10. A truck is towing 3000 pounds. This is $\frac{2}{3}$ of the truck's towing capacity.

a. Is the truck's towing capacity more or less than 4000 pounds?

b. If you were to multiply $\frac{2}{3}$ times 3000, would the product be more or less than 3000?

c. What is the towing capacity of the truck?

Example 10 Application: Multiplying and Dividing Fractions

A box contains 30 pieces of candy. This is $\frac{3}{5}$ of the maximum amount of this candy the box can hold.

a. Is the maximum amount of candy the box can hold more or less than 30 pieces?

b. If you want to multiply $\frac{3}{5}$ times 30, would the product be more or less than 30?

c. What is the maximum number of pieces of candy the box can hold?

Solution

a. The maximum number of pieces of candy is more than 30, because $\frac{3}{5}$ is less than the whole box.

b. Less than 30.

c. To find the maximum number of pieces, divide.

$$30 \div \frac{3}{5} = \frac{30}{1} \cdot \frac{5}{3} = \frac{\cancel{3} \cdot 10 \cdot 5}{1 \cdot \cancel{3}} = 50$$

The maximum number of pieces the box will hold is 50.

Now work margin exercise 10.

Completion Example Answers

7. $\frac{39}{20x^2}$; $-\frac{4 \cdot x \cdot 3 \cdot 13}{13 \cdot 4 \cdot 5 \cdot x \cdot x}$; $-\frac{3}{5x}$

Margin Exercise Answers

1. $\frac{8}{7}$ **2.** $\frac{1}{3x}$ **3.** $\frac{20}{27}$ **4.** $\frac{7}{45}$ **5.** $\frac{4}{3}$ or $1\frac{1}{3}$ **6.** $\frac{4}{5}$ **7.** $\frac{5}{38x}$ **8.** $\frac{5}{21}$ **9.** 128 strips of tape

10. a. More than 4000 lb **b.** Less than 3000 **c.** 4500 pounds

3.3 Exercises

Concept Check

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

1. The _____ of $-\frac{7}{8}$ is $-\frac{8}{7}$.

2. The product of any nonzero number and its reciprocal is always _____.

3. The reciprocal of 5 is _____.

4. The number 0 has _____ reciprocal.

5. To divide by any nonzero number, multiply by its _____.

6. The result of $\frac{3}{5} \div \frac{1}{15}$ 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. The reciprocal of 1 is undefined.

8. The product of a nonzero number and its reciprocal is undefined.

9. The reciprocal of -12 is $-\frac{12}{1}$.

10. The result of $\frac{1}{3} \div \frac{1}{6}$ is 2.

Practice

Find the reciprocal. See Examples 1 and 2.

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

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

3. $-\frac{1}{3}$

4. $\frac{1}{8}$

5. -2

6. $7x$

7. 0

8. 1

9. $\frac{12a}{7b}$

10. $\frac{9}{28x^2}$

Divide and reduce to lowest terms. See Examples 5 through 7.

11. $\frac{2}{3} \div \frac{3}{4}$

12. $\frac{1}{5} \div \frac{3}{4}$

13. $\frac{3}{7} \div \frac{3}{5}$

14. $\frac{2}{11} \div \frac{2}{3}$

15. $0 \div \frac{5}{6}$

16. $0 \div \frac{6}{7}$

17. $\frac{5}{6} \div 0$

18. $\frac{6}{7} \div 0$

19. $-\frac{3}{5} \div \frac{3}{7}$

20. $\frac{2}{3} \div \left(-\frac{2}{11}\right)$

21. $\frac{3}{4} \div \frac{1}{-4}$

22. $\frac{-1}{5} \div \frac{2}{5}$

23. $\frac{5}{16} \div \frac{15}{16}$

24. $\frac{4}{23} \div \frac{16}{23}$

25. $\frac{5}{12} \div \frac{15}{16}$

26. $\frac{8}{25} \div \frac{2}{15}$

27. $\frac{-16}{35} \div \frac{2}{7}$

28. $\frac{-15}{27} \div \frac{5}{9}$

29. $\left(-\frac{12}{27}\right) \div \left(-\frac{10}{18}\right)$

30. $\left(-\frac{14}{15}\right) \div \left(-\frac{21}{25}\right)$

31. $\frac{20}{21} \div \frac{15}{42}$

32. $\frac{16}{33} \div \frac{24}{55}$

33. $\frac{3}{7} \div \frac{3}{7}$

34. $\frac{6}{13} \div \frac{6}{13}$

35. $\frac{-15}{24} \div \frac{-25}{18}$

36. $\frac{-36}{25} \div \frac{-24}{20}$

37. $\frac{3}{10} \div \frac{7}{8}$

38. $\frac{5}{6} \div \frac{13}{4}$

39. $\frac{21}{5} \div 3$

40. $\frac{15}{8} \div 5$

41. $\frac{41}{6} \div (-2)$

42. $-\frac{1}{7} \div 14$

43. $-3 \div \frac{21}{5}$

44. $5 \div \left(-\frac{15}{8} \right)$

45. $\frac{5x}{8} \div \frac{-5x}{8}$

46. $\frac{-3}{7r} \div \frac{3}{-7r}$

47. $\frac{34b}{21a} \div \frac{17b}{14a}$

48. $\frac{16x}{20y} \div \frac{18x}{10y}$

49. $\frac{20x}{21y} \div \frac{10y}{14x}$

50. $\frac{15a}{28b} \div \frac{5b}{8a}$

51. $14x \div \frac{1}{7x}$

52. $25y \div \frac{1}{5y}$

53. $-30a \div \frac{1}{10}$

54. $-50b \div \frac{1}{2}$

55. $\frac{3x}{4y} \div -4x$

56. $\frac{-7a}{8b} \div 8a$

57. $\frac{29a}{50} \div \frac{31a}{10}$

58. $\frac{92}{71} \div \frac{46a}{11}$

59. $\frac{-33x^2}{32} \div \frac{11x}{4}$

60. $\frac{-26}{9b} \div \frac{-52}{63b^2}$

Applications

Solve.

61. The result of multiplying two numbers is $\frac{2}{5}$. If one of the numbers is $\frac{5}{6}$, what is the other number?

62. The result of multiplying two numbers is $\frac{3}{8}$. If one of the numbers is $\frac{15}{7}$, what is the other number?

63. The floor of the Atlantic Ocean is spreading apart at an average rate of $\frac{3}{50}$ of a meter per year. How long will it take for the ocean floor to spread 12 meters?

64. A small private college has determined that about $\frac{11}{25}$ of the students that it accepts will actually enroll. If the college wants 550 freshmen to enroll, how many should it accept?

65. An airplane is carrying 180 passengers. This is $\frac{9}{10}$ of the capacity of the airplane.

a. Is the capacity of the airplane more or less than 180?

b. If you were to multiply 180 times $\frac{9}{10}$, would the product be more or less than 180?

c. What is the capacity of the airplane?

66. Due to environmental considerations, homeowners in a particularly dry area have been asked to use less water than usual. One home is currently using 630 gallons per day. This is $\frac{7}{10}$ of the usual amount of water used in this home.

a. Is the usual amount of water used more or less than 630 gallons?

b. If you were to multiply $\frac{7}{10}$ times 630, would the product be more or less than 630?

c. What is the usual amount of water used in this home?

67. A manufacturing plant is currently producing 6000 steel rods per week. Because of difficulties getting materials, this number is only $\frac{3}{4}$ of the plant's potential production.

a. Is the potential production number more or less than 6000 rods?

b. If you were to multiply $\frac{3}{4}$ times 6000, would the product be more or less than 6000?

c. What is the plant's potential production?

68. A grove of orange trees was struck by an off-season frost and the result was a relatively poor harvest. This year's crop was 10,000 tons of oranges, which is about $\frac{4}{5}$ of the usual crop.

a. Is the usual crop more or less than 10,000 tons of oranges?

b. If you were to multiply 10,000 times $\frac{4}{5}$, would the product be more or less than 10,000?

c. About how many tons of oranges are usually harvested?

Writing & Thinking

69. Explain why the number 0 has no reciprocal.

70. Show that the phrases "15 divided by 3" and "15 divided by one-third" have different meanings.

71. Show that the phrases "12 divided by three" and "12 times one-third" have the same meaning.

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

73. Is division a commutative operation? Explain briefly and give three examples using fractions to help justify your answer.