: My dog is asleep; q: I hear him snoring; $p \wedge q$

p	q	$p \wedge q$
T	T	T
T	F	F
F	T	F
F	F	F

9. p: It is raining; q: He wants to go outside; $p \wedge \sim q$

p	q	$\sim q$	$p \wedge \sim q$
T	T	F	F
T	F	T	T
F	T	F	F
F	F	T	F

11. p: The sky is blue; q: There are clouds; $p \vee q$

p	q	$p \vee q$
T	T	T
T	F	T
F	T	T
F	F	F

13. p: He has children; $p \vee \sim p$

p	$\sim p$	$p \vee \sim p$
T	F	T
F	T	T

15. p: He played baseball; q: She played softball; $p \vee \sim q$

p	q	$\sim q$	$p \vee \sim q$
T	T	F	T
T	F	T	T
F	T	F	F
F	F	T	T

17. p: Her son studies hard; q: She will make him cookies; $p \Rightarrow q$

p	q	$p \Rightarrow q$
T	T	T
T	F	F
F	T	T
F	F	T

19. p: I read Stephen King; q: I can sleep at night; $p \Rightarrow \sim q$

p	q	$\sim q$	$p \Rightarrow \sim q$
T	T	F	F
T	F	T	T
F	T	F	T
F	F	T	T

21. p: It rains; q: I washed my car; $\sim p \Rightarrow \sim q$

p	q	$\sim p$	$\sim q$	$\sim p \Rightarrow \sim q$
T	T	F	F	T
T	F	F	T	T
F	T	T	F	F
F	F	T	T	T

23. p: My dog is awake; q: I hear him snoring; $(\sim p \wedge q) \vee p$

p	q	$\sim p$	$\sim p \wedge q$	$(\sim p \wedge q) \vee p$
T	T	F	F	T
T	F	F	F	T
F	T	T	T	T
F	F	T	F	F

25. p: It is raining; q: I have an umbrella; r: I will get wet; $(p \wedge q) \Rightarrow \sim r$

p	q	r	$\sim r$	$p \wedge q$	$(p \wedge q) \Rightarrow r$
T	T	T	F	T	F
T	T	F	T	T	T
T	F	T	F	F	T
T	F	F	T	F	T
F	T	T	F	F	T
F	T	F	T	F	T
F	F	T	F	F	T
F	F	F	T	F	T

27. Answers will vary. A possible answer is "I have a dog or I don't have a dog."

Chapter 9: Statistical Pathways: Introduction to Probability

9.1 Answers

Concept Check

1. trial

3. outcomes, trials

5. outcomes, sample space

7. False; the possible outcomes are a head or a tail.

9. True

Practice

1. The conditions are met.

3. The conditions are not met; the outcome is certain.

5. The conditions are met.

7. The conditions are not met; the outcome is certain.

9. **a.** $\frac{6}{11} \approx 0.545$

b. $\frac{5}{11} \approx 0.455$

11. **a.** $\frac{1}{10} = 0.1$

b. $\frac{9}{10} = 0.9$

13. $\frac{2}{3} \approx 0.667$

15. $\frac{19}{30} \approx 0.633$

17. $\frac{39}{70} \approx 0.557$

19. **a.** $\frac{73}{200} = 0.365$

b. $\frac{443}{500} = 0.886$

21.

Outcome	Empirical Probability
Tails	$\frac{89}{182} \approx 0.489$
Heads	$\frac{93}{182} \approx 0.511$

23.

Outcome	Empirical Probability
1	$\frac{49}{200} = 0.245$
2	$\frac{21}{80} \approx 0.263$
3	$\frac{107}{400} \approx 0.268$
4	$\frac{9}{40} = 0.225$

25. $\frac{1}{4} = 0.25$

27. **a.** $\frac{5}{9} \approx 0.5556$

b. $\frac{4}{9} \approx 0.4444$

29. $\frac{1}{8} = 0.125$

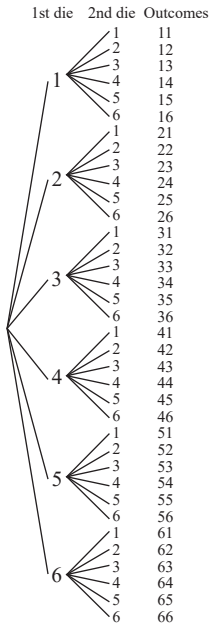
31. $\frac{1}{12} \approx 0.0833$

33. $\frac{3}{400} = 0.0075$

35. **a.** $\frac{3}{8} = 0.375$

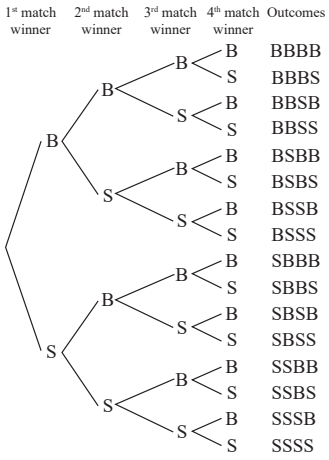
b. $\frac{5}{16} = 0.3125$

37. **a.**



b. $\frac{5}{6} \approx 0.833$

39. a.



b. $\frac{5}{16} = 0.3125$

41. a.

b.

Writing & Thinking

43. Answers will vary but may include tossing a coin, rolling a die, choosing a card, or picking a ball from a bag.

45. We are given that the coin is fair, so the classical, or actual, probabilities of observing a head and observing a tail are equal. The empirical probabilities of 0.51 and 0.49 that we get from the experiment do not have to be the same as the actual probabilities.

9.2 Exercises

Concept Check

1. occur

3. intersection

5. complement

7. False; they are not mutually exclusive.

9. True

Practice

1. Yes

3. No

5. Yes

7. Yes

9. Yes

11. Yes

13. $\frac{2}{3} \approx 0.6667$

15. $\frac{5}{6} \approx 0.8333$

17. $\frac{3}{5} = 0.6$

19. $\frac{3}{4} = 0.75$

21. $\frac{5}{6} \approx 0.8333$

23. $\frac{3}{4} = 0.75$

25. $\frac{2}{5} = 0.4$

27. $\frac{19}{20} = 0.95$

29. $\frac{7}{10} = 0.7$

31. $\frac{11}{100} = 0.11$

33. $\frac{199}{200} = 0.995$

35. a. $\frac{1}{10} = 0.1$

b. $\frac{9}{10} = 0.9$

c. 1 : 9

37. a. $\frac{3}{250} = 0.012$

b. $\frac{247}{250} = 0.988$

c. 247 : 3

39. a. $\frac{249}{250} = 0.996$

b. $\frac{1}{250} = 0.004$

c. 249 : 1

41. $\frac{1}{4} = 0.25$

43. $\frac{5}{7} \approx 0.7143$

45. $\frac{2}{9} \approx 0.2222$

47. $\frac{12}{25} = 0.48$

Writing & Thinking

49. The events are mutually exclusive if they have no common outcomes. The events are non-mutually exclusive if they have common outcomes.

9.3 Exercises

Concept Check

1. conditional

3. given

5. product

7. False; the probability of an event B, given that event A has occurred is usually not equal to the probability of an event A, given that event B has occurred.

9. False; the probability that mutually independent events occur at the same time is the product of their probabilities.

Practice

1. $\frac{13}{18} \approx 0.7222$

3. $\frac{12}{13} \approx 0.9231$

5. $\frac{21}{59} \approx 0.3559$

7. $\frac{77}{120} \approx 0.6417$

9. $\frac{3}{82} \approx 0.0366$

11. $\frac{73}{76} \approx 0.9605$

13. a. $\frac{3}{4} = 0.75$

b. $\frac{3}{11} \approx 0.2727$

15. a. $\frac{3}{17} \approx 0.1765$

b. $\frac{5}{7} \approx 0.7143$

17. a. $\frac{7}{16} = 0.4375$

b. $\frac{105}{202} \approx 0.5198$

19. Yes

21. No

23. No

25. $\frac{1}{4} = 0.25$

27. $\frac{1}{4} = 0.25$

29. $\frac{1}{26} \approx 0.0385$

31. $\frac{2}{9} \approx 0.2222$

33. $\frac{1}{225} \approx 0.0044$

35. a. $\frac{27}{64} \approx 0.4219$

b. $\frac{63}{64} \approx 0.9844$

37. a. 0.0003 **b.** 0.5212

39. $\frac{11}{221} \approx 0.0498$

41. $\frac{8}{16,575} \approx 0.00048$

43. $\frac{4}{15} \approx 0.2667$

45. $\frac{32}{825} \approx 0.0388$

47. $\frac{20}{297} \approx 0.0673$

Writing & Thinking

49. We want to determine $P(B \mid A)$ that is equal to $\frac{P(A \cap B)}{P(A)}$. Hence, we should know the probability of event A and

the joint probability of A and B.

51. Two events A and B are independent when $P(A \cap B) = P(A) \cdot P(B)$. For mutually exclusive events, $P(A \cap B) = 0$. Thus, two mutually exclusive events can be independent only if at least one of them has a probability of 0.

9.4 Exercises

Concept Check

1. branch out

3. arrangement

5. $n!$

7. False; there are $m \cdot n$ ways for the two events to occur in the given order.

9. False; each ordering of a set of elements is called a permutation.

Practice

1. 27

3. 45

5. 450

7. 2520

9. 2

11. 362,880

13. 720

15. 30

17. 14

19. 990

21. 3024

Applications

23. **a.** 720 **b.** 1000

25. **a.** 360 **b.** 1296

27. **a.** 6720 **b.** 32,768

29. **a.** 30,240 **b.** 100,000

31. 90

33. 3360

35. 3024

37. 30,240

39. 20,160

Writing & Thinking

41. The notation ${}_nP_r$ is for the number of permutations of n elements taken r at a time. That is, we take r elements from a set of n elements. So, when $n < r$, we do not have enough elements in the set. Thus, we cannot calculate ${}_nP_r$.

43. We can find the number of possible lists in each group by using the permutation formula. Then, since every list from the first group can be paired with every list from the second group, we multiply the obtained numbers (that is, use the fundamental counting principle).

9.5 Exercises

Concept Check

1. permutation, permutation

3. $r!$

5. permutation

7. False; the number of combinations of n elements taken r at a time is smaller than the number of permutations of n elements taken r at a time.

9. True

Practice

1. Combination

3. Permutation

5. Permutation

7. Permutation

9. Combination

11. 15

13. 45

15. 15

17. 17

Applications

19. 36

21. 120

23. 455

25. 4845

27. 230,300

29. 1,184,040

31. **a.** 210; **b.** 5040

33. **a.** 14,950; **b.** 358,800

35. 1620

37. 980

39. 360,360

41. 9,338,000

43. 408,282,336

45. 69,300

Writing & Thinking

47. You should find the number of combinations of three elements from the first group and the number of permutations of three elements from the second group, and then use the fundamental counting principle to multiply the results. Alternatively, you can find permutations in the first group and combinations in the second, and then multiply.

9.6 Exercises

Applications

1. $\frac{1}{6840}$

3. $\frac{1}{840}$

5. $\frac{1}{7}$

7. $\frac{1}{358{,}800}$

9. $\frac{1}{1680}$

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

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

15. $\frac{6}{143}$

17. $\frac{3}{19{,}600}$

19. $\frac{11}{4165}$

21. $\frac{6}{11}$

22. $\frac{15}{38}$

23. $\frac{105}{442}$

25. $\frac{1128}{5525}$

27. $\frac{15}{34}$

29. $\frac{625}{10{,}626}$

31. $\frac{75}{308}$

33. $\frac{56}{143}$

35. $\frac{4}{13}$

37. $\frac{231}{2584}$

39. $\frac{588}{2431}$

Writing & Thinking

41. Suppose we are choosing k out of n objects. The probability of choosing them in a specific order is $\frac{1}{{}_nP_k} = \frac{(n-k)!}{n!}$, while the probability of choosing them in a random order is $\frac{1}{{}_nC_k} = \frac{k!(n-k)!}{n!}$. We can see that the second probability is greater by $k!$ times (if $k > 1$).

43. The experiment should meet the conditions of a random experiment and all outcomes in the sample space should be equally likely to occur.

Chapter 10: Statistical Pathways: Introduction to Statistics

10.1 Exercises

Concept Check

1. population

3. sample

5. sample statistics

7. False; a census collects data from every member of a population.

9. True

Practice

1. Population: local high school students; Sample: 300 students surveyed; The 62% of local high school students indicating that they ate unhealthy foods at least once a day is a sample statistic as it only refers to the students surveyed.

3. Population: parents in a large metropolitan area; Sample: 850 parents interviewed; The 54% of the parents in the large metropolitan area who believe there is too much homework in middle school is a population parameter as it refers to all parents in the large metropolitan area. The population parameter is based on the sample statistics that are not reported.

5. Cluster sampling

7. Stratified sampling

9. Systematic sampling

11. Convenience sampling

13. Systematic sampling

15. Systematic sampling

17. Random sampling

19. Random sampling

21. Cluster sampling

23. Random sampling

25. Systematic sampling

27. Cluster sampling

29. Random sampling

Writing & Thinking

31. Answers will vary.

10.2 Exercises

Concept Check

1. frequency distribution

3. class width

5. histogram

7. False; in a grouped frequency distribution, classes cannot overlap.

9. True

Practice

1. **a.** biology; **b.** 15

3. **a.** February; **b.** 50; **c.** 4

5. **a.** 32; **b.** 28; **c.** 14

7.

Number of Cups of Coffee Drank	Frequency
0	3
1	5
2	8
3	6
4	5
5	3
6	2

9.

Grades	Frequency
51–60	3
61–70	4
71–80	8
81–90	10
91–100	9

11. **a.** 49; **b.** 28; **c.** 11

13. **a.** 50; **b.** 34; **c.** 42

15.

17.

19.

21.

Stem	Leaf
7	0 1 2 2 4 5
8	0 0 2 3 4 4 8 9 9
9	0 0 1 1 2 2 3 4 4

23.

Stem	Leaf
2	3 4 5 6 7 8 9 9
3	0 1 2 3 4 6 7 8
4	1 2 3 5 8
5	4 6 8 9
6	2 8 8

25. **a.** 3; **b.** 12; **c.** 32

27. At first glance it appears that no one Toyota and that a much larger percentage of people preferred Volkswagen. However, upon further examination note the scale on the vertical axis. It does not start at 0, but at 20%. So, the difference between Honda and Volkswagen is only 10%. It is also possible that Toyota is preferred but simply had less than 20% indicate so. Assuming that the three categories sum to 100% one could assume that Toyota is 10%.

Writing & Thinking

29. Answers will vary. When creating a grouped frequency distribution, split the data so that all the classes are the same size and there is no overlap. If necessary, extend the range of the last class so that all class widths are the same.

10.3 Exercises

Concept Check

1. central tendency

3. median

5. two

7. False; the median is the middle data value in a ranked data set.

9. False; the mode must be a value in the data set.

Practice

1. Mean: 18.6; Median: 18.5; Mode: None

3. Mean: 7; Median: 6; Mode: 6

5. Mean: 84.25; Median: 84; Mode: 84, 86

7. **a.** $62,000; **b.** $78,000

9. Mean: 38; Median: 39; Mode: 40

11. Mean: 1.75; Median: 2; Mode: 2

13. Mean: 83.6; Median: 83; Mode: 78

15. 86.45%

17. Lydia: 74.75; Adah: 72.5; Adah wins.
19. Mean: 1.9375; Median: 2; Mode: 2
21. Mean: 27.72; Median: 27; Mode: 30
23. No mode
25. No Mode
27. Mode: 2, 3, 4; multimodal

Writing & Thinking

29. Answers will vary. The mode would be better to use if there was one or two values that occurred more than all the other values.

10.4 Exercises

Concept Check

1. range
3. standard deviation
5. relative position
7. False; the range takes only two data values into consideration.
9. False; quartiles divide a data set into four equal parts.

Practice

1. Range: 7; Standard Deviation: 2.38
3. Range: 12; Standard Deviation: 3.36
5. Range: 6; Standard Deviation: 2
7. **a.** \$78,000; **b.** 25%; **c.** 25%; **d.** 20%
9. **a.** \$16.00/hour; **b.** 32%; **c.** 50%; **d.** 75%
11. Range: 16; Standard Deviation: 4.55
13. Range: 43; Standard Deviation: 13.86
15. Range: 8; Standard Deviation: 2.47
17. Q_1: 3.5; Q_2: 5; Q_3: 8
19. Q_1: 21.5; Q_2: 31; Q_3: 37
21. Q_1: 8.5; Q_2: 12; Q_3: 14
23. Isabella.
25. This can be interpreted as the average exam score earned by a student on the statistics exam is about 3.5 points different from the mean score of 82.

Writing & Thinking

27. Answers will vary. Data Set 1: 2, 4, 5, 6, 7, 9, 10, 12; Data Set 2: 2, 5, 5, 6, 7, 7, 7, 12

    The range for both data sets is 10. The standard deviation for data set 1 is 3.31, and the standard deviation for data set 2 is 2.83.

10.5 Exercises

Concept Check

1. normal distribution
3. mean, median, mode (in any order)
5. z-score
7. True
9. True

Practice

1. **a.** 66; **b.** 69; **c.** 57; **d.** 54
3. **a.** 34; **b.** 36; **c.** 28; **d.** 24
5. **a.** $z = 2.1$; **b.** $z = -1.3$; **c.** $z = 1.21$
7. **a.** $z = 1.64$; **b.** $z = -1.7$; **c.** $z = 2.4$
9. **a.** 95%; **b.** 66 hours to 74 hours
11. **a.** 95%; **b.** 66 to 78 inches
13. 68%
15. 99.7%
17. 97.5%
19. 2.5%
21. 84%
23. 2.5%
25. 68%
27. 99.7%
29. 97.5%
31. 84%
33. 0.15%

Applications

35. Jordan
37. Jameson

Writing & Thinking

39. Answers will vary. A normal distribution is bell-shaped, symmetrical, and is unimodal. The mean, median, and mode are equal. The distribution is completely defined by its mean and standard deviations.

Appendix

A.1 Exercises

Concept Check

1. matrix, matrices
2. capital letters, entry
3. subscript notation
4. same dimensions
5. real number, scalar
6. columns, rows
7. False; it is read "b sub four three".
8. True
9. False; it is written as the number of rows by the number of columns.
10. True

Practice

1. 2×2
2. 2×3
3. 3×2
4. 1×3
5. 2×4
6. 5×1
7. 3×5
8. 4×4
9.
10.
11.
12. Not possible
13.
14. Not possible
15.
16.
17.
18.
19. Not possible
20.
21.
22.
23. Not possible
24.
25.
26.

27.

28.

29.

30.

31.

32.

33. **a.** Possible, 3×4;
b. Not possible

34. **a.** Not possible;
b. Possible, 6×3

35. **a.** Possible, 3×3;
b. Possible, 4×4

36. **a.** Possible, 7×3;
b. Not possible

37.

38.

39.

40.

41.

42.

43.

44.

45.

46.

47.

48.

49. Product does not exist

50.

Writing & Thinking

51. Matrices cannot be added or subtracted if they have different dimensions. Answers will vary.

52. Yes. For matrices to be added, they must have the same dimension. However, for a matrices to be multiplied only the number of columns in the first matrix must equal the number of rows in the second. Answers will vary.

53. The number of columns in A must equal the number of rows in B and the numbers of rows in A must equal the number of columns in B. Answers will vary.

A.2 Exercises

Concept Check

1. $\log_b x$

3. logarithmic

5. reflecting

7. True

9. True

Practice

1.

3.

5.

7.

9. $\log_{10} 23 = k$

11.

13.

15.

17.

19.

21.

23.

25. $x = 16$

27. $x = 2$

29. $x = -3$

31.

33. $x = 2$

35. $x = 32$

37. $x = 3.7$

39. $x = 2$

41.

43.

45.

47.

49.

51. **a.** $D =$

b. $R =$

c. $y = 0$

d. Answers will vary.

Writing & Thinking

53. The two functions are symmetric about the line $y = x$.

A.3 Exercises

Concept Check

1. decomposition, centuries

3. Richter

5. False; The variable t is measured in days.

Applications

1. \$4027.51

3. 11.55 years

5.

7. 1.73 hours

9. 10.99 days

11. 7.44 hours

13. 2350.02 years

15. 2.31 days

17. 39.65 minutes

19. 7.00 years

21. 5600 years

23. **a.** 13.86 years

b. 6.93 years

25. 100

27. 8.64 million

29. 2083, 2437, 2744

31. **a.** 117.95 dB

b.

c.