Solution

Using a calculator, the sum of the speeds is 1008 mph.

Dividing by 15 gives the average speed.

$$1008 \div 15 = 67.2 \text{ mph}$$

The average speed was 67.2 mph.

Now work margin exercise 8.

Margin Exercise Answers

1. a. −28 **b.** −28 **c.** −40 **d.** −35 **e.** −6.4 **f.** $-\frac{7}{2}$ **2. a.** +24 **b.** $+\frac{22}{15}$ **c.** +17.5 **d.** +48
3. a. 0 **b.** 0 **4. a.** 6 **b.** −6 **c.** −6 **d.** 6 **e.** undefined **f.** 0 **5. a.** 12 **b.** $-\frac{7}{4}$ **c.** −2.1 **d.** 2.9
6. 4 °F **7.** 79 **8.** 47.7 mph

3.4 Exercises

Concept Check

Fill-in-the-Blank. Complete each sentence using information found in this section.

1. The value found by adding numbers and then dividing the sum by the number of items in the set is the _____ (or _____) of the numbers.
2. When a positive number and negative number are multiplied, the result is a _____ number.
3. If two positive numbers are being multiplied, the product is a _____ number.
4. If two negative numbers are being divided, the quotient is a _____ number.
5. When zero is divided by a nonzero number, the answer is always ___.
6. The quotient of a number divided by zero is _____.

True/False. Determine whether each statement is true or false. If a statement is false, explain how it can be changed so the statement will be true. (**Note:** There may be more than one acceptable change.)

7. If a negative number is divided by a positive number, the result will be a negative number.
8. The product of zero and a number is zero.
9. If two numbers have the same sign, both the product and the quotient of the two numbers will be negative.
10. The mean of a set of numbers is always positive.

Practice

Multiply. Reduce fractions to lowest terms. See Examples 1 through 3.

1. $4(-3)$

2. $6(-5)$

3. $12 \cdot 4$

4. $19 \cdot 3$

5. $(-8)(-7)$

6. $(-11)(-2)$

7. $-3 \cdot 7$

8. $-7 \cdot 5$

9. $(-14)(-4)$

10. $(-11)(-6)$

11. $(-13)(-2)$

12. $(-8)(-9)$

13. $10(-7)$

14. $(-5)(12)$

15. $(-2)(-3)(-4)$

16. $(-6)(-3)(-9)$

17. $-8 \cdot 4 \cdot 9$

18. $(-3)(2)(-3)$

19. $(-7)(-16)(0)$

20. $-9 \cdot 0 \cdot 4$

21. $(-2)(4.5)$

22. $(-5)(-3.8)$

23. $4.3(-1.7)$

24. $(-2.6)(-0.2)$

25. $-\frac{3}{8} \cdot \frac{4}{9}$

26. $\frac{4}{5} \cdot \frac{-3}{14}$

27. $\frac{-4}{5} \cdot \frac{-9}{2}$

28. $-\frac{3}{4} \cdot -\frac{6}{7}$

29. $-4 \cdot \frac{3}{5}$

30. $-7 \cdot \frac{5}{6}$

31. $\frac{5}{2} \cdot \frac{-15}{10} \cdot \frac{6}{5}$

32. $\frac{-4}{7} \cdot \frac{2}{5} \cdot \frac{-2}{13}$

Divide. Reduce fractions to lowest terms. Round answers with decimals to the nearest tenth. See Examples 4 and 5.

33. $\frac{-8}{-2}$

34. $\frac{-20}{-10}$

35. $\frac{-30}{5}$

36. $\frac{-51}{3}$

37. $\frac{-26}{-13}$

38. $\frac{-91}{-7}$

39. $\frac{0}{6}$

40. $\frac{16}{0}$

41. $\frac{39}{-13}$

42. $\frac{44}{-4}$

43. $\frac{-34}{2}$

44. $\frac{-36}{9}$

45. $\frac{-3}{0}$

46. $\frac{0}{-7}$

47. $\frac{-60}{-12}$

48. $\frac{-48}{-16}$

49. $\frac{-4.8}{8}$

50. $\frac{-5.6}{7}$

51. $\frac{-4}{-0.2}$

52. $\frac{-3}{-8}$

53. $\frac{2.99}{-1.3}$

54. $\frac{2.8}{-1.4}$

55. $\frac{-2}{15} \div \frac{8}{5}$

56. $\frac{-3}{5} \div \frac{-9}{10}$

57. $\frac{6}{11} \div \frac{4}{3}$

58. $\frac{-10}{3} \div \frac{-7}{5}$

59. $\frac{-9}{14} \div \frac{54}{35}$

60. $\frac{45}{8} \div \frac{35}{12}$

Determine whether each statement is true or false. If a statement is false, rewrite it in a form that is true. (There may be more than one correct new form.)

61. $(-4)(6) \geq 3 \cdot 8$

62. $(-7)(-9) \leq 3 \cdot 21$

63. $-\frac{3}{4} \cdot \frac{5}{8} = \frac{15}{16}\left(-\frac{1}{2}\right)$

64. $(-6.0)(9.1) = (6.1)(-9.0)$

65. $6(-3) > (-14) + (-4)$

66. $7 + 8 > (-10) + (-5)$

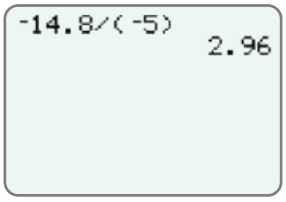
67. $-\frac{2}{3} + \frac{1}{2} \leq \frac{1}{2} - \frac{1}{4}$

68. $1.7 + (-3.9) < (-1.4) + (-4.2)$

69. $(-4)(9) = (-24) + (-12)$

70. $14 + 6 \leq (-2)(-10)$

Use a graphing calculator to find the value of each expression. Round quotients to the nearest hundredth, if necessary. Remember the negative sign (-) is next to ENTER. For example, $-14.8 \div (-5)$ would appear as follows.



71. $(27)(-24)(-180)$

72. $(-461)(-45)(-17)$

73. $(54)(-17)(-24)$

74. $(-77,459) \div 29$

75. $(-62,234) \div (-37)$

76. $(-35 - 45 - 56) \div 3$

77. $(-52 - 30 - 40 - 60) \div 4$

78. $72 \div (15 - 22)$

79. $95 \div (-3 - 7)$

80. $-15.3 \div (-5.4)$

81. $(-13.4)(-2.5)(-1.63)$

82. $(-2.5)(-3.41)(-10.6)$

Applications

Solve.

83. Find the mean of the following set of integers: –10, 15, 16, –17, –34, and –42.

84. Find the mean of the following set of integers: –72, –100, –54, 82, and –96.

85. The Math Club members decided to attend the national meeting of the NCTM (National Council of Teachers of Mathematics) and had a book sale to raise money for the event. Registration fees were $85 per member and the club had 35 members. How much money did the club need to raise for registration fees?

86. If one regular pack of candy contains 250 calories, how many calories are there in 37 packs of the same candy?

87. A sandwich shop buys 372 loaves of bread for the week. If each loaf of bread has 24 slices, how many slices of bread were purchased?

88. Students at the local community college must pay $83 for a math textbook. If there are 43 students in the class, find the total amount the class will spend on textbooks.

89. Your company bought 18 new cars, each with blind-spot monitoring and backup cameras, at a price of $24,600 per car. How much did your company pay for these cars?

90. According to the US Fish and Wildlife Service, migratory birds are imported at a value of about $19 each. Suppose that about 800,000 live birds are imported each year. What is the total value of these imported birds?

91. A mother has 12 cookies that she will equally divide among 4 children. How many cookies will each child get?

92. Seven students sold a total of 392 raffle tickets. Assuming that each student sold the same number of raffle tickets, how many tickets did each student sell?

93. The Cedarville Baseball Camp has 198 campers. How many 9-member teams can this camp have?

94. Jane Scott tutors students in reading and makes $25 per student. If she makes $475 in a week, how many students did she tutor?

95. One pint of Ben and Jerry's Crème Brûlée Ice Cream has 68 grams of fat. If there are 4 servings per pint, how many grams of fat are in each serving? [1]

96. If one person can paint a small house in 48 hours, how long will it take a crew of 8 people to paint the house, assuming that all 8 work at the same speed, and do not interfere with each other?

97. For 2021–2022, the average tuition cost for four years at a public 4-year institution was $42,960. If tuition did not increase each year, how much would you pay per year for the four years you were in college? [2]

98. Smithfield High School paid $29,022 for six pianos. How much did each piano cost?

99. The area of every NFL football field is 57,600 square feet. If a bag of grass seed covers 50 square feet, how many bags of grass seed will be needed to cover one grass football field? [3]

100. US Astronaut Peggy Whitson orbited the Earth 6032 times during her space flights on the International Space Station. If the International Space Station orbits the Earth 16 times a day, how many days was Peggy Whitson in space? [4]

101. A community has 5978 square feet available for individual gardens that will be evenly distributed among 14 people. How much space will each person get?

102. Thirteen men purchase a boat together. If the cost of the boat is $33,462, how much will each man contribute if each contributes an equal amount?

103. A large chicken farm produces 65,076 eggs during a typical week. How many dozen eggs does this represent? (**Note:** 1 dozen = 12 eggs)

1 Source: Ben and Jerry's
2 Source: www.collegeboard.com
3 Source: National Football League
4 Source: National Aeronautics and Space Administration

104. 262,800 pounds of pasta is served every year at Mama Melrose's Ristorante Italiano at Disney MGM Studios. How many pounds of pasta are served every day, assuming there are 365 days in each year? [5]

105. Katelyn is having a birthday party and has invited 11 friends. For lunch, Katelyn's parents bought 3 large pizzas that have 8 slices per pizza. How many slices of pizza will each child get? (Assume only Katelyn and her 11 friends are eating the pizza.)

106. The costs of a one-way flight from Baltimore, MD, to Orlando, FL, for seven different flight times are as follows: $73, $171, $147, $87, $89, $111, $100. What is the average cost of a flight from Baltimore to Orlando? [6]

107. The numbers of fatal motor vehicle accidents in the United States each year from 2005 to 2015 are as follows: 39,252; 38,648; 37,435; 34,172; 30,862; 30,296; 29,867; 31,006; 30,202; 30,056; 32,166. What was the average number of fatal accidents in the United States per year from 2005 to 2015? (Round your answer to the nearest tenth.) [7]

108. During one day, Sebastian made several transactions with his checking account. He deposited $150 at the beginning of the day, bought groceries for $45.50, filled his car with gas for $39, bought tutoring supplies for $15, and deposited $120 at the end of the day.

- **a.** Which amounts are credits to Sebastian's account? Be sure to include the sign.
- **b.** Which amounts are debits to his account? Be sure to include the sign.
- **c.** What was the average transaction amount that Sebastian made during the day? (**Hint:** Be sure to use the amounts from parts a. and b.)

109. An auto tire manufacturer recommends using 35 psi of air pressure in their standard tires. A tire has a leak that causes the air pressure of the tire to change at a rate of –2 psi per hour.

- **a.** How much will the tire's air pressure change after 4 hours?
- **b.** A tire with a standard air pressure of 35 psi is considered to be flat when it has only 24.5 psi of pressure. What change in air pressure will cause the tire to be considered flat?
- **c.** How long will it take the tire to lose the amount of air pressure determined in part b.?

5 Source: www.diningindisney.com
6 Source: Expedia.com
7 Source: NHTSA

110. In King Salmon, Alaska, the lowest monthly temperature was recorded for several months as shown in the table. Use the data to answer the following questions. Round your answers to the nearest hundredth. [8]

Lowest Monthly Temperature in King Salmon, Alaska

Month	Temperature
October 2012	4 °F
November 2012	–4 °F
December 2012	–22 °F
January 2013	–11 °F
February 2013	–14 °F
March 2013	–18 °F

a. What was the average of the low temperatures over these months?

b. The lowest temperature recorded for April 2013 was 1 °F. Will the average low temperature increase or decrease if this data value is now used in calculating the average? Do not calculate the average.

c. Find the average lowest temperature from October 2012 through April 2013. (**Hint:** part b. gives the lowest temperature for April 2013.)

d. How do the average temperatures from parts a. and c. compare?

e. What is the range of the lowest monthly temperatures for the months given in the table?

111. Twenty business executives made the following numbers of telephone calls during one week. Find the mean number of calls (to the nearest tenth) made by these executives.

20	16	14	11	51
40	36	28	52	25
18	16	42	49	12
18	22	33	9	19

112. The blood calcium level (in milligrams per deciliter) for 20 patients was reported as follows.

8.2	10.2	9.3	8.5	7.3
9.7	9.6	8.3	9.8	9.1
9.4	11.1	10.0	8.5	9.9
8.6	10.2	9.4	9.1	9.2

Find the mean blood calcium level (to the nearest hundredth) for these patients.

113. Fifteen students scored the following scores on an exam in accounting: 1 scored 67, 4 scored 73, 3 scored 77, 2 scored 80, 3 scored 88, and 2 scored 93. What was the average score for these students?

114. On an exam in history, a class of twenty-one students had the following test scores: 4 scored 65, 3 scored 70, 6 scored 78, 2 scored 82, 1 scored 85, 3 scored 91, and 2 scored 95. What was the mean score (to the nearest tenth) on this test for the class?

8 Source: weather.gov

The frequency of a number is a count of how many times that number appears. In statistics, data is commonly given in the table form of a frequency distribution as illustrated. To find the mean, multiply each number by its frequency, add these products, and divide the sum by the sum of the frequencies.

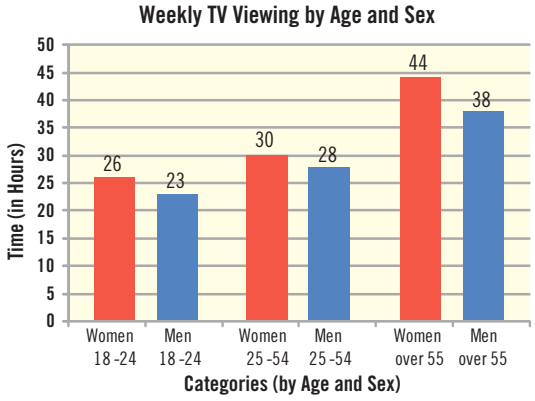
115. The heights of the top 30 NBA scorers for the 2021–2022 season are listed in the frequency table. Find the mean height for these men. [9]

Height (in inches)	73	74	75	76	77	78	79	80	81	82	83	84	85
Frequency	3	3	1	2	3	2	3	4	1	2	4	1	1

116. The students in a psychology class were asked the number of books that they had read in the last month. The following frequency distribution indicates the results. Find the mean number of books read (to the nearest tenth) by these students

Number of Books	0	1	2	3	4	5
Frequency	3	2	6	4	2	1

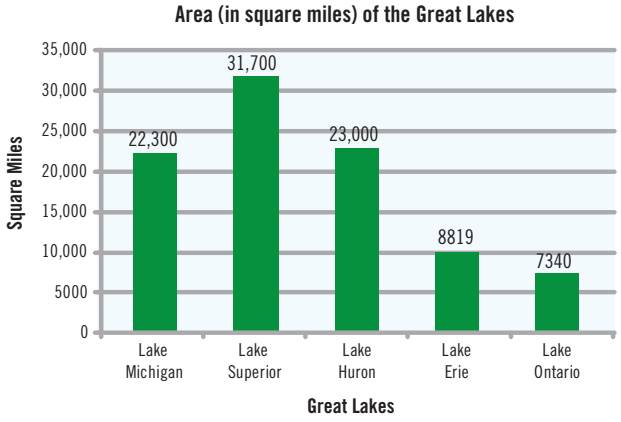
117. The following bar graph shows the approximate amounts of time per week spent by people watching broadcast TV or a streaming service for six groups (by age and sex) of people 18 years of age and older. What is the average amount of time per week people over the age of 18 spend watching broadcast TV or a streaming service? (Assume each group has the same number of people.)



118. The following pictograph shows the number of phone calls received by a 1-hour radio talk show in Seattle during one week. (Not all calls actually get on the air.) What was the mean number of calls per show received that week?

9 Source: NBA

119. The following bar graph shows the area of each of the five Great Lakes. Lake Superior, with an area of about 31,700 square miles, is the world's largest fresh water lake. What is the mean size of these lakes?



Writing & Thinking

120. If you multiply an odd number of negative numbers together, do you think that the product will be positive or negative? Explain your reasoning.

121. If you multiply an even number of negative numbers together, do you think that the product will be positive of negative? Explain your reasoning.

122. Explain the conditions under which the quotient of two numbers is 0.

123. Explain, in your own words, why division by 0 is not a valid arithmetic operation.