3.5 Exercises

Concept Check

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

1. One way to estimate a difference with decimal numbers is to round each number to the _____ nonzero digit, and perform the subtraction.
2. In order to estimate a sum, round each _____ before performing the addition.
3. Estimating with decimal numbers is especially important because it helps ensure that the _____ was placed correctly.
4. One way to estimate a product or quotient is to round each number to the _____ nonzero digit, then perform the indicated operation.
5. When using the order of operations, the next step after removing symbols of inclusion is to evaluate any _____ _____.

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.)

6. An estimate of the sum $71.369 + 49.1$ is 120.
7. One way to estimate the product of decimal numbers is to round the numbers to the rightmost nonzero digit before performing the multiplication.
8. An estimate of the quotient $16.469 \div 3.87$ would be 4.
9. Experience and understanding are needed to decide whether or not a particular answer is reasonably close to an estimate.
10. According to the rules for order of operations, addition and subtraction should be performed before multiplication and division.

Practice

Estimate each sum; then find the actual sum. See Example 1.

1. $\begin{array}{r} 29.03 \\ +\ 3.79 \\ \hline \end{array}$

2. $\begin{array}{r} 58.2 \\ +\ 63.02 \\ \hline \end{array}$

3. $13 + 8.79$

4. $9.66 + 14$

5. $\begin{array}{r} 51.07 \\ 45.2 \\ +\ 6.19 \\ \hline \end{array}$

6. $\begin{array}{r} 4.22 \\ 71.6 \\ +\ 36.75 \\ \hline \end{array}$

7. $0.7 + 0.3 + 2.31$

8. $6 + 5.1 + 0.8$

9.
$$\begin{array}{r} 121.6 \\ 55.9 \\ 8.32 \\ +\,21.63 \\ \hline \end{array}$$

10.
$$\begin{array}{r} 44.4 \\ 3.211 \\ 0.19 \\ +\,5.6 \\ \hline \end{array}$$

Estimate each difference; then find the actual difference. See Example 2.

11.
$$\begin{array}{r} 51.21 \\ -\,25.13 \\ \hline \end{array}$$

12.
$$\begin{array}{r} 91.67 \\ -\,43.92 \\ \hline \end{array}$$

13. $5.3 - 3.75$

14. $12.82 - 8.9$

15.
$$\begin{array}{r} 22 \\ -\,12.91 \\ \hline \end{array}$$

16.
$$\begin{array}{r} 204 \\ -\,38.08 \\ \hline \end{array}$$

17.
$$\begin{array}{r} 3.21 \\ -\,0.589 \\ \hline \end{array}$$

18.
$$\begin{array}{r} 0.345 \\ -\,0.0691 \\ \hline \end{array}$$

19. $7521.22 - 973.16$

20. $4732.61 - 931.98$

Estimate each product; then find the actual product. See Example 3.

21. $1.62(3)$

22. $16.2(3)$

23. $(0.92)(0.81)$

24. $(0.22)(0.62)$

25. $(0.64)(9.71)$

26. $(33.6)(0.11)$

27. $(4.7)(1.1)$

28. $(6.3)(1.6)$

29.
$$\begin{array}{r} 5.08 \\ \times\,0.4 \\ \hline \end{array}$$

30.
$$\begin{array}{r} 3.07 \\ \times\,0.5 \\ \hline \end{array}$$

31. $(1.62)(0.03)$

32. $1.62(0.003)$

33.
$$\begin{array}{r} 86.1 \\ \times\,0.057 \\ \hline \end{array}$$

34.
$$\begin{array}{r} 0.506 \\ \times\,0.091 \\ \hline \end{array}$$

Estimate each quotient; then find the actual quotient rounded to the nearest hundredth, if necessary. See Example 4.

35. $3.1\overline{)6.36}$

36. $3.1\overline{)0.0636}$

37. $28.34 \div 3$

38. $28.34 \div 0.3$

39. $0.003\overline{)28.34}$

40. $0.03\overline{)28.34}$

41. $0.1\overline{)211.5}$

42. $0.01\overline{)34.82}$

43. $282.4 \div 3.6$

44. $632.9 \div 8.2$

45. $23\overline{)71}$

46. $69\overline{)293}$

47. $6.27 \div 25.7$

48. $24.31 \div 85.3$

Simplify. See Examples 6 and 7.

49. $1.5^2 + 1.25 \div 0.5$

50. $5.4 \div 0.4 - 2.4^2$

51. $\dfrac{14.26 - 6.56}{2.5}$

52. $\dfrac{16.68 - 6.88}{2.5}$

53. $1.52 - 0.56 + 2.2 \cdot 6.5$

54. $12.6 - 5.88 + 13.9 \cdot 6.5$

55. $8.6 \div 2.15 + 3.6 \cdot 20.3$

56. $43.5 + 23.78 \div 5.8 \cdot 5.4$

57. $3.1(50 - 25.8) - 12.9$

58. $4.1(38.6 - 29.8) + 8.6$

59. $1.7(4.1 + 3.3) - 6.2$

60. $2.5(6.8 - 4.3) + 1.1$

61. $40.7 - (2.5^2 + 7.25) \div 0.5$

62. $97.5 + (30.46 - 4.6^2) \div 1.5$

63. $9.3 \cdot 1.1 + 2.4(5.7 - 8.4 \div 2.1)$

64. $5.4 \div 1.2 - 0.6(6.2 - 7.2 \div 1.5)$

65. $(1.3 + 5.9) \cdot 2.6 + 8.16$

66. $4.2 + 23.79 \div (7.4 - 3.5)$

67. $(4.2 + 4.8) \cdot (3.3^2 - 9.9) + 7.2$

68. $(5.7 + 2.9)^2 - (2.1 + 4.1) \cdot 3.4$

Applications

Solve.

69. Jim is packing three sculptures in a box for shipping. The weights of the sculptures are 5.63 pounds, 12.4 pounds, and 3 pounds. The shipping materials weigh 17.4 pounds.

a. Estimate the total weight.

b. Find the actual weight.

70. A road trip is being planned from New York City, NY, to Lawrence, KS. The first leg of the trip will be to Cleveland, OH, which will take 2.817 hours driving time; then on to Des Moines, IA, which will take 11.15 hours; followed by Kansas City, MO, which will take exactly 3 hours; and the final leg to Lawrence, KS, which will take 0.7 hours.

a. Estimate the driving time.

b. Calculate the actual driving time.

71. Five boxes of unequal size are placed side-by-side along a wall, where the first box is 2.36 feet wide, the second is 1.76 feet wide, the third is 3.8 feet wide, the fourth is 0.94 feet wide, and the fifth is 6.17 feet wide.

a. Estimate the length of all the boxes together.

b. Calculate the actual length of all the boxes together.

72. Suppose the price to buy and install granite countertops is $64.85 per square foot.

a. Estimate the price of a new 11 square foot granite countertop that was installed.

b. What is the exact amount paid for the countertop?

73. Suppose Ted is ordering more refrigerators for his stockroom after an appliance sale. He orders 12 new refrigerators at the whole sale price of $496.65.

a. Estimate the total price Ted paid.

b. What is the exact price paid?

74. A sales person at an appliance store receives a 0.12 commission on all items she sells. Assume a customer purchases a front loading washing machine for $996.45, a matching dryer for $891.58, and two matching pedestals for $282.17 each.

a. Estimate what the commission will be. (**Hint:** Add all the prices before computing the commission. Commission = total sales times commission rate.)

b. What is the actual commission on the sale? Round your answer to the nearest cent.

75. Each month, Sydney is setting aside 0.26 times her take-home pay of $3428.84 for a down payment on a condominium.

a. Estimate how much is being placed in savings each month.

b. Compute the exact value of the savings each month. Round your answer to the nearest hundredth.

c. How much money is being saved each year? Use the monthly savings found in part **b.** for the computation.

76. Suppose the sale price of an LED Smart TV is $683 and sales tax is figured at 0.08 times the price.

a. Approximately what total amount is paid for the TV?

b. What is the exact amount paid for the TV? Round your answer to the nearest cent.

77. Suppose a car averages 25.3 miles per gallon.

a. Approximately how far will it go on 19 gallons of gas?

b. What is the actual distance the car will go on 19 gallons of gas?

78. Bicycle racer Peter Sagan rode 125.09 miles in 5.35 hours.

a. Estimate how fast he was riding per hour.

b. What was his average speed per hour (to the nearest hundredth)?

79. A quarter section of beef can be bought cheaper than the same amount of meat purchased a few pounds at a time. Suppose it costs $765.80 to purchase a quarter section which weighs 150 pounds.

a. Estimate the cost per pound for this quarter section.

b. What is the actual cost per pound for this quarter section?

80. According to the latest measurements, Mt. Everest is 29,035 feet above sea level. There are 5280 feet in a mile. [1]

a. Estimate how high Mt. Everest is in miles.

b. What is the actual elevation in miles? Round your answer to the nearest tenth of a mile.

81. Suppose a car travels 330 miles on 15 gallons of gas.

a. Approximately how many miles does the car travel per gallon?

b. Exactly how many miles does the car travel per gallon?

82. Kristin bought three pens that cost $1.25 each, two binders that cost $2.55, and had a coupon for $1.55 off of her total purchase.

a. Approximately how much did Kristin owe, not including tax?

b. Determine the exact amount that Kristin paid for the purchase, not including tax.

83. Stephen is taking 7 credit hours of courses at his local community college. Each credit hour costs $105.50. He also has to pay two technology fees of $16.75 each.

a. Approximately how much will Stephen's tuition be for the semester?

b. Determine the exact amount that Stephen will pay for tuition.

84. Last week, Sam worked 6 days driving a delivery truck. He drove 437.8 miles each day the first two days. Then the next three days he drove 562.6 miles each day. On the final day, he drove 521.4 miles.

a. Approximately how many miles did Sam drive during the week?

b. Determine the exact mileage Sam drove during the week.

c. If Sam earns $0.28 per mile, how much money did he earn during the week? (Round to the nearest cent, if necessary.)

85. Maya and Michelle run a small online business after school. This week, they fulfilled online orders that brought in profits of $11.20, $26.89, $8.90, and $51.33.

a. Estimate the total profit from the orders.

b. Find the exact total profit from the orders.

c. If Maya and Michelle split the profits evenly, how much will each of them get?

86. Kayla purchased four shirts for a total of $69.52, including a tax of $5.72.

a. Estimate the price of each shirt before tax.

b. Find the exact price of each shirt before tax.

1 Source: www.mnteverest.net/history.html

Writing & Thinking

87. In Example 5, we stated the following problem:

> You can buy a car for $19,000 cash or you can make a down payment of $3750 and pay $483.33 each month for 36 months. How much can you save by paying cash?

Estimate the savings by rounding all values. (This includes rounding 36 months to 40 months.) Explain why this estimated savings does not seem reasonable, and explain why we must be careful about using rounded numbers in practical applications.

88. Suppose you are only interested in an approximate answer for a product. Would there be any difference in the products produced by the following two procedures?

a. First multiply the two numbers as they are and then round the product to the desired place of accuracy.

b. First round each number to the desired place of accuracy and then multiply the rounded numbers.

Explain why you think these two procedures would produce the same result or different results.