Chapter 1

Exercise Set 1.1

Simplify without using a calculator.

1. $3-4-5$

2. $3-(4-5)$

3. $7+2\cdot 8$

4. $(7+2)\cdot 8$

5. $-2(6-9)-1$

6. $-2\cdot 6-9-1$

7. $-9(2-5)-7$

8. $-9\cdot 2-(5-7)$

9. $30\div 2\cdot 5$

10. $30\div(2\cdot 5)$

11. $(30\div 2)\cdot 5$

12. $6-8\div 2$

13. $(6-8)\div 2$

14. $6-(8\div 2)$

15. $48\div 8\div 2$

16. $48\div(8\div 2)$

17. $(48\div 8)\div 2$

18. $3\cdot 5-3\cdot 7$

19. $3(5-7)$

20. $3\cdot(5-3)\cdot 7$

Simplify without using a calculator.

21. 3^4

22. 5^3

23. 2^5

24. 7^2

25. $(-4)^2$

26. -4^2

27. $(-2)^3\cdot(-3)^2$

28. $-2^3\cdot(-3)^2$

29. $(2-7)^2$

30. 2^2-7^2

31. $(3-5)^3$

32. 3^3-5^3

33. $-7+3\cdot 2^2$

34. $-7+(3\cdot 2)^2$

35. $(-7+3)\cdot 2^2$

36. $8-2\cdot 3^2$

37. $(8-2)\cdot 3^2$

38. $8-(2\cdot 3)^2$

39. $20\div 2^2$

40. $(20\div 2)^2$

41. $3\cdot 5^2$

42. $(3\cdot 5)^2$

43. $3^2\cdot 5^2$

44. $(3+5)^2$

45. 3^2+5^2

46. $-6+5\cdot(-3)^2$

47. $(-6+5)\cdot(-3)^2$

48. $-6-5\cdot 3^2$

Find the value of the algebraic expression at the specified values of its variable or variables.

49. $x^2-2x-5;\ x=-3$

50. $4-x;\ x=-3$

51. $x-2(1-3x);\ x=-1$

52. $x^3-4x^2-5x;\ x=-1$

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

54. $x-(y-x^2); x=-3, y=2$

55. $-x+3y^2; x=-6, y=-2$

56. $3+xy^2; x=-5, y=-2$

57. $(3+x)y^2; x=-5, y=-2$

58. $3+(xy)^2; x=-5, y=-2$

Exercise Set 1.2

Find the prime factorization of the given positive integer.

1. 35

2. 63

3. 88

4. 120

5. 78

6. 84

7. 68

8. 210

9. 112

10. 675

11. 612

12. 693

Find the greatest common factor (*GCF*) *and the least common multiple* (*LCM*) *of the following pairs of numbers.*

13. 9, 12

14. 13, 17

15. 8, 18

16. 14, 25

17. 6, 15

18. 12, 90

19. 50, 60

20. 54, 84

21. 45, 75

22. 28, 42

23. $2^4 \cdot 3^2$, $2 \cdot 3^4$

24. $2^3 \cdot 3^2$, $2^2 \cdot 3 \cdot 5$

25. $3^2 \cdot 5 \cdot 7$, $3 \cdot 7^2 \cdot 13$

26. $5^2 \cdot 11$, $5 \cdot 7 \cdot 11^2$

27. $2^4 \cdot 5^2 \cdot 17$, $2^2 \cdot 5^3$

28. $2^4 \cdot 3^2$, $5^2 \cdot 13$

Find the greatest common factor (*GCF*) *and the least common multiple* (*LCM*) *of the following pairs of expressions. Treat the variables as prime numbers.*

29. a^2b^3, ab^7

30. $x^3y^2z^5$, $x^5y^9z^2$

31. a^7bc^3, a^2b^5

32. x^3y^5w, xz^4w^8

33. $6x^3$, $15x^7$

34. $12xy$, $9x^3$

35. $8a^2b^7,\ \ 15a^4b^2$

36. $24y^{13},\ \ 60y^{10}$

37. $51x^2w,\ \ 27w^5$

38. $9x^3,\ \ 8y^3$

39. $16ab^2,\ \ 52a^2b^5$

40. $48x^7y^3,\ \ 28y^7zw$

Find the greatest common factor (*GCF*) *and the least common multiple* (*LCM*) *of the following triples of expressions. Treat the variables as prime numbers.*

41. $8xy^2,\ \ 20x^3yw,\ \ 12x^4y^3w^5$

42. $21a^3b^9,\ \ 9a^7b^5,\ \ 15a^5b^{12}$

43. $18b^4c^3,\ \ 24c^6d^2,\ \ 42bc^2d^7$

44. $8x^5,\ \ 9x^{12},\ \ 6x^7$

Exercise Set 1.3

Reduce the given fraction to lowest terms.

1. $\frac{6}{15}$

2. $\frac{27}{48}$

3. $\frac{12}{18}$

4. $\frac{21}{66}$

5. $\frac{2^3 \cdot 3^2}{2^2 \cdot 3^4 \cdot 5}$

6. $\frac{2 \cdot 3^4}{2^3 \cdot 3^5 \cdot 7}$

7. $\frac{2 \cdot 3^7 \cdot 5}{2^5 \cdot 3^5 \cdot 7}$

8. $\frac{2 \cdot 3^7 \cdot 5}{2^5 \cdot 3^5 \cdot 5^2}$

9. $\frac{a^7 b^2}{a^3 b^9}$

10. $\frac{a^5 b^2 c}{a^2 b^7 c^4}$

11. $\frac{6xy}{21x^3}$

12. $\frac{24x^2 y^5}{16x^3 y^8 z^3}$

Write the mixed number to an improper fraction.

13. $7\frac{3}{4}$

14. $2\frac{4}{7}$

15. $5\frac{2}{3}$

16. $6\frac{7}{8}$

Write the improper fraction as a mixed number.

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

18. $\frac{38}{7}$

19. $\frac{40}{9}$

20. $\frac{52}{3}$

Add (or subtract) the fractions without a calculator and express the answer in reduced form. Specify the least common denominator (LCD) in each case.

21. $\frac{2}{3}+\frac{3}{4}$

22. $\frac{5}{6}+\frac{7}{15}$

23. $\frac{1}{6}-\frac{3}{2}$

24. $\frac{9}{4}-\frac{7}{10}$

25. $\frac{5}{3}+\frac{13}{2^2\cdot 3}$

26. $\frac{5}{2^3\cdot 3}+\frac{7}{2^2\cdot 3^2}$

27. $\frac{1}{2^2\cdot 5}-\frac{1}{2\cdot 5^2}$

28. $\frac{5}{2\cdot 7}+\frac{3}{2^2}$

29. $\frac{3}{a}+\frac{2}{b}$

30. $\frac{3}{ab}-\frac{2}{b^2}$

31. $\frac{1}{2a^2}+\frac{1}{6a}$

32. $\frac{2}{3b}-\frac{5}{6b^2}$

33. $\frac{a}{2}+\frac{b}{5}$

34. $\frac{a}{18}-\frac{b}{15}$

35. $\frac{x}{7}-\frac{y}{5}$

36. $\frac{x}{12}+\frac{y}{8}$

Perform the indicated calculations.

37. $\frac{2}{5}+\frac{5}{6}$

38. $\frac{2}{5}\cdot\frac{5}{6}$

39. $\frac{7}{8}-\frac{1}{6}$

40. $\frac{7}{8}\div\frac{1}{6}$

41. $3\frac{3}{5}+1\frac{2}{5}$

42. $4\frac{2}{3}-3\frac{3}{4}$

43. $3-\frac{2}{5}$

44. $\frac{3}{4}\div\frac{9}{8}$

45. $\frac{3}{4}\cdot\frac{8}{15}$

46. $\frac{2}{3}\div\frac{7}{6}$

47. $1\frac{3}{5}\cdot 3\frac{1}{4}$

48. $2\frac{3}{7}\div 1\frac{5}{7}$

49. $\left(-\frac{2}{3}\right)^2$

50. $\left(\frac{2}{-3}\right)^2$

51. $\left(\frac{-2}{3}\right)^2$

52. $-\left(\frac{2}{3}\right)^2$

53. $3-\frac{2}{5}$

54. $1\frac{2}{7}+8$

55. $\frac{3+5}{4-16}$

56. $-4+\frac{3-6}{3+2}$

57. $\frac{-6-2(-5)}{3-10}$

58. $\frac{2}{3}-\frac{(-2)5}{8-5}$

59. $\left(-\frac{3}{4}\right)^3$

60. $\left(\frac{3}{4}\right)^3$

61. $\left(-\frac{1}{2}\right)^3\cdot\left(\frac{2}{3}\right)^2$

62. $\frac{2+3}{2^4-3^2}$

63. $2-\left(\frac{3}{5}\right)^2$

64. $\frac{3^2+4^2}{3+4}$

Find the value of the algebraic expression at the specified values of its variables.

65. $\frac{x^2-y^2}{x-y};\quad x=3, y=-1$

66. $\frac{2x-y}{y};\quad x=3, y=-8$

67. $\frac{1}{x}+\frac{1}{y};\quad x=4, y=3$

68. $\frac{1}{x}-\frac{1}{y};\quad x=-5, y=7$

69. $\frac{x}{y^3}-y^2;\quad x=-5, y=-2$

70. $\frac{x-(2-y)}{x+y};\quad x=-2, y=-4$

71. $\frac{6xy-y^2}{y^2};\quad x=2, y=-2$

72. $\frac{x^2-(y-y^3)}{2x+y};\quad x=-4, y=-1$

Exercise Set 1.4

Round each number to the nearest tenth, nearest hundredth and nearest thousandth.

1. 2.76381 **2.** 251.3517 **3.** 37.469 **4.** 0.7528

Write each decimal number as a fraction in reduced form.

5. 2.8 **6.** 0.025 **7.** 1.52 **8.** 0.65

Write each fraction or mixed number in decimal form.

9. $\frac{3}{8}$ **10.** $4\frac{5}{8}$ **11.** $\frac{5}{6}$ **12.** $7\frac{3}{5}$

Write each fraction as a percentage.

13. $\frac{1}{20}$ **14.** $\frac{3}{50}$ **15.** $1\frac{2}{5}$ **16.** $\frac{5}{16}$

Write each percentage as a decimal.

17. 5% **18.** 6.3% **19.** 0.45% **20.** 0.075%

Problems involving percentages

21. What is $2\frac{1}{2}\%$ of 16,000?

22. What is 0.04% of 24,000?

23. What is $5\frac{3}{8}\%$ of 750?

24. The number 4 is what percent of 32?

25. The number 7 is what percent of 80?

26. The number 35 is what 20 percent of what number?

27. The number 12 is 0.80 percent of what number?

28. The number 500 is $2\frac{3}{4}$ percent of what number?

Exercise Set 1.5

Perform the indicated calculation.

1. $|-7|$ **2.** $-|7|$ **3.** $-|-(2-5)|$ **4.** $-5-|3-8|$

Find the value of the algebraic expression at the specified values of its variable.

5. $|3-(1-x)|;\quad x=-9$ **6.** $|x^2-x^3|;\quad x=-2$

7. $|-x-x^2|;\quad x=-3$ **8.** $|-1+2(x-5)|;\quad x=3$

Place the numbers x *and* y *on a number line and find the distance between them. Check the answer by calculating* $|x-y|$.

9. $x=5, y=2$ **10.** $x=5, y=-2$ **11.** $x=-5, y=-2$ **12.** $x=-5, y=2$

13. $x=3, y=7$ **14.** $x=-4, y=-8$ **15.** $x=2, y=-7$ **16.** $x=-5, y=1$

Determine which of the two fractions is the largest (to the right of the other on the number line) by writing them as equivalent fractions with the same LCD.

17. $\frac{2}{5}, \frac{3}{8}$ **18.** $\frac{4}{9}, \frac{5}{11}$ **19.** $-\frac{5}{6}, -\frac{3}{4}$ **20.** $-\frac{7}{18}, -\frac{5}{12}$

21. $\frac{3}{15}, \frac{1}{6}$ **22.** $\frac{5}{12}, \frac{6}{14}$ **23.** $-\frac{17}{6}, -\frac{49}{18}$ **24.** $\frac{25}{4}, \frac{73}{12}$

For the number pair a, b *in each exercise, write* $a<b$, $a>b$, *or* $a=b$ *depending on which of the three relationships is true.*

25. $\frac{1}{3}, 0.33$ **26.** $0.24, \frac{2}{7}$ **27.** $3\frac{4}{5}, \frac{12}{5}$ **28.** $7\frac{3}{8}, \frac{59}{8}$

29. $-1\frac{5}{16}, -\frac{5}{4}$ **30.** $-\frac{15}{13}, -\frac{45}{39}$ **31.** $4.375, 4.357$ **32.** $-7.43, -7.435$

33. $-\frac{2}{3}, -0.666$ **34.** $-\frac{3}{4}, -\frac{7}{9}$ **35.** $0.0357, 0.00753$ **36.** $-0.158, -0.0581$

Find the median of the given set.

37. $\left\{\frac{1}{6}, \frac{5}{36}, \frac{1}{9}, \frac{1}{4}, \frac{5}{18}, \frac{7}{36}, \frac{2}{9}\right\}$

38. $\{-0.103, -0.132, -0.12, -0.137, -0.1, -0.117\}$

Exercise Set 1.6

1. John bought an iPad for $480 and paid $31.20 in sales tax. What was the sales tax rate?

2. A man tips a server $3.00 on meal costing $14.50. What percentage of this cost is the tip? Round to the nearest tenth of a percent.

3. The price of a shirt is reduced from $27 to $20. What is percentage decrease in the price? Round to the nearest hundredth of a percent.

4. (a) A woman whose annual salary is $55,400 gets a 4% raise. What is her new annual salary? **(b)** If her annual salary is x dollars and she gets a 4% raise, what is her new annual salary in terms of x?

5. (a) Jennifer bought a pair of running shoes selling for $75. If the sales tax was 5.8%, what was the total cost of the purchase? **(b)** If the shoes sold for x dollars, what would the total cost of the purchase be in terms of x?

6. (a) A coat that sells for $240 is marked down 20%. What is the sales price of the coat? (**b)** If the coat sells for x dollars, what would the sales price of the coat be in terms of x?

7. (a) The Dow Jones Industrial Average drops 0.25% on one day. If the average is 12, 600 at the beginning of the day, what is this average at the end of the day? **(b)** If the average is x at the beginning of the day, what is this average at the end of the day in terms of x?

8. Mark wanted to buy a new car for $22,000. The salesman told him that with rebate and discounts he could lower the price by 25%. What is the sale price of the car? What is the final cost of the car if Kentucky sales tax of 6% is added?

9. Mark wanted to buy a new car for x dollars. The salesman told him that with rebate and discounts he could lower the price by 25%. What is the sale price of the car in terms of x? What is the final cost of the car in terms of x if Kentucky sales tax of 6% is added?

10. (a) Emily got a job at Big Bob's Storage. Her weekly salary is $700. What is her weekly take home pay if she must pay 13% federal tax and 6% sales tax on her salary? **(b)** If her weekly salary is x dollars, what is her take home pay in terms of x?

11. (a) A woman makes 15% more than her husband. If her husband's annual salary is $45,000, what is the combined annual income of the couple? **(b)** If her husband's annual salary is x dollars, what would the couple's combined annual income be in terms of x?

12. (a) A man invests $10,000 in two certificates of deposit, $6,000 in the first account earning 5% annual interest and the rest in the second account earning 4% annual interest. How much annual interest does the man earn on this investment? **(b**) If he invests x

dollars in the first account and the rest in the second account, express the annual interest he earns on this investment in terms of x.

13. John has \$1400 in his savings account and withdraws $\frac{2}{7}$ of it. How much is left in his account?

14. Beth has \$5400 in her savings account and withdraws $\frac{1}{6}$ of it. The next day, she withdraws $\frac{2}{9}$ of what remains. How much is left in her account after these two transactions?

15. Diana has x dollars in her savings account and withdraws $\frac{1}{6}$ of it. The next day, she withdraws $\frac{2}{9}$ of what remains. How much is left in her account after these two transactions in terms of x?

16. David wanted to buy a new suit selling for \$400. He negotiated with the salesperson and the price was reduced by $\frac{1}{5}$. He then bought the suit and paid a sales tax that was $\frac{3}{50}$ of the sales price. How much did he pay for the suit?

17. (a) Mary got a sales job at her father's company. She was paid \$9 per hour plus a 5% commission on her sales. Last week she worked 40 hours with sales of \$5560. How much was she paid? **(b)** If she worked *h* hours with sales of *S* dollars, write an expression for the amount, A, she was paid in terms of *h* and *S*.

18. (a) Lisa's job pays \$8 per hour, but if she works more than 35 hours per week she is paid $1\frac{1}{2}$ times her regular salary for the overtime hours. How much is she paid if she works hours 42 hours in one week? **(b)** If she works x overtime hours in one week, how much is she paid in terms of x?

19. (a) A plumber charges \$55 an hour for his labor and his assistant charges \$30. If the plumber works twice as long as his assistant on a job, and his assistant works 4 hours, how much did they charge for their labor altogether? **(b)** If the assistant works x hours, how much did they charge for their labor in terms of x?

20. (a) A girl has twice as many nickels as dimes, and 3 more quarters than dimes, in her piggy bank. If she has 8 dimes in her bank, how much money, in dollars, does she have in her bank? **(b)** If she has n dimes in her bank, how much money, in dollars, does she have in her bank in terms of n?

21. (a) Michael has only \$5 bills and \$20 bills in his wallet. If he has 3 more \$20 bills than \$5 bills, and he has 7 \$20 bills, how much money, in dollars, does he have in his wallet? **(b)** If he has n \$20 bills, then how much money, in dollars, does he have in his wallet in terms of n?

22. Two cars pass one another going in opposite directions along a long straight road. The westbound car is going 60 miles per hour and the eastbound car is going 66 miles per hour. How far apart are the two cars after 5 minutes?

23. Two cars are initially 10 miles apart on the same straight road and are moving towards each other, one car going 30 miles per hour and the other 36 miles per hour. How far apart are the two cars 2 minutes later?

24. Two trees are standing side-by-side in the sunlight. One is 50 feet tall and the other is 20 feet tall. If the taller tree casts an 18-foot shadow, what is the length, in feet, of the shadow of the shorter tree?

25. The Body Mass Index (BMI) for two people of the same height is proportional to their weight. **(a)** If a man 6 feet tall and weighing 180 pounds has a BMI of 24.4, what is the BMI of a man 6 feet tall and weighing 200 pounds? Round the answer to the nearest tenth. **(b)** What is the weight of a man 6 feet tall with a BMI of 30? Round the answer to the nearest pound.

26. The Body Mass Index (BMI) for two people of the same height is proportional to their weight. **(a)** If a woman 5 feet, 4 inches tall and weighing 130 pounds has a BMI of 22.3, what is the BMI of a woman 5 feet, 4 inches tall and weighing 140 pounds? **(b)** What is the weight of a woman 5 feet, 4 inches tall with a BMI of 28? Round the answer to the nearest pound.

27. The time it takes a trained runner to run a 10K is proportional to the time it takes him to run a 5K. Suppose a runner has a 10K time of 37 minutes, 15 seconds and a 5K time of 18 minutes. What is the best approximation to the time it takes his friend to run a 5K if his friend runs the 10K in 39 minutes, 15 seconds? Write the answer in minutes and seconds, rounded to the nearest second.

28. A box of Oaties contains 28 grams of cereal and 140 milligrams of sodium. How many milligrams of sodium are in 5 grams of Oaties?

29. A box of Crunchies contains 59 grams of cereal and 46 grams of carbohydrates. How many grams of carbohydrates are in 6 grams of Crunchies?

30. Northern Kentucky University President Geoffrey Mearns ran a marathon (26.2 miles) in 2 hours and 16 minutes to qualify for the Olympic trials in 1984. How fast did he run in feet per second? Round your answer to the nearest hundredth. *Hint*: 5280 feet =1 mile

31. A woman is walking at the rate of 90 yards per minute. How fast is she going in feet per second?

32. A man can run 1 mile in 6 minutes. How fast is this measured in feet per second? How fast is this measured in miles per hour? *Hint*: 5280 feet=1 mile

33. A car is going 80 kilometers per hour. How fast is this measured in miles per hour? Round the answer to the nearest tenth of a mile per hour. *Hint*: 1 kilometer $\approx$ 0.621 miles

34. A car is going 90 kilometers per hour. How fast is this measured in meters per second?

35. How many minutes does it take for a woman to walk 1200 feet if she walks at the rate of 4 feet per second?

36. How many minutes does it take a man to walk a mile if he walks at the constant rate of 4 feet per second? *Hint*: 5280 feet =1 mile

37. How many centimeters are in $\frac{5}{8}$ of a meter?

38. How many meters are in $\frac{3}{7}$ of a kilometer? Round your answer to the nearest hundredth of a meter.

39. How many centimeters are in 2 kilometers?

40. How many seconds are in 3 hour and 15 minutes?

41. How many inches are in 3 yards, 2 feet and 7 inches?

42. How many inches are in one meter? *Hint*: 1 inch $\approx$ 2.54 centimeters

43. A car gets 25 miles per gallon. How many gallons of gas are needed for the car to go 180 miles?

44. A car gets 25 miles per gallon. How many gallons of gas are needed for the car to go 300 kilometers? *Hint*: 1 kilometer $\approx$ 0.621 miles