Similarly, to add $4\frac{1}{3}+1\frac{5}{6}$, press the keys

[4] [a b/c] [1] [a b/c] [3] [+] [1] [a b/c] [5] [a b/c] [6]. Then press [=].

The display will read 6 ⌟1/6.

Completion Example Answers

7. $\frac{7}{2}\cdot\frac{1}{4}+\frac{9}{10}\div\frac{9}{25}=\frac{7}{2}\cdot\frac{1}{4}+\frac{9}{10}\cdot\frac{25}{9}=\frac{7}{8}+\frac{5}{2}=\frac{27}{8}$ or $3\frac{3}{8}$

Margin Exercise Answers

1. $\frac{9}{22}$ is larger by $\frac{7}{66}$. **2.** $\frac{19}{24}$ is larger by $\frac{1}{72}$. **3.** $\frac{5}{9}, \frac{7}{12}, \frac{2}{3}; \frac{1}{9}$ **4.** $\frac{17}{45}$ **5.** $\frac{31}{108}$ **6.** $\frac{1}{4}$

7. $\frac{23}{12}$ or $1\frac{11}{12}$ **8.** $\frac{3x+2}{3}$ **9.** $\frac{55}{18}$ or $3\frac{1}{18}$ **10.** $\frac{10}{9}$ or $1\frac{1}{9}$ **11.** 4 **12.** $-\frac{1}{10}$

3.8 Exercises

Concept Check

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

1. To compare two or more fractions, change each fraction to an equivalent fraction with the LCD and then compare the _____.

2. Once fractions have common denominators, they can be compared by looking at the _____.

3. According to the rules for order of operations, after exponential expressions have been simplified, perform any _____ or _____ from left to right.

4. According to the rules for order of operations, first simplify within _____ _____.

5. To find the average of a set of numbers, add the numbers and _____ that sum by the number of numbers in the set.

6. A fraction that contains another fraction in the numerator and/or denominator is a/an _____ fraction.

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. The rules for order of operations are the same for fractions and mixed numbers as they are for whole numbers.

8. According to the rules for order of operations, multiplication occurs before division.

9. An average is found by adding all the numbers in the set and then dividing by the number of numbers in the set.

10. To simplify a complex fraction, first divide the numerator by the denominator.

Practice

For each pair of fractions, determine which fraction is larger and by how much it is larger. See Examples 1 and 2.

1. $\frac{2}{3}, \frac{3}{4}$

2. $\frac{1}{2}, \frac{2}{5}$

3. $\frac{7}{10}, \frac{8}{15}$

4. $\frac{4}{10}, \frac{3}{8}$

5. $\frac{4}{5}, \frac{17}{20}$

6. $\frac{5}{6}, \frac{31}{36}$

7. $\frac{13}{20}, \frac{5}{8}$

8. $\frac{10}{36}, \frac{7}{24}$

9. $\frac{14}{35}, \frac{12}{30}$

10. $\frac{37}{100}, \frac{24}{75}$

Arrange each set of fractions in order from smallest to largest. Then find the difference between the largest and smallest fractions. See Example 3.

11. $\frac{1}{2}, \frac{2}{5}, \frac{3}{8}$

12. $\frac{2}{3}, \frac{3}{4}, \frac{5}{8}$

13. $\frac{1}{2}, \frac{1}{3}, \frac{1}{4}$

14. $\frac{1}{5}, \frac{1}{7}, \frac{1}{9}$

15. $\frac{7}{9}, \frac{31}{36}, \frac{17}{18}$

16. $\frac{5}{8}, \frac{25}{48}, \frac{9}{16}$

17. $\frac{8}{9}, \frac{9}{10}, \frac{11}{12}$

18. $\frac{7}{6}, \frac{11}{12}, \frac{19}{20}$

19. $\frac{1}{100}, \frac{3}{1000}, \frac{20}{10,000}$

20. $\frac{32}{100}, \frac{298}{1000}, \frac{3}{10}$

Simplify. See Examples 4 through 8.

21. $\frac{1}{2} \div \frac{7}{8} + \frac{1}{7} \cdot \frac{2}{3}$

22. $\frac{1}{2} \div \frac{1}{2} + \frac{2}{3} \cdot \frac{2}{3}$

23. $-\frac{3}{5} \cdot \frac{1}{6} + \frac{1}{5} \div (-2)$

24. $-\frac{2}{3} \cdot \frac{1}{4} + \left(-\frac{1}{2}\right) \div 3$

25. $\frac{5}{8} \cdot \left|-\frac{1}{10}\right| \div \frac{3}{4} + \frac{1}{6}$

26. $\frac{2}{15} \cdot \frac{1}{4} \div \frac{3}{5} + \left|-\frac{1}{36}\right|$

27. $\left(\frac{7}{15} + \frac{8}{21}\right) \div \frac{3}{35}$

28. $\left(\frac{5}{14} + \frac{3}{10}\right) \div \frac{23}{35}$

29. $\left(\frac{1}{2} - \frac{1}{3}\right) \div \left(\frac{5}{8} + \frac{3}{16}\right)$

30. $\left(\frac{7}{8} - \frac{3}{16}\right) \div \left(\frac{1}{3} - \frac{1}{4}\right)$

31. $\left(\frac{5}{6} - \frac{1}{3}\right) - \left(\frac{1}{2} + \frac{1}{5}\right)$

32. $\left(\frac{1}{2} - \frac{4}{9}\right) - \left(\frac{5}{6} - \frac{2}{3}\right)$

33. $\left(\frac{1}{2}\right)^2 - \left(\frac{1}{4}\right)^3$

34. $\left(\frac{1}{3}\right)^3 - \left(\frac{1}{9}\right)^2$

35. $\left(\frac{1}{3}+\frac{1}{5}\right)\cdot\left(\frac{3}{4}-\frac{1}{6}\right)$

36. $\left(\frac{2}{5}+\frac{1}{4}\right)\cdot\left(\frac{3}{4}-\frac{1}{2}\right)$

37. $-\left|\frac{2}{3}\right|+\frac{1}{6}+\left(-\frac{1}{2}\right)^3$

38. $-\frac{1}{2}\div\left|-\frac{2}{3}\right|-\left(\frac{1}{3}\right)^2$

39. $\left(\frac{1}{3}\right)^2+\left(-\frac{1}{6}\right)^2+\frac{2}{3}$

40. $\left(-\frac{1}{8}\right)^2+\left(\frac{1}{4}\right)^2+\frac{1}{2}$

41. $\left(2+\frac{1}{5}\right)\div 2\frac{1}{5}$

42. $\left(4+\frac{1}{2}\right)\div 4\frac{1}{2}$

43. $\left(\frac{5}{8}+\frac{5}{8}\right)\div\left(2\frac{1}{2}\right)^2$

44. $\left(\frac{7}{12}+\frac{7}{12}\right)\div\left(2\frac{1}{3}\right)^2$

45. $-1\frac{1}{7}+\left(4\frac{1}{2}+5\frac{3}{5}\right)\div\left(-2\frac{1}{10}\right)$

46. $-8\frac{2}{5}+\left(1\frac{3}{4}+5\frac{3}{10}\right)\div 2\frac{1}{4}$

47. $2\frac{2}{5}\cdot\left(-4\frac{1}{6}\right)\div\frac{5}{2}+\frac{14}{3}$

48. $-2\frac{1}{2}\cdot 3\frac{1}{5}\div\left(-\frac{3}{4}\right)+\frac{7}{10}$

49. $\left|-\frac{5}{8}\right|-\left|-\frac{1}{3}\right|\cdot\frac{2}{5}+6\frac{1}{10}$

50. $\frac{5}{6}-\left|-\frac{4}{7}\right|\cdot\left|\frac{1}{2}\right|+5\frac{1}{10}$

51. $\left(2\frac{4}{9}+1\frac{1}{18}\right)\div\left(-1\frac{2}{9}-\frac{1}{6}\right)$

52. $\left(-2\frac{1}{6}-1\frac{5}{12}\right)\div\left(1\frac{3}{4}-\frac{2}{3}\right)$

53. $1\frac{1}{6}\cdot 1\frac{2}{19}\div\frac{7}{8}+\frac{1}{38}$

54. $2\frac{1}{13}\cdot 3\frac{1}{3}\div\frac{5}{6}+\frac{7}{39}$

55. $x-\frac{1}{5}-\frac{2}{3}$

56. $y+\frac{1}{7}+\frac{1}{6}$

57. $x+\frac{3}{4}+2\frac{1}{2}$

58. $y-\frac{4}{5}-3\frac{1}{3}$

59. $\frac{1}{x}\cdot\frac{3}{7}-\frac{1}{7}\div\frac{1}{2}$

60. $\frac{a}{3}\cdot\frac{1}{2}-\frac{2}{3}\div 1\frac{1}{3}$

Simplify each complex fraction. See Examples 10 through 12.

61. $\dfrac{\frac{4}{3x}}{\frac{8}{9x}}$

62. $\dfrac{\frac{a}{6}}{\frac{2a}{3}}$

63. $\dfrac{-2\frac{1}{3}}{-1\frac{2}{5}}$

64. $\dfrac{-7\frac{3}{4}}{-5\frac{7}{11}}$

65. $\dfrac{\frac{2}{3}+\frac{1}{5}}{4\frac{1}{2}}$

66. $\dfrac{\frac{1}{2}+\frac{4}{5}}{3\frac{1}{3}}$

67. $\dfrac{\frac{5}{8}-\frac{1}{2}}{\frac{1}{8}-\frac{3}{16}}$

68. $\dfrac{\frac{7}{9}-\frac{1}{3}}{\frac{2}{9}-\frac{5}{18}}$

69. $\dfrac{3\frac{1}{5}-1\frac{1}{10}}{3\frac{1}{2}-1\frac{3}{10}}$

70. $\dfrac{6\frac{1}{10}-3\frac{1}{15}}{2\frac{1}{5}+1\frac{1}{2}}$

Find each average. See Example 9.

71. Find the average of the numbers $\frac{5}{6}, \frac{1}{15}$, and $\frac{17}{30}$.

72. Find the average of the numbers $\frac{5}{8}, \frac{3}{10}$, and $1\frac{1}{4}$.

73. Find the average of the numbers $\frac{7}{8}, \frac{9}{10}$, and $1\frac{3}{4}$.

74. Find the average of the numbers $\frac{5}{6}, 1\frac{2}{3}$, and $\frac{3}{4}$.

75. Find the average of the numbers $5\frac{1}{8}, 7\frac{1}{2}, 4\frac{3}{4}$, and $10\frac{1}{2}$.

76. Find the average of the numbers $4\frac{7}{10}, 3\frac{9}{10}, 5\frac{1}{100}$, and $11\frac{3}{20}$.

77. Find the average of the numbers $7\frac{3}{5}, 4\frac{3}{5}, 8\frac{1}{3}$, and $3\frac{1}{18}$.

78. Find the average of the numbers $6\frac{4}{7}, 3\frac{1}{4}, 1\frac{11}{12}$, and $5\frac{6}{7}$.

Applications

Solve.

79. If the product of $5\frac{1}{2}$ and $2\frac{1}{4}$ is added to the quotient of $\frac{9}{10}$ and $\frac{3}{4}$, what is the total?

80. If $\frac{9}{10}$ of 70 is divided by $\frac{3}{4}$ of 10, what is the quotient?

81. An $8\frac{1}{2}$ inch by $10\frac{3}{4}$ inch picture is placed in a frame that is $\frac{9}{16}$ inches wide. Find the perimeter of the outside edges of the frame. (Reminder: The perimeter of a rectangle is computed by adding twice the length to twice the width.)

82. A recipe calls for $2\frac{1}{5}$ cups of stewed tomatoes and $1\frac{2}{3}$ cups of fully cooked beans. If the recipe is multiplied by $2\frac{1}{2}$, how much tomato/bean mixture will there be?

83. The force between two charged particles is a product of terms divided by the square of the distance between two particles. Assume that the product of the terms is $\frac{3}{5}$ and the distance between the two particles is $\frac{1}{25}$. What is the force?

84. Two painters paint $76\frac{1}{2}$ feet of fencing in one day. The first painter works for $2\frac{1}{2}$ hours and the second works for $5\frac{3}{5}$ hours. How many feet of fencing are painted in each hour? (**Hint:** Add the number of hours then divide the length of fencing by this sum.)

85. A customer orders some items from an online store. Included in this order are five boxes of candy that weigh $1\frac{1}{3}$ pounds each. The order also contains two of each of the following items: a $\frac{2}{3}$ pound box of chewing gum, a $2\frac{1}{2}$ pound can of peanuts, and a $1\frac{1}{4}$ pound box of gourmet popping corn. If the packaging materials weigh $1\frac{1}{2}$ pounds, what is the total shipping weight of the order?

86. An art book has 40 two-sided pages of pictures, each of which is $\frac{1}{32}$ inch thick. Each two-sided page is protected by a $\frac{1}{80}$ inch thick piece of paper. Each side of the book is bound by a $\frac{1}{6}$ inch cover. What is the total thickness of the book?

87. Emma goes to a buffet where the cost of the meal is determined by the weight of the food. Among the items currently on the buffet are $\frac{8}{9}$ kg of potato salad and $\frac{3}{4}$ kg of chicken salad. Emma puts $\frac{3}{16}$ of the potato salad and $\frac{2}{15}$ of the chicken salad onto her plate. She also takes 2 slices of bread that weigh $\frac{1}{30}$ kg each.

a. What is the total weigh of the food taken? (The weight of the plate is not included.)

b. If the restaurant charges \$18 for each kg of food (including taxes), how much will Emma spend?

88. A building was partially destroyed by a bad storm and it had to be torn down because it was condemned by the city. At the beginning of the demolition project, $\frac{8}{9}$ of the building was standing. After the first day of work $\frac{1}{3}$ of the building was standing. If the crew spent $6\frac{2}{3}$ hours of work on the project during the first day, what fraction of the building was torn down each hour?

89. A person has a collection of four snakes with the following lengths: $1\frac{1}{4}$ feet, $3\frac{1}{8}$ feet, $\frac{7}{8}$ feet, and $2\frac{1}{3}$ feet. What is the average length of the four snakes?

90. A town that normally does not receive significant snow experienced measurable snow for three weeks in a row. The first week it snowed $2\frac{1}{4}$ inches, the second week it snowed $9\frac{2}{3}$ inches, and the third week it snowed $1\frac{5}{6}$ inches. What was the average weekly snowfall for this three-week period?

Writing & Thinking

91. **a.** If two fractions are between 0 and 1, can their sum be more than 1? Explain.

b. If two fractions are between 0 and 1, can their product be more than 1? Explain.

92. If a fraction is between 0 and 1 and the fraction is squared, will the result be larger or smaller than the original fraction? Explain.

93. Consider the fraction $\frac{1}{2}$.

a. If this fraction is divided by 2, will the quotient be more or less than $\frac{1}{2}$?

b. If this fraction is divided by 3, will the quotient be more or less than the quotient in part a.?

94. Will the quotient always get smaller and smaller when an integer is divided by larger and larger integers? Can you think of a case in which this is not true? What happens when 0 is divided by larger and larger numbers? What happens when a negative integer is divided by larger and larger integers?