

Answer Key

Chapter 1: Review of Foundational Math Skills

1.1 Exercises

Concept Check

- 0
- base, exponent
- addition, subtraction
- True
- False; if there are no grouping symbols, multiplication and division should be performed in the order they appear, from left to right.

Practice

- 11^3 3. 7^4
- $2^3 \cdot 3^2$ 7. $5^3 \cdot 7^2$
- $2 \cdot 3^2 \cdot 11^2$
- a. 4 b. 2 c. 16
- a. 2 b. 3 c. 8
- a. 1 b. 6 c. 1
- a. 5 b. 3 c. 125
- a. 2 b. 4 c. 16
- a. 9 b. 2 c. 81
- a. 7 b. 2 c. 49
- a. 3 b. 5 c. 243
- a. 30 b. 2 c. 900
- a. 20 b. 3 c. 8000
- a. 1 b. 57 c. 1
- a. 4 b. 0 c. 1
- a. 13 b. 1 c. 13
- a. 22 b. 0 c. 1
- 64 41. 16
- 64 45. -125
- 3 49. 3
- 14 53. -22
- 39 57. 4
- 6 61. 33
- 27 65. 49
- 45 69. -9
- 4624 73. -105

75. 1026 77. -70

79. a. -17 b. -27

81. 0 83. -6

Applications

85. 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; $\frac{15 \cdot 10 \cdot 20 + 132}{6}$

87. \$78 per share

89. 85

91. a. 71 b. 1

93. 8 degrees Fahrenheit

Writing & Thinking

95. Adding $1 + 3$ first, then squaring, would give 16. But the order of operations indicates that 3 should be squared first and then 1 added. This gives a result of 10.

1.2 Exercises

Concept Check

- two
- exactly divisible
- prime
- False; a composite number is a counting number with more than two different factors.
- True

Practice

- 13, 17
- 2
- 8, 9
- 4, 17
- 2, 251

11. 10, 17

13. 4, 111

15. $2^2 \cdot 13$

17. $2^3 \cdot 7 \cdot 11$

19. $-1 \cdot 2^2 \cdot 7 \cdot 11$

21. 79 is prime.

23. 17^2

25. 5^3

27. $-1 \cdot 2^4 \cdot 5^2$

29. $2^3 \cdot 3 \cdot 5$

31. $3 \cdot 7 \cdot 11$

33. $2^2 \cdot 3^2 \cdot 47$

34. $2^2 \cdot 3 \cdot 11 \cdot 13$

35. 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

37. 105 39. 40

41. 66 43. 140

45. 150 47. 180

49. 196 51. 210

53. 90 55. 100

57. 150 59. 364

61. 2520 63. 924

65. 7623 67. 2880

Applications

71. a. 90 hours

b. 6 and 5 orbits, respectively

73. a. 840 days

b. 105, 70, 60, and 56 trips, respectively

75. a. 840 seconds

b. 24 laps, 21 laps, and 20 laps, respectively

Writing & Thinking

77. 53, 59, 61, 67, 71; answers will vary.

79. 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.

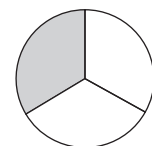
1.3 Exercises

Concept Check

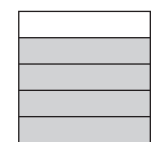
- improper
- 1
- 1
- False; The numerator is 11.
- True

Practice

1.



3.



5. $\frac{5}{4}$ 7. $\frac{10}{4}$

9. $\frac{1}{49}$ 11. 0

13. $\frac{12}{35}$ 15. $\frac{15}{32}$

17. $-\frac{27}{28}$ 19. $\frac{343}{216}$

21. $\frac{4}{45}$ 23. $\frac{2}{9}$
 25. $\frac{3}{4} = \frac{3}{4} \cdot \frac{3}{3} = \frac{9}{12}$
 27. $\frac{6}{7} = \frac{6}{7} \cdot \frac{2}{2} = \frac{12}{14}$
 29. $\frac{3}{16} = \frac{3}{16} \cdot \frac{5}{5} = \frac{15}{80}$
 31. $\frac{7}{26} = \frac{7}{26} \cdot \frac{2}{2} = \frac{14}{52}$
 33. $\frac{18}{1} = \frac{18}{1} \cdot \frac{3}{3} = \frac{54}{3}$
 35. $\frac{1}{3}$ 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. $\frac{9}{4}$ 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.

1.4 Exercises

Concept Check

- denominators
- denominators
- equivalent
- True
- 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. $\frac{11}{15}$ 27. $\frac{11}{20}$

29. $-\frac{11}{20}$ 31. $\frac{317}{1000}$
 33. $\frac{631}{100}$ 35. $\frac{3}{5}$
 37. $\frac{1}{3}$ 39. $-\frac{2}{3}$
 41. $\frac{1}{2}$ 43. $-\frac{5}{16}$
 45. $\frac{3}{5}$ 47. $\frac{3}{5}$
 49. $\frac{5}{16}$ 51. $\frac{13}{20}$
 53. $-\frac{1}{4}$ 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 cook-

ing or when measuring sewing or construction materials.

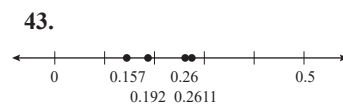
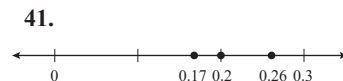
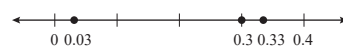
1.5 Exercises

Concept Check

- and
- two, eight hundredths
- right
- True
- False; On a number line, any number to the right of another number is larger than that other number.

Practice

1. 6.5 3. 18.76
 5. 56.03 7. 37.498
 9. 87.003
 11. Nine tenths
 13. Twenty and seven tenths
 15. One and fifty-three hundredths
 17. Nineteen and one hundred two thousandths
 19. Eight hundred and nine thousandths
 21. 0.3 23. 7.9
 25. 0.23 27. 6.028
 29. 0.4502 31. 0.27
 33. 0.163 35. 24.295
 37. 0.01
 39.



45. 7, 8, 8, 7, 8, 8, 34.8
 47. 5, 2, 2, 5, 2, 3.0065
 49. 8.6 51. 10.0
 53. 1.68 55. 0.08
 57. 0.057 59. 3.003
 61. 4 63. 30

65. 5200 67. 400
69. 103,000 71. 51,000

Applications

73. One hundred fourteen and eight tenths
75. Nine-hundred fourteen thousandths; One and nine hundredths; Thirty-nine and thirty-seven hundredths; Three and thirty-seven hundredths
77. Two and eight-hundred twenty-five ten-thousandths
79. Two and seventy-one thousand eight hundred twenty-eight hundred-thousandths
81. Nine and fifty-eight hundredths; Nineteen and nineteen hundredths; forty-three and three hundredths
83. Thirty-five and eight tenths; Twenty-six and nine tenths; Eighteen and nine tenths; Twelve and three tenths; Seven and two tenths

Writing & Thinking

85. Answers will vary. Example: If the bill is \$129, then that would be 129 and one hundred twenty-nine.
87. Moving left to right, compare digits with the same place value. When one compared digit is larger, the corresponding number is larger.

1.6 Exercises

Concept Check

1. vertically 3. whole
5. dividend
7. False; once decimal points and corresponding digits have been aligned vertically, add or subtract from right to left.
9. True

Practice

1. 50.085 3. 237.74
5. 9.83 7. 72.31
9. 599.07 11. 156.305
13. 19.541 15. 40.313
17. 11.131 19. 17.8
21. 45.01 23. 4.7974
25. 8.93 27. 1.44
29. 0.9757 31. 17.5616
33. -13.15 35. -15.43
37. 3.3 39. 6.3
41. 5.8 43. 12.51
45. 0.42 47. -0.75
49. 0.42 51. -0.112
53. 0.01096 55. 1.4000
57. -3.975 59. 1.200
61. 65.3980 63. 0.04336
65. -0.18 67. -0.08
69. 6.54 71. 20
73. 0.01 75. 5.78
77. 12.12 79. 0.56
81. -14.75 83. -12.22
85. 62.12 87. 13.7

Applications

89. a. \$94.85 b. \$5.15
91. \$671.75
93. 12.1778 tons
95. No, he is short \$0.19.
97. \$240.90 99. \$936,945
101. \$239.56 103. \$295

Writing & Thinking

105. Decimal numbers need to be aligned vertically so that numbers with the same place value are being added together. If not, then a 60 may be added to a 7 as if it were a 6 being added to a 7, giving 13, not the value of 67 that it should be.
107. In multiplication with decimal numbers, placement of the decimal point must be considered. Otherwise, multiplication with whole numbers and decimal numbers are the same.

1.7 Exercises

Concept Check

1. numerator, denominator
3. repeating, nonrepeating
5. terminating
7. True
9. False; In some cases, fractions can be converted to decimal form without losing accuracy.

Practice

1. $\frac{9}{10}$ 3. $-\frac{57}{100}$
5. $\frac{16}{1000}$ 7. $-\frac{72}{10}$
9. $-\frac{17}{100}$ 11. $\frac{1}{8}$
13. $-\frac{7}{2}$ or $-3\frac{1}{2}$
15. $\frac{177}{100}$ or $1\frac{77}{100}$
17. 0.05 19. $-0.\overline{6}$
21. $-0.\overline{27}$ 23. $0.\overline{5}$
25. 6.67 27. -0.48
29. 0.03 31. -1.43
33. 1.64 35. 72.31
37. 1.13 39. -1
41. 0.09 43. -10.40
45. -120.31 47. 2.64
49. -17.55 51. -1.7
53. 0.878 is larger; 0.003
55. 3.3 is larger; $0.\overline{1571428}$
57. $3\frac{2}{3}$ is larger; $0.\overline{016}$
59. $\frac{7}{10}, \frac{3}{4}, 0.76$
61. $\frac{5}{16}, 0.3126, 0.314$
63. 0
65. $-\frac{5}{9}$ 67. $15\frac{5}{8}$

Applications

69. $93\frac{4}{5}$
71. $30\frac{3}{10}; 28\frac{2}{5}$

73. $21\frac{1}{2}$

75. 0.58
77. 2.9
79. 17.92 inches
81. 20.2 miles
83. 60 students that drive to school and have a job are taking AP English
85. 0.9 ounces
87. 25 slides

Writing & Thinking

89. For the numerator, write the whole number formed by all the digits of the decimal number, and for the denominator, write the power of 10 that corresponds to the rightmost digit. Reduce the fraction, if possible.
91. This problem could be solved by converting all numbers to fractions or all numbers to decimal numbers. Answers will vary.

1.8 Exercises

Concept Check

1. 100
3. two; left
5. reduced or simplified
7. False; It is possible to have a percent greater than 100%.
9. False; To change from a percent to a decimal, move the decimal point two places to the left and omit the percent sign.

Practice

1. 60% 3. 72%
5. 20% 7. 125%
9. 0.5% 11. 2.14%
13. 2% 15. 10%
17. 36% 19. 12.8%
21. 112% 23. 200%
25. 0.02 27. 0.18

29. 0.6 31. 1.25
 33. 0.173 35. 0.0026
 37. 7% 39. 50%
 41. 55%
 43. 87.5% or $87\frac{1}{2}\%$
 45. 12.5% or $12\frac{1}{2}\%$
 47. 125%
 49. 210%
 51. 206.7% or $206\frac{2}{3}\%$
 53. $\frac{1}{25}$ 55. $\frac{1}{4}$
 57. 1 59. $1\frac{1}{2}$
 61. $\frac{3}{400}$ 63. $\frac{1}{200}$

65. $\frac{1}{8}$ 67. $\frac{1}{6}$
 69. a. 0.625 b. 62.5%
 71. a. $\frac{9}{100}$ b. 9%
 73. a. $\frac{9}{25}$ b. 0.36

Applications

75. 28% 77. 4%
 79. 0.085 81. 0.45
 83. 5.23 85. $\frac{3}{10}$
 87. $3\frac{17}{20}$
 89. a. $8\frac{1}{3}\%$ b. 25%

- c. $6\frac{1}{4}\%$ or 6.25%
 91. 85%
 93. a. 0.0011 b. 0.11%
 c. Yes
 95. 9.8%

Writing & Thinking

97. Sometimes it is possible to have percentages over 100%. For example, if a bank account had \$50 and someone put in \$75, the amount deposited would have been 150% (starting \$50 + \$25 more) of the original amount. However, sometimes more than 100% is not possible.

For example, if a gas tank can hold exactly 16 gallons of gas, 110% of the capacity could not be put into the tank.

99. $100\% = 1$ so anytime there is a mixed number, which has a value greater than 1, the percentage will be greater than 100%. Proper fractions (numerator is smaller than denominator) have a value less than 1 and therefore the percentage will be less than 100%.

Chapter 2: Geometry and Statistics

2.1 Exercises

Concept Check

1. polygon 3. square
 5. True 7. True
 9. True

Practice

1. 44 cm 3. 48.1 yd
 5. 40 cm 7. 45 cm
 9. 34 cm 11. 200 yd
 13. 36 cm 15. 35 ft
 17. 25.12 m 19. 35.98 in.
 21. 21.42 m 23. 81 ft²
 25. 67.24 cm²
 27. 48 in.² 29. 162 yd²
 31. 25 yd² 33. 48 cm²
 35. 160 in.² 37. 75.3914 m²
 39. 26.13 cm²
 41. 11.14 m² 43. 70 in.³
 45. 381.51 cm³
 47. 12.56 mm³
 49. 60 in.³ 51. 14.13 ft³
 53. 401.92 m³
 55. 376.8 ft³
 57. 2289.06 cm³
 59. 224 cm³

Applications

61. a. 4605 ft
 b. 15.7 minutes
 63. 135 square feet
 65. a. 2350 square feet
 b. 11.75 pounds
 67. 7100.6 in.³
 69. 96 mL

Writing & Thinking

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

2.2 Exercises

Concept Check

1. angle 3. scalene
 5. shape 7. True
 9. False; a triangle with three angles that each measure less than 90 degrees is an acute triangle.

Practice

1. Acute
 3. Obtuse

5. Acute
 7. a. Obtuse b. Acute
 c. Right
 9. a. 75° b. 87° c. 45°
 d. 15°
 11. a. $\angle AOB$ and $\angle BOE$;
 $\angle AOB$ and $\angle AOF$;
 $\angle AOC$ and $\angle COE$;
 $\angle AOD$ and $\angle DOE$;
 $\angle AOF$ and $\angle FOE$;
 $\angle BOC$ and $\angle COF$;
 $\angle BOD$ and $\angle DOF$;
 $\angle BOE$ and $\angle EOF$
 b. $\angle AOB$ and $\angle BOC$;
 $\angle COD$ and $\angle DOE$;
 $\angle BOC$ and $\angle EOF$
 13. $m\angle 2 = 150^\circ$; $m\angle 3 = 30^\circ$;
 $m\angle 4 = 150^\circ$
 15. a. $m\angle 2 = 70^\circ$;
 $m\angle 3 = 90^\circ$;
 $m\angle 4 = 20^\circ$;
 $m\angle 5 = 70^\circ$
 b. $\angle 3$ c. $\angle 2$ and $\angle 5$

17. Scalene
 19. Right
 21. Isosceles
 23. Isosceles and right
 25. Acute

27. Acute
 29. The triangles are not similar. The corresponding sides are not proportional.
 31. $\triangle PQR \sim \triangle SUT$. All pairs of corresponding sides are proportional to the ratio 1:2.
 33. $\triangle ABC \sim \triangle EDC$. The corresponding angles have the same measure.
 35. $x = 50^\circ$; $y = 70^\circ$
 37. $x = 50^\circ$; $y = 50^\circ$
 39. $x = 4.8$; $y = 7.2$
 41. $x = 95^\circ$; $y = 20$
 43. Congruent by SAS
 45. Congruent by ASA
 47. Not congruent
 49. Congruent by SSS

Applications

51. 7.5 feet 53. 125 yd
 55. 480 ft 57. 48 ft
 59. 6.9 ft

Writing & Thinking

61. a. $\angle B$ should be equal to $m\angle E$ and $m\angle C$ should be equal to $m\angle F$.

b. Corresponding sides are proportional, not that they have the same length.

2.3 Exercises

Concept Check

- central tendency
- median
- two
- False; the median is the middle data value in a ranked data set.
- False; the mode must be a value in the data set.

Practice

- Mean: 18.6; Median: 18.5; Mode: None
- Mean: 7; Median: 6; Mode: 6
- Mean: 84.25; Median: 84; Mode: 84, 86
- a. \$62,000; b. \$78,000
- Mean: 38; Median: 39; Mode: 40

- Mean: 1.75; Median: 2; Mode: 2
- Mean: 83.6; Median: 83; Mode: 78
- Mean: 7; Median: 7; Mode: 6
- Mean: 2.375; Median: 2; Mode: 2
- Mode: 5, 6; bimodal
- Mode: 2, 3; bimodal
- Mode: 3, 4, 5; multimodal

Applications

- a. 79.5
b. 82
c. It is not possible as you would need to score 107, but there are only 100 points possible.

- 86.8%
- Camera A: 7.9; Camera B: 7.7; Choose Camera A.
- 3.3

Writing & Thinking

- 5.5

2.4 Exercises

Concept Check

- range
- standard deviation
- relative position
- False; the range takes only two data values into consideration.
- False; quartiles divide a data set into four equal parts.

Practice

- Range: 7; Standard Deviation: 2.38
- Range: 12; Standard Deviation: 3.36
- Range: 6; Standard Deviation: 2
- Range: 13; Standard Deviation: 3.89
- Range: 4; Standard Deviation: 1.29
- Range: 26; Standard Deviation: 7.83

- a. \$78,000; b. 25%; c. 25%; d. 20%
- a. \$16.00/hour; b. 32%; c. 50%; d. 75%
- $Q_1: 3.5; Q_2: 5; Q_3: 8$
- $Q_1: 21.5; Q_2: 31; Q_3: 37$
- $Q_1: 8.5; Q_2: 12; Q_3: 14$

Applications

- Isabella.
- 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

- 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.

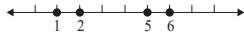


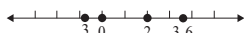


Chapter 3: Introduction to Algebra

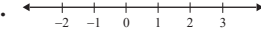
3.1 Exercises

Concept Check

- integers
- irrational
- graph
- True
- True


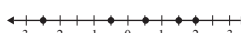
Practice

- 3
- 0
- 2
- 
- 
- 
- 
- 
- 

- 
- 4, 8
- 7, -2, 0, 4, 8
- $-7, -2, -\frac{5}{3}, -1.4, 0, \frac{3}{5}, 4, 5.9, 8$
- <
- >
- <
- =
- >
- =
- True
- False; $-9 < -8.5$
- True
- True
- False; $-|-3| > -|4|$
- $x = -5, 5$
- $x = -2, 2$
- No solution

- $x = -23, 23$
- Sometimes. Examples will vary.
- Always. Examples will vary.

Applications

- 4500 meters
- +8844 meters
- a. $|x| \leq 3$
b. 
- a. 
b. $-\frac{5}{2}$ has the furthest distance from zero.
- a. $x = -5$ millimeters, 5 millimeters

- The length of the board can be 5 mm longer or 5 mm shorter than 1 meter.
- 1.05 m or 0.95 m

- a. Fresno
b. El Centro

Writing & Thinking

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

3.2 Exercises

Concept Check

- positive
- negative
- equation
- True

Practice

- 1. 13 3. -4
- 5. 0 7. 5
- 9. -13 11. -8
- 13. -10 15. 0
- 17. 17 19. -4.6
- 21. -29 23. -9
- 25. -15.4 27. -3
- 29. -54 31. -2.5
- 33. $\frac{3}{7}$ 35. $\frac{5}{8}$
- 37. $-\frac{7}{4}$ 39. -7
- 41. -0.5 43. 76
- 45. -310 47. 27
- 49. 2.3 51. 18
- 53. 14 55. 35
- 57. 84 59. 3807
- 61. -97,714

Applications

- 63. Profit: \$6000
b. \$50,000
- 65. a. -0.3 cm, -0.1 cm
b. 0.02 cm
c. Increase
- 67. 275 feet
- 69. 8 feet
- 71. 8
- 73. The solution is -\$97.86.

Writing & Thinking

- 75. $|0| + |0| = 0$
- 77. Sometimes. Examples will vary.
- 79. Sometimes. Examples will vary.
- 81. Never. Examples will vary.
- 83. Never. Examples will vary.

3.3 Exercises

Concept Check

- 1. additive inverse
- 3. left

- 5. subtract
- 7. False; The sum of a number and its additive inverse is zero.
- 9. True

Practice

- 1. -11 3. 6
- 5. -4.7 7. 0
- 9. $\frac{5}{7}$ 11. 5
- 13. -10 15. 7
- 17. 3 19. 12
- 21. 24 23. 5.9
- 25. -4 27. 10
- 29. $-\frac{7}{20}$ 31. $-\frac{1}{4}$
- 33. $\frac{3}{40}$ 35. -15
- 37. -1 39. -3
- 41. 1 43. 0

- 45. $-8 < -5$
- 47. $-3.1 < 3.1$
- 49. $\frac{19}{4} = \frac{19}{4}$
- 51. $0 > -27$
- 53. $-237 > -248$
- 55. $1044 > -39$
- 57. $-15,254 > -35,090$
- 59. 1 61. -7
- 63. -26 65. 11

Applications

- 67. -18°F (a decrease of 18 degrees Fahrenheit)
- 69. \$7 (an increase of 7 dollars)
- 71. -14,787 ft (a decrease of 14,787 feet)
- 73. a. Negative b. Positive
c. May and June
d. Answer will vary.
March and April or April and May

- 75. \$250,404
- 77. \$847
- 79. \$165
- 81. -6 °C (or 6 °C below 0 °C)

- 83. 2316 points
- 85. 1220 gallons
- 87. a. 1454 people
b. 198,580 people
- 89. The solution is 90.85 g
- 91. 3 °F
- 93. 4238 points

Writing & Thinking

- 95. Add the opposite of the second number to the first number.
- 97. Answers will vary. When the absolute value of the number being subtracted is greater than the absolute value of the other number, the difference will be positive.

- 59. $-\frac{5}{12}$
- 61. False; $(-4)(6) < 3 \cdot 8$
- 63. True
- 65. False;
 $6(-3) = (-14) + (-4)$
- 67. True
- 69. True
- 71. 116,640
- 73. 22,032
- 75. 1682
- 77. -45.5
- 79. -9.5
- 81. -54.605

Applications

- 83. -12
- 85. \$2975
- 87. 8928 slices of bread
- 89. \$442,800

3.4 Exercises

Concept Check

- 1. average, mean
- 3. positive
- 5. 0
- 7. True
- 9. False; The product and quotient will be positive.

Practice

- 1. -12 3. 48
- 5. 56 7. -21
- 9. 56 11. 26
- 13. -70 15. -24
- 17. -288 19. 0
- 21. -9 23. -7.31
- 25. $-\frac{1}{6}$ 27. $\frac{18}{5}$
- 29. $-\frac{12}{5}$ 31. $-\frac{9}{2}$
- 33. 4 35. -6
- 37. 2 39. 0
- 41. -3 43. -17
- 45. Undefined
- 47. 5 49. -0.6
- 51. 20 53. -2.3
- 55. $-\frac{1}{12}$ 57. $\frac{9}{22}$

- 91. 3 cookies
- 93. 22 teams
- 95. 17 grams
- 97. \$10,740 per year
- 99. 1152 bags
- 101. 427 sq ft
- 103. 5423 dozen
- 105. 2 slices
- 107. 33,087.5 accidents
- 109. a. -8 psi
b. -10.5 psi
c. 5.25 hours (or 5 hours 15 minutes)

- 111. 26.6 calls
- 113. 80
- 115. 78.6 inches
- 117. 31.5 hours
- 119. 18,631.8 square miles

Writing & Thinking

- 121. Positive; The product of two negative numbers will be positive so an even number of negatives will give a positive product.
- 123. Answers will vary.

3.5 Exercises

Concept Check

- grouping symbols
- left, right
5. -1
- True
- True

Practice

- a. 36 b. 16
- 25
- 45
11. 152
13. -189
15. 143
17. -36
- 10
21. $\frac{11}{30}$
23. $\frac{1}{24}$
25. $\frac{31}{24}$
27. $\frac{10}{3}$
29. $\frac{41}{32}$
31. $\frac{3}{5}$
33. -5.7
- 3.5
37. 24
- 5
41. 1
43. $-\frac{13}{64}$
45. 42.45
47. 67.77
49. 15.41

Applications

- a. $\$11 \cdot \left(1\frac{1}{4}\right) + \8.50
b. \$22.25
c. \$31
- a. $-\$42 - \$35 - (3 \cdot \$5)$
b. $-\$92$
- 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
- a. $2 \cdot \$225 + 4 \cdot \$20 + 4 \cdot \$15$
b. \$147.50

Writing & Thinking

- 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.

3.6 Exercises

Concept Check

- reciprocal
- zero-factor
- opposite
- False; The commutative property of addition allows the order to change.
- False; The additive identity of all numbers is 0.

Practice

- $3 + 7$
- $4 \cdot 19$
- $30 + 48$
- $(2 \cdot 3) \cdot x$
- $(3 + x) + 7$
- 0
- $x + 7$
- $2x - 24$
- 0
- Commutative property of addition
- Multiplicative identity
- Associative property of addition
- Commutative property of multiplication
- Commutative property of multiplication
- Multiplicative inverse
- Additive inverse
- Multiplicative identity
- Zero-factor law
- Associative property of addition
- $6(11) = 66$ and $6 \cdot 3 + 6 \cdot 8 = 66$
- $10(-7) = -70$ and $10 \cdot 2 - 10 \cdot 9 = -70$
- Commutative property of multiplication; $6 \cdot 4 = 4 \cdot 6 = 24$

- Associative property of addition; $8 + (5 + (-2)) = (8 + 5) + (-2) = 11$
- Distributive property; $5(4 + 18) = 5(4) + 90 = 110$
- Associative property of multiplication; $(6 \cdot (-2)) \cdot 9 = 6 \cdot (-2 \cdot 9) = -108$
- Commutative property of addition; $3 + (-34) = (-34) + 3 = -31$
- Commutative property of addition; $2(3 + 4) = 2(4 + 3) = 14$
- Commutative property of addition; $5 + (4 - 15) = (4 - 15) + 5 = -6$
- Associative property of multiplication; $(3 \cdot 4) \cdot 5 = 3 \cdot (4 \cdot 5) = 60$

Applications

- a. \$118.25
b. $\$11 \cdot \left(6\frac{1}{2}\right) + \$11 \cdot \left(4\frac{1}{4}\right)$
c. Distributive property
- a. $\$85.04 - \$28.79 - \$50.00 - \12.16 or $\$85.04 - (\$28.79 + \$50.00 + \$12.16)$
b. $-\$5.91$
c. $-\$5.91 + \$5.91 = 0$
d. The additive inverse property

3.7 Exercises

Concept Check

- 1
- constant
- coefficients
- True
- False; In the term $12a$, 12 is the coefficient.

Practice

- 5, 3, and 8 are like terms; $7x$ and $9x$ are like terms.
- $-x^2$ and $2x^2$ are like terms; $-6xy$ and $5xy$ are like terms; $3x^2y$ and $5x^2y$ are like terms.
- 24, -6, and 8.3 are like terms; $1.5xyz$, $-1.4xyz$, and xyz are like terms.
- $15x$
- $3x$
- $5y^2$
- $10x$
- $-2c$
- $7x + 2$
- $2x^2 + 2x$
- $3x^2 + 20$
- $13x^2 - 2y$
- $7x - 1$
- $-2n^2 + 2n - 3$
- $-x^2 + 3x + 45$
- $4n + 3$
- $7a - 8b$
- $8x + y$
- $-2y$
- $\frac{8x}{3}$
- 4
- 4
- 2
- $3x + 4$; 13
- $5y + 1$; 16
- $-3.1a^2 + 4a$; -20.4
- $3.7x + 1.1$; 15.9
- $8a$; -16
- $3b$; -3
- $-x^2 + 5x - 7$; -21
- $3y^2 - y$; 4
- $4y^3 - 4y^2 + 5y + 1$; -12
- $5x^2 + 9x - 22$; -20
- $2a^2 - 2a$; 4
- $9ab - 7a + 2b$; 21
- $14a - 15b + 2c + 2$; 24
- $10a + 10b + 10c$; 0

Applications

- \$50,000
- 375 pounds
- a. $47s + 143m$
b. 6170 boxes

Writing & Thinking

- A number is a constant and its value does not change regardless of where it appears in an expression or equation. A

variable, usually represented by a letter, represents an unknown number or numbers.

83. a. For $x = 3$,

$$4x^2 - 5(x + 2) + 3x + 10 + 2x$$

$$= 4(3)^2 - 5(3 + 2) + 3(3) + 10 + 2(3)$$

$$= 4(9) - 5(5) + 9 + 10 + 6$$

$$= 36 - 25 + 9 + 10 + 6$$

$$= 36$$

b.

$$4x^2 - 5(x + 2) + 3x + 10 + 2x$$

$$= 4x^2 - 5x - 10 + 3x + 10 + 2x$$

$$= 4x^2$$

For $x = 3$,

$$4x^2 = 4(3)^2$$

$$= 4(9) = 36$$

The second method, as it requires fewer calculations.

3.8 Exercises

Concept Check

- ambiguous
- subtraction
- multiplication
- True
- False; Subtraction is indicated by the phrase "five less than a number."

Practice

- $x + 6$
- $y - 4$
- $\frac{2m}{10}$
- $6y - 4$
- $4x + 2x$
- $15 - 2y$
- $3x - 5x$
- $9(x + 2)$
- $4(x + 1) - 13$
- $3(x + 6) + 8$
- $3(7 - x) - 4$
- $\frac{x}{2} - 18$
- a. $x - 6$
b. $6 - x$

- a. $3x - 5$
b. $5 - 3x$
- $24d$
- $365y$
- $7t + 3$
- $7t + 3$
- $\$20 + \$0.15m$
- $2w + 2(2w - 3) = 6w - 6$
- Four times a number
- A number increased by five
- Four times a number decreased by seven
- Seven times the sum of a number and one
- Negative two times the difference between a number and eight
- Five times the sum of twice a number and three
- The quotient of six and the difference between a number and one
- Six times a number plus the number minus one

- Eight increased by twice the difference between a number and one
- The sum of three times a number and seven; three times the sum of a number and seven
- The product of seven and a number minus three; seven times the difference between a number and three

Writing & Thinking

- 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.
- Answers will vary.

Chapter 4: Solving Linear Equations and Inequalities

4.1 Exercises

Concept Check

- equation
- addition, equality
- dividing
- True
- True

Practice

- $x = -2$ is a solution
- $x = 4$ is not a solution
- $x = -4$ is a solution
- $x = -18$ is a solution
- $x = -28$ is a solution
- $x = 7$
- $y = -4$
- $x = -19$
- $n = 37$
- $z = -6$
- $x = 5$
- $y = -5.9$
- $x = -1.2$

- $x = \frac{11}{20}$
- $x = 9$
- $y = 8$
- $x = 20$
- $y = 10$
- $x = -8$
- $x = 12$
- $n = 8$
- $y = 2.1$
- $x = \frac{20}{9}$
- $x = -13.3$
- $y = -12$
- $x = -\frac{2}{5}$
- $x = -4$
- $x = \frac{5}{8}$
- $n = 9.7$
- $x = -4$
- $y = -50.753$
- $x = -17.214$
- $x = 246$
- $x = -153.17$

Applications

- 1945 *kanji* characters

- a. Answers will vary.
b. $x = 12.5$
c. The garden should be 12.5 feet wide.
- 4.24 light years
- 11,500 words
- 2250 students
- a. Answers will vary.
b. $x = 11,550$
c. Clara will need a loan for \$11,550.

Writing & Thinking

- 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.

4.2 Exercises

Concept Check

- like
- multiplication
- substituting
- False; Subtract 3 from both sides.
- True

Practice

- $x = -3$
- $x = 2$
- $x = 2$
- $x = 2$
- $y = -1$
- $t = -1$
- $x = -0.12$
- $x = 4$
- $x = 0$
- $y = 0$
- $x = -2$
- $y = -6$
- $n = 6$
- $n = 8$
- $x = 0$
- $x = -7$

33. $x = -\frac{1}{8}$ 35. $x = -\frac{13}{2}$
 37. $x = -\frac{21}{5}$ 39. $x = -\frac{8}{15}$
 41. $y = \frac{28}{5}$ 43. $x = 2$
 45. $y = \frac{7}{5}$ 47. $x = -4.5$
 49. $x = -44$ 51. $x = 2$
 53. $x = -4$ 55. $y = 0.5$
 57. $x = 1.5$ 59. $x = 0.2$
 61. $x = 6.1$ 63. $x = 1.12$

Applications

65. 14,000 tickets per hour
 67. 52 pages
 69. 240 cookies of each remaining variety
 71. 135 yards
 73. 379.7 feet
 75. a. Lowest temperature; Change in temperature per hour; Current temperature
 b. $x = 4$
 c. The low temperature occurred 4 hours ago.

Writing & Thinking

77. a. The 4 should have been multiplied by 3 so that the 3 was distributed over the entire left-hand side of the equation; Correct answer is $x = 15$.
 b. 3 should be subtracted from each side, not from each term, and $5x - 3$ doesn't simplify to $2x$; Correct answer is $x = \frac{8}{5}$.

4.3 Exercises

Concept Check

1. identity
 3. conditional
 5. real, \mathbb{R}
 7. True 9. True

Practice

1. $x = -5$ 3. $n = 3$
 5. $y = 6$ 7. $x = 3$
 9. $n = 0$ 11. $y = 0$
 13. $z = -1$ 15. $y = \frac{1}{5}$
 17. $x = -3$ 19. $x = -4$
 21. $x = -21$ 23. $y = 0$
 25. $y = 1$ 27. $x = -\frac{3}{2}$
 29. $x = \frac{1}{4}$ 31. $x = \frac{3}{17}$
 33. $x = -\frac{1}{4}$ 35. $x = \frac{8}{5}$
 37. $x = \frac{2}{3}$ 39. $x = 6$
 41. $x = -11$ 43. $x = \frac{1}{2}$
 45. $x = -5$ 47. $n = -1.5$
 49. $x = 0$
 51. Conditional
 53. Conditional
 55. Contradiction
 57. Identity
 59. Conditional
 61. $x = -50.21$
 63. $x = 1.067$

Applications

65. 20 guests
 67. 0.34 hours
 69. a. The area of the first flyer
 b. The width of the second flyer
 c. $x = 5$
 d. Solution should be correct if part c. is correct.
 e. The first flyer has a width of 5 inches.
 71. 1800 square feet
 73. 240 sundaes

Writing & Thinking

75. a. $5x + 1$ b. $x = 6$
 c. Answers will vary.

4.4 Exercises

Concept Check

1. mathematically
 3. time
 5. substitute
 7. False; Case matters in formulas.
 9. True

Applications

1. \$192 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. \$5 million
 23. \$2400 25. 7 hours
 27. 1.625 mph
 29. $b = P - a - c$

31. $m = \frac{F}{a}$ 33. $w = \frac{A}{l}$
 35. $n = \frac{R}{p}$ 37. $P = A - I$
 39. $m = 2A - n$
 41. $t = \frac{I}{Pr}$
 43. $b = \frac{P - a}{2}$
 45. $\beta = 180^\circ - \alpha - \gamma$
 47. $h = \frac{V}{lw}$
 49. $b = \frac{2A}{h}$
 51. $h = \frac{V}{\pi r^2}$
 53. $g = \frac{mv^2}{2K}$
 55. $y = \frac{6 - 2x}{3}$
 57. $x = \frac{11 - 2y}{5}$
 59. $b = \frac{2A - hc}{h}$ or
 $b = \frac{2A}{h} - c$

61. $x = \frac{8R + 36}{3}$ or
 $x = \frac{8R}{3} + 12$
 63. $y = -x - 12$
 65. $C = nt + 9$
 67. $C = 325n + 5400$
 69. a. $I = Prt$
 b. $P = \$8000$; $I = \$600$;
 $t = 0.5$
 c. r d. $r = 15\%$
 71. a. $A = \frac{1}{2}bh$ b. $b = 3h$
 c. $A = \frac{1}{2}(3h)h = \frac{3}{2}h^2$
 d. $h^2 = \frac{2}{3}A$
 e. Take the square root of both sides
 f. 10 g. 30 feet

Writing & Thinking

73. a. 1 b. -1
 c. 1.5 d. -12

4.5 Exercises

Concept Check

1. consecutive
 3. $n + 2, n + 4$
 5. 2 7. True
 9. False; Integers that are not even

Practice

1. $x =$ savings account balance in dollars (or other unit of money); $\frac{3}{5}x$
 3. $s =$ the length of a side of the square; $4s = 20$
 5. $x - 5 = 13 - x$; 9
 7. $36 = 2x + 4$; 16
 9. $7x = 2x + 35$; 7
 11. $3x + 14 = 6 - x$; -2
 13. $\frac{2x}{5} = x + 6$; -10
 15. $4(x - 5) = x + 4$; 8
 17. $\frac{2x + 5}{11} = 4 - x$; 3

- 19. $2x + 3x = 4(x + 3); 12$
- 21. $n + (n + 2) = 60; 29, 31$
- 23. $n + (n + 1) + (n + 2) = 69; 22, 23, 24$
- 25. $n + (n + 1) + (n + 2) + (n + 3) = 74; 17, 18, 19, 20$
- 27. $171 - n = (n + 1) + (n + 2); 56, 57, 58$
- 29. $208 - 3n = (n + 1) + (n + 2) + (n + 3) - 50; 42, 43, 44, 45$
- 31. $n + 2(n + 2) = 4(n + 4) - 54; 42, 44, 46$
- 33. $(n + 2) + (n + 4) - n = 66; 60, 62, 64$
- 35. $2n + 3(n + 2) = 2(n + 4) + 7; 3, 5, 7$

Applications

- 37. a. The unknown value is the number of postcards purchased.
b. $p = 9$
c. Brooke purchased 9 postcards.
- 39. a. The number of slices each pizza was cut into
b. $\frac{1}{4}p + \frac{1}{2}p + \frac{3}{8}p = 9$
c. $p = 8$
d. Each pizza was cut into 8 slices.
- 41. $(c - 58.96) + c = 96.94;$
Flash drive: \$18.99;
Printer: \$77.95
- 43. $7x = 91,399; 13,057$
- 45. $x + x + (x + 3) + (x + 3 + 5) = 19;$
2 magazines
- 47. $50 - 2x = 10.50; \$19.75$
- 49. $800 + 50(x - 2) = 1450;$
15 hours
- 51. $19.99 + 0.65x = 127.24;$
165 miles
- 53. $n + 4n - 4 + 2n + 7 = 59;$
8 cm, 28 cm, 23 cm

- 55. $x + 3x - 1 + 2x + 5 = 64;$
10 inches, 29 inches,
25 inches
- Note:** Answers for 57 through 61 will vary.
- 57. Twice a number increased by 3 equals 9; $x = 3$
- 59. Find 3 consecutive even integers such that the sum of the first and the third is 3 times the second; $n = -2, 0, 2$
- 61. Find a number such that twice the sum of the number and 2, decreased by 6 is equal to the sum of the number and 4 minus the number; $n = 3$

4.6 Exercises

Concept Check

- 1. rate, time 3. 12%
- 5. one
- 7. False; The value of r should be written as a decimal number.
- 9. True

Applications

- 1. a. Original price
b. $x; 0.20x$ c. \$119.95
- 3. a. 2 liters b. 0.25x
c. $x + 20$
d. $0.20(x + 20) = 2 + 0.25x$
- 5. a. x is the number of quarters in Brian's pocket;
 $0.10(2q) + 0.25q = 2.70;$
 $q = 6$, so Brian has 6 quarters and 12 dimes.
b. Check against the language of the problem: 12 is twice as much as 6, and 6 quarters (\$1.50) and 12 dimes (\$1.20) add up to \$2.70.
- 7. 1.68 mph 9. 8.75 hours

- 11. 3 hours
- 13. 50 mph; 300 miles
- 15. 7 hours
- 17. 36 mph; 60 mph
- 19. Day: 56 mph;
Night: 69 mph
- 21. 4.5 miles

23. 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
- 25. \$7400 at 5.5%;
\$2600 at 6%
- 27. \$7000 at 6%; \$9000 at 8%
- 29. \$5500 at 8%;
\$6500 at 10%

31. a.

	Principal (\$)	Rate	=	Interest (\$)
High-Risk Fund	P	0.08		$0.08P$
Low-Risk Fund	$3600 - P$	0.04		$0.04(3600 - P)$

- b. $0.08P + 0.04(3600 - P) = 198$
- c. $P = \$1350$
- d. High-risk fund: \$1350;
Low-risk fund: \$2250
- e. Answer will vary.
- 33. \$6720 at 5.5%;
\$5280 at 7%
- 35. \$600 at 2.5%; \$800 at 4%
- 37. \$11,000 at 4%;
\$9500 at 5%
- 39. \$40.50
- 41. \$113.75
- 43. a. \$1140
b. $x - 0.05x$ or $0.95x$
c. $x - 0.05x - 2850 = 1140$ or
 $0.95x - 2850 = 1140$
d. \$4200

e. Robin's Refurbished Wrecks should sell the used car for \$4200.

- 45. 94
- 47. 4 phone calls
- 49. \$20
- 51. a. Not possible
b. 192
- 53. a. 3.2 inches
b. 7.1 inches
c. 6.9 inches
- 55. a. 80.4 million
b. 26 million
c. 75 million

Writing & Thinking

- 57. If each equal side is 9 cm long, that would make the perimeter more than 18 cm; Correct answer: 6 cm
- 59. 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

4.7 Exercises

Concept Check

- 1. look back or check
- 3. (total) sale or selling
- 5. appreciation
- 7. True 9. True

Practice

- 1. 91% 3. 137%
- 5. 37.5% 7. 150%
- 9. 0.69 11. 0.113
- 13. 0.005 15. 0.82
- 17. $\frac{7}{20}$ 19. $\frac{13}{10}$
- 21. 7 23. 11.4
- 25. 50

Applications

- 27. a. \$30 b. \$270

- 29. a. \$465 b. \$15,035
- 31. \$16.88; \$5.63
- 33. \$61.25
- 35. a. \$161 b. \$5474
- 37. \$52
- 39. a. \$6.93 b. \$122.38
- 41. 1.5%
- 43. a. \$250 b. 20%
c. \$216

- 45. \$11,700 47. \$875
- 49. \$28,000 51. \$770
- 53. \$2520 55. \$112,700
- 57. \$10,000 59. 5.9%
- 61. 2.484%
- 63. 214,926 people
- 65. a. \$200.00 b. 11.11%
- 67. 38%

- 69. a. \$7 b. $33\frac{1}{3}\%$
c. 25%
- 71. a. \$180 b. 40%
c. $28\frac{4}{7}\%$ or 28.6%
- 73. a. \$500 b. 25% c. 20%
- 75. a. \$1075 b. \$258
c. 24% d. 30%
- 77. \$1.89
- 79. \$1.39; \$1.75
- 81. \$8.64
- 83. \$31.80
- 85. a. \$3.60 b. \$22.50
- 87. \$111.60

Writing & Thinking

- 89. 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?"
- 91. For both types of percent of profit, the profit (the difference between selling

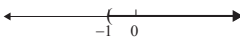
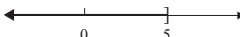

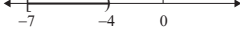
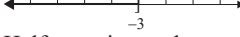
price and cost) must be determined first. The profit is then used as a numerator. In profit based on cost, the denominator is the cost. In profit based on selling price, the selling price is the denominator. The fraction is then divided and the result is a percent of profit, either based on cost or selling price.

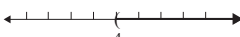

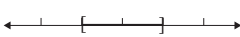
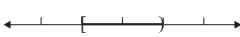
4.8 Exercises

Concept Check

- 1. interval 3. closed
- 5. addition 7. True
- 9. False; Only one value in the solution set needs to be checked.

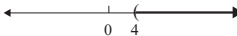
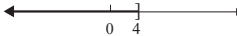
Practice

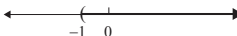
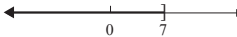
- 1. $(-1, \infty)$

- 3. $(-\infty, 5]$

- 5. $[-5, -1]$

- 7. $[-7, -4)$

- 9. 
Half-open interval

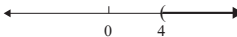
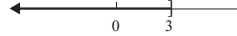
- 11. 
Open interval
- 13. 
Half-open interval
- 15. 
Closed interval
- 17. 
Half-open interval
- 19. a. $x \leq -2$
b. $(-\infty, -2]$
Half-open interval

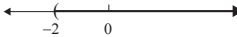
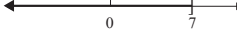
- 21. a. $x \geq -4$
b. $[-4, \infty)$
Half-open interval
- 23. a. $-3 < x < 1$
b. $(-3, 1)$
Open interval
- 25. a. $-2 \leq x \leq 2$
b. $[-2, 2]$
Closed interval

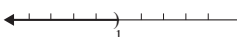
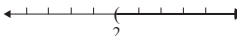
- 27. a. $x < 3$
b. $(-\infty, 3)$
Open interval

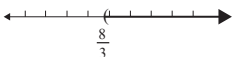
- 29. $(4, \infty)$

- 31. $(-\infty, 4]$


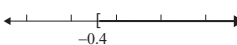
- 33. $(-1, \infty)$

- 35. $(-\infty, 7]$


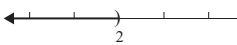
- 37. $(4, \infty)$

- 39. $(-\infty, 3]$


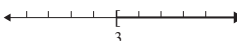
- 41. $(-2, \infty)$

- 43. $(-\infty, 7]$


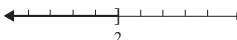
- 45. $(-\infty, 1)$

- 47. $(2, \infty)$


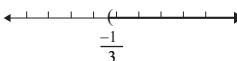
- 49. $(\frac{8}{3}, \infty)$


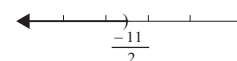
- 51. $[-0.4, \infty)$


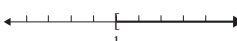
- 53. $(-\infty, 2)$


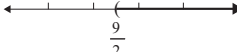
- 55. $[3, \infty)$


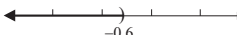
- 57. $(-\infty, 2]$


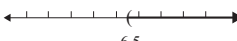
- 59. $(-\frac{1}{3}, \infty)$


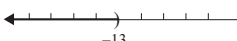
- 61. $(-\infty, -\frac{11}{2})$


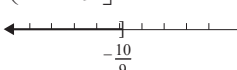
- 63. $[1, \infty)$


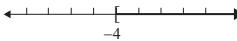
- 65. $(\frac{9}{2}, \infty)$


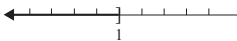
- 67. $(-\infty, -0.6)$


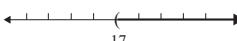
- 69. $(6.5, \infty)$


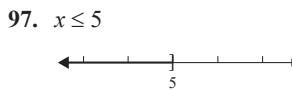
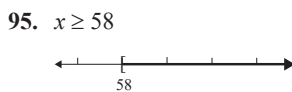
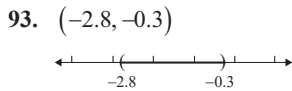
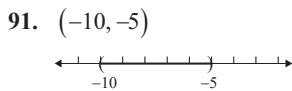
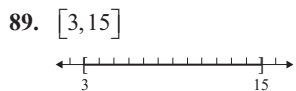
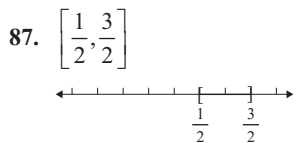
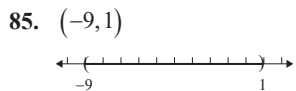
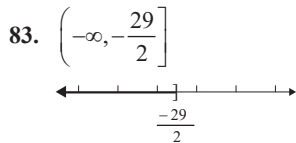
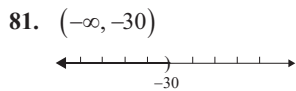
- 71. $(-\infty, -13)$


- 73. $(-\infty, -\frac{10}{9})$


- 75. $[-4, \infty)$


- 77. $(-\infty, 1]$


- 79. $(-17, \infty)$




Applications

99. 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.

101. He must sell at least 10 cars.

103. a. $15 - x$

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

c. 8 large arrangements

105. $100 - 5(x - 3) \geq 70$;
9 unexcused absences

107. 22,500 tickets

109. 8 times

111. 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.

113. a. $\frac{92 + 74 + 80 + 72 + E}{5} \geq 80$

b. $E \geq 82$

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

Chapter 5: Graphing Linear Equations and Inequalities

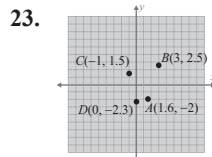
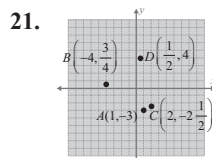
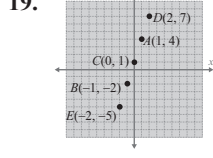
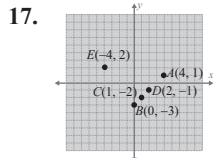
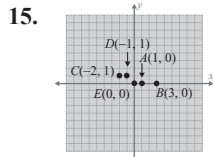
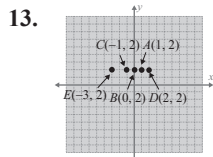
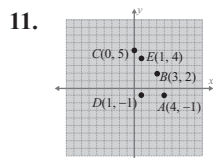
5.1 Exercises

Concept Check

- 1. quadrants
- 3. III 5. origin
- 7. True 9. True

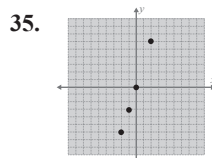
Practice

- 1. $\left\{ \begin{array}{l} A(-5, 1), B(-3, 3), \\ C(-1, 1), D(1, 2), \\ E(2, -2) \end{array} \right\}$
- 3. $\left\{ \begin{array}{l} A(-3, -2), \\ B(-1, -3), C(-1, 3), \\ D(0, 0), E(2, 1) \end{array} \right\}$
- 5. $\left\{ \begin{array}{l} A(-4, 4), B(-3, -4), \\ C(0, -4), D(0, 3), \\ E(4, 1) \end{array} \right\}$
- 7. $\left\{ \begin{array}{l} A(-3, -5), B(-1, 4), \\ C(0, -1), D(3, 1), \\ E(6, 0) \end{array} \right\}$
- 9. $\left\{ \begin{array}{l} A(-5, 0), B(-2, 2), \\ C(-1, -4), D(0, 6), \\ E(2, 0) \end{array} \right\}$

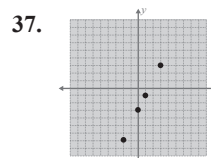


- 25. $(0, -4), (2, -2), (4, 0), (1, -3)$
- 27. $(0, 3), (2, 2), (6, 0), (-2, 4)$
- 29. $(0, -8), (1, -4), (2, 0), (3, 4)$
- 31. $(0, 2), (-1, \frac{8}{3}), (3, 0), (6, -2)$

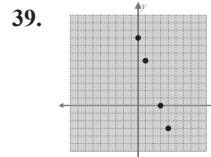
- 33. $(0, -\frac{7}{4}), (1, -1), (\frac{7}{3}, 0), (3, \frac{1}{2})$



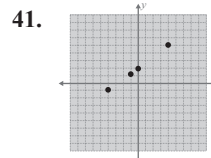
- $(0, 0), (-1, -3), (-2, -6), (2, 6)$



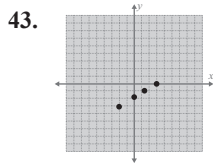
- $(0, -3), (1, -1), (-2, -7), (3, 3)$



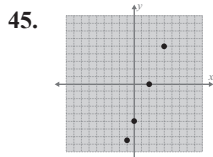
- $(0, 9), (3, 0), (1, 6), (4, -3)$



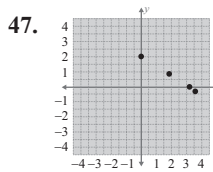
- $(0, 2), (4, 5), (-4, -1), (-1, \frac{5}{4})$



$(0, -\frac{9}{5}), (3, 0)$
 $(-2, -3), (\frac{4}{3}, -1)$



$(0, -5), (2, 0)$
 $(-1, -\frac{15}{2}), (4, 5)$



$(0, 2), (3.2, 0)$
 $(1.92, 0.8), (3.52, -0.2)$

49. b, c, d

51. a, d

53. a, c, d

55. For example, $(-3, -3)$, $(0, 1)$, and $(3, 5)$.

57. For example, $(-3, -1)$, $(0, 0)$, and $(3, 1)$.

59. For example, $(-2, 3)$, $(0, 3)$, and $(4, 3)$.

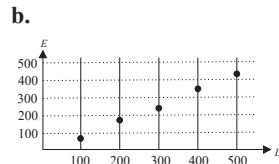
61. For example, $(-4, -4)$, $(0, -3)$, and $(4, -2)$.

63. For example, $(-3, -3)$, $(-2, 0)$, and $(-1, 3)$.

Applications

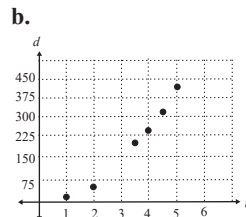
65. a.

D	E
100	85
200	170
300	255
400	340
500	425

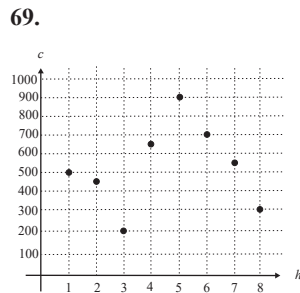


67. a.

t	d
1	16
2	64
3.5	196
4	256
4.5	324
5	400

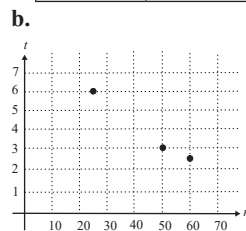


c. The time t is squared in the equation.



71. a.

r (mph)	t (hours)
25	6
50	3
60	2.5



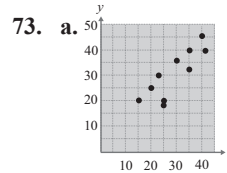
c. The time decreases as the rate increases.

d.

r (mph)	t (hours)
30	5
60	2.5
150	1
300	0.5
1500	0.1

e. Answers will vary. Rate increases as the time decreases.

Writing & Thinking



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

c. 24 sit-ups, 33 sit-ups, 36 sit-ups, 45 sit-ups. Answers will vary.

75. Answers will vary. Not all scatter plots can be used to predict information related to the two variables graphed because not all variables are related.

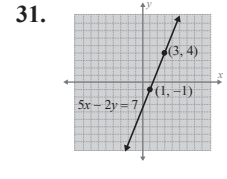
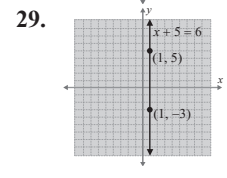
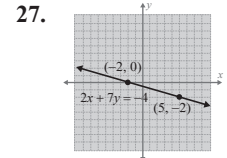
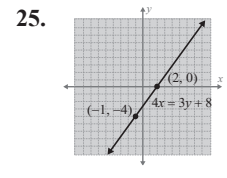
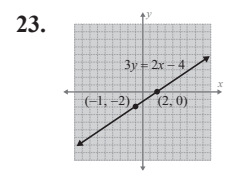
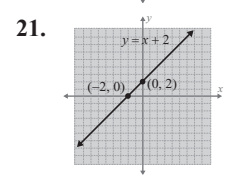
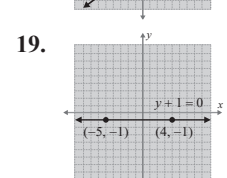
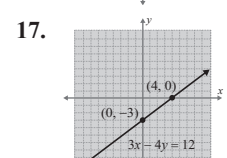
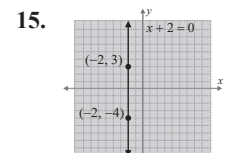
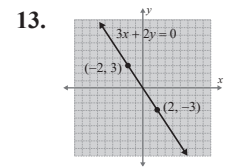
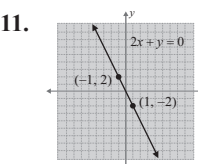
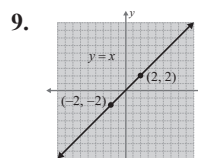
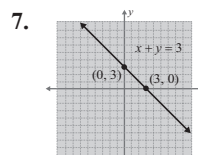
5.2 Exercises

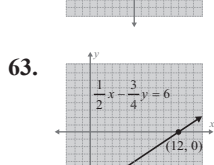
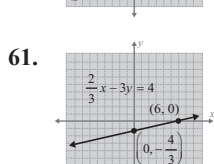
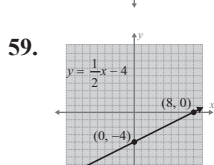
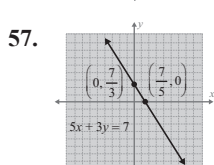
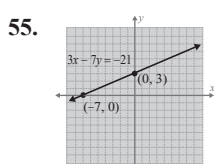
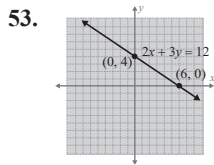
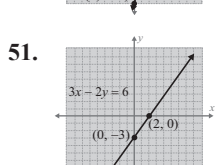
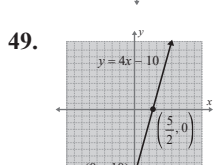
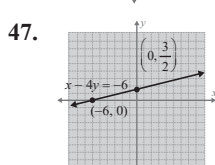
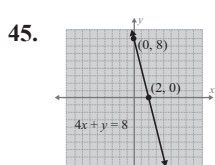
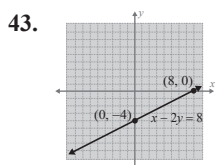
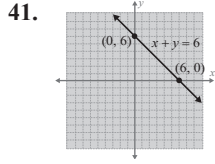
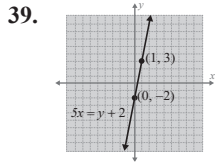
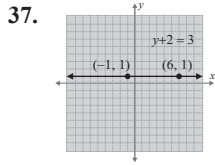
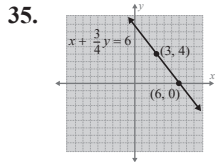
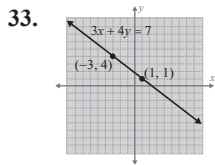
Concept Check

- 1. y
- 3. infinite
- 5. line
- 7. True
- 9. False; Horizontal lines have y -intercepts.

Practice

- 1. a.
- 3. d.
- 5. f.

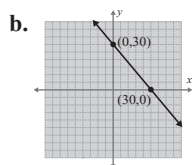




Applications

65. The x -intercept is $(12, 0)$ meaning that after 12 days, there will be 0 mg of potassium remaining in the bottle of sports drink. The y -intercept is $(0, 360)$ meaning that the original amount of potassium in the sports drink is 360 mg.

67. a. C -intercept: $(30, 0)$
 P -intercept: $(0, 30)$



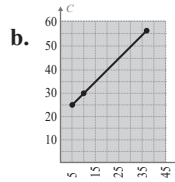
c. Answers will vary.
 Negative number of

cookies; Total amount of cookies is over 30 dozen.

d. 14 dozen chocolate chip cookies

69. a.

n	5	10	37
C	25	30	57



c. Answers will vary.
 Negative number of songs; Negative cost.

d. \$57

Writing & Thinking

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

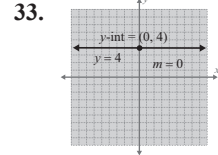
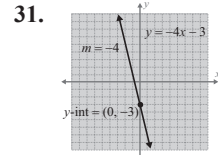
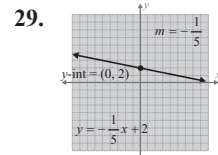
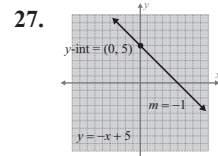
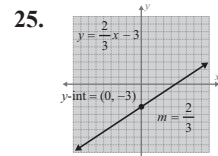
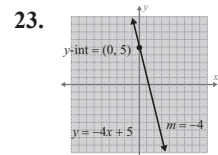
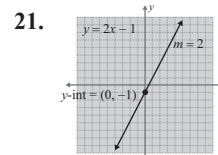
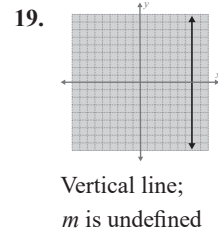
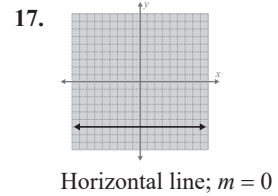
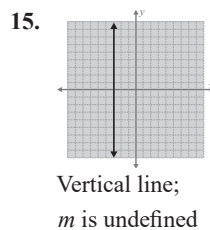
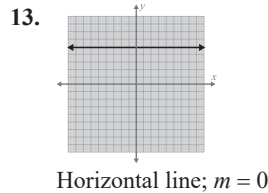
5.3 Exercises

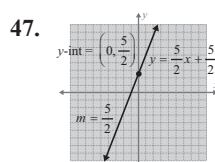
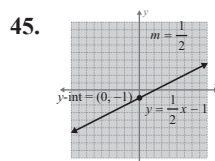
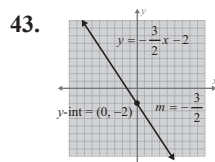
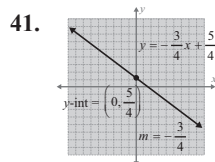
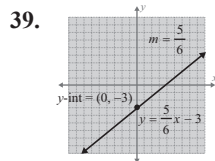
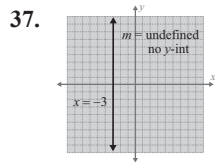
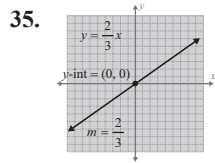
Concept Check

- 1. run
- 3. positive
- 5. 0
- 7. True
- 9. True

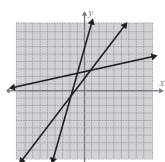
Practice

- 1. $m = 5$
- 3. $m = -\frac{1}{7}$
- 5. $m = 0$
- 7. $m = \frac{1}{2}$
- 9. $m = 2$
- 11. $m = \frac{1}{5}$

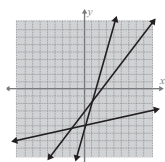




49. Answers will vary.



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. $m = -\frac{1}{6}$ b. $(0, \frac{5}{2})$

c. $y = -\frac{1}{6}x + \frac{5}{2}$

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

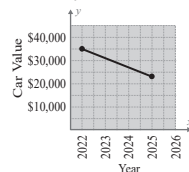
75. Yes

Applications

77. $\frac{3}{4}$ 79. $\frac{11}{10}$

81. 54 mph

83. \$4000/year

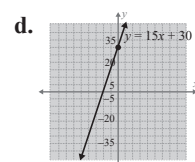


85. -5.66

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

b. $(0, 30)$

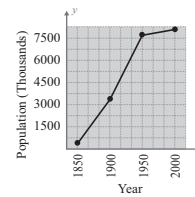
c. $y = 15x + 30$



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

f. \$90

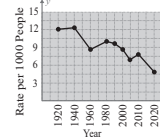
89. a. and b.



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, -0.14, -0.17

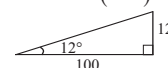
d. # of marriages decreased 0.18 marriages/1000 people from '40–'60, increased 0.075 marriages/1000 people from '60–'80, decreased 0.02 marriages/1000 people from '80–'90, decreased 0.13 marriages/1000 people from '90–'00, decreased 0.14 marriages/1000 people from '00–'10, and decreased 0.17 marriages/1000 people per year from '10–'20.

Writing & Thinking

93. a. The x -axis

b. The y -axis

95. A grade of 12% means that the slope of the road is 0.12. For every 100 feet of horizontal distance (run) there is a vertical distance (rise) of 12 feet.



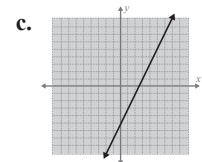
5.4 Exercises

Concept Check

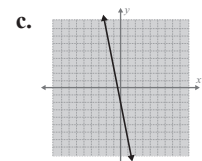
1. negative reciprocals
3. same
5. slope
7. True
9. True

Practice

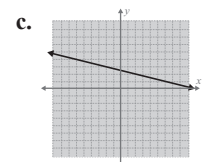
1. a. $m = 2$ b. $(3, 1)$



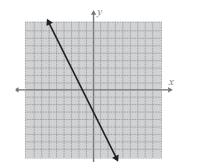
3. a. $m = -5$ b. $(0, -2)$



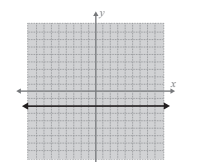
5. a. $m = -\frac{1}{4}$ b. $(-2, 3)$



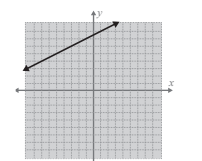
7. $2x + y = -3$



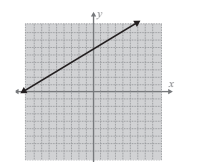
9. $y = -2$



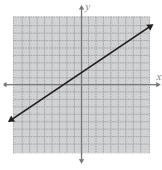
11. $x - 2y = -15$



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. $x - y = 1$

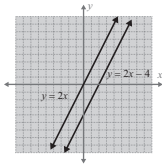
29. $3x + y = 2$

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

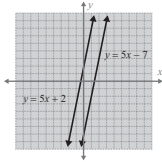
33. $7x + 3y = -5$

35. $y = 6$ 37. $y = 7$

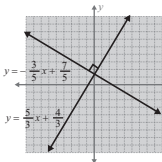
39. $y = 7$ 41. $y = 2x$



43. $y = 5x + 2$

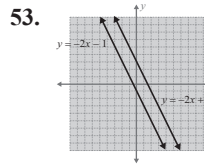
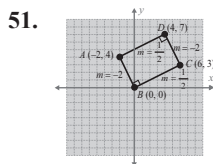


45. $y = -\frac{3}{5}x + \frac{7}{5}$

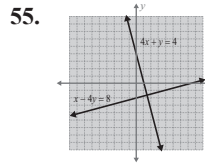


47. $y = -\frac{1}{3}x$

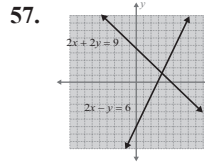
49. $y = -\frac{1}{2}x - 2$



53. Parallel



55. Perpendicular

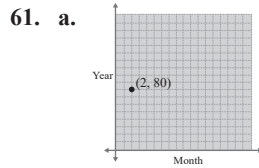


57. Neither

Applications

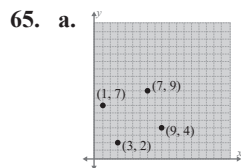
59. a. $P = 100t - 5000$

b. 50 tickets



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

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



65. a. 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

5.5 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. $\{(-4, -3), (-4, 1), (-1, -1), (-1, 3), (3, -4)\}$;

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

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

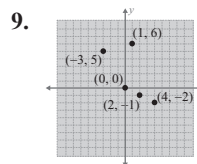
Not a function

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

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

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

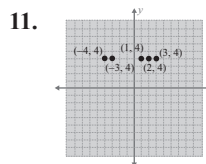
Not a function



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

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

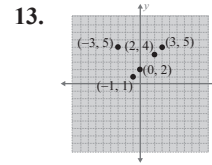
Function



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

$R = \{4\}$;

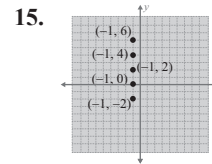
Function



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

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

Function



$D = \{-1\}$;

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

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

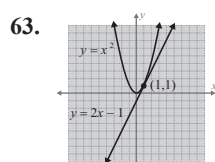
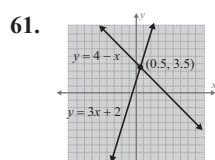
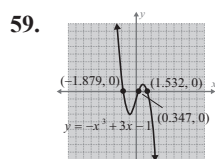
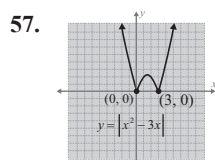
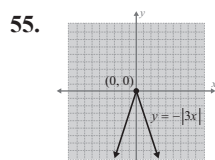
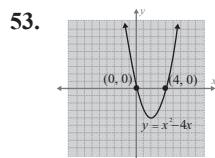
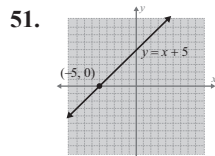
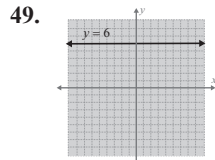
31. $\left\{(-2, -11), (-1, -2), \left(0, 1\right), (1, -2), (2, -11)\right\}$

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. $f(4) = 0$



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

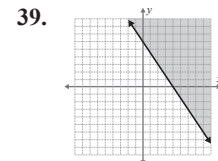
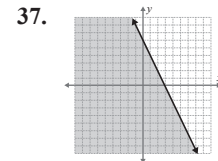
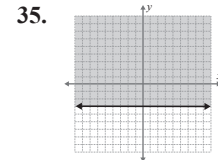
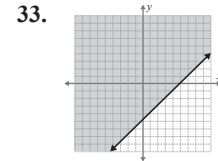
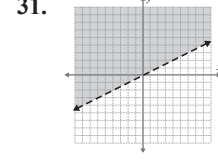
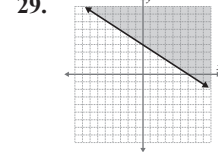
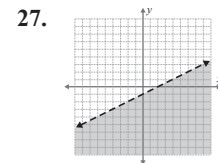
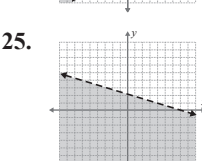
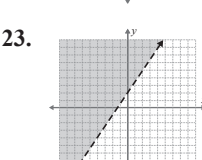
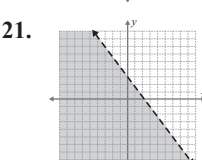
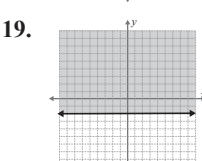
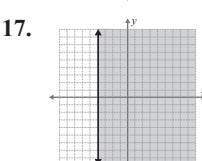
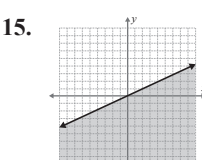
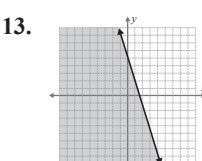
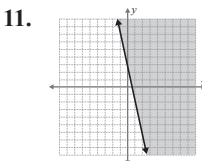
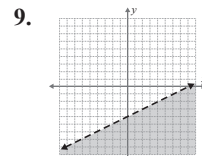
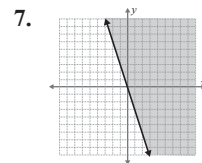
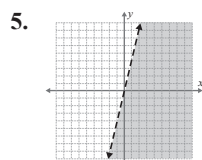
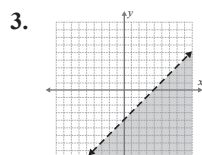
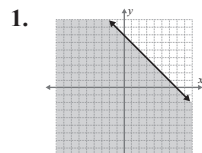
71. a. (0, 250), represents Ariella's base weekly salary
 b. 0.15; Represents the commission rate
 c. $y = 0.15x + 250$
 d. $f(x) = 0.15x + 250$
 e. Domain is all real numbers; Range is all real numbers
 f. Answers will vary. Some students may say sales cannot be negative, some will allow negative sales due to returns.
 g. \$1000

5.6 Exercises

Concept Check

1. test 3. open
 5. closed 7. True
 9. False; The boundary line is solid if the inequality uses \leq or \geq .

Practice



Applications

41. a. $x + y \geq 75$
 b.
 c. No; $67 < 75$
 d. Answers will vary; Any points with x or $y < 0$ or > 50 .

43. a.

Domain, d	Range, m
1	$\frac{23}{10}$
2	$\frac{13}{5}$
3	$\frac{29}{10}$
4	$\frac{16}{5}$
5	$\frac{7}{2}$
6	$\frac{19}{5}$
7	$\frac{41}{10}$

Writing & Thinking

45. A closed half-plane includes points on the line and is symbolized by a solid boundary line. An open half-plane does not include points on the line and is symbolized by a dashed boundary line.

b. 6.2

Chapter 6: Systems of Linear Equations

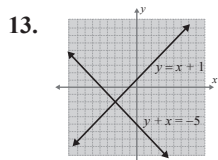
6.1 Exercises

Concept Check

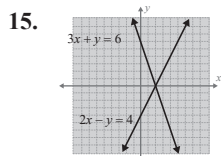
1. simultaneous
3. same 5. one
7. False; The solution must be checked in all equations.
9. True

Practice

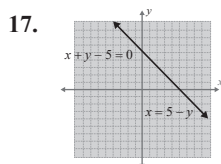
1. c 3. a, c
5. (0, 2) 7. (4, 2)
9. $m_1 = -2, b_1 = 3,$
 $m_2 = -2, b_2 = \frac{5}{2}$
11. $m_1 = \frac{1}{2}, b_1 = 3,$
 $m_2 = \frac{1}{2}, b_2 = -\frac{1}{2}$



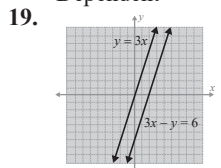
(-3, -2); Consistent; Independent



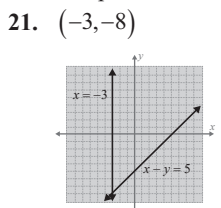
(2, 0); Consistent; Independent



(x, -x + 5); Consistent; Dependent

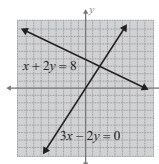


No solution; Inconsistent; Independent

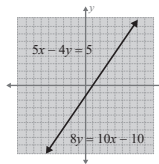


21. (-3, -8)

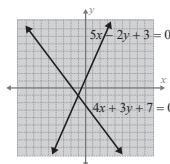
23. (2, 3)



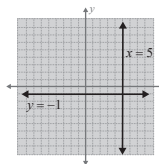
25. $(x, \frac{5}{4}x - \frac{5}{4})$



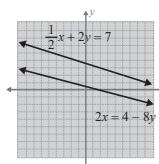
27. (-1, -1)



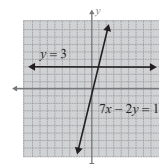
29. (5, -1)



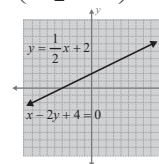
31. No solution



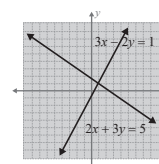
33. (1, 3)



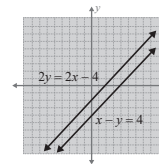
35. $(x, \frac{1}{2}x + 2)$



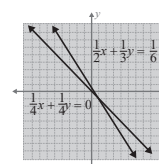
37. (1, 1)



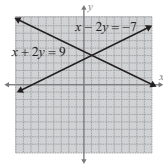
39. No solution



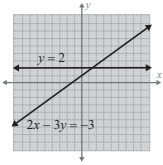
41. (1, -1)



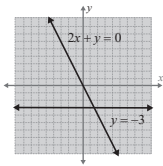
43. (1, 4)



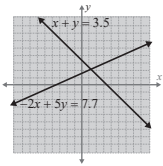
45. (1.5, 2)



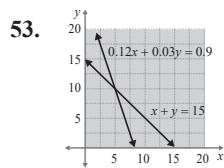
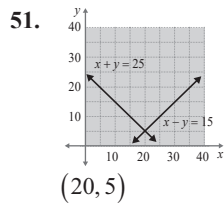
47. (1.5, -3)



49. (1.4, 2.1)



Applications

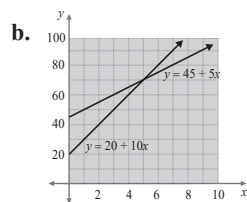


5 gallons of 12%;
10 gallons of 3%

55. 134 hours

57. a. Fit4life: $y = 20 + 10x$;
Workout Nation:

$y = 45 + 5x$



c. (5, 70)

- d. The gym memberships will cost the same amount per month if 5 classes are taken.
e. Workout Nation

Writing & Thinking

59. The solution to a consistent system of linear equations is a single point, which is easily written as an ordered pair.

6.2 Exercises

Concept Check

1. variables 3. no
5. back substitution
7. True 9. True

Practice

1. (2, 4)
3. $(x, 3x - 7)$
5. $(-6, -2)$ 7. (4, 1)
9. No solution
11. (3, 2) 13. $(4, -5)$
15. $(3, -2)$ 17. $(2, \frac{5}{2})$

19. $(\frac{1}{2}, -4)$ 21. $(\frac{7}{2}, -\frac{1}{2})$

23. $(x, 2 - 3x)$
25. $(-2, 1)$

27. $(-\frac{4}{5}, -\frac{7}{5})$

29. $(\frac{11}{7}, \frac{8}{7})$

31. $(x, \frac{1}{6}x + \frac{10}{3})$

33. (3, 3)

35. (10, 20)

37. No solution

39. $(x, -\frac{3}{2}x + 12)$

41. $(2, \frac{5}{3})$

Applications

43. (20, 5)

45. 5 gallons of 12%;
10 gallons of 3%

47. 3 months

49. a. $\begin{cases} c = 45 + 0.15t \\ c = 55 + 0.10t \end{cases}$

b. $t = 200, c = 75$

c. The plans will both cost \$75 when 200 text messages are sent.

d. More than 200 text messages

Writing & Thinking

51. Answers will vary.

6.3 Exercises

Concept Check

1. eliminate 3. standard
5. combining
7. False; The solution always needs to be checked in both original equations.
9. False; Both methods give exact solutions.

Practice

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

5. No solution

7. $(x, 3 - x)$ 9. $(-2, -3)$

11. (7, 5) 13. (1, -5)

15. $(x, \frac{1}{2}x - 2)$

17. $(\frac{22}{7}, -\frac{2}{7})$

19. (2, -2)

21. $(x, 2x - 4)$

23. (2, -1) 25. (5, -6)

27. (3, -1) 29. (2, 4)

31. $(-6, 2)$

33. No solution

35. (20, 10)

37. $(2, \frac{10}{9})$

39. No solution

41. $(-\frac{45}{7}, \frac{92}{7})$

43. $y = 5x - 7; m = 5, b = -7$

45. $y = -3; m = 0, b = -3$

47. $y = \frac{1}{2}x + \frac{3}{2};$

$m = \frac{1}{2}, b = \frac{3}{2}$

Applications

49. $y = 25x + 50$

51. \$4000 at 10%;
\$6000 at 6%

53. 40 liters of 30% solution (x), 60 liters of 40% solution (y)

55. a. $\begin{cases} y = 3500 + 1.5x \\ y = 1000 + 2x \end{cases}$

b. $x = 5000, y = 11,000$

c. The cards will earn the same amount of rewards points if you spend \$5000.

d. City

Writing & Thinking

57. Answers will vary.

6.4 Exercises

Practice

1. 23, 33 3. 15, 21

5. 37, 50

Applications

7. $80^\circ, 100^\circ$

9. $55^\circ, 55^\circ, 70^\circ$

11. The rate of the boat is 10 mph and the rate of the current is 2 mph.

13. Bolt's speed was 10.32 meters per second and the wind speed was 0.12 meters per second.

15. He traveled $1\frac{1}{2}$ hours at 52 mph and 2 hours at 56 mph.

17. Marcos traveled at 40 mph and Cana traveled at 51 mph.

19. Steve traveled at 28 mph and Tim traveled at 7 mph.

- 21. The westbound train was traveling 45 mph and the eastbound train was traveling 40 mph.
- 23. He jogged 12 miles.
- 25. 20 nickels and 10 dimes
- 27. 52 nickels and 130 pennies
- 29. 800 adults and 2700 children attended.
- 31. $l = 14$ meters; $w = 8$ meters
- 33. 100 yards \times 45 yards
- 35. $l = 33$ meters; $w = 17$ meters
- 37. Priscilla was 21 years old and Elvis was 32 years old.
- 39. She bought 10 paperbacks and 5 hardbacks.
- 41. 5000 general admission and 7500 reserved tickets were sold.
- 43. 22 at \$625 and 25 at \$550
- 45. 30 dozen (360 balls)
- 47. The store sold 22 of the \$95 jackets and 18 of the \$120 jackets.
- 49. One Big Mac costs \$4.11 and one order of medium French fries costs \$1.84.
- 51. They will produce 7 of Model X and 10 of Model Y.
- 53. a. $\begin{cases} 5c + 10a = 1400 \\ c + a = 200 \end{cases}$
 b. $c = 120, a = 80$
 c. 120 children and 80 adults visited the petting zoo on Tuesday.

- 7. False; When interest is calculated on an annual basis, $t = 1$.
 - 9. True
- Applications
- 1. \$5500 at 6%; \$3500 at 10%
 - 3. \$7400 at 5.5%; \$2600 at 6%
 - 5. \$450
 - 7. \$3500 in each or \$7000 total
 - 9. \$20,000 at 24%; \$11,000 at 18%
 - 11. \$800 at 5%; \$2100 at 7%
 - 13. \$8500 at 9%; \$3500 at 11%
 - 15. \$87,000 in bonds; \$37,000 in certificates
 - 17. 20 pounds of 20%; 30 pounds of 70%
 - 19. 20 ounces of 30%; 30 ounces of 20%
 - 21. 450 pounds of 35%; 1350 pounds of 15%
 - 23. 20 pounds of 40%; 30 pounds of 15%
 - 25. 10 g of pure acid; 20 g of the 40% solution
 - 27. 10 oz of salt; 50 oz of the 4% solution
 - 29. 2 lb of 72%; 4 lb of 42%
 - 31. 7.11 ounces of 0.5% solution; 0.89 ounces of the 5% solution

Account	Principal	Interest Rate	Interest
Account A	x	0.04	$0.04x$
Account B	y	0.09	$0.09y$
Totals	\$5000	N/A	\$350

Writing & Thinking

- 55. The number is 49.

6.5 Exercises

Concept Check

- 1. payment, interest
- 3. paid or earned
- 5. time

- b. $x = 2000, y = 3000$
- c. Sanjay should invest \$2000 in Account A and \$3000 in Account B to earn \$350 in interest.
- d. Yes; Invest more in Account B.
- 35. a. $5x + 7.50y = 6.50;$
 $x + y = 1$

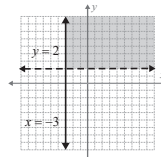
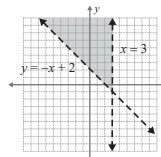
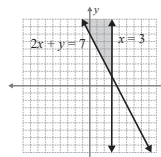
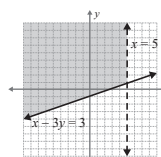
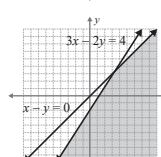
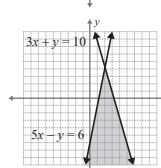
- b. $x = 0.4, y = 0.6$
- c. The manager should mix 0.4 pounds of cashews with 0.6 pounds of almonds to create a mixture which will cost \$6.50 for a one-pound bag.

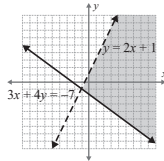
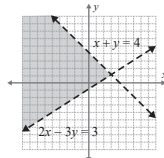
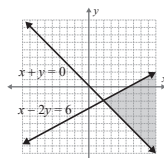
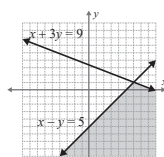
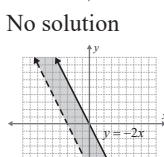
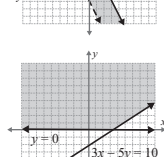
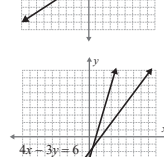
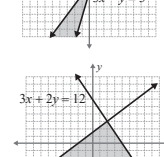
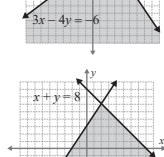
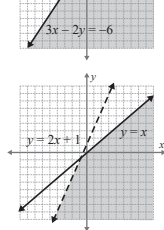
6.6 Exercises

Concept Check

- 1. test-point 3. closed
- 5. three
- 7. False; When boundary lines are parallel, the solution is either the strip between the boundary lines, a half-plane, or there is no solution.
- 9. True

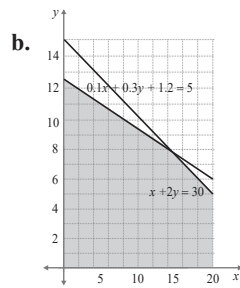
Practice

- 1. 
- 3. 
- 5. 
- 7. 
- 9. 
- 11. 

- 13. 
- 15. 
- 17. 
- 19. 
- 21. No solution
- 23. 
- 25. 
- 27. 
- 29. 
- 31. 
- 33. 

Applications

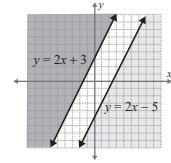
35. a. $\begin{cases} 0.1x + 0.3y + 1.2 < 5 \\ x + 2y < 30 \end{cases}$



b. 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

37. The solutions of the two inequalities do not overlap.



Chapter 7: Exponents and Polynomials

7.1 Exercises

Concept Check

- 1. subtract 3. positive
- 5. a
- 7. False; If there is no exponent written, the exponent is assumed to be 1.
- 9. True

Practice

- 1. 27 3. 512
- 5. $\frac{1}{3}$ 7. $\frac{1}{25}$
- 9. 16 11. 24
- 13. -500 15. $\frac{3}{8}$
- 17. $-\frac{3}{25}$ 19. x^5
- 21. y^2 23. $\frac{1}{x^3}$
- 25. $\frac{2}{x}$ 27. $-\frac{8}{y^2}$
- 29. $\frac{5x^6}{y^4}$ 31. 4
- 33. 49 35. $\frac{1}{10}$
- 37. $\frac{1}{8}$ 39. x^2
- 41. x^2 43. x^4
- 45. $\frac{1}{x^4}$ 47. x^6
- 49. x^2 51. y^2
- 53. $3x^3$ 55. x^4
- 57. $36x^3$ 59. $-14x^5$
- 61. $-12x^6$ 63. $4y$
- 65. $3y^2$ 67. $-2y^2$

- 69. $\frac{1}{x^2}$ 71. 1000
- 73. 1 75. $-18x^5y^7$
- 77. $-\frac{2y^2}{x}$ 79. $12a^3b^9c$
- 81. $-4a^{10}b^3c$
- 83. $\frac{5}{x}$
- 85. 1 87. 0.3906
- 89. 8875.147264

Applications

- 91. 2⁸ GB
- 93. 10⁻²⁴ cm³
- 95. 1 delivery
- 97. 3⁹ square yards
- 99. a. $(2x)^3$
 b. Product rule for exponents
 c. $8x^3$ d. 64 cm³
- 101. a. $\frac{2^{38}}{230} = 28$ gigabytes
 b. 256 gigabytes
 c. Quotient rule

7.2 Exercises

Concept Check

- 1. exponent(s)
- 3. multiply, keep
- 5. coefficient
- 7. True 9. True

Practice

- 1. -81 3. -16
- 5. 1,000,000 7. a^6

- 9. $\frac{1}{x^{10}}$ 11. $\frac{1}{256}$
- 13. $9y^2$ 15. $16x^2y^2$
- 17. $\frac{1}{x^6y^6}$ 19. $36x^6$
- 21. $-108x^6$ 23. $\frac{5x^2}{y}$
- 25. $-\frac{2y^6}{27x^{15}}$ 27. $\frac{a^4}{b^4}$
- 29. $\frac{4}{9}$ 31. $\frac{x^6}{y^6}$
- 33. $\frac{27x^3}{y^3}$ 35. 1
- 37. $4x^4y^4$ 39. $\frac{y^2}{x^2}$
- 41. $\frac{1}{3xy^2}$ 43. $-\frac{x^3y^6}{27}$
- 45. m^2n^4 47. $-\frac{y^2}{49x^2}$
- 49. $\frac{25x^6}{y^2}$ 51. $\frac{x^6}{y^6}$
- 53. $\frac{36y^{14}}{x^4}$ 55. $\frac{49y^4}{x^6}$
- 57. $\frac{24y^5}{x^7}$ 59. $\frac{4x^3}{3}$

- 61. $\frac{16x^{13}}{243y^6}$
- 63. $96x^2y^4z^4$
- 65. 19.4481
- 67. 208.5136x⁴
- 69. 22.7024

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

49. $3E8$ 51. $8.5E7$

53. $3E22$

55. $1.6051E15$

57. $1E2$ 59. $1.02E22$

Applications

61. 1.67×10^{-24} grams

63. 60,000,000,000,000 cells

65. 5.98×10^{27} grams

67. 4.0678×10^{16} m

69. 6.5×10^{-19} grams

71. 2.592×10^6 seconds

73. No. Should be 5.2×10^5

7.4 Exercises

Concept Check

- 1. descending
- 3. leading 5. binomial
- 7. False; Degree of 0
- 9. True

Practice

- 1. Monomial 3. Binomial
- 5. Trinomial

- 7. Not a polynomial
- 9. Binomial
- 11. $4y$; First-degree monomial; Leading coefficient 4
- 13. $x^3 + 3x^2 - 2x$; Third-degree trinomial; Leading coefficient 1
- 15. $-2x^2$; Second-degree monomial; Leading coefficient -2
- 17. 0; Monomial of no degree; Leading coefficient 0
- 19. $6a^5 - 7a^3 - a^2$; Fifth-degree trinomial; Leading coefficient 6
- 21. $2y^3 + 4y$; Third-degree binomial; Leading coefficient 2
- 23. 4; Monomial of degree 0; Leading coefficient 4
- 25. $2x^3 + 3x^2 - x + 1$; Third-degree polynomial; Leading coefficient 2
- 27. $4x^4 - x^2 + 4x - 10$; Fourth-degree polynomial; Leading coefficient 4
- 29. $9x^3 + 4x^2 + 8x$; Third-degree trinomial; Leading coefficient 9

- 31. a. -4 b. -16 c. -10
- 33. -16 35. -41
- 37. 4379 39. 13
- 41. -28
- 43. $3a^4 + 5a^3 - 8a^2 - 9a$
- 45. $3a + 11$ 47. $10a + 25$

Applications

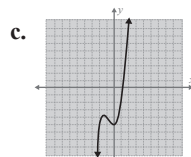
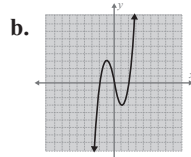
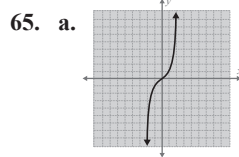
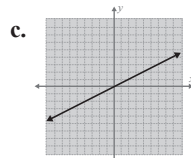
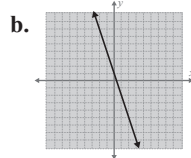
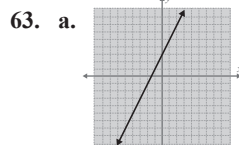
- 49. a. First degree polynomial
- b. 5 feet per second
- c. 50 feet per second
- d. 95 feet per second
- 51. a. First degree polynomial
- b. 9 games c. 11 games
- d. 29 games
- 53. a. \$20,250 b. \$16,000
- 55. a. 12 feet b. 28 feet
- c. 72 feet

d. No. Answers will vary.

- 57. \$45,950 in 2020; \$24,950 in 2026
- 59. 61 after 4 hours; 250,122 after 2 days (48 hours)

Writing & Thinking

61. He was correct. The expression is a sum/difference of monomials.



7.5 Exercises

Concept Check

- 1. sign 3. like
- 5. variables
- 7. False; All terms are subtracted.
- 9. False; They are like terms because they have the same variable raised to the same exponent.

Practice

- 1. $3x^2 + 7x + 2$
- 3. $2x^2 + 11x - 7$
- 5. $3x^2$
- 7. $x^2 - 5x + 17$
- 9. $-x^2 + 2x - 7$
- 11. $2x^3 + 4x^2 - 3x - 7$
- 13. $-x^2 + 7x - 3$
- 15. $-x^3 + 2x^2 + 3x - 4$
- 17. $4x^3 + 7$
- 19. $2x^3 + 11x^2 - 4x - 3$
- 21. $x^2 + x + 6$
- 23. $-3x^2 - 6x - 2$
- 25. $3x^2 - 4x - 8$
- 27. $-x^4 - 2x^3 - 16$
- 29. $-4x^4 - 7x^3 - 11x^2 + 5x + 13$
- 31. $-4x^2 + 6x + 1$
- 33. $3x^4 - 7x^3 + 3x^2 - 5x + 9$
- 35. $6x^2 - 7x + 18$
- 37. $8x^4 + 6x^2 + 15$
- 39. $2x^3 + 4x^2 + 3x - 10$
- 41. $4x - 13$
- 43. $-7x + 9$
- 45. $2x + 17$
- 47. $3x^3 + 13x^2 + 9$
- 49. $8x^2 - x - 2$
- 51. $3x - 19$
- 53. $x^2 - 2x + 13$
- 55. $7x - 3$
- 57. $4x^2 + 3x + 5$
- 59. $7x - 18$
- 61. $x^2 + 11x - 8$
- 63. $7x^3 - x^2 - 7$

Applications

- 65. a. $3.50x^3 + 4x^2 - 30$ dollars
- b. $6.50x^3 + 4x^2 - 20$ dollars
- c. \$460
- 67. a. $27x - 40$ dollars
- b. \$284

Writing & Thinking

69. Add the opposite of each term in the polynomial being subtracted to the original polynomial and combine like terms.

7.6 Exercises

Concept Check

- distributive
- FOIL
- like
- False; The product of $(a + b)$ and $(c + d)$ is $ac + ad + bc + bd$.

Practice

- $-6x^5 - 15x^3$
- $4x^7 - 12x^6 + 4x^5$
- $-y^5 + 8y - 2$
- $-4x^8 + 8x^7 - 12x^4$
- $25x^5 - 5x^4 + 10x^3$
- $a^7 + 2a^6 - 5a^3 + a^2$
- $x^2 + x - 12$
- $a^2 - 2a - 48$
- $x^2 - 3x + 2$
- $3t^2 - 3t - 60$
- $x^3 + 11x^2 + 24x$
- $2x^2 - 7x - 4$
- $6x^2 + 17x - 3$
- $4x^2 - 9$
- $16x^2 + 8x + 1$
- $y^3 + 2y^2 + y + 12$
- $3x^2 - 8x - 35$
- $5x^3 + 6x^2 - 22x - 9$
- $2x^4 + 7x^3 + 5x^2 + x - 15$
- $3x^2 + 2x - 8$
- $2x^2 + 3x - 5$
- $7x^2 - 13x - 2$
- $6x^2 - 13x - 8$
- $4x^2 + 12x + 9$
- $x^3 + 3x^2 - 4x - 12$
- $4x^2 - 49$
- $x^3 + 1$

- $49a^2 - 28a + 4$
- $x^3 + 8x^2 + 15x$
- $6x^3 - 2x^2 - 4x$
- $2x^3 + x^2 - 5x - 3$
- $x^3 + 6x^2 + 11x + 6$
- $a^4 - a^2 + 2a - 1$
- $t^4 + 6t^3 + 13t^2 + 12t + 4$
- $6x^2 - x - 2$
- $9a^2 - 25$
- $-10x^2 + 39x - 14$
- $x^3 + 5x^2 + 8x + 4$
- $2y^2 - 61$
- $3a^2 - 17a + 11$
- $-3x - 21$
- $a^2 + 9a - 1$

Applications

- $6x^2 + 15x$ square inches
- $R(x) = -8x^2 + 70x + 1500$
- $A(x) = 280 - 4x^2$
 - $14 - 2x$ and $20 - 2x$
 - $B(x) = 4x^2 - 68x + 280$
 - $V(x) = 4x^3 - 68x^2 + 280x$

Writing & Thinking

- Answers will vary.
 - Answers will vary.

7.7 Exercises

Concept Check

- difference
- trinomial
- False; The product will be a binomial.
- True

Practice

- $x^2 - 14x + 49$;
Perfect square trinomial
- $x^2 + 8x + 16$;
Perfect square trinomial
- $x^2 - 9$;
Difference of two squares
- $x^2 - 81$;
Difference of two squares

- $2x^2 + x - 3$
- $9x^2 - 24x + 16$;
Perfect square trinomial
- $25x^2 - 4$;
Difference of two squares
- $9x^2 - 12x + 4$;
Perfect square trinomial
- $x^2 - 16x + 64$;
Perfect square trinomial
- $16x^2 - 25$;
Difference of two squares
- $25x^2 - 81$;
Difference of two squares
- $x^2 - 8x + 16$;
Perfect square trinomial
- $4x^2 - 49$;
Difference of two squares
- $10x^4 - 11x^2 - 6$
- $49x^2 + 14x + 1$;
Perfect square trinomial
- $x^2 + 10x + 25$
- $x^4 - 1$
- $x^4 + 6x^2 + 9$
- $x^6 - 4x^3 + 4$
- $9x^2 - 4$
- $16x^2 - 9$
- $25x^2 + 30x + 9$
- $36x^2 - 60x + 25$
- $x^2 - 1.96$
- $x^2 - 5x + 6.25$
- $x^2 - 4.6225$
- $x^2 + 2.48x + 1.5376$
- $2.0164x^2 + 27.264x + 92.16$
- $129.96x^2 - 12.25$
- $93.24x^2 + 142.46x - 104.04$

Applications

- $A(x) = 900 - 4x^2$
 - $P(x) = 4(30 - 2x) + 8x = 120$
 - $f(x) = 15x^6 - 30x^5 + 15x^4$
 - 0.234375
- $A(x) = 150 - 4x^2$

$$b. P(x) = 2(15 - 2x) + 2(10 - 2x) + 8x = 50$$

$$c. V(x) = (10 - 2x)(15 - 2x)x = 4x^3 - 50x^2 + 150x$$

- $A(x) = 400 - 4x^2$
 - $20 - 2x$ and $20 - 2x$
 - $B(x) = 400 - 80x + 4x^2$
 - $V(x) = 400x - 80x^2 + 4x^3$

7.8 Exercises

Concept Check

- rational
- numerator, simplify
- 0
- False; Descending order
- True

Practice

- $y^2 - 2y + 3$
- $2x^2 - 3x + 1$
- $10x^3 - 11x^2 + x$
- $-4x^2 + 7x - \frac{5}{2}$
- $y^3 - \frac{7}{2}y^2 - \frac{15}{2}y + 4$
- $x - 6 + \frac{4}{x + 4}$
- $3x - 4 - \frac{7}{2x - 1}$
- $3x + 4 + \frac{1}{7x - 1}$
- $x - 9$
- $x^2 - x - \frac{3}{x - 8}$
- $4x^2 - 6x + 9 - \frac{17}{x + 2}$
- $x^2 + 7x + 55 + \frac{388}{x - 7}$
- $2x^2 - 9x + 18 - \frac{30}{x + 2}$
- $7x^2 + 2x + 1$
- $x^2 + 2x + 2 - \frac{12}{2x + 3}$

31. $x^2 + 3x + 2 - \frac{2}{x-4}$
 33. $2x^2 + x - 3 + \frac{18}{5x+3}$
 35. $2x^2 - 8x + 25 - \frac{98}{x+4}$
 37. $3x^2 + 2x - 5 - \frac{1}{3x-2}$
 39. $3x^2 - 2x + 5$
 41. $x^3 + 2x + 5 + \frac{17}{x-3}$
 43. $x^3 + 2x^2 + 6x + 9 + \frac{23}{x-2}$
 45. $x^3 + \frac{1}{2}x^2 - \frac{3}{4}x - \frac{3}{8}$

$$+ \frac{45}{16\left(x - \frac{1}{2}\right)}$$

 47. $3x + 5 + \frac{x-1}{x^2+2}$
 49. $x^2 + x - 4 + \frac{-8x+17}{x^2+4}$
 51. $2x + 3 + \frac{6}{3x^2 - 2x - 1}$
 53. $3x^2 - 10x + 12$

$$+ \frac{-x-14}{x^2+x+1}$$

 55. $x^2 - 2x + 7 + \frac{-17x+14}{x^2+2x-3}$
 57. $x^2 + 3x + 9$

59. $x^5 - x^4 + x^3 - x^2 + x - 1$
 61. $x^4 + x^3 + x^2 + x + 1$

$$+ \frac{2}{x-1}$$

 63. $x^4 - \frac{1}{2}x^3 - \frac{3}{4}x^2 + \frac{3}{8}x$

$$+ \frac{13}{16} - \frac{13}{32\left(x + \frac{1}{2}\right)}$$

Applications

65. a. $x^2 - 4x - 5$ square inches
 b. $x^2 - 3x - 10$ square inches

Writing & Thinking

67. $3x^3 + 4x^2 + 8x + 12$;
 Multiply the divisor $(3x-2)$ by the quotient, $x^2 + 2x + 4 + \frac{20}{3x-2}$, to get the original polynomial.
 69. a. 19;

$$2x^2 - 4x + 2 + \frac{19}{x-2}$$

 b. -5;

$$2x^2 - 10x + 20 - \frac{5}{x+1}$$

 c. 55; $2x^2 + 10 + \frac{55}{x-4}$
 Yes; $R = P(a)$ when $P(x)$ is divided by $x - a$.

Chapter 8: Factoring Polynomials

8.1 Exercises

Concept Check

- product, factors
- greatest common factor, largest
- negative / opposite
- True
- False; Binomials can be common factors.

Practice

- 5
- 8
- 1
- $10x^3$
- $4a^2$
- $13ab$
- $15xy^2z^2$
- x^4
- $-4y$
- $3x^3$
- $2x^2y$
- $m + 9$
- $x - 6$
- $b + 1$
- $3y + 4x + 1$
- $11(x - 11)$
- $4y(4y^2 + 3)$
- $-3a(2x - 3y)$
- $5xy(2x - 5)$
- $-2yz(9yz - 1)$
- $8(y^2 - 4y + 1)$

- $x(2y^2 - 3y - 1)$
- $4m^2(2x^3 - 3y + z)$
- $-7x^2z^3(8x^2 + 14xz + 5z^2)$
- $x^4y^2(15 + 24x^2y^4 - 32x^3y)$
- $(y+3)(7y^2+2)$
- $(x-4)(3x+1)$
- $(x-2)(4x^3-1)$
- $(2y+3)(10y-7)$
- $(x-2)(a-b)$
- $(b+c)(x+1)$
- $(x^2+6)(x+3)$
- Not factorable
- $(3-b)(x+y)$
- $(y-4)(5x+z)$
- $(z^2+3)(a+1)$
- $(6x+1)(a+2)$
- $(x+1)(y+1)$
- $(2y-7z)(5x-y)$
- $(3x-4u)(y-2v)$
- Not factorable
- $(2c-3d)(3a+b)$

Applications

85. 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.
 87. a. 32 feet b. $16x(3-x)$
 c. 32 feet
 d. Yes. They are equivalent expressions.

- $\{1, 16\}, \{-1, -16\}, \{4, 4\}, \{-4, -4\}, \{8, 2\}, \{-8, -2\}$
- $\{1, -10\}, \{10, -1\}, \{5, -2\}, \{2, -5\}$
- 4, 3 13. -7, 2
- 8, -1 17. -6, -6
- 5, -4 21. $x + 1$
- $p - 10$ 25. $a + 6$

8.2 Exercises

Concept Check

- constant, middle
- positive
- different
- False; One factor is negative, one is positive.
- True

Practice

- $\{1, 15\}, \{-1, -15\}, \{3, 5\}, \{-3, -5\}$
- $\{1, 20\}, \{-1, -20\}, \{4, 5\}, \{-4, -5\}, \{2, 10\}, \{-2, -10\}$
- $\{1, -6\}, \{6, -1\}, \{2, -3\}, \{3, -2\}$

- $(x-4)(x+3)$
- $(y+6)(y-5)$
- Not factorable
- $(x-4)(x-4)$
- $(x+4)(x+3)$
- $(y-1)(y-2)$
- Not factorable
- $(x+8)(x-9)$
- $(z-6)(z-9)$
- $x(x+7)(x+3)$
- $5(x-4)(x+3)$
- $10y(y-3)(y+2)$
- $4p^2(p+1)(p+8)$
- $2x^2(x-9)(x+2)$
- $2(x^2-x-36)$
- $2a^2(a-10)(a+6)$

59. $3y^3(y-8)(y+1)$

61. $x(x-2)(x-8)$

63. $5(a^2+2a-6)$

65. $20a^2(a+1)(a+1)$

Applications

67. Base = $x + 48$; Height = x

69. $x + 5$

71. a. 0 feet

b. $-16(t-3)(t+2)$

c. 0 feet

d. Yes. They are equivalent expressions.

Writing & Thinking

73. If the sign of the constant term is positive, the signs in the factors will both be positive or both be negative. If the sign of the constant term is negative, the sign in one factor will be positive and the sign in the other factor will be negative.

8.3 Exercises

Concept Check

- factors
- factorable
- False; The trial-and-error method of factoring is the opposite of the FOIL method.

Practice

- $(x+2)(x+3)$
- $(2x-5)(x+1)$
- $(6x+5)(x+1)$
- $-(x-2)(x-1)$
- $(x-5)(x+2)$
- $-(x-14)(x+1)$
- Not factorable
- $-x(2x+1)(x-1)$
- $(t-1)(4t+1)$
- $(5a-6)(a+1)$
- $(7x-2)(x+1)$

23. $(2x-3)(4x+1)$

25. $(3x+4)(3x-5)$

27. $2(2x-5)(3x-2)$

29. $(3x-1)(x-2)$

31. $(3x-1)(3x-1)$

33. $(3y+2)(2y+1)$

35. $(x-1)(x-45)$

37. Not factorable

39. $3n(4m+1)(m-4)$

41. Not factorable

Writing & Thinking

43. This is not an error, but the trinomial is not completely factored. The completely factored form of this trinomial is $2(x+2)(x+3)$.

8.4 Exercises

Concept Check

- product, sum
- False; The middle term should be the sum of the inner and outer products.
- False; The first step is to multiply a and c .

Practice

- $(3x-2)(x+3)$
- $2(2x-3)(2x+4)$
- Not factorable
- $(2x+3)(3x+2)$
- $-(2x+1)(x+5)$
- $(5x+2)(10x-1)$
- $(3x-1)(5x-1)$
- $3n(4m+1)(m-4)$
- $(4x-1)(4x-1)$
- $(8x-3)(8x-3)$
- $2(3x-5)(x+2)$
- $5(2x+3)(x+2)$
- $-2(9x^2-36x+4)$
- $-15(3y+4)(y-2)$
- $3(2x-5)(2x-5)$
- $3x(2x-1)(x+2)$

33. $3x(2x-9)(2x-9)$

35. $9xy^3(x^2+x+1)$

37. $4xy(3y-4)(4y-3)$

39. $7y^2(y-4)(3y-2)$

Writing & Thinking

41. $x(5-2x)(25-2x)$; The height is x , the width is $(5-2x)$, and the length is $(25-2x)$.

8.5 Exercises

Concept Check

- binomial
- $2ax, -2ax$
- $(x+a)(x^2-ax+a^2)$
- True
- False; The sum of two squares is not factorable.

Practice

- $(x-5)(x+5)$
- $(9-y)(9+y)$
- $2(x-8)(x+8)$
- $4(x-2)(x+2)(x^2+4)$
- Not factorable
- $(y-8)^2$
- $-4(x-5)(x+5)$
- $(3x-5)(3x+5)$
- $(y-5)^2$
- $(2x-1)^2$
- $(5x+3)^2$
- $(4x-5)^2$
- $4x(x-4)(x+4)$
- $2xy(x+8)^2$
- $(y+3)^2$
- $(x-10)^2$
- $(x^2+5y)^2$
- $(x-5)(x^2+5x+25)$
- $(y+6)(y^2-6y+36)$
- $(x+3y)(x^2-3xy+9y^2)$
- Not factorable

43. $4(x-2)(x^2+2x+4)$

45. $2(3x-y)(9x^2+3xy+y^2)$

47. $y(x+y)(x^2-xy+y^2)$

49. $x^2y^2(1-y)(1+y+y^2)$

51. $3xy(2x+3y)(4x^2-6xy+9y^2)$

53. $(x^2-y^3)(x^4+x^2y^3+y^6)$

55. $(3x+y^2)(9x^2-3xy^2+y^4)$

57. $(2x+y)(4x^2-2xy+y^2)$

59. $8(y-1)(y^2+y+1)$

61. $(3x-y)(3x+y)$

63. $(x-2y)(x+2y)(x^2+4y^2)$

65. $(x-y-9)(x-y+9)$

67. $(x-y-6)(x-y+6)$

69. $(4x+1-y)(4x+1+y)$

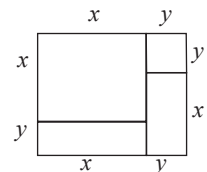
71. a. x^2-16

b. $\boxed{}x-4$
 $x+4$

Writing & Thinking

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

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



75. For a 3-digit integer: $abc = 100a+10b+c = (99+1)a+(9+1)b+c = 9(11a+b)+a+b+c$. So, if the sum $(a+b+c)$ is divisible by 3 (or 9), then the number abc will be divisible by 3 (or 9).

For a 4-digit integer:
 $abcd$
 $= 1000a + 100b + 10c + d$
 $= (999 + 1)a + (99 + 1)b$
 $+ (9 + 1)c + d$
 $= 9(111a + 11b + c) + a$
 $+ b + c + d$
 So, if the sum
 $(a + b + c + d)$ is divisible
 by 3 (or 9), then the number $abcd$ will be divisible
 by 3 (or 9).

8.6 Exercises

Concept Check

1. trial-and-error, ac
3. original
5. monomial
7. True

Practice

1. $(m + 6)(m + 1)$
3. $(x + 9)(x + 2)$
5. $(x - 10)(x + 10)$
7. $(m - 3)(m + 2)$
9. Not factorable
11. $(8a - 1)(8a + 1)$
13. $(x + 5)^2$
15. $(x + 12)(x - 3)$
17. $3(a + 6)(a - 2)$
19. $-5(x - 6)(x - 8)$
21. Not factorable
23. $x(x - 6)(x + 2)$
25. $-2a(a + 8)(a - 7)$
27. $4x(2x - 5)(2x + 5)$
29. $-(x - 5)(3x - 2)$
31. $(2x - 1)(3x - 4)$
33. $(4m + 3)(3m - 2)$
35. $2(2x - 1)(x - 3)$
37. $(4x - 7)(2x + 5)$
39. $(5x + 6)(4x - 9)$
41. $-(5x - 7)(3x + 2)$
43. $-(2a - 3)(4a - 5)$

45. $(4y + 5)(5y - 4)$
47. $(6x - 1)(3x - 2)$
49. $-6(5x - 4)(5x + 4)$
51. $3(4n^2 - 20n - 25)$
53. $a(21a^2 - 13a - 2)$
55. $3x(3x - 2)(4x + 5)$
57. $2x(2x - 1)(4x - 11)$
59. $5(24m^2 + 2m + 15)$
61. $(y - 4)(x + 3)$
63. $(x + 2y)(x - 6)$
65. $-(x^2 - 5)(x - 8)$
67. $(x + 5)(x^2 - 5x + 25)$
69. $x^4(y - 1)(y^2 + y + 1)$
71. $(2a^2 + 3b^2)(4a^4 - 6a^2b^2 + 9b^4)$
73. $(x^2y - 5)(x^4y^2 + 5x^2y + 25)$
75. $(x - 3)(x + 3)(x + 7)$
77. $(3x + y + 6)(3x - y - 6)$
79. $(y + 10 + 7x)(y + 10 - 7x)$
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. $x = -\frac{3}{2}, 4$
75. $y^2 - y - 6 = 0$
77. $2x^2 + 11x + 5 = 0$
79. $8x^2 - 10x + 3 = 0$
81. $x^3 - x^2 - 6x = 0$
83. $y^3 - 4y^2 - 3y + 18 = 0$

8.7 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. $x = -2, \frac{4}{3}$
85. a. 640 ft; 384 ft
- b. 144 ft; 400 ft
- c. 7 seconds;
 $0 = -16(t + 7)(t - 7)$
87. 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.
89. 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

91. This allows for use of the zero-factor law, which says that for the product to equal zero one of the factors must equal zero. Answers will vary.

8.8 Exercises

Concept Check

1. variable, unknown
3. consecutive
5. 1
7. False; The sum of the squares of the lengths of the legs is equal to the hypotenuse squared.
9. 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. $x(x + 1) = 72$; $x = 8$, so the integers are 8 and 9 .
17. $x^2 + (x + 1)^2 = 85$;
 $x = 6$, so the integers are 6 and 7 .
19. $x(x + 2) = 63$; $x = -9, 7$, so the integers are -9 and -7 or 7 and 9 .
21. $4x + (x + 1)^2 = 41$; $x = 4$, so the integers are 4 and 5 .

23. $2x(x+1) = (x+1)(x+2) + 88$;
 $x = 10$, so the integers are 10, 11, and 12.
25. $6x(x+2) = (x+1) + (x+3)^2$;
 $x = -2, 1$, so the integers are $-2, -1, 0$, and 1 or $1, 2, 3$, and 4 .
27. $w(2w) = 72$; $w = 6$, so width is 6 in. and length is 12 in.
29. $w(4w) = 64$; $w = 4$, so width is 4 ft and length is 16 ft.
31. $l(l-4) = 45$; $l = 9$, so width is 5 ft and length is 9 ft.
33. $\frac{1}{2}b(b-4) = 16$; $b = 8$, so base is 8 ft and height is 4 ft.
35. $\frac{1}{2}(h+6)h = 20$; $h = 4$, so the base is 10 in.
37. $w(16-w) = 48$; $w = 4, 12$, so the rectangle is 4 in. by 12 in.
39. $r(r+13) = 140$; $r = 7$, so there are 7 trees in each row.
41. $r(r+7) = 144$; $r = 9$, so there are 9 rows.
43. $n(n+1675) = 8400$; $n = 5$, so there are 5 floors.
45. $(w+11)(w+4) = 98$; $w = 3$, so the rectangle was 3 cm by 10 cm.
47. $w = 10, 15$, so width is 10 ft and length is 30 ft or width is 15 ft and length is 20 ft.
49. $h^2 + (h-34)^2 = (h+2)^2$;
 $h = 48$, so the height of the pole is 48 ft.
51. $x^2 + (x-49)^2 = (x+1)^2$;
 $x = 60$, so height is 60 ft.
53. $l^2 + (l-28)^2 = (l+8)^2$;
 $l = 60$, so the length of the mat is 60 inches.
55. a. Figures will vary.
 b. $(17-x)^2 + x^2 = 13^2$
 c. $x = 12, x = 5$
 d. Yes
 e. The wire is attached to the pole 5 feet from the ground (12 feet from the top) and attached to the stake which is 12 feet from the pole. Or the wire is attached to the pole 12 feet from the ground (5 feet from the top) and attached to the stake which is 5 feet from the pole.
- f. Answers will vary.
57. \$1.50 per pound
59. \$16 or \$20 per reel

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.

Chapter 9: Rational Expressions

9.1 Exercises

Concept Check

- rational
- fundamental
- fractions
- True
- False; A rational expression cannot have a zero denominator.

Practice

- $\frac{3x}{4y}$; $x \neq 0, y \neq 0$
- $\frac{2x^3}{3y^3}$; $x \neq 0, y \neq 0$
- $\frac{1}{x-3}$; $x \neq 0, 3$
- 7; $x \neq 2$ 9. $-\frac{3}{4}$; $x \neq 3$
- $\frac{2x}{y}$; $x \neq -\frac{2}{3}, y \neq 0$
- $\frac{x}{x-1}$; $x \neq -6, 1$
- $\frac{x-7}{x-3}$; $x \neq -3, 3$

- $\frac{x-3}{y-2}$; $y \neq -2, 2$
- $\frac{x+7}{y+5}$; $x \neq 2, y \neq -5$
- $\frac{2}{75}$ 23. 9
- 0 27. $\frac{-3}{32}$
- 1

Applications

- a. $p(x) = \frac{15x+200}{x}$
 b. \$35 c. $x \neq 0$
 d. The variable cannot be negative because you cannot have a negative quantity of people. There would also be a maximum number depending on the size of the room.
- a. \$11.62
 b. \$6.29
 c. \$5.33

- The cost per calculator decreases as the number of calculators purchased increases.
 e. $x \neq -20$
 f. The value of x cannot be negative because you cannot buy a negative quantity of calculators

35. $(2x-5)$ feet

Writing & Thinking

- a. A rational expression is an algebraic expression that can be written in the form $\frac{P}{Q}$ where P and Q are polynomials and $Q \neq 0$.
 b. $\frac{x-1}{(x+2)(x-3)}$
 Answers will vary.
 c. $\frac{1}{x+5}$
 Answers will vary.

9.2 Exercises

Concept Check

- factor
- numerator, denominator
- numerators, denominators
- True
- False; the restriction is 0.

Practice

- $\frac{ab}{6y}$ 3. $\frac{8x^2y^3}{15}$
- $\frac{x+3}{x}$ 7. $\frac{x-1}{x+1}$
- $-\frac{1}{x-8}$ 11. $\frac{x-2}{x}$
- $\frac{4x+20}{x(x+1)}$
- $\frac{x}{(x+3)(x-1)}$
- $-\frac{x+4}{x(x+1)}$
- $\frac{x+2y}{(x-3y)(x-2y)}$
- $\frac{x-1}{x(2x-1)}$

23. $\frac{1}{x+1}$ 25. $\frac{x+2}{x-2}$ 13. $\frac{6}{5}$ 15. $\frac{23}{30}$
27. $\frac{1}{3xy^6}$ 29. $\frac{6y^7}{x^4}$ 17. $\frac{28}{27}$
31. $\frac{x}{12}$ 33. $\frac{6x+18}{x^2}$ 19. $7(x+5)(x-5)$
35. $\frac{6}{5x}$ 37. $\frac{3x+1}{x+1}$ 21. $30(y-4)$
39. $\frac{x-2}{2x-1}$ 23. $(x+3)(x-3)(x-3)$
41. $-\frac{x+4}{x(2x-1)}$ 25. $-(y-3)$
43. $\frac{x+1}{x-1}$ 27. $-2(x+12)(x-12)$
45. $\frac{6x^3-x^2+1}{x^2(4x-3)(x-1)}$ 29. $(x+4)(x-3)(x+5)$
47. $\frac{x^2+4x+4}{x^2(2x-5)}$ 31. $(x-2)(y+3)(x+7)$
49. $\frac{x^2-6x+5}{(x-7)(x-2)(x+7)}$ 33. $2(x+6)(x-6)(x+3)$
51. $\frac{x^2-3x}{(x-1)^2}$ 35. $6(x-5)(y+6)(y+1)$
53. $\frac{x^2+5x}{2x+1}$ 37. $(x+2)(x-2)(x^2+4)$
55. 1 39. 28
41. $33(x-3)$
43. $-3x^2$
45. $2(y+3)(y-1) = 2y^2+4y-6$
47. $(x+1)(x+3) = x^2+4x+3$

Applications

57. a. $\frac{x^2-3x-10}{x+3}$
 b. $\frac{x^2+5x+6}{x-5}$
 c. $(x+2)^2 = x^2+4x+4$

9.3 Exercises

Concept Check

- smallest
- prime factorization
- equivalent
- True
- False; You completely factor each polynomial, including prime factors for numerical terms.

Practice

- 150
- 432
- 600
- 60
- $\frac{11}{17}$
- $\frac{3}{2}$

9.4 Exercises

Concept Check

- numerator, denominator
- most
- equivalent
- True
- True

Practice

- 3
- 2
- 1
- $\frac{2}{x-1}$
- $\frac{14}{7-x}$
- 4
- $\frac{x^2-x+1}{(x+4)(x-3)}$
- $\frac{5}{x-3}$
- $\frac{4x+5}{2(7x-2)}$
- $\frac{6x+15}{(x+3)(x-3)}$
- $\frac{x^2-2x+4}{(x+2)(x-1)}$

- $\frac{-x^2-3x-6}{(x+3)(3-x)}$
- $\frac{8x^2+13x-21}{6(x+3)(x-3)}$
- $\frac{3x^2-20x}{(x+6)(x-6)}$
- $\frac{-4x}{x-7}$
- $\frac{4x^2-x-12}{(x+7)(x-4)(x-1)}$
- $\frac{x-6}{(x-10)(x-8)}$
- $\frac{6x}{(x-1)(x-7)}$
- $\frac{4x-19}{(7x+4)(x-1)(x+2)}$
- $\frac{-7x-9}{(4x+3)(x-2)}$
- $\frac{4x^2-41x+3}{(x+4)(x-4)}$
- $\frac{x-4}{2(x-2)}$
- $\frac{x^2-4x-6}{(x+2)(x-2)(x-1)}$
- $\frac{3x^2+26x-3}{(x+7)(x-3)(x+1)}$
- $\frac{6x+2}{(x-1)(x+3)}$
- $\frac{2x^2+x-4}{(x-2)(y+1)(x+1)}$
- $\frac{2x+4xy-15y}{(x+3)(y+2)(x-5)}$
- $\frac{-2x+2}{2x-1}$
- $\frac{2x^2-x-5}{(x-3)(x+3)(x^2+1)}$
- $\frac{x^2+9x+6}{(3x+1)(x+3)(x-1)}$

Applications

- a. $\frac{7x^2+3}{x-2}$ b. $\frac{4x^2+5}{x+2}$
 c. $\frac{22x^3+12x^2+16x-8}{(x+2)(x-2)}$
- $\frac{5x+6}{2x(x+3)}$

- a. $\frac{100}{x}$ b. $\frac{100}{2x+15}$
 c. $\frac{100x+1500}{x(2x+15)}$
- a. \$5750
 b. $C(x) = 5750 + 0.35x$
 c. $A(x) = \frac{5750 + 0.35x}{x}$
 d. \$6.40 per cupcake
 e. \$1.99 per cupcake

9.5 Exercises

Concept Check

- rational
- LCM
- complex algebraic
- True
- True

Practice

- $\frac{4}{5xy}$
- $\frac{8}{7x^2y}$
- $\frac{2x^2+6x}{2x-1}$
- $\frac{2x-1}{2+3x}$
- $\frac{7}{2(x+2)}$
- $\frac{x}{x-1}$
- $\frac{4x}{3(x+6)}$
- $\frac{7x}{x+2}$
- $\frac{2x+6}{3(x-2)}$
- $\frac{24y+9x}{2(9y-10x)}$
- $\frac{x}{x-1}$
- $\frac{xy}{x+y}$
- $\frac{1}{xy}$
- $\frac{y+x}{y-x}$
- $\frac{3-x}{x}$
- $\frac{x+1}{x+3}$
- $\frac{-1}{x(x+h)}$
- $\frac{-1}{x(x+h)}$
- $-(x-2y)(x-y)$
- $\frac{2x}{x^2+1}$
- $\frac{(x-3)(x^2-2x+4)}{(x-4)(x-2)(x+1)}$
- $\frac{-5}{x+1}$

45. $\frac{29}{4(4x+5)}$
 47. $\frac{x^2-3x-6}{x(x-1)}$
 49. $\frac{x^2-4x-2}{(x-4)(x+4)}$

Applications

51. a. $\frac{2r_1r_2}{r_1+r_2}$
 b. 44.2 miles per hour
 c. 1.8 hours

Writing & Thinking

53. a. $\frac{8}{5}$
 b. 1
 c. $\frac{x^4+x^3+3x^2+2x+1}{x^3+x^2+2x+1}$

9.6 Exercises

Concept Check

- 1. ratio 3. extraneous
- 5. variables
- 7. False; It is not a proportion.
- 9. True

Practice

- 1. $x = 7$
- 3. $x \neq 0, 2; x = 4$
- 5. $x \neq -3, 4; x = -10$
- 7. $x \neq 0; x = 18$
- 9. $x \neq 6; x = -\frac{74}{9}$
- 11. $x = \frac{1}{4}$
- 13. $x = 6$
- 15. $x = 4$
- 17. $x \neq 0; x = \frac{10}{3}$
- 19. $x \neq 0; x = -\frac{3}{4}$
- 21. $x \neq 0; x = -\frac{3}{16}$
- 23. $x \neq -9, -\frac{1}{4}, 0; x = -2, 1$

25. $x \neq \frac{3}{2}, 0, 6; x = \frac{3}{5}, 9$
 27. $x \neq \frac{1}{2}, 4; x = -3$
 29. $x \neq -4, -1; x = 2$
 31. $x \neq -1, \frac{1}{4}; x = \frac{2}{3}$
 33. $x \neq 2, 3; x = \frac{13}{10}$
 35. $x \neq -\frac{2}{3}, 2; \text{ no solution}$

37. $x \neq -1, \frac{1}{3}, \frac{1}{2}; x = \frac{1}{5}$

39. $r = \frac{S-a}{S}$

41. $s = \frac{x-\bar{x}}{z}$

43. $y = m(x-x_1) + y_1$

45. $R_{\text{total}} = \frac{R_1R_2}{R_1+R_2}$

47. $P = \frac{A}{1+r}$

49. $LK = 15, JB = 5$

51. $AC = 2, ST = 12$

53. $ST = 8, TU = 12, QR = 24$

55. $AP = \frac{9}{2}$ in.; $PC = \frac{15}{2}$ in.

Applications

- 57. 360 defective computers
- 59. 36,800 students
- 61. 34 miles
- 63. 6.8 cups
- 65. Width = 3 inches;
Length = 7.5 inches
- 67. 4 hours
- 69. First group: 10 hours;
Second group: 6 hours.
- 71. a. $\frac{3x}{3} = \frac{16}{x}$
 b. $x = -4, +4$
 c. $x = -4$ does not make sense because length cannot be negative
 d. The side of the small triangle is 4 feet long

and the base of the large triangle is 12 feet long.

Writing & Thinking

73. a. $\frac{x^2-8x}{4(x-4)(x+4)}$

b. $x = 0, 8$

75. a. $\frac{14x-16}{5x(x-4)}$ b. $x = \frac{8}{7}$

- b. $x = 5$
- c. It would take the newest printer 5 hours to complete the job and the old printer 20 hours to complete the job.

Writing & Thinking

- 35. a. 5 and 7 b. 2 and 4

9.7 Exercises

Concept Check

- 1. unit, time 3. check
- 5. diagram, chart
- 7. True

Applications

- 1. 72, 45 3. 9
- 5. $\frac{6}{13}$ 7. 36, 27
- 9. 7, 12 11. 37.5 miles
- 13. $\frac{12}{5}$ or $2\frac{2}{5}$ hours
- 15. $\frac{9}{5}$ or $1\frac{4}{5}$ hours
- 17. 6 hours
- 19. Charles: 8 mph;
Chase: 6 mph

- 21. 63 mph
- 23. sailboat: 5 mph; cruise ship: 25 mph
- 25. 20 mph
- 27. 120 hours
- 29. John: 11 hours;
Raul: 22 hours;
Denny: 33 hours
- 31. 1 mph
- 33. a. $\frac{1}{x} + \frac{1}{4x} = \frac{1}{4}$

Printer	Time of Work (in Hours)	Part of Work Done in 1 Hour
Newest	x	$\frac{1}{x}$
Old	$4x$	$\frac{1}{4x}$
Together	4	$\frac{1}{4}$

9.8 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 cm³ 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

Chapter 10: Roots and Radicals

10.1 Exercises

Concept Check

- 2
- square root
- radical, radicand
- False; If the original number is negative, the principal square root will not be the same as the original number.
- False; The radicand is underneath the radical symbol.

Practice

- | | |
|-------------------|-------------------|
| 1. 3 | 3. 9 |
| 5. 17 | 7. 13 |
| 9. 1 | 11. 5 |
| 13. 6 | 15. $\frac{1}{2}$ |
| 17. $\frac{3}{4}$ | 19. 0.2 |
| 21. -10 | 23. -0.04 |
| 25. -3 | 27. -5 |
| 29. $\frac{3}{5}$ | |
31. $\sqrt{64} < \sqrt{74} < \sqrt{81}$ and $8 < \sqrt{74} < 9$ because $64 < 74 < 81$ or $(8.6023)^2 = 73.99956529$
33. $\sqrt{25} < \sqrt{32} < \sqrt{36}$ and $5 < \sqrt{32} < 6$ because $25 < 32 < 36$ or $(5.6569)^2 = 32.00051761$
- | | |
|-----------------------|----------------|
| 35. > | 37. < |
| 39. = | 41. = |
| 43. Rational | 45. Rational |
| 47. Irrational | |
| 49. Not a real number | |
| 51. Rational | 53. Irrational |
| 55. 6.2450 | 57. 2.4960 |
| 59. 0.4472 | 61. 8.9443 |
| 63. -8.2462 | 65. 2.6207 |
| 67. 4.9324 | |

Applications

69. $5\sqrt{2}$ or 6.30 inches
71. a. 4 inches
b. 12 tiles
73. 10 inches
75. 4.64 cm
77. a. 1.7 meters
b. 1.6 meters
c. 1.8 meters
79. a. 4.2 ft
b. 10.2 ft
c. 18 tiles

Writing & Thinking

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

10.2 Exercises

Concept Check

1. factor 3. 2
5. $\sqrt{a}\sqrt{b}$ 7. True
9. False; If x is a real number, then $\sqrt{x^2} = |x|$.

Practice

- | | |
|--------------------------------|----------------------------------|
| 1. $2\sqrt{3}$ | 3. $12\sqrt{2}$ |
| 5. $-6\sqrt{2}$ | 7. $-2\sqrt{14}$ |
| 9. $-5\sqrt{5}$ | 11. $\frac{1}{2}$ |
| 13. $-\frac{\sqrt{11}}{8}$ | 15. $\frac{2\sqrt{7}}{5}$ |
| 17. $6x$ | 19. $2x\sqrt{2x}$ |
| 21. $2x^5y\sqrt{6x}$ | 23. $5xy^3\sqrt{5x}$ |
| 25. $-3xy\sqrt{2}$ | 27. $2bc\sqrt{3ac}$ |
| 29. $5x^2y^3z^4\sqrt{3}$ | |
| 31. $\frac{x^2\sqrt{5}}{3}$ | 33. $\frac{4a^2\sqrt{2a}}{9b^8}$ |
| 35. $\frac{10x^4\sqrt{2}}{17}$ | 37. 6 |
| 39. $2\sqrt[3]{7}$ | 41. -1 |
| 43. $-4\sqrt[3]{2}$ | 45. $5x\sqrt[3]{x}$ |

47. $-2x^2\sqrt[3]{x^2}$
49. $2a^2b\sqrt[3]{9b}$
51. $6x^2y\sqrt[3]{y^2}$
53. $2xy^2z^3\sqrt[3]{3x^2y}$
55. $\frac{\sqrt[3]{3}}{2}$ 57. $\frac{5\sqrt[3]{3}}{2}$
59. $\frac{5y^4}{3x^2}$

Applications

61. $\sqrt{6} \approx 2.45$ amperes
63. 120 volts
65. a. 10 cm
b. $2\sqrt{30}$ cm
c. $5\sqrt{6}$ cm

Writing & Thinking

67. A cube root has no restrictions as the cube root of a negative number is negative.

10.3 Exercises

Concept Check

1. radical, index
3. $a^{\frac{1}{2}}$ 5. $\sqrt[3]{a}$
7. True 9. True

Practice

- | | |
|-------------------------|-----------------------|
| 1. $\sqrt[3]{8}$ | 3. $-\sqrt[6]{x}$ |
| 5. $\sqrt[5]{4z^2}$ | 7. $13^{\frac{1}{7}}$ |
| 9. $(-9)^{\frac{1}{3}}$ | 11. 3 |
| 13. $\frac{1}{10}$ | 15. -512 |
| 17. -4 | |
| 19. Not a real number | |
| 21. $\frac{3}{7}$ | 23. 16 |
| 25. $-\frac{1}{6}$ | 27. $\frac{5}{2}$ |
| 29. $\frac{1}{4}$ | 31. $\frac{3}{8}$ |
| 33. $-\frac{1}{1000}$ | 35. 64 |

37. 8.5499
39. 10,000,000
41. 99.6055 43. 0.0922
45. 1.6083 47. 0.2236
49. 7.7460 51. 2.0408
53. $8x$ 55. $\frac{1}{3a^2}$
57. $8x^{\frac{5}{2}}$ 59. $5a^{\frac{13}{6}}$

61. $x^{\frac{7}{12}}$ 63. $x^{\frac{1}{2}}$
65. $\frac{1}{a^{\frac{9}{8}}}$ 67. $a^{\frac{1}{4}}$
69. $\frac{a^2}{b^{\frac{6}{5}}}$ 71. $8x^{\frac{3}{2}}y$
73. $\frac{x^{\frac{3}{2}}}{16y^{\frac{2}{5}}}$ 75. $\frac{x^2y^4}{z^4}$
77. $\frac{y^{\frac{3}{2}}z^2}{x}$ 79. $\frac{8b^{\frac{9}{4}}}{a^3c^3}$

81. $x^{\frac{1}{4}}y^{\frac{5}{4}}$ 83. $\frac{y^{\frac{2}{3}}}{50x^{\frac{3}{5}}}$
85. $\frac{b^{\frac{5}{12}}}{a^{\frac{11}{12}}}$ 87. $\frac{3x^{\frac{1}{2}}}{20y^{\frac{2}{3}}}$
89. $\sqrt[6]{x^5}$ 91. $\sqrt[12]{y^7}$
93. $\sqrt[30]{x^{11}}$ 95. $\sqrt[6]{y}$
97. $\sqrt[9]{x}$ 99. $\sqrt[3]{7a}$
101. $\sqrt[24]{x}$ 103. $a^{20}b^5c^{10}$

Applications

105. 0.24 Earth years
107. 576 ft²
109. a. 20 feet per second
b. 35.78 feet per second
111. a. 50 kmph
b. 20 kmph

Writing & Thinking

113. a. n must be an integer greater than 1.
b. n must be a number less than 0.

- c. n must equal 0.
- d. n must be a rational number that is not an integer.

10.4 Exercises

Concept Check

1. index
3. False; \sqrt{a} and $\sqrt[3]{a}$ do not have the same index, so they are not like radicals.
5. True

Practice

1. $8\sqrt{2}$
3. $\sqrt{11}$
5. $-3\sqrt{10}$
7. $13\sqrt[3]{3}$
9. $-\sqrt{11}$
11. $3\sqrt{a}$
13. $7\sqrt{x}$
15. $4\sqrt{2} + 3\sqrt{3}$
17. $8\sqrt{b} - 4\sqrt{a}$
19. $13\sqrt[3]{x} - 2\sqrt[3]{y}$
21. $5\sqrt{3}$
23. 0
25. $17\sqrt[3]{2}$
27. $2\sqrt{2} - 6\sqrt{3}$
29. $6 + \sqrt{5}$
31. $\sqrt{3} - 4\sqrt{2}$
33. $5\sqrt[3]{2} - 8\sqrt[3]{3}$
35. $4\sqrt{2x}$
37. $2y\sqrt{2y}$
39. $-4x\sqrt{3xy}$
41. $15x\sqrt{x}$
43. $-xy^2\sqrt{x}$
45. $4x^5y^{10}\sqrt{3}$
47. $-8x^8y^2$
49. $xy^2\sqrt[3]{2}(-2x^2y^2 - 2x^3y + 3)$

Applications

51. $5\sqrt{6} + \sqrt{170} \approx 25.29$ ft
53. a. $7\sqrt{2t}$ dollars
- b. $\sqrt{2t}$ dollars

Writing & Thinking

55. $\sqrt[3]{-125} + \sqrt[3]{98}$
 $\neq \sqrt[3]{-125+98}$
 as radicals cannot be added by simply adding their radicands. Also, a negative sign is missing when evaluating the cube root, since $\sqrt[3]{-27} = -3$.

10.5 Exercises

Concept Check

1. distributive
3. comma
5. True

Practice

1. $3\sqrt{2} - 8$
3. 18
5. $-8\sqrt{3}$
7. $12 + \sqrt{6}$
9. $2y + \sqrt{xy}$
11. $13 + 2\sqrt{2}$
13. $3x - 9\sqrt{3x} + 8$
15. $2 - 2\sqrt{7}$
17. $13 + 4\sqrt{10}$
19. $\sqrt{10} + \sqrt{15} - \sqrt{6} - 3$
21. $x - 2\sqrt{6x} - 18$
23. 58
25. $x + 10\sqrt{xy} + 25y$
27. $x + 28 - 10\sqrt{x+3}$
29. $2x + 19 - 8\sqrt{2x+3}$
31. $\sqrt{5}$
33. $4\sqrt{10x}$
35. $\sqrt[3]{6y} + 7y$
37. $15 + 4\sqrt{x}$
39. $\sqrt[3]{4-8b}$
41. $\frac{\sqrt{3}}{a} - 7$
43. 4.3397
45. 31.6
47. -57
49. -37.3569

Applications

51. $\frac{118 + 52\sqrt{7}}{9}$ square yards

10.6 Exercises

Concept Check

1. denominator
3. rational
5. conjugate
7. True
9. False; You would need to multiply by $\sqrt[3]{a^2}$.

Practice

1. $\frac{5\sqrt{2}}{2}$
3. $\frac{-3\sqrt{7}}{7}$
5. $2\sqrt{3}$
7. 3
9. 3
11. $\frac{1}{3}$
13. $\frac{2\sqrt{3}}{3}$
15. $\frac{3\sqrt{2}}{2}$
17. $\frac{\sqrt{x}}{x}$
19. $\frac{\sqrt{2xy}}{y}$
21. $\frac{\sqrt{2y}}{y}$
23. $\frac{3\sqrt{7}}{5}$
25. $\frac{-\sqrt{2y}}{5}$
27. $\frac{\sqrt[3]{30}}{3}$
29. $\frac{-5\sqrt{x}}{x^2}$
31. $\frac{2\sqrt{3x}}{3y}$
33. $\frac{2\sqrt{b}}{b}$
35. $\frac{\sqrt[3]{28xy^2}}{2y^2}$
37. $\frac{x\sqrt[3]{3xy^2}}{3y}$
39. $\frac{\sqrt[3]{22}}{2}$
41. $\frac{\sqrt[3]{45ab^2}}{3b^2}$
43. $\frac{a\sqrt[3]{2ab^2}}{2b}$
45. $\sqrt{6} + 2$
47. $\frac{-(\sqrt{5} + 3)}{4}$
49. $\frac{-6(5 + 3\sqrt{2})}{7}$
51. $\frac{\sqrt{3}(\sqrt{2} - 5)}{23}$
53. $\frac{-7(1 + 3\sqrt{5})}{44}$
55. $\frac{-(\sqrt{3} + \sqrt{5})}{2}$
57. $5(\sqrt{2} - \sqrt{3})$
59. $\frac{4(\sqrt{x} - 1)}{x - 1}$

61. $\frac{5(6 - \sqrt{y})}{36 - y}$
63. $\frac{8(2\sqrt{x} - 3)}{4x - 9}$
65. $\frac{2\sqrt{y}(\sqrt{5y} + \sqrt{3})}{5y - 3}$
67. $\frac{3(\sqrt{x} + \sqrt{y})}{x - y}$
69. $\frac{x(\sqrt{x} - 2\sqrt{y})}{x - 4y}$
71. $-(\sqrt{3} + 1)(\sqrt{3} + 2)$
73. $\frac{-(\sqrt{5} - 2)(\sqrt{5} - 3)}{4}$
75. $\frac{(\sqrt{x} + 1)^2}{x - 1}$
77. $\frac{(\sqrt{x} + 2)(\sqrt{3x} - y)}{3x - y^2}$
79. The numerator and denominator were not multiplied by the conjugate of the denominator. The conjugate is $\sqrt{3} - y$. Also, the multiplication is incorrect: $(\sqrt{3} + y)(\sqrt{3} + y) \neq 3 + y^2$.

Applications

81. $r = \frac{\sqrt{V\pi h}}{\pi h}$
83. a. $\frac{5\sqrt{6}}{3}$ cm
- b. $\frac{2\sqrt{30}}{3}$ cm
- c. $\frac{5\sqrt{3}}{3}$ cm
85. a. $r = \frac{\sqrt{AP}}{P} - 1$
- b. 5%

10.7 Exercises

Concept Check

1. isolate
3. radicals
5. extraneous
7. True
9. True

Practice

1. $x = 3$
3. No solution
5. $x = -3$ 7. $x = 14$
9. $x = 9$
11. No solution
13. $x = 6$ 15. $x = -4, 1$
17. $x = -5, \frac{5}{2}$
19. $x = -2$ 21. $x = 2, 3$
23. $x = 2, 5$ 25. $x = -5, 5$
27. $x = 4$ 29. $x = 4$
31. $x = 3$ 33. $x = 2$
35. $x = 2$ 37. $x = 7$
39. $x = 4$ 41. $x = 0$
43. $x = 5$ 45. No solution
47. $x = 4$ 49. $x = -1, 3$
51. $x = 5$ 53. $x = 2$
55. $x = 1$ 57. $x = -4$
59. $x = 12$

Applications

61. a. \$1814.06
b. $r = \sqrt{\frac{A}{P}} - 1$
63. a. 1 sec
b. 3 ft
65. 28.63 m
67. a. 0.64 seconds
b. 1.01 seconds
c. 1.09 seconds

10.8 Answers

Concept Check

1. 90
3. scalene
5. False; the term distance refers to a nonnegative number (positive or 0).

Practice

1. Yes, $6^2 + 8^2 = 10^2$
3. No, $3^2 + 4^2 \neq 6^2$
5. Yes, $5^2 + 12^2 = 13^2$
7. $c = 2.23$
9. $c = 5$
11. $c = 20.62$
13. $c = 14.14$ cm
15. 4 17. 3
19. $\frac{7}{2}$ 21. $\sqrt{2}$
23. $\sqrt{13}$ 25. 13
27. $\frac{5}{7}$ 29. 5
31. 13 33. 10
35. 5 37. 2
39. Yes
41. Yes, $AB = AC = 4\sqrt{5}$
43. Yes, each side is 4 units.

45. $10 + 4\sqrt{5}$

47. $\sqrt{10} + \sqrt{41} + \sqrt{65}$

Applications

49. a. $C = 2\pi r \approx 94.2$ ft,
 $A = \pi r^2 \approx 706.5$ ft²
b. $P \approx 84.85$ ft, $A = 450$ ft²
51. 2.24 miles
53. 58.31 ft
55. 522.0 feet
57. a. 20 in. b. 25 in.²
c. 7.0711 in.
59. 64.9 inches
61. a. 17 feet b. 51 feet
63. a. $4\sqrt{34}$ inches
b. 13 inches
c. $8\sqrt{34} + 26$

Chapter 11: Quadratic Equations

11.1 Exercises

Concept Check

1. hypotenuse, squares
3. negative
5. True

Practice

1. $x = 0, 11$
3. $x = -12, -3$
5. $x = 1, -\frac{5}{3}$
7. $x = -1, 3$
9. $x = \frac{3}{4}, 1$
11. $x = \pm 11$
13. $x = \pm 6$
15. $x = \pm\sqrt{35}$
17. $x = \pm 5$
19. $x = \pm\sqrt{62}$
21. $x = \pm 3\sqrt{5}$
23. $x = \pm 3\sqrt{2}$

25. $x = \pm \frac{2}{3}$

27. $x = -1, 3$

29. $-7, 3$

31. 1, 5

33. $x = -\frac{3}{2}, -\frac{1}{2}$

35. $x = \frac{7}{4}, \frac{9}{4}$

37. $x = -2 \pm \sqrt{7}$

39. $x = \frac{2 \pm 3\sqrt{7}}{5}$

41. $x = \frac{-4 \pm 3\sqrt{3}}{3}$

43. $x = 7 \pm 2\sqrt{3}$

45. $x = 5 \pm \sqrt{10}$

47. $x = \pm 2\sqrt{6}$

49. $c = 15$

51. $b = 6\sqrt{3}$

53. $b = 1$

55. $x = \pm 25.44$

57. $x = \pm 5.25$

59. $x = \pm 1.70$

61. $x = \pm 4.13$

63. 4.2361, -0.2361

65. 2.3229, -0.3229

Applications

67. The length of the leg is 4 feet and the hypotenuse is 8 feet.
69. $3\sqrt{2}$ cm
71. a. $35^2 = x^2 + 34^2 \rightarrow 8.3$ ft
b. No, $\frac{1}{4}$ of 34 is 8.5, so the distance is too short by 0.2 feet.
73. 125 yards
75. a. 640 ft; 384 ft
b. 144 ft; 400 ft
c. 7 seconds;
 $0 = -16(t+7)(t-7)$
77. 3.2 miles

11.2 Exercises

Concept Check

1. trinomial
3. 1
5. square
7. False; It's also possible for there to be one solution.

Practice

1. $x^2 - 12x + 36 = (x-6)^2$

3. $x^2 + 6x + 9 = (x+3)^2$

5. $x^2 - 5x + \frac{25}{4} = \left(x - \frac{5}{2}\right)^2$

7. $y^2 + y + \frac{1}{4} = \left(y + \frac{1}{2}\right)^2$

9. $x^2 + \frac{1}{3}x + \frac{1}{36} = \left(x + \frac{1}{6}\right)^2$

11. $2x^2 + 4x + 2 = 2(x+1)^2$

13. $x = -5, 1$

15. $y = -1 \pm \sqrt{6}$

- 17. $x = 5 \pm \sqrt{22}$
- 19. $x = -5, 9$
- 21. $x = -5, 8$
- 23. $x = -\frac{4}{3}, 1$
- 25. $x = 1, 5$
- 27. $x = 1, 11$
- 29. $y = 5 \pm \sqrt{21}$
- 31. $z = \frac{-3 \pm \sqrt{29}}{2}$
- 33. $x = \frac{-1 \pm \sqrt{5}}{2}$
- 35. $x = \frac{-5 \pm \sqrt{17}}{2}$
- 37. $x = \frac{5 \pm \sqrt{10}}{3}$
- 39. $x = -1 \pm \sqrt{5}$
- 41. $x = \frac{1 \pm \sqrt{11}}{4}$
- 43. $y = \frac{-3 \pm \sqrt{29}}{2}$
- 45. $y = -\frac{4}{3}, 1$
- 47. $x = 2 \pm \sqrt{2}$
- 49. $x^2 - 7 = 0$
- 51. $x^2 - 2x - 2 = 0$
- 53. $y^2 + 4y - 16 = 0$

Applications

- 55. a. $p = 0, 90$
 b. No income revenue is made if the price is set to \$0 or \$90 per frame.

Writing & Thinking

- 57. See Example 2.

11.3 Exercises

Concept Check

- 1. $ax^2 + bx + c = 0$
- 3. $\frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$
- 5. completing
- 7. True 9. True

Practice

- 1. 68; Two real solutions
- 3. 0; One real solution
- 5. -44; No real solution
- 7. 4; Two real solutions
- 9. 19,600; Two real solutions
- 11. -11; No real solution
- 13. $x = -2 \pm 2\sqrt{2}$
- 15. $x = -\frac{2}{3}$
- 17. $x = 1 \pm \sqrt{5}$
- 19. $x = -3, \frac{1}{2}$
- 21. $x = \frac{-3 \pm \sqrt{5}}{4}$
- 23. No real solution
- 25. $x = \frac{-3 \pm \sqrt{29}}{2}$
- 27. $x = -3, -1$
- 29. No real solution
- 31. $x = \frac{5 \pm \sqrt{17}}{2}$
- 33. $x = -\frac{1}{4}$
- 35. $x = \pm \frac{2\sqrt{3}}{3}$
- 37. $x = \frac{2}{3}$
- 39. No real solution
- 41. $x = \frac{3 \pm \sqrt{34}}{5}$
- 43. $x = -2, \frac{5}{3}$
- 45. No real solution
- 47. $x = -1, 0$
- 49. $x = \frac{9 \pm \sqrt{65}}{2}, 0$
- 51. $x = \frac{-3 \pm \sqrt{5}}{2}, 0$
- 53. $x = \frac{1}{2}, -3$
- 55. $x = -\frac{1}{3}, 3$
- 57. $x = \frac{2 \pm \sqrt{3}}{3}$
- 59. No real solution

- 61. $x = \frac{2 \pm \sqrt{10}}{2}$
- 63. $x = \frac{-7 \pm \sqrt{17}}{4}$
- 65. $c < 16$ 67. $c = \frac{81}{4}$
- 69. $a > 3$ 71. $a > -\frac{1}{36}$
- 73. $a = \frac{49}{48}$ 75. $c > \frac{4}{3}$
- 77. $x \approx 2.5993, 60.4007$
- 79. $x \approx -0.7862, 2.0110$
- 81. $x \approx -4.1334, -0.5806$
- 83. $x \approx -2.6933, 2.6933$

Applications

- 85. a. 3.35 seconds
 b. 4.15 seconds
 c. 0.80 seconds

Writing & Thinking

- 87. $x^4 - 13x^2 + 36 = 0$;
 multiplied
 $(x-2)(x+2)(x-3)(x+3)$

11.4 Exercises

Concept Check

- 1. read, think, translate
- 3. diagram 5. True

Applications

- 1. $w(2w-5) = 63$; $w = 7$, the rectangle is 7 m by 9 m
- 3. $x + (x+9)^2 = 147$; $x = 3$, the numbers are 3 and 12
- 5. $(w+12)(w+22) = 1344$; $w = 20$, the pool is 20 ft by 30 ft
- 7. $(x+5)^2 = 4x^2$; $x = 5$, the side of the original square is 5 m
- 9. $w^2 + (w+4)^2 = 400$; $w = 12$, the rectangle is 12 m by 16 m
- 11. $x(x+16) = 960$; $x = 24$, there are 40 seats

- 13. a. $x(29-x) = 198$
 b. $x = 11$ or $x = 18$
 c. Either length = 11 meters and width = 18 meters, or length = 18 meters and width = 11 meters.
- 15. $(9+2x)(12+2x) - (9)(12) = 162$;
 $x = 3$, the frame is 3 in. thick
- 17. $40I - 4I^2 = 100$; $I = 5$, It needs a current of 5 amperes
- 19. $x(40-x) = 336$; $x = 12, 28$; He must sell 12 signs
- 21. a. \$307.20
 b. $(600+20x)(0.5-0.01x) = 315$;
 $x = 5, 15$; He must charge 45 cents or 35 cents
- 23. $(15-x)(700+70x) = 10,920$;
 $x = 2$ or 3 , the rental rate is \$840 or \$910.
- 25. $\frac{8}{x+2} + \frac{4}{x-2} = 2$;
 $x = 6$, the speed of the boat in still water is 6 mph
- 27. $\frac{540}{x-9} - \frac{540}{x} = 2$; their average speed to San Francisco was 54 mph
- 29. $\frac{120}{x} + 2 = \frac{120}{x-5}$; $x = 20$, there were initially 20 members
- 31. After about 3.8 seconds
- 33. $\frac{1}{x} + \frac{1}{x+8} = \frac{1}{3}$; $x = 4$, the mother would take 4 hours
- 35. $\frac{1}{x} + \frac{1}{x+30} = \frac{1}{8}$; $x = 10$; the smaller pipe would take 40 min

37. a. $\frac{1}{x} + \frac{1}{x+6} = \frac{1}{4}$

Persons	Time of work (in Hours)	Part of work Done in 1 Hour
Jack	x	$\frac{1}{x}$
Diane	$x + 6$	$\frac{1}{x + 6}$
Together	4	$\frac{1}{4}$

b. $x = -4, 6$

c. 6 hours; Time cannot be negative in this context.

d. It would take Jack 6 hours to decorate the nursery and it would take Diane 12 hours to decorate the nursery.

39. a. 4 sec

b. No, the projectile's maximum height is 256 ft.

c. 3 seconds, 5 seconds

d. 8 sec

41. 34.6 ft

Writing & Thinking

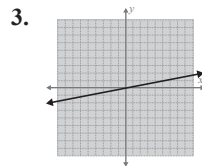
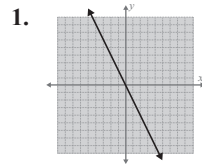
43. a cannot be equal to zero and b^2 must be greater than or equal to $4ac$ to produce a real solution. Also, all the solutions found may not apply to the problem at hand. You must check that each answer makes sense in the context of the problem.

11.5 Exercises

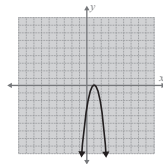
Concept Check

- 1. parabola 3. >
- 5. zeros, 0
- 7. False; the vertex of a parabola is either the lowest or highest point on the parabola.

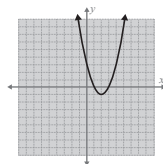
Practice



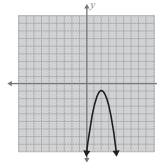
5. $x = 1$; Vertex: $(1, 0)$;
 x -int: $(1, 0)$; y -int: $(0, -3)$



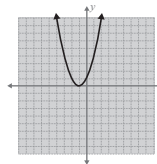
7. $x = 2$; Vertex: $(2, -1)$;
 x -int: $(3, 0), (1, 0)$;
 y -int: $(0, 3)$



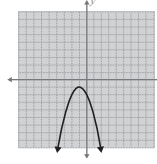
9. $x = 2$; Vertex: $(2, -1)$;
 x -int: None; y -int: $(0, -9)$



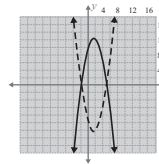
11. $x = -1$; Vertex: $(-1, 0)$;
 x -int: $(-1, 0)$; y -int: $(0, 1)$



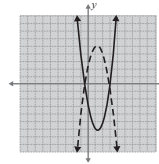
13. $x = -1$; Vertex: $(-1, -1)$;
 x -int: None; y -int: $(0, -2)$



- 15. a. No b. Yes
- c. One function is a reflection of the other across the x -axis.



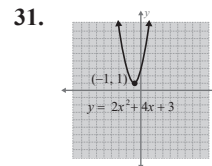
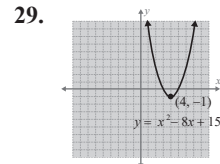
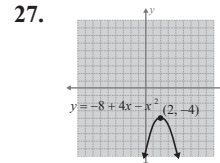
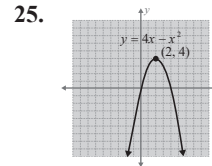
- 17. a. No b. Yes
- c. One function is a reflection of the other across the x -axis.



19. Zeros: $x \approx -0.7321, 2.7321$

21. Zeros: $x \approx -1.1583, 2.1583$

23. No real zeros



Applications

33. a. 3.5 s b. 196 ft

35. a. 5 s b. 420 ft

37. a. \$50 b. \$2500

39. \$20

41. a. Two sides are 150 yards and one side is 300 yards b. 45,000 yd²

Writing & Thinking

- 43. a. Parabola
- b. $x = -\frac{b}{2a}$
- c. $x = -\frac{b}{2a}$
- d. No. A graph can be entirely above or below the x -axis.

