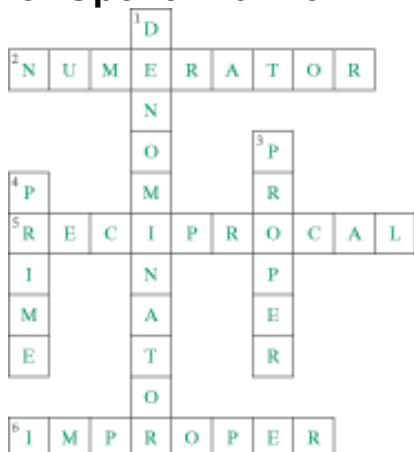


Chapter 2 Fractions and Mixed Numbers: Multiplication and Division

Chapter Opener Puzzle



Section 2.1 Introduction to Fractions and Mixed Numbers

Section 2.1 Practice Exercises

- Answers will vary.
- A **fraction** is a part of a whole unit.
 - The **numerator** of a fraction denotes the number of pieces of the whole being considered.
 - The **denominator** of a fraction denotes the number of equal pieces into which a whole unit is divided.
 - A fraction is a **proper fraction** if the numerator is less than the denominator.
 - An **improper fraction** is a fraction in which the numerator is greater than or equal to the denominator.
 - A **mixed number** is a sum of a whole number and a fractional part of a whole.
- Numerator: 2; denominator: 3
- Numerator: 8; denominator: 9
- Numerator: 12; denominator: 11
- Numerator 1; denominator: 2
- $6 \div 1; 6$
- $9 \div 1; 9$
- $2 \div 2; 1$
- $8 \div 8; 1$
- $0 \div 3; 0$
- $0 \div 7; 0$
- $2 \div 0$; undefined
- $11 \div 0$; undefined
- $\frac{3}{4}$
- $\frac{1}{2}$
- $\frac{5}{9}$

18. $\frac{3}{5}$

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

20. $\frac{4}{7}$

21. $\frac{3}{8}$

22. $\frac{2}{3}$

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

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

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

26. $\frac{2}{8}$ or $\frac{1}{4}$

27. $\frac{41}{103}$

28. $\frac{43}{103}$

29. $\frac{10}{21}$

30. $\frac{10}{63}$

31. Proper

32. Proper

33. Improper

34. Improper

35. Improper

36. Improper

37. Proper

38. Proper

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

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

41. $\frac{12}{4}$

42. $\frac{27}{9}$

43. $\frac{7}{4}; 1\frac{3}{4}$

44. $\frac{13}{4}; 3\frac{1}{4}$

45. $\frac{13}{8}; 1\frac{5}{8}$

46. $\frac{5}{2}; 2\frac{1}{2}$

47. $1\frac{3}{4} = \frac{4 \times 1 + 3}{4} = \frac{7}{4}$

48. $6\frac{1}{3} = \frac{6 \times 3 + 1}{3} = \frac{19}{3}$

49. $4\frac{2}{9} = \frac{4 \times 9 + 2}{9} = \frac{38}{9}$

50. $3\frac{1}{5} = \frac{3 \times 5 + 1}{5} = \frac{16}{5}$

51. $3\frac{3}{7} = \frac{3 \times 7 + 3}{7} = \frac{24}{7}$

52. $8\frac{2}{3} = \frac{8 \times 3 + 2}{3} = \frac{26}{3}$

53. $7\frac{1}{4} = \frac{7 \times 4 + 1}{4} = \frac{29}{4}$

$$54. 10\frac{3}{5} = \frac{10 \times 5 + 3}{5} = \frac{53}{5}$$

$$55. 11\frac{5}{12} = \frac{11 \times 12 + 5}{12} = \frac{137}{12}$$

$$56. 12\frac{1}{6} = \frac{12 \times 6 + 1}{6} = \frac{73}{6}$$

$$57. 21\frac{3}{8} = \frac{21 \times 8 + 3}{8} = \frac{171}{8}$$

$$58. 15\frac{1}{2} = \frac{15 \times 2 + 1}{2} = \frac{31}{2}$$

$$59. 2\frac{3}{8} = \frac{2 \times 8 + 3}{8} = \frac{19}{8}$$

19 eighths

$$60. 2\frac{3}{5} = \frac{2 \times 5 + 3}{5} = \frac{13}{5}$$

13 fifths

$$61. 1\frac{3}{4} = \frac{1 \times 4 + 3}{4} = \frac{7}{4}$$

7 fourths

$$62. 5\frac{2}{3} = \frac{5 \times 3 + 2}{3} = \frac{17}{3}$$

17 thirds

$$63. 8\overline{)37} \quad 4\frac{5}{8}$$

$$\begin{array}{r} 8 \overline{) 37} \\ \underline{-32} \\ 5 \end{array}$$

$$64. 7\overline{)13} \quad 1\frac{6}{7}$$

$$\begin{array}{r} 7 \overline{) 13} \\ \underline{-7} \\ 6 \end{array}$$

$$65. 5\overline{)39} \quad 7\frac{4}{5}$$

$$\begin{array}{r} 5 \overline{) 39} \\ \underline{-35} \\ 4 \end{array}$$

$$66. 4\overline{)19} \quad 4\frac{3}{4}$$

$$\begin{array}{r} 4 \overline{) 19} \\ \underline{-16} \\ 3 \end{array}$$

$$67. 10\overline{)27} \quad 2\frac{7}{10}$$

$$\begin{array}{r} 10 \overline{) 27} \\ \underline{-20} \\ 7 \end{array}$$

$$68. 18\overline{)43} \quad 2\frac{7}{18}$$

$$\begin{array}{r} 18 \overline{) 43} \\ \underline{-36} \\ 7 \end{array}$$

$$69. 9\overline{)52} \quad 5\frac{7}{9}$$

$$\begin{array}{r} 9 \overline{) 52} \\ \underline{-45} \\ 7 \end{array}$$

$$70. 12\overline{)67} \quad 5\frac{7}{12}$$

$$\begin{array}{r} 12 \overline{) 67} \\ \underline{-60} \\ 7 \end{array}$$

$$71. 11\overline{)133} \quad 12\frac{1}{11}$$

$$\begin{array}{r} 11 \overline{) 133} \\ \underline{-11} \\ 23 \\ \underline{-22} \\ 1 \end{array}$$

$$72. 10\overline{)51} \quad 5\frac{1}{10}$$

$$\begin{array}{r} 10 \overline{) 51} \\ \underline{-50} \\ 1 \end{array}$$

$$73. 6\overline{)23} \quad 3\frac{5}{6}$$

$$\begin{array}{r} 6 \overline{) 23} \\ \underline{-18} \\ 5 \end{array}$$

$$74. 7\overline{)115} \quad 16\frac{3}{7}$$

$$\begin{array}{r} 7 \overline{) 115} \\ \underline{-7} \\ 45 \\ \underline{-42} \\ 3 \end{array}$$

$$75. 7\overline{)309} \quad 44\frac{1}{7}$$

$$\begin{array}{r} 7 \overline{) 309} \\ \underline{-28} \\ 29 \\ \underline{-28} \\ 1 \end{array}$$

$$76. \begin{array}{r} 230 \\ 4 \overline{) 921} \\ \underline{-8} \\ 12 \\ \underline{-12} \\ 1 \\ \underline{-0} \\ 1 \end{array} \quad 230\frac{1}{4}$$

$$77. \begin{array}{r} 1056 \\ 5 \overline{) 5281} \\ \underline{-5} \\ 2 \\ \underline{-0} \\ 28 \\ \underline{-25} \\ 31 \\ \underline{-30} \\ 1 \end{array} \quad 1056\frac{1}{5}$$

$$78. \begin{array}{r} 901 \\ 8 \overline{) 7213} \\ \underline{-72} \\ 1 \\ \underline{-0} \\ 13 \\ \underline{-8} \\ 5 \end{array} \quad 901\frac{5}{8}$$

$$79. \begin{array}{r} 810 \\ 11 \overline{) 8913} \\ \underline{-88} \\ 11 \\ \underline{-11} \\ 3 \\ \underline{-0} \\ 3 \end{array} \quad 810\frac{3}{11}$$

$$80. \begin{array}{r} 185 \\ 23 \overline{) 4257} \\ \underline{-23} \\ 195 \\ \underline{-184} \\ 117 \\ \underline{-115} \\ 2 \end{array} \quad 185\frac{2}{23}$$

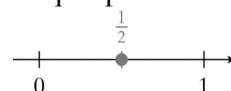
$$81. \begin{array}{r} 12 \\ 15 \overline{) 187} \\ \underline{-15} \\ 37 \\ \underline{-30} \\ 7 \end{array} \quad 12\frac{7}{15}$$

$$82. \begin{array}{r} 20 \\ 34 \overline{) 695} \\ \underline{-68} \\ 15 \\ \underline{-0} \\ 15 \end{array} \quad 20\frac{15}{34}$$

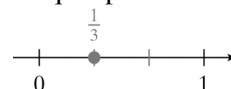
83. Divide the distance between 0 and 1 into 4 equal parts.



84. Divide the distance between 0 and 1 into 2 equal parts.



85. Divide the distance between 0 and 1 into 3 equal parts.



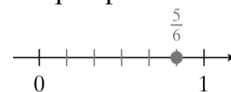
86. Divide the distance between 0 and 1 into 5 equal parts.



87. Divide the distance between 0 and 1 into 3 equal parts.

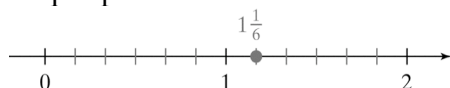


88. Divide the distance between 0 and 1 into 6 equal parts.



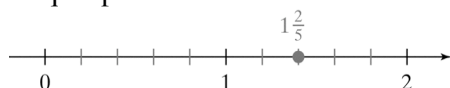
89. $\frac{7}{6} = 1\frac{1}{6}$

Divide the distance between 1 and 2 into 6 equal parts.



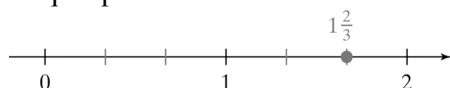
90. $\frac{7}{5} = 1\frac{2}{5}$

Divide the distance between 1 and 2 into 5 equal parts.



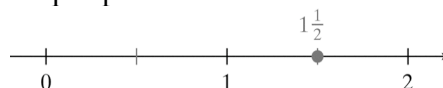
91. $\frac{5}{3} = 1\frac{2}{3}$

Divide the distance between 1 and 2 into 3 equal parts.



92. $\frac{3}{2} = 1\frac{1}{2}$

Divide the distance between 1 and 2 into 2 equal parts.



93. False; whole numbers cannot be written as proper fractions.

94. True

95. True

96. True

Section 2.2 Prime Numbers and Factorization

Section 2.2 Practice Exercises

1. Answers will vary.

2. (a) A **factor** of a number n is a nonzero whole number that divides evenly into n .

(b) A **factorization** of a number n is a product of factors that equals n .

(c) A **prime number** is a whole number greater than 1 that has only two factors (itself and 1).

(d) A **composite number** is a whole number greater than 1 that is not prime.

(e) The **prime factorization** of a number is the factorization in which every factor is a prime number.

3. $\frac{8}{12}; \frac{4}{12}$

4. $\frac{5}{2}; \frac{1}{2}$

5. $\frac{5}{4}; \frac{3}{4}$

6. $\frac{6}{5}$; improper

7. $\frac{7}{12}$; proper

8. $\frac{6}{6}$; improper

9.
$$\begin{array}{r} 4 \\ 5 \overline{) 23} \\ \underline{-20} \\ 3 \end{array} \quad 4\frac{3}{5}$$

10. $6\frac{2}{7} = \frac{6 \times 7 + 2}{7} = \frac{44}{7}$

11. For example: $2 \cdot 4$ and $1 \cdot 8$

12. For example: $2 \cdot 10$ and $4 \cdot 5$

13. For example: $4 \cdot 6$ and $2 \cdot 2 \cdot 2 \cdot 3$

14. For example: $1 \cdot 14$ and $2 \cdot 7$

15.

Product	42	30	15	81
Factor	7	30	15	27
Factor	6	1	1	3
Sum	13	31	16	30

16.

Product	42	45	72	24
Factor	7	15	18	8
Factor	6	3	4	3
Sum	1	12	14	5

17. A whole number is divisible by 2 if it is an even number.

18. A whole number is divisible by 10 if its ones-place digit is 0.

19. A whole number is divisible by 3 if the sum of its digits is divisible by 3.

20. A whole number is divisible by 5 if its ones-place digit is 5 or 0.

21. 45

- (a) No; 45 is not even.
- (b) Yes; $4 + 5 = 9$ is divisible by 3.
- (c) Yes; the ones-place digit is 5.
- (d) No; the ones-place digit is not 0.

22. 100

- (a) Yes; 100 is even.
- (b) No; $1 + 0 + 0 = 1$ is not divisible by 3.
- (c) Yes; the ones-place digit is 0.
- (d) Yes; the ones-place digit is 0.

23. 137

- (a) No; 137 is not even.
- (b) No; $1 + 3 + 7 = 11$ is not divisible by 3.
- (c) No; the ones-place digit is not 0 or 5.
- (d) No; the ones-place digit is not 0.

24. 241

- (a) No; 241 is not even.
- (b) No; $2 + 4 + 1 = 7$ is not divisible by 3.
- (c) No; the ones-place digit is not 0 or 5.
- (d) No; the ones-place digit is not 0.

25. 108

- (a) Yes; 108 is even.
- (b) Yes; $1 + 0 + 8 = 9$ is divisible by 3.
- (c) No; the ones-place digit is not 0 or 5.
- (d) No; the ones-place digit is not 0.

26. 1040

- (a) Yes; 1040 is even.
- (b) No; $1 + 0 + 4 + 0 = 5$ is not divisible by 3.
- (c) Yes; the ones-place digit is 0.
- (d) Yes; the ones-place digit is 0.

27. 3140

- (a) Yes; 3140 is even.
- (b) No; $3 + 1 + 4 + 0 = 8$ is not divisible by 3.
- (c) Yes; the ones-place digit is 0.
- (d) Yes; the ones-place digit is 0.

28. 2115

- (a) No; 2115 is not even.
- (b) Yes; $2 + 1 + 1 + 5 = 9$ is divisible by 3.
- (c) Yes; the ones-place digit is 5.
- (d) No; the ones-place digit is not 0.

29.
$$\begin{array}{r} 3 \\ 28 \overline{) 84} \\ \underline{-84} \\ 0 \end{array}$$

Yes, 84 is divisible by 28.

30.
$$\begin{array}{r} 5 \\ 22 \overline{) 110} \\ \underline{-110} \\ 0 \end{array}$$

Yes, 110 is divisible by 22.

31. Prime

32. Prime

33. Composite $2 \cdot 5 = 10$

34. Composite $3 \cdot 7 = 21$

35. Composite $3 \cdot 17 = 51$

36. Composite $3 \cdot 19 = 57$

37. Prime

38. Prime

39. Neither

40. Neither

41. Composite $11 \cdot 11 = 121$

42. Composite $3 \cdot 23 = 69$

43. Prime

44. Prime

45. Composite $3 \cdot 13 = 39$

46. Composite $7 \cdot 7 = 49$

47. There are two whole numbers that are neither prime nor composite, 0 and 1.

48. False; the square of any prime number is divisible by that prime number.

49. False; 9 is not prime.

50. False; 2 is not composite.

51. 2, 3, 5, 7, 11, 13, 17, 19, 23, 29, 31, 37, 41, 43, 47

52. 2, 3, 5, 7, 11, 13, 17, 19, 23, 29, 31, 37, 41, 43, 47, 53, 59, 61, 67, 71, 73, 79

53. No, 9 is not a prime number.

54. No, 8 is not a prime number.

55. Yes

56. Yes

57.
$$\begin{array}{r} 7 \\ 5 \overline{)35} \\ 2 \overline{)70} \end{array} \quad 2 \cdot 5 \cdot 7 = 70$$

58.
$$\begin{array}{r} 11 \\ 5 \overline{)55} \\ 3 \overline{)165} \\ 3 \overline{)495} \end{array} \quad 3 \cdot 3 \cdot 5 \cdot 11 = 3^2 \cdot 5 \cdot 11 = 495$$

59.
$$\begin{array}{r} 13 \\ 5 \overline{)65} \\ 2 \overline{)130} \\ 2 \overline{)260} \end{array} \quad 2 \cdot 2 \cdot 5 \cdot 13 = 2^2 \cdot 5 \cdot 13 = 260$$

60.
$$\begin{array}{r} 7 \\ 5 \overline{)35} \\ 5 \overline{)175} \end{array} \quad 5 \cdot 5 \cdot 7 = 5^2 \cdot 7 = 175$$

61.
$$\begin{array}{r} 7 \\ 7 \overline{)49} \\ 3 \overline{)147} \end{array} \quad 3 \cdot 7 \cdot 7 = 3 \cdot 7^2 = 147$$

62.
$$\begin{array}{r} 17 \\ 3 \overline{)51} \\ 2 \overline{)102} \end{array} \quad 2 \cdot 3 \cdot 17 = 51$$

63.
$$\begin{array}{r} 23 \\ 3 \overline{)69} \\ 2 \overline{)138} \end{array} \quad 2 \cdot 3 \cdot 23 = 138$$

64.
$$\begin{array}{r} 11 \\ 7 \overline{)77} \\ 3 \overline{)231} \end{array} \quad 3 \cdot 7 \cdot 11 = 231$$

65.
$$\begin{array}{r} 11 \\ 7 \overline{)77} \\ 2 \overline{)154} \\ 2 \overline{)308} \\ 2 \overline{)616} \end{array} \quad 2 \cdot 2 \cdot 2 \cdot 7 \cdot 11 = 2^3 \cdot 7 \cdot 11 = 616$$

66.
$$\begin{array}{r} 13 \\ 7 \overline{)91} \\ 2 \overline{)182} \\ 2 \overline{)364} \end{array} \quad 2 \cdot 2 \cdot 7 \cdot 13 = 2^2 \cdot 7 \cdot 13 = 364$$

67. 47 is prime.

68. 41 is prime.

69. 1, 2, 3, 4, 6, 12
 70. 1, 2, 3, 6, 9, 18
 71. 1, 2, 4, 8, 16, 32
 72. 1, 5, 11, 55
 73. 1, 3, 9, 27, 81
 74. 1, 2, 3, 4, 5, 6, 10, 12, 15, 20, 30, 60
 75. 1, 2, 3, 4, 6, 8, 12, 16, 24, 48
 76. 1, 2, 3, 4, 6, 8, 9, 12, 18, 24, 36, 72
 77. No; 30 is not divisible by 4.
 78. No; 46 is not divisible by 4.
 79. Yes; 16 is divisible by 4.
 80. Yes; 64 is divisible by 4.
 81. Yes; 32 is divisible by 8.
 82. Yes; 520 is divisible by 8.
 83. No; 126 is not divisible by 8.
 84. No; 58 is not divisible by 8.
 85. Yes; $3 + 9 + 6 = 18$ is divisible by 9.
 86. Yes; $4 + 1 + 4 = 9$ is divisible by 9.
 87. No; $8 + 4 + 5 + 3 = 20$ is not divisible by 9.
 88. No; $1 + 5 + 8 + 7 = 21$ is not divisible by 9.
 89. Yes; 522 is even and $5 + 2 + 2 = 9$ is divisible by 3.
 90. Yes; 546 is even and $5 + 4 + 6 = 15$ is divisible by 3.
 91. No; 5917 is not even.
 92. No; $6 + 3 + 9 + 4 = 22$ is not divisible by 3.

Section 2.3 Simplifying Fractions to Lowest Terms

Section 2.3 Practice Exercises

1. Answers will vary.
 2. (a) A fraction is said to be in **lowest terms** if the numerator and denominator share no common factor other than 1.
 (b) The largest number that divides evenly into the numerator and denominator is call their **greatest common factor**.

$$3. \begin{array}{r} 29 \\ 5 \overline{)145} \end{array} \quad 5 \cdot 29 = 145$$

$$4. \begin{array}{r} 19 \\ 3 \overline{)57} \\ 2 \overline{)114} \end{array} \quad 2 \cdot 3 \cdot 19 = 114$$

$$5. \begin{array}{r} 23 \\ 2 \overline{)46} \\ 2 \overline{)92} \end{array} \quad 2 \cdot 2 \cdot 23 = 2^2 \cdot 23 = 92$$

$$6. \begin{array}{r} 17 \\ 3 \overline{)51} \\ 3 \overline{)153} \end{array} \quad 3 \cdot 3 \cdot 17 = 3^2 \cdot 17 = 153$$

$$7. \begin{array}{r} 17 \\ 5 \overline{)85} \end{array} \quad 5 \cdot 17 = 85$$

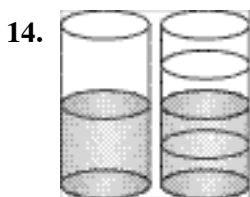
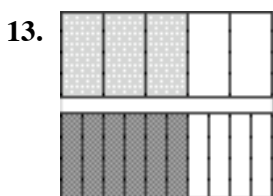
$$8. \begin{array}{r} 5 \\ 3 \overline{)15} \\ 2 \overline{)30} \\ 2 \overline{)60} \\ 2 \overline{)120} \end{array} \quad 2 \cdot 2 \cdot 2 \cdot 3 \cdot 5 = 2^3 \cdot 3 \cdot 5 = 120$$

$$9. \begin{array}{r} 13 \\ 5 \overline{) 65} \\ 3 \overline{) 195} \end{array}$$

$$3 \cdot 5 \cdot 13 = 195$$

$$10. \begin{array}{r} 5 \\ 3 \overline{) 15} \\ 3 \overline{) 45} \\ 2 \overline{) 90} \\ 2 \overline{) 180} \end{array}$$

$$2 \cdot 2 \cdot 3 \cdot 3 \cdot 5 = 2^2 \cdot 3^2 \cdot 5 = 180$$



15. False; $5 \times 5 \neq 4 \times 4$

16. Two fractions are equivalent if they both represent the same part of a whole.

$$17. \begin{array}{l} 2 \times 5 \nabla 3 \times 3 \\ 10 \neq 9 \\ \frac{2}{3} \neq \frac{3}{5} \end{array}$$

$$18. \begin{array}{l} 1 \times 9 \nabla 4 \times 2 \\ 9 \neq 8 \\ \frac{1}{4} \neq \frac{2}{9} \end{array}$$

$$19. \begin{array}{l} 1 \times 6 \nabla 2 \times 3 \\ 6 = 6 \\ \frac{1}{2} = \frac{3}{6} \end{array}$$

$$20. \begin{array}{l} 6 \times 8 \nabla 16 \times 3 \\ 48 = 48 \\ \frac{6}{16} = \frac{3}{8} \end{array}$$

$$21. \begin{array}{l} 12 \times 4 \nabla 16 \times 3 \\ 48 = 48 \\ \frac{12}{6} = \frac{3}{4} \end{array}$$

$$22. \begin{array}{l} 4 \times 15 \nabla 5 \times 12 \\ 60 = 60 \\ \frac{4}{5} = \frac{12}{15} \end{array}$$

$$23. \begin{array}{l} 8 \times 27 \nabla 9 \times 20 \\ 216 \neq 180 \\ \frac{8}{9} \neq \frac{20}{27} \end{array}$$

$$24. \begin{array}{l} 5 \times 18 \nabla 6 \times 12 \\ 90 \neq 72 \\ \frac{5}{6} \neq \frac{12}{18} \end{array}$$

$$25. \frac{12}{24} = \frac{\cancel{2} \cdot \cancel{2} \cdot \cancel{3}}{\cancel{2} \cdot \cancel{2} \cdot 2 \cdot \cancel{3}} = \frac{1}{2}$$

$$26. \frac{15}{18} = \frac{\cancel{3} \cdot 5}{2 \cdot \cancel{3} \cdot 3} = \frac{5}{6}$$

$$27. \frac{6}{18} = \frac{\cancel{2} \cdot \cancel{3}}{\cancel{2} \cdot \cancel{3} \cdot 3} = \frac{1}{3}$$

$$28. \frac{21}{24} = \frac{\cancel{3} \cdot 7}{2 \cdot 2 \cdot 2 \cdot \cancel{3}} = \frac{7}{8}$$

$$29. \frac{36}{20} = \frac{\cancel{2} \cdot \cancel{2} \cdot 3 \cdot 3}{\cancel{2} \cdot \cancel{2} \cdot 5} = \frac{9}{5}$$

$$30. \frac{49}{42} = \frac{\cancel{7} \cdot 7}{2 \cdot 3 \cdot \cancel{7}} = \frac{7}{6}$$

$$31. \frac{15}{12} = \frac{\cancel{3} \cdot 5}{2 \cdot 2 \cdot \cancel{3}} = \frac{5}{4}$$

$$32. \frac{30}{25} = \frac{2 \cdot 3 \cdot \cancel{5}}{\cancel{5} \cdot 5} = \frac{6}{5}$$

$$33. \frac{20}{25} = \frac{2 \cdot 2 \cdot \cancel{5}}{\cancel{5} \cdot 5} = \frac{4}{5}$$

$$34. \frac{8}{16} = \frac{\cancel{8}}{2 \cdot \cancel{8}} = \frac{1}{2}$$

$$35. \frac{14}{14} = 1$$

$$36. \frac{8}{8} = 1$$

$$37. \frac{50}{25} = \frac{2 \cdot \cancel{25}}{\cancel{25}} = 2$$

$$38. \frac{24}{6} = \frac{4 \cdot \cancel{6}}{\cancel{6}} = 4$$

$$39. \frac{9}{9} = 1$$

$$40. \frac{2}{2} = 1$$

$$41. \frac{105}{140} = \frac{3 \cdot \cancel{5} \cdot \cancel{7}}{2 \cdot 2 \cdot \cancel{5} \cdot \cancel{7}} = \frac{3}{4}$$

$$42. \frac{84}{126} = \frac{\cancel{2} \cdot 2 \cdot \cancel{3} \cdot \cancel{7}}{\cancel{2} \cdot \cancel{3} \cdot 3 \cdot \cancel{7}} = \frac{2}{3}$$

$$43. \frac{33}{11} = \frac{3 \cdot \cancel{11}}{\cancel{11}} = 3$$

$$44. \frac{65}{5} = \frac{\cancel{5} \cdot 13}{\cancel{5}} = 13$$

$$45. \frac{77}{110} = \frac{7 \cdot \cancel{11}}{10 \cdot \cancel{11}} = \frac{7}{10}$$

$$46. \frac{85}{153} = \frac{5 \cdot \cancel{17}}{3 \cdot 3 \cdot \cancel{17}} = \frac{5}{9}$$

$$47. \frac{130}{150} = \frac{\cancel{2} \cdot \cancel{5} \cdot 13}{\cancel{2} \cdot 3 \cdot \cancel{5} \cdot 5} = \frac{13}{15}$$

$$48. \frac{70}{120} = \frac{\cancel{2} \cdot \cancel{5} \cdot 7}{\cancel{2} \cdot 2 \cdot 2 \cdot 3 \cdot \cancel{5}} = \frac{7}{12}$$

$$49. \frac{385}{195} = \frac{\cancel{5} \cdot 7 \cdot 11}{3 \cdot \cancel{5} \cdot 13} = \frac{77}{39}$$

$$50. \frac{39}{130} = \frac{3 \cdot \cancel{13}}{2 \cdot 5 \cdot \cancel{13}} = \frac{3}{10}$$

$$51. \frac{34}{85} = \frac{2 \cdot \cancel{17}}{5 \cdot \cancel{17}} = \frac{2}{5}$$

$$52. \frac{69}{92} = \frac{3 \cdot \cancel{23}}{2 \cdot 2 \cdot \cancel{23}} = \frac{3}{4}$$

$$53. \frac{6-2}{10+4} = \frac{4}{14} = \frac{\cancel{2} \cdot 2}{\cancel{2} \cdot 7} = \frac{2}{7}$$

$$54. \frac{9-1}{15+3} = \frac{8}{18} = \frac{\cancel{2} \cdot 2 \cdot 2}{\cancel{2} \cdot 3 \cdot 3} = \frac{4}{9}$$

$$55. \frac{5-5}{7-2} = \frac{0}{5} = 0$$

$$56. \frac{11-11}{4+7} = \frac{0}{11} = 0$$

$$57. \frac{7-2}{5-5} = \frac{5}{0} = \text{undefined}$$

$$58. \frac{4+7}{11-11} = \frac{11}{0} = \text{undefined}$$

$$59. \frac{8-2}{8+2} = \frac{6}{10} = \frac{\cancel{2} \cdot 3}{\cancel{2} \cdot 5} = \frac{3}{5}$$

$$60. \frac{15+3}{15-3} = \frac{18}{12} = \frac{\cancel{3} \cdot 3}{\cancel{3} \cdot 2} = \frac{3}{2}$$

$$61. \frac{12\cancel{0}}{16\cancel{0}} = \frac{12}{16} = \frac{\cancel{2} \cdot \cancel{2} \cdot 3}{\cancel{2} \cdot \cancel{2} \cdot 2 \cdot 2} = \frac{3}{4}$$

$$62. \frac{72\cancel{0}}{80\cancel{0}} = \frac{72}{80} = \frac{\cancel{8} \cdot 9}{\cancel{8} \cdot 10} = \frac{9}{10}$$

$$63. \frac{30\cancel{0}\cancel{0}}{18\cancel{0}\cancel{0}} = \frac{30}{18} = \frac{\cancel{2} \cdot \cancel{3} \cdot 5}{\cancel{2} \cdot \cancel{3} \cdot 3} = \frac{5}{3}$$

$$64. \frac{20\cancel{0}\cancel{0}}{15\cancel{0}\cancel{0}} = \frac{20}{15} = \frac{2 \cdot \cancel{2} \cdot \cancel{5}}{3 \cdot \cancel{5}} = \frac{4}{3}$$

$$65. \frac{42, \cancel{0}\cancel{0}\cancel{0}}{22, \cancel{0}\cancel{0}\cancel{0}} = \frac{42}{22} = \frac{\cancel{2} \cdot 21}{\cancel{2} \cdot 11} = \frac{21}{11}$$

$$66. \frac{50, \cancel{0}\cancel{0}\cancel{0}}{65, \cancel{0}\cancel{0}\cancel{0}} = \frac{50}{65} = \frac{2 \cdot \cancel{5} \cdot 5}{\cancel{5} \cdot 13} = \frac{10}{13}$$

$$67. \frac{51\cancel{0}\cancel{0}}{30, \cancel{0}\cancel{0}\cancel{0}} = \frac{51}{300} = \frac{\cancel{3} \cdot 17}{\cancel{3} \cdot 100} = \frac{17}{100}$$

$$68. \frac{98\cancel{0}\cancel{0}}{28, \cancel{0}\cancel{0}\cancel{0}} = \frac{98}{280} = \frac{\cancel{2} \cdot \cancel{7} \cdot 7}{\cancel{2} \cdot 2 \cdot 2 \cdot 5 \cdot \cancel{7}} = \frac{7}{20}$$

$$69. \text{ Heads: } \frac{20}{48} = \frac{\cancel{2} \cdot \cancel{2} \cdot 5}{\cancel{2} \cdot \cancel{2} \cdot 2 \cdot 2 \cdot 3} = \frac{5}{12}$$

$$\text{ Tails: } 48 - 20 = 28$$

$$\frac{28}{48} = \frac{\cancel{2} \cdot \cancel{2} \cdot 7}{\cancel{2} \cdot \cancel{2} \cdot 2 \cdot 2 \cdot 3} = \frac{7}{12}$$

$$70. \frac{70}{105} = \frac{2 \cdot \cancel{5} \cdot \cancel{7}}{3 \cdot \cancel{5} \cdot \cancel{7}} = \frac{2}{3}$$

$$71. (a) \frac{6}{26} = \frac{\cancel{2} \cdot 3}{\cancel{2} \cdot 13} = \frac{3}{13}$$

$$(b) 26 - 6 = 20$$

$$\frac{20}{26} = \frac{\cancel{2} \cdot 2 \cdot 5}{\cancel{2} \cdot 13} = \frac{10}{13}$$

$$72. (a) \frac{12}{88} = \frac{\cancel{2} \cdot \cancel{2} \cdot 3}{\cancel{2} \cdot \cancel{2} \cdot 2 \cdot 11} = \frac{3}{22}$$

$$(b) \frac{36}{88} = \frac{\cancel{2} \cdot \cancel{2} \cdot 3 \cdot 3}{\cancel{2} \cdot \cancel{2} \cdot 2 \cdot 11} = \frac{9}{22}$$

$$73. (a) \text{ Jonathan: } \frac{25}{35} = \frac{\cancel{5} \cdot 5}{\cancel{5} \cdot 7} = \frac{5}{7}$$

$$\text{ Jared: } \frac{24}{28} = \frac{\cancel{2} \cdot \cancel{2} \cdot 2 \cdot 3}{\cancel{2} \cdot \cancel{2} \cdot 7} = \frac{6}{7}$$

(b) Jared sold the greater fractional part

$$\text{ because } \frac{6}{7} > \frac{5}{7}.$$

$$74. (a) \text{ Lynette: } \frac{15}{24} = \frac{\cancel{3} \cdot 5}{2 \cdot 2 \cdot 2 \cdot \cancel{3}} = \frac{5}{8}$$

$$\text{ Lisa: } \frac{14}{16} = \frac{\cancel{2} \cdot 7}{\cancel{2} \cdot 2 \cdot 2 \cdot 2} = \frac{7}{8}$$

(b) Lisa has completed more of her course

$$\text{ because } \frac{7}{8} > \frac{5}{8}.$$

75. (a) Raymond:

$$\frac{720}{792} = \frac{\cancel{2} \cdot \cancel{2} \cdot \cancel{2} \cdot 2 \cdot \cancel{3} \cdot \cancel{3} \cdot 5}{\cancel{2} \cdot \cancel{2} \cdot \cancel{2} \cdot \cancel{3} \cdot \cancel{3} \cdot 11} = \frac{10}{11}$$

$$\text{ Travis: } \frac{540}{660} = \frac{\cancel{2} \cdot \cancel{2} \cdot \cancel{3} \cdot 3 \cdot 3 \cdot \cancel{5}}{\cancel{2} \cdot \cancel{2} \cdot \cancel{3} \cdot \cancel{3} \cdot 11} = \frac{9}{11}$$

(b) Raymond read the greater fractional

$$\text{ part because } \frac{10}{11} > \frac{9}{11}.$$

$$76. (a) \frac{15}{27} = \frac{\cancel{3} \cdot 5}{\cancel{3} \cdot 3 \cdot 3} = \frac{5}{9}$$

$$(b) \frac{16}{36} = \frac{\cancel{2} \cdot \cancel{2} \cdot 2 \cdot 2}{\cancel{2} \cdot \cancel{2} \cdot 3 \cdot 3} = \frac{4}{9}$$

77. (a) 300,000,000

(b) 36,000,000

$$(c) \frac{36, \cancel{0}\cancel{0}\cancel{0}, \cancel{0}\cancel{0}\cancel{0}}{300, \cancel{0}\cancel{0}\cancel{0}, \cancel{0}\cancel{0}\cancel{0}} = \frac{36}{300} = \frac{\cancel{2} \cdot \cancel{3} \cdot \cancel{2} \cdot 3}{\cancel{2} \cdot \cancel{2} \cdot \cancel{3} \cdot 5 \cdot 5} = \frac{3}{25}$$

78. (a) 300,000,000

(b) 75,000,000

$$(c) \frac{300, \cancel{0}\cancel{0}\cancel{0}, \cancel{0}\cancel{0}\cancel{0}}{75, \cancel{0}\cancel{0}\cancel{0}, \cancel{0}\cancel{0}\cancel{0}} = \frac{300}{75} = \frac{2 \cdot 2 \cdot \cancel{3} \cdot \cancel{3} \cdot \cancel{5}}{\cancel{3} \cdot \cancel{3} \cdot \cancel{5}} = \frac{4}{1}$$

(d) 4 times greater

79. For example, $\frac{6}{8}, \frac{9}{12}, \frac{12}{16}$

80. For example, $\frac{2}{6}, \frac{3}{9}, \frac{4}{12}$

81. For example, $\frac{6}{9}, \frac{4}{6}, \frac{2}{3}$

82. For example, $\frac{40}{50}, \frac{8}{10}, \frac{4}{5}$

83. $\frac{792}{891} = \frac{8}{9}$

84. $\frac{728}{784} = \frac{13}{14}$

85. $\frac{779}{969} = \frac{41}{51}$

86. $\frac{462}{220} = \frac{21}{10}$

87. $\frac{493}{510} = \frac{29}{30}$

88. $\frac{871}{469} = \frac{13}{7}$

89. $\frac{969}{646} = \frac{3}{2}$

90. $\frac{713}{437} = \frac{31}{19}$

Section 2.4 Multiplication of Fractions and Applications

Section 2.4 Practice Exercises

1. Pages 152–156; answers will vary.

2. A **power of one-tenth** is $\frac{1}{10}$ raised to a whole-number power.

3. Numerator: 10; denominator: 14

$$\frac{10}{14} = \frac{\cancel{2} \cdot 5}{\cancel{2} \cdot 7} = \frac{5}{7}$$

4. Numerator: 32; denominator: 36

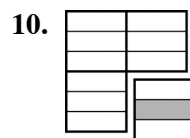
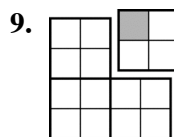
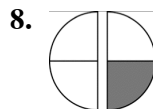
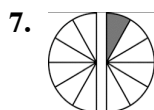
$$\frac{32}{36} = \frac{\cancel{2} \cdot \cancel{2} \cdot 2 \cdot 2 \cdot 2}{\cancel{2} \cdot \cancel{2} \cdot 3 \cdot 3} = \frac{8}{9}$$

5. Numerator: 25; denominator: 15

$$\frac{25}{15} = \frac{\cancel{5} \cdot 5}{3 \cdot \cancel{5}} = \frac{5}{3}$$

6. Numerator: 2100; denominator: 7000

$$\frac{21\cancel{0}\cancel{0}}{70\cancel{0}\cancel{0}} = \frac{21}{70} = \frac{3 \cdot \cancel{7}}{2 \cdot 5 \cdot \cancel{7}} = \frac{3}{10}$$



11. $\frac{1}{2} \cdot \frac{1}{4} = \frac{1 \cdot 1}{2 \cdot 4} = \frac{1}{8}$

12. $\frac{2}{3} \cdot \frac{1}{5} = \frac{2 \cdot 1}{3 \cdot 5} = \frac{2}{15}$

13. $\frac{3}{4} \cdot 8 = \frac{3}{4} \cdot \frac{8}{1} = \frac{24}{4} = 6$

14. $\frac{2}{5} \cdot 20 = \frac{2}{5} \cdot \frac{20}{1} = \frac{40}{5} = 8$

$$15. \frac{1}{2} \times \frac{3}{8} = \frac{1 \times 3}{2 \times 8} = \frac{3}{16}$$

$$16. \frac{2}{3} \times \frac{1}{3} = \frac{2 \times 1}{3 \times 3} = \frac{2}{9}$$

$$17. \frac{14}{9} \cdot \frac{1}{9} = \frac{14 \cdot 1}{9 \cdot 9} = \frac{14}{81}$$

$$18. \frac{1}{8} \cdot \frac{9}{8} = \frac{1 \cdot 9}{8 \cdot 8} = \frac{9}{64}$$

$$19. \left(\frac{12}{7} \right) \left(\frac{2}{5} \right) = \frac{12 \times 2}{7 \times 5} = \frac{24}{35}$$

$$20. \left(\frac{9}{10} \right) \left(\frac{7}{4} \right) = \frac{9 \times 7}{10 \times 4} = \frac{63}{40}$$

$$21. 8 \cdot \left(\frac{1}{11} \right) = \frac{8}{1} \cdot \frac{1}{11} = \frac{8 \cdot 1}{1 \cdot 11} = \frac{8}{11}$$

$$22. 3 \cdot \left(\frac{2}{7} \right) = \frac{3}{1} \cdot \frac{2}{7} = \frac{3 \cdot 2}{1 \cdot 7} = \frac{6}{7}$$

$$23. \frac{4}{5} \cdot 6 = \frac{4}{5} \cdot \frac{6}{1} = \frac{4 \cdot 6}{5 \cdot 1} = \frac{24}{5}$$

$$24. \frac{5}{8} \cdot 5 = \frac{5}{8} \cdot \frac{5}{1} = \frac{5 \cdot 5}{8 \cdot 1} = \frac{25}{8}$$

$$25. \frac{13}{9} \times \frac{5}{4} = \frac{13 \times 5}{9 \times 4} = \frac{65}{36}$$

$$26. \frac{6}{5} \times \frac{7}{5} = \frac{6 \times 7}{5 \times 5} = \frac{42}{25}$$

$$27. \frac{2}{9} \times \frac{3}{5} = \frac{2}{\cancel{3} \cdot 3} \times \frac{\cancel{3}}{5} = \frac{2}{15}$$

$$28. \frac{1}{8} \times \frac{4}{7} = \frac{1}{2 \cdot \cancel{4}} \times \frac{\cancel{4}}{7} = \frac{1}{14}$$

$$29. \frac{5}{6} \times \frac{3}{4} = \frac{5}{2 \cdot \cancel{3}} \times \frac{\cancel{3}}{4} = \frac{5}{8}$$

$$30. \frac{7}{12} \times \frac{18}{5} = \frac{7}{\cancel{2} \cdot 2 \cdot \cancel{3}} \times \frac{\cancel{2} \cdot \cancel{3} \cdot 3}{5} = \frac{21}{10}$$

$$31. \frac{21}{5} \cdot \frac{25}{12} = \frac{\cancel{3} \cdot 7}{5} \cdot \frac{\cancel{5} \cdot 5}{2 \cdot 2 \cdot \cancel{3}} = \frac{35}{4}$$

$$32. \frac{16}{25} \cdot \frac{15}{32} = \frac{\cancel{16}}{\cancel{5} \cdot 5} \cdot \frac{3 \cdot \cancel{8}}{2 \cdot \cancel{16}} = \frac{3}{10}$$

$$33. \frac{24}{15} \cdot \frac{5}{3} = \frac{2 \cdot 2 \cdot 2 \cdot \cancel{3}}{\cancel{3} \cdot \cancel{5}} \cdot \frac{\cancel{5}}{3} = \frac{8}{3}$$

$$34. \frac{49}{24} \cdot \frac{6}{7} = \frac{\cancel{7} \cdot 7}{\cancel{2} \cdot 2 \cdot 2 \cdot \cancel{3}} \cdot \frac{\cancel{2} \cdot \cancel{3}}{\cancel{7}} = \frac{7}{4}$$

$$35. \left(\frac{6}{11} \right) \left(\frac{22}{15} \right) = \frac{6 \cdot 22}{11 \cdot 15} = \frac{2 \cdot \cancel{3} \cdot 2 \cdot \cancel{11}}{\cancel{11} \cdot \cancel{3} \cdot 5} = \frac{4}{5}$$

$$36. \left(\frac{12}{45} \right) \left(\frac{5}{4} \right) = \frac{12 \cdot 5}{45 \cdot 4} = \frac{\cancel{3} \cdot \cancel{4} \cdot \cancel{3}}{\cancel{3} \cdot 3 \cdot \cancel{3} \cdot \cancel{4}} = \frac{1}{3}$$

$$37. \left(\frac{17}{9} \right) \left(\frac{72}{17} \right) = \frac{17 \cdot 72}{9 \cdot 17} = \frac{\cancel{17} \cdot 8 \cdot \cancel{9}}{\cancel{9} \cdot \cancel{17}} = \frac{8}{1} = 8$$

$$38. \left(\frac{39}{11} \right) \left(\frac{11}{13} \right) = \frac{39 \cdot 11}{11 \cdot 13} = \frac{3 \cdot \cancel{11} \cdot \cancel{11}}{\cancel{11} \cdot \cancel{13}} = \frac{3}{1} = 3$$

$$39. \frac{21}{4} \cdot \frac{16}{7} = \frac{3 \cdot \cancel{7}}{\cancel{4}} \cdot \frac{\cancel{4} \cdot 4}{\cancel{7}} = \frac{12}{1} = 12$$

$$40. \frac{85}{6} \cdot \frac{12}{10} = \frac{\cancel{5} \cdot 17}{\cancel{2} \cdot \cancel{3}} \cdot \frac{\cancel{2} \cdot \cancel{2} \cdot \cancel{3}}{\cancel{2} \cdot \cancel{5}} = \frac{17}{1} = 17$$

$$41. 12 \times \frac{15}{42} = \frac{\cancel{2} \cdot 2 \cdot 3}{1} \times \frac{\cancel{3} \cdot 5}{\cancel{2} \cdot \cancel{3} \cdot 7} = \frac{30}{7}$$

$$42. 4 \times \frac{8}{92} = \frac{\cancel{2} \cdot \cancel{2}}{1} \times \frac{2 \cdot 2 \cdot 2}{\cancel{2} \cdot \cancel{2} \cdot 23} = \frac{8}{23}$$

$$\begin{aligned} 43. \frac{9}{15} \times \frac{16}{3} \times \frac{25}{8} &= \frac{\cancel{3} \cdot \cancel{3}}{\cancel{3} \cdot \cancel{5}} \times \frac{\cancel{2} \cdot \cancel{2} \cdot \cancel{2} \cdot 2}{\cancel{2}} \times \frac{\cancel{5} \cdot 5}{\cancel{2} \cdot \cancel{2} \cdot \cancel{2}} \\ &= \frac{10}{1} = 10 \end{aligned}$$

$$44. \frac{49}{8} \times \frac{4}{5} \times \frac{20}{7} = \frac{\cancel{7} \cdot 7}{\cancel{2} \cdot \cancel{2} \cdot \cancel{2}} \times \frac{\cancel{2} \cdot \cancel{2}}{\cancel{5}} \times \frac{\cancel{2} \cdot 2 \cdot \cancel{5}}{\cancel{7}} \\ = \frac{14}{1} = 14$$

$$45. \frac{5}{2} \times \frac{10}{21} \times \frac{7}{5} = \frac{\cancel{5}}{\cancel{2}} \times \frac{\cancel{2} \cdot 5}{3 \cdot \cancel{7}} \times \frac{\cancel{7}}{\cancel{5}} = \frac{5}{3}$$

$$46. \frac{55}{9} \times \frac{18}{32} \times \frac{24}{11} \\ = \frac{5 \cdot \cancel{11}}{\cancel{3} \cdot \cancel{3}} \times \frac{\cancel{2} \cdot \cancel{3} \cdot \cancel{3}}{\cancel{2} \cdot \cancel{2} \cdot \cancel{2} \cdot \cancel{2} \cdot 2} \times \frac{\cancel{2} \cdot \cancel{2} \cdot \cancel{2} \cdot 3}{\cancel{11}} \\ = \frac{15}{2}$$

$$47. \frac{7}{10} \cdot \frac{3}{28} \cdot 5 = \frac{\cancel{7}}{2 \cdot \cancel{5}} \cdot \frac{3}{2 \cdot 2 \cdot \cancel{7}} \cdot \frac{\cancel{5}}{1} = \frac{3}{8}$$

$$48. \frac{11}{18} \cdot \frac{2}{20} \cdot 15 = \frac{11}{\cancel{2} \cdot \cancel{3} \cdot 3} \cdot \frac{\cancel{2}}{2 \cdot 2 \cdot \cancel{5}} \cdot \frac{\cancel{3} \cdot \cancel{5}}{1} = \frac{11}{12}$$

$$49. \frac{100}{49} \times 21 \times \frac{14}{25} = \frac{2 \cdot 2 \cdot \cancel{5} \cdot \cancel{5}}{\cancel{7} \cdot \cancel{7}} \times \frac{3 \cdot \cancel{7}}{1} \times \frac{2 \cdot \cancel{7}}{\cancel{5} \cdot \cancel{5}} \\ = \frac{24}{1} = 24$$

$$50. \frac{38}{22} \times 11 \times \frac{5}{19} = \frac{\cancel{2} \cdot \cancel{19}}{\cancel{2} \cdot \cancel{11}} \times \frac{\cancel{11}}{1} \times \frac{5}{\cancel{19}} = \frac{5}{1} = 5$$

$$51. \left(\frac{1}{10}\right)^3 = \frac{1}{10} \cdot \frac{1}{10} \cdot \frac{1}{10} = \frac{1}{1000}$$

$$52. \left(\frac{1}{10}\right)^4 = \frac{1}{10} \cdot \frac{1}{10} \cdot \frac{1}{10} \cdot \frac{1}{10} = \frac{1}{10,000}$$

$$53. \left(\frac{1}{10}\right)^6 = \frac{1}{10} \cdot \frac{1}{10} \cdot \frac{1}{10} \cdot \frac{1}{10} \cdot \frac{1}{10} \cdot \frac{1}{10} \\ = \frac{1}{1,000,000}$$

$$54. \left(\frac{1}{10}\right)^9 \\ = \frac{1}{10} \cdot \frac{1}{10} \cdot \frac{1}{10} \cdot \frac{1}{10} \cdot \frac{1}{10} \cdot \frac{1}{10} \cdot \frac{1}{10} \cdot \frac{1}{10} \cdot \frac{1}{10} \\ = \frac{1}{1,000,000,000}$$

$$55. \left(\frac{1}{9}\right)^2 = \frac{1}{9} \cdot \frac{1}{9} = \frac{1}{81}$$

$$56. \left(\frac{1}{4}\right)^2 = \frac{1}{4} \cdot \frac{1}{4} = \frac{1}{16}$$

$$57. \left(\frac{3}{2}\right)^3 = \frac{3}{2} \cdot \frac{3}{2} \cdot \frac{3}{2} = \frac{27}{8}$$

$$58. \left(\frac{4}{3}\right)^3 = \frac{4}{3} \cdot \frac{4}{3} \cdot \frac{4}{3} = \frac{64}{27}$$

$$59. \left(4 \cdot \frac{3}{4}\right)^3 = \left(\frac{\cancel{4}}{1} \cdot \frac{3}{\cancel{4}}\right)^3 = 3^3 = 27$$

$$60. \left(5 \cdot \frac{2}{5}\right)^3 = \left(\frac{\cancel{5}}{1} \cdot \frac{2}{\cancel{5}}\right)^3 = 2^3 = 8$$

$$61. \left(\frac{1}{\cancel{5}} \cdot \frac{\cancel{5}}{5}\right)^2 = \left(\frac{1}{15}\right)^2 = \frac{1}{15} \cdot \frac{1}{15} = \frac{1}{225}$$

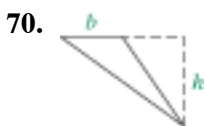
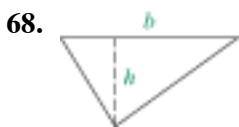
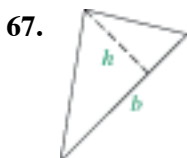
$$62. \left(\frac{\cancel{10}}{3} \cdot \frac{1}{\cancel{100}}\right)^2 = \left(\frac{1}{30}\right)^2 = \frac{1}{30} \cdot \frac{1}{30} = \frac{1}{900}$$

$$63. \frac{1}{3} \cdot \left(\frac{\cancel{3}}{\cancel{1}} \cdot \frac{\cancel{2}}{\cancel{1}}\right) = \frac{1}{\cancel{3}} \cdot \frac{\cancel{2}}{1} = 2$$

$$64. \frac{1}{6} \cdot \left(\frac{\cancel{3}}{\cancel{1}} \cdot \frac{\cancel{30}}{\cancel{1}}\right) = \frac{1}{\cancel{6}} \cdot \frac{\cancel{30}}{1} = 3$$

$$65. \frac{16}{9} \cdot \left(\frac{1}{2}\right)^3 = \frac{16}{9} \cdot \frac{1}{8} = \frac{2}{9}$$

$$66. \frac{28}{6} \cdot \left(\frac{3}{2}\right)^2 = \frac{28}{6} \cdot \frac{9}{4} = \frac{21}{2}$$



$$71. A = \frac{1}{2}bh = \frac{1}{2}(11)(8) = \frac{1}{2} \cdot \frac{11}{1} \cdot \frac{8}{1} = 44 \text{ cm}^2$$

$$72. A = \frac{1}{2}bh = \frac{1}{2}(15)(12) = \frac{1}{2} \cdot \frac{15}{1} \cdot \frac{12}{1} = 90 \text{ in.}^2$$

$$73. A = \frac{1}{2}bh = \frac{1}{2}(8)(8) = \frac{1}{2} \cdot \frac{8}{1} \cdot \frac{8}{1} = 32 \text{ m}^2$$

$$74. A = \frac{1}{2}bh = \frac{1}{2}\left(\frac{7}{4}\right)(1) = \frac{1}{2} \cdot \frac{7}{4} \cdot \frac{1}{1} = \frac{7}{8} \text{ ft}^2$$

$$75. A = \frac{1}{2}bh = \frac{1}{2}(5)\left(\frac{8}{5}\right) = \frac{1}{2} \cdot \frac{8}{1} \cdot \frac{1}{1} = 4 \text{ yd}^2$$

$$76. A = \frac{1}{2}bh = \frac{1}{2}(3)\left(\frac{16}{9}\right) = \frac{1}{2} \cdot \frac{16}{3} \cdot \frac{1}{1} = \frac{8}{3} \text{ or } 2\frac{2}{3} \text{ mm}^2$$

$$77. A = l \times w = \frac{1}{4} \cdot \frac{1}{4} = \frac{1}{16} \text{ cm}^2$$

$$78. A = l \times w = \frac{8}{3} \cdot 3 = \frac{8}{1} \cdot \frac{3}{1} = 8 \text{ m}^2$$

$$79. A = l \times w = \frac{13}{16} \cdot \frac{15}{16} = \frac{195}{256} \text{ in.}^2$$

$$80. A = l \times w = \frac{23}{24} \cdot \frac{1}{4} = \frac{23}{96} \text{ ft}^2$$

$$81. A = (8)(4) + \frac{1}{2}(8)(4) = 32 + 4 \cdot 4 = 32 + 16 = 48 \text{ yd}^2$$

$$82. A = (8)(3) + \frac{1}{2}(8)(3) = 24 + 4 \cdot 3 = 24 + 12 = 36 \text{ m}^2$$

$$83. A = \frac{1}{2}(6)\left(\frac{7}{3}\right) + \frac{1}{2}(6)\left(\frac{2}{3}\right) = 3 \cdot \frac{7}{3} + 3 \cdot \frac{2}{3} = \frac{7}{1} + \frac{2}{1} = 7 + 2 = 9 \text{ cm}^2$$

$$84. A = \frac{1}{2}(8)\left(\frac{9}{4}\right) + \frac{1}{2}(8)\left(\frac{15}{4}\right) = 4 \cdot \frac{9}{4} + 4 \cdot \frac{15}{4} = \frac{9}{1} + \frac{15}{1} = 9 + 15 = 24 \text{ m}^2$$

$$85. \frac{5}{8} \cdot 16 = \frac{5}{\cancel{8}_1} \cdot \frac{\cancel{16}^2}{1} = 10$$

The amount left is 10 gal.

$$86. \frac{3}{4} \cdot 11,000 = \frac{3}{\cancel{4}_1} \cdot \frac{\cancel{11,000}^{2750}}{1} = 8250$$

The cost is \$8250.

$$87. \frac{1}{4} \cdot \frac{1}{2} = \frac{1}{8}$$

Jim ate $\frac{1}{8}$ of the pizza for breakfast.

$$88. \frac{1}{\cancel{4}_2} \cdot \frac{\cancel{2}^1}{5} = \frac{1}{10}$$

$\frac{1}{10}$ of the sample has O negative blood.

$$89. \frac{2}{3} \cdot 9,825,000 = \frac{2}{\cancel{3}_1} \cdot \frac{\cancel{9,825,000}^{3,275,000}}{1} = 6,550,000$$

There are 6,550,000 viewers.

$$90. 3 \cdot \frac{3}{4} = \frac{3}{1} \cdot \frac{3}{4} = \frac{9}{4} \text{ or } 2\frac{1}{4}$$

Nancy spends $\frac{9}{4}$ or $2\frac{1}{4}$ hr a day.

$$91. \text{ First place: } \frac{2}{3} \cdot 1200 = \frac{2}{\cancel{3}_1} \cdot \frac{\cancel{1200}^{400}}{1} = \$800$$

$$\text{Second place: } \frac{1}{4} \cdot 1200 = \frac{1}{\cancel{4}_1} \cdot \frac{\cancel{1200}^{300}}{1} = \$300$$

$$\text{Third place: } \frac{1}{12} \cdot 1200 = \frac{1}{\cancel{12}_1} \cdot \frac{\cancel{1200}^{100}}{1} = \$100$$

$$92. \frac{2}{3} \cdot (40)(36) = \frac{2}{\cancel{3}_1} \cdot \frac{40}{1} \cdot \frac{\cancel{36}^{12}}{1} = 960$$

$$40 \times 36 = 1440$$

$$1440 - 960 = 480$$

Frankie mowed 960 yd². He has 480 yd² left to mow.

$$93. \text{ (a) } \left(\frac{1}{6}\right)^2 = \frac{1}{6} \cdot \frac{1}{6} = \frac{1}{36}$$

$$\text{ (b) } \sqrt{\frac{1}{36}} = \sqrt{\frac{1}{6} \cdot \frac{1}{6}} = \frac{1}{6}$$

$$94. \text{ (a) } \left(\frac{2}{7}\right)^2 = \frac{2}{7} \cdot \frac{2}{7} = \frac{4}{49}$$

$$\text{ (b) } \sqrt{\frac{4}{49}} = \sqrt{\frac{2}{7} \cdot \frac{2}{7}} = \frac{2}{7}$$

$$95. \sqrt{\frac{1}{25}} = \sqrt{\frac{1}{5} \cdot \frac{1}{5}} = \frac{1}{5}$$

$$96. \sqrt{\frac{1}{100}} = \sqrt{\frac{1}{10} \cdot \frac{1}{10}} = \frac{1}{10}$$

$$97. \sqrt{\frac{64}{81}} = \sqrt{\frac{8}{9} \cdot \frac{8}{9}} = \frac{8}{9}$$

$$98. \sqrt{\frac{9}{4}} = \sqrt{\frac{3}{2} \cdot \frac{3}{2}} = \frac{3}{2}$$

$$99. \frac{1}{2}, \frac{1}{4} = \frac{1}{2 \cdot 2}, \frac{1}{8} = \frac{1}{4 \cdot 2}, \frac{1}{16} = \frac{1}{8 \cdot 2}$$

The next number is $\frac{1}{16 \cdot 2} = \frac{1}{32}$.

$$100. \frac{2}{3}, \frac{2}{9} = \frac{2}{3 \cdot 3}, \frac{2}{27} = \frac{2}{9 \cdot 3}$$

The next number is $\frac{2}{27 \cdot 3} = \frac{2}{81}$.

$$101. \frac{1}{2} \left(\frac{1}{8} \right) = \frac{1}{16}$$

$$\frac{1}{8} \left(\frac{1}{2} \right) = \frac{1}{16}$$

They are the same.

$$102. \frac{2}{3} \left(\frac{1}{4} \right) = \frac{2}{12} = \frac{1}{6}$$

$$\frac{1}{4} \left(\frac{2}{3} \right) = \frac{2}{12} = \frac{1}{6}$$

They are the same.

Section 2.5 Division of Fractions and Applications

Section 2.5 Practice Exercises

1. Page 143

Answers will vary.

2. To find the **reciprocal** of a nonzero fraction, interchange the numerator and denominator.

$$3. \frac{9}{\cancel{11}_1} \times \frac{\cancel{22}^2}{5} = \frac{18}{5}$$

$$4. \frac{\cancel{24}^3}{\cancel{7}_1} \cdot \frac{\cancel{7}_1}{\cancel{8}_1} = 3$$

$$5. \frac{\cancel{34}^2}{\cancel{8}_1} \cdot \frac{\cancel{8}_1}{\cancel{17}_1} = 2$$

$$6. 3 \cdot \left(\frac{7}{6} \right) = \frac{\cancel{7}^1}{1} \cdot \frac{7}{\cancel{6}_2} = \frac{7}{2}$$

$$7. 8 \cdot \left(\frac{5}{24} \right) = \frac{\cancel{8}^1}{1} \cdot \frac{5}{\cancel{24}_3} = \frac{5}{3}$$

$$8. \left(\frac{2}{7} \right) \left(\frac{7}{2} \right) = \frac{14}{14} = 1$$

$$9. \left(\frac{9}{5} \right) \left(\frac{5}{9} \right) = \frac{45}{45} = 1$$

$$10. \frac{1}{10} \times 10 = \frac{1}{10} \cdot \frac{10}{1} = \frac{10}{10} = 1$$

$$11. \frac{1}{3} \times 3 = \frac{1}{3} \cdot \frac{3}{1} = \frac{3}{3} = 1$$

$$12. (a) \text{ Yes, } \frac{2}{1} = 2$$

$$(b) \text{ Yes, } \frac{3}{5}$$

$$(c) \text{ Yes, } \frac{1}{6}$$

$$(d) \text{ No, } \frac{1}{0} \text{ is undefined.}$$

$$13. \frac{8}{7}$$

$$14. \frac{6}{5}$$

$$15. \frac{9}{10}$$

$$16. \frac{5}{14}$$

$$17. \frac{1}{4}$$

$$18. \frac{1}{9}$$

19. No reciprocal exists.

20. No reciprocal exists.

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

22. $\frac{1}{5}$

23. multiplying

24. multiplying

25. $\frac{2}{15} \div \frac{5}{12} = \frac{2}{15} \cdot \frac{12}{5} = \frac{2}{\cancel{3} \cdot 5} \cdot \frac{2 \cdot \cancel{2} \cdot \cancel{3}}{5} = \frac{8}{25}$

26. $\frac{11}{3} \div \frac{6}{5} = \frac{11}{3} \cdot \frac{5}{6} = \frac{55}{18}$

27. $\frac{7}{13} \div \frac{2}{5} = \frac{7}{13} \cdot \frac{5}{2} = \frac{35}{26}$

28. $\frac{8}{7} \div \frac{3}{10} = \frac{8}{7} \cdot \frac{10}{3} = \frac{80}{21}$

29. $\frac{14}{3} \div \frac{6}{5} = \frac{\cancel{14}^7}{3} \cdot \frac{5}{\cancel{6}_3} = \frac{35}{9}$

30. $\frac{11}{2} \div \frac{3}{4} = \frac{11}{\cancel{2}_1} \cdot \frac{\cancel{4}^2}{3} = \frac{22}{3}$

31. $\frac{15}{2} \div \frac{3}{2} = \frac{\cancel{15}^5}{\cancel{2}_1} \cdot \frac{\cancel{2}^1}{\cancel{3}_1} = 5$

32. $\frac{9}{10} \div \frac{9}{2} = \frac{\cancel{9}^1}{\cancel{10}_5} \cdot \frac{\cancel{2}^1}{\cancel{9}_1} = \frac{1}{5}$

33. $\frac{3}{4} \div \frac{3}{4} = \frac{3}{4} \cdot \frac{4}{3} = \frac{12}{12} = 1$

34. $\frac{6}{5} \div \frac{6}{5} = \frac{6}{5} \cdot \frac{5}{6} = \frac{30}{30} = 1$

35. $7 \div \frac{2}{3} = \frac{7}{1} \cdot \frac{3}{2} = \frac{21}{2}$

36. $4 \div \frac{3}{5} = \frac{4}{1} \cdot \frac{5}{3} = \frac{20}{3}$

37. $\frac{10}{9} \div \frac{1}{18} = \frac{10}{\cancel{9}_3} \cdot \frac{\cancel{18}^2}{1} = 20$

38. $\frac{4}{3} \div \frac{1}{3} = \frac{4}{\cancel{3}_1} \cdot \frac{\cancel{3}^1}{1} = 4$

39. $12 \div \frac{3}{4} = \frac{\cancel{12}^4}{1} \cdot \frac{4}{\cancel{3}_1} = 16$

40. $24 \div \frac{8}{5} = \frac{\cancel{24}^3}{1} \cdot \frac{5}{\cancel{8}_1} = 15$

41. $\frac{12}{5} \div 4 = \frac{\cancel{12}^3}{5} \cdot \frac{1}{\cancel{4}_1} = \frac{3}{5}$

42. $\frac{20}{6} \div 5 = \frac{\cancel{20}^4}{6} \cdot \frac{1}{\cancel{5}_1} = \frac{4}{6} = \frac{2}{3}$

43. $\frac{9}{50} \div \frac{18}{25} = \frac{\cancel{9}^1}{\cancel{50}_2} \cdot \frac{\cancel{25}^1}{\cancel{18}_2} = \frac{1}{4}$

44. $\frac{30}{40} \div \frac{15}{8} = \frac{\cancel{30}^2}{\cancel{40}_5} \cdot \frac{\cancel{8}^1}{\cancel{15}_1} = \frac{2}{5}$

45. $\frac{9}{100} \div \frac{13}{1000} = \frac{9}{\cancel{100}_1} \cdot \frac{\cancel{1000}^{10}}{13} = \frac{90}{13}$

$$46. \frac{1000}{17} \div \frac{10}{3} = \frac{\overset{100}{\cancel{1000}}}{17} \cdot \frac{3}{\cancel{10}_1} = \frac{300}{17}$$

$$47. \frac{36}{5} \div \frac{9}{25} = \frac{\overset{4}{\cancel{36}}}{5} \cdot \frac{\overset{5}{\cancel{25}}}{\cancel{9}_1} = 20$$

$$48. \frac{13}{5} \div \frac{17}{10} = \frac{13}{\cancel{5}_1} \cdot \frac{\overset{2}{\cancel{10}}}{17} = \frac{26}{17}$$

$$49. \frac{7}{8} \div \frac{1}{4} = \frac{7}{\cancel{8}_2} \cdot \frac{\overset{1}{\cancel{4}}}{1} = \frac{7}{2}$$

$$50. \frac{7}{12} \div \frac{5}{3} = \frac{7}{\cancel{12}_4} \cdot \frac{\overset{1}{\cancel{3}}}{5} = \frac{7}{20}$$

$$51. \frac{5}{\cancel{8}_4} \cdot \frac{\overset{1}{\cancel{2}}}{9} = \frac{5}{36}$$

$$52. \frac{1}{\cancel{16}_4} \cdot \frac{\overset{1}{\cancel{4}}}{3} = \frac{1}{12}$$

$$53. 6 \cdot \frac{4}{3} = \frac{\overset{2}{\cancel{4}}}{1} \cdot \frac{4}{\cancel{3}_1} = 8$$

$$54. 12 \cdot \frac{5}{6} = \frac{\overset{2}{\cancel{12}}}{1} \cdot \frac{5}{\cancel{6}_1} = 10$$

$$55. \frac{16}{5} \div 8 = \frac{\overset{2}{\cancel{16}}}{5} \cdot \frac{1}{\cancel{8}_1} = \frac{2}{5}$$

$$56. \frac{42}{11} \div 7 = \frac{\overset{6}{\cancel{42}}}{11} \cdot \frac{1}{\cancel{7}_1} = \frac{6}{11}$$

$$57. \frac{16}{3} \div \frac{2}{5} = \frac{\overset{8}{\cancel{16}}}{3} \cdot \frac{5}{\cancel{2}_1} = \frac{40}{3}$$

$$58. \frac{17}{8} \div \frac{1}{4} = \frac{17}{\cancel{8}_2} \cdot \frac{\overset{1}{\cancel{4}}}{1} = \frac{17}{2}$$

$$59. \frac{1}{8} \cdot 16 = \frac{1}{\cancel{8}_1} \cdot \frac{\overset{2}{\cancel{16}}}{1} = 2$$

$$60. \frac{2}{3} \cdot 9 = \frac{2}{\cancel{3}_1} \cdot \frac{\overset{3}{\cancel{9}}}{1} = 6$$

$$61. \frac{22}{7} \cdot \frac{5}{16} = \frac{\cancel{2} \cdot 11}{7} \cdot \frac{5}{\cancel{2} \cdot 8} = \frac{55}{56}$$

$$62. \frac{40}{21} \cdot \frac{18}{25} = \frac{\cancel{4} \cdot 8}{\cancel{3} \cdot 7} \cdot \frac{\cancel{3} \cdot 6}{\cancel{5} \cdot 5} = \frac{48}{35}$$

$$63. 8 \div \frac{16}{3} = \frac{1}{\cancel{16}_2} \cdot \frac{3}{\cancel{8}_1} = \frac{3}{2}$$

$$64. 5 \div \frac{15}{4} = \frac{1}{\cancel{15}_3} \cdot \frac{4}{\cancel{3}_1} = \frac{4}{3}$$

$$65. \frac{2}{3} \cdot 6 \text{ multiplies } \frac{2}{3} \text{ by } \frac{6}{1}, \text{ and } \frac{2}{3} \div 6$$

$$\text{multiplies } \frac{2}{3} \text{ by } \frac{1}{6}. \text{ So } \frac{2}{3} \cdot 6 = \frac{2}{\cancel{3}_1} \cdot \frac{\overset{2}{\cancel{6}}}{1} = 4$$

$$\text{and } \frac{2}{3} \div 6 = \frac{\overset{1}{\cancel{2}}}{3} \cdot \frac{1}{\cancel{6}_3} = \frac{1}{9}.$$

$$\begin{aligned}
 66. \quad 8 \cdot \frac{2}{3} \text{ multiplies } 8 \text{ by } \frac{2}{3}, \text{ and } 8 \div \frac{2}{3} \\
 \text{multiplies } 8 \text{ by } \frac{3}{2}. \text{ So } 8 \cdot \frac{2}{3} = \frac{8}{1} \cdot \frac{2}{3} = \frac{16}{3} \\
 \text{and } 8 \div \frac{2}{3} = \frac{8}{1} \cdot \frac{3}{2} = 12.
 \end{aligned}$$

$$\begin{aligned}
 67. \quad \frac{54}{21} \div \frac{2}{3} \div 9 &= \frac{\cancel{54}^{27}}{\cancel{21}_7} \cdot \frac{\cancel{3}^1}{\cancel{2}_1} \div 9 = \frac{27}{7} \div 9 \\
 &= \frac{\cancel{27}^3}{7} \cdot \frac{1}{\cancel{9}_1} = \frac{3}{7}
 \end{aligned}$$

$$\begin{aligned}
 68. \quad \frac{48}{56} \div \frac{3}{8} \div 8 &= \frac{\cancel{48}^{16}}{\cancel{56}_7} \cdot \frac{\cancel{8}^1}{\cancel{3}_1} \div 8 = \frac{16}{7} \div 8 \\
 &= \frac{\cancel{16}^2}{7} \cdot \frac{1}{\cancel{8}_1} = \frac{2}{7}
 \end{aligned}$$

$$\begin{aligned}
 69. \quad \frac{3}{5} \div \frac{6}{7} \cdot \frac{5}{3} &= \frac{\cancel{3}^1}{5} \cdot \frac{7}{\cancel{6}_2} \cdot \frac{5}{\cancel{3}_1} = \frac{7}{\cancel{10}_2} \cdot \frac{\cancel{5}^1}{\cancel{3}_1} = \frac{7}{6}
 \end{aligned}$$

$$\begin{aligned}
 70. \quad \frac{5}{8} \div \frac{35}{16} \cdot \frac{1}{4} &= \frac{\cancel{5}^1}{8} \cdot \frac{\cancel{16}^2}{\cancel{35}_7} \cdot \frac{1}{4} = \frac{\cancel{2}^1}{7} \cdot \frac{1}{\cancel{4}_2} = \frac{1}{14}
 \end{aligned}$$

$$\begin{aligned}
 71. \quad \left(\frac{3}{8}\right)^2 \div \frac{9}{14} &= \frac{3}{8} \cdot \frac{3}{8} \div \frac{9}{14} = \frac{9}{64} \div \frac{9}{14} \\
 &= \frac{9}{64} \cdot \frac{14}{9} = \frac{\cancel{9}}{\cancel{2} \cdot 32} \cdot \frac{\cancel{2} \cdot 7}{\cancel{9}} = \frac{7}{32}
 \end{aligned}$$

$$\begin{aligned}
 72. \quad \frac{7}{8} \div \left(\frac{1}{2}\right)^2 &= \frac{7}{8} \div \left(\frac{1}{2} \cdot \frac{1}{2}\right) = \frac{7}{8} \div \frac{1}{4} \\
 &= \frac{7}{\cancel{8}_2} \cdot \frac{\cancel{4}^1}{1} = \frac{7}{2}
 \end{aligned}$$

$$\begin{aligned}
 73. \quad \left(\frac{2}{5} \div \frac{8}{3}\right)^2 &= \left(\frac{\cancel{2}^1}{5} \cdot \frac{3}{\cancel{8}_4}\right)^2 = \left(\frac{3}{20}\right)^2 = \frac{3}{20} \cdot \frac{3}{20} \\
 &= \frac{9}{400}
 \end{aligned}$$

$$\begin{aligned}
 74. \quad \left(\frac{5}{12} \div \frac{2}{3}\right)^2 &= \left(\frac{5}{\cancel{12}_4} \cdot \frac{\cancel{3}^1}{2}\right)^2 = \left(\frac{5}{8}\right)^2 = \frac{5}{8} \cdot \frac{5}{8} \\
 &= \frac{25}{64}
 \end{aligned}$$

$$\begin{aligned}
 75. \quad \left(\frac{63}{8} \div \frac{9}{4}\right)^2 \cdot 4 &= \left(\frac{\cancel{63}^7}{\cancel{8}_2} \cdot \frac{\cancel{4}^1}{\cancel{9}_1}\right)^2 \cdot 4 = \left(\frac{7}{2}\right)^2 \cdot 4 \\
 &= \frac{7}{2} \cdot \frac{7}{2} \cdot \frac{4}{1} = \frac{49}{\cancel{4}_1} \cdot \frac{\cancel{4}^1}{1} = 49
 \end{aligned}$$

$$\begin{aligned}
 76. \quad \left(\frac{25}{3} \div \frac{50}{9}\right)^2 \cdot 8 &= \left(\frac{\cancel{25}^1}{3} \cdot \frac{\cancel{9}^3}{\cancel{50}_2}\right)^2 \cdot 8 = \left(\frac{3}{2}\right)^2 \cdot 8 \\
 &= \frac{3}{2} \cdot \frac{3}{2} \cdot \frac{8}{1} = \frac{9}{\cancel{4}_1} \cdot \frac{\cancel{4}^1}{1} = 18
 \end{aligned}$$

$$\begin{aligned}
 77. \quad \frac{15}{16} \cdot \left(\frac{2}{3}\right)^2 \div \frac{20}{21} &= \frac{15}{16} \cdot \left(\frac{2 \cdot 2}{3 \cdot 3}\right) \div \frac{20}{21} \\
 &= \frac{15}{16} \cdot \frac{4}{9} \div \frac{20}{21} = \frac{\cancel{15} \cdot 4}{\cancel{16} \cdot 9} \cdot \frac{\cancel{21}}{\cancel{4} \cdot 3} \div \frac{20}{21} \\
 &= \frac{5}{12} \div \frac{20}{21} = \frac{5}{12} \cdot \frac{21}{20} \\
 &= \frac{\cancel{5} \cdot \cancel{21} \cdot 7}{\cancel{12} \cdot 4 \cdot \cancel{3}} = \frac{7}{16}
 \end{aligned}$$

$$\begin{aligned}
 78. \quad \frac{8}{27} \cdot \left(\frac{3}{4}\right)^2 \div \frac{13}{18} &= \frac{8}{27} \cdot \left(\frac{3 \cdot 3}{4 \cdot 4}\right) \div \frac{13}{18} \\
 &= \frac{8}{27} \cdot \frac{9}{16} \div \frac{13}{18} = \frac{\cancel{8} \cdot \cancel{9}}{27 \cdot \cancel{16}} \cdot \frac{\cancel{18}}{2 \cdot \cancel{9}} \div \frac{13}{18} \\
 &= \frac{1}{6} \div \frac{13}{18} = \frac{1}{6} \cdot \frac{18}{13} = \frac{1 \cdot \cancel{18}}{\cancel{6} \cdot 13} = \frac{3}{13}
 \end{aligned}$$

$$79. \quad \frac{9}{4} \div \frac{1}{8} = \frac{9}{\cancel{4}} \cdot \frac{\cancel{8}^2}{1} = 18$$

$$80. \quad \frac{4}{3} \div \frac{1}{6} = \frac{4}{\cancel{3}} \cdot \frac{\cancel{6}^2}{1} = 8$$

$$81. \quad 36 \div \frac{2}{3} = \frac{\cancel{36}^{18}}{1} \cdot \frac{3}{\cancel{2}} = 54$$

Li wrapped 54 packages.

$$82. \quad 60 \div \frac{3}{4} = \frac{\cancel{60}^{20}}{1} \cdot \frac{4}{\cancel{3}} = 80$$

She can sell 80 parcels of land.

$$83. \quad \frac{3}{2} \div \frac{1}{16} = \frac{3}{\cancel{2}} \cdot \frac{\cancel{16}^8}{1} = 24 \text{ cups of juice}$$

$$84. \quad \frac{5}{4} \div \frac{1}{100} = \frac{5}{\cancel{4}} \cdot \frac{\cancel{100}^{25}}{1} = 125 \text{ cm}$$

$$85. \quad 16 \cdot \frac{3}{4} = \frac{\cancel{16}^4}{1} \cdot \frac{3}{\cancel{4}} = 12$$

The stack will be 12 in. high.

$$86. \quad 24 \cdot \frac{5}{4} = \frac{\cancel{24}^6}{1} \cdot \frac{5}{\cancel{4}} = 30$$

Yes, the books will take up only 30 in.

$$87. \quad (a) \quad 18 \div \frac{2}{3} = \frac{\cancel{18}^9}{1} \cdot \frac{3}{\cancel{2}} = 27$$

27 commercials in 1 hr

$$(b) \quad 27 \times 24 = 648$$

648 commercials in 1 day

$$88. \quad (a) \quad 20 \div \frac{1}{2} = \frac{20}{1} \cdot \frac{2}{1} = 40$$

40 commercials in 1 hr

$$(b) \quad 40 \times 24 = 960$$

960 commercials in 1 day

$$\begin{aligned}
 89. \quad (a) \quad \frac{1}{10} \cdot 240,000 &= \frac{1}{10} \cdot \frac{240,000}{1} \\
 &= \frac{240,000}{10} \\
 &= 24,000
 \end{aligned}$$

The down payment is \$24,000.

$$\frac{2}{3} \cdot 24,000 = \frac{2}{\cancel{3}} \cdot \frac{\cancel{24,000}^{8000}}{1} = 16,000$$

Ricardo's mother will pay \$16,000.

$$(b) \quad \$24,000 - \$16,000 = \$8000$$

Ricardo will have to pay \$8000.

$$(c) \quad \$240,000 - \$24,000 = \$216,000$$

He will have to finance \$216,000.

$$90. (a) \frac{1}{12} \cdot 18,000 = \frac{1}{12} \cdot \frac{18,000}{1} = \frac{18,000}{12} = 1500$$

The down payment is \$1500.

$$\frac{1}{2} \cdot 1500 = \frac{1}{2} \cdot \frac{1500}{1} = 750$$

Althea's parents will pay \$750.

$$(b) \$1500 - \$750 = \$750$$

Althea will have to pay \$750.

$$(c) \$18,000 - \$1500 = \$16,500$$

She will have to finance \$16,500.

$$91. (a) \frac{1}{\cancel{2}} \cdot \frac{\cancel{3}}{4} = \frac{3}{4}$$

She plans to sell $\frac{3}{4}$ acre.

$$(b) \text{ She keeps } \frac{2}{3} \text{ of the land.}$$

$$\frac{\cancel{1}}{\cancel{2}} \cdot \frac{\cancel{3}}{\cancel{4}} = \frac{3}{2} \text{ or } 1\frac{1}{2} \text{ acres}$$

$$92. (a) \frac{1}{6} \cdot (24 + 18) = \frac{1}{6} \cdot (42) = \frac{1}{\cancel{6}} \cdot \frac{\cancel{42}^7}{1} = 7$$

Josh has read 7 pages.

$$(b) (24 + 18) - 7 = 42 - 7 = 35$$

He still must read 35 pages.

$$93. \frac{7}{4} \div \frac{1}{8} = \frac{7}{\cancel{4}} \cdot \frac{\cancel{8}^2}{1} = 14$$

She can prepare 14 samples.

$$94. \frac{7}{8} \div \frac{1}{16} = \frac{7}{\cancel{8}} \cdot \frac{\cancel{16}^2}{1} = 14$$

Tony must make 14 strikes.

$$95. \text{ The length is 12 ft, because}$$

$$30 \div \frac{5}{2} = \frac{30}{1} \cdot \frac{2}{5} = \frac{\cancel{30}^6 \cdot 2}{\cancel{5}_1} = \frac{12}{1} = 12$$

$$96. \text{ The width is } \frac{4}{7} \text{ m, because}$$

$$8 \div 14 = \frac{8}{1} \cdot \frac{1}{14} = \frac{\cancel{8}^4 \cdot 1}{\cancel{14}_7} = \frac{4}{7}$$

Problem Recognition Exercises: Multiplication and Division of Fractions

$$1. (a) \frac{8}{3} \cdot \frac{6}{5} = \frac{8}{\cancel{3}} \cdot \frac{\cancel{6}^2}{5} = \frac{16}{5}$$

$$(b) \frac{6}{5} \cdot \frac{8}{3} = \frac{\cancel{6}^2}{5} \cdot \frac{8}{\cancel{3}} = \frac{16}{5}$$

$$(c) \frac{8}{3} \div \frac{6}{5} = \frac{8}{3} \cdot \frac{5}{6} = \frac{\cancel{8}^4}{\cancel{3}_1} \cdot \frac{5}{\cancel{6}_2} = \frac{20}{9}$$

$$(d) \frac{6}{5} \div \frac{8}{3} = \frac{6}{5} \cdot \frac{3}{8} = \frac{\cancel{6}^3}{\cancel{5}_1} \cdot \frac{3}{\cancel{8}_4} = \frac{9}{20}$$

$$2. (a) \frac{10}{3} \cdot \frac{12}{7} = \frac{10}{\cancel{3}} \cdot \frac{\cancel{12}^4}{7} = \frac{40}{7}$$

$$(b) \frac{12}{7} \cdot \frac{10}{3} = \frac{\cancel{12}^4}{7} \cdot \frac{10}{\cancel{3}} = \frac{40}{7}$$

$$(c) \frac{10}{3} \div \frac{12}{7} = \frac{10}{3} \cdot \frac{7}{12} = \frac{\cancel{10}^5}{\cancel{3}_1} \cdot \frac{7}{\cancel{12}_4} = \frac{35}{18}$$

$$(d) \frac{12}{7} \div \frac{10}{3} = \frac{12}{7} \cdot \frac{3}{10} = \frac{\cancel{12}^6}{\cancel{7}_1} \cdot \frac{3}{\cancel{10}_5} = \frac{18}{35}$$

$$3. (a) \quad 12 \cdot \frac{9}{8} = \frac{12}{1} \cdot \frac{9}{8} = \frac{3 \cdot \cancel{4}}{1} \cdot \frac{9}{2 \cdot \cancel{4}} = \frac{27}{2}$$

$$(b) \quad \frac{9}{8} \cdot 12 = \frac{9}{8} \cdot \frac{12}{1} = \frac{9}{2 \cdot \cancel{4}} \cdot \frac{3 \cdot \cancel{4}}{1} = \frac{27}{2}$$

$$(c) \quad 12 \div \frac{9}{8} = \frac{12}{1} \cdot \frac{8}{9} = \frac{\cancel{3} \cdot 4}{1} \cdot \frac{8}{\cancel{3} \cdot 3} = \frac{32}{3}$$

$$(d) \quad \frac{9}{8} \div 12 = \frac{9}{8} \cdot \frac{1}{12} = \frac{\cancel{3} \cdot 3}{8} \cdot \frac{1}{\cancel{3} \cdot 4} = \frac{3}{32}$$

$$4. (a) \quad 15 \cdot \frac{3}{5} = \frac{15}{1} \cdot \frac{3}{5} = \frac{3 \cdot \cancel{5}}{1} \cdot \frac{3}{\cancel{5}} = \frac{9}{1} = 9$$

$$(b) \quad \frac{3}{5} \cdot 15 = \frac{3}{5} \cdot \frac{15}{1} = \frac{3}{\cancel{5}} \cdot \frac{3 \cdot \cancel{5}}{1} = \frac{9}{1} = 9$$

$$(c) \quad 15 \div \frac{3}{5} = \frac{15}{1} \cdot \frac{5}{3} = \frac{\cancel{3} \cdot 5}{1} \cdot \frac{5}{\cancel{3}} = \frac{25}{1} = 25$$

$$(d) \quad \frac{3}{5} \div 15 = \frac{3}{5} \cdot \frac{1}{15} = \frac{\cancel{3}}{5} \cdot \frac{1}{\cancel{3} \cdot 5} = \frac{1}{25}$$

$$5. (a) \quad \frac{5}{6} \cdot \frac{5}{6} = \frac{25}{36}$$

$$(b) \quad \frac{\cancel{5}}{\cancel{6}} \cdot \frac{\cancel{5}}{\cancel{6}} = \frac{1}{1} = 1$$

$$(c) \quad \frac{5}{6} \div \frac{5}{6} = \frac{\cancel{5}}{\cancel{6}} \cdot \frac{\cancel{6}}{\cancel{5}} = \frac{1}{1} = 1$$

$$(d) \quad \frac{5}{6} \div \frac{6}{5} = \frac{5}{6} \cdot \frac{5}{6} = \frac{25}{36}$$

$$6. (a) \quad \frac{9}{8} \cdot 0 = 0$$

$$(b) \quad 0 \cdot \frac{9}{8} = 0$$

$$(c) \quad \frac{9}{8} \div 0 = \text{Undefined}$$

$$(d) \quad 0 \div \frac{9}{8} = 0 \cdot \frac{8}{9} = 0$$

$$7. (a) \quad \frac{1}{12} \cdot \frac{2}{3} \cdot \frac{16}{21} = \frac{1}{3 \cdot \cancel{4}} \cdot \frac{2}{3} \cdot \frac{\cancel{4} \cdot 4}{21} = \frac{8}{189}$$

$$(b) \quad \frac{1}{12} \cdot \frac{2}{3} \div \frac{16}{21} = \frac{1}{12} \cdot \frac{2}{3} \cdot \frac{21}{16} \\ = \frac{1}{12} \cdot \frac{\cancel{2}}{\cancel{3}} \cdot \frac{\cancel{3} \cdot 7}{\cancel{2} \cdot 8} = \frac{7}{96}$$

$$(c) \quad \frac{1}{12} \div \frac{2}{3} \cdot \frac{16}{21} = \frac{1}{\cancel{3} \cdot \cancel{4}} \cdot \frac{\cancel{3}}{\cancel{2}} \cdot \frac{\cancel{4} \cdot \cancel{2} \cdot 2}{21} \\ = \frac{2}{21}$$

$$(d) \quad \frac{1}{12} \div \frac{2}{3} \div \frac{16}{21} = \frac{1}{12} \cdot \frac{3}{2} \cdot \frac{21}{16} \\ = \frac{1}{\cancel{3} \cdot 4} \cdot \frac{\cancel{3}}{2} \cdot \frac{21}{16} = \frac{21}{128}$$

$$8. (a) \quad \frac{1}{\cancel{2}} \cdot \frac{7}{9} \cdot \frac{\cancel{2}}{3} = \frac{7}{27}$$

$$(b) \quad \frac{1}{2} \cdot \frac{7}{9} \div \frac{2}{3} = \frac{1}{2} \cdot \frac{7}{9} \cdot \frac{3}{2} = \frac{1}{2} \cdot \frac{7}{\cancel{3}} \cdot \frac{\cancel{3}}{2} = \frac{7}{12}$$

$$(c) \quad \frac{1}{2} \div \frac{7}{9} \cdot \frac{2}{3} = \frac{1}{2} \cdot \frac{9}{7} \cdot \frac{2}{3} = \frac{1}{\cancel{2}} \cdot \frac{\cancel{3} \cdot 3}{7} \cdot \frac{\cancel{2}}{\cancel{3}} = \frac{3}{7}$$

$$(d) \quad \frac{1}{2} \div \frac{7}{9} \div \frac{2}{3} = \frac{1}{2} \cdot \frac{9}{7} \cdot \frac{3}{2} = \frac{27}{28}$$

$$9. (a) \quad \frac{9}{10} \cdot 6 \cdot \frac{1}{4} = \frac{9}{10} \cdot \frac{6}{1} \cdot \frac{1}{4} \\ = \frac{9}{10} \cdot \frac{\cancel{2} \cdot 3}{1} \cdot \frac{1}{\cancel{2} \cdot 2} = \frac{27}{20}$$

$$(b) \quad \frac{9}{10} \cdot 6 \div \frac{1}{4} = \frac{9}{10} \cdot \frac{6}{1} \cdot \frac{4}{1} \\ = \frac{9}{\cancel{2} \cdot 5} \cdot \frac{\cancel{2} \cdot 3}{1} \cdot \frac{4}{1} = \frac{108}{5}$$

$$(c) \quad \frac{9}{10} \div 6 \cdot \frac{1}{4} = \frac{9}{10} \cdot \frac{1}{6} \cdot \frac{1}{4} \\ = \frac{3 \cdot \cancel{3}}{10} \cdot \frac{1}{2 \cdot \cancel{3}} \cdot \frac{1}{4} = \frac{3}{80}$$

$$(d) \quad \frac{9}{10} \div 6 \div \frac{1}{4} = \frac{9}{10} \cdot \frac{1}{6} \cdot \frac{4}{1} \\ = \frac{3 \cdot \cancel{3}}{\cancel{2} \cdot 5} \cdot \frac{1}{\cancel{2} \cdot \cancel{3}} \cdot \frac{\cancel{2} \cdot \cancel{2}}{1} = \frac{3}{5}$$

$$10. (a) \quad \frac{4}{5} \cdot \frac{1}{20} \cdot 10 = \frac{2 \cdot \cancel{2}}{5} \cdot \frac{1}{\cancel{2} \cdot \cancel{10}} \cdot \frac{\cancel{10}}{1} = \frac{2}{5}$$

$$(b) \quad \frac{4}{5} \cdot \frac{1}{20} \div 10 = \frac{\cancel{4}}{5} \cdot \frac{1}{\cancel{4} \cdot 5} \cdot \frac{1}{10} = \frac{1}{250}$$

$$(c) \quad \frac{4}{5} \div \frac{1}{20} \cdot 10 = \frac{4}{\cancel{5}} \cdot \frac{20}{1} \cdot \frac{2 \cdot \cancel{5}}{1} = \frac{160}{1} = 160$$

$$(d) \quad \frac{4}{5} \div \frac{1}{20} \div 10 = \frac{4}{5} \cdot \frac{20}{1} \cdot \frac{1}{10} = \frac{2 \cdot \cancel{2}}{\cancel{5}} \cdot \frac{4 \cdot \cancel{5}}{1} \cdot \frac{1}{\cancel{2} \cdot 5} = \frac{8}{5}$$

$$11. (a) \quad \frac{2}{3} \cdot 1 = \frac{2}{3}$$

$$(b) \quad 1 \cdot \frac{2}{3} = \frac{2}{3}$$

$$(c) \quad \frac{2}{3} \div 1 = \frac{2}{3}$$

$$(d) \quad 1 \div \frac{2}{3} = 1 \cdot \frac{3}{2} = \frac{3}{2}$$

$$12. (a) \quad 6 \div 10 = \frac{6}{1} \cdot \frac{1}{10} = \frac{\cancel{2} \cdot 3}{1} \cdot \frac{1}{\cancel{2} \cdot 5} = \frac{3}{5}$$

$$(b) \quad 10 \div 6 = \frac{10}{1} \cdot \frac{1}{6} = \frac{\cancel{2} \cdot 5}{1} \cdot \frac{1}{\cancel{2} \cdot 3} = \frac{5}{3}$$

$$(c) \quad 6 \cdot 10 = 60$$

$$(d) \quad 10 \cdot 6 = 60$$

$$13. (a) \quad 8 \div \frac{1}{4} = 8 \cdot 4 = 32$$

$$(b) \quad 8 \cdot \frac{1}{4} = \frac{8}{4} = 2$$

$$(c) \quad 8 \div 4 = 2$$

$$(d) \quad 8 \cdot 4 = 32$$

$$14. (a) \quad \frac{1}{7} \div 2 = \frac{1}{7} \cdot \frac{1}{2} = \frac{1}{14}$$

$$(b) \quad \frac{1}{7} \cdot 2 = \frac{1}{7} \cdot \frac{2}{1} = \frac{2}{7}$$

$$(c) \quad \frac{1}{7} \cdot \frac{1}{2} = \frac{1}{14}$$

$$(d) \quad \frac{1}{7} \div \frac{1}{2} = \frac{1}{7} \cdot \frac{2}{1} = \frac{2}{7}$$

$$15. (a) \quad 4^2 \cdot \frac{1}{6} = 4 \cdot 4 \cdot \frac{1}{6} = 16 \cdot \frac{1}{6} = \frac{\cancel{2} \cdot 8}{1} \cdot \frac{1}{\cancel{2} \cdot 3} = \frac{8}{3}$$

$$(b) \quad 4^2 \div \frac{1}{6} = 4 \cdot 4 \div \frac{1}{6} = 16 \cdot \frac{6}{1} = 16 \cdot 6 = 96$$

$$(c) \quad 4 \cdot \left(\frac{1}{6}\right)^2 = \frac{4}{1} \cdot \frac{1}{6} \cdot \frac{1}{6} = \frac{4}{36} = \frac{\cancel{4}}{\cancel{4} \cdot 9} = \frac{1}{9}$$

$$(d) \quad 4 \div \left(\frac{1}{6}\right)^2 = \frac{4}{1} \div \left(\frac{1}{6} \cdot \frac{1}{6}\right) = \frac{4}{1} \div \left(\frac{1}{36}\right) = \frac{4}{1} \cdot \frac{36}{1} = 144$$

$$16. (a) \quad \left(\frac{1}{2}\right)^2 \cdot \frac{2}{3} = \frac{1}{2} \cdot \frac{1}{\cancel{2}} \cdot \frac{\cancel{2}}{3} = \frac{1}{6}$$

$$(b) \quad \left(\frac{1}{2}\right)^2 \div \frac{2}{3} = \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{3}{2} = \frac{3}{8}$$

$$(c) \quad \frac{1}{2} \cdot \left(\frac{2}{3}\right)^2 = \frac{1}{\cancel{2}} \cdot \frac{2}{3} \cdot \frac{\cancel{2}}{3} = \frac{2}{9}$$

$$(d) \quad \frac{1}{2} \div \left(\frac{2}{3}\right)^2 = \frac{1}{2} \div \left(\frac{2}{3} \cdot \frac{2}{3}\right) = \frac{1}{2} \div \frac{4}{9} = \frac{1}{2} \cdot \frac{9}{4} = \frac{9}{8}$$

Section 2.6 Multiplication and Division of Mixed Numbers

Section 2.6 Practice Exercises

1. Chapter Review Exercises, pages 157–160
Chapter Test, pages 160–161
Cumulative Review Exercises,
pages 161–162
Answers will vary.

$$2. \frac{5}{\cancel{6}_3} \cdot \frac{\cancel{2}^1}{9} = \frac{5}{27}$$

$$3. \frac{13}{\cancel{8}_1} \cdot \frac{\cancel{10}^2}{9} = \frac{26}{9}$$

$$4. \frac{20}{9} \div \frac{10}{3} = \frac{\cancel{20}^2}{\cancel{9}_3} \cdot \frac{\cancel{3}^1}{\cancel{10}_1} = \frac{2}{3}$$

$$5. \frac{42}{11} \div \frac{7}{2} = \frac{\cancel{42}^6}{\cancel{11}_1} \cdot \frac{2}{\cancel{7}_1} = \frac{12}{11}$$

$$6. \frac{32}{15} \div 4 = \frac{\cancel{32}^8}{\cancel{15}_4} \cdot \frac{1}{\cancel{4}_1} = \frac{8}{15}$$

$$7. \frac{52}{18} \div 13 = \frac{\cancel{52}^4}{\cancel{18}_3} \cdot \frac{1}{\cancel{13}_1} = \frac{4}{18} = \frac{2}{9}$$

8. 1. Multiply the whole number by the denominator.
2. Add the result to the numerator.
3. Write the result from step 2 over the denominator.

$$9. 3\frac{2}{5} = \frac{3 \times 5 + 2}{5} = \frac{17}{5}$$

$$10. 2\frac{7}{10} = \frac{2 \times 10 + 7}{10} = \frac{27}{10}$$

$$11. 1\frac{4}{7} = \frac{1 \times 7 + 4}{7} = \frac{11}{7}$$

$$12. 4\frac{1}{8} = \frac{4 \times 8 + 1}{8} = \frac{33}{8}$$

$$13. \begin{array}{r} 6 \overline{) 77} \\ \underline{-6} \\ 17 \\ \underline{-12} \\ 5 \end{array} \quad 12\frac{5}{6}$$

$$14. \begin{array}{r} 11 \overline{) 57} \\ \underline{-55} \\ 2 \end{array} \quad 5\frac{2}{11}$$

$$15. \begin{array}{r} 4 \overline{) 39} \\ \underline{-36} \\ 3 \end{array} \quad 9\frac{3}{4}$$

$$16. \begin{array}{r} 2 \overline{) 31} \\ \underline{-2} \\ 11 \\ \underline{-10} \\ 1 \end{array} \quad 15\frac{1}{2}$$

$$17. \left(2\frac{2}{5}\right) \left(3\frac{1}{12}\right) = \frac{\cancel{12}^1}{5} \cdot \frac{37}{\cancel{12}_1} = \frac{37}{5}$$

$$5 \overline{) 37} = 7\frac{2}{5}$$

$$18. \left(5\frac{1}{5}\right)\left(3\frac{3}{4}\right) = \frac{\cancel{26}^{13}}{\cancel{1}} \cdot \frac{\cancel{15}^3}{\cancel{4}_2} = \frac{39}{2}$$

$$2 \overline{) 39} = 19\frac{1}{2}$$

$$\begin{array}{r} 2 \overline{) 39} \\ \underline{-2} \\ 19 \\ \underline{-18} \\ 1 \end{array}$$

$$19. 2\frac{1}{3} \cdot \frac{5}{7} = \frac{\cancel{7}^1}{3} \cdot \frac{5}{\cancel{7}_1} = \frac{5}{3}$$

$$3 \overline{) 5} = 1\frac{2}{3}$$

$$\begin{array}{r} 3 \overline{) 5} \\ \underline{-3} \\ 2 \end{array}$$

$$20. 6\frac{1}{8} \cdot \frac{4}{7} = \frac{\cancel{49}^7}{8} \cdot \frac{4}{\cancel{7}_1} = \frac{7}{2}$$

$$2 \overline{) 7} = 3\frac{1}{2}$$

$$\begin{array}{r} 2 \overline{) 7} \\ \underline{-6} \\ 1 \end{array}$$

$$21. 4\frac{2}{9} \cdot 9 = \frac{38}{\cancel{9}_1} \cdot \frac{\cancel{9}^1}{1} = 38$$

$$22. 3\frac{1}{3} \cdot 6 = \frac{10}{\cancel{3}_1} \cdot \frac{\cancel{6}^2}{1} = 20$$

$$23. \left(5\frac{3}{16}\right)\left(5\frac{1}{3}\right) = \frac{83}{\cancel{16}_1} \cdot \frac{\cancel{16}^1}{3} = \frac{83}{3}$$

$$3 \overline{) 83} = 27\frac{2}{3}$$

$$\begin{array}{r} 3 \overline{) 83} \\ \underline{-6} \\ 23 \\ \underline{-21} \\ 2 \end{array}$$

$$24. \left(8\frac{2}{3}\right)\left(2\frac{1}{13}\right) = \frac{\cancel{26}^2}{\cancel{3}_1} \cdot \frac{\cancel{27}^9}{\cancel{13}_1} = 18$$

$$25. \left(7\frac{1}{4}\right) \cdot 10 = \frac{29}{\cancel{4}_2} \cdot \frac{\cancel{10}^5}{1} = \frac{145}{2}$$

$$2 \overline{) 145} = 72\frac{1}{2}$$

$$\begin{array}{r} 2 \overline{) 145} \\ \underline{-14} \\ 5 \\ \underline{-4} \\ 1 \end{array}$$

$$26. \left(2\frac{2}{3}\right) \cdot 3 = \frac{8}{\cancel{3}_1} \cdot \frac{\cancel{3}^1}{1} = 8$$

$$27. 4\frac{5}{8} \cdot 0 = 0$$

$$28. 0 \cdot 6\frac{1}{10} = 0$$

$$29. \left(3\frac{1}{2}\right)\left(2\frac{1}{7}\right) = \frac{\cancel{7}^1}{2} \cdot \frac{15}{\cancel{7}_1} = \frac{15}{2} = 7\frac{1}{2}$$

$$30. \left(1\frac{3}{10}\right)\left(1\frac{1}{4}\right) = \frac{13}{\cancel{10}_2} \cdot \frac{\cancel{4}^1}{4} = \frac{13}{8} = 1\frac{5}{8}$$

$$31. \left(5\frac{2}{5}\right)\left(\frac{2}{9}\right)\left(1\frac{4}{5}\right) = \frac{27}{5} \cdot \frac{2}{\cancel{9}_1} \cdot \frac{\cancel{4}^1}{5} = \frac{54}{25} = 2\frac{4}{25}$$

$$32. \left(6\frac{1}{8}\right)\left(2\frac{3}{4}\right)\left(\frac{8}{7}\right) = \frac{\cancel{49}^7}{8} \cdot \frac{11}{4} \cdot \frac{\cancel{8}^1}{\cancel{7}_1} = \frac{77}{4} = 19\frac{1}{4}$$

$$33. 1\frac{7}{10} \div 2\frac{3}{4} = \frac{17}{10} \div \frac{11}{4} = \frac{17}{10} \cdot \frac{4}{11} = \frac{34}{55}$$

$$34. 5\frac{1}{10} \div \frac{3}{4} = \frac{51}{10} \div \frac{3}{4} = \frac{51}{10} \cdot \frac{4}{3} = \frac{34}{5} = 6\frac{4}{5}$$

$$35. 5\frac{8}{9} \div 1\frac{1}{3} = \frac{53}{9} \div \frac{4}{3} = \frac{53}{9} \cdot \frac{3}{4} = \frac{53}{12} = 4\frac{5}{12}$$

$$36. 12\frac{4}{5} \div 2\frac{3}{5} = \frac{64}{5} \div \frac{13}{5} = \frac{64}{5} \cdot \frac{5}{13} = \frac{64}{13} = 4\frac{12}{13}$$

$$37. 2\frac{1}{2} \div 1\frac{1}{16} = \frac{5}{2} \div \frac{17}{16} = \frac{5}{2} \cdot \frac{16}{17} = \frac{40}{17} = 2\frac{6}{17}$$

$$38. 7\frac{3}{5} \div 1\frac{7}{12} = \frac{38}{5} \div \frac{19}{12} = \frac{38}{5} \cdot \frac{12}{19} = \frac{24}{5} = 4\frac{4}{5}$$

$$39. 4\frac{1}{2} \div 2\frac{1}{4} = \frac{9}{2} \div \frac{9}{4} = \frac{9}{2} \cdot \frac{4}{9} = 2$$

$$40. 5\frac{5}{6} \div 2\frac{1}{3} = \frac{35}{6} \div \frac{7}{3} = \frac{35}{6} \cdot \frac{3}{7} = \frac{5}{2} = 2\frac{1}{2}$$

$$41. 0 \div 6\frac{7}{12} = 0$$

$$42. 0 \div 1\frac{9}{11} = 0$$

$$43. 2\frac{5}{6} \div \frac{1}{6} = \frac{17}{6} \div \frac{1}{6} = \frac{17}{6} \cdot \frac{6}{1} = 17$$

$$44. 6\frac{1}{2} \div \frac{1}{2} = \frac{13}{2} \div \frac{1}{2} = \frac{13}{2} \cdot \frac{2}{1} = 13$$

$$45. 1\frac{1}{3} \div \frac{2}{7} = \frac{4}{3} \div \frac{2}{7} = \frac{4}{3} \cdot \frac{7}{2} = \frac{14}{3} = 4\frac{2}{3}$$

$$46. 2\frac{1}{7} \div \frac{5}{13} = \frac{15}{7} \div \frac{5}{13} = \frac{15}{7} \cdot \frac{13}{5} = \frac{39}{7} = 5\frac{4}{7}$$

$$47. 3\frac{1}{2} \div 2 = \frac{7}{2} \div \frac{2}{1} = \frac{7}{2} \cdot \frac{1}{2} = \frac{7}{4} = 1\frac{3}{4}$$

$$48. 4\frac{2}{3} \div 3 = \frac{14}{3} \div \frac{3}{1} = \frac{14}{3} \cdot \frac{1}{3} = \frac{14}{9} = 1\frac{5}{9}$$

$$49. 4\frac{3}{4} \cdot 8 = \frac{19}{4} \cdot \frac{8}{1} = 38$$

Tabitha earned \$38.

$$50. 2\frac{2}{3} \cdot 10,500 = \frac{8}{3} \cdot \frac{31,500}{1} = 28,000$$

The land will cost Kurt \$28,000.

$$51. 25\frac{7}{10} \cdot 25 = \frac{257}{10} \cdot \frac{25}{1} = \frac{1285}{2} = 642\frac{1}{2}$$

Average Americans consume $642\frac{1}{2}$ lb.

$$52. 6\frac{2}{3} \cdot 15\frac{3}{4} = \frac{20}{3} \cdot \frac{63}{4} = \frac{105}{1} = 105$$

Kayla is paid \$105.

$$53. \text{ (a) } 1\frac{3}{4} \div \frac{1}{4} = \frac{7}{4} \div \frac{1}{4} = \frac{7}{\cancel{4}} \cdot \frac{\cancel{4}^1}{1} = 7 \text{ weeks old}$$

$$\begin{aligned} \text{(b) } 2\frac{1}{8} \div \frac{1}{4} &= \frac{17}{8} \div \frac{1}{4} \\ &= \frac{17}{\cancel{8}} \cdot \frac{\cancel{4}^1}{1} = \frac{17}{2} = 8\frac{1}{2} \text{ weeks old} \end{aligned}$$

$$54. 1\frac{3}{4} \div 3 = \frac{7}{4} \div \frac{3}{1} = \frac{7}{4} \cdot \frac{1}{3} = \frac{7}{12}$$

Each child will inherit $\$ \frac{7}{12}$ million.

$$55. 28 \div 1\frac{17}{24} = \frac{28}{1} \div \frac{41}{24} = \frac{28}{1} \cdot \frac{24}{41} = \frac{672}{41}$$

$$= 16\frac{16}{41}$$

The roll is $16\frac{16}{41}$ ft long.

$$56. \text{ (a) Lucy: } 35\frac{1}{2} \times 14 = \frac{71}{2} \cdot \frac{\cancel{14}^7}{1} = 497$$

$$\text{Ricky: } 42\frac{1}{2} \times 10 = \frac{85}{2} \cdot \frac{\cancel{10}^5}{1} = 425$$

$$497 - 425 = 72$$

Lucy earned \$72 more than Ricky.

$$\text{(b) } 497 + 425 = 922$$

Together they earned \$922.

$$57. 2\frac{1}{5} \div 1\frac{1}{10} = \frac{11}{5} \div \frac{11}{10} = \frac{\cancel{11}^1}{5} \cdot \frac{\cancel{10}^2}{\cancel{11}_1} = 2$$

$$58. 3\frac{3}{4} \cdot 1\frac{5}{6} = \frac{\cancel{15}^5}{4} \cdot \frac{11}{\cancel{6}_2} = \frac{55}{8} = 6\frac{7}{8}$$

$$59. 6 \div 1\frac{1}{8} = \frac{6}{1} \div \frac{9}{8} = \frac{\cancel{6}^2}{1} \cdot \frac{8}{\cancel{9}_3} = \frac{16}{3} = 5\frac{1}{3}$$

$$60. 8 \div 2\frac{1}{3} = \frac{8}{1} \div \frac{7}{3} = \frac{8}{1} \cdot \frac{3}{7} = \frac{24}{7} = 3\frac{3}{7}$$

$$61. \frac{2}{3} \cdot 2\frac{7}{10} = \frac{\cancel{2}^1}{3} \cdot \frac{\cancel{20}^9}{\cancel{10}_5} = \frac{9}{5} = 1\frac{4}{5}$$

$$62. \frac{4}{3} \cdot 5\frac{1}{8} = \frac{\cancel{4}^1}{3} \cdot \frac{41}{\cancel{8}_2} = \frac{41}{6} = 6\frac{5}{6}$$

$$63. 4\frac{1}{12} \cdot 0 = 0$$

$$64. 5\frac{1}{3} \cdot 6 = \frac{16}{\cancel{3}_1} \cdot \frac{\cancel{6}^2}{1} = 32$$

$$65. 10\frac{1}{2} \div 9 = \frac{21}{2} \div \frac{9}{1} = \frac{\cancel{21}^7}{2} \cdot \frac{1}{\cancel{9}_3} = \frac{7}{6} = 1\frac{1}{6}$$

$$66. \frac{2}{7} \cdot 1\frac{8}{9} = \frac{2}{7} \cdot \frac{17}{9} = \frac{34}{63}$$

$$67. 0 \div 9\frac{2}{3} = 0$$

$$68. \frac{3}{8} \div 2\frac{1}{2} = \frac{3}{8} \div \frac{5}{2} = \frac{3}{\cancel{8}_4} \cdot \frac{\cancel{2}^1}{5} = \frac{3}{20}$$

$$69. 12 \cdot \frac{1}{8} = \frac{\cancel{12}^3}{1} \cdot \frac{1}{\cancel{8}_2} = \frac{3}{2} = 1\frac{1}{2}$$

$$70. 20 \cdot \frac{2}{15} = \frac{\cancel{20}^4}{1} \cdot \frac{2}{\cancel{15}_3} = \frac{8}{3} = 2\frac{2}{3}$$

71. $6\frac{8}{9} \div 0$ is undefined.

72. $0 \cdot 2\frac{1}{8} = 0$

73.
$$\left(3\frac{2}{5}\right)\left(\frac{7}{34}\right)\left(3\frac{3}{4}\right) = \frac{\cancel{17}^1}{\cancel{85}^5} \cdot \frac{7}{\cancel{34}_2} \cdot \frac{\cancel{15}^3}{4} = \frac{21}{8}$$
$$= 2\frac{5}{8}$$

74.
$$\left(5\frac{1}{6}\right)\left(1\frac{4}{7}\right)\left(\frac{14}{33}\right) = \frac{31}{6} \cdot \frac{\cancel{14}^2}{\cancel{33}_3} \cdot \frac{\cancel{14}^2}{\cancel{33}_3}$$
$$= \frac{62}{18} = \frac{31}{9} = 3\frac{4}{9}$$

75.
$$7\frac{1}{8} \div 1\frac{1}{3} \div 2\frac{1}{4} = \frac{57}{8} \div \frac{4}{3} \div \frac{9}{4}$$
$$= \frac{\cancel{57}^{19}}{8} \cdot \frac{\cancel{3}^1}{\cancel{4}_1} \cdot \frac{\cancel{4}^1}{\cancel{9}_3} = \frac{19}{8} = 2\frac{3}{8}$$

76.
$$3\frac{1}{8} \div 5\frac{5}{7} \div 1\frac{5}{16} = \frac{25}{8} \div \frac{40}{7} \div \frac{21}{16}$$
$$= \frac{\cancel{25}^5}{\cancel{8}_1} \cdot \frac{\cancel{7}^1}{\cancel{40}_8} \cdot \frac{\cancel{16}^2}{\cancel{21}_3} = \frac{10}{24} = \frac{5}{12}$$

77. The perimeter of the garden is
 $2(20) + 2(15) = 40 + 30 = 70$ ft.

$$70 \div 1\frac{1}{4} = \frac{70}{1} \div \frac{5}{4} = \frac{\cancel{70}^{14}}{1} \cdot \frac{4}{\cancel{5}_1} = 56$$

56 bricks will be needed.

$$56 \times \$3 = \$168$$

The total cost is \$168.

78.
$$64\frac{1}{2} \div 21\frac{1}{2} = \frac{129}{2} \div \frac{43}{2} = \frac{\cancel{129}^3}{\cancel{43}_1} \cdot \frac{\cancel{2}^1}{\cancel{43}_1} = 3$$

It takes 3 gallons of gas for Sara to get to and from work.

$$3 \times \$5 = \$15$$

It costs Sara \$15 each day.

79.
$$12\frac{2}{3} \cdot 25\frac{1}{8} = 318\frac{1}{4}$$

80.
$$38\frac{1}{3} \div 12\frac{1}{2} = 3\frac{1}{15}$$

81.
$$56\frac{5}{6} \div 3\frac{1}{6} = 17\frac{18}{19}$$

82.
$$25\frac{1}{5} \cdot 18\frac{1}{2} = 466\frac{1}{5}$$

83.
$$32\frac{7}{12} \div 12\frac{1}{6} = 2\frac{99}{146}$$

84.
$$106\frac{1}{9} \div 41\frac{5}{6} = 2\frac{404}{753}$$

85.
$$11\frac{1}{2} \cdot 41\frac{3}{4} = 480\frac{1}{8}$$

86.
$$9\frac{8}{9} \cdot 28\frac{1}{3} = 280\frac{5}{27}$$

Chapter 2 Review Exercises

Section 2.1

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

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

3. (a) $\frac{5}{3}$
(b) Improper

4. (a) $\frac{1}{6}$
(b) Proper

5. $\frac{7}{15}$

6. $\frac{23}{8}$ or $2\frac{7}{8}$

7. $\frac{7}{6}$ or $1\frac{1}{6}$

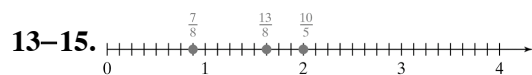
8. $6\frac{1}{7} = \frac{6 \times 7 + 1}{7} = \frac{43}{7}$

9. $11\frac{2}{5} = \frac{11 \times 5 + 2}{5} = \frac{57}{5}$

10. $4\frac{1}{4} \div \frac{1}{4} = \frac{17}{4} \div \frac{1}{4} = \frac{17}{\cancel{4}} \cdot \frac{\cancel{4}^1}{1} = 17$

11. $9\overline{)47} \quad 5\frac{2}{9}$
 $\underline{-45}$
 2

12. $\frac{23}{21} = 1\frac{2}{21}$



16. $7\overline{)134} \quad 134\frac{3}{7}$
 $\underline{-7}$
 24
 $\underline{-21}$
 31
 $\underline{-28}$
 3

17. $26\overline{)1582} \quad 60\frac{22}{26} = 60\frac{11}{13}$
 $\underline{-156}$
 22
 $\underline{-0}$
 22

Section 2.2

18. 21, 51, 1200

19. 55, 140, 260, 1200

20. 58, 124, 140, 260, 1200

21. Prime

22. Composite
 $44 = 4 \times 11$

23. Neither

24. Neither

25. $2\overline{)2}$
 $2\overline{)8}$
 $2\overline{)16}$
 $2\overline{)32}$
 $2\overline{)64}$
 $2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 = 2^6 = 64$

26. $5\overline{)11}$
 $3\overline{)165}$
 $2\overline{)330}$
 $2 \cdot 3 \cdot 5 \cdot 11 = 330$

$$27. \begin{array}{r} 3 \overline{) 9} \\ 5 \overline{) 45} \\ 5 \overline{) 225} \\ 2 \overline{) 450} \\ 2 \overline{) 900} \end{array}$$

$$2 \cdot 2 \cdot 3 \cdot 3 \cdot 5 \cdot 5 = 2^2 \cdot 3^2 \cdot 5^2 = 900$$

$$28. 1, 2, 3, 4, 6, 8, 12, 16, 24, 48$$

$$29. 1, 2, 4, 5, 8, 10, 16, 20, 40, 80$$

Section 2.3

$$30. 3 \times 9 \nabla 6 \times 5$$

$$18 \neq 30$$

$$\frac{3}{6} \neq \frac{5}{9}$$

$$31. 15 \times 14 \nabla 21 \times 10$$

$$210 = 210$$

$$\frac{15}{21} = \frac{10}{14}$$

$$32. \frac{5}{20} = \frac{\cancel{5}}{4 \cdot \cancel{5}} = \frac{1}{4}$$

$$33. \frac{14}{49} = \frac{2 \cdot \cancel{7}}{\cancel{7} \cdot 7} = \frac{2}{7}$$

$$34. \frac{24}{16} = \frac{3 \cdot \cancel{8}}{2 \cdot \cancel{8}} = \frac{3}{2}$$

$$35. \frac{63}{27} = \frac{\cancel{9} \cdot 7}{\cancel{9} \cdot 3} = \frac{7}{3}$$

$$36. \frac{17}{17} = 1$$

$$37. \frac{42}{21} = \frac{2 \cdot \cancel{21}}{\cancel{21}} = 2$$

$$38. \frac{12\cancel{0}}{15\cancel{0}} = \frac{12}{15} = \frac{\cancel{3} \cdot 4}{\cancel{3} \cdot 5} = \frac{4}{5}$$

$$39. \frac{14\cancel{0}\cancel{0}}{20\cancel{0}\cancel{0}} = \frac{14}{20} = \frac{\cancel{2} \cdot 7}{\cancel{2} \cdot 10} = \frac{7}{10}$$

$$40. \frac{42}{45} = \frac{\cancel{3} \cdot 14}{\cancel{3} \cdot 15} = \frac{14}{15}$$

$$45 - 42 = 3$$

$$\frac{3}{45} = \frac{\overset{1}{\cancel{3}}}{\underset{1}{\cancel{3}} \cdot 15} = \frac{1}{15}$$

$$41. (a) \frac{6}{10} = \frac{\cancel{2} \cdot 3}{\cancel{2} \cdot 5} = \frac{3}{5}$$

$$(b) \frac{6}{15} = \frac{2 \cdot \cancel{3}}{\cancel{3} \cdot 5} = \frac{2}{5}$$

Section 2.4

$$42. \frac{3}{5} \times \frac{2}{7} = \frac{6}{35}$$

$$43. \frac{4}{3} \times \frac{8}{3} = \frac{32}{9}$$

$$44. 14 \cdot \frac{9}{2} = \frac{\cancel{14}^7}{1} \cdot \frac{9}{\cancel{2}_1} = 63$$

$$45. 33 \cdot \frac{5}{11} = \frac{\overset{3}{\cancel{33}}}{1} \cdot \frac{5}{\cancel{11}_1} = 15$$

$$46. \frac{\overset{1}{\cancel{2}}}{\underset{1}{\cancel{2}}} \cdot \frac{\overset{1}{\cancel{3}}}{\underset{1}{\cancel{3}}} \cdot \frac{\overset{1}{\cancel{36}}}{\underset{5}{\cancel{25}}} = \frac{1}{5}$$

$$47. \frac{\overset{1}{\cancel{45}}}{\underset{1}{\cancel{7}}} \cdot \frac{\overset{3}{\cancel{6}}}{\underset{1}{\cancel{10}}} \cdot \frac{\overset{4}{\cancel{28}}}{\underset{7}{\cancel{63}}} = \frac{12}{7}$$

$$48. \left(\frac{1}{10}\right)^4 = \frac{1}{10} \cdot \frac{1}{10} \cdot \frac{1}{10} \cdot \frac{1}{10} = \frac{1}{10,000}$$

$$\begin{aligned}
 49. \left(\frac{2}{5}\right)^2 \cdot \left(\frac{1}{10}\right)^2 &= \left(\frac{2}{5} \cdot \frac{2}{5}\right) \cdot \left(\frac{1}{10} \cdot \frac{1}{10}\right) \\
 &= \frac{\cancel{4}^1}{25} \cdot \frac{\cancel{100}}{25} \\
 &= \frac{1}{625}
 \end{aligned}$$

$$50. \left(\frac{\cancel{20}^1}{10} \cdot \frac{\cancel{2}^1}{\cancel{2}^1}\right)^3 = \left(\frac{1}{10}\right)^3 = \frac{1}{10} \cdot \frac{1}{10} \cdot \frac{1}{10} = \frac{1}{1000}$$

$$51. \left(\frac{1}{10}\right)^3 \left(\frac{1000}{17}\right) = \frac{1}{\cancel{1000}_1} \cdot \frac{\cancel{1000}^1}{17} = \frac{1}{17}$$

$$52. A = \frac{1}{2}bh$$

$$53. A = lw$$

$$54. A = \frac{1}{2}(12)\left(\frac{17}{2}\right) = 6 \cdot \frac{17}{2} = \frac{\cancel{3}^3}{1} \cdot \frac{17}{\cancel{2}_1} = 51 \text{ ft}^2$$

$$55. A = lw = \frac{5}{\cancel{4}_1} \cdot \frac{\cancel{8}^2}{3} = \frac{10}{3} \text{ or } 3\frac{1}{3} \text{ m}^2$$

$$\begin{aligned}
 56. A &= \frac{20}{3} \cdot 3 + \frac{1}{2} \cdot \frac{20}{3} \cdot 6 \\
 &= \frac{20}{\cancel{3}_1} \cdot \frac{\cancel{3}^1}{1} + \frac{1}{\cancel{2}_1} \cdot \frac{\cancel{20}^{10}}{\cancel{3}_1} \cdot \frac{\cancel{6}^2}{1} \\
 &= 20 + 20 \\
 &= 40 \text{ yd}^2
 \end{aligned}$$

$$57. 4 \cdot \frac{7}{8} = \frac{\cancel{4}^1}{1} \cdot \frac{7}{\cancel{8}_2} = \frac{7}{2} \text{ or } 3\frac{1}{2}$$

Maximus requires $\frac{7}{2}$ or $3\frac{1}{2}$ yd of lumber.

$$58. \frac{1}{4} \cdot 3600 = \frac{1}{\cancel{4}_1} \cdot \frac{\cancel{3600}^{900}}{1} = 900$$

There are 900 African American students.

$$59. \frac{1}{12} \cdot 3600 = \frac{1}{\cancel{12}_1} \cdot \frac{\cancel{3600}^{300}}{1} = 300$$

There are 300 Asian American students.

$$60. \frac{1}{2} \cdot \frac{1}{6} \cdot 3600 = \frac{1}{2} \cdot \frac{1}{6} \cdot \frac{3600}{1} = \frac{3600}{12} = 300$$

There are 300 Hispanic female students.

$$61. \frac{1}{2} \cdot \frac{5}{12} \cdot 3600 = \frac{1}{2} \cdot \frac{5}{\cancel{12}_1} \cdot \frac{\cancel{3600}^{300}}{1} = \frac{1500}{2} = 750$$

There are 750 Caucasian male students.

Section 2.5

$$62. \frac{\cancel{2}^1}{\cancel{4}_1} \cdot \frac{\cancel{4}^1}{\cancel{2}_1} = 1$$

$$63. \frac{1}{12} \cdot 12 = \frac{1}{\cancel{12}_1} \cdot \frac{\cancel{12}^1}{1} = 1$$

$$64. \frac{2}{7}$$

$$65. \frac{1}{7}$$

66. Reciprocal does not exist.

67. 6

$$68. \frac{1}{5}$$

69. Multiplying

$$70. \frac{28}{15} \div \frac{21}{20} = \frac{28}{15} \cdot \frac{20}{21} = \frac{4 \cdot \cancel{7}}{3 \cdot \cancel{3}} \cdot \frac{4 \cdot \cancel{5}}{3 \cdot \cancel{7}} = \frac{16}{9}$$

$$71. \frac{7}{9} \div \frac{35}{63} = \frac{7}{9} \cdot \frac{63}{35} = \frac{\cancel{7}}{\cancel{9}} \cdot \frac{7 \cdot \cancel{9}}{\cancel{5} \cdot 7} = \frac{7}{5}$$

$$72. \frac{6}{7} \div 18 = \frac{\cancel{6}}{7} \cdot \frac{1}{\cancel{18}_3} = \frac{1}{21}$$

$$73. \frac{3}{10} \div \frac{9}{5} = \frac{\cancel{3}}{\cancel{10}_2} \cdot \frac{\cancel{5}}{\cancel{9}_3} = \frac{1}{6}$$

$$74. \frac{200}{51} \div \frac{25}{17} = \frac{200}{51} \cdot \frac{17}{25} = \frac{\cancel{25} \cdot 8}{\cancel{17}_3 \cdot \cancel{25}_1} = \frac{8}{3}$$

$$75. 12 \div \frac{6}{7} = \frac{\cancel{12}_2}{1} \cdot \frac{7}{\cancel{6}_1} = 14$$

$$76. \left(\frac{2}{19} \div \frac{8}{19} \right)^3 = \left(\frac{\cancel{2}}{\cancel{19}_4} \cdot \frac{\cancel{19}_4}{\cancel{8}_2} \right)^3 = \left(\frac{1}{4} \right)^3$$

$$= \frac{1}{4} \cdot \frac{1}{4} \cdot \frac{1}{4} = \frac{1}{64}$$

$$77. \left(\frac{12}{5} \right)^2 \div \frac{36}{5} = \frac{144}{25} \div \frac{36}{5} = \frac{144}{25} \cdot \frac{5}{36}$$

$$= \frac{\cancel{144}_4 \cdot 4}{\cancel{36}_1 \cdot 5} \cdot \frac{\cancel{5}_1}{\cancel{36}_1} = \frac{4}{5}$$

$$78. \frac{81}{55} \div \frac{3}{11} \div \frac{3}{2} = \frac{\cancel{81}_9}{\cancel{55}_5} \cdot \frac{\cancel{11}_1}{\cancel{3}_1} \cdot \frac{2}{\cancel{3}_1} = \frac{18}{5}$$

$$79. \frac{4}{13} \cdot \left(\frac{1}{2} \right)^3 \div 2 = \frac{\cancel{4}}{13} \cdot \frac{1}{\cancel{8}_2} \div 2 = \frac{1}{26} \div 2$$

$$= \frac{1}{26} \cdot \frac{1}{2} = \frac{1}{52}$$

$$80. \frac{4}{5} \cdot 20 = \frac{4}{\cancel{5}_1} \cdot \frac{\cancel{20}_4}{1} = 16$$

$$81. 18 \div \frac{2}{3} = \frac{\cancel{18}_9}{1} \cdot \frac{3}{\cancel{2}_1} = 27$$

$$82. 24 \div \frac{2}{3} = \frac{\cancel{24}_{12}}{1} \cdot \frac{3}{\cancel{2}_1} = 36$$

36 bags of candy

$$83. \frac{4}{5} \cdot 40 = \frac{4}{\cancel{5}_1} \cdot \frac{\cancel{40}_8}{1} = 32 \text{ hr}$$

$$32 \times \$18 = \$576$$

Amelia earned \$576.

$$84. \frac{4}{3} \cdot \frac{4}{3} = \frac{16}{9}$$

$$\frac{16}{9} \cdot 10 \cdot 12 = \frac{16}{\cancel{9}_3} \cdot \frac{10}{1} \cdot \frac{\cancel{12}_4}{1} = \frac{640}{3}$$

The area is $\frac{640}{3}$ or $213\frac{1}{3} \text{ ft}^2$.

$$85. 9 \div \frac{3}{8} = \frac{\cancel{9}_3}{1} \cdot \frac{8}{\cancel{3}_1} = 24$$

Yes, he will have 24 pieces, which is more than enough for his class.

Section 2.6

$$86. \left(3\frac{2}{3} \right) \left(6\frac{2}{5} \right) = \frac{11}{3} \cdot \frac{32}{5} = \frac{352}{15}$$

$$15 \overline{) 352}^{23} = 23\frac{7}{15}$$

$$\begin{array}{r} 352 \\ -30 \\ \hline 52 \\ -45 \\ \hline 7 \end{array}$$

$$87. \left(11\frac{1}{3}\right)\left(2\frac{3}{34}\right) = \frac{34}{3} \cdot \frac{71}{34} = \frac{71}{3} = 23\frac{2}{3}$$

$$88. 6\frac{1}{2} \cdot 1\frac{3}{13} = \frac{13}{2} \cdot \frac{16}{13} = 8$$

$$89. 4 \cdot \left(5\frac{5}{8}\right) = \frac{4}{1} \cdot \frac{45}{8} = \frac{45}{2} = 22\frac{1}{2}$$

$$90. 45\frac{5}{13} \cdot 0 = 0$$

$$91. 4\frac{5}{16} \div 2\frac{7}{8} = \frac{69}{16} \div \frac{23}{8} = \frac{69}{16} \cdot \frac{8}{23} = \frac{3}{2} = 1\frac{1}{2}$$

$$92. 3\frac{5}{11} \div 3\frac{4}{5} = \frac{38}{11} \div \frac{19}{5} = \frac{38}{11} \cdot \frac{5}{19} = \frac{10}{11}$$

$$93. 7 \div 1\frac{5}{9} = \frac{7}{1} \div \frac{14}{9} = \frac{7}{1} \cdot \frac{9}{14} = \frac{9}{2} = 4\frac{1}{2}$$

$$94. 4\frac{6}{11} \div 2 = \frac{50}{11} \div \frac{2}{1} = \frac{50}{11} \cdot \frac{1}{2} = \frac{25}{11} = 2\frac{3}{11}$$

$$95. 10\frac{1}{5} \div 17 = \frac{51}{5} \div \frac{17}{1} = \frac{51}{5} \cdot \frac{1}{17} = \frac{3}{5}$$

$$96. 0 \div 3\frac{5}{12} = 0$$

$$97. 2\frac{1}{2} \cdot 1\frac{1}{4} = \frac{5}{2} \cdot \frac{5}{4} = \frac{25}{8} = 3\frac{1}{8}$$

It will take $3\frac{1}{8}$ gal.

$$98. 12\frac{1}{2} \div 1\frac{1}{4} = \frac{25}{2} \div \frac{5}{4} = \frac{25}{2} \cdot \frac{4}{5} = 10$$

There will be 10 pieces.

Chapter 2 Test

1. (a) $\frac{5}{8}$
(b) Proper

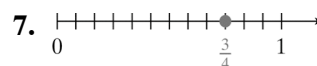
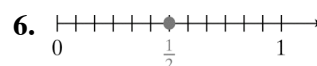
2. (a) $\frac{7}{3}$
(b) Improper

3. $\frac{11}{2}; 5\frac{1}{2}$

4. $\frac{7}{7}$ is an improper fraction because the numerator is greater than or equal to the denominator.

5. (a) $12 \overline{) 44} \quad 3\frac{8}{12} = 3\frac{2}{3}$

(b) $3\frac{7}{9} = \frac{3 \times 9 + 7}{9} = \frac{34}{9}$



10. (a) Composite $15 = 3 \times 5$
 (b) Neither
 (c) Prime
 (d) Neither
 (e) Prime
 (f) Composite $39 = 3 \times 13$

11. (a) 1, 3, 5, 9, 15, 45

$$(b) \begin{array}{r} 3 \\ 3 \overline{)9} \\ 5 \overline{)45} \end{array}$$

$$3 \cdot 3 \cdot 5 = 3^2 \cdot 5 = 45$$

12. (a) Add the digits of the number. If the sum is divisible by 3, then the original number is divisible by 3.

- (b) Yes; $1 + 9 + 8 + 1 + 0 + 1 + 1 = 21$
 and 21 is divisible by 3.

13. (a) No; 1155 is not even.

- (b) Yes; $1 + 1 + 5 + 5 = 12$ is divisible by 3.

- (c) Yes; the digit in the ones-place is a 5.

- (d) No; the digit in the ones-place is not 0.

14. $15 \times 4 \blacklozenge 12 \times 5$

$$60 = 60$$

$$\frac{15}{12} = \frac{5}{4}$$

15. $2 \times 25 \blacklozenge 5 \times 4$

$$50 \neq 20$$

$$\frac{2}{5} \neq \frac{4}{25}$$

16. $\frac{150}{105} = \frac{\cancel{3} \cdot 5 \cdot 2 \cdot \cancel{3}}{\cancel{3} \cdot \cancel{3} \cdot 7} = \frac{10}{7}$ or $1\frac{3}{7}$

17. $\frac{1,2\cancel{0}\cancel{0},\cancel{0}\cancel{0}\cancel{0}}{1,4\cancel{0}\cancel{0},\cancel{0}\cancel{0}\cancel{0}} = \frac{12}{14} = \frac{\cancel{2} \cdot 6}{\cancel{2} \cdot 7} = \frac{6}{7}$

18. (a) Christine: $\frac{15}{25} = \frac{3 \cdot \cancel{5}}{5 \cdot \cancel{5}} = \frac{3}{5}$

$$\text{Brad: } \frac{16}{20} = \frac{\cancel{4} \cdot 4}{\cancel{4} \cdot 5} = \frac{4}{5}$$

- (b) Brad has the greater fractional part

$$\text{completed since } \frac{4}{5} > \frac{3}{5}.$$

$$19. \frac{2}{9} \times \frac{57}{46} = \frac{\cancel{2}}{\cancel{3} \cdot 3} \cdot \frac{\cancel{3} \cdot 19}{\cancel{2} \cdot 23} = \frac{19}{69}$$

$$20. \left(\frac{75}{24}\right) \cdot 4 = \frac{75}{\cancel{24}} \cdot \frac{\overset{1}{\cancel{4}}}{1} = \frac{75}{6} = \frac{\cancel{3} \cdot 25}{\cancel{3} \cdot 2} = \frac{25}{2} \text{ or } 12\frac{1}{2}$$

$$21. \frac{28}{24} \div \frac{21}{8} = \frac{28}{24} \cdot \frac{8}{21} = \frac{\cancel{2} \cdot \cancel{2} \cdot \cancel{7}}{\cancel{2} \cdot \cancel{2} \cdot \cancel{3}} \cdot \frac{\cancel{2} \cdot 2 \cdot 2}{3 \cdot \cancel{7}} = \frac{4}{9}$$

$$22. \frac{105}{42} \div 5 = \frac{\overset{21}{\cancel{105}}}{42} \cdot \frac{1}{\cancel{5}} = \frac{21}{42} = \frac{1}{2}$$

$$23. \frac{2}{18} \times \frac{9}{25} \times \frac{40}{6} = \frac{\cancel{2}}{\cancel{2} \cdot \cancel{3} \cdot \cancel{3}} \cdot \frac{\cancel{3} \cdot \cancel{3}}{\cancel{3} \cdot 5} \cdot \frac{\cancel{2} \cdot 2 \cdot 2 \cdot \cancel{3}}{\cancel{2} \cdot 3} = \frac{4}{15}$$

$$24. \frac{600}{1200} \div \frac{50}{65} \div \frac{13}{15} = \frac{1}{2} \div \frac{\overset{1}{\cancel{3}} \cdot 10}{\cancel{3} \cdot 13} \div \frac{13}{15} = \frac{1}{2} \cdot \frac{\overset{1}{\cancel{3}}}{\cancel{10}} \cdot \frac{\overset{3}{\cancel{15}}}{\cancel{13}} = \frac{3}{4}$$

$$25. \frac{10}{21} \div 4\frac{1}{6} = \frac{10}{21} \div \frac{25}{6} = \frac{10}{21} \cdot \frac{6}{25} = \frac{2 \cdot \cancel{3}}{\cancel{3} \cdot 7} \cdot \frac{2 \cdot \cancel{3}}{\cancel{3} \cdot 5} = \frac{4}{35}$$

$$26. \quad 4\frac{4}{17} \cdot 2\frac{4}{15} = \frac{72}{\cancel{17}_1} \cdot \frac{\cancel{34}^2}{15} = \frac{144}{15} = \frac{\cancel{8} \cdot 48}{\cancel{3} \cdot 5} \\ = \frac{48}{5} = 9\frac{3}{5}$$

$$27. \quad \frac{52}{72} \div \left[\left(\frac{1}{2} \right)^2 \cdot \frac{8}{3} \right] = \frac{52}{72} \div \left[\frac{1}{\cancel{4}_1} \cdot \frac{\cancel{8}^2}{3} \right] = \frac{52}{72} \div \frac{2}{3} \\ = \frac{\cancel{52}^{26}}{\cancel{72}^{24}} \cdot \frac{1}{\cancel{2}_1} = \frac{26}{24} = \frac{13}{12}$$

$$28. \quad A = \frac{1}{2}bh = \frac{1}{2}(8)\left(\frac{11}{3}\right) \\ = \frac{1}{\cancel{2}_1} \cdot \frac{\cancel{8}^4}{1} \cdot \frac{11}{3} = \frac{44}{3} \text{ or } 14\frac{2}{3} \text{ cm}^2$$

$$29. \quad 20 \cdot \frac{1}{4} = \frac{\cancel{20}^5}{1} \cdot \frac{1}{\cancel{4}_1} = 5$$

$$20 \div \frac{1}{4} = \frac{20}{1} \div \frac{1}{4} = \frac{20}{1} \cdot \frac{4}{1} = 80$$

$$20 \div \frac{1}{4} \text{ is greater.}$$

$$30. \quad 12 \div \frac{1}{4} = \frac{12}{1} \div \frac{1}{4} = \frac{12}{1} \cdot \frac{4}{1} = 48 \\ 48 \text{ quarter-pounds}$$

$$31. \quad \frac{1}{15} \cdot \frac{5}{8} \cdot 120 = \frac{1}{\cancel{15}_3} \cdot \frac{\cancel{8}^1}{1} \cdot \frac{\cancel{120}^{15}}{1} = \frac{15}{3} = 5$$

5 dogs are female pure breeds.

$$32. \quad \frac{1}{2} \cdot \frac{4}{5} = \frac{4}{10} = \frac{2}{5}$$

They can build on a maximum of $\frac{2}{5}$ acre.

Chapters 1–2 Cumulative Review Exercises

1. 17,000; nineteen thousand, three hundred forty; 22,047; fifteen thousand, seven hundred seventy-one

$$2. \quad \begin{array}{r} 432 \\ + 998 \\ \hline 1430 \end{array}$$

$$3. \quad \begin{array}{r} 572 \\ - 433 \\ \hline 139 \end{array}$$

$$4. \quad \begin{array}{r} 4122 \\ \times 52 \\ \hline 8244 \\ 206100 \\ \hline 214,344 \end{array}$$

$$5. \quad \begin{array}{r} 24 \\ 16 \overline{) 384} \\ \underline{-32} \\ 64 \\ \underline{-64} \\ 0 \end{array}$$

$$6. \quad \begin{array}{r} 23 \\ \times 81 \\ \hline 23 \\ 1840 \\ \hline 1863 \end{array}$$

$$7. \quad \begin{array}{r} 18 \text{ R } 2 \\ 4 \overline{) 74} \\ \underline{-4} \\ 34 \\ \underline{-32} \\ 2 \end{array}$$

8.
$$\begin{array}{r} 3,000,000 \\ \times \quad 40,000 \\ \hline 120,000,000,000 \end{array}$$
9.
$$\begin{array}{r} 1007 \\ - 823 \\ \hline 184 \end{array}$$
10. $\frac{48}{8} = 6$
11. $6 + 2 \cdot 8 = 6 + 16 = 22$
12. $5^2 - 3^2 = 25 - 9 = 16$
13. $(5 - 3)^2 = 2^2 = 4$
14. d
15. c
16. b
17. e
18. a
19. (a) $\frac{4}{7}$
 (b) $\frac{7}{3}$ or $2\frac{1}{3}$
20. (a) Proper
 (b) Improper
 (c) Improper
21. (a) 1, 2, 3, 5, 6, 10, 15, 30
 (b)
$$\begin{array}{r} 5 \\ 3 \overline{)15} \\ 2 \overline{)30} \\ \hline 2 \cdot 3 \cdot 5 = 30 \end{array}$$
22. (a) $\frac{144}{84} = \frac{\cancel{2} \cdot \cancel{2} \cdot 2 \cdot 2 \cdot \cancel{3} \cdot 3}{\cancel{2} \cdot \cancel{2} \cdot \cancel{3} \cdot 7} = \frac{12}{7}$ or $1\frac{5}{7}$
 (b) $\frac{6\cancel{0}, \cancel{0}\cancel{0}\cancel{0}}{15\cancel{0}, \cancel{0}\cancel{0}\cancel{0}} = \frac{6}{15} = \frac{2 \cdot \cancel{3}}{5 \cdot \cancel{3}} = \frac{2}{5}$
23. $\frac{35}{27} \cdot \frac{51}{95} = \frac{\cancel{5} \cdot 7}{\cancel{3} \cdot 3 \cdot 3} \cdot \frac{\cancel{3} \cdot 17}{\cancel{5} \cdot 19} = \frac{119}{171}$
24. $5\frac{2}{3} \div 6\frac{4}{5} = \frac{17}{3} \div \frac{34}{5} = \frac{\cancel{17}}{3} \cdot \frac{5}{\cancel{34}} = \frac{5}{6}$
25. Yes; $\frac{\cancel{5}}{13} \cdot \frac{5}{\cancel{16}_2} = \frac{5}{26}$ and $\frac{5}{\cancel{16}_2} \cdot \frac{\cancel{5}}{13} = \frac{5}{26}$.
26. Yes; $\left(\frac{1}{\cancel{2}_1} \cdot \frac{\cancel{2}}{9}\right) \cdot \frac{5}{3} = \frac{1}{9} \cdot \frac{5}{3} = \frac{5}{27}$ and

$$\frac{1}{2} \cdot \left(\frac{2}{9} \cdot \frac{5}{3}\right) = \frac{1}{\cancel{2}_1} \cdot \frac{\cancel{2} \cdot 5}{27} = \frac{5}{27}.$$
27.
$$\left(\frac{\cancel{2}}{\cancel{2}} \cdot \frac{\cancel{25}}{\cancel{25}}\right)^2 \div \frac{2}{3} = \left(\frac{2}{5}\right)^{\frac{2^2}{5}} \div \frac{2}{3} = \frac{4}{25} \div \frac{2}{3}$$

$$= \frac{\cancel{4}}{25} \cdot \frac{3}{\cancel{2}_1} = \frac{6}{25}$$
28. $A = lw = \frac{11}{\cancel{9}_1} \cdot \frac{\cancel{9}}{9} = \frac{11}{9}$ or $1\frac{2}{9}$ m²
29. $A = \frac{1}{2}bh$

$$= \frac{1}{2} \left(\frac{25}{2}\right)(8) = \frac{1}{\cancel{2}} \cdot \frac{25}{\cancel{2}} \cdot \frac{\cancel{2} \cdot \cancel{2} \cdot 2}{1} = 50 \text{ ft}^2$$
30. $\frac{1}{10} \cdot \frac{3}{4} = \frac{3}{40}$
 $\frac{3}{40}$ of the students are males from out of state.