Basic College Mathematics 6th edition Martin Gay Solutions Manual

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Chapter 2

Section 2.1 Practice Exercises

1. $\frac{9}{2}$ ← numerator
← denominator

2. $\frac{10}{17}$ ← numerator
← denominator

3. $\frac{0}{2} = 0$

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

5. $\frac{4}{0}$ is undefined.

6. $\frac{20}{1} = 20$

7. In this figure, 3 of the 8 equal parts are shaded.
Thus, the fraction is $\frac{3}{8}$.

8. In this figure, 1 of the 6 equal parts is shaded.
Thus, the fraction is $\frac{1}{6}$.

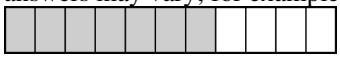
9. Of the 10 parts of the syringe, 7 parts are filled.
Thus, the fraction is $\frac{7}{10}$.

10. Of the 16 parts of one inch, 9 parts are measured.
Thus, the fraction is $\frac{9}{16}$.

11. answers may vary; for example,



12. answers may vary; for example,



13. number of planets farther $\rightarrow 5$
number of planets in our solar system $\rightarrow 8$
$\frac{5}{8}$ of the planets in our solar system are farther from the Sun than Earth is.

14. **a.** $\frac{5}{8}$ is a proper fraction.

b. $\frac{7}{7}$ is an improper fraction.

c. $\frac{14}{13}$ is an improper fraction.

d. $\frac{13}{14}$ is a proper fraction.

e. $5\frac{1}{4}$ is a mixed number.

f. $\frac{100}{49}$ is an improper fraction.

15. Each part is $\frac{1}{3}$ of a whole. There are 8 parts shaded, or 2 wholes and 2 more parts.
improper fraction: $\frac{8}{3}$
mixed number: $2\frac{2}{3}$

16. Each part is $\frac{1}{4}$ of a whole. There are 5 parts shaded, or 1 whole and 1 more part.
improper fraction: $\frac{5}{4}$
mixed number: $1\frac{1}{4}$

17. **a.** $2\frac{5}{7} = \frac{7 \cdot 2 + 5}{7} = \frac{14 + 5}{7} = \frac{19}{7}$

b. $5\frac{1}{3} = \frac{3 \cdot 5 + 4}{3} = \frac{15 + 1}{3} = \frac{16}{3}$

c. $9\frac{3}{10} = \frac{10 \cdot 9 + 3}{10} = \frac{90 + 3}{10} = \frac{93}{10}$

d. $1\frac{1}{5} = \frac{5 \cdot 1 + 1}{5} = \frac{5 + 1}{5} = \frac{6}{5}$

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18. a. $5\overline{)9}$, $\underline{5}$, 4

$\frac{9}{5} = 1\frac{4}{5}$

b. $9\overline{)23}$, $\underline{18}$, 5

$\frac{23}{9} = 2\frac{5}{9}$

c. $4\overline{)48}$, $\underline{4}$, 8, $\underline{8}$, 0

$\frac{48}{4} = 12$

d. $13\overline{)62}$, $\underline{52}$, 10

$\frac{62}{13} = 4\frac{10}{13}$

e. $7\overline{)51}$, $\underline{49}$, 2

$\frac{51}{7} = 7\frac{2}{7}$

f. $20\overline{)21}$, $\underline{20}$, 1

$\frac{21}{20} = 1\frac{1}{20}$

Vocabulary, Readiness & Video Check 2.1

1. The number $\frac{17}{31}$ is called a fraction. The number 31 is called its denominator and 17 is called its numerator.

2. If we simplify each fraction, $\frac{9}{9} = 1$, $\frac{0}{4} = 0$, and we say $\frac{4}{0}$ is undefined.

3. The fraction $\frac{8}{3}$ is called an improper fraction, the fraction $\frac{3}{8}$ is called a proper fraction, and $10\frac{3}{8}$ is called a mixed number.

4. The value of an improper fraction is always ≥ 1 and the value of a proper fraction is always < 1.

5. The fraction is equal to 1.

6. The total number of marbles in the bag.

7. Each shape is divided into 3 parts.

8. The operation of addition is understood in a mixed number; for example, $1\frac{1}{3}$ means $1 + \frac{1}{3}$.

9. division

Exercise Set 2.1

2. In the fraction $\frac{1}{4}$, the numerator is 1 and the denominator is 4. Since $1 < 4$, the fraction is proper.

4. In the fraction $\frac{53}{21}$, the numerator is 53 and the denominator is 21. Since $53 > 21$, the fraction is improper.

6. In the fraction $\frac{26}{26}$, the numerator is 26 and the denominator is 26. Since $26 \geq 26$, the fraction is improper.

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

10. $\frac{1}{0}$ is undefined.

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

14. $\frac{0}{17} = 0$

16. $\frac{0}{18} = 0$

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

20. 4 of the 7 parts are shaded: $\frac{4}{7}$

22. 5 of the 8 equal parts are shaded: $\frac{5}{8}$

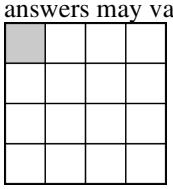
24. 5 of the 12 equal parts are shaded: $\frac{5}{12}$

26. 7 of the 8 equal parts are shaded: $\frac{7}{8}$

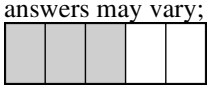
28. 3 of the 8 equal parts are shaded: $\frac{3}{8}$

30. 13 of the 16 equal parts are shaded: $\frac{13}{16}$

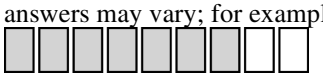
32. answers may vary; for example,



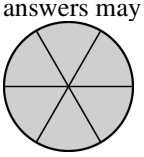
34. answers may vary; for example,



36. answers may vary; for example,



38. answers may vary; for example,



40. $\begin{matrix}\text{men} & \rightarrow 22 \\ \text{employees} & \rightarrow 63\end{matrix}$

$\frac{22}{63}$ of the employees are men.

42. a. number of women employees $= 63 - 22$
$= 41$

b. $\begin{matrix}\text{women} & \rightarrow 41 \\ \text{employees} & \rightarrow 63\end{matrix}$

$\frac{41}{63}$ of the employees are women.

44. $\begin{matrix}\text{planets with longer days} & \rightarrow 4 \\ \text{number of planets in solar system} & \rightarrow 8\end{matrix}$

$\frac{4}{8}$ of the planets in our solar system have longer days than Earth has.

46. 5 of 12 inches is $\frac{5}{12}$ of a foot.

48. 37 of 60 minutes is $\frac{37}{60}$ of an hour.

50. $\begin{matrix}\text{number of boys} & \rightarrow 9 \\ \text{number on team} & \rightarrow 20\end{matrix}$

$\frac{9}{20}$ of the team is boys.

52. There are 50 states total. Consumer fireworks are legal in 46 states.

a. Consumer fireworks are legal in $\frac{46}{50}$ of the states.

b. $50 - 46 = 4$
Consumer fireworks are illegal in 4 states.

c. Consumer fireworks are illegal in $\frac{4}{50}$ of the states.

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54. There are 37 total pieces. 15 are watercolor paintings and 17 are oil paintings.

a. $\frac{15}{37}$ of the inventory is watercolor paintings.

b. $\frac{17}{37}$ of the inventory is oil paintings.

c. $37 - 15 - 17 = 5$
There are 5 sculptures.

d. $\frac{5}{37}$ of the inventory is sculptures.

56. Each part is $\frac{1}{4}$ of a whole and 10 parts are shaded, or 2 wholes and 2 more parts.

a. $\frac{10}{4}$ **b.** $2\frac{2}{4}$

58. Each part is $\frac{1}{3}$ of a whole and 11 parts are shaded, or 3 wholes and 2 more parts.

a. $\frac{11}{3}$ **b.** $3\frac{2}{3}$

60. Each part is $\frac{1}{5}$ of a whole and 6 parts are shaded, or 1 whole and 1 more part.

a. $\frac{6}{5}$ **b.** $1\frac{1}{5}$

62. Each part is $\frac{1}{5}$ of a whole and 23 parts are shaded, or 4 wholes and 3 more parts.

a. $\frac{23}{5}$ **b.** $4\frac{3}{5}$

64. $6\frac{3}{4} = \frac{4 \cdot 6 + 3}{4} = \frac{27}{4}$

66. $2\frac{5}{9} = \frac{9 \cdot 2 + 5}{9} = \frac{23}{9}$

68. $7\frac{3}{8} = \frac{8 \cdot 7 + 3}{8} = \frac{59}{8}$

70. $1\frac{13}{17} = \frac{17 \cdot 1 + 13}{17} = \frac{30}{17}$

72. $12\frac{2}{5} = \frac{5 \cdot 12 + 2}{5} = \frac{62}{5}$

74. $8\frac{9}{10} = \frac{10 \cdot 8 + 9}{10} = \frac{89}{10}$

76. $5\frac{17}{25} = \frac{25 \cdot 5 + 17}{25} = \frac{142}{25}$

78. $12\frac{7}{15} = \frac{15 \cdot 12 + 7}{15} = \frac{187}{15}$

80. $10\frac{14}{27} = \frac{27 \cdot 10 + 14}{27} = \frac{284}{27}$

82. $3\frac{27}{125} = \frac{125 \cdot 3 + 27}{125} = \frac{402}{125}$

84. $114\frac{2}{7} = \frac{7 \cdot 114 + 2}{7} = \frac{800}{7}$

86.
$$7\overline{)13} \quad 1 \text{ R } 6$$
$$\underline{-7}$$
$$6$$

$\frac{13}{7} = 1\frac{6}{7}$

88.
$$9\overline{)64} \quad 7 \text{ R } 1$$
$$\underline{-63}$$
$$1$$

$\frac{64}{9} = 7\frac{1}{9}$

90.
$$12\overline{)65} \quad 5 \text{ R } 5$$
$$\underline{-60}$$
$$5$$

$\frac{65}{12} = 5\frac{5}{12}$

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92.
$$17\overline{)\,67}\quad 3 \text{ R } 16$$
$$\underline{-51}$$
$$16$$

$$\frac{67}{17} = 3\frac{16}{17}$$

94.
$$7\overline{)\,112}\quad 16$$
$$\underline{-7}$$
$$42$$
$$\underline{-42}$$
$$0$$

$$\frac{112}{7} = 16$$

96.
$$14\overline{)\,196}\quad 14$$
$$\underline{-14}$$
$$56$$
$$\underline{-56}$$
$$0$$

$$\frac{196}{14} = 14$$

98.
$$7\overline{)\,300}\quad 42 \text{ R } 6$$
$$\underline{-28}$$
$$20$$
$$\underline{-14}$$
$$6$$

$$\frac{300}{7} = 42\frac{6}{7}$$

100.
$$53\overline{)\,437}\quad 8 \text{ R } 13$$
$$\underline{-424}$$
$$18$$

$$\frac{437}{53} = 8\frac{13}{53}$$

102.
$$21\overline{)\,404}\quad 19 \text{ R } 5$$
$$\underline{-21}$$
$$194$$
$$\underline{-189}$$
$$5$$

$$\frac{404}{21} = 19\frac{5}{21}$$

104.
$$143\overline{)\,149}\quad 1 \text{ R } 6$$
$$\underline{-143}$$
$$6$$

$$\frac{149}{143} = 1\frac{6}{143}$$

106.
$$123\overline{)\,901}\quad 7 \text{ R } 40$$
$$\underline{-861}$$
$$40$$

$$\frac{901}{123} = 7\frac{40}{123}$$

108. $4^3 = 4 \cdot 4 \cdot 4 = 64$

110. $3^4 = 3 \cdot 3 \cdot 3 \cdot 3 = 81$

112. $5 \cdot 5 \cdot 5 \cdot 5 = 5^4$

114. $4 \cdot 4 \cdot 10 \cdot 10 \cdot 10 = 4^2 \cdot 10^3$

116. answers may vary

118. $\frac{7}{4} = 1\frac{3}{4}$

$\frac{3}{5} = \frac{3}{5}$

$\frac{7}{4}$ is the larger fraction.

120. △▲ △△ △△

122. 84 + 52 + 20 + 5 = 161
52 of the 161 licensees are universities or colleges: $\frac{52}{161}$

124. 1 + 1 + 4 = 6
Four of the six United States Mint facilities produce coins: $\frac{4}{6}$

Section 2.2 Practice Exercises

1. a. First we write all the two-number factors of 15.
$1 \cdot 15 = 15$
$3 \cdot 5 = 15$
The factors of 15 are 1, 3, 5, and 15.

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b. First we write all the two-number factors of 7.
$1 \cdot 7 = 7$
The factors of 7 are 1 and 7.

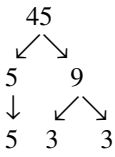
c. First we write all the two-number factors of 24.
$1 \cdot 24 = 24$
$2 \cdot 12 = 24$
$3 \cdot 8 = 24$
$4 \cdot 6 = 24$
The factors of 24 are 1, 2, 3, 4, 6, 8, 12, and 24.

2. The number 21 is composite. Its factors are 1, 3, 7, and 21.
The number 13 is prime. Its only factors are 1 and 13.
The number 18 is composite. Its factors are 1, 2, 3, 6, 9, and 18.
The number 29 is prime. Its only factors are 1 and 29.
The number 39 is composite. Its factors are 1, 3, 13, and 39.

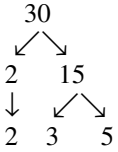
3.
$$2\overline{)\,14}$$
$$2\overline{)\,28}$$
$28 = 2 \cdot 2 \cdot 7 = 2^2 \cdot 7$

4.
$$3\overline{)\,15}$$
$$2\overline{)\,30}$$
$$2\overline{)\,60}$$
$$2\overline{)\,120}$$
$120 = 2 \cdot 2 \cdot 2 \cdot 3 \cdot 5 = 2^3 \cdot 3 \cdot 5$

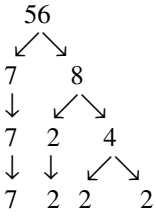
5.
$$3\overline{)\,21}$$
$$3\overline{)\,63}$$
$$3\overline{)\,189}$$
$$3\overline{)\,378}$$
$$2\overline{)\,756}$$
$756 = 2 \cdot 2 \cdot 3 \cdot 3 \cdot 3 \cdot 7 = 2^2 \cdot 3^3 \cdot 7$

6.


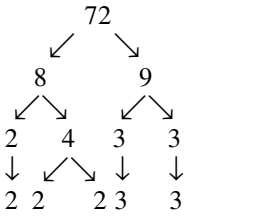
$45 = 3 \cdot 3 \cdot 5 = 3^2 \cdot 5$

7. a.


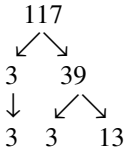
$30 = 2 \cdot 3 \cdot 5$

b.


$56 = 2 \cdot 2 \cdot 2 \cdot 7 = 2^3 \cdot 7$

c.


$72 = 2 \cdot 2 \cdot 2 \cdot 3 \cdot 3 = 2^3 \cdot 3^2$

8.


$117 = 3 \cdot 3 \cdot 13 = 3^2 \cdot 13$

Vocabulary, Readiness & Video Check 2.2

1. The number 40 equals $2 \cdot 2 \cdot 2 \cdot 5$. Since each factor is prime, we call $2 \cdot 2 \cdot 2 \cdot 5$ the prime factorization of 40.

2. A natural number, other than 1, that is not prime is called a composite number.

3. A natural number that has exactly two different factors, 1 and itself, is called a prime number.

4. The numbers 1, 2, 3, 4, 5, ... are called the natural numbers.

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5. Since $30 = 5 \cdot 6$, the numbers 5 and 6 are factors of 30.

6. True or false: $5 \cdot 6$ is the prime factorization of 30. false

7. Because order doesn't matter when we multiply, so switching the order doesn't give us any new factors of 12.

8. No, the natural number 1 is neither prime nor composite.

9. You may write factors in different order, but every natural number has only one prime factorization.

Exercise Set 2.2

2. $1 \cdot 6 = 6$
$2 \cdot 3 = 6$
The factors of 6 are 1, 2, 3, and 6.

4. $1 \cdot 30 = 30$
$2 \cdot 15 = 30$
$3 \cdot 10 = 30$
$5 \cdot 6 = 30$
The factors of 30 are 1, 2, 3, 5, 6, 10, 15, and 30.

6. $1 \cdot 9 = 9$
$3 \cdot 3 = 9$
The factors of 9 are 1, 3, and 9.

8. $1 \cdot 48 = 48$
$2 \cdot 24 = 48$
$3 \cdot 16 = 48$
$4 \cdot 12 = 48$
$6 \cdot 8 = 48$
The factors of 48 are 1, 2, 3, 4, 6, 8, 12, 16, 24 and 48.

10. $1 \cdot 37 = 37$
The factors of 37 are 1 and 37.

12. $1 \cdot 100 = 100$
$2 \cdot 50 = 100$
$4 \cdot 25 = 100$
$5 \cdot 20 = 100$
$10 \cdot 10 = 100$
The factors of 100 are 1, 2, 4, 5, 10, 20, 25, 50, and 100.

14. $1 \cdot 28 = 28$
$2 \cdot 14 = 28$
$4 \cdot 7 = 28$
The factors of 28 are 1, 2, 4, 7, 14 and 28.

16. $1 \cdot 26 = 26$
$2 \cdot 13 = 26$
The factors of 26 are 1, 2, 13, and 26.

18. Prime, since its only factors are 1 and 5.

20. Composite, since its factors are 1, 2, 5, and 10.

22. Prime, since its only factors are 1 and 13.

24. Composite, since its factors are 1, 3, 5, 9, 15 and 45.

26. Prime, since its only factors are 1 and 89.

28. Composite, since its factors are 1, 3, 7, and 21.

30. Composite, since its factors are 1, 3, 9, and 27.

32. Composite, since its factors are 1, 3, 17, and 51.

34. Composite, since its factors are 1, 3, 7, 21, 49, and 147.

36.
$$\begin{array}{r} 2 \\ 2\overline{)\,4} \\ 2\overline{)\,8} \\ 2\overline{)16} \\ 2\overline{)32} \\ 2\overline{)64} \end{array}$$
$64 = 2^6$

38.
$$\begin{array}{r} 7 \\ 3\overline{)21} \end{array}$$
$21 = 3 \cdot 7$

40.
$$\begin{array}{r} 7 \\ 3\overline{)21} \\ 3\overline{)63} \end{array}$$
$63 = 3^2 \cdot 7$

42.
$$\begin{array}{r} 5 \\ 2\overline{)10} \\ 2\overline{)20} \\ 2\overline{)40} \\ 2\overline{)80} \end{array}$$
$80 = 2^4 \cdot 5$

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44.
$$\begin{array}{r} 7 \\ 2\overline{)14} \\ 2\overline{)28} \\ 2\overline{)56} \end{array}$$
$56 = 2^3 \cdot 7$

46.
$$\begin{array}{r} 7 \\ 3\overline{)21} \\ 2\overline{)42} \\ 2\overline{)84} \end{array}$$
$84 = 2^2 \cdot 3 \cdot 7$

48.
$$\begin{array}{r} 13 \\ 5\overline{)65} \\ 2\overline{)130} \end{array}$$
$130 = 2 \cdot 5 \cdot 13$

50.
$$\begin{array}{r} 31 \\ 3\overline{)93} \end{array}$$
$93 = 3 \cdot 31$

52.
$$\begin{array}{r} 3 \\ 3\overline{)9} \\ 3\overline{)27} \\ 3\overline{)81} \end{array}$$
$81 = 3^4$

54.
$$\begin{array}{r} 11 \\ 3\overline{)33} \\ 3\overline{)99} \\ 2\overline{)198} \end{array}$$
$198 = 2 \cdot 3^2 \cdot 11$

56.
$$\begin{array}{r} 5 \\ 3\overline{)15} \\ 3\overline{)45} \\ 2\overline{)90} \\ 2\overline{)180} \\ 2\overline{)360} \end{array}$$
$360 = 2^3 \cdot 3^2 \cdot 5$

58.
$$\begin{array}{r} 19 \\ 11\overline{)209} \\ 2\overline{)418} \\ 2\overline{)836} \end{array}$$
$826 = 2^2 \cdot 11 \cdot 19$

60.
$$\begin{array}{r} 7 \\ 3\overline{)21} \\ 3\overline{)63} \\ 2\overline{)126} \\ 2\overline{)252} \\ 2\overline{)504} \end{array}$$
$504 = 2^3 \cdot 3^2 \cdot 7$

62.
$$\begin{array}{r} 5 \\ 3\overline{)15} \\ 3\overline{)45} \\ 3\overline{)135} \\ 3\overline{)405} \end{array}$$
$405 = 3^4 \cdot 5$

64.
$$\begin{array}{r} 11 \\ 7\overline{)77} \\ 7\overline{)539} \end{array}$$
$539 = 7^2 \cdot 11$

66.
$$\begin{array}{r} 3 \\ 2\overline{)6} \\ 2\overline{)12} \\ 2\overline{)24} \\ 2\overline{)48} \end{array}$$
$48 = 2^4 \cdot 3$

68.
$$\begin{array}{r} 3 \\ 3\overline{)9} \\ 3\overline{)27} \\ 2\overline{)54} \end{array}$$
$54 = 2 \cdot 3^3$

70. 59 is prime since its only factors are 1 and 59.

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72.
$$\begin{array}{r} 13 \\ 2\overline{)\,26} \\ 2\overline{)\,52} \\ 2\overline{)104} \\ 2\overline{)208} \end{array}$$
$208 = 2^4 \cdot 13$

74. 103 is prime since its only factors are 1 and 103.

76.
$$\begin{array}{r} 5 \\ 5\overline{)\,25} \\ 5\overline{)\,125} \\ 2\overline{)\,250} \\ 2\overline{)\,500} \\ 2\overline{)1000} \end{array}$$
$1000 = 2^3 \cdot 5^3$

78. To round 32,465 to the nearest thousand, observe that the digit in the hundreds place is 4. Since this digit is less than 5, we do not add 1 to the digit in the thousands place. The number 32,465 rounded to the nearest thousand is 32,000.

80. To round 4,286,340 to the nearest ten, observe that the digit in the ones place is 0. Since this digit is less than 5, we do not add 1 to the digit in the tens place. The number 4,286,340 rounded to the nearest ten is 4,286,340.

82. To round 10,292,876 to the nearest million, observe that the digit in the hundred-thousands place is 2. Since this digit is less than 5, we do not add 1 to the digit in the millions place. The number 10,292,876 rounded to the nearest million is 10,000,000.

84. 2003 patents were granted in 2014 and 938 patents were granted in 2015.
$2003 - 1938 = 65$
65 fewer patents were granted in 2015 than in 2014.

86. Of the 6043 total patents, 2102 were granted in 2016. $\frac{2102}{6043}$ of the patents were granted in 2016.

88.
$$\begin{array}{r} 13 \\ 5\overline{)\,65} \\ 5\overline{)\,325} \\ 5\overline{)\,1625} \\ 3\overline{)\,4875} \\ 3\overline{)\,14,625} \\ 3\overline{)\,43,875} \\ 3\overline{)131,625} \end{array}$$
$131,625 = 3^4 \cdot 5^3 \cdot 13$

90. answers may vary

92. no; answers may vary

Section 2.3 Practice Exercises

1. Notice that 30 and 45 have a common factor of 15.
$$\frac{30}{45} = \frac{15 \cdot 2}{15 \cdot 3} = \frac{15}{15} \cdot \frac{2}{3} = 1 \cdot \frac{2}{3} = \frac{2}{3}$$

2. $$\frac{39}{51} = \frac{3 \cdot 13}{3 \cdot 17} = \frac{3}{3} \cdot \frac{13}{17} = 1 \cdot \frac{13}{17} = \frac{13}{17}$$

3. $$\frac{9}{50} = \frac{3 \cdot 3}{2 \cdot 5 \cdot 5}$$
Since 9 and 50 have no common factors, $\frac{9}{50}$ is already in simplest form.

4. $$\frac{49}{112} = \frac{7 \cdot 7}{2 \cdot 2 \cdot 2 \cdot 2 \cdot 7} = \frac{7}{7} \cdot \frac{7}{2 \cdot 2 \cdot 2 \cdot 2} = 1 \cdot \frac{7}{16} = \frac{7}{16}$$

5. $$\frac{64}{20} = \frac{\overset{1}{\cancel{2}} \cdot \overset{1}{\cancel{2}} \cdot 2 \cdot 2 \cdot 2 \cdot 2}{\underset{1}{\cancel{2}} \cdot \underset{1}{\cancel{2}} \cdot 5} = \frac{1 \cdot 1 \cdot 2 \cdot 2 \cdot 2 \cdot 2}{1 \cdot 1 \cdot 5} = \frac{16}{5} \text{ or } 3\frac{1}{5}$$

6. $$\frac{8}{56} = \frac{\overset{1}{\cancel{2}} \cdot \overset{1}{\cancel{2}} \cdot \overset{1}{\cancel{2}}}{\underset{1}{\cancel{2}} \cdot \underset{1}{\cancel{2}} \cdot \underset{1}{\cancel{2}} \cdot 7} = \frac{1 \cdot 1 \cdot 1}{1 \cdot 1 \cdot 1 \cdot 7} = \frac{1}{7}$$

7. $$\frac{42}{48} = \frac{\overset{1}{\cancel{6}} \cdot 7}{\underset{1}{\cancel{6}} \cdot 8} = \frac{1 \cdot 7}{1 \cdot 8} = \frac{7}{8}$$

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8. $\frac{7}{9}$ is in simplest form.

$$\frac{21}{27}=\frac{\overset{1}{\cancel{3}}\cdot 7}{\underset{1}{\cancel{3}}\cdot 3\cdot 3}=\frac{1\cdot 7}{1\cdot 3\cdot 3}=\frac{7}{9}$$

Since these fractions are the same, $\frac{7}{9}=\frac{21}{27}$. The fractions are equivalent.

9. Check the cross products:
$4 \cdot 18 = 72$ and $13 \cdot 5 = 65$
Since $72 \neq 65$, the fractions are not equivalent.

10. $$\frac{4 \text{ parks in Virginia}}{46 \text{ national historical parks}}=\frac{2\cdot 2}{2\cdot 23}=\frac{\overset{1}{\cancel{2}}\cdot 2}{\underset{1}{\cancel{2}}\cdot 23}=\frac{2}{23}$$

$\frac{2}{23}$ of the national historical parks are in Virginia.

Calculator Explorations

1. $\frac{128}{224}=\frac{4}{7}$

2. $\frac{231}{396}=\frac{7}{12}$

3. $\frac{340}{459}=\frac{20}{27}$

4. $\frac{999}{1350}=\frac{37}{50}$

5. $\frac{810}{432}=\frac{15}{8}$

6. $\frac{315}{225}=\frac{7}{5}$

7. $\frac{243}{54}=\frac{9}{2}$

8. $\frac{689}{455}=\frac{53}{35}$

Vocabulary, Readiness & Video Check 2.3

1. In $\frac{11}{48}$, since 11 and 48 have no common factors other than 1, $\frac{11}{48}$ is in simplest form.

2. Fractions that represent the same portion of a whole are called equivalent fractions.

3. In the statement $\frac{5}{12}=\frac{15}{36}$, $5 \cdot 36$ and $12 \cdot 15$ are called cross products.

4. The fraction $\frac{7}{7}$ simplifies to 1.

5. The fraction $\frac{0}{7}$ simplifies to 0.

6. The fraction $\frac{n}{1}$ simplifies to n.

7. A special form of an equivalent form of a fraction is called simplest form.

8. Two fractions are equivalent if they simplify to the same fraction. $\frac{3}{9}$ and $\frac{6}{18}$ both simplify to $\frac{1}{3}$, so the original fractions are equal.

9. $\frac{10}{24}$ is not in simplest form; $\frac{5}{12}$

Exercise Set 2.3

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

4. $\frac{9}{48}=\frac{3\cdot 3}{3\cdot 16}=\frac{3}{16}$

6. $\frac{22}{34}=\frac{2\cdot 11}{2\cdot 17}=\frac{11}{17}$

8. $\frac{70}{80}=\frac{7\cdot 10}{8\cdot 10}=\frac{7}{8}$

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10. $\frac{25}{55}=\frac{5\cdot5}{5\cdot11}=\frac{5}{11}$

12. $\frac{21}{49}=\frac{3\cdot7}{7\cdot7}=\frac{3}{7}$

14. $\frac{36}{54}=\frac{2\cdot18}{3\cdot18}=\frac{2}{3}$

16. $\frac{32}{63}=\frac{32}{63}$
32 and 63 have no common factors other than 1.

18. $\frac{36}{42}=\frac{6\cdot6}{6\cdot7}=\frac{6}{7}$

20. $\frac{28}{60}=\frac{4\cdot7}{4\cdot15}=\frac{7}{15}$

22. $\frac{39}{42}=\frac{3\cdot13}{3\cdot14}=\frac{13}{14}$

24. $\frac{60}{36}=\frac{5\cdot12}{3\cdot12}=\frac{5}{3}$ or $1\frac{2}{3}$

26. $\frac{60}{150}=\frac{2\cdot30}{5\cdot30}=\frac{2}{5}$

28. $\frac{98}{126}=\frac{14\cdot7}{14\cdot9}=\frac{7}{9}$

30. $\frac{65}{234}=\frac{13\cdot5}{13\cdot18}=\frac{5}{18}$

32. $\frac{78}{90}=\frac{6\cdot13}{6\cdot15}=\frac{13}{15}$

34. $\frac{72}{420}=\frac{12\cdot6}{12\cdot35}=\frac{6}{35}$

36. $\frac{144}{162}=\frac{18\cdot8}{18\cdot9}=\frac{8}{9}$

38. $\frac{135}{585}=\frac{45\cdot3}{45\cdot13}=\frac{3}{13}$

40. $\frac{270}{15}=\frac{15\cdot18}{15}=\frac{18\cdot15}{1\cdot15}=\frac{18}{1}=18$

42. Equivalent, since the cross products are equal: $9 \cdot 2 = 18$ and $6 \cdot 3 = 18$.

44. Not equivalent, since the cross products are not equal: $5 \cdot 4 = 20$ and $11 \cdot 2 = 22$.

46. Equivalent, since the cross products are equal: $10 \cdot 6 = 60$ and $15 \cdot 4 = 60$.

48. Equivalent, since the cross products are equal: $8 \cdot 7 = 56$ and $28 \cdot 2 = 56$.

50. Not equivalent, since the cross products are not equal: $20 \cdot 9 = 180$ and $12 \cdot 16 = 192$.

52. Not equivalent, since the cross products are not equal: $21 \cdot 14 = 294$ and $35 \cdot 6 = 210$.

54. $\frac{200 \text{ caps}}{2000 \text{ caps}}=\frac{1\cdot200}{10\cdot200}=\frac{1}{10}$

200 caps represents $\frac{1}{10}$ of the total caps sold.

56. $\frac{20 \text{ centimeters}}{100 \text{ centimeters}}=\frac{1\cdot20}{5\cdot20}=\frac{1}{5}$

20 centimeters is $\frac{1}{5}$ of a meter.

58. a. $\frac{12 \text{ medals}}{27 \text{ medals}}=\frac{3\cdot4}{3\cdot9}=\frac{4}{9}$

$\frac{4}{9}$ of these gold medals have been won by an American team.

b. $27 - 12 = 15$
15 of these gold medals have been won by non-American teams.

c. $\frac{15 \text{ medals}}{27 \text{ medals}}=\frac{3\cdot5}{3\cdot9}=\frac{5}{9}$

$\frac{5}{9}$ of these gold medals have been won by teams other than Americans.

60. $\frac{10 \text{ students}}{35 \text{ students}}=\frac{5\cdot2}{5\cdot7}=\frac{2}{7}$

$\frac{2}{7}$ of the students made and A on the first test.

62. a. $28{,}000 - 12{,}000 = 16{,}000$
$16,000 was not covered by her trade-in.

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b. $\frac{\$16,000}{\$28,000} = \frac{4000 \cdot 4}{4000 \cdot 7} = \frac{4}{7}$

$\frac{4}{7}$ of the purchase price was not covered by the trade-in.

64. $\frac{8 \text{ movies}}{20 \text{ movies}} = \frac{8}{20} = \frac{2 \cdot 4}{4 \cdot 5} = \frac{2}{5}$

$\frac{2}{5}$ of the 20 most popular films released in 2016 were R-rated.

66.
$$\begin{array}{r} 73 \\ \times\ 8 \\ \hline 584 \end{array}$$

68.
$$\begin{array}{r} 562 \\ \times\ 9 \\ \hline 5058 \end{array}$$

70.
$$\begin{array}{r} 238 \\ \times\ 26 \\ \hline 1428 \\ 4760 \\ \hline 6188 \end{array}$$

72. answers may vary

74. $\frac{9506}{12,222} = \frac{1358 \cdot 7}{1358 \cdot 9} = \frac{7}{9}$

76. $37 + 7 = 44$

$\frac{44 \text{ donors}}{100 \text{ donors}} = \frac{4 \cdot 11}{4 \cdot 25} = \frac{11}{25}$

$\frac{11}{25}$ of blood donors have an O blood type.

78. $9 + 1 = 10$

$\frac{10 \text{ donors}}{100 \text{ donors}} = \frac{1 \cdot 10}{10 \cdot 10} = \frac{1}{10}$

$\frac{1}{10}$ of blood donors have B blood type.

80. The piece representing biological sciences is labeled $\frac{8}{100}$, so $\frac{8}{100} = \frac{2 \cdot 4}{4 \cdot 25} = \frac{2}{25}$ of entering college freshmen plan to major in biological sciences.

82. answers may vary

84. The piece representing National Parks is labeled $\frac{9}{60}$, so $\frac{9}{60} = \frac{3 \cdot 3}{3 \cdot 20} = \frac{3}{20}$ of National Park Service areas are National Parks.

86. answers may vary

88. 1235, 2235, 85, 105, 900, and 1470 are divisible by 5 because each number ends with a 0 or 5.
8691, 786, 2235, 105, 222, 900, and 1470 are divisible by 3 because the sum of each number's digits is divisible by 3.
2235, 105, 900, and 1470 are divisible by both 3 and 5.

90. 15; answers may vary

Integrated Review

1. 3 of the 6 parts are shaded: $\frac{3}{6}$

$\frac{3}{6}$ simplifies as $\frac{3}{6} = \frac{3 \cdot 1}{3 \cdot 2} = \frac{1}{2}$.

2. Each part is $\frac{1}{4}$ of a whole and 7 parts are shaded, or 1 whole and 3 more parts: $\frac{7}{4}$ or $1\frac{3}{4}$

3. People getting fewer than 8 hours of sleep $\rightarrow 73$
People in survey $\rightarrow 85$

$\frac{73}{85}$ of the people in a survey get fewer than 8 hours of sleep.

4. 

5. $\frac{11}{11} = 1$

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

7. $\frac{0}{3} = 0$

8. $\frac{7}{0}$ is undefined.

9. $3\frac{1}{8} = \frac{8 \cdot 3 + 1}{8} = \frac{25}{8}$

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10. $5\frac{3}{5} = \frac{5 \cdot 5 + 3}{5} = \frac{28}{5}$

11. $9\frac{6}{7} = \frac{7 \cdot 9 + 6}{7} = \frac{69}{7}$

12. $20\frac{1}{7} = \frac{7 \cdot 20 + 1}{7} = \frac{141}{7}$

13.
$$7\overline{)\,20}\quad 2 \text{ R } 6$$
$$\underline{-14}$$
$$6$$

$$\frac{20}{7} = 2\frac{6}{7}$$

14.
$$11\overline{)\,55}\quad 5$$
$$\underline{-55}$$
$$0$$

$$\frac{55}{11} = 5$$

15.
$$8\overline{)\,39}\quad 4 \text{ R } 7$$
$$\underline{-32}$$
$$7$$

$$\frac{39}{8} = 4\frac{7}{8}$$

16.
$$11\overline{)\,98}\quad 8 \text{ R } 10$$
$$\underline{-88}$$
$$10$$

$$\frac{98}{11} = 8\frac{10}{11}$$

17. $1 \cdot 35 = 35$
$5 \cdot 7 = 35$
The factors of 35 are 1, 5, 7, and 35.

18. $1 \cdot 40 = 40$
$2 \cdot 20 = 40$
$4 \cdot 10 = 40$
$5 \cdot 8 = 40$
The factors of 40 are 1, 2, 4, 5, 8, 10, 20, and 40.

19. Composite since its factors are 1, 2, 3, 4, 6, 8, 9, 12, 18, 24, 36, and 72.

20. Prime, since its only factors are 1 and 13.

21.
$$5\overline{)65}\quad 13$$

$65 = 5 \cdot 13$

22.
$$5\overline{)35}\quad 7$$
$$2\overline{)70}$$

$70 = 2 \cdot 5 \cdot 7$

23.
$$2\overline{)\,6}\quad 3$$
$$2\overline{)12}$$
$$2\overline{)24}$$
$$2\overline{)48}$$
$$2\overline{)96}$$

$96 = 2^5 \cdot 3$

24.
$$3\overline{)\,33}\quad 11$$
$$2\overline{)\,66}$$
$$2\overline{)132}$$

$132 = 2^2 \cdot 3 \cdot 11$

25.
$$3\overline{)\,21}\quad 7$$
$$3\overline{)\,63}$$
$$3\overline{)126}$$
$$2\overline{)252}$$

$252 = 2^2 \cdot 3^2 \cdot 7$

26. Prime, since its only factors are 1 and 31.

27.
$$5\overline{)\,35}\quad 7$$
$$3\overline{)105}$$
$$3\overline{)315}$$

$315 = 3^2 \cdot 5 \cdot 7$

28.
$$7\overline{)\,49}\quad 7$$
$$3\overline{)147}$$
$$3\overline{)441}$$

$441 = 3^2 \cdot 7^2$

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29. $11\overline{)143}$, $2\overline{)286}$

$286 = 2 \cdot 11 \cdot 13$

30. Prime, since its only factor are 1 and 41.

31. $\frac{2}{14} = \frac{2 \cdot 1}{2 \cdot 7} = \frac{1}{7}$

32. $\frac{24}{20} = \frac{4 \cdot 6}{4 \cdot 5} = \frac{6}{5}$ or $1\frac{1}{5}$

33. $\frac{18}{38} = \frac{2 \cdot 9}{2 \cdot 19} = \frac{9}{19}$

34. $\frac{42}{110} = \frac{2 \cdot 21}{2 \cdot 55} = \frac{21}{55}$

35. $\frac{56}{60} = \frac{4 \cdot 14}{4 \cdot 15} = \frac{14}{15}$

36. $\frac{72}{80} = \frac{8 \cdot 9}{8 \cdot 10} = \frac{9}{10}$

37. $\frac{54}{135} = \frac{27 \cdot 2}{27 \cdot 5} = \frac{2}{5}$

38. $\frac{90}{240} = \frac{30 \cdot 3}{30 \cdot 8} = \frac{3}{8}$

39. $\frac{165}{210} = \frac{15 \cdot 11}{15 \cdot 14} = \frac{11}{14}$

40. $\frac{245}{385} = \frac{35 \cdot 7}{35 \cdot 11} = \frac{7}{11}$

41. Not equivalent, since the cross products are not equal: $8 \cdot 9 = 72$ and $10 \cdot 7 = 70$

42. Equivalent, since the cross products are equal: $12 \cdot 15 = 180$ and $18 \cdot 10 = 180$

43. a. $\frac{2 \text{ states}}{50 \text{ states}} = \frac{2 \cdot 1}{2 \cdot 25} = \frac{1}{25}$

$\frac{1}{25}$ of the states are not adjacent to any other states.

b. $50 - 2 = 48$

48 states are adjacent to other states.

c. $\frac{48 \text{ states}}{50 \text{ states}} = \frac{24 \cdot 2}{25 \cdot 2} = \frac{24}{25}$

$\frac{24}{25}$ of the states are adjacent to other states.

44. a. $\frac{22 \text{ films}}{42 \text{ films}} = \frac{2 \cdot 11}{2 \cdot 21} = \frac{11}{21}$

$\frac{11}{21}$ of the films were rated PG-13.

b. $42 - 22 = 20$

20 of the films were rated other than PG-13.

c. $\frac{20 \text{ films}}{42 \text{ films}} = \frac{2 \cdot 10}{2 \cdot 21} = \frac{10}{21}$

$\frac{10}{21}$ of the films were rated other than PG-13.

Section 2.4 Practice Exercises

1. $\frac{3}{8} \cdot \frac{5}{7} = \frac{3 \cdot 5}{8 \cdot 7} = \frac{15}{56}$

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

3. $\frac{6}{55} \cdot \frac{5}{8} = \frac{6 \cdot 5}{55 \cdot 8} = \frac{\overset{1}{\cancel{2}} \cdot 3 \cdot \overset{1}{\cancel{5}}}{\underset{1}{\cancel{5}} \cdot 11 \cdot \underset{1}{\cancel{2}} \cdot 2 \cdot 2} = \frac{3}{11 \cdot 2 \cdot 2} = \frac{3}{44}$

4. $\frac{4}{15} \cdot \frac{3}{8} = \frac{4 \cdot 3}{15 \cdot 8} = \frac{\overset{1}{\cancel{4}} \cdot \overset{1}{\cancel{3}}}{\underset{1}{\cancel{3}} \cdot 5 \cdot 2 \cdot \underset{1}{\cancel{4}}} = \frac{1}{5 \cdot 2} = \frac{1}{10}$

5. $\frac{2}{5} \cdot \frac{20}{7} = \frac{2 \cdot 20}{5 \cdot 7} = \frac{2 \cdot 4 \cdot \overset{1}{\cancel{5}}}{\underset{1}{\cancel{5}} \cdot 7} = \frac{8}{7}$

6. $\frac{4}{11} \cdot \frac{33}{16} = \frac{4 \cdot 33}{11 \cdot 16} = \frac{\overset{1}{\cancel{4}} \cdot 3 \cdot \overset{1}{\cancel{11}}}{\underset{1}{\cancel{11}} \cdot \underset{1}{\cancel{4}} \cdot 4} = \frac{3}{4}$

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7. $\frac{1}{6}\cdot\frac{3}{10}\cdot\frac{25}{16}=\frac{1\cdot3\cdot25}{6\cdot10\cdot16}=\frac{\overset{1}{\cancel{3}}\cdot\overset{1}{\cancel{5}}\cdot5}{2\cdot\underset{1}{\cancel{3}}\cdot2\cdot\underset{1}{\cancel{5}}\cdot16}=\frac{5}{64}$

8. $2\frac{1}{2}=\frac{5}{2}$

$2\frac{1}{2}\cdot\frac{8}{15}=\frac{5}{2}\cdot\frac{8}{15}=\frac{\overset{1}{\cancel{5}}\cdot\overset{1}{\cancel{2}}\cdot4}{\underset{1}{\cancel{2}}\cdot3\cdot\underset{1}{\cancel{5}}}=\frac{4}{3}$ or $1\frac{1}{3}$

9. $\frac{2}{3}\cdot18=\frac{2}{3}\cdot\frac{18}{1}=\frac{2\cdot18}{3\cdot1}=\frac{2\cdot\overset{1}{\cancel{3}}\cdot6}{\underset{1}{\cancel{3}}\cdot1}=\frac{12}{1}=12$

10. $3\frac{1}{5}\cdot2\frac{3}{4}=\frac{16}{5}\cdot\frac{11}{4}=\frac{16\cdot11}{5\cdot4}=\frac{\overset{1}{\cancel{4}}\cdot4\cdot11}{5\cdot\underset{1}{\cancel{4}}}=\frac{44}{5}$ or $8\frac{4}{5}$

11. $5\cdot3\frac{11}{15}=\frac{5}{1}\cdot\frac{56}{15}=\frac{5\cdot56}{1\cdot15}=\frac{\overset{1}{\cancel{5}}\cdot56}{1\cdot3\cdot\underset{1}{\cancel{5}}}=\frac{56}{3}$ or $18\frac{2}{3}$

12. $\frac{9}{11}\cdot0=0$

13. $0\cdot4\frac{1}{8}=0$

14. $\frac{5}{16}\cdot48=\frac{5}{16}\cdot\frac{48}{1}=\frac{5\cdot48}{16\cdot1}=\frac{5\cdot3\cdot16}{16\cdot1}=\frac{5\cdot3}{1}=15$

Thus, there are 15 roller coasters in Kings Dominion.

Vocabulary, Readiness & Video Check 2.4

1. To multiply two fractions, we write $\frac{a}{b}\cdot\frac{c}{d}=\frac{a\cdot c}{\underline{b\cdot d}}$.

2. Using the definition of an exponent, the expression $\frac{2^3}{7}=\frac{2\cdot2\cdot2}{\underline{7}}$ while $\left(\frac{2}{7}\right)^3=\underline{\frac{2}{7}\cdot\frac{2}{7}\cdot\frac{2}{7}}$.

3. The word "of" indicates <u>multiplication</u>.

4. $\frac{1}{5}\cdot0=\underline{0}$

5. There's a common factor of 2 in the numerator and denominator that can be divided out first.

6. To multiply mixed numbers, we first write them as equivalent improper fractions and then multiply as we multiply for fractions.

7. radius is $\frac{1}{2}$ of diameter

Exercise Set 2.4

2. $\frac{2}{3}\cdot\frac{4}{7}=\frac{2\cdot4}{3\cdot7}=\frac{8}{21}$

4. $\frac{7}{3}\cdot\frac{1}{4}=\frac{7\cdot1}{3\cdot4}=\frac{7}{12}$

6. $\frac{2}{5}\cdot\frac{7}{11}=\frac{2\cdot7}{5\cdot11}=\frac{14}{55}$

8. $\frac{7}{8}\cdot\frac{2}{3}=\frac{7\cdot2}{8\cdot3}=\frac{7\cdot2}{4\cdot2\cdot3}=\frac{7}{4\cdot3}=\frac{7}{12}$

10. $\frac{8}{3}\cdot\frac{5}{12}=\frac{8\cdot5}{3\cdot12}=\frac{4\cdot2\cdot5}{3\cdot4\cdot3}=\frac{2\cdot5}{3\cdot3}=\frac{10}{9}$ or $1\frac{1}{9}$

12. $\frac{4}{35}\cdot\frac{5}{24}=\frac{4\cdot5}{35\cdot24}=\frac{4\cdot5\cdot1}{5\cdot7\cdot4\cdot6}=\frac{1}{7\cdot6}=\frac{1}{42}$

14. $\frac{11}{12}\cdot0=0$

16. $\frac{1}{9}\cdot\frac{1}{13}=\frac{1\cdot1}{9\cdot13}=\frac{1}{117}$

18. $\frac{5}{32}\cdot\frac{64}{100}=\frac{5\cdot2\cdot32}{32\cdot5\cdot2\cdot10}=\frac{1}{10}$

20. $\frac{4}{5}\cdot\frac{8}{25}=\frac{4\cdot8}{5\cdot25}=\frac{32}{125}$

22. $\frac{27}{32}\cdot\frac{10}{13}\cdot\frac{16}{30}=\frac{27\cdot10\cdot16}{32\cdot13\cdot30}$

$=\frac{3\cdot9\cdot10\cdot16}{2\cdot16\cdot13\cdot3\cdot10}$

$=\frac{9}{2\cdot13}$

$=\frac{9}{26}$

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24. $\frac{3}{5}\cdot\frac{1}{2}\cdot\frac{3}{7}=\frac{3\cdot1\cdot3}{5\cdot2\cdot7}=\frac{9}{70}$

26. $\frac{8}{11}\cdot\frac{4}{7}\cdot0=0$

28. $\frac{7}{8}\cdot\frac{9}{20}\cdot\frac{12}{22}\cdot\frac{11}{14}=\frac{7\cdot9\cdot12\cdot11}{8\cdot20\cdot22\cdot14}$
$=\frac{7\cdot9\cdot3\cdot4\cdot11}{2\cdot4\cdot20\cdot2\cdot11\cdot2\cdot7}$
$=\frac{9\cdot3}{2\cdot20\cdot2\cdot2}$
$=\frac{27}{160}$

30. $11\frac{3}{4}$ rounds to 12.

32. $4\frac{1}{9}$ rounds to 4.

34. $18\frac{12}{22}$ rounds to 19.

36. $\frac{2}{3}\cdot6=\frac{2}{3}\cdot\frac{6}{1}=\frac{2\cdot6}{3\cdot1}=\frac{2\cdot2\cdot3}{3\cdot1}=\frac{2\cdot2}{1}=\frac{4}{1}=4$

38. $10\cdot\frac{7}{8}=\frac{10}{1}\cdot\frac{7}{8}$
$=\frac{10\cdot7}{1\cdot8}$
$=\frac{2\cdot5\cdot7}{1\cdot2\cdot4}$
$=\frac{5\cdot7}{1\cdot4}$
$=\frac{35}{4}$ or $8\frac{3}{4}$

40. $\frac{3}{22}\cdot3\frac{2}{3}=\frac{3}{22}\cdot\frac{11}{3}=\frac{3\cdot11}{22\cdot3}=\frac{3\cdot11}{2\cdot11\cdot3}=\frac{1}{2}$

42. $2\frac{1}{9}\cdot\frac{6}{7}=\frac{19}{9}\cdot\frac{6}{7}$
$=\frac{19\cdot6}{9\cdot7}$
$=\frac{19\cdot2\cdot3}{3\cdot3\cdot7}$
$=\frac{19\cdot2}{3\cdot7}$
$=\frac{38}{21}$ or $1\frac{17}{21}$

44. $1\cdot\frac{5}{9}=\frac{5}{9}$

46. Exact: $2\frac{1}{4}\cdot7\frac{1}{8}=\frac{9}{4}\cdot\frac{57}{8}=\frac{513}{32}$ or $16\frac{1}{32}$

Estimate: $2\frac{1}{4}$ rounds to 2, $7\frac{1}{8}$ rounds to 7.

$2\cdot7=14$, so the answer is reasonable.

48. Exact: $5\frac{5}{6}\cdot7\frac{3}{5}=\frac{35}{6}\cdot\frac{38}{5}$
$=\frac{35\cdot38}{6\cdot5}$
$=\frac{5\cdot7\cdot2\cdot19}{2\cdot3\cdot5}$
$=\frac{7\cdot19}{3}$
$=\frac{133}{3}$ or $44\frac{1}{3}$

Estimate: $5\frac{5}{6}$ rounds to 6, $7\frac{3}{5}$ rounds to 8.

$6\cdot8=48$, so the answer is reasonable.

50. $4\cdot3\frac{1}{3}=\frac{4}{1}\cdot\frac{10}{3}$
$=\frac{4\cdot10}{1\cdot3}$
$=\frac{40}{3}$ or $13\frac{1}{3}$

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52. $1\frac{1}{6}\cdot 7\frac{1}{5}=\frac{7}{6}\cdot\frac{36}{5}$
$=\frac{7\cdot 36}{6\cdot 5}$
$=\frac{7\cdot 6\cdot 6}{6\cdot 5}$
$=\frac{7\cdot 6}{5}$
$=\frac{42}{5}$ or $8\frac{2}{5}$

54. $\frac{7}{8}\cdot 24\cdot\frac{1}{3}=\frac{7}{8}\cdot\frac{24}{1}\cdot\frac{1}{3}$
$=\frac{7\cdot 24\cdot 1}{8\cdot 1\cdot 3}$
$=\frac{7\cdot 8\cdot 3\cdot 1}{8\cdot 3\cdot 1}$
$=\frac{7}{1}$
$=7$

56. $\frac{11}{14}\cdot 6\cdot 2\frac{2}{3}=\frac{11}{14}\cdot\frac{6}{1}\cdot\frac{8}{3}$
$=\frac{11\cdot 6\cdot 8}{14\cdot 1\cdot 3}$
$=\frac{11\cdot 2\cdot 3\cdot 8}{2\cdot 7\cdot 1\cdot 3}$
$=\frac{11\cdot 8}{7\cdot 1}$
$=\frac{88}{7}$ or $12\frac{4}{7}$

58. $4\frac{1}{2}\cdot 2\frac{1}{9}\cdot 1\frac{1}{5}=\frac{9}{2}\cdot\frac{19}{9}\cdot\frac{6}{5}$
$=\frac{9\cdot 19\cdot 6}{2\cdot 9\cdot 5}$
$=\frac{9\cdot 19\cdot 2\cdot 3}{2\cdot 9\cdot 5}$
$=\frac{19\cdot 3}{5}$
$=\frac{57}{5}$ or $11\frac{2}{5}$

60. $\frac{3}{8}\cdot\frac{5}{12}=\frac{3\cdot 5}{8\cdot 12}=\frac{3\cdot 5}{8\cdot 3\cdot 4}=\frac{5}{8\cdot 4}=\frac{5}{32}$

62. $0\cdot\frac{3}{31}=0$

64. $3\frac{1}{5}\cdot 2\frac{11}{32}=\frac{16}{5}\cdot\frac{75}{32}$
$=\frac{16\cdot 75}{5\cdot 32}$
$=\frac{16\cdot 5\cdot 15}{5\cdot 16\cdot 2}$
$=\frac{15}{2}$ or $7\frac{1}{2}$

66. $\frac{15}{2}\cdot\frac{3}{5}=\frac{15\cdot 3}{2\cdot 5}=\frac{5\cdot 3\cdot 3}{2\cdot 5}=\frac{3\cdot 3}{2}=\frac{9}{2}$ or $4\frac{1}{2}$

68. $\frac{9}{20}\cdot\frac{10}{90}=\frac{9\cdot 10}{20\cdot 90}=\frac{9\cdot 10}{20\cdot 9\cdot 10}=\frac{1}{20}$

70. $\frac{3}{80}\cdot\frac{2}{27}=\frac{3\cdot 2}{80\cdot 27}=\frac{3\cdot 2}{2\cdot 40\cdot 3\cdot 9}=\frac{1}{40\cdot 9}=\frac{1}{360}$

72. $30\cdot\frac{8}{9}=\frac{30}{1}\cdot\frac{8}{9}$
$=\frac{30\cdot 8}{1\cdot 9}$
$=\frac{3\cdot 10\cdot 8}{1\cdot 3\cdot 3}$
$=\frac{10\cdot 8}{1\cdot 3}$
$=\frac{80}{3}$ or $26\frac{2}{3}$

74. $4\frac{11}{13}\cdot 0\cdot 12\frac{1}{13}=0$

76. $14\frac{2}{5}\cdot 8\frac{1}{3}\cdot\frac{11}{16}=\frac{72}{5}\cdot\frac{25}{3}\cdot\frac{11}{16}$
$=\frac{72\cdot 25\cdot 11}{5\cdot 3\cdot 16}$
$=\frac{3\cdot 3\cdot 8\cdot 5\cdot 5\cdot 11}{5\cdot 3\cdot 2\cdot 8}$
$=\frac{3\cdot 5\cdot 11}{2}$
$=\frac{165}{2}$ or $82\frac{1}{2}$

78. $\frac{1}{5}\cdot 200=\frac{1}{5}\cdot\frac{200}{1}=\frac{1\cdot 200}{5\cdot 1}=\frac{1\cdot 5\cdot 40}{5\cdot 1}=\frac{40}{1}=40$

$\frac{1}{5}$ of 200 is 40.

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80. $\frac{5}{8}\cdot 24=\frac{5}{8}\cdot\frac{24}{1}=\frac{5\cdot 24}{8\cdot 1}=\frac{5\cdot 3\cdot 8}{8\cdot 1}=\frac{5\cdot 3}{1}=\frac{15}{1}=15$

$\frac{5}{8}$ of 24 is 15.

82. $\frac{1}{5}$ of $3000=\frac{1}{5}\cdot 3000$

$=\frac{1}{5}\cdot\frac{3000}{1}$

$=\frac{1\cdot 3000}{5\cdot 1}$

$=\frac{1\cdot 5\cdot 600}{5\cdot 1}$

$=600$

The diet can contain 600 calories from fat per day.

84. $\frac{12}{25}$ of 1300 million $=\frac{12}{25}\cdot 1,300,000,000$

$=\frac{12}{25}\cdot\frac{1,300,000,000}{1}$

$=\frac{12\cdot 1,300,000,000}{25\cdot 1}$

$=\frac{12\cdot 25\cdot 52,000,000}{25\cdot 1}$

$=\frac{12\cdot 52,000,000}{1}$

$=624,000,000$

In 2016, 624 million movie tickets were purchased by frequent moviegoers.

86. $\frac{3}{16}$ of $8=\frac{3}{16}\cdot 8$

$=\frac{3}{16}\cdot\frac{8}{1}$

$=\frac{3\cdot 8}{16\cdot 1}$

$=\frac{3\cdot 8}{8\cdot 2\cdot 1}$

$=\frac{3}{2\cdot 1}$

$=\frac{3}{2}$

The screw sinks $\frac{3}{2}$ or $1\frac{1}{2}$ inches deep after 8 turns.

88. $d=2\cdot r$

$=2\cdot\frac{7}{20}$

$=\frac{2}{1}\cdot\frac{7}{20}$

$=\frac{2\cdot 7}{1\cdot 20}$

$=\frac{2\cdot 7}{1\cdot 2\cdot 10}$

$=\frac{7}{10}$

The diameter is $\frac{7}{10}$ foot.

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

$\frac{8}{5}$ feet or $1\frac{3}{5}$ feet of the post is to be buried.

92. $2\cdot 17\frac{1}{2}=2\cdot\frac{35}{2}=\frac{2}{1}\cdot\frac{35}{2}=\frac{2\cdot 35}{1\cdot 2}=\frac{35}{1}=35$

Jock's waist measurement is 35 inches.

94. $\frac{1}{2}\cdot\frac{1}{3}=\frac{1\cdot 1}{2\cdot 3}=\frac{1}{6}$

$\frac{1}{6}$ of a cup of flour should be used.

96. $\frac{7}{10}\cdot 31,050=\frac{7}{10}\cdot\frac{31,050}{1}$

$=\frac{7\cdot 31,050}{10\cdot 1}$

$=\frac{7\cdot 3105\cdot 10}{10\cdot 1}$

$=\frac{7\cdot 3105}{1}$

$=\frac{21,735}{1}$

$=21,735$

21,735 tornadoes occurred during these four months.

98. $\frac{1}{2}\cdot\frac{3}{8}=\frac{1\cdot 3}{2\cdot 8}=\frac{3}{16}$

The area is $\frac{3}{16}$ of a square mile.

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100. $5 \cdot 3\frac{1}{2} = \frac{5}{1} \cdot \frac{7}{2} = \frac{5 \cdot 7}{1 \cdot 2} = \frac{35}{2}$ or $17\frac{1}{2}$

The area is $\frac{35}{2}$ square inches or $17\frac{1}{2}$ square inches.

102. $\frac{3}{25} \cdot 12{,}000 = \frac{3}{25} \cdot \frac{12{,}000}{1}$
$= \frac{3 \cdot 12{,}000}{25 \cdot 1}$
$= \frac{3 \cdot 25 \cdot 480}{25 \cdot 1}$
$= \frac{3 \cdot 480}{1}$
$= 1440$

The family drove 1440 miles for shopping.

104. $\frac{1}{100} \cdot 12{,}000 = \frac{1}{100} \cdot \frac{12{,}000}{1}$
$= \frac{1 \cdot 12{,}000}{100 \cdot 1}$
$= \frac{1 \cdot 120 \cdot 100}{100 \cdot 1}$
$= 120$

The family drove 120 miles for medical needs.

106.
$$\begin{array}{r} 560 \\ 7\overline{)\,3920} \\ -35 \\ \hline 42 \\ -42 \\ \hline 00 \\ -0 \\ \hline 0 \end{array}$$

108.
$$\begin{array}{r} 80 \text{ R } 20 \\ 31\overline{)\,2500} \\ -248 \\ \hline 20 \\ -0 \\ \hline 20 \end{array}$$

110. answers may vary

112. $5 \cdot 2\frac{1}{4} = \frac{5}{1} \cdot \frac{9}{4} = \frac{45}{4} = 11\frac{1}{4}$

114. $\frac{11}{12}$ rounds to 1

$4\frac{1}{16}$ rounds to 4

$1 \cdot 4 = 4$

The best estimate is c.

116. $7\frac{1}{4}$ rounds to 7

$4\frac{1}{5}$ rounds to 4

$7 \cdot 4 = 28$

The best estimate is d.

118. $\frac{14}{25}$ of 250 million $= \frac{14}{25} \cdot 250{,}000{,}000$
$= \frac{14}{25} \cdot \frac{250{,}000{,}000}{1}$
$= \frac{14 \cdot 250{,}000{,}000}{25 \cdot 1}$
$= \frac{14 \cdot 25 \cdot 10{,}000{,}000}{25 \cdot 1}$
$= \frac{14 \cdot 10{,}000{,}000}{1}$
$= 140{,}000{,}000$

Approximately 140 million U.S. adults owned a smartphone in 2016.

120. $\frac{1}{9}$ of $317{,}295{,}000 = \frac{1}{9} \cdot 317{,}295{,}000$
$= \frac{1}{9} \cdot \frac{317{,}295{,}000}{1}$
$= \frac{1 \cdot 317{,}295{,}000}{9 \cdot 1}$
$= \frac{9 \cdot 35{,}255{,}000}{9}$
$= 35{,}255{,}000$

The approximate population of California is 35,255,000.

Section 2.5 Practice Exercises

1. The reciprocal of $\frac{4}{9}$ is $\frac{9}{4}$.

2. The reciprocal of $\frac{15}{7}$ is $\frac{7}{15}$.

3. The reciprocal of 9, or $\frac{9}{1}$, is $\frac{1}{9}$.

4. The reciprocal of $\frac{1}{8}$ is $\frac{8}{1}$ or 8.

5. $\frac{3}{2} \div \frac{14}{5} = \frac{3}{2} \cdot \frac{5}{14} = \frac{3 \cdot 5}{2 \cdot 14} = \frac{15}{28}$

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6. $\frac{8}{7} \div \frac{2}{9} = \frac{8}{7} \cdot \frac{9}{2} = \frac{8 \cdot 9}{7 \cdot 2} = \frac{4 \cdot \cancel{2}^{1} \cdot 9}{7 \cdot \cancel{2}_{1}} = \frac{36}{7}$ or $5\frac{1}{7}$

7. $\frac{4}{9} \div \frac{1}{2} = \frac{4}{9} \cdot \frac{2}{1} = \frac{4 \cdot 2}{9 \cdot 1} = \frac{8}{9}$

8. $\frac{14}{17} \div 0$ is undefined.

9. $0 \div \frac{1}{8} = 0 \cdot \frac{8}{1} = 0$

10. $\frac{4}{9} \div 7 = \frac{4}{9} \div \frac{7}{1} = \frac{4}{9} \cdot \frac{1}{7} = \frac{4 \cdot 1}{9 \cdot 7} = \frac{4}{63}$

11.
$$\frac{8}{15} \div 3\frac{4}{5} = \frac{8}{15} \div \frac{19}{5}$$
$$= \frac{8}{15} \cdot \frac{5}{19}$$
$$= \frac{8 \cdot 5}{15 \cdot 19}$$
$$= \frac{8 \cdot \cancel{5}^{1}}{3 \cdot \cancel{5}_{1} \cdot 19}$$
$$= \frac{8}{57}$$

12.
$$3\frac{2}{7} \div 2\frac{3}{14} = \frac{23}{7} \div \frac{31}{14}$$
$$= \frac{23}{7} \cdot \frac{14}{31}$$
$$= \frac{23 \cdot 14}{7 \cdot 31}$$
$$= \frac{23 \cdot 2 \cdot \cancel{7}^{1}}{\cancel{7}_{1} \cdot 31}$$
$$= \frac{46}{31} \text{ or } 1\frac{15}{31}$$

13. Number of outfits | is | 30 | divided by | $2\frac{1}{7}$

↓ ↓ ↓ ↓ ↓

Number of outfits = 30 ÷ $2\frac{1}{7}$

$$30 \div 2\frac{1}{7} = 30 \div \frac{15}{7}$$
$$= \frac{30}{1} \cdot \frac{7}{15}$$
$$= \frac{30 \cdot 7}{1 \cdot 15}$$
$$= \frac{2 \cdot \cancel{15}^{1} \cdot 7}{1 \cdot \cancel{15}_{1}} = \frac{14}{1}$$
$$= 14$$

14 outfits can be made from a 30-yard bolt of material.

Vocabulary, Readiness & Video Check 2.5

1. Two numbers are reciprocals of each other if their product is 1.

2. Every number has a reciprocal except 0.

3. To divide two fractions, we write $\frac{a}{b} \div \frac{c}{d} = \frac{a \cdot d}{b \cdot c}$.

4. The word "per" usually indicates division.

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

6. 0

7. Because we still have a division problem and we can't divide out common factors until we rewrite the division as a multiplication.

8. equally divided

Exercise Set 2.5

2. The reciprocal of $\frac{9}{10}$ is $\frac{10}{9}$.

4. The reciprocal of $\frac{1}{20}$ is $\frac{20}{1}$ or 20.

6. The reciprocal of $13 = \frac{13}{1}$ is $\frac{1}{13}$.

8. The reciprocal of $\frac{10}{3}$ is $\frac{3}{10}$.

10. $\frac{5}{8} \div \frac{2}{3} = \frac{5}{8} \cdot \frac{3}{2} = \frac{5 \cdot 3}{8 \cdot 2} = \frac{15}{16}$

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12. $\frac{10}{11} \div \frac{4}{5} = \frac{10}{11} \cdot \frac{5}{4}$
$= \frac{10 \cdot 5}{11 \cdot 4}$
$= \frac{2 \cdot 5 \cdot 5}{11 \cdot 2 \cdot 2}$
$= \frac{5 \cdot 5}{11 \cdot 2}$
$= \frac{25}{22}$ or $1\frac{3}{22}$

14. $\frac{16}{27} \div \frac{8}{15} = \frac{16}{27} \cdot \frac{15}{8}$
$= \frac{16 \cdot 15}{27 \cdot 8}$
$= \frac{8 \cdot 2 \cdot 3 \cdot 5}{3 \cdot 9 \cdot 8}$
$= \frac{2 \cdot 5}{9}$
$= \frac{10}{9}$ or $1\frac{1}{9}$

16. $\frac{11}{16} \div \frac{13}{16} = \frac{11}{16} \cdot \frac{16}{13} = \frac{11 \cdot 16}{16 \cdot 13} = \frac{11}{13}$

18. $\frac{3}{13} \div \frac{13}{3} = \frac{3}{13} \cdot \frac{3}{13} = \frac{3 \cdot 3}{13 \cdot 13} = \frac{9}{169}$

20. $\frac{6}{11} \div \frac{6}{5} = \frac{6}{11} \cdot \frac{5}{6} = \frac{6 \cdot 5}{11 \cdot 6} = \frac{5}{11}$

22. $\frac{7}{8} \div \frac{5}{6} = \frac{7}{8} \cdot \frac{6}{5}$
$= \frac{7 \cdot 6}{8 \cdot 5}$
$= \frac{7 \cdot 2 \cdot 3}{2 \cdot 4 \cdot 5}$
$= \frac{7 \cdot 3}{4 \cdot 5}$
$= \frac{21}{20}$ or $1\frac{1}{20}$

24. $\frac{14}{52} \div \frac{1}{13} = \frac{14}{52} \cdot \frac{13}{1}$
$= \frac{14 \cdot 13}{52 \cdot 1}$
$= \frac{2 \cdot 7 \cdot 13}{2 \cdot 2 \cdot 13 \cdot 1}$
$= \frac{7}{2 \cdot 1}$
$= \frac{7}{2}$ or $3\frac{1}{2}$

26. $\frac{1}{3} \div \frac{6}{17} = \frac{1}{3} \cdot \frac{17}{6} = \frac{1 \cdot 17}{3 \cdot 6} = \frac{17}{18}$

28. $\frac{6}{15} \div \frac{7}{10} = \frac{6}{15} \cdot \frac{10}{7} = \frac{6 \cdot 10}{15 \cdot 7} = \frac{2 \cdot 3 \cdot 2 \cdot 5}{3 \cdot 5 \cdot 7} = \frac{2 \cdot 2}{7} = \frac{4}{7}$

30. $\frac{7}{13} \div \frac{7}{13} = \frac{7}{13} \cdot \frac{13}{7} = \frac{7 \cdot 13}{13 \cdot 7} = 1$

32. $0 \div \frac{4}{11} = 0 \cdot \frac{11}{4} = 0$

34. $\frac{2}{3} \div 0$ is undefined.

36. $\frac{65}{495} \div \frac{26}{231} = \frac{65}{495} \cdot \frac{231}{26}$
$= \frac{65 \cdot 231}{495 \cdot 26}$
$= \frac{5 \cdot 13 \cdot 3 \cdot 7 \cdot 11}{3 \cdot 3 \cdot 5 \cdot 11 \cdot 2 \cdot 13}$
$= \frac{7}{2 \cdot 3}$
$= \frac{7}{6}$ or $1\frac{1}{6}$

38. $\frac{5}{6} \div 10 = \frac{5}{6} \cdot \frac{1}{10} = \frac{5 \cdot 1}{6 \cdot 10} = \frac{5 \cdot 1}{6 \cdot 2 \cdot 5} = \frac{1}{6 \cdot 2} = \frac{1}{12}$

40. $7 \div \frac{2}{11} = \frac{7}{1} \cdot \frac{11}{2} = \frac{7 \cdot 11}{1 \cdot 2} = \frac{77}{2}$ or $38\frac{1}{2}$

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42. $4\frac{2}{3} \div \frac{2}{5} = \frac{14}{3} \div \frac{2}{5}$
$= \frac{14}{3} \cdot \frac{5}{2}$
$= \frac{14 \cdot 5}{3 \cdot 2}$
$= \frac{2 \cdot 7 \cdot 5}{3 \cdot 2}$
$= \frac{7 \cdot 5}{3}$
$= \frac{35}{3}$ or $11\frac{2}{3}$

44. $\frac{4}{15} \div 2\frac{1}{2} = \frac{4}{15} \div \frac{5}{2} = \frac{4}{15} \cdot \frac{2}{5} = \frac{4 \cdot 2}{15 \cdot 5} = \frac{8}{75}$

46. $2\frac{5}{6} \div 4\frac{6}{7} = \frac{17}{6} \div \frac{34}{7}$
$= \frac{17}{6} \cdot \frac{7}{34}$
$= \frac{17 \cdot 7}{6 \cdot 34}$
$= \frac{17 \cdot 7}{6 \cdot 2 \cdot 17}$
$= \frac{7}{6 \cdot 2}$
$= \frac{7}{12}$

48. $3\frac{1}{10} \div 2\frac{1}{5} = \frac{31}{10} \div \frac{11}{5}$
$= \frac{31}{10} \cdot \frac{5}{11}$
$= \frac{31 \cdot 5}{10 \cdot 11}$
$= \frac{31 \cdot 5}{2 \cdot 5 \cdot 11}$
$= \frac{31}{2 \cdot 11}$
$= \frac{31}{22}$ or $1\frac{9}{22}$

50. $\frac{33}{50} \div 1 = \frac{33}{50} \div \frac{1}{1} = \frac{33}{50} \cdot \frac{1}{1} = \frac{33 \cdot 1}{50 \cdot 1} = \frac{33}{50}$

52. $0 \div 7\frac{9}{10} = 0 \div \frac{79}{10} = 0 \cdot \frac{10}{79} = 0$

54. $\frac{17}{75} \div 1 = \frac{17}{75} \div \frac{1}{1} = \frac{17}{75} \cdot \frac{1}{1} = \frac{17 \cdot 1}{75 \cdot 1} = \frac{17}{75}$

56. $20\frac{5}{6} \div 137\frac{1}{2} = \frac{125}{6} \div \frac{275}{2}$
$= \frac{125}{6} \cdot \frac{2}{275}$
$= \frac{125 \cdot 2}{6 \cdot 275}$
$= \frac{5 \cdot 25 \cdot 2}{2 \cdot 3 \cdot 25 \cdot 11}$
$= \frac{5}{3 \cdot 11}$
$= \frac{5}{33}$

58. $\frac{4}{15} \div \frac{8}{3} = \frac{4}{15} \cdot \frac{3}{8} = \frac{4 \cdot 3}{15 \cdot 8} = \frac{4 \cdot 3}{5 \cdot 3 \cdot 4 \cdot 2} = \frac{1}{5 \cdot 2} = \frac{1}{10}$

60. $\frac{9}{20} \div \frac{2}{9} = \frac{9}{20} \cdot \frac{9}{2} = \frac{9 \cdot 9}{20 \cdot 2} = \frac{81}{40}$ or $2\frac{1}{40}$

62. $9 \div \frac{1}{6} = \frac{9}{1} \div \frac{1}{6} = \frac{9}{1} \cdot \frac{6}{1} = \frac{9 \cdot 6}{1 \cdot 1} = \frac{54}{1} = 54$

64. $\frac{3}{8} \div \frac{5}{8} = \frac{3}{8} \cdot \frac{8}{5} = \frac{3 \cdot 8}{8 \cdot 5} = \frac{3}{5}$

66. $20\frac{1}{5} \div 0$ is undefined.

68. $\frac{13}{84} \div \frac{3}{16} = \frac{13}{84} \cdot \frac{16}{3} = \frac{13 \cdot 16}{84 \cdot 3} \cdot \frac{13 \cdot 4 \cdot 4}{4 \cdot 21 \cdot 3} = \frac{13 \cdot 4}{21 \cdot 3} = \frac{52}{63}$

70. $8\frac{2}{7} \div 3\frac{1}{7} = \frac{58}{7} \div \frac{22}{7}$
$= \frac{58}{7} \cdot \frac{7}{22}$
$= \frac{58 \cdot 7}{7 \cdot 22}$
$= \frac{2 \cdot 29 \cdot 7}{7 \cdot 2 \cdot 11}$
$= \frac{29}{11}$ or $2\frac{7}{11}$

72. $\frac{25}{128} \div \frac{5}{32} = \frac{25}{128} \cdot \frac{32}{5}$
$= \frac{25 \cdot 32}{128 \cdot 5}$
$= \frac{5 \cdot 5 \cdot 32}{32 \cdot 4 \cdot 5}$
$= \frac{5}{4}$ or $1\frac{1}{4}$

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74. $27\frac{3}{4} \div \frac{1}{4} = \frac{111}{4} \div \frac{1}{4} = \frac{111}{4} \cdot \frac{4}{1} = \frac{111}{1} = 111$

This will make 111 quarter-pound hamburgers.

76. $13\frac{1}{3} \div 4 = \frac{40}{3} \div \frac{4}{1}$

$$= \frac{40}{3} \cdot \frac{1}{4}$$
$$= \frac{40 \cdot 1}{3 \cdot 4}$$
$$= \frac{4 \cdot 10 \cdot 1}{3 \cdot 4}$$
$$= \frac{10 \cdot 1}{3}$$
$$= \frac{10}{3} \text{ or } 3\frac{1}{3}$$

Each ounce of lean hamburger meat has $\frac{10}{3}$ or $3\frac{1}{3}$ grams of fat.

78. $125 \div 2\frac{3}{5} = \frac{125}{1} \div \frac{13}{5}$

$$= \frac{125}{1} \cdot \frac{5}{13}$$
$$= \frac{125 \cdot 5}{1 \cdot 13}$$
$$= \frac{625}{13} \text{ or } 48\frac{1}{13}$$

The worker can complete the order in $\frac{625}{13}$ hours or $48\frac{1}{13}$ hours.

80. $450 \div \frac{3}{4} = \frac{450}{1} \cdot \frac{4}{3}$

$$= \frac{450 \cdot 4}{1 \cdot 3}$$
$$= \frac{3 \cdot 150 \cdot 4}{1 \cdot 3}$$
$$= \frac{150 \cdot 4}{1}$$
$$= \frac{600}{1}$$
$$= 600$$

The cost of one carat is \$600.

82. $23\frac{1}{2} \div 4 = \frac{47}{2} \div \frac{4}{1} = \frac{47}{2} \cdot \frac{1}{4} = \frac{47 \cdot 1}{2 \cdot 4} = \frac{47}{8}$ or $5\frac{7}{8}$

The length of each side of the square is $5\frac{7}{8}$ feet.

84. $\frac{2}{5} \div \frac{4}{7} = \frac{2}{5} \cdot \frac{7}{4} = \frac{2 \cdot 7}{5 \cdot 4} = \frac{2 \cdot 7}{5 \cdot 2 \cdot 2} = \frac{7}{5 \cdot 2} = \frac{7}{10}$

86. $2\frac{2}{3} \cdot 1\frac{1}{16} = \frac{8}{3} \cdot \frac{17}{16}$

$$= \frac{8 \cdot 17}{3 \cdot 16}$$
$$= \frac{8 \cdot 17}{3 \cdot 8 \cdot 2}$$
$$= \frac{17}{3 \cdot 2}$$
$$= \frac{17}{6} \text{ or } 2\frac{5}{6}$$

88. $8\frac{1}{6} \cdot \frac{3}{7} \cdot \frac{18}{25} = \frac{49}{6} \cdot \frac{3}{7} \cdot \frac{18}{25}$

$$= \frac{49 \cdot 3 \cdot 18}{6 \cdot 7 \cdot 25}$$
$$= \frac{7 \cdot 7 \cdot 3 \cdot 6 \cdot 3}{6 \cdot 7 \cdot 25}$$
$$= \frac{7 \cdot 3 \cdot 3}{25}$$
$$= \frac{63}{25} \text{ or } 2\frac{13}{25}$$

90. $2\frac{1}{5} \div 1\frac{7}{10} = \frac{11}{5} \div \frac{17}{10}$

$$= \frac{11}{5} \cdot \frac{10}{17}$$
$$= \frac{11 \cdot 10}{5 \cdot 17}$$
$$= \frac{11 \cdot 2 \cdot 5}{5 \cdot 17}$$
$$= \frac{11 \cdot 2}{17}$$
$$= \frac{22}{17} \text{ or } 1\frac{5}{17}$$

92.
$$\begin{array}{r} {\scriptstyle 11} \\ 811 \\ 42 \\ +\ 69 \\ \hline 922 \end{array}$$

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94.
$$\begin{array}{r} 882 \\ -\ 773 \\ \hline 109 \end{array}$$

96.
$$\begin{array}{r} 500 \\ -\ 92 \\ \hline 408 \end{array}$$

98. $6\frac{1}{4} \div \frac{1}{2} = \frac{25}{4} \cdot \frac{2}{1} = \frac{50}{4} = 12\frac{2}{4}$ or $12\frac{1}{2}$

100. $\frac{11}{12}$ rounds to 1

$16\frac{1}{5}$ rounds to 16

$1 \div 16 = \frac{1}{1} \div \frac{16}{1} = \frac{1}{1} \cdot \frac{1}{16} = \frac{1 \cdot 1}{1 \cdot 16} = \frac{1}{16}$

The best estimate is a.

102. $10\frac{1}{4}$ rounds to 10

$2\frac{1}{16}$ rounds to 2

$10 \div 2 = 5$

The best estimate is b.

104.
$$\left(\frac{8}{13} \cdot \frac{39}{16} \cdot \frac{8}{9}\right)^2 \div \frac{1}{2} = \left(\frac{8 \cdot 39 \cdot 8}{13 \cdot 16 \cdot 9}\right)^2 \div \frac{1}{2}$$
$$= \left(\frac{2 \cdot 4 \cdot 13 \cdot 3 \cdot 8}{13 \cdot 2 \cdot 8 \cdot 3 \cdot 3}\right)^2 \div \frac{1}{2}$$
$$= \left(\frac{4}{3}\right)^2 \div \frac{1}{2}$$
$$= \frac{4}{3} \cdot \frac{4}{3} \div \frac{1}{2}$$
$$= \frac{4 \cdot 4}{3 \cdot 3} \div \frac{1}{2}$$
$$= \frac{16}{9} \div \frac{1}{2}$$
$$= \frac{16}{9} \cdot \frac{2}{1}$$
$$= \frac{16 \cdot 2}{9 \cdot 1}$$
$$= \frac{32}{9} \text{ or } 3\frac{5}{9}$$

106.
$$5144 \div \frac{1}{3} = \frac{5144}{1} \cdot \frac{3}{1}$$
$$= \frac{5144 \cdot 3}{1 \cdot 1}$$
$$= \frac{15,432}{1}$$
$$= 15,432$$

There are 15,432 flowering plant species native to the United States.

108. answers may vary

Chapter 2 Vocabulary Check

1. Two numbers are reciprocals of each other if their product is 1.

2. A composite number is a natural number greater than 1 that is not prime.

3. Fractions that represent the same portion of a whole are called equivalent fractions.

4. An improper fraction is a fraction whose numerator is greater than or equal to its denominator.

5. A prime number is a natural number that has exactly two different factors, 1 and itself.

6. A fraction is in simplest form when the numerator and the denominator have no factors in common other than 1.

7. A proper fraction is one whose numerator is less than its denominator.

8. A mixed number contains a whole number part and a fraction part.

9. In the fraction $\frac{7}{9}$, the 7 is called the numerator and the 9 is called the denominator.

10. The prime factorization of a number is the factorization in which all the factors are prime numbers.

11. The fraction $\frac{3}{0}$ is undefined.

12. The fraction $\frac{0}{5} = 0$.

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13. In $\frac{a}{b}=\frac{c}{d}$, $a \cdot d$ and $b \cdot c$ are called cross products.

Chapter 2 Review

1. $\frac{11}{23}$ is a proper fraction.

2. $\frac{9}{8}$ is an improper fraction.

3. $\frac{1}{2}$ is a proper fraction.

4. $2\frac{1}{4}$ is a mixed number.

5. 2 of the 6 equal parts are shaded: $\frac{2}{6}$

6. 4 of the 7 equal parts are shaded: $\frac{4}{7}$

7. Each part is $\frac{1}{3}$ of a whole and 7 parts are shaded: $\frac{7}{3}$

8. Each part is $\frac{1}{4}$ of a whole and 13 parts are shaded: $\frac{13}{4}$

9. free throws made $\rightarrow$ 11
free throws during game $\rightarrow$ 12
The player made $\frac{11}{12}$ of his free throws.

10. a. $131 - 23 = 108$
108 cars on the lot are not blue.

b. There are 131 cars, of which 108 are not blue. $\frac{108}{131}$ of the cars are not blue.

11.
$$\begin{array}{r} 3 \text{ R } 3 \\ 4\overline{)\,15} \\ \underline{-12} \\ 3 \end{array}$$
$\frac{15}{4}=3\frac{3}{4}$

12.
$$\begin{array}{r} 45 \text{ R } 5 \\ 6\overline{)\,275} \\ \underline{-24} \\ 35 \\ \underline{-30} \\ 5 \end{array}$$
$\frac{275}{6}=45\frac{5}{6}$

13.
$$\begin{array}{r} 3 \\ 13\overline{)\,39} \\ \underline{-39} \\ 0 \end{array}$$
$\frac{39}{13}=3$

14.
$$\begin{array}{r} 5 \\ 12\overline{)\,60} \\ \underline{-60} \\ 0 \end{array}$$
$\frac{60}{12}=5$

15. $1\frac{1}{5}=\frac{5\cdot 1+1}{5}=\frac{6}{5}$

16. $1\frac{1}{21}=\frac{21\cdot 1+1}{21}=\frac{22}{21}$

17. $2\frac{8}{9}=\frac{9\cdot 2+8}{9}=\frac{26}{9}$

18. $3\frac{11}{12}=\frac{12\cdot 3+11}{12}=\frac{47}{12}$

19. Composite, since the factors of 51 are 1, 3, 17, and 51.

20. Prime, since the only factors of 17 are 1 and 17.

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21. $1 \cdot 42 = 42$
$2 \cdot 21 = 42$
$3 \cdot 14 = 42$
$6 \cdot 7 = 42$
The factors of 42 are 1, 2, 3, 6, 7, 14, 21, and 42.

22. $1 \cdot 20 = 20$
$2 \cdot 10 = 20$
$4 \cdot 5 = 20$
The factors of 20 are 1, 2, 4, 5, 10, and 20.

23.
$$\begin{array}{r} 17 \\ 2\overline{)34} \\ 2\overline{)68} \end{array}$$
$68 = 2^2 \cdot 17$

24.
$$\begin{array}{r} 5 \\ 3\overline{)15} \\ 3\overline{)45} \\ 2\overline{)90} \end{array}$$
$90 = 2 \cdot 3^2 \cdot 5$

25.
$$\begin{array}{r} 157 \\ 5\overline{)785} \end{array}$$
$785 = 5 \cdot 157$

26.
$$\begin{array}{r} 17 \\ 5\overline{)\ 85} \\ 3\overline{)255} \end{array}$$
$255 = 3 \cdot 5 \cdot 17$

27. $\frac{12}{28} = \frac{3 \cdot 4}{7 \cdot 4} = \frac{3}{7}$

28. $\frac{15}{27} = \frac{3 \cdot 5}{3 \cdot 9} = \frac{5}{9}$

29. $\frac{25}{75} = \frac{25 \cdot 1}{25 \cdot 3} = \frac{1}{3}$

30. $\frac{36}{72} = \frac{36 \cdot 1}{36 \cdot 2} = \frac{1}{2}$

31. $\frac{29}{32} = \frac{29}{32}$
29 and 32 have no common factors other than 1.

32. $\frac{18}{23} = \frac{18}{23}$
18 and 23 have no common factors other than 1.

33. $\frac{48}{6} = \frac{6 \cdot 8}{6 \cdot 1} = \frac{8}{1} = 8$

34. $\frac{54}{9} = \frac{6 \cdot 9}{1 \cdot 9} = \frac{6}{1} = 6$

35. $\frac{8 \text{ inches}}{12 \text{ inches}} = \frac{8}{12} = \frac{4 \cdot 2}{4 \cdot 3} = \frac{2}{3}$
8 inches represents $\frac{2}{3}$ of a foot.

36. $15 - 6 = 9$ cars are not white.
$\frac{9 \text{ non-white cars}}{15 \text{ total cars}} = \frac{9}{15} = \frac{3 \cdot 3}{3 \cdot 5} = \frac{3}{5}$
$\frac{3}{5}$ of the cars are not white.

37. Not equivalent, since the cross products are not equal: $34 \cdot 4 = 136$ and $14 \cdot 10 = 140$

38. Equivalent, since the cross products are equal: $50 \cdot 9 = 450$ and $15 \cdot 30 = 450$

39. $\frac{3}{5} \cdot \frac{1}{2} = \frac{3 \cdot 1}{5 \cdot 2} = \frac{3}{10}$

40. $\frac{6}{7} \cdot \frac{5}{12} = \frac{6 \cdot 5}{7 \cdot 12} = \frac{6 \cdot 5}{7 \cdot 6 \cdot 2} = \frac{5}{7 \cdot 2} = \frac{5}{14}$

41. $\frac{24}{5} \cdot \frac{15}{8} = \frac{24 \cdot 15}{5 \cdot 8} = \frac{3 \cdot 8 \cdot 3 \cdot 5}{5 \cdot 8} = \frac{3 \cdot 3}{1} = 9$

42. $\frac{27}{21} \cdot \frac{7}{18} = \frac{27 \cdot 7}{21 \cdot 18} = \frac{9 \cdot 3 \cdot 7}{7 \cdot 3 \cdot 9 \cdot 2} = \frac{1}{2}$

43. $5 \cdot \frac{7}{8} = \frac{5}{1} \cdot \frac{7}{8} = \frac{5 \cdot 7}{1 \cdot 8} = \frac{35}{8}$ or $4\frac{3}{8}$

44. $6 \cdot \frac{5}{12} = \frac{6}{1} \cdot \frac{5}{12} = \frac{6 \cdot 5}{1 \cdot 12} = \frac{6 \cdot 5}{1 \cdot 6 \cdot 2} = \frac{5}{1 \cdot 2} = \frac{5}{2}$ or $2\frac{1}{2}$

45. $\frac{39}{3} \cdot \frac{7}{13} \cdot \frac{5}{21} = \frac{39 \cdot 7 \cdot 5}{3 \cdot 13 \cdot 21} = \frac{3 \cdot 13 \cdot 7 \cdot 5}{3 \cdot 13 \cdot 7 \cdot 3} = \frac{5}{3}$ or $1\frac{2}{3}$

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46. $\frac{42}{5}\cdot\frac{15}{6}\cdot\frac{7}{9}=\frac{42\cdot15\cdot7}{5\cdot6\cdot9}$
$=\frac{6\cdot7\cdot3\cdot5\cdot7}{5\cdot6\cdot3\cdot3}$
$=\frac{7\cdot7}{3}$
$=\frac{49}{3}$ or $16\frac{1}{3}$

47. Exact: $1\frac{5}{8}\cdot3\frac{1}{5}=\frac{13}{8}\cdot\frac{16}{5}$
$=\frac{13\cdot16}{8\cdot5}$
$=\frac{13\cdot8\cdot2}{8\cdot5}$
$=\frac{13\cdot2}{5}$
$=\frac{26}{5}$ or $5\frac{1}{5}$

Estimate: $1\frac{5}{8}$ rounds to 2, $3\frac{1}{5}$ rounds to 3.
$2\cdot3=6$

48. Exact: $3\frac{6}{11}\cdot1\frac{7}{13}=\frac{39}{11}\cdot\frac{20}{13}$
$=\frac{39\cdot20}{11\cdot13}$
$=\frac{13\cdot3\cdot20}{11\cdot13}$
$=\frac{3\cdot20}{11}$
$=\frac{60}{11}$ or $5\frac{5}{11}$

Estimate: $3\frac{6}{11}$ rounds to 4, $1\frac{7}{13}$ rounds to 2.
$4\cdot2=8$

49. $\frac{3}{4}\cdot8\cdot4\frac{1}{8}=\frac{3}{4}\cdot\frac{8}{1}\cdot\frac{33}{8}$
$=\frac{3\cdot8\cdot33}{4\cdot1\cdot8}$
$=\frac{3\cdot33}{4\cdot1}$
$=\frac{99}{4}$ or $24\frac{3}{4}$

50. $2\frac{1}{9}\cdot3\cdot\frac{1}{38}=\frac{19}{9}\cdot\frac{3}{1}\cdot\frac{1}{38}$
$=\frac{19\cdot3\cdot1}{9\cdot1\cdot38}$
$=\frac{19\cdot3\cdot1}{3\cdot3\cdot1\cdot2\cdot19}$
$=\frac{1}{3\cdot1\cdot2}$
$=\frac{1}{6}$

51. $5\cdot7\frac{1}{3}=\frac{5}{1}\cdot\frac{22}{3}=\frac{5\cdot22}{1\cdot3}=\frac{110}{3}$ or $36\frac{2}{3}$

A 5-ounce hamburger patty has $\frac{110}{3}$ grams or $36\frac{2}{3}$ grams of fat.

52. $45\cdot\frac{3}{4}=\frac{45}{1}\cdot\frac{3}{4}=\frac{45\cdot3}{1\cdot4}=\frac{135}{4}$ or $33\frac{3}{4}$

The art teacher needs $\frac{135}{4}$ inches or $33\frac{3}{4}$ inches of piping.

53. $\frac{7}{10}\cdot2\frac{1}{8}=\frac{7}{10}\cdot\frac{17}{8}=\frac{7\cdot17}{10\cdot8}=\frac{119}{80}$ or $1\frac{39}{80}$

The area is $\frac{119}{80}$ square inches or $1\frac{39}{80}$ square inches.

54. $6\frac{7}{8}\cdot5=\frac{55}{8}\cdot\frac{5}{1}=\frac{55\cdot5}{8\cdot1}=\frac{275}{8}$ or $34\frac{3}{8}$

The area is $\frac{275}{8}$ square meters or $34\frac{3}{8}$ square meters.

55. The reciprocal of 7, or $\frac{7}{1}$, is $\frac{1}{7}$.

56. The reciprocal of $\frac{1}{8}$ is $\frac{8}{1}$ or 8.

57. The reciprocal of $\frac{14}{23}$ is $\frac{23}{14}$.

58. The reciprocal of $\frac{17}{5}$ is $\frac{5}{17}$.

59. $\frac{3}{4}\div\frac{3}{8}=\frac{3}{4}\cdot\frac{8}{3}=\frac{3\cdot8}{4\cdot3}=\frac{3\cdot4\cdot2}{4\cdot3}=\frac{2}{1}=2$

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60. $\frac{21}{4} \div \frac{7}{5} = \frac{21}{4} \cdot \frac{5}{7}$
$= \frac{21 \cdot 5}{4 \cdot 7}$
$= \frac{3 \cdot 7 \cdot 5}{4 \cdot 7}$
$= \frac{3 \cdot 5}{4}$
$= \frac{15}{4}$ or $3\frac{3}{4}$

61. $\frac{5}{3} \div 2 = \frac{5}{3} \div \frac{2}{1} = \frac{5}{3} \cdot \frac{1}{2} = \frac{5 \cdot 1}{3 \cdot 2} = \frac{5}{6}$

62. $5 \div \frac{15}{8} = \frac{5}{1} \cdot \frac{8}{15} = \frac{5 \cdot 8}{1 \cdot 15} = \frac{5 \cdot 8}{1 \cdot 5 \cdot 3} = \frac{8}{1 \cdot 3} = \frac{8}{3}$ or $2\frac{2}{3}$

63. $6\frac{3}{4} \div 1\frac{2}{7} = \frac{27}{4} \div \frac{9}{7}$
$= \frac{27}{4} \cdot \frac{7}{9}$
$= \frac{27 \cdot 7}{4 \cdot 9}$
$= \frac{3 \cdot 9 \cdot 7}{4 \cdot 9}$
$= \frac{3 \cdot 7}{4}$
$= \frac{21}{4}$ or $5\frac{1}{4}$

64. $5\frac{1}{2} \div 2\frac{1}{11} = \frac{11}{2} \div \frac{23}{11}$
$= \frac{11}{2} \cdot \frac{11}{23}$
$= \frac{11 \cdot 11}{2 \cdot 23}$
$= \frac{121}{46}$ or $2\frac{29}{46}$

65. $341 \div 15\frac{1}{2} = \frac{341}{1} \div \frac{31}{2}$
$= \frac{341}{1} \cdot \frac{2}{31}$
$= \frac{341 \cdot 2}{1 \cdot 31}$
$= \frac{11 \cdot 31 \cdot 2}{1 \cdot 31}$
$= \frac{11 \cdot 2}{1}$
$= 22$
We might expect the truck to travel 22 miles on 1 gallon of gas.

66. $5\frac{1}{4} \div 5 = \frac{21}{4} \div \frac{5}{1} = \frac{21}{4} \cdot \frac{1}{5} = \frac{21 \cdot 1}{4 \cdot 5} = \frac{21}{20}$ or $1\frac{1}{20}$
He walks $\frac{21}{20}$ miles or $1\frac{1}{20}$ miles each day.

67. $\frac{0}{3}$ is a proper fraction.

68. $\frac{12}{12}$ is an improper fraction.

69. $5\frac{6}{7}$ is a mixed number.

70. $\frac{13}{9}$ is an improper fraction.

71.
$$\begin{array}{r} 31 \text{ R } 1 \\ 4\overline{)\,125} \\ \underline{-12} \\ 05 \\ \underline{-4} \\ 1 \end{array}$$
$\frac{125}{4} = 31\frac{1}{4}$

72.
$$\begin{array}{r} 6 \\ 9\overline{)\,54} \\ \underline{-54} \\ 0 \end{array}$$
$\frac{54}{9} = 6$

73. $5\frac{10}{17} = \frac{17 \cdot 5 + 10}{17} = \frac{95}{17}$

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74. $7\frac{5}{6} = \frac{6 \cdot 7 + 5}{6} = \frac{47}{6}$

75. Composite, since the factors of 27 are 1, 3, 9, and 27.

76. Prime, since the only factors of 23 are 1 and 23.

77.
$$\begin{array}{r} 5 \\ 3\overline{)\,15} \\ 3\overline{)\,45} \\ 2\overline{)\,90} \\ 2\overline{)180} \end{array}$$

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

78.
$$\begin{array}{r} 7 \\ 7\overline{)49} \\ 2\overline{)98} \end{array}$$

$90 = 2 \cdot 7^2$

79. $\frac{45}{50} = \frac{9 \cdot 5}{10 \cdot 5} = \frac{9}{10}$

80. $\frac{30}{42} = \frac{6 \cdot 5}{6 \cdot 7} = \frac{5}{7}$

81. $\frac{140}{150} = \frac{14 \cdot 10}{15 \cdot 10} = \frac{14}{15}$

82. $\frac{84}{140} = \frac{28 \cdot 3}{28 \cdot 5} = \frac{3}{5}$

83. $\frac{7}{8} \cdot \frac{2}{3} = \frac{7 \cdot 2}{8 \cdot 3} = \frac{7 \cdot 2}{4 \cdot 2 \cdot 3} = \frac{7}{4 \cdot 3} = \frac{7}{12}$

84. $\frac{6}{15} \cdot \frac{5}{8} = \frac{6 \cdot 5}{15 \cdot 8} = \frac{2 \cdot 3 \cdot 5}{3 \cdot 5 \cdot 2 \cdot 4} = \frac{1}{4}$

85. $\frac{18}{5} \div \frac{2}{5} = \frac{18}{5} \cdot \frac{5}{2} = \frac{18 \cdot 5}{5 \cdot 2} = \frac{2 \cdot 9 \cdot 5}{5 \cdot 2} = \frac{9}{1} = 9$

86. $\frac{9}{2} \div \frac{1}{3} = \frac{9}{2} \cdot \frac{3}{1} = \frac{9 \cdot 3}{2 \cdot 1} = \frac{27}{2}$ or $13\frac{1}{2}$

87. Exact: $4\frac{1}{6} \cdot 2\frac{2}{5} = \frac{25}{6} \cdot \frac{12}{5}$

$$= \frac{25 \cdot 12}{6 \cdot 5}$$
$$= \frac{5 \cdot 5 \cdot 6 \cdot 2}{6 \cdot 5}$$
$$= \frac{5 \cdot 2}{1}$$
$$= 10$$

Estimate: $4\frac{1}{6}$ rounds to 4

$2\frac{2}{5}$ rounds to 2

$4 \cdot 2 = 8$

88. Exact: $5\frac{2}{3} \cdot 2\frac{1}{4} = \frac{17}{3} \cdot \frac{9}{4}$

$$= \frac{17 \cdot 9}{3 \cdot 4}$$
$$= \frac{17 \cdot 3 \cdot 3}{3 \cdot 4}$$
$$= \frac{17 \cdot 3}{4}$$
$$= \frac{51}{4} \text{ or } 12\frac{3}{4}$$

Estimate: $5\frac{2}{3}$ rounds to 6

$2\frac{1}{4}$ rounds to 2

$6 \cdot 2 = 12$

89. $\frac{7}{2} \div 1\frac{1}{2} = \frac{7}{2} \div \frac{3}{2} = \frac{7}{2} \cdot \frac{2}{3} = \frac{7 \cdot 2}{2 \cdot 3} = \frac{7}{3}$ or $2\frac{1}{3}$

90. $1\frac{3}{5} \div \frac{1}{4} = \frac{8}{5} \cdot \frac{4}{1} = \frac{8 \cdot 4}{5 \cdot 1} = \frac{32}{5}$ or $6\frac{2}{5}$

91. $5\frac{1}{2} \cdot 7\frac{4}{11} = \frac{11}{2} \cdot \frac{81}{11} = \frac{11 \cdot 81}{2 \cdot 11} = \frac{81}{2}$ or $40\frac{1}{2}$

The area is $\frac{81}{2}$ square feet or $40\frac{1}{2}$ square feet.

92. $23\frac{1}{2} \div 30\frac{1}{2} = \frac{47}{2} \div \frac{61}{2} = \frac{47}{2} \cdot \frac{2}{61} = \frac{47 \cdot 2}{2 \cdot 61} = \frac{47}{61}$

This is $\frac{47}{61}$ inch of rain per 1 hour.

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Chapter 2 Getting Ready for the Test

1. $\frac{5}{5} = 1$; B.

2. $\frac{5}{0}$ is undefined; C.

3. $\frac{0}{5} = 0$; A.

4. $\frac{5}{1} = 5$; D.

5. Since $10 \cdot 10 = 100 \neq 20$, $10 \cdot 10$ is not a factorization of 20; C.

6. Since $14 = 2 \cdot 7$, the factors of 14 are 1, 2, 7, and 14, so 14 is not a prime number; A.

7. Since $\frac{30}{20} = \frac{3 \cdot 10}{2 \cdot 10} = \frac{3}{2}$, while $\frac{18}{15} = \frac{3 \cdot 6}{3 \cdot 5} = \frac{6}{5}$, $1\frac{1}{5} = \frac{5 \cdot 1 + 1}{5} = \frac{5+1}{5} = \frac{6}{5}$, and $\frac{12}{10} = \frac{2 \cdot 6}{2 \cdot 5}$, $\frac{30}{20}$ is not equivalent to $\frac{6}{5}$; B.

8. $\frac{2}{5} \cdot \frac{1}{5} = \frac{2 \cdot 1}{5 \cdot 5} = \frac{2}{25}$
The operation is multiplication; A.

9. $\frac{2}{5} \div \frac{1}{5} = \frac{2}{5} \cdot \frac{5}{1} = \frac{2 \cdot 5}{5 \cdot 1} = \frac{2}{1} = 2$
The operation is division; B.

10. $\frac{6}{11} \div \frac{6}{7} = \frac{6}{11} \cdot \frac{7}{6} = \frac{6 \cdot 7}{11 \cdot 6} = \frac{7}{11}$
The operation is division; B.

11. $\frac{6}{11} \cdot \frac{6}{7} = \frac{6 \cdot 6}{11 \cdot 7} = \frac{36}{77}$
The operation is multiplication; A.

Chapter 2 Test

1. 7 of the 16 equal parts are shaded: $\frac{7}{16}$

2. Each part is $\frac{1}{5}$ of a whole and 13 parts are shaded: $\frac{13}{5}$

3. $7\frac{2}{3} = \frac{3 \cdot 7 + 2}{3} = \frac{23}{3}$

4. $3\frac{6}{11} = \frac{11 \cdot 3 + 6}{11} = \frac{39}{11}$

5.
$$5\overline{)23}\quad 4 \text{ R } 3$$
$$\underline{20}$$
$$3$$

$\frac{23}{5} = 4\frac{3}{5}$

6.
$$4\overline{)75}\quad 18 \text{ R } 3$$
$$\underline{-4}$$
$$35$$
$$\underline{-32}$$
$$3$$

$\frac{75}{4} = 18\frac{3}{4}$

7. $\frac{24}{210} = \frac{6 \cdot 4}{6 \cdot 35} = \frac{4}{35}$

8. $\frac{42}{70} = \frac{14 \cdot 3}{14 \cdot 5} = \frac{3}{5}$

9. Not equivalent, since the cross products are not equal: $7 \cdot 8 = 56$ and $11 \cdot 5 = 55$.

10. Equivalent, since the cross products are equal: $27 \cdot 14 = 378$ and $63 \cdot 6 = 378$.

11.
$$3\overline{)21}$$
$$2\overline{)42}$$
$$2\overline{)84}$$

$84 = 2^2 \cdot 3 \cdot 7$

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12. $5\overline{)55}$

$3\overline{)165}$

$3\overline{)495}$

$495 = 3^2 \cdot 5 \cdot 11$

13. $\frac{4}{4} \div \frac{3}{4} = \frac{4}{4} \cdot \frac{4}{3} = \frac{4 \cdot 4}{4 \cdot 3} = \frac{4}{3}$ or $1\frac{1}{3}$

14. $\frac{4}{3} \cdot \frac{4}{4} = \frac{4 \cdot 4}{3 \cdot 4} = \frac{4}{3}$ or $1\frac{1}{3}$

15. $2 \cdot \frac{1}{8} = \frac{2}{1} \cdot \frac{1}{8} = \frac{2 \cdot 1}{1 \cdot 8} = \frac{2 \cdot 1}{1 \cdot 2 \cdot 4} = \frac{1}{4}$

16. $\frac{2}{3} \cdot \frac{8}{15} = \frac{2 \cdot 8}{3 \cdot 15} = \frac{16}{45}$

17. $8 \div \frac{1}{2} = \frac{8}{1} \cdot \frac{2}{1} = \frac{8 \cdot 2}{1 \cdot 1} = 16$

18. $13\frac{1}{2} \div 3 = \frac{27}{2} \div \frac{3}{1}$

$= \frac{27}{2} \cdot \frac{1}{3}$

$= \frac{27 \cdot 1}{2 \cdot 3}$

$= \frac{3 \cdot 9 \cdot 1}{2 \cdot 3}$

$= \frac{9}{2}$ or $4\frac{1}{2}$

19. $\frac{3}{8} \cdot \frac{16}{6} \cdot \frac{4}{11} = \frac{3 \cdot 16 \cdot 4}{8 \cdot 6 \cdot 11} = \frac{3 \cdot 2 \cdot 8 \cdot 4}{8 \cdot 2 \cdot 3 \cdot 11} = \frac{4}{11}$

20. $5\frac{1}{4} \div \frac{7}{12} = \frac{21}{4} \cdot \frac{12}{7} = \frac{21 \cdot 12}{4 \cdot 7} = \frac{3 \cdot 7 \cdot 3 \cdot 4}{4 \cdot 7} = \frac{3 \cdot 3}{1} = 9$

21. $\frac{16}{3} \div \frac{3}{12} = \frac{16}{3} \cdot \frac{12}{3}$

$= \frac{16 \cdot 12}{3 \cdot 3}$

$= \frac{16 \cdot 3 \cdot 4}{3 \cdot 3}$

$= \frac{16 \cdot 4}{3}$

$= \frac{64}{3}$ or $21\frac{1}{3}$

22. $3\frac{1}{3} \cdot 6\frac{3}{4} = \frac{10}{3} \cdot \frac{27}{4}$

$= \frac{10 \cdot 27}{3 \cdot 4}$

$= \frac{2 \cdot 5 \cdot 3 \cdot 9}{3 \cdot 2 \cdot 2}$

$= \frac{5 \cdot 9}{2}$

$= \frac{45}{2}$ or $22\frac{1}{2}$

23. $12 \div 3\frac{1}{3} = \frac{12}{1} \div \frac{10}{3}$

$= \frac{12}{1} \cdot \frac{3}{10}$

$= \frac{12 \cdot 3}{1 \cdot 10}$

$= \frac{2 \cdot 6 \cdot 3}{1 \cdot 2 \cdot 5}$

$= \frac{6 \cdot 3}{1 \cdot 5}$

$= \frac{18}{5}$ or $3\frac{3}{5}$

24. $\frac{14}{5} \cdot \frac{25}{21} \cdot 2 = \frac{14}{5} \cdot \frac{25}{21} \cdot \frac{2}{1}$

$= \frac{14 \cdot 25 \cdot 2}{5 \cdot 21 \cdot 1}$

$= \frac{2 \cdot 7 \cdot 5 \cdot 5 \cdot 2}{5 \cdot 3 \cdot 7 \cdot 1}$

$= \frac{2 \cdot 5 \cdot 2}{3 \cdot 1}$

$= \frac{20}{3}$ or $6\frac{2}{3}$

25. $\frac{2}{3} \cdot 1\frac{8}{9} = \frac{2}{3} \cdot \frac{17}{9} = \frac{2 \cdot 17}{3 \cdot 9} = \frac{34}{27}$ or $1\frac{7}{27}$

The area is $\frac{34}{27}$ square miles or $1\frac{7}{27}$ square miles.

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26. $258 \div 10\frac{3}{4} = \frac{258}{1} \div \frac{43}{4}$

$= \frac{258}{1} \cdot \frac{4}{43}$

$= \frac{258 \cdot 4}{1 \cdot 43}$

$= \frac{43 \cdot 6 \cdot 4}{1 \cdot 43}$

$= \frac{24}{1}$

$= 24$

We expect the car to travel 24 miles on 1 gallon of gas.

27. $100 \cdot 53\frac{1}{3} = \frac{100}{1} \cdot \frac{160}{3}$

$= \frac{100 \cdot 160}{1 \cdot 3}$

$= \frac{16,000}{3}$ or $5333\frac{1}{3}$

$\frac{16,000}{3}$ square yards or $5333\frac{1}{3}$ square yards of artificial turf are necessary to cover the football field.

28. $120 \cdot \frac{3}{4} = \frac{120}{1} \cdot \frac{3}{4} = \frac{120 \cdot 3}{1 \cdot 4} = \frac{4 \cdot 30 \cdot 3}{1 \cdot 4} = \frac{30 \cdot 3}{1} = 90$

The stock sold for \$90 per share after the oil spill.

Cumulative Review Chapters 1–2

1. The place value of the 3 in 396,418 is hundred-thousands.

2. 2036 is written as two thousand, thirty-six.

3. Eight hundred five in standard form is 805.

4.
$$\begin{array}{r} {\scriptstyle 2} \\ 7 \\ 6 \\ 10 \\ 3 \\ +\ 5 \\ \hline 31 \end{array}$$

5.
$$\begin{array}{r} {\scriptstyle 11\ 1} \\ 34,285 \\ +\ 149,761 \\ \hline 184,046 \end{array}$$

6.
$$\begin{array}{r} {\scriptstyle 1} \\ 56 \\ 18 \\ +\ 43 \\ \hline 117 \end{array}$$

$$3\overline{)117}$$

$$\begin{array}{r} 39 \\ -9 \\ \hline 27 \\ -27 \\ \hline 0 \end{array}$$

The average is 39.

7.
$$\begin{array}{r} {\scriptstyle 1} \\ 2 \\ 3 \\ 1 \\ 3 \\ +\ 4 \\ \hline 13 \end{array}$$

The perimeter is 13 inches.

8.
$$\begin{array}{r} 25 \\ -\ 8 \\ \hline 17 \end{array}$$

9.
$$\begin{array}{r} 9,879,465 \\ +\ 712,397 \\ \hline 10,591,862 \end{array}$$

The total number of trucks sold in the United States in 2016 was 10,591,862.

10. $\sqrt{25} = 5$, since $5 \cdot 5 = 25$.

11.
$$\begin{array}{r} 7826 \\ -\ 505 \\ \hline 7321 \end{array}$$

Check:
$$\begin{array}{r} 7321 \\ +\ 505 \\ \hline 7826 \end{array}$$

12. $8^2 = 8 \cdot 8 = 64$

13. a. The country with the greatest number of threatened mammal species is Indonesia.

b. The number of threatened mammal species for Malaysia is 72, the number of threatened mammal species for China is 74, and the number of threatened mammal species for Indonesia is 187.

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$$\begin{array}{r} 72 \\ 74 \\ +\,187 \\ \hline 333 \end{array}$$

The total number of threatened mammal species for these three countries is 333.

14. $8\overline{)205}$ R 5

$$\begin{array}{r} -16 \\ \hline 45 \\ -40 \\ \hline 5 \end{array}$$

$205 \div 8 = 25$ R 5

15. To round 568 to the nearest ten, observe that the digit in the ones place is 8. Since this digit is at least 5, we add 1 to the tens place. The number 568 rounded to the tens place is 570.

16. To round 2366 to the nearest hundred, observe that the digit in the tens place is 6. Since this digit is at least 5, we add 1 to the hundreds place. The number 2366 rounded to the nearest hundred is 2400.

17.

$$\begin{array}{rcr} 4725 & \text{rounds to} & 4700 \\ -\,2879 & \text{rounds to} & -\,2900 \\ \hline & & 1800 \end{array}$$

The estimated difference is 1800.

18.

$$\begin{array}{rcr} & & {\scriptstyle 2} \\ 38 & \text{rounds to} & 40 \\ 43 & \text{rounds to} & 40 \\ 126 & \text{rounds to} & 130 \\ +\,92 & \text{rounds to} & +\,90 \\ \hline & & 300 \end{array}$$

The estimated sum is 300.

19. a. $6 \times 1 = 6$

b. $0(8) = 0$

c. $1 \cdot 45 = 45$

d. $(75)(0) = 0$

20. $30 \div 3 \cdot 2 = 10 \cdot 2 = 20$

21. a. $3(4 + 5) = 3 \cdot 4 + 3 \cdot 5$

b. $10(6 + 8) = 10 \cdot 6 + 10 \cdot 8$

c. $2(7 + 3) = 2 \cdot 7 + 2 \cdot 3$

22.

$$\begin{array}{r} 12 \\ \times\,15 \\ \hline 60 \\ 120 \\ \hline 180 \end{array}$$

23. a. $9\overline{)0}$

$$\begin{array}{r} -0 \\ \hline 0 \end{array}$$

Check: $0 \cdot 9 = 0$

b. $0 \div 12 = 0$

Check: $0 \cdot 12 = 0$

c. $\frac{0}{5} = 0$

Check: $0 \cdot 5 = 0$

d. $\frac{3}{0}$ is undefined.

24. Area = length · width
$= 7 \cdot 22$
$= 154$ square miles

The area is 154 square miles..

25. $9\overline{)1872}$

$$\begin{array}{r} -18 \\ \hline 07 \\ -0 \\ \hline 72 \\ -72 \\ \hline 0 \end{array}$$

Check: $\begin{array}{r} 208 \\ \times\ 9 \\ \hline 1872 \end{array}$

26.

$$\begin{array}{r} 5000 \\ -\,986 \\ \hline 4014 \end{array}$$

27. $19\overline{)238}$

$$\begin{array}{r} -19 \\ \hline 48 \\ -38 \\ \hline 10 \end{array}$$

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28.
$$\begin{array}{r} 9 \\ \times\ 7 \\ \hline 63 \end{array}$$
The product of 9 and 7 is 63.

29.
$$\begin{array}{r} 30 \\ \times\ 20 \\ \hline 0 \\ 600 \\ \hline 600 \end{array}$$
$$15\overline{)\,600}\quad 40$$
$$\begin{array}{r} -60 \\ \hline 00 \\ -0 \\ \hline 0 \end{array}$$
The new length of the garden is 40 ft.

30.
$$\begin{array}{r} {\scriptstyle 1} \\ 9 \\ +\ 7 \\ \hline 16 \end{array}$$
The sum of 9 and 7 is 16.

31. $7 \cdot 7 \cdot 7 = 7^3$

32. $7 \cdot 7 \cdot 7 \cdot 7 = 7^4$

33. $3 \cdot 3 \cdot 3 \cdot 3 \cdot 17 \cdot 17 \cdot 17 = 3^4 \cdot 17^3$

34. $2 \cdot 2 \cdot 3 \cdot 3 \cdot 3 \cdot 3 = 2^2 \cdot 3^4$

35. $2 \cdot 4 - 3 \div 3 = 8 - 3 \div 3 = 8 - 1 = 7$

36.
$$\begin{aligned} 8 \cdot \sqrt{100} - 4^2 \cdot 5 &= 8 \cdot 10 - 4^2 \cdot 5 \\ &= 80 - 16 \cdot 5 \\ &= 80 - 80 \\ &= 0 \end{aligned}$$

37. 2 of the 5 equal parts are shaded: $\frac{2}{5}$

38.
$$3\overline{)\,39}\quad 13$$
$$2\overline{)\,78}$$
$$2\overline{)156}$$
$156 = 2^2 \cdot 3 \cdot 13$

39. a. $4\frac{2}{9} = \frac{9 \cdot 4 + 2}{9} = \frac{38}{9}$

b. $1\frac{8}{11} = \frac{11 \cdot 1 + 8}{11} = \frac{19}{11}$

40. $7\frac{4}{5} = \frac{5 \cdot 7 + 4}{5} = \frac{39}{5}$

41. $1 \cdot 20 = 20$
$2 \cdot 10 = 20$
$4 \cdot 5 = 20$
The factors of 20 are 1, 2, 4, 5, 10, and 20.

42. Equivalent, since the cross products are equal: $20 \cdot 14 = 280$ and $35 \cdot 8 = 280$.

43. $\frac{42}{66} = \frac{6 \cdot 7}{6 \cdot 11} = \frac{7}{11}$

44. $\frac{70}{105} = \frac{35 \cdot 2}{35 \cdot 3} = \frac{2}{3}$

45.
$$\begin{aligned} 3\frac{1}{3} \cdot \frac{7}{8} &= \frac{10}{3} \cdot \frac{7}{8} \\ &= \frac{10 \cdot 7}{3 \cdot 8} \\ &= \frac{2 \cdot 5 \cdot 7}{3 \cdot 2 \cdot 4} \\ &= \frac{5 \cdot 7}{3 \cdot 4} \\ &= \frac{35}{12} \text{ or } 2\frac{11}{12} \end{aligned}$$

46. $\frac{2}{3} \cdot 4 = \frac{2}{3} \cdot \frac{4}{1} = \frac{2 \cdot 4}{3 \cdot 1} = \frac{8}{3}$ or $2\frac{2}{3}$

47. The reciprocal of $\frac{1}{3}$ is $\frac{3}{1}$ or 3.

48. The reciprocal of 9, or $\frac{9}{1}$, is $\frac{1}{9}$.

49. $\frac{5}{16} \div \frac{3}{4} = \frac{5}{16} \cdot \frac{4}{3} = \frac{5 \cdot 4}{16 \cdot 3} = \frac{5 \cdot 4}{4 \cdot 4 \cdot 3} = \frac{5}{4 \cdot 3} = \frac{5}{12}$

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50. $1\frac{1}{10} \div 5\frac{3}{5} = \frac{11}{10} \div \frac{28}{5}$

$$= \frac{11}{10} \cdot \frac{5}{28}$$

$$= \frac{11 \cdot 5}{10 \cdot 28}$$

$$= \frac{11 \cdot 5}{2 \cdot 5 \cdot 28}$$

$$= \frac{11}{2 \cdot 28}$$

$$= \frac{11}{56}$$

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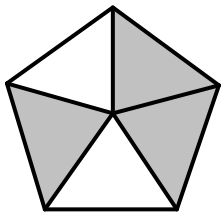
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Additional Exercises 2.1

Name:
Date:

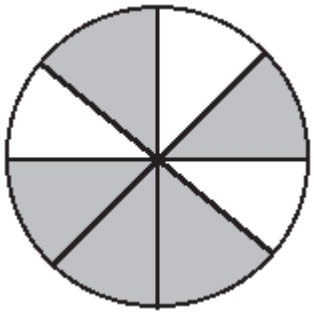
Write a fraction to represent the shaded part of each figure.

1.



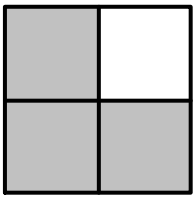
1. _____

2.



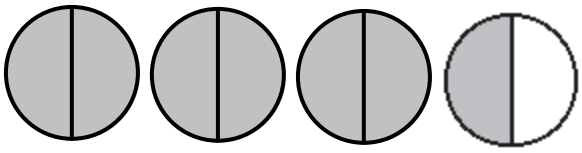
2. _____

3.



3. _____

4.



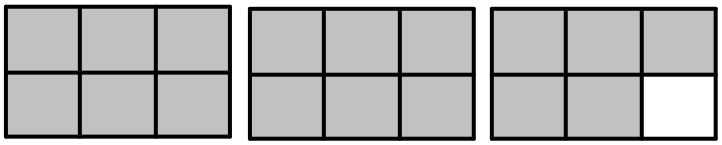
4. _____

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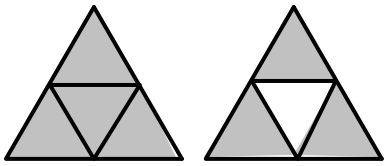
Additional Exercises 2.1 (*cont.*)

5.



5. _____

6.



6. _____

7. Of the 525 people at a high school, 17 are teachers. What fraction of the people are teachers?

7. _____

Write each mixed number as an improper fraction.

8. $4\frac{5}{8}$

8. _____

9. $2\frac{2}{5}$

9. _____

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

10. _____

11. $3\frac{2}{15}$

11. _____

12. $19\frac{5}{6}$

12. _____

13. $4\frac{7}{12}$

13. _____

Write each improper fraction as a mixed number or a whole number.

14. $\frac{53}{8}$

14. _____

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Additional Exercises 2.1 (*cont.*)

15. $\frac{80}{7}$ **15.** _____

16. $\frac{189}{27}$ **16.** _____

17. $\frac{36}{12}$ **17.** _____

18. $\frac{91}{13}$ **18.** _____

19. $\frac{84}{13}$ **19.** _____

20. $\frac{74}{3}$ **20.** _____

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Additional Exercises 2.2

Name:
Date:

List all the factors of each number.

1. 28 **1.** _____

2. 10 **2.** _____

3. 78 **3.** _____

4. 77 **4.** _____

5. 47 **5.** _____

6. 141 **6.** _____

Identify each number as prime or composite.

7. 11 **7.** _____

8. 23 **8.** _____

9. 16 **9.** _____

10. 51 **10.** _____

11. 37 **11.** _____

12. 133 **12.** _____

Find the prime factorization of each composite number. Write prime if the number is prime.

13. 70 **13.** _____

14. 130 **14.** _____

15. 55 **15.** _____

16. 196 **16.** _____

17. 107 **17.** _____

18. 256 **18.** _____

19. 882 **19.** _____

20. 1050 **20.** _____

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Additional Exercises 2.3

Name:
Date:

Write each fraction in simplest form.

1. $\frac{4}{12}$ **1.** _____

2. $\frac{24}{54}$ **2.** _____

3. $\frac{80}{90}$ **3.** _____

4. $\frac{17}{119}$ **4.** _____

5. $\frac{62}{93}$ **5.** _____

6. $\frac{125}{300}$ **6.** _____

7. $\frac{52}{169}$ **7.** _____

8. $\frac{64}{160}$ **8.** _____

9. $\frac{255}{465}$ **9.** _____

Determine whether each pair of fractions is equivalent.

10. $\frac{25}{55}$ *and* $\frac{30}{77}$ **10.** _____

11. $\frac{6}{42}$ *and* $\frac{3}{21}$ **11.** _____

12. $\frac{16}{24}$ *and* $\frac{24}{36}$ **12.** _____

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13. $\frac{252}{612}$ *and* $\frac{7}{17}$ **13.** _____

14. $\frac{27}{45}$ *and* $\frac{24}{35}$ **14.** _____

15. $\frac{26}{117}$ *and* $\frac{20}{90}$ **15.** _____

16. $\frac{7}{147}$ *and* $\frac{1}{21}$ **16.** _____

17. $\frac{77}{70}$ *and* $\frac{10}{11}$ **17.** _____

18. The drive from Sam Shepard's home to work takes 25 minutes. What fraction of the drive is represented by 10 minutes? **18.** _____

19. There are 5280 feet in a mile. What fraction of a mile is represented by1320 feet? **19.** _____

20. On a hot summer day, an ice cream stand sold 1700 ice cream cones. What fractional part of this total does 1275 ice cream cones represent? **20.** _____

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Additional Exercises 2.4

Name:
Date:

Multiply. Write each answer in simplest form.

1. $\frac{1}{3}\times\frac{5}{8}$ **1.** _____

2. $\frac{7}{8}\times\frac{4}{3}$ **2.** _____

3. $\frac{4}{9}\times\frac{18}{8}$ **3.** _____

4. $\frac{3}{7}\times\frac{5}{17}$ **4.** _____

5. $\frac{5}{8}\times\frac{16}{15}$ **5.** _____

6. $\frac{7}{4}\times\frac{2}{5}$ **6.** _____

7. $\frac{15}{4}\times\frac{7}{5}\times\frac{8}{11}$ **7.** _____

8. $\frac{15}{30}\times\frac{3}{7}$ **8.** _____

9. $1\frac{1}{2}\times 7$ **9.** _____

10. $3\times 1\frac{4}{9}$ **10.** _____

11. $7\frac{1}{2}\times 1\frac{2}{3}$ **11.** _____

12. $4\frac{4}{5}\times 6\frac{1}{2}$ **12.** _____

13. $5\frac{4}{5}\times 6$ **13.** _____

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Additional Exercises 2.4 (*cont.*)

14. $\frac{1}{5} \times 2\frac{3}{5}$ **14.** _____

15. $7\frac{3}{7} \times 3\frac{1}{2} \times \frac{4}{13}$ **15.** _____

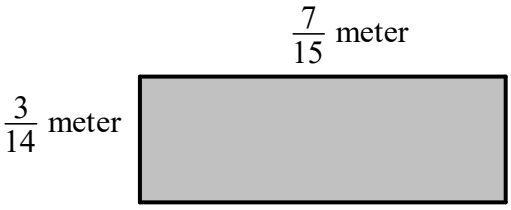
16. $5 \times 7\frac{3}{5}$ **16.** _____

17. A flight attendant can purchase a ticket for $\frac{3}{5}$ of the regular price. If the regular price of a particular trip is $625, what will the attendant pay? **17.** _____

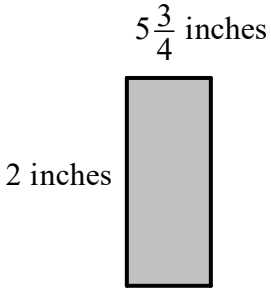
18. A picture frame's width is $\frac{2}{3}$ of the frame's length. What is the width if the length is $18\frac{1}{2}$ inches? **18.** _____

Find the area of each rectangle.

19. **19.** _____



20. **20.** _____



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Additional Exercises 2.5

Name:
Date:

Find the reciprocal of each fraction.

1. $\frac{12}{5}$ **1.** _____

2. 19 **2.** _____

Divide. Write each answer in simplest form.

3. $\frac{1}{4} \div \frac{1}{2}$ **3.** _____

4. $1 \div \frac{1}{8}$ **4.** _____

5. $\frac{1}{2} \div \frac{4}{5}$ **5.** _____

6. $\frac{2}{5} \div \frac{2}{3}$ **6.** _____

7. $\frac{2}{3} \div \frac{1}{4}$ **7.** _____

8. $\frac{5}{9} \div \frac{5}{3}$ **8.** _____

9. $\frac{4}{5} \div \frac{1}{8}$ **9.** _____

10. $\frac{2}{3} \div \frac{1}{3}$ **10.** _____

11. $\frac{4}{9} \div \frac{5}{6}$ **11.** _____

12. $2\frac{3}{5} \div 11$ **12.** _____

13. $2\frac{1}{5} \div \frac{1}{5}$ **13.** _____

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Additional Exercises 2.5 (*cont.*)

14. $\frac{6}{7} \div \frac{1}{5}$ **14.** _____

15. $4\frac{1}{5} \div 0$ **15.** _____

16. $1\frac{3}{4} \div 1\frac{2}{5}$ **16.** _____

17. $6\frac{2}{3} \div 2\frac{1}{3}$ **17.** _____

18. $6\frac{1}{4} \div 1$ **18.** _____

19. Rita Koff must give her child $5\frac{1}{2}$ milliliters of a medicine per day in 3 equally divided doses. How much medicine is given in each dose? **19.** _____

20. Keneth Kelly has flown 345 hours this summer. If this makes up $\frac{5}{9}$ of his yearly hours, how many hours has he flown this year? **20.** _____

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Mini-Lecture 2.1

Introduction to Fractions and Mixed Numbers

Learning Objectives:

1. Identify the numerator and the denominator of a fraction and review division properties of 0 and 1.
2. Write a fraction to represent parts of figures or real-life data.
3. Identify proper fractions, improper fractions, and mixed numbers.
4. Write mixed numbers as improper fractions.
5. Write improper fractions as mixed numbers or whole numbers.
6. Key Vocabulary: *numerator, denominator, proper fraction, improper fraction, mixed number*

Examples:

1. Identify the numerator and the denominator of each fraction.

   a) $\frac{1}{7}$ b) $\frac{11}{17}$ c) $\frac{27}{13}$ d) $\frac{12}{12}$

   Simplify.

   e) $\frac{5}{1}$ f) $\frac{8}{0}$ g) $\frac{14}{14}$ h) $\frac{19}{0}$

2. a) Write a fraction to represent the shaded part: 

   b) Of the 18 employees at a restaurant, 11 are women. What fraction of the employees are women?

3. Determine whether each fraction is proper, improper, or a mixed number.

   a) $\frac{4}{9}$ b) $7\frac{1}{3}$ c) $\frac{12}{5}$ d) $\frac{9}{9}$

4. Write each mixed number as an improper fraction.

   a) $4\frac{1}{2}$ b) $10\frac{5}{8}$ c) $14\frac{3}{4}$ d) $121\frac{6}{11}$

5. Write each improper fraction as a mixed number.

   a) $\frac{13}{2}$ b) $\frac{57}{12}$ c) $\frac{161}{7}$ d) $\frac{207}{17}$

Teaching Notes:

- Most students find this material easy. Remind students that division by zero is undefined.
- As students progress in their study of fractions, they will need to be reminded how to convert between improper fractions and mixed numbers, and vice-versa.

Answers: 1a) n=1, d=7, b) n=11,d=17, c) n=27, d=13, d) n=12, d=12, e) 5, f) undefined, g) 1, h) undefined; 2a) 3/7, b) 11/18; 3a) proper, b) mixed, c) improper, d) improper; 4a) 9/2, b) 85/8, c) 59/4, d) 1337/11; 5a) 6 ½, b) 4 9/12, c) 23, d) 12 3/17

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Mini-Lecture 2.2

Factors and Prime Factorization

Learning Objectives:

1. Find the factors of a number.
2. Identify prime and composite numbers.
3. Find the prime factorization of a number.
4. Key Vocabulary: *natural numbers, factors, factorization, prime numbers, composite numbers, prime factorization, divisibility tests (2, 3, 4, 5, 6, 9)*

Examples:

1. List all the factors of each number.

   a) 15 b) 64 c) 43 d) 144

2. Identify each number as prime, composite or neither.

   a) 6 b) 47 c) 123 d) 1

3. Find the prime factorization of each number. Use exponents with any repeated factors.

   a) 16 b) 50 c) 72 d) 132

   e) 76 f) 200 g) 480 h) 12,600

Teaching Notes:

- Review the first 10 or so primes and have students be able to recognize them.
- Many students will not factor completely. For example: $72 = 2^3 \times 9$
- Prime factorization is an important skill as students progress into the study of fractions.

Answers: 1a) 1,3,5,15, b) 1,2,4,8,32,64 c) 1,43 d) 1,2,3,4,6,8,9,12,16,18,24,36,48,72,144; 2a) composite, b) prime, c) composite, d) neither; 3a) 2^4, b) $2 \cdot 5^2$, c) $2^3 \cdot 3^2$, d) $2^2 \cdot 3 \cdot 11$, e) $2^2 \cdot 19$, f) $2^3 \cdot 5^2$, g) $2^5 \cdot 3 \cdot 5$, h) $2^3 \cdot 3^2 \cdot 5^2 \cdot 7$

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Mini-Lecture 2.3

Simplest Form of a Fraction

Learning Objectives:

1. Write a fraction in simplest form or lowest terms.
2. Determine whether two fractions are equivalent.
3. Solve problems by writing fractions in simplest form.
4. Key Vocabulary: *equivalent fractions, simplest form, lowest form, simplifying, cross products, equality of fractions*

Examples:

1. Write each fraction in simplest form or lowest terms.

a) $\frac{8}{8}$ b) $\frac{2}{4}$ c) $\frac{18}{45}$ d) $\frac{24}{150}$

e) $\frac{14}{84}$ f) $\frac{35}{20}$ g) $\frac{98}{14}$ h) $\frac{138}{42}$

2. Determine whether each pair of fractions is equivalent.

a) $\frac{3}{6}$ *and* $\frac{11}{22}$ b) $\frac{12}{20}$ *and* $\frac{21}{35}$ c) $\frac{14}{21}$ *and* $\frac{5}{15}$

d) $\frac{3}{9}$ *and* $\frac{7}{21}$ e) $\frac{30}{46}$ *and* $\frac{15}{24}$ f) $\frac{9}{27}$ *and* $\frac{12}{36}$

3. a) There are 36 inches in a yard. What fraction of a yard is represented by 9 inches?

   b) Twenty-eight students are enrolled in Math Class. On Monday, only 21 students attended class. What fraction of the class attended on Monday?

Teaching Notes:

- Remind students to check their final answer to be sure it is completely reduced.
- Many students prefer to simplify rather than use cross products.
- Refer students to Section 1.8 for a review of **Problem-Solving Steps**.

Answers: 1a) 1, b) ½, c) 2/5, d) 4/25, e) 1/6, f) 7/4, g) 7, h) 23/7; 2a) yes, b) yes, c) no, d) yes, e) no, f) yes; 3a) ¼, b) ¾

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Mini-Lecture 2.4

Multiplying Fractions and Mixed Numbers

Learning Objectives:

1. Multiply fractions.
2. Multiply fractions and mixed numbers or whole numbers.
3. Solve problems by multiplying fractions.
4. Key Vocabulary: *of, is*

Examples:

1. Multiply. Write each answer in simplest form.

   a) $\frac{1}{2}\cdot\frac{3}{7}$ b) $\frac{2}{5}\cdot\frac{2}{7}$ c) $\frac{2}{9}\cdot\frac{3}{8}$ d) $\frac{7}{3}\cdot\frac{9}{14}\cdot\frac{8}{15}$

2. Multiply. Write each answer in simplest form.

   a) $2\frac{1}{2}\cdot\frac{1}{10}$ b) $5\frac{1}{4}\cdot\frac{3}{7}$ c) $\frac{2}{3}\cdot 4\frac{1}{2}$ d) $7\frac{3}{4}\cdot 2\frac{2}{3}$

   e) $6\cdot\frac{2}{3}$ f) $\frac{7}{10}\cdot 5$ g) $\frac{7}{7}\cdot 28$ h) $\frac{1}{6}\cdot 0$

3. a) Find $\frac{2}{5}$ of 75

   b) A tiled wall is built 6 tiles wide. If the side of the square tile measures $2\frac{5}{8}$", what is the width of the wall?

Teaching Notes:

- Suggest to students that they always write their fractions with a horizontal bar ($\frac{2}{3}$) instead of a vertical bar (2/3).
- Students will need a review of converting mixed numbers to improper fractions.
- Most students will need to be shown how to convert a whole number to a fraction.
- Students need to be reminded to always convert mixed numbers to improper fractions before beginning multiplication.

Answers: 1a) 3/14, b) 4/35, c) 1/12, d) 4/5; 2a) ¼, b) 2 ¼, c) 3, d) 20 2/3, e) 4, f) 3 ½, g) 28, h) 0; 3a) 30, b) 15 ¾"

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Mini-Lecture 2.5

Dividing Fractions and Mixed Numbers

Learning Objectives

1. Find the reciprocal of a fraction.
2. Divide fractions.
3. Divide fractions and mixed numbers or whole numbers.
4. Solve problems by dividing fractions.
5. Key Vocabulary: *reciprocal*

Examples:

1. Find the reciprocal of each number.

   a) $\frac{2}{7}$ b) $\frac{15}{8}$ c) 6 d) $\frac{1}{10}$

2. Divide and simplify.

   a) $\frac{1}{3} \div \frac{5}{6}$ b) $\frac{7}{8} \div \frac{3}{4}$ c) $\frac{5}{9} \div \frac{10}{9}$ d) $\frac{6}{17} \div \frac{6}{17}$

3. Divide and simplify.

   a) $3\frac{2}{9} \div \frac{3}{2}$ b) $1\frac{3}{7} \div \frac{2}{7}$ c) $2\frac{3}{5} \div 1\frac{3}{5}$ d) $4\frac{1}{6} \div 3\frac{3}{4}$

   e) $27 \div 4\frac{1}{2}$ f) $2\frac{8}{9} \div 13$ g) $5\frac{5}{9} \div 10$ h) $6\frac{1}{3} \div 0$

4. a) How many $\frac{5}{8}$-pound boxes of pasta can be made from 7880 pounds of pasta?

   b) Ally drove 262 miles on $8\frac{1}{6}$ gallons of gasoline. How many miles per gallon did she average?

Teaching Notes:

- Remind students that mixed numbers must be changed to improper fractions.
- Some students simplify before taking the reciprocal of the second fraction.
- Some students change division to multiplication but do not multiply by reciprocal.
- Many students have trouble deciding which number does the dividing in word problems.

Answers: 1a) 7/2, b) 8/15, c) 1/6, d) 10/1; 2a) 2/5, b) 1 1/6, c) ½, d) 1; 3a) 2 4/27, b) 5, c) 1 5/8, d) 1 1/9, e) 6, f) 2/9, g)1 5/9, h) undefined; 4a) 12,608 boxes, b) 32 4/49 miles per gallon

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Activity 2-A

Multiplying and Dividing Fractions

Explain Your Thinking!

Write one or more complete sentences to explain your thinking for each example.

1. How do you know that $\frac{1}{4}$ is smaller than $\frac{1}{2}$? Explain your thinking.

2. Does $7\frac{1}{3} \times 5$ equal $35\frac{1}{3}$? Explain your thinking.

3. Why is $\frac{3}{7} \div \frac{3}{7}$ the same thing as $11 \div 11$? Explain your thinking.

4. Explain why any number times its reciprocal equals 1.

5. Why is $10 \div \frac{1}{2}$ not 5? Explain your thinking. Use a picture to illustrate your answer.

6. You were asked to choose between $\boxed{\$500 \times 10}$ or $\boxed{\$500 \div \frac{5}{50}}$. Which would you choose? Explain your thinking.

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Activity 2-B

Multiplying and Dividing Fractions

How Many Loaves Can You Make?

You have decided to make banana bread for some upcoming gatherings. You estimated that one loaf of banana bread would serve 8 people. The table below lists the ingredients you will need for 1 loaf of banana bread. Complete the table with the correct amount of ingredients. If necessary, simplify and express all measurements as a mixed number.

Ingredient	1 loaf 8 servings	½ loaf 4 servings	3½ loafs 28 servings
Shortening	$\frac{1}{2}$ cup		
Sugar	1 cup		
Eggs (beaten)	2		
Sifted Flour	2 cups		
Baking Soda	1 tsp		
Bananas (medium)	3		
Chopped Walnuts	$\frac{1}{4}$ cup		
Maraschino Cherries	$\frac{1}{3}$ cup		
Chocolate Chips	$\frac{1}{4}$ cup		

Try It At Home!

Cream shortening and sugar. Add beaten eggs, sifted flour, and baking soda. Add a little of the dry ingredients at a time until mixed well. Add mashed bananas, mixing only until well mixed. Then, by hand, add chopped cherries, nuts, and chocolate chips. Pour into a greased and floured loaf pan. Bake at 350º for 50–60 minutes. (May need to bake longer).

Enjoy!

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Activity 3-A

Adding and Subtracting Fractions

The Magic "T" Game

Directions to Instructor

- This activity works best if you arrange the class into groups of 3–4 students each.
- There are two rules for this game, but you will not tell the students. They will need to discover the rules as a group.
- Have the students copy the following problems onto a piece of paper.

5	3

11	6

$\frac{1}{2}$	$\frac{2}{3}$

$1\frac{3}{7}$	$2\frac{1}{5}$

- Begin by writing the answers. Write slowly and do not tell the students the rules! The lower left block will contain the sum of the two numbers in the top blocks, the lower right will contain the product of these two values. Some students will discover the rule quickly; others will take a little time. After the majority of students discover the rule, have them try the following:

$\frac{4}{9}$	$\frac{11}{12}$

$6\frac{1}{3}$	$3\frac{7}{9}$

$\frac{3}{7}$	
$1\frac{13}{21}$	

Challenge!

$5\frac{4}{5}$	
	$48\frac{1}{3}$

Challenge!

- Finally, encourage the students to write their own problem and exchange for more practice.

Answers:

5	*3*
8	*15*

11	*6*
17	*66*

$\frac{1}{2}$	$\frac{2}{3}$
$1\frac{1}{6}$	$\frac{1}{3}$

$1\frac{3}{7}$	$2\frac{1}{5}$
$3\frac{22}{35}$	$3\frac{1}{7}$

$\frac{4}{9}$	$\frac{11}{12}$
$1\frac{13}{36}$	$\frac{11}{27}$

$6\frac{1}{3}$	$3\frac{7}{9}$
$10\frac{1}{9}$	$23\frac{25}{27}$

$\frac{3}{7}$	$1\frac{4}{21}$
$1\frac{13}{25}$	$\frac{25}{49}$

$5\frac{4}{5}$	$8\frac{1}{3}$
$14\frac{2}{5}$	$48\frac{1}{3}$

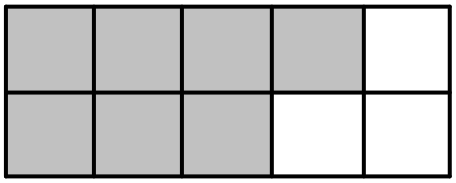
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Chapter 2 PreTest – Form A

Name:
Date:

1. Use a fraction to represent the shaded area of the figure.



1. _____

2. Write the number as an improper fraction.

$9\frac{4}{7}$

2. _____

3. Write the improper fraction as a mixed number or a whole number.

$\frac{75}{15}$

3. _____

4. List all the factors of 64.

4. _____

Identify each number as prime or composite.

5. 17

5. _____

6. 119

6. _____

7. Find the prime factorization of 162.

7. _____

Write the fraction in simplest form.

8. $\frac{28}{35}$

8. _____

Determine whether each pair of fractions is equivalent.

9. $\frac{12}{30}, \frac{18}{45}$

9. _____

10. $\frac{42}{13}, \frac{7}{22}$

10. _____

11. Find the reciprocal of $\frac{14}{27}$.

11. _____

Multiply. Write each answer in simplest form.

12. $\frac{3}{4} \cdot \frac{7}{11}$

12. _____

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13. $\frac{3}{5} \cdot \frac{25}{27}$ **13.** _____

14. $1\frac{3}{4} \cdot 3\frac{4}{5}$ **14.** _____

15. $\frac{4}{5} \cdot \frac{3}{3}$ **15.** _____

16. Clara Chi spends \$200 per month on car expenses. $\frac{9}{10}$ of these expenses is spent on gasoline. How much is her monthly gas bill? **16.** _____

Divide. Write all answers in simplest form.

17. $\frac{3}{4} \div \frac{5}{6}$ **17.** _____

18. $2\frac{2}{9} \div \frac{1}{3}$ **18.** _____

19. $\frac{7}{9} \div \frac{3}{3}$ **19.** _____

20. Crystal Freeman used $5\frac{1}{2}$ gallons of gas to plow 110 acres of field. How many acres could she plow using one gallon of gas? **20.** _____

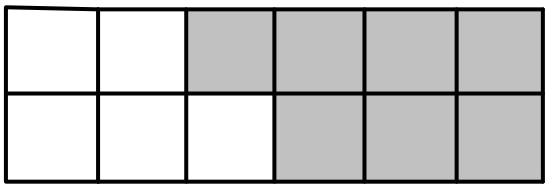
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Chapter 2 PreTest – Form B

Name:
Date:

1. Use a fraction to represent the shaded area of the figure.



1. _____

2. Write the number as an improper fraction.

$3\frac{5}{6}$

2. _____

3. Write the improper fraction as a mixed number or a whole number.

$\frac{25}{7}$

3. _____

4. List all factors of 99.

4. _____

Identify each number as prime or composite.

5. 57

5. _____

6. 79

6. _____

7. Find the prime factorization of 180.

7. _____

Write the fraction in simplest form.

8. $\frac{35}{60}$

8. _____

Determine whether each pair of fractions is equivalent.

9. $\frac{27}{64}, \frac{9}{32}$

9. _____

10. $\frac{2}{13}, \frac{14}{91}$

10. _____

Multiply. Write each answer in simplest form.

11. $\frac{3}{7} \cdot \frac{2}{7}$

11. _____

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12. $\frac{5}{9} \cdot \frac{18}{25}$ **12.** _____

13. $1\frac{3}{10} \cdot 6\frac{1}{2}$ **13.** _____

14. $\frac{4}{5} \cdot \frac{5}{5}$ **14.** _____

15. Ron Lathrop spends \$300 per month on entertainment. $\frac{3}{5}$ of his expenses is spent on dining. How much is his monthly dining expense? **15.** _____

16. Find the reciprocal of $\frac{13}{24}$. **16.** _____

Divide. Write all answers in simplest form.

17. $\frac{5}{7} \div \frac{3}{4}$ **17.** _____

18. $1\frac{1}{2} \div \frac{9}{10}$ **18.** _____

19. $\frac{7}{8} \div \frac{8}{8}$ **19.** _____

20. Billy Williams used $3\frac{1}{2}$ cups of flour to make $15\frac{3}{4}$ dozen cookies. How many dozen cookies could he make using 1 cup of flour? **20.** _____

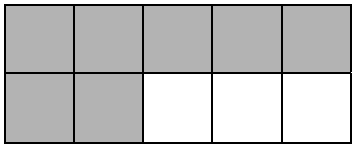
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Chapter 2 Test – Form A

Name:
Date:

1. Write a fraction to represent the shaded area. **1.** _____



2. Write $7\frac{2}{3}$ as an improper fraction. **2.** _____

3. Write $\frac{23}{5}$ as a mixed number or whole number. **3.** _____

Write each fraction in simplest form.

4. $\frac{50}{75}$ **4.** _____

5. $\frac{105}{120}$ **5.** _____

Determine whether the fractions are equivalent.

6. $\frac{4}{6}$ and $\frac{12}{16}$ **6.** _____

7. $\frac{3}{5}$ and $\frac{90}{150}$ **7.** _____

Find the prime factorization of each number.

8. 60 **8.** _____

9. 245 **9.** _____

Perform each indicated operation. Write each answer in simplest form.

10. $\frac{3}{3} \div \frac{2}{3}$ **10.** _____

11. $\frac{3}{2} \cdot \frac{3}{3}$ **11.** _____

12. $4 \cdot \frac{1}{12}$ **12.** _____

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13. $\frac{1}{6} \cdot \frac{2}{3}$ **13.** _____

14. $9 \div \frac{1}{3}$ **14.** _____

15. $7\frac{1}{2} \div 3$ **15.** _____

16. $\frac{2}{9} \cdot \frac{15}{4} \cdot \frac{4}{12}$ **16.** _____

17. $\frac{1}{2} \div 6\frac{1}{4}$ **17.** _____

18. $\frac{5}{6} \div \frac{2}{5}$ **18.** _____

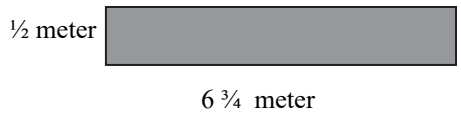
19. $1\frac{1}{3} \cdot 6\frac{3}{5}$ **19.** _____

20. $4 \div 5\frac{3}{5}$ **20.** _____

21. $\frac{16}{5} \cdot \frac{25}{24} \cdot \frac{4}{12}$ **21.** _____

22. Fill in the blank: Two numbers are _____ of each other if their product is 1. **22.** _____

23. Find the area of the figure. **23.** _____



24. A designer of doll's clothing needs $1\frac{1}{8}$ yards of fabric for one outfit. How many outfits can be made from 18 yards of fabric? **24.** _____

25. Marge Haggar earns $480 per week. She budgets $\frac{2}{5}$ of this income for rent. How much does she budget for rent each week? **25.** _____

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Chapter 2 Test – Form B

Name:
Date:

1. Write a fraction to represent the shaded area. **1.** _____



2. Write $6\frac{3}{4}$ as an improper fraction. **2.** _____

3. Write $\frac{43}{7}$ as a mixed number or whole number. **3.** _____

Write each fraction in simplest form.

4. $\frac{45}{60}$ **4.** _____

5. $\frac{111}{123}$ **5.** _____

Determine whether the fractions are equivalent.

6. $\frac{9}{15}$ and $\frac{24}{40}$ **6.** _____

7. $\frac{20}{68}$ and $\frac{8}{28}$ **7.** _____

Find the prime factorization of each number.

8. 63 **8.** _____

9. 405 **9.** _____

Perform each indicated operation. Write each answer in simplest form.

10. $\frac{2}{2} \div \frac{2}{5}$ **10.** _____

11. $\frac{1}{2} \cdot \frac{1}{2}$ **11.** _____

12. $\frac{12}{9} \cdot \frac{3}{20}$ **12.** _____

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13. $\frac{1}{6} \cdot 16$ **13.** _____

14. $\frac{1}{2} \div 12$ **14.** _____

15. $6\frac{1}{2} \div 6$ **15.** _____

16. $\frac{3}{7} \cdot \frac{14}{6} \cdot \frac{5}{11}$ **16.** _____

17. $4\frac{4}{5} \div 12$ **17.** _____

18. $1\frac{1}{9} \div 1$ **18.** _____

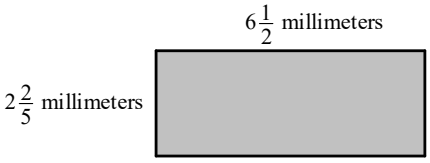
19. $4\frac{1}{4} \cdot 3\frac{2}{3}$ **19.** _____

20. $23 \div 5\frac{3}{4}$ **20.** _____

21. $5 \cdot \frac{6}{5} \cdot \frac{13}{12}$ **21.** _____

22. Fill in the blank: A _____ fraction is one whose numerator is less than its denominator. **22.** _____

23. Find the area of the figure. **23.** _____



24. The Raymond family was on vacation in Europe for 21 days. It rained for $\frac{1}{3}$ of these days. How many days did it rain? **24.** _____

25. A car used $13\frac{3}{4}$ gallons of gas to drive $5\frac{1}{2}$ hours. How many gallons of gas were used each hour? **25.** _____

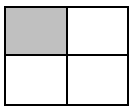
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Chapter 2 Test – Form C

Name:
Date:

1. Write a fraction to represent the shaded area. **1.** _____



2. Write $3\frac{2}{3}$ as an improper fraction. **2.** _____

3. Write $\frac{27}{2}$ as a mixed number or whole number. **3.** _____

Write each fraction in simplest form.

4. $\frac{34}{51}$ **4.** _____

5. $\frac{14}{118}$ **5.** _____

Determine whether the fractions are equivalent.

6. $\frac{15}{35}$ and $\frac{12}{30}$ **6.** _____

7. $\frac{2}{16}$ and $\frac{5}{40}$ **7.** _____

Find the prime factorization of each number.

8. 72 **8.** _____

9. 325 **9.** _____

Perform each indicated operation. Write each answer in simplest form.

10. $\frac{1}{2} \cdot \frac{5}{5}$ **10.** _____

11. $\frac{5}{6} \div \frac{2}{2}$ **11.** _____

12. $6 \div \frac{1}{2}$ **12.** _____

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13. $\frac{48}{27} \cdot \frac{18}{40}$ **13.** _____

14. $4 \cdot \frac{1}{10}$ **14.** _____

15. $11\frac{1}{3} \div 7$ **15.** _____

16. $\frac{1}{5} \cdot \frac{20}{6} \cdot \frac{2}{9}$ **16.** _____

17. $7\frac{1}{2} \cdot \frac{2}{7}$ **17.** _____

18. $\frac{12}{5} \div \frac{4}{15}$ **18.** _____

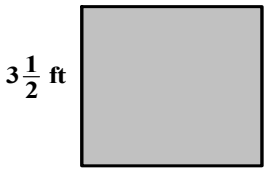
19. $2\frac{1}{3} \cdot 4\frac{3}{4}$ **19.** _____

20. $\frac{1}{12} \div 3\frac{1}{2}$ **20.** _____

21. $\frac{16}{3} \cdot \frac{18}{15} \cdot 3$ **21.** _____

22. Fill in the blank: An _____ fraction is a fraction whose numerator is greater than or equal to its denominator. **22.** _____

23. Find the area of the square. **23.** _____



24. A floor tile is $4\frac{3}{5}$ in. wide. How many tiles in a row are needed to cross a room 460 in. wide ? **24.** _____

25. Randy had a paycheck for \$150. He spent $\frac{2}{3}$ of his paycheck on groceries. How much money did he spend on groceries? **25.** _____

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Chapter 2 Test – Form D

Name:
Date:

1. Write a fraction to represent the shaded area. **1.** _____



2. Write $7\frac{7}{17}$ as an improper fraction **2.** _____

3. Write $\frac{34}{8}$ as a mixed number or whole number. **3.** _____

Write each fraction in simplest form.

4. $\frac{72}{81}$ **4.** _____

5. $\frac{77}{121}$ **5.** _____

Determine whether the fractions are equivalent.

6. $\frac{18}{12}$ and $\frac{54}{36}$ **6.** _____

7. $\frac{33}{22}$ and $\frac{55}{44}$ **7.** _____

Find the prime factorization of each number.

8. 82 **8.** _____

9. 111 **9.** _____

Perform each indicated operation. Write each answer in simplest form.

10. $\frac{1}{4} \cdot \frac{2}{3}$ **10.** _____

11. $\frac{3}{5} \div \frac{7}{10}$ **11.** _____

12. $\frac{7}{8} \div \frac{3}{3}$ **12.** _____

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13. $9 \div \frac{1}{3}$ **13.** _____

14. $\frac{5}{4} \cdot \frac{4}{4}$ **14.** _____

15. $3 \div \frac{1}{9}$ **15.** _____

16. $\frac{2}{5} \cdot \frac{25}{20} \cdot \frac{4}{8}$ **16.** _____

17. $6\frac{1}{3} \div \frac{7}{15}$ **17.** _____

18. $9\frac{1}{3} \div 2$ **18.** _____

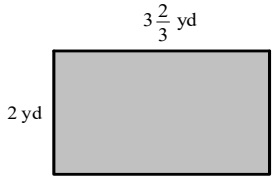
19. $2\frac{2}{3} \cdot 4\frac{4}{5}$ **19.** _____

20. $14 \div 3\frac{1}{2}$ **20.** _____

21. $2 \cdot \frac{3}{5} \cdot \frac{20}{18}$ **21.** _____

22. Fill in the blank: A _____ number contains a whole number part and a fraction part. **22.** _____

23. Find the area of the figure. **23.** _____



24. A piece of land whose area is $4\frac{3}{7}$ acres sold for \$31,000. What was the price per acre? **24.** _____

25. Sue had a paycheck for \$180. She spent $\frac{3}{5}$ of her paycheck on groceries. How much money did she spend on groceries? **25.** _____

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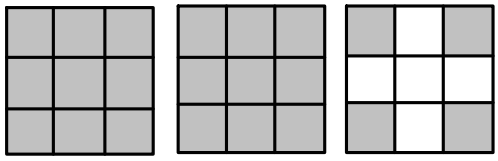
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Chapter 2 Test – Form E

Name:
Date:

1. Write a mixed number to represent the shaded area.

a. $2\frac{4}{9}$ **b.** $2\frac{4}{22}$ **c.** $\frac{9}{22}$ **d.** $\frac{22}{9}$



2. Write $7\frac{9}{13}$ as an improper fraction.

a. $\frac{81}{7}$ **b.** $\frac{100}{13}$ **c.** $\frac{29}{13}$ **d.** $\frac{13}{100}$

3. Write $\frac{32}{3}$ as a mixed number.

a. $\frac{3}{32}$ **b.** 10.7 **c.** $10\frac{1}{3}$ **d.** $10\frac{2}{3}$

4. Write $\frac{6}{36}$ in simplest form.

a. $\frac{1}{6}$ **b.** $\frac{2}{12}$ **c.** $\frac{3}{18}$ **d.** 6

5. Write $\frac{27}{117}$ in simplest form.

a. $\frac{9}{39}$ **b.** $\frac{3}{13}$ **c.** $\frac{117}{27}$ **d.** $\frac{13}{3}$

6. Determine whether the fractions are equivalent: $\frac{56}{63}$ and $\frac{88}{99}$

a. yes **b.** no

7. Determine whether the fractions are equivalent: $\frac{13}{12}$ and $\frac{14}{15}$

a. yes **b.** no

8. Find the prime factorization of 124.

a. $4 \cdot 31$ **b.** $2^3 \cdot 13$ **c.** $2^2 \cdot 31$ **d.** $2^2 \cdot 29$

9. Find the prime factorization of 500.

a. $2^2 \cdot 5^3$ **b.** $2^3 \cdot 5^2$ **c.** $2 \cdot 4 \cdot 5^2$ **d.** $2^3 \cdot 25$

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Perform the indicated operation. Write each answer in simplest form.

10. $\frac{7}{7} \div \frac{1}{6}$

a. 6 **b.** $1\frac{6}{7}$ **c.** $\frac{1}{6}$ **d.** $\frac{8}{13}$

11. $\frac{8}{8} \cdot \frac{9}{21}$

a. $\frac{29}{17}$ **b.** $\frac{17}{29}$ **c.** $\frac{3}{7}$ **d.** $\frac{7}{3}$

12. $\frac{2}{3} \cdot 5$

a. $\frac{10}{3}$ **b.** $\frac{2}{15}$ **c.** $\frac{17}{3}$ **d.** $\frac{11}{9}$

13. $\frac{5}{6} \cdot \frac{11}{14}$

a. $\frac{19}{17}$ **b.** $\frac{35}{33}$ **c.** $\frac{55}{84}$ **d.** $\frac{4}{5}$

14. $10 \div \frac{5}{4}$

a. 9 **b.** $\frac{13}{2}$ **c.** 8 **d.** 7

15. $9 \div 2\frac{1}{4}$

a. $18\frac{1}{4}$ **b.** $20\frac{1}{4}$ **c.** 4 **d.** $\frac{36}{9}$

16. $\frac{2}{3} \cdot \frac{5}{7} \cdot \frac{5}{8}$

a. $\frac{25}{18}$ **b.** $\frac{5}{42}$ **c.** $\frac{25}{84}$ **d.** $\frac{7}{12}$

17. $2\frac{2}{5} \div \frac{3}{5}$

a. 5 **b.** $2\frac{1}{2}$ **c.** 4 **d.** 3

18. $\frac{1}{3} \div \frac{4}{9}$

a. $\frac{3}{4}$ **b.** $\frac{9}{12}$ **c.** $\frac{4}{27}$ **d.** $1\frac{1}{3}$

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19. $6\frac{1}{2} \cdot 2\frac{2}{5}$

a. $12\frac{1}{5}$ **b.** $\frac{65}{24}$ **c.** $15\frac{3}{5}$ **d.** $2\frac{17}{24}$

20. $44 \div 5\frac{1}{2}$

a. 8 **b.** 9 **c.** $6\frac{1}{2}$ **d.** 7

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

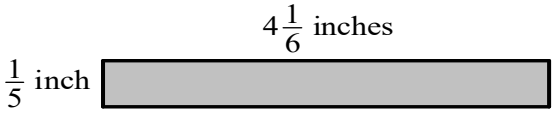
a. $\frac{4}{17}$ **b.** $\frac{7}{4}$ **c.** $\frac{1}{4}$ **d.** $\frac{16}{49}$

22. Fill in the blank: The fraction $\frac{5}{0}$ is _____.

a. equal to 0 **b.** equal to 1 **c.** undefined **d.** equal to 5

23. Find the area of the figure.

a. $\frac{6}{125}$ sq. in. **b.** $4\frac{1}{30}$ sq. in. **c.** $\frac{5}{6}$ sq. in. **d.** $8\frac{11}{15}$ sq. in.



24. During a $401\frac{5}{8}$ mile trip, a car uses $12\frac{3}{4}$ gallons of gas. How many miles could we expect the car to travel on one gallon of gas?

a. $31\frac{1}{2}$ miles **b.** $33\frac{1}{2}$ miles **c.** $5120\frac{23}{32}$ miles **d.** 31 miles

25. Sheila's English homework was to read $\frac{1}{3}$ of her book. Her book was 180 pages long. How many pages did Sheila read for homework?

a. 60 pages **b.** 90 pages **c.** 30 pages **d.** 180 pages

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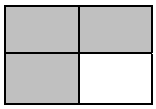
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Chapter 2 Test – Form F

Name:
Date:

1. Write a fraction to represent the shaded area.

a. $\frac{3}{4}$ **b.** $\frac{3}{1}$ **c.** $\frac{1}{4}$ **d.** $\frac{1}{3}$



2. Write $3\frac{7}{9}$ as an improper fraction.

a. $\frac{27}{9}$ **b.** $\frac{21}{9}$ **c.** $\frac{19}{9}$ **d.** $\frac{34}{9}$

3. Write $\frac{48}{5}$ as a mixed number.

a. $9\frac{3}{5}$ **b.** 9.6 **c.** $9\frac{2}{5}$ **d.** $\frac{5}{48}$

4. Write $\frac{99}{121}$ in simplest form.

a. $\frac{121}{99}$ **b.** $\frac{9}{11}$ **c.** $1\frac{2}{9}$ **d.** $\frac{18}{22}$

5. Write $\frac{204}{360}$ in simplest form.

a. $\frac{34}{60}$ **b.** $\frac{51}{90}$ **c.** $\frac{17}{30}$ **d.** $\frac{360}{204}$

6. Determine whether the fractions are equivalent: $\frac{50}{60}$ and $\frac{36}{48}$

a. yes **b.** no

7. Determine whether the fractions are equivalent: $\frac{45}{75}$ and $\frac{60}{100}$

a. yes **b.** no

8. Find the prime factorization of 490.

a. $10 \cdot 49$ **b.** $3 \cdot 5 \cdot 7$ **c.** $7^2 \cdot 10$ **d.** $2 \cdot 5 \cdot 7^2$

9. Find the prime factorization of 1089.

a. $3^2 \cdot 11^2$ **b.** $2 \cdot 5 \cdot 89$ **c.** $9 \cdot 121$ **d.** $3 \cdot 11^1$

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Perform the indicated operation. Write each answer in simplest form.

10. $\frac{2}{2} \div \frac{5}{8}$

a. 1 **b.** $\frac{7}{10}$ **c.** $\frac{8}{5}$ **d.** $\frac{5}{8}$

11. $\frac{4}{4} \cdot \frac{8}{18}$

a. $\frac{9}{4}$ **b.** $\frac{6}{11}$ **c.** $\frac{4}{9}$ **d.** $\frac{11}{6}$

12. $\frac{2}{3} \cdot 7$

a. $\frac{13}{9}$ **b.** $\frac{23}{3}$ **c.** $\frac{14}{3}$ **d.** $\frac{2}{21}$

13. $\frac{3}{5} \cdot \frac{1}{5}$

a. 3 **b.** $\frac{3}{25}$ **c.** $\frac{1}{15}$ **d.** $\frac{2}{15}$

14. $36 \div \frac{12}{5}$

a. $\frac{27}{2}$ **b.** 16 **c.** 15 **d.** 14

15. $2\frac{3}{4} \div \frac{1}{2}$

a. $\frac{22}{4}$ **b.** $5\frac{1}{2}$ **c.** $\frac{11}{8}$ **d.** $4\frac{3}{4}$

16. $\frac{7}{8} \cdot \frac{4}{7} \cdot \frac{2}{3}$

a. $\frac{28}{3}$ **b.** $\frac{1}{18}$ **c.** $\frac{49}{48}$ **d.** $\frac{1}{3}$

17. $\frac{5}{9} \div 1\frac{1}{3}$

a. $\frac{20}{27}$ **b.** $\frac{15}{36}$ **c.** $\frac{5}{12}$ **d.** $1\frac{5}{27}$

18. $\frac{1}{3} \div \frac{1}{6}$

a. $\frac{1}{2}$ **b.** $\frac{1}{18}$ **c.** 2 **d.** $\frac{6}{3}$

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19. $6\frac{3}{5} \cdot 1\frac{1}{4}$

a. $\frac{165}{20}$ **b.** $\frac{33}{4}$ **c.** $6\frac{3}{20}$ **d.** $6\frac{1}{4}$

20. $29 \div 5\frac{4}{5}$

a. 4 **b.** 6 **c.** 5 **d.** $3\frac{1}{2}$

21. $\frac{1}{3} \cdot \frac{3}{4} \cdot 2$

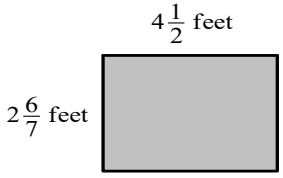
a. $\frac{8}{9}$ **b.** $\frac{3}{2}$ **c.** $\frac{1}{2}$ **d.** $\frac{4}{9}$

22. Fill in the blank: A _____ number is a natural number greater than 1 whose only factors are 1 and itself.

a. composite **b.** prime **c.** mixed **d.** numerator

23. Find the area of the figure.

a. $14\frac{5}{7}$ square feet **b.** $8\frac{3}{7}$ square feet **c.** $\frac{40}{63}$ square feet **d.** $12\frac{6}{7}$ square feet



24. Crystal Freeman used $6\frac{1}{2}$ gallons of gas to plow 260 acres of field. How many acres could she plow using one gallon of gas?

a. 40 **b.** 32 **c.** 41 **d.** 44

25. The Larsson family has a weekly income of \$950, $\frac{2}{5}$ of which must be budgeted for groceries. How much is budgeted each week for groceries?

a. \$380 **b.** \$2375 **c.** \$190 **d.** \$95

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Chapters 1-2 Test – Form A

Name:
Date:

Evaluate.

1. $500 - 147$ **1.** _____

2. 293×50 **2.** _____

3. $28{,}941 \div 72$ **3.** _____

4. $3{,}256 \times 1{,}000$ **4.** _____

5. $4^2 \cdot 5^2$ **5.** _____

6. $17 - 16 \div 2 + 4 \cdot 3$ **6.** _____

7. $\dfrac{36 \div 9 \cdot 2}{(\sqrt{25} - 3)^2 + 4}$ **7.** _____

8. Estimate the sum by rounding each number to the nearest hundred.
1642 + 2351 + 398 **8.** _____

Perform each indicated operation and write each answer in simplest form.

9. $\frac{5}{8} \cdot \frac{2}{15}$ **9.** _____

10. $\frac{4}{9} \div \frac{5}{6}$ **10.** _____

11. $2\frac{2}{5} \cdot 3\frac{1}{8}$ **11.** _____

12. $1\frac{7}{8} \div \frac{3}{4}$ **12.** _____

13. Write $6\frac{4}{9}$ as an improper fraction. **13.** _____

14. Write $\frac{72}{132}$ in simplest form. **14.** _____

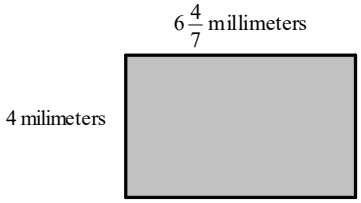
15. Determine whether the fractions are equivalent.
$\frac{64}{72}$ and $\frac{24}{27}$ **15.** _____

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16. Find the prime factorization of 88. **16.** _____

17. Find the area of the rectangle. **17.** _____



18. A store bought 24 ten-pound bags of oranges for $168. How much did they pay per bag? **18.** _____

19. Ben drove 198 miles. When he filled his car's gas tank, it took $7\frac{1}{3}$ gallons of gas to fill it. How far did his car travel per gallon of gas? **19.** _____

20. Find the product of $3\frac{1}{2}$ and 14. **20.** _____

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Chapters 1-2 Test – Form B

Name:
Date:

1. Evaluate: $800 - 239$

a. 661 **b.** 561 **c.** 571 **d.** 671

2. Evaluate:
$$\begin{array}{r} 375 \\ \times\ 40 \\ \hline \end{array}$$

a. 1,500 **b.** 16,000 **c.** 12,800 **d.** 15,000

3. Evaluate: $5640 \cdot 100$

a. 564 **b.** 56,400 **c.** 5,640,000 **d.** 564,000

4. Evaluate: $33{,}279 \div 61$

a. 545, R: 34 **b.** 545, R: 44 **c.** 535, R: 34 **d.** 535, R: 44

5. Evaluate: $5^3 \cdot 3^1$

a. 225 **b.** 125 **c.** 375 **d.** 75

6. Evaluate: $7 + 28 \div 7 - 72 \div 9$

a. 5 **b.** 7 **c.** 8 **d.** 3

7. Evaluate: $\dfrac{49 \div 7 \cdot 2}{(\sqrt{25} - 3)^2 + 3}$

a. 2 **b.** 4 **c.** 1 **d.** 7

8. Estimate the difference by rounding each number to the nearest hundred: $7483 - 1927$

a. 5000 **b.** 5600 **c.** 5500 **d.** 5700

9. Multiply and simplify: $\dfrac{8}{25} \cdot \dfrac{5}{12}$

a. $\dfrac{10}{3}$ **b.** $\dfrac{2}{75}$ **c.** $\dfrac{2}{15}$ **d.** $\dfrac{1}{15}$

10. Divide and simplify: $\dfrac{2}{5} \div \dfrac{7}{10}$

a. $\dfrac{7}{25}$ **b.** $\dfrac{1}{14}$ **c.** $\dfrac{2}{7}$ **d.** $\dfrac{4}{7}$

11. Multiply and simplify: $2\dfrac{2}{3} \cdot 1\dfrac{5}{7}$

a. $4\dfrac{2}{21}$ **b.** $3\dfrac{3}{7}$ **c.** $4\dfrac{4}{7}$ **d.** $2\dfrac{10}{21}$

12. Divide and simplify: $2\dfrac{1}{6} \div \dfrac{11}{12}$

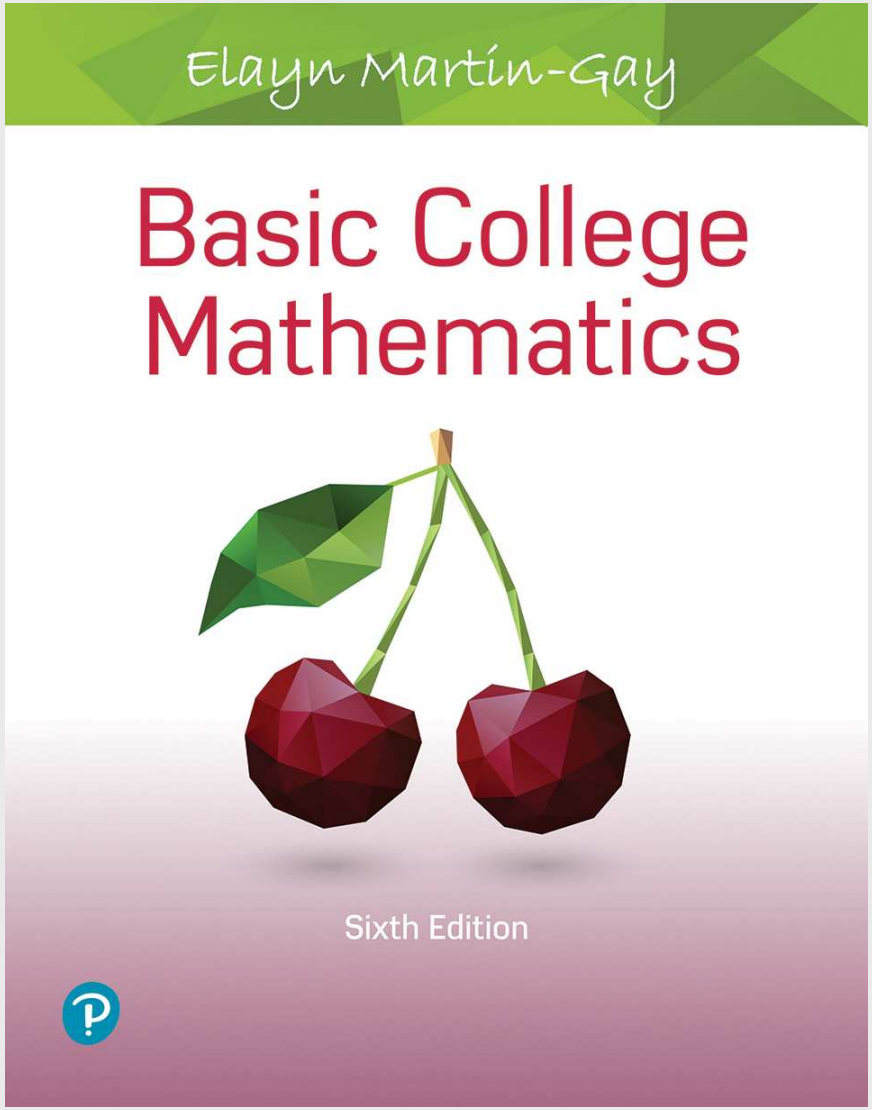
a. $1\dfrac{4}{11}$ **b.** $2\dfrac{4}{11}$ **c.** $2\dfrac{5}{11}$ **d.** $2\dfrac{2}{11}$

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Chapter 2

Multiplying and Dividing Fractions



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Section 2.1

Introduction to Fractions and Mixed Numbers

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Objectives

A. Identify the Numerator and the Denominator of a Fraction and Review Division Properties of 0 and 1.

B. Write a Fraction to Represent Parts of Figures or Real-Life Data.

C. Identify Proper Fractions, Improper Fractions, and Mixed Numbers.

D. Write Mixed Numbers as Improper Fractions.

E. Write Improper Fractions as Mixed Numbers or Whole Numbers.

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Identifying Numerators and Denominators

In a fraction, the top number is called the **numerator** and the bottom number is called the **denominator**. The bar between the numbers is called the **fraction bar**.

Names	Fraction	Meaning
Numerator →	$\frac{5}{6}$	← number of parts being considered
Denominator →		← number of equal parts in the whole

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Examples 1 and 2

Identify the numerator and denominator of each fraction.

a. $\frac{11}{2}$ $\frac{\leftarrow \text{numerator}}{\leftarrow \text{denominator}}$

b. $\frac{10}{17}$ $\frac{\leftarrow \text{numerator}}{\leftarrow \text{denominator}}$

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Division Properties of 0 and 1

If n is any whole number, except 0.

$$\frac{n}{n} = 1$$

$$\frac{0}{n} = 0$$

$$\frac{n}{1} = n$$

$$\frac{n}{0} = \text{undefined}$$

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Examples 3 to 6

Simplify.

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

b. $\frac{6}{6} = 1$

c. $\frac{0}{1} = 0$

d. $\frac{5}{1} = 5$

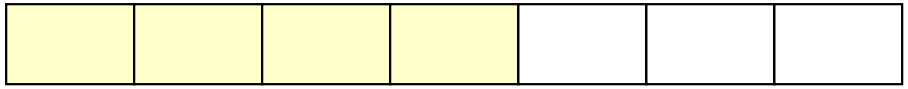
e. $\frac{13}{0}$ undefined

f. $\frac{13}{1} = 13$

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Example 7

Write the fraction to represent the shaded part of the figure.

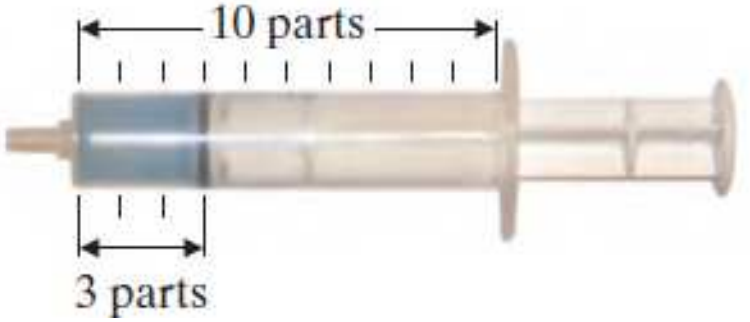


In this figure, 4 out of the 7 equal parts are shaded. Thus the fraction is $\frac{4}{7}$.

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Example 9

Write the fraction to represent the shaded part of the diagram.



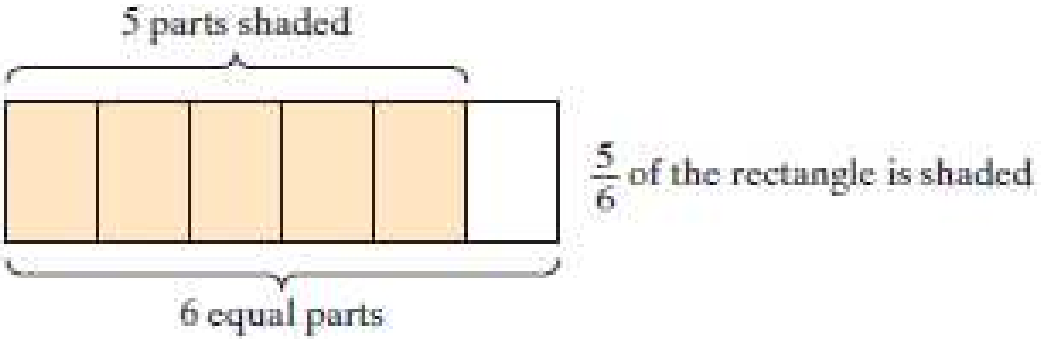
In this diagram, 3 out of the 10 equal parts are shaded. Thus the fraction is $\frac{3}{10}$.

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Example 11

Draw a figure and then shade a part of it to represent the fraction $\frac{5}{6}$.

Since the denominator is 6, we divide the rectangle into 6 equal parts. Then we shade 5 of the equal parts.



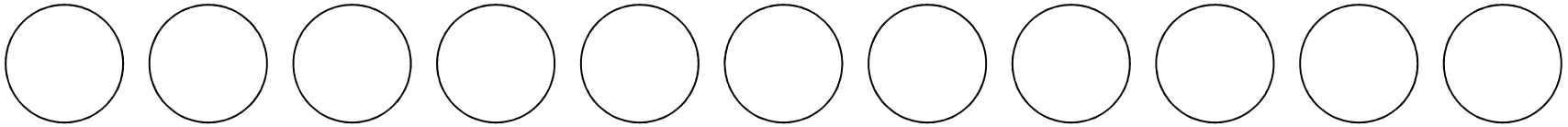
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Example 11

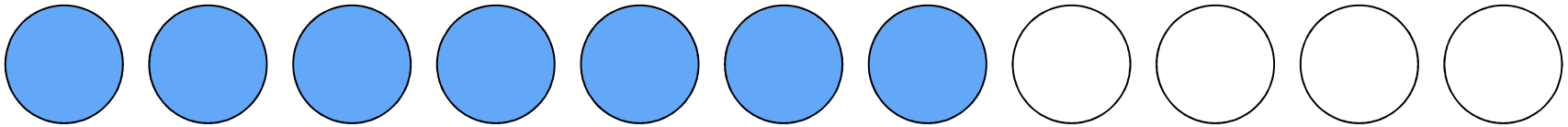
Draw and shade a part of a figure to represent the fraction.

$$\frac{7}{11}$$

The figure consists of 11 circles of the same size.



We will shade 7 of the circles.



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Example

Of the eight planets in our solar system, five are farther from the Sun than Earth is. What fraction of the planets are farther from the Sun than Earth is?

$$\frac{5 \leftarrow \text{number of planets farther}}{8 \leftarrow \text{number of planets in our solar system}}$$

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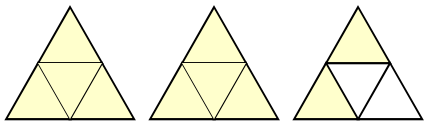
Identifying Proper Fractions, Improper Fractions and Mixed Numbers

Proper Fraction: A fraction whose numerator is less than its denominator.

Numerator $\longrightarrow$ $\frac{3}{8}$

Denominator $\longrightarrow$ $\frac{3}{8}$

Improper Fraction: A fraction whose numerator is greater than or equal to its denominator.



$$= \frac{10}{4} = 2\frac{2}{4}$$

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Example

Identify each number as a proper fraction, improper fraction, or mixed number.

a. $\frac{5}{8}$ proper fraction

b. $\frac{7}{7}$ improper fraction

c. $\frac{14}{13}$ improper fraction

d. $\frac{13}{14}$ proper fraction

e. $5\frac{1}{4}$ mixed number

f. $\frac{100}{49}$ improper fraction

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Writing a Mixed Number as an Improper Fraction

To write a mixed number as an improper fraction:

Step 1: Multiply the denominator of the fraction by the whole number.

Step 2: Add the numerator of the fraction to the product from Step 1.

Step 3: Write the sum from Step 2 as the numerator of the improper fraction over the original denominator.

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Example 17 and 18

Write each as an improper fraction.

a. $5\frac{2}{7} = \frac{7 \cdot 5 + 2}{7} = \frac{35 + 2}{7} = \frac{37}{7}$

b. $4\frac{1}{5} = \frac{5 \cdot 4 + 1}{5} = \frac{20 + 1}{5} = \frac{21}{5}$

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Writing an Improper Fraction as a Mixed Number or a Whole Number

To write an improper fraction as a mixed number or a whole number:

Step 1: Divide the denominator into the numerator.

Step 2: The whole number part of the mixed number is the quotient. The fraction part of the mixed number is the remainder over the original denominator.

$$\text{quotient } \frac{\text{remainder}}{\text{original denominator}}$$

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Example 18 and 19

Write each as a mixed number of whole number.

a. $\frac{9}{5}$: $5\overline{)9}$

$$\begin{array}{r} 1 \\ 5\overline{)9} \\ \underline{5} \\ 4 \end{array}$$

$$\frac{9}{5} = 1\frac{4}{5}$$

b. $\frac{23}{9}$: $9\overline{)23}$

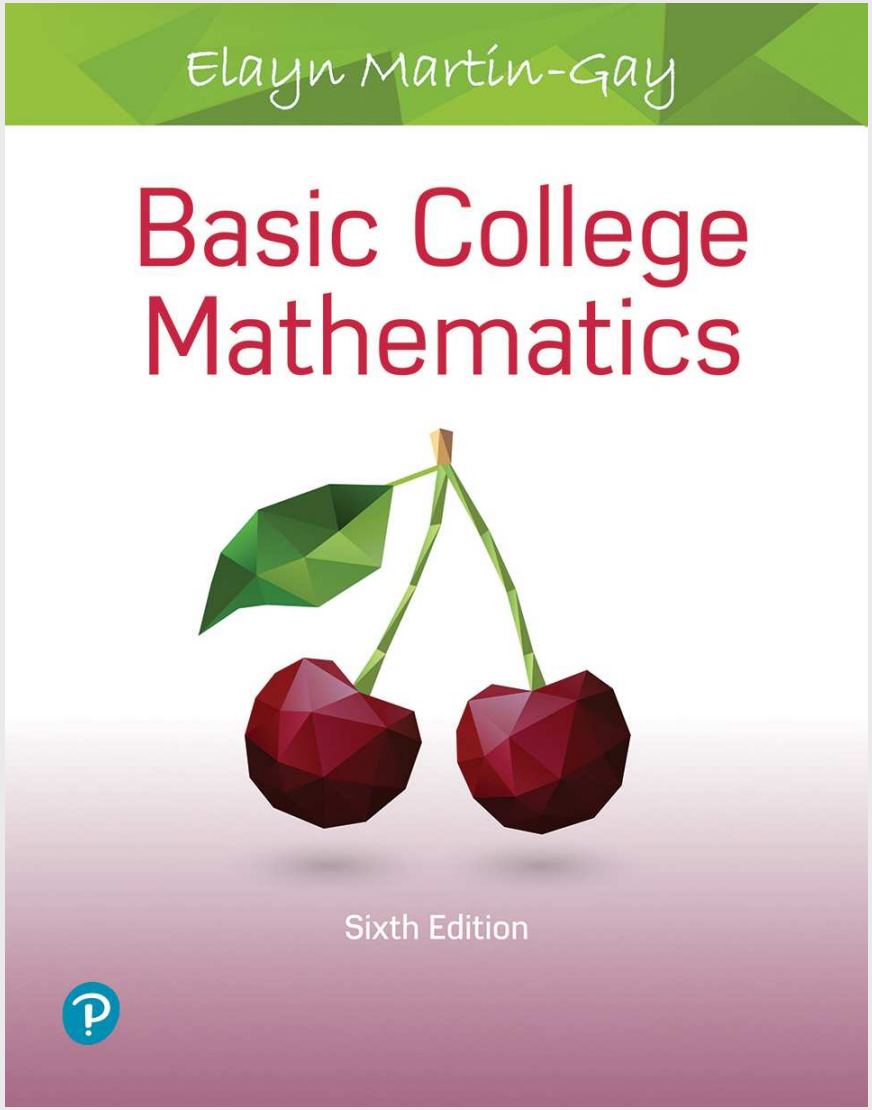
$$\begin{array}{r} 2 \\ 9\overline{)23} \\ \underline{18} \\ 5 \end{array}$$

$$\frac{23}{9} = 2\frac{5}{9}$$

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Chapter 2

Multiplying and Dividing Fractions



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Section 2.2

Factors and Prime Factorization

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Objectives

A. Find the Factors of a Number.

B. Identify Prime and Composite Numbers.

C. Find the Prime Factorization of a Number.

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Finding the Factors of Numbers

To perform many operations, it is necessary to be able to factor a number.

Since $7 \cdot 9 = 63$, both 7 and 9 are factors of 63, and $7 \cdot 9$ is called a factorization of 63.

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Example 1

Find all the factors of each number.

a. 15 1, 3, 5, 15

b. 7 1, 7

c. 24 1, 2, 3, 4, 6, 8, 12, 24

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Prime and Composite Numbers

Prime Numbers

A **prime number** is a natural number that has exactly two different factors 1 and itself. The first few prime numbers are 2, 3, 5, 7, 11, 13, 17, 19, 23, 29, … .

Composite Numbers

A **composite number** is a natural number, other than 1, that is not prime.

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Example 2

Determine whether each number is prime or composite. Explain your answers.

a. 16 Composite, it has more than two factors: 1, 2, 4, 8, 16.

b. 31 Prime, its only factors are 1 and 31.

c. 49 Composite, it has more than two factors: 1, 7, 49.

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Prime Factorization

Prime Factorization

The **prime factorization** of a number is the factorization in which all the factors are prime numbers.

Every whole number greater than 1 has exactly one prime factorization.

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Divisibility Tests

Divisibility Tests

A whole number is divisible by:

- 2 if the last digit is 0, 2, 4, 6, or 8.

  ↓

  132 is divisible by 2 since the last digit is a 2.

- 3 if the sum of the digits is divisible by 3.

  144 is divisible by 3 since $1 + 4 + 4 = 9$ is divisible by 3.

- 5 if the last digit is 0 or 5.

  ↓

  1115 is divisible by 5 since the last digit is a 5.

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Example 5

Write the prime factorization of 63.

The first prime number 2 does not divide evenly, but 3 does.

$$3\overline{)63}\quad 21$$

Because 21 is not prime, we divide again.

$$3\overline{)21}\quad 7$$

$$3\overline{)63}$$

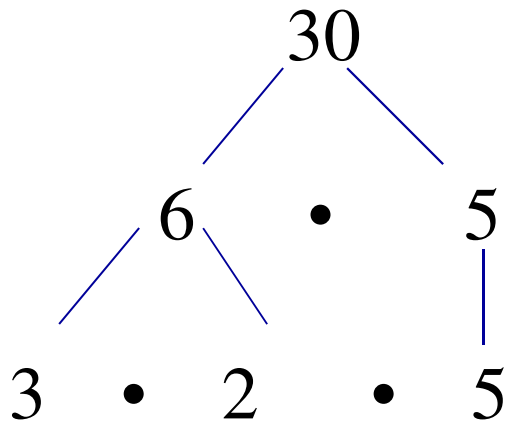
The quotient 7 is prime, so we are finished. The prime factorization of 63 is $3 \cdot 3 \cdot 7$.

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Example: Prime Factorization

Find the prime factorization of 30.

Write 30 as the product of two numbers. Continue until all factors are prime.



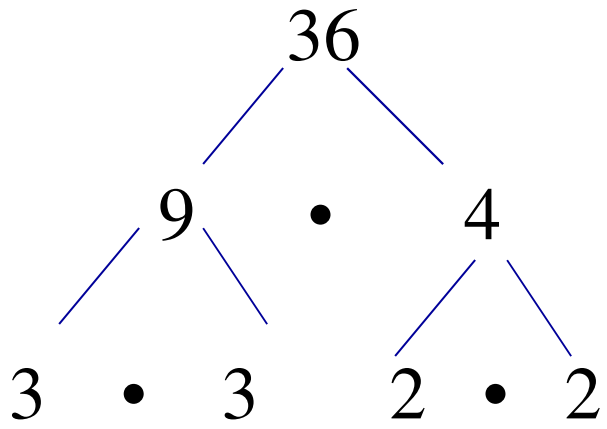
The prime factorization of 30 is $2 \cdot 3 \cdot 5$.

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Example 6

Find the prime factorization of 36.

Write 36 as the product of two numbers. Continue until all factors are prime.



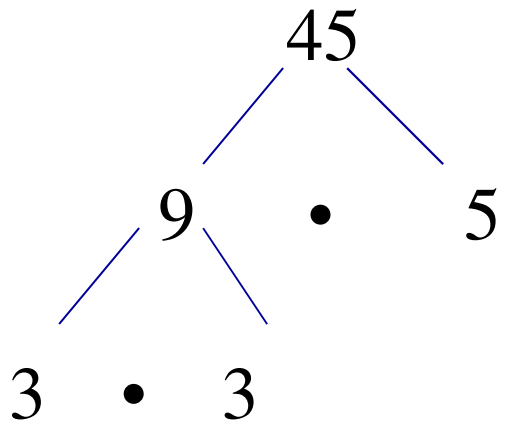
The prime factorization of 36 is $3 \cdot 3 \cdot 2 \cdot 2$ or $3^2 \cdot 2^2$.

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Example 7

Find the prime factorization of 45.

Write 45 as the product of two numbers. Continue until all factors are prime.



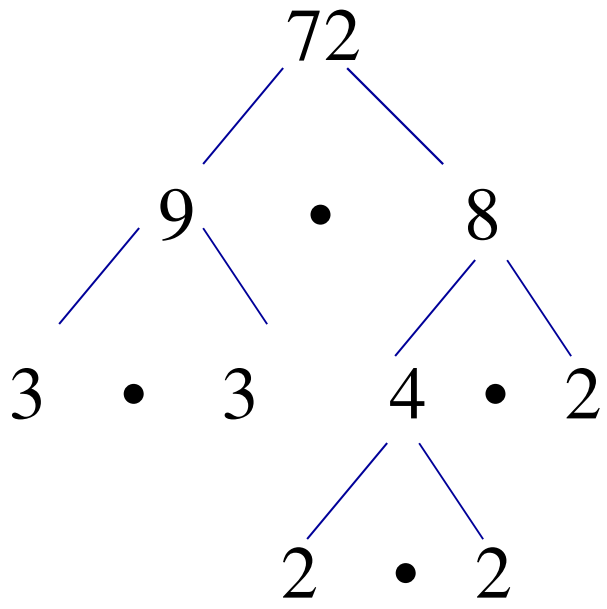
The prime factorization of 45 is $3 \cdot 3 \cdot 5$ or $3^2 \cdot 5$.

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Example 8

Find the prime factorization of 72.

Write 72 as the product of two numbers. Continue until all factors are prime.

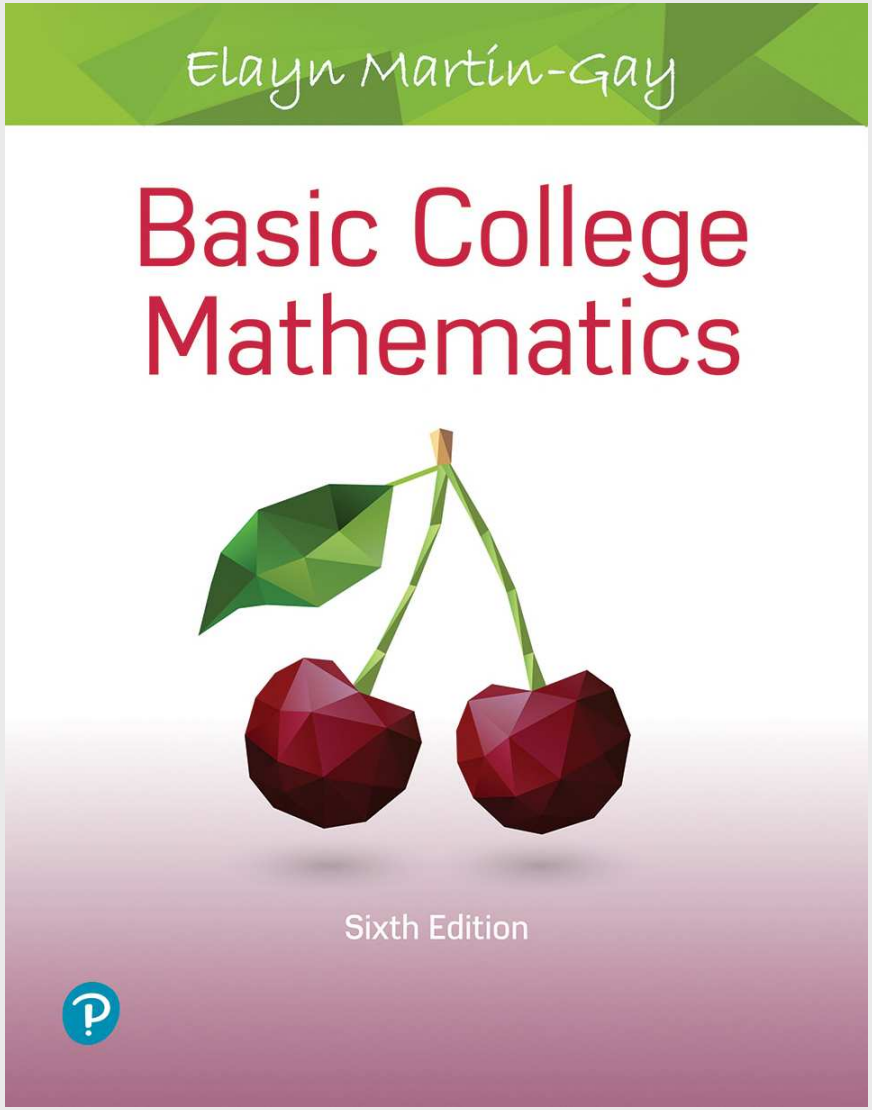


$2 \cdot 2 \cdot 2 \cdot 3 \cdot 3$ or $2^3 \cdot 3^2$

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Chapter 2

Multiplying and Dividing Fractions



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Section 2.3

Simplest Form of a Fraction

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Objectives

A. Write a Fraction in Simplest Form or Lowest Terms.

B. Determine Whether Two Fractions Are Equivalent.

C. Solve Problems by Writing Fractions in Simplest Form.

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Writing Fractions in Simplest Form

Fractions that represent the same portion of a whole are called equivalent fractions.

There are many equivalent forms of a fraction. A special form of a fraction is called **simplest form**.

Simplest Form of a Fraction
A fraction is written in **simplest form** or **lowest terms** when the numerator and denominator have no common factors other than 1.

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Examples 1, 2, and 3

Write in simplest form.

a. $\frac{10}{42} = \frac{5 \cdot 2}{21 \cdot 2} = \frac{5}{21} \cdot 1 = \frac{5}{21}$

b. $\frac{9}{27} = \frac{3 \cdot 3}{3 \cdot 3 \cdot 3} = \frac{3}{3} \cdot \frac{3}{3} \cdot \frac{1}{3} = \frac{1}{3}$

c. $\frac{8}{36} = \frac{4 \cdot 2}{4 \cdot 9} = 1 \cdot \frac{2}{9} = \frac{2}{9}$

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Simplest Form

Writing a Fraction in Simplest Form

To write a fraction in simplest form, write the prime factorization of the numerator and the denominator and then divide both by all common factors.

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Example 5

Write in simplest form.

a. $\frac{50}{22} = \frac{5 \cdot 5 \cdot \cancel{2}}{11 \cdot \cancel{2}} = \frac{25}{11}$

b. $\frac{9}{90} = \frac{\cancel{3} \cdot \cancel{3}}{\cancel{3} \cdot \cancel{3} \cdot 5 \cdot 2} = \frac{1}{10}$

c. $\frac{35}{75} = \frac{\cancel{5} \cdot 7}{\cancel{5} \cdot 5 \cdot 3} = \frac{7}{15}$

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Example 6

Write in simplest form: $\frac{7}{56}$

$$\frac{7}{56} = \frac{\cancel{7}}{\cancel{7} \cdot 8} = \frac{1}{8}$$

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Example 8

Determine whether $\frac{3}{9}$ and $\frac{2}{6}$ are equivalent.

Simplify each fraction.

$$\frac{3}{9} = \frac{3}{3 \cdot 3} = \frac{1}{3}$$

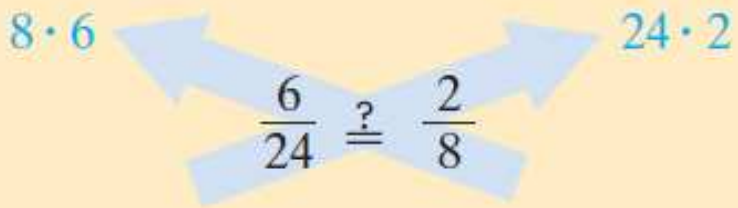
$$\frac{2}{6} = \frac{2}{3 \cdot 2} = \frac{1}{3}$$

Since both of the simplified fractions are the same, they are equivalent.

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Equality of Fractions

Equality of Fractions



Since the cross products ($8 \cdot 6 = 48$ and $24 \cdot 2 = 48$) are equal, the fractions are equal.

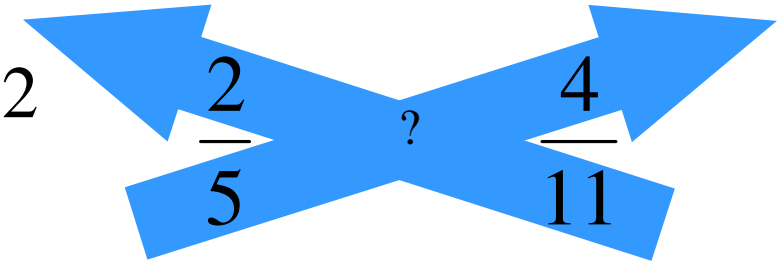
Note: If the cross products are not equal, the fractions are not equal.

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Example 9

Determine whether $\frac{2}{5}$ and $\frac{4}{11}$ are equivalent by cross multiplying.

$2 \cdot 11 = 22$



$5 \cdot 4 = 20$

Since $22 \neq 20$, then $\frac{2}{5} \neq \frac{4}{11}$.

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Example: Fractions in Distance

There are 5280 feet in a mile. What fraction of a mile is represented by 2640.

$$\frac{2640}{5280}$$ ← Both 2640 and 5280 have a common factor of 2640.

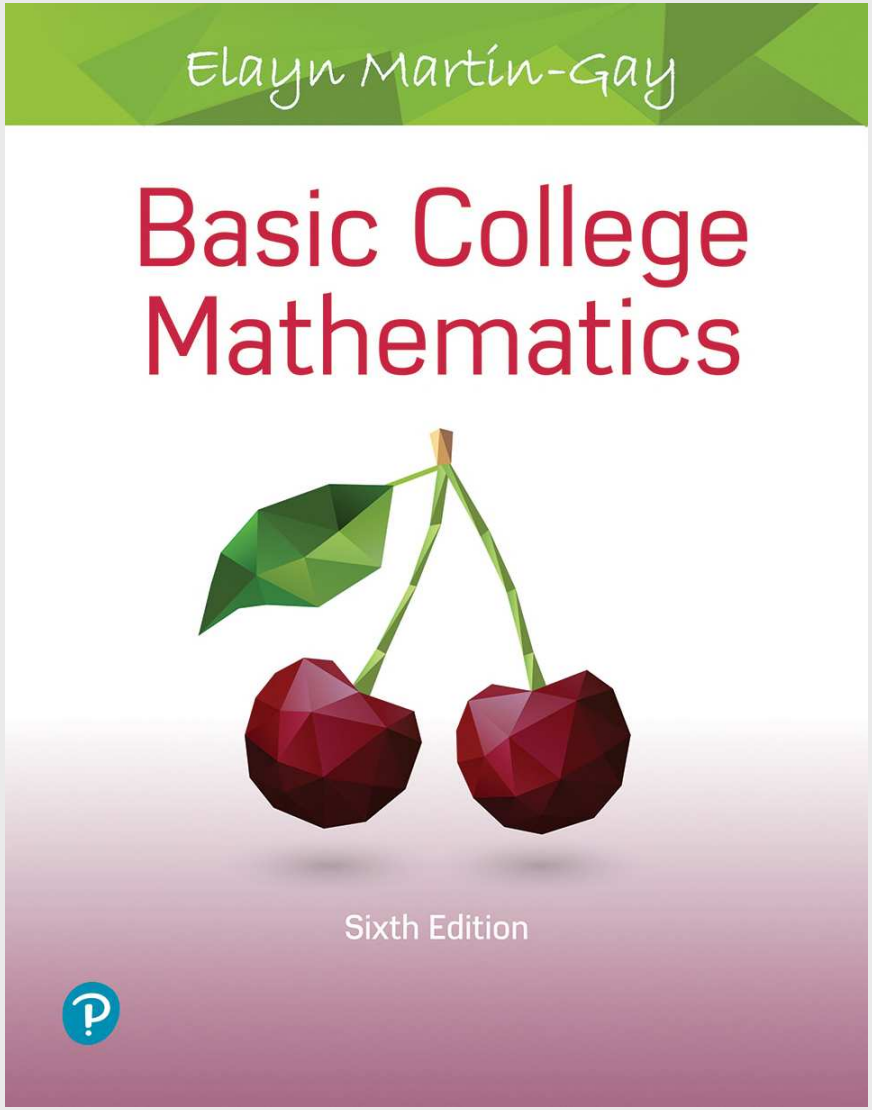
$$= \frac{2640 \div 2640}{5280 \div 2640} = \frac{1}{2}$$

The fraction of a mile represented by 2640 is 1/2.

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Chapter 2

Multiplying and Dividing Fractions



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Section 2.4

Multiplying Fractions and Mixed Numbers

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Objectives

A. Multiply Fractions.

B. Multiply Fractions and Mixed Numbers or Whole Numbers.

C. Solve Problems by Multiplying Fractions.

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Multiplying Fractions

Multiplying Fractions

To multiply two fractions, multiply the numerators and multiply the denominators.

If a, b, c, and d represent positive whole numbers we have

$$\frac{a}{b} \cdot \frac{c}{d} = \frac{a \cdot c}{b \cdot d}$$

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Examples 1, 2, and 3

Multiply.

a. $\frac{2}{7} \cdot \frac{3}{5} = \frac{2 \cdot 3}{7 \cdot 5} = \frac{6}{35}$

b. $\frac{1}{11} \cdot \frac{1}{3} = \frac{1 \cdot 1}{11 \cdot 3} = \frac{1}{33}$

c. $\frac{2}{3} \cdot \frac{4}{7} = \frac{8}{21}$

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Examples 5 and 6

Multiply and simplify.

a. $\frac{3}{4} \cdot \frac{8}{11} = \frac{3 \cdot \cancel{2} \cdot \cancel{2} \cdot 2}{\cancel{2} \cdot \cancel{2} \cdot 11} = \frac{6}{11}$

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

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Multiplying Fractions and Mixed Numbers or Whole Numbers

To multiply with mixed numbers or whole numbers, first write any mixed or whole numbers as fractions and then multiply as usual.

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Example 9

Multiply 10 by $\frac{7}{8}$.

$$10 \longrightarrow \frac{10}{1} \cdot \frac{7}{8}$$

$$= \frac{10 \cdot 7}{1 \cdot 8} = \frac{70}{8}$$

$$= \frac{35}{4} \text{ or } 8\frac{3}{4}$$

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Example 10

Multiply $3\frac{1}{5} \cdot 2\frac{3}{4}$

$$3\frac{1}{5} \cdot 2\frac{3}{4} = \frac{16}{5} \cdot \frac{11}{4} = \frac{16 \cdot 11}{5 \cdot 4} = \frac{\cancel{4} \cdot 4 \cdot 11}{5 \cdot \cancel{4}} = \frac{44}{5} = 8\frac{4}{5}$$

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Example 11

Multiply $5 \cdot 3\frac{11}{15}$

$$5 \cdot 3\frac{11}{15} = \frac{5}{1} \cdot \frac{56}{15} = \frac{5 \cdot 56}{1 \cdot 3 \cdot 5} = \frac{56}{3} = 18\frac{2}{3}$$

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Examples 12 and 13

Multiply.

a. $0 \cdot \frac{9}{11} = 0$

b. $4\frac{1}{8} \cdot 0 = 0$

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Example 14 (1 of 2)

Cedar Point is an amusement park located in Sandusky, Ohio. Its collection of 72 rides is the largest in the world. Of the rides, 2/9 are roller coasters. How many roller coasters are in Cedar Point's collection of rides.

1. Understand.

   Read and reread the problem. We are told that 2/9 of the rides are roller coasters. The word "of" means multiplication.

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Example 14 (2 of 2)

2. Translate.

number of roller coasters is 2/9 of total rides at Cedar Point

$$\text{number of coasters} = \frac{2}{9} \cdot 72$$

3. Solve.

$$\frac{2}{9} \cdot 72 = \frac{2}{9} \cdot \frac{72}{1} = \frac{2 \cdot 72}{9 \cdot 1} = \frac{2 \cdot \cancel{9} \cdot 8}{\cancel{9} \cdot 1} = \frac{16}{1} \text{ or } 16$$

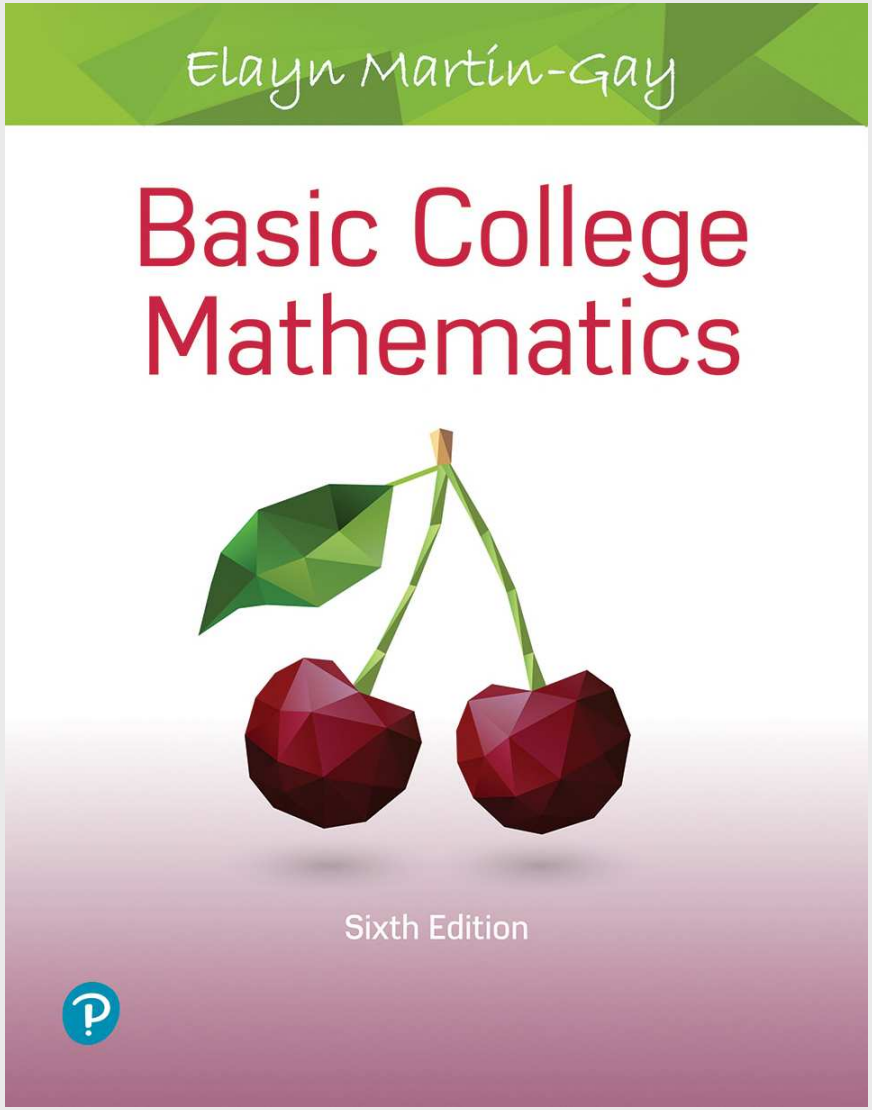
4. Interpret.

The number of roller coasters at Cedar Point is 16.

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Chapter 2

Multiplying and Dividing Fractions



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Section 2.5

Dividing Fractions and Mixed Numbers

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Objectives

A. Find the Reciprocal of a Fraction.

B. Divide Fractions.

C. Divide Fractions and Mixed Numbers or Whole Numbers.

D. Solve Problems by Dividing Fractions.

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Finding Reciprocals of Fractions

Definition	Example
Reciprocals: Two numbers are reciprocals of each other if their product is 1.	$\frac{9}{10} \cdot \frac{10}{9} = 1$
Reciprocal of a fraction: To find the reciprocal of a fraction, interchange its numerator and denominator.	$\frac{1}{11} \quad \frac{11}{1}$

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Examples 1, 2 and 4

Find the reciprocal of each number.

a. $\frac{4}{9}$ $\frac{9}{4}$

b. $\frac{13}{9}$ $\frac{9}{13}$

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

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Dividing Fractions

Dividing Fractions

To divide two fractions, multiply the first fraction by the reciprocal of the second fraction.

If a, b, c, and d represent numbers, and b, c, and d are not 0, then

$$\frac{a}{b} \div \frac{c}{d} = \frac{a}{b} \cdot \frac{d}{c} = \frac{a \cdot d}{b \cdot c}$$

reciprocal

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Examples 5 and 6

Divide and simplify.

a. $\frac{4}{5} \div \frac{1}{8} = \frac{4}{5} \cdot \frac{8}{1} = \frac{32}{5}$ or $6\frac{2}{5}$

b. $\frac{14}{17} \div \frac{2}{5} = \frac{14}{17} \cdot \frac{5}{2} = \frac{7 \cdot \cancel{2}}{17} \cdot \frac{5}{\cancel{2}} = \frac{35}{17} = 2\frac{1}{17}$

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Examples 8 and 9

Divide.

a. $\frac{14}{17} \div 0$ undefined

b. $0 \div 2\frac{1}{8} = 0 \cdot \frac{8}{17} = 0$

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Example 10

Divide: $\frac{4}{9} \div 7$

$$\frac{4}{9} \div 7 = \frac{4}{9} \cdot \frac{1}{7} = \frac{4}{63}$$

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Example 12

Divide: $3\frac{2}{7} \div 2\frac{3}{14}$

$$3\frac{2}{7} \div 2\frac{3}{14} = \frac{23}{7} \div \frac{31}{14} = \frac{23}{7} \cdot \frac{14}{31} = \frac{23 \cdot 14}{7 \cdot 31}$$

$$= \frac{23 \cdot 2 \cdot \cancel{7}}{\cancel{7} \cdot 31}$$

$$= \frac{46}{31} = 1\frac{15}{31}$$

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Example 13

A designer of clothing designs an outfit that requires 2 1/7 yards of material. How many outfits can be made from a 30-yard bolt of material?

Number of outfits = 30 divided by 2 1/7

$$30 \div 2\frac{1}{7} = \frac{30}{1} \div \frac{15}{7} = \frac{30}{1} \cdot \frac{7}{15} = \frac{\cancel{5} \cdot 2 \cdot \cancel{3} \cdot 7}{\cancel{3} \cdot \cancel{5}} = 14 \text{ outfits}$$

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