

Solution Manual for Basic College Mathematics 2nd
Edition Miller Neill Hyde 0077281136 9780077281137

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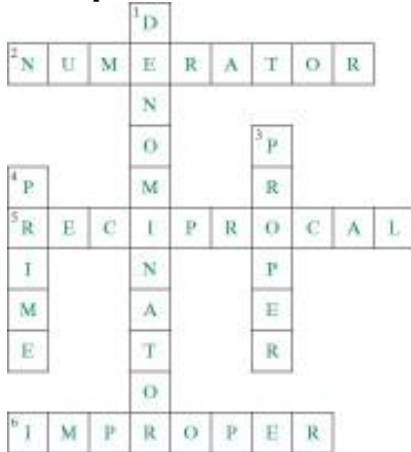
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Chapter 2 Fractions and Mixed Numbers: Multiplication and Division

Chapter Opener Puzzle



Section 2.1 Introduction to Fractions and Mixed Numbers

Section 2.1 Practice Exercises

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

Chapter 2 Fractions and Mixed Numbers: Multiplication and Division

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

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

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

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

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

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

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

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

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

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

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

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

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

31. Proper

32. Proper

33. Improper

34. Improper

37. Proper

38. Proper

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

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

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

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

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

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

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

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

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

48. $6\frac{2}{3} = \frac{6 \cdot 3 + 2}{3} = \frac{20}{3}$

49. $4\frac{4}{9} = \frac{4 \cdot 9 + 4}{9} = \frac{40}{9}$

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

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

35. Improper

36. Improper

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

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

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

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

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

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

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

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

19 eighths

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

13 fifths

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

7 fourths

$$2 \quad 5 \cdot 3 + 2 \quad 17$$

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

17 thirds

$$63. 8 \frac{4}{5} = \frac{8 \cdot 5 + 4}{5} = \frac{44}{5}$$

$$64. 7 \frac{1}{7} = \frac{7 \cdot 7 + 1}{7} = \frac{50}{7}$$

$$65. 5 \frac{7}{4} = \frac{5 \cdot 4 + 7}{4} = \frac{27}{4}$$

66.

$$\frac{\quad}{\quad} = \frac{\quad}{\quad}$$

$$67. 10 \frac{2}{10} = \frac{10 \cdot 10 + 2}{10} = \frac{102}{10} = 2 \frac{7}{10}$$

$$68. 18 \frac{2}{18} = \frac{18 \cdot 18 + 2}{18} = \frac{326}{18} = 2 \frac{7}{18}$$

$$69. 9 \frac{5}{9} = \frac{9 \cdot 9 + 5}{9} = \frac{85}{9} = 5 \frac{7}{9}$$

$$70. 12 \frac{5}{12} = \frac{12 \cdot 12 + 5}{12} = \frac{149}{12} = 5 \frac{7}{12}$$

$$71. 11 \frac{12}{11} = \frac{11 \cdot 11 + 12}{11} = \frac{133}{11} = 12 \frac{1}{11}$$

$$72. 10 \frac{5}{10} = \frac{10 \cdot 10 + 5}{10} = \frac{105}{10} = 5 \frac{1}{10}$$

$$73. 6 \frac{3}{6} = \frac{6 \cdot 6 + 3}{6} = \frac{39}{6} = 3 \frac{5}{6}$$

$$74. 115 \frac{16}{115} = \frac{115 \cdot 115 + 16}{115} = \frac{13231}{115} = 16 \frac{3}{7}$$

$$75. 44 \frac{44}{7} = \frac{44 \cdot 7 + 44}{7} = \frac{352}{7} = 44 \frac{1}{7}$$

$$4 \frac{4}{19} = 4 \frac{4}{19}$$

$$\frac{116}{4} \quad 309$$

$$3 \quad \frac{!28}{2}$$

$$\quad \quad \frac{!}{9}$$

$$\quad \quad \frac{!}{2}$$

$$\quad \quad \frac{!}{8}$$

$$\quad \quad \quad 1$$

7

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Chapter 2 Fractions and Mixed Numbers: Multiplication and Division

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

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

$$77. \begin{array}{r} \overline{3)1056} \\ \underline{!5} \\ 2 \\ \underline{!0} \\ 28 \end{array} \quad 1056\frac{1}{5}$$

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

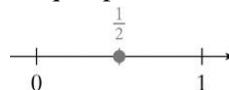
$$\begin{array}{r} \overline{!25} \\ 31 \\ \underline{!30} \\ \hline 1 \end{array}$$

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



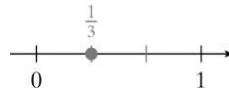
$$78. \begin{array}{r} \overline{8)7213} \\ \underline{!72} \\ 1 \\ \underline{!0} \\ 13 \\ \underline{!8} \\ 5 \end{array} \quad 901\frac{5}{8}$$

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



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

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

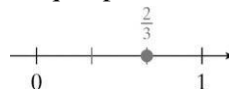


$$80. \begin{array}{r} \overline{23)4257} \\ \underline{!23} \\ 195 \\ \underline{!184} \\ 117 \\ \underline{!115} \\ 2 \end{array} \quad 185\frac{2}{23}$$

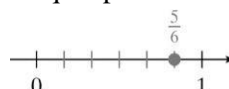
86. Divide the distance between 0 and 1 into 5 equal parts.



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



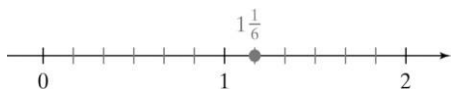
88. Divide the distance between 0 and 1 into 6 equal parts.



Section 2.2 Prime Numbers and Factorization

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

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



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

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



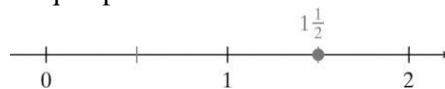
91. $\frac{5}{3} = 1\frac{2}{3}$

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



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

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



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

94. True

95. True

96. True

Section 2.2 Prime Numbers and Factorization

Section 2.2 Practice Exercises

- Answers will vary.
- A **factor** of a number n is a nonzero whole number that divides evenly into n .
 - A **factorization** of a number n is a product of factors that equals n .
 - A **prime number** is a whole number greater than 1 that has only two factors (itself and 1).
 - A **composite number** is a whole number greater than 1 that is not prime.
 - The **prime factorization** of a number is the factorization in which every factor is a prime number.

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

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

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

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

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

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

9. $5 \overline{) 23} \frac{4}{3}$ $4\frac{3}{5}$

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

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

Chapter 2 Fractions and Mixed Numbers: Multiplication and Division

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

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

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

15.

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

16.

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

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

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

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

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

21. 45

(a) No; 45 is not even.

(b) Yes; $4 + 5 = 9$ is divisible by 3.

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

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

22. 100

(a) Yes; 100 is even.

(b) No; $1 + 0 + 0 = 1$ is not divisible by 3.

(c) Yes; the ones-place digit is 0.

(d) Yes; the ones-place digit is 0.

23. 137

(a) No; 137 is not even.

(b) No; $1 + 3 + 7 = 11$ is not divisible by 3.

(c) No; the ones-place digit is not 0 or 5.

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

24. 241

(a) No; 241 is not even.

(b) No; $2 + 4 + 1 = 7$ is not divisible by 3.

(c) No; the ones-place digit is not 0 or 5.

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

25. 108

(a) Yes; 108 is even.

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

(c) No; the ones-place digit is not 0 or 5.

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

26. 1040

(a) Yes; 1040 is even.

(b) No; $1 + 0 + 4 + 0 = 5$ is not divisible by 3.

(c) Yes; the ones-place digit is 0.

(d) Yes; the ones-place digit is 0.

27. 3140

(a) Yes; 3140 is even.

(b) No; $3 + 1 + 4 + 0 = 8$ is not divisible by 3.

(c) Yes; the ones-place digit is 0.

(d) Yes; the ones-place digit is 0.

28. 2115

(a) No; 2115 is not even.

(b) Yes; $2 + 1 + 1 + 5 = 9$ is divisible by 3.

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

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

$$\begin{array}{r} 3 \\ \overline{) 84} \\ \underline{84} \\ 0 \end{array}$$

29. $28 \overline{) 84}$
 $\underline{84}$
 0

Yes, 84 is divisible by 28.

$$\begin{array}{r} 5 \\ \overline{) 110} \\ \underline{110} \\ 0 \end{array}$$

30. $22 \overline{) 110}$
 $\underline{110}$
 0

Yes, 110 is divisible by 22.

31. Prime

32. Prime

33. Composite $2 \cdot 5 = 10$

34. Composite $3 \cdot 7 = 21$

Section 2.2 Prime Numbers and Factorization

35. Composite $3 \cdot 17 = 51$

36. Composite $3 \cdot 19 = 57$

37. Prime

38. Prime

39. Neither

40. Neither

41. Composite $11 \cdot 11 = 121$

42. Composite $3 \cdot 23 = 69$

43. Prime

44. Prime

45. Composite $3 \cdot 13 = 39$

46. Composite $7 \cdot 7 = 49$

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

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

49. False; 9 is not prime.

50. False; 2 is not composite.

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

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

53. No, 9 is not a prime number.

54. No, 8 is not a prime number.

55. Yes

56. Yes

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

$2 \cdot 5 \cdot 7 = 70$

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

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

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

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

17

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

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

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

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

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

67. 47 is prime.

68. 41 is prime.

Chapter 2 Fractions and Mixed Numbers: Multiplication and Division

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

Section 2.3 Simplifying Fractions to Lowest Terms

Section 2.3 Practice Exercises

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

$$3. \quad 5 \overline{)145} \quad 5 \cdot 29 = 145$$

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

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

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

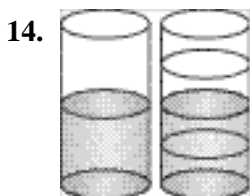
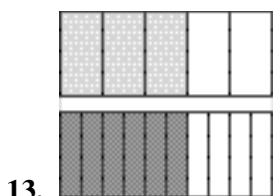
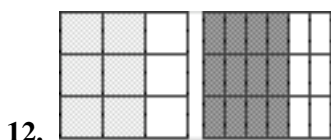
$$7. \quad \begin{array}{r} 17 \\ 5 \overline{)85} \end{array} \quad 5 \cdot 17 = 85$$

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

Section 2.3 Simplifying Fractions to Lowest Terms

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

10.
$$\begin{array}{r} 5 \\ 3 \overline{) 15} \\ \underline{3) 45} \\ \underline{2) 90} \\ \underline{2) 180} \end{array} \quad 2!2!3!3!5 = 2^2!3^2!5 = 180$$



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

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

17. $2!5!3!3$

$10 \text{ " } 9$

$\underline{2}! \underline{3}$

$3 \text{ } 5$

18. $1!9!4!2$

$9 \text{ " } 8$

$\frac{1}{4}! \frac{2}{9}$

19. $1!6!2!3$

$6 = 6$

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

20. $6!8!16!3$

$48 = 48$

$\frac{6}{16} = \frac{3}{8}$

21. $12!4!16!3$

$48 = 48$

$\frac{12}{6} = \frac{3}{4}$

22. $4!15!5!12$

$60 = 60$

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

23. $8!27!9!20$

$216 \text{ " } 180$

$\frac{8}{9}! \frac{20}{27}$

24. $5!18!6!12$

$90 \text{ " } 72$

$\frac{5}{6}! \frac{12}{18}$

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

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

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

$18 \text{ } 2!3!3 \text{ } 3$

$\frac{21}{24} = \frac{\cancel{3}! \cancel{7}}{\cancel{3}! 7} = \frac{7}{8}$

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

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

$20 \text{ } 2!2!5 \text{ } 5$

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

Chapter 2 Fractions and Mixed Numbers: Multiplication and Division

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

$$56. \frac{11!11}{2} = \frac{0}{2} = 0$$

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

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

$$43. \frac{\quad}{11} = \frac{3!11}{11} = 3$$

$$44. \frac{65}{110} = \frac{5!13}{10!11} = 13$$

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

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

$$8!2 \quad 6 \quad 2"3 \quad 3$$

$$59. \frac{\quad}{8+2} = \frac{6}{10} = \frac{2"5}{5} = \frac{3}{5}$$

$$60. \frac{15+3}{160} = \frac{18}{16} = \frac{6"3}{2!2!2!2} = \frac{3}{4}$$

$$61. \frac{120}{160} = \frac{12}{16} = \frac{2!2!3}{2!2!2!2} = \frac{3}{4}$$

$$62. \frac{720/72}{800} = \frac{8!9}{8!10} = \frac{9}{10}$$

Section 2.3 Simplifying Fractions to Lowest Terms

$$63. \frac{3000}{18000} = \frac{30}{18} = \frac{2 \cancel{!} 3 \cancel{!} 5}{\cancel{!} \cancel{!} 3} = \frac{5}{3}$$

$$64. \frac{20000}{15000} = \frac{20}{15} = \frac{2 \cancel{!} 2 \cancel{!} \cancel{!}}{3 \cancel{!} \cancel{!}} = \frac{4}{3}$$

$$65. \frac{42,000}{22,000} = \frac{42}{22} = \frac{2 \cancel{!} 21}{\cancel{!} 11} = \frac{21}{11}$$

$$66. \frac{50,000}{65,000} = \frac{50}{65} = \frac{2 \cancel{!} 5 \cancel{!} 5}{\cancel{!} 13} = \frac{10}{13}$$

$$67. \frac{5100}{30,000} = \frac{51}{300} = \frac{\cancel{!} 17}{3 \cancel{!} 100} = \frac{17}{100}$$

$$68. \frac{9800}{28,000} = \frac{98}{280} = \frac{\cancel{!} 2 \cancel{!} 7 \cancel{!} 7}{\cancel{!} 2 \cancel{!} 2 \cancel{!} 5 \cancel{!} \cancel{!}} = \frac{7}{20}$$

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

Tails: $48 - 20 = 28$

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

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

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

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

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

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

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

(b) Jared sold the greater fractional part

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

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

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

(b) Lisa has completed more of her course

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

75. (a) Raymond:

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

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

(b) Raymond read the greater fractional

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

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

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

77. (a) 300,000,000

(b) 36,000,000

$$(c) \frac{36,000,000}{300,000,000} = \frac{\cancel{!} \cancel{!} \cancel{!} \cancel{!} \cancel{!} \cancel{!}}{\cancel{!} \cancel{!} \cancel{!} \cancel{!} \cancel{!} \cancel{!} \cancel{!} \cancel{!} \cancel{!} \cancel{!}} = \frac{36}{300} = \frac{\cancel{!} \cancel{!} \cancel{!} \cancel{!} 3}{\cancel{!} \cancel{!} \cancel{!} \cancel{!} 5 \cancel{!} 5} = \frac{3}{25}$$

78. (a) 300,000,000

73. (a) Jonathan: $\frac{25}{5} = \frac{5!5}{5} = 5$

Jared: $\frac{24}{28} = \frac{35 \cancel{7}!7}{\cancel{2}!2!2!3} = \frac{7}{7}$

(b) 75,000,000

(c) $\frac{300,000,000}{75,000,000} = \frac{300}{75}$

$$= \frac{2!2\cancel{3}\cancel{5}\cancel{5}}{\cancel{3}!5!5} = \frac{4}{1}$$

(d) 4 times greater

///

Chapter 2 Fractions and Mixed Numbers: Multiplication and Division

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

$\frac{8}{12}, \frac{12}{16}$

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

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

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

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

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

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

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

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

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

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

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

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

Section 2.4 Multiplication of Fractions and Applications

Section 2.4 Practice Exercises

1. Pages 152–156; answers will vary.

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

3. Numerator: 10; denominator: 14

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

4. Numerator: 32; denominator: 36

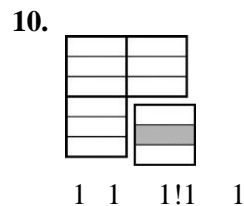
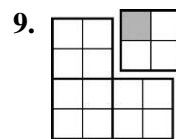
$\frac{32}{36} = \frac{\cancel{2}!\cancel{2}!\cancel{2}!\cancel{2}!\cancel{2}}{\cancel{2}!\cancel{2}!3!3} = \frac{8}{9}$

5. Numerator: 25; denominator: 15

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

6. Numerator: 2100; denominator: 7000

//

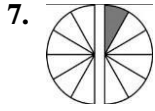


11. $\frac{1}{2} \cdot \frac{1}{4} = \frac{1}{2!4} = \frac{1}{8}$

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

13. $\frac{2100}{7000} = \frac{21}{70} = \frac{3!7}{10!7} = \frac{3}{10}$

$$7000 \quad 70 \quad 2!5!7! \quad 10$$



$$\frac{3}{4}!8 = \frac{3}{4}! \frac{8}{1} = \frac{24}{4} = 6$$

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

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

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

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

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

$$30. \frac{7}{12}! \frac{18}{5} =$$

$$42 \quad 1 \quad 2!3!7 \quad 7$$

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

$$43. \frac{9}{15}! \frac{16}{3}! \frac{25}{8}$$

$$= \frac{3!3!}{3!5}! \frac{2!2!2!2!}{3}! \frac{5!}{2!2!2!}$$

$$= \frac{10}{1} = 10$$

$$7 \text{ „ } 2!3!$$

$$3 =_{21} \frac{5}{\cancel{2}10!\cancel{3}} \frac{//}{\quad} \text{ —}$$

1 1 1 1

& 5%

51. $\exists \% = \# \# =$
 $\& 10', 10 10 10 1000$
 $\text{---} 4 \text{---} \text{---} \text{---} \text{---} \text{---}$

52. $! 1'' = 1_{\#} 1_{\#} 1_{\#} 1 = 1$
 $\exists 10\% , 10 10 10 10 10,000$
 $! 1''^6 \quad 1 \quad 1 \quad 1 \quad 1 \quad 1 \quad 1$

53. $\text{---} \% = \text{---} \# \# \# \# \# \text{---}$
 $\& 10', 10 10 10 10 10 10$
 $= \text{---} 1 \text{---}$
 1,000,000

$\exists 15', \%$
 15
 15
 22
 5

$'' 1 \quad 1_{\#} \quad '' 1_{\#} \quad \frac{1}{\text{---}} \quad \frac{1}{\text{---}} \quad \frac{1}{\text{---}}$

62. $\exists 10! \% \exists \% = ! =$
 $\& 3' 100', \& 30', 30 30 900$
 10

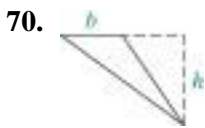
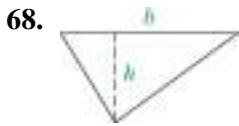
63. $\frac{1}{3} ! \frac{21}{4} ! \frac{80}{7} \% = \frac{1}{3} ! \frac{6}{1} = 2$

$$\begin{aligned}
 & 1! \cdot 3! = 6 \neq 1! \cdot 3! = 6 \\
 \mathbf{64.} \quad & \frac{24}{6} = \frac{30}{6} = \frac{18}{6} = 4
 \end{aligned}$$

Section 2.4 Multiplication of Fractions and Applications

$$65. \frac{16 \cancel{2} \cdot 1}{9 \cdot 2} = \frac{16 \cdot 1}{9 \cdot 2} = \frac{16}{18} = \frac{8}{9}$$

$$66. \frac{28 \cdot 3}{6 \cdot 2} = \frac{28 \cdot 3}{12} = \frac{28}{4} = 7$$



$$71. A = \frac{1}{2}bh = \frac{1}{2}(11)(8) = \frac{1}{2} \cdot 88 = 44 \text{ cm}^2$$

$$72. A = \frac{1}{2}bh = \frac{1}{2}(15)(12) = \frac{1}{2} \cdot 180 = 90 \text{ in.}^2$$

$$73. A = \frac{1}{2}bh = \frac{1}{2}(8)(8) = \frac{1}{2} \cdot 64 = 32 \text{ m}^2$$

$$75. A = \frac{1}{2}bh = \frac{1}{2}(5)(8) = \frac{1}{2} \cdot 40 = 20 \text{ yd}^2$$

$$76. A = \frac{1}{2}bh = \frac{1}{2}(3)(16) = \frac{1}{2} \cdot 48 = 24 \text{ mm}^2$$

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

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

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

$$80. A = l \cdot w = \frac{23}{24} \cdot \frac{2}{4} = \frac{23}{48} \text{ ft}^2$$

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

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

$$83. A = \frac{1}{2}bh + \frac{1}{2}bh = \frac{1}{2}(6)(8) + \frac{1}{2}(6)(8) = 24 + 24 = 48$$

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

$$\frac{1}{2} \cdot \frac{7}{4} \cdot 8$$

$$\frac{1}{2} \cdot \frac{3}{4} \cdot \frac{2}{3} = \frac{1}{2} \cdot \frac{3 \cdot 2}{4 \cdot 3} = \frac{1}{2} \cdot \frac{2}{4} = \frac{1}{2} \cdot \frac{1}{2} = \frac{1}{4}$$

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

1 4 1 4

Chapter 2 Fractions and Mixed Numbers: Multiplication and Division

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

The amount left is 10 gal.

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

The cost is \$8250.

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

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

$$88. \frac{1}{2} \cdot \frac{2}{5} = \frac{1}{5}$$

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

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

There are 6,550,000 viewers.

$$90. 3! = \frac{3 \cdot 2 \cdot 1}{1} = 6 \text{ or } 2 \cdot 3$$

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

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

$$40 \times 36 = 1440$$

$$1440 - 960 = 480$$

Frankie mowed 960 yd². He has 480 yd²

left to mow.

$$93. (a) \frac{1}{6} \cdot \frac{1}{6} = \frac{1}{36}$$

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

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

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

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

$$\sqrt{\frac{25}{5}} = \sqrt{\frac{5}{1}} = \frac{5}{1}$$

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

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

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

91. First place: $\frac{2}{2}!1200 = \frac{2}{1}! \frac{400}{1200} = \800

$$\frac{3}{1} \frac{\cancel{2}}{1} 1$$

Second place: $\frac{1}{4}!1200 = \frac{1}{\cancel{4}}! \frac{300}{1200} = \300

Third place: $\frac{1}{12}!1200 = \frac{1}{\cancel{12}}! \frac{100}{1200} = \100

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

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

$$\frac{2}{2}, \frac{2}{2}, \frac{2}{2}, \frac{2}{2}, \frac{2}{2}$$

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

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

101. $\frac{1!1''}{- - -} = 1$

$\frac{2^{\#} \exists}{\%8 \& 16} = 1$

They are the same.

102. $\frac{2!1''}{- -} = \frac{2}{-} = \frac{1}{-}$

$\frac{3^{\#} \exists}{\%4 \& 12 \ 6} = \frac{2}{-} = \frac{1}{-}$

They are the same.

Section 2.5 Division of Fractions and Applications

Section 2.5 Practice Exercises

1. Page 143
Answers will vary.

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

3. $\frac{9}{11} \cdot \frac{2}{5} = \frac{18}{55}$

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

5. $\frac{34}{8} \cdot \frac{1}{17} = 2$

6. $3 \cdot \frac{7}{6} = \frac{7}{2}$

7. $8 \cdot \frac{5}{24} = \frac{5}{3}$

$\frac{12}{-} \cdot \frac{7}{-} = \frac{14}{-} = 1$

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

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

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

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

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

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

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

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

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

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

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

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

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

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

19. No reciprocal exists.

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20. No reciprocal exists.

$$\frac{1}{-}$$

21. 3

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

23. multiplying

24. multiplying

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

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

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

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

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

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

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

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

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

$$37. \frac{10}{9} \div \frac{1}{18} = \frac{10}{9} \cdot \frac{18}{1} = 20$$

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

$$39. 12 \div \frac{3}{4} = 12 \cdot \frac{4}{3} = 16$$

$$40. 24 \div \frac{8}{5} = 24 \cdot \frac{5}{8} = 15$$

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

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

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

$$32. \frac{9}{10} \div \frac{9}{2} = \frac{9}{10} \cdot \frac{2}{9} = \frac{2}{10} = \frac{1}{5}$$

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

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

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

$$44. \frac{30}{40} \div \frac{15}{8} = \frac{30}{40} \cdot \frac{8}{15} = \frac{\cancel{3} \cdot 2 \cdot \cancel{2}}{\cancel{4} \cdot 2 \cdot \cancel{3}} = \frac{2}{2} = 1$$

$$45. \frac{9}{100} \div \frac{13}{1000} = \frac{9}{100} \cdot \frac{1000}{13} = \frac{9 \cdot \cancel{10} \cdot 10}{13} = \frac{900}{13}$$

Section 2.5 Division of Fractions and Applications

$$46. \frac{1000}{17} \div \frac{10}{3} = \frac{1000}{17} \cdot \frac{3}{10} = \frac{300}{17}$$

$$47. \frac{36}{5} \div \frac{9}{25} = \frac{36}{5} \cdot \frac{25}{9} = 20$$

$$48. \frac{13}{5} \div \frac{17}{10} = \frac{13}{5} \cdot \frac{10}{17} = \frac{26}{17}$$

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

$$50. \frac{7}{12} \div \frac{5}{3} = \frac{7}{12} \cdot \frac{3}{5} = \frac{7}{20}$$

$$51. \frac{5}{8} \div \frac{2}{9} = \frac{5}{8} \cdot \frac{9}{2} = \frac{45}{16}$$

$$52. \frac{1}{16} \div \frac{4}{3} = \frac{1}{16} \cdot \frac{3}{4} = \frac{3}{64}$$

$$53. 6! \div 3! = \frac{6!}{3!} = 240$$

$$54. 12! \div 10! = \frac{12!}{10!} = 12 \cdot 11 = 132$$

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

$$57. \frac{16}{3} \div \frac{2}{5} = \frac{16}{3} \cdot \frac{5}{2} = \frac{40}{3}$$

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

$$59. \frac{1}{8} \div 16 = \frac{1}{8} \cdot \frac{1}{16} = \frac{1}{128}$$

$$60. \frac{2}{3} \div 9 = \frac{2}{3} \cdot \frac{1}{9} = \frac{2}{27}$$

$$61. \frac{22}{7} \div 5 = \frac{22}{7} \cdot \frac{1}{5} = \frac{22}{35}$$

$$62. \frac{40}{21} \div \frac{18}{25} = \frac{40}{21} \cdot \frac{25}{18} = \frac{1000}{378} = \frac{500}{189}$$

$$63. 8 \div \frac{16}{3} = 8 \cdot \frac{3}{16} = \frac{3}{2}$$

$$64. 5 \div \frac{15}{4} = 5 \cdot \frac{4}{15} = \frac{20}{15} = \frac{4}{3}$$

$$\begin{array}{r} 6 \quad 1 \quad \cancel{6} \\ \quad \quad \phantom{\cancel{6}} \\ \hline 1 \end{array}$$

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

65. $\frac{2}{3} \cdot 6$ multiplies $\frac{2}{3}$ by $\frac{1}{1}$ and $\frac{2}{3} \div 6$
 multiplies $\frac{2}{3}$ by $\frac{1}{6}$. So $\frac{2}{3} \cdot 6 = \frac{2}{\cancel{3}_1} \cdot \frac{\cancel{6}^2}{1} = 4$

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

Chapter 2 Fractions and Mixed Numbers: Multiplication and Division

66. $8 \times \frac{2}{3}$ multiplies 8 by $\frac{2}{3}$, and $8 \div \frac{2}{3}$

multiplies 8 by $\frac{3}{2}$. So $8 \times \frac{2}{3} = \frac{16}{3}$

and $8 \div \frac{2}{3} = 8 \times \frac{3}{2} = 12$.

67. $\frac{54}{21} \div 9 = \frac{54}{21} \times \frac{1}{9} = \frac{27}{21} \div 9 = \frac{27}{21} \times \frac{1}{9} = \frac{1}{7}$

$\frac{21}{7} \div \frac{3}{1} = \frac{21}{7} \times \frac{1}{3} = \frac{3}{1} = 3$

68. $\frac{48}{56} \div \frac{3}{8} = \frac{48}{56} \times \frac{8}{3} = \frac{48 \times 8}{56 \times 3} = \frac{16}{7}$

$\frac{16}{7} \div \frac{1}{1} = \frac{16}{7}$

69. $\frac{3}{5} \div \frac{6}{7} = \frac{3}{5} \times \frac{7}{6} = \frac{7}{10}$

$\frac{5}{16} \div \frac{1}{5} = \frac{5}{16} \times \frac{5}{1} = \frac{25}{16}$

70. $8 \div 16 = \frac{8}{16} = \frac{1}{2}$; $8 \div 35 = \frac{8}{35}$; $7 \div 4 = \frac{7}{4}$

$7 \div 1 = \frac{7}{1} = 7$

72. $\frac{7}{8} \div \frac{1}{2} = \frac{7}{8} \times \frac{2}{1} = \frac{7}{4}$

$\frac{7}{8} \div \frac{1}{2} = \frac{7}{8} \times \frac{2}{1} = \frac{7}{4}$

73. $\frac{5}{3} \div \frac{2}{3} = \frac{5}{3} \times \frac{3}{2} = \frac{5}{2}$

$\frac{9}{400}$

74. $\frac{5}{12} \div \frac{2}{3} = \frac{5}{12} \times \frac{3}{2} = \frac{5}{8}$

75. $\frac{63}{8} \div \frac{9}{4} = \frac{63}{8} \times \frac{4}{9} = \frac{63 \times 4}{8 \times 9} = \frac{7}{2}$

$\frac{774}{221} \div \frac{494}{41} = \frac{774}{221} \times \frac{41}{494} = \frac{774 \times 41}{221 \times 494} = 49$

76. $\frac{25}{9} \div \frac{50}{8} = \frac{25}{9} \times \frac{8}{50} = \frac{25 \times 8}{9 \times 50} = \frac{8}{9}$

$$\frac{1}{7} \div \frac{1}{2}$$

2

!3E 9 3 3 9 9 9

$$71. \frac{1}{8} \div \frac{1}{14} = \frac{14}{8} = \frac{7}{4}$$

$$= \frac{9 \cdot 14}{64 \cdot 9} = \frac{14}{32} = \frac{7}{16}$$

$$\frac{1}{3} \div \frac{1}{9} = \frac{9}{3} = 3$$

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

$$\frac{2}{1} \div \frac{1}{4} = 8$$

Section 2.5 Division of Fractions and Applications

$$77. \frac{15}{16} \div \frac{2}{3} = \frac{15}{16} \cdot \frac{3}{2} = \frac{45}{32}$$

$$= \frac{15}{16} \cdot \frac{3}{2} = \frac{45}{32}$$

$$= \frac{5}{12} \div \frac{2}{21} = \frac{5}{12} \cdot \frac{21}{2} = \frac{105}{24}$$

$$= \frac{5}{12} \cdot \frac{21}{2} = \frac{105}{24}$$

$$78. \frac{8}{27} \div \frac{3}{4} = \frac{8}{27} \cdot \frac{4}{3} = \frac{32}{81}$$

$$= \frac{8}{27} \cdot \frac{4}{3} = \frac{32}{81}$$

$$= \frac{1}{6} \div \frac{13}{18} = \frac{1}{6} \cdot \frac{18}{13} = \frac{3}{13}$$

$$79. \frac{9}{4} \div \frac{1}{8} = \frac{9}{4} \cdot \frac{8}{1} = 18$$

$$80. \frac{4}{3} \div \frac{1}{6} = \frac{4}{3} \cdot \frac{6}{1} = 8$$

$$81. 36 \div \frac{3}{4} = 36 \cdot \frac{4}{3} = 48$$

Li wrapped 54 packages.

$$82. 60 \div \frac{3}{4} = 60 \cdot \frac{4}{3} = 80$$

She can sell 80 parcels of land.

$$85. 16 \div \frac{3}{4} = 16 \cdot \frac{4}{3} = \frac{64}{3}$$

The stack will be 12 in. high.

$$86. 24 \div \frac{5}{6} = 24 \cdot \frac{6}{5} = \frac{144}{5}$$

Yes, the books will take up only 30 in.

$$87. (a) 18 \div \frac{18}{3} = 18 \cdot \frac{3}{18} = 3$$

$$= 3$$

27 commercials in 1 hr

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

648 commercials in 1 day

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

$$= 40$$

40 commercials in 1 hr

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

960 commercials in 1 day

$$89. (a) \frac{1}{10} \cdot 240,000 = \frac{240,000}{10} = 24,000$$

The down payment is \$24,000.

$$\frac{2}{3} \cdot 24,000 = \frac{2}{3} \cdot 24,000 = 16,000$$

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

$$(b) \$24,000 - \$16,000 = \$8,000$$

Ricardo will have to pay \$8,000.

83. $\frac{3}{2} \div \frac{1}{16} = 3 \frac{16}{2} = 24$ cups of juice

(c) $\$240,000 - \$24,000 = \$216,000$
He will have to finance \$216,000.

84. $\frac{5}{4} \div \frac{1}{100} = 5 \frac{100}{4} = 125$ cm

Chapter 2 Fractions and Mixed Numbers: Multiplication and Division

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

$$= \frac{18,000}{12} = 1500$$

The down payment is \$1500.

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

Althea's parents will pay \$750.

(b) $\$1500 - \$750 = \$750$
 Althea will have to pay \$750.

(c) $\$18,000 - \$1500 = \$16,500$
 She will have to finance \$16,500.

91. (a) $\frac{1}{3} \cdot \frac{2}{4} = \frac{2}{12} = \frac{1}{6}$

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

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

$\frac{1}{2} \cdot \frac{3}{4} = \frac{3}{8}$ or $\frac{3}{8}$ r 12 acres

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

Josh has read 7 pages.

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

He still must read 35 pages.

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

She can prepare 14 samples.

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

Tony must make 14 strikes.

95. The length is 12 ft, because

$30 \div \frac{5}{2} = \frac{30}{1} \cdot \frac{2}{5} = \frac{60}{5} = 12$

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

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

Problem Recognition Exercises: Multiplication and Division of Fractions

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

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

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

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

$$(c) \quad \frac{8}{3} \div \frac{6}{5} = \frac{8}{3} \cdot \frac{5}{6} = \frac{\cancel{2}^1 4}{3} \cdot \frac{5}{\cancel{2}^1 3} = \frac{20}{9}$$

$$(d) \quad \frac{6}{5} \div \frac{8}{3} = \frac{6}{5} \cdot \frac{3}{8} = \frac{\cancel{2}^1 3}{5} \cdot \frac{3}{\cancel{2}^1 4} = \frac{9}{20}$$

$$(c) \quad \frac{10}{3} \div \frac{12}{7} = \frac{10}{3} \cdot \frac{7}{12} = \frac{\cancel{2}^1 5}{3} \cdot \frac{7}{\cancel{2}^1 6} = \frac{35}{18}$$

$$(d) \quad \frac{12}{7} \div \frac{10}{3} = \frac{12}{7} \cdot \frac{3}{10} = \frac{\cancel{2}^1 6}{7} \cdot \frac{3}{\cancel{2}^1 5} = \frac{18}{35}$$

Problem Recognition Exercises: Multiplication and Division of Fractions

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

(b) $\frac{9}{!} \frac{12}{!} = \frac{9}{!} \frac{12}{!} = \frac{9}{!} \frac{3!4}{!} = \frac{27}{!}$

(c) $12 \div \frac{9}{8} = \frac{12}{1} \frac{8}{9} = \frac{1}{1} \frac{3!4}{1} = \frac{3}{3}$

(d) $\frac{9}{8} \div 12 = \frac{9}{8} \frac{1}{12} = \frac{3!13}{8} \frac{1}{3!4} = \frac{3}{32}$

4. (a) $15! \frac{1}{5} = \frac{15}{5} \frac{1}{15} = \frac{1}{1} \frac{1}{15} = \frac{1}{15} = 9$

(b) $\frac{1}{!} \frac{15}{!} = \frac{1}{5} \frac{15}{5} = \frac{1}{1} \frac{3!5}{1} = \frac{9}{1}$

(c) $15 \div \frac{3}{5} = \frac{15}{1} \frac{5}{3} = \frac{3!5}{1} \frac{5}{3} = \frac{25}{3} = 25$

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

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

(b) $\frac{5}{7} \frac{1}{7} = \frac{5}{49} = 1$

(c) $\frac{6}{5} \div \frac{5}{6} = \frac{6}{5} \frac{6}{5} = \frac{36}{25} = 1$

6 6 6 5 1

7. (a) $\frac{1}{12} \frac{2}{3} \frac{16}{21} = \frac{1}{12} \frac{2}{3} \frac{4!4}{3!4} = \frac{8}{21}$

(b) $\frac{1}{!} \frac{2}{!} \frac{16}{!} = \frac{1}{!} \frac{2}{!} \frac{21}{!} = \frac{21}{!}$

$\frac{12}{12} \frac{3}{3} \frac{21}{21} = \frac{12}{12} \frac{3}{3} \frac{16}{2!8} = \frac{7}{96}$

(c) $\frac{1}{12} \div \frac{2}{3} \frac{16}{21} = \frac{1}{12} \frac{3}{2} \frac{4!2!2}{3!4} = \frac{21}{1321}$

(d) $\frac{1}{12} \div \frac{1}{3} \div \frac{16}{21} = \frac{1}{12} \frac{3}{1} \frac{21}{16} = \frac{21}{128}$

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

(b) $\frac{1}{2} \frac{9}{9} \frac{2}{2} = \frac{1}{2} \frac{1}{3} \frac{2}{2} = \frac{1}{12}$

(c) $\frac{1}{2} \frac{7}{9} \frac{2}{3} = \frac{1}{2} \frac{7}{9} \frac{2}{3} = \frac{1}{2} \frac{7}{9} \frac{2}{3} = \frac{7}{27}$

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

9. (a) $\frac{1}{10} \frac{4}{4} \frac{10}{10} \frac{1}{4} = \frac{1}{4}$

$$(d) \frac{5}{6} \div \frac{6}{5} = \frac{5}{1} \cdot \frac{5}{6} = \frac{25}{6}$$

$$\frac{6}{5} \cdot \frac{5}{6} = \frac{36}{36} = 1$$

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

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

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

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

$$= \frac{9}{1} \cdot \frac{2}{3} \cdot \frac{3}{1} \cdot \frac{1}{6} = \frac{27}{6} = \frac{9}{2}$$

$$(b) \frac{9}{10} \div \frac{6}{4} = \frac{9}{10} \cdot \frac{4}{6} = \frac{9 \cdot 2}{10 \cdot 3} = \frac{18}{30} = \frac{3}{5}$$

$$= \frac{9}{10} \cdot \frac{2}{3} \cdot \frac{4}{6} = \frac{9 \cdot 2 \cdot 4}{10 \cdot 3 \cdot 6} = \frac{72}{180} = \frac{2}{5}$$

$$(c) \frac{9}{10} \div 6 = \frac{9}{10} \cdot \frac{1}{6} = \frac{9}{60} = \frac{3}{20}$$

$$= \frac{3}{10} \cdot \frac{1}{2} = \frac{3}{20}$$

$$(d) \frac{9}{10} \div 6 \div \frac{6}{4} = \frac{9}{10} \cdot \frac{1}{6} \cdot \frac{4}{6} = \frac{9 \cdot 4}{10 \cdot 6 \cdot 6} = \frac{36}{360} = \frac{1}{10}$$

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

$${}^2P_1 = 2$$

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Chapter 2 Fractions and Mixed Numbers: Multiplication and Division

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

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

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

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

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

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

(c) $\frac{2 \cdot 2}{3 \div 1} = \frac{4}{3}$

(d) $1 \div \frac{2 \cdot 3 \cdot 3}{6} = 1! = 1$

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

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

(c) $6! \cdot 10 = 60$
 (d) $10! \cdot 6 = 60$

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

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

(c) $\frac{1! \cdot 1!}{7} = \frac{1}{7}$

(d) $\frac{7! \cdot 2! \cdot 14}{1! \cdot 1! \cdot 1! \cdot 2 \cdot 2} = \frac{7! \cdot 2! \cdot 7!}{1! \cdot 1! \cdot 1! \cdot 7} = 7!$

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

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

(c) $4! \cdot 3! = \frac{4! \cdot 3!}{1! \cdot 6 \cdot 6} = \frac{4! \cdot 3!}{36} = \frac{4! \cdot 3!}{4! \cdot 9} = \frac{3!}{9} = \frac{6}{9} = \frac{2}{3}$

(d) $4 \div \frac{1}{6} = 4 \cdot 6 = 24$

16. (a) $\frac{4! \cdot 36}{1! \cdot 1!} = 144$

(b) $\frac{1! \cdot 3! \cdot 2! \cdot 1! \cdot 1! \cdot 2! \cdot 1!}{3! \cdot 2! \cdot 2! \cdot 3! \cdot 6} = \frac{1! \cdot 3! \cdot 2! \cdot 1! \cdot 1! \cdot 3!}{3! \cdot 2! \cdot 2! \cdot 3!} = \frac{1! \cdot 3! \cdot 2! \cdot 1! \cdot 1! \cdot 3!}{2! \cdot 2! \cdot 3!} = \frac{1! \cdot 2! \cdot 1! \cdot 2! \cdot 2!}{2! \cdot 2!} = 1$

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

(b) $8!4 = 8 = 2$

$4 \cdot 4$

(c) $8 \div 4 = 2$

(d) $8!4 = 32$

(c) $2 \frac{!}{\#} 3 \& = \frac{!}{2} \frac{!}{3} \frac{!}{3} = 9$

$1 \ !2\exists \quad 1 \ !2 \ 2\exists \quad 1 \ 4$

(d) $\frac{-}{2} \div \frac{-}{\#} \frac{-}{3} \& = \frac{-}{2} \div \frac{-}{\#} \frac{-}{3} \& = \frac{-}{2} \div \frac{-}{9}$

$= \frac{1}{2}, \frac{9}{4} = \frac{9}{8}$

Section 2.6 Multiplication and Division of Mixed Numbers

Section 2.6 Practice Exercises

1. Chapter Review Exercises, pages 157–160

Chapter Test, pages 160–161

Cumulative Review Exercises,

pages 161–162

Answers will vary.

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

$$3. \frac{13}{9} \cdot \frac{10}{9} = \frac{26}{9}$$

$$\frac{9}{1} \cdot \frac{9}{2} = \frac{81}{2}$$

$$4. \frac{20}{9} \div \frac{10}{3} = \frac{20}{9} \cdot \frac{3}{10} = \frac{2}{3}$$

$$5. \frac{42}{11} \div \frac{7}{2} = \frac{42}{11} \cdot \frac{2}{7} = \frac{12}{11}$$

$$6. \frac{3}{2} \div 4 = \frac{3}{2} \cdot \frac{1}{4} = \frac{3}{8}$$

$$\frac{15}{1} \cdot \frac{15}{1} = \frac{225}{1}$$

$$\frac{52}{1} \div 13 = \frac{52}{1} \cdot \frac{1}{13} = \frac{4}{1}$$

$$7. \frac{18}{1} \cdot \frac{18}{9} = \frac{18}{1}$$

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

$$11. 1\frac{4}{7} = \frac{11 \cdot 7 + 4}{7} = \frac{81}{7}$$

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

$$13. 6\frac{12}{77} = 6\frac{12}{77}$$

$$14. 11\frac{5}{57} = 11\frac{5}{57}$$

$$15. 4\frac{39}{3} = 4 \cdot 3 + \frac{39}{3} = 12 + 13 = 25$$

$$16. 2\frac{15}{31} = 2\frac{15}{31}$$

$$\frac{11}{1} \cdot \frac{110}{1} = \frac{1210}{1}$$

$$! 2 \quad 1 \quad 1 \quad 37$$

$$17. \# 2 \cdot \frac{37}{12} = \frac{74}{12} = \frac{37}{6}$$

$$\% 5 \cdot \frac{12}{5} = 12$$

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

$$\frac{7}{5} = \frac{37}{135} = \frac{7}{2}$$

$$\Rightarrow 7^2 = 5 -$$

9. $3 \frac{3}{5} = \frac{18}{5} = \frac{18}{5}$

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

Chapter 2 Fractions and Mixed Numbers: Multiplication and Division

$$18. \quad 5 \frac{1}{3} \cdot 3 = \frac{13}{26} \cdot \frac{3}{13} = \frac{39}{26} = \frac{3}{2}$$

$$\begin{array}{r} 5 \frac{1}{3} \cdot 3 \\ \hline 15 \end{array}$$

$$\begin{array}{r} 19 \\ 2 \overline{) 39} \\ \underline{10} \\ 29 \\ \underline{18} \\ 11 \end{array}$$

$$\begin{array}{r} 19 \\ 2 \overline{) 39} \\ \underline{10} \\ 29 \\ \underline{18} \\ 11 \end{array}$$

$$19. \quad 2 \frac{1}{3} \cdot \frac{5}{7} = \frac{7}{3} \cdot \frac{5}{7} = \frac{5}{3}$$

$$\begin{array}{r} 1 \\ 3 \overline{) 5} \\ \underline{3} \\ 2 \end{array}$$

$$20. \quad 6 \frac{1}{8} \cdot \frac{7}{7} = \frac{49}{8} \cdot \frac{1}{7} = \frac{7}{2}$$

$$\begin{array}{r} 7 \\ 2 \overline{) 14} \\ \underline{14} \\ 0 \end{array}$$

$$21. \quad 4 \frac{2}{9} \cdot 9 = \frac{38}{9} \cdot \frac{9}{1} = 38$$

$$\begin{array}{r} 38 \\ 9 \overline{) 38} \\ \underline{27} \\ 11 \end{array}$$

$$22. \quad 3 \frac{1}{6} \cdot 6 = \frac{19}{6} \cdot \frac{6}{1} = 19$$

$$\begin{array}{r} 19 \\ 3 \overline{) 19} \\ \underline{18} \\ 1 \end{array}$$

$$24. \quad 2 \frac{2}{8} \cdot 1 \frac{1}{13} = \frac{26}{8} \cdot \frac{14}{13} = 18$$

$$\begin{array}{r} 26 \\ 8 \overline{) 26} \\ \underline{24} \\ 2 \end{array}$$

$$\begin{array}{r} 14 \\ 13 \overline{) 14} \\ \underline{13} \\ 1 \end{array}$$

$$\begin{array}{r} 145 \\ 29 \overline{) 145} \\ \underline{58} \\ 87 \\ \underline{87} \\ 0 \end{array}$$

$$25. \quad 7 \frac{1}{4} \cdot 10 = \frac{29}{4} \cdot \frac{10}{1} = 72 \frac{1}{2}$$

$$\begin{array}{r} 72 \\ 2 \overline{) 145} \\ \underline{144} \\ 1 \end{array}$$

$$\begin{array}{r} 14 \\ 1 \overline{) 14} \\ \underline{14} \\ 0 \end{array}$$

$$26. \quad 2 \frac{2}{3} \cdot 3 = \frac{8}{3} \cdot \frac{3}{1} = 8$$

$$\begin{array}{r} 8 \\ 3 \overline{) 8} \\ \underline{6} \\ 2 \end{array}$$

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

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

$$29. \quad \frac{1}{2} \cdot \frac{1}{7} \cdot \frac{15}{2} \cdot \frac{15}{2} = \frac{225}{28}$$

$$\begin{array}{r} 15 \\ 2 \overline{) 15} \\ \underline{14} \\ 1 \end{array}$$

$$\begin{array}{r} 15 \\ 13 \overline{) 15} \\ \underline{13} \\ 2 \end{array}$$

$$30. \quad 1 \frac{1}{10} \cdot 4 = \frac{11}{10} \cdot \frac{4}{1} = 4 \frac{4}{10} = 4 \frac{2}{5}$$

$$\begin{array}{r} 44 \\ 10 \overline{) 44} \\ \underline{40} \\ 4 \end{array}$$

$$23. \frac{5^3 - 3^3}{5^1 - 3^1} = \frac{83, 16}{2} = \underline{83}$$

$$\sqrt[3]{\frac{16}{1}} = \sqrt[3]{16}$$

$$= 27^{\frac{2}{3}}$$

$$3 \overline{) 83}$$

$$\begin{array}{r} 27 \\ 3 \overline{) 83} \\ \underline{54} \\ 29 \\ \underline{21} \\ 8 \end{array}$$

$$31. \frac{5^9 - 3^9}{5^1 - 3^1} = \frac{27, 279}{2} = 2$$

$$\frac{5^9 - 3^9}{5^1 - 3^1} = \frac{27, 279}{2} = 2$$

$$\frac{5^7 - 3^7}{5^1 - 3^1} = \frac{11, 877}{2} = 2$$

$$32. \frac{6^8 - 2^8}{4^8 - 7^8} = \frac{1, 471, 859}{1} = 1$$

$$4 = 19_4$$

— —

Section 2.6 Multiplication and Division of Mixed Numbers

$$33. 1\frac{7}{10} \div 2\frac{3}{4} = \frac{17}{10} \div \frac{11}{4} = 17 \overline{) \cancel{10}^2 11} = 34$$

$$34. 5\frac{1}{10} \div \frac{3}{4} = \frac{51}{10} \div \frac{3}{4} = 10 \overline{) \cancel{51}^2 4} = 6\frac{4}{5}$$

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

$$\frac{4}{7}$$

$$36. 12\frac{1}{5} \div 2\frac{3}{5} = \frac{64}{5} \div \frac{13}{5} = \frac{64}{13} \overline{) 13} = 4\frac{12}{13}$$

$$37. 2\frac{1}{2} \div 1\frac{1}{16} = \frac{5}{2} \div \frac{17}{16} = \frac{5}{2} \overline{) \cancel{16}^8 17} = 2\frac{6}{17}$$

$$38. 7\frac{3}{5} \div 1\frac{7}{12} = \frac{38}{5} \div \frac{19}{12} = \frac{38}{5} \overline{) \cancel{19}^2 12} = 4\frac{4}{5}$$

$$39. 4\frac{1}{2} \div 2\frac{1}{4} = \frac{9}{2} \div \frac{9}{4} = \frac{9}{2} \overline{) \cancel{9}^2 4} = 2$$

$$40. 5\frac{5}{6} \div 2\frac{1}{3} = \frac{35}{6} \div \frac{7}{3} = \frac{35}{6} \overline{) \cancel{7}^5 3} = 2\frac{1}{2}$$

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

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

$$45. 1\frac{2}{3} \div \frac{4}{5} = \frac{8}{3} \div \frac{4}{5} = \frac{8}{3} \overline{) 4} = 4$$

$$46. 2\frac{1}{7} \div 5 = \frac{15}{7} \div 5 = \frac{15}{7} \overline{) 5} = 5\frac{4}{7}$$

$$47. 3\frac{1}{2} \div 2 = \frac{7}{2} \div 2 = \frac{7}{2} \overline{) 2} = 1\frac{3}{2}$$

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

$$49. 4\frac{1}{4} \div 8 = \frac{17}{4} \div 8 = \frac{17}{4} \overline{) 8} = \frac{38}{1}$$

Tabitha earned \$38.

3500

$$50. 2\frac{2}{3} \div 10,500 = \frac{8}{3} \overline{) 10,500} = 28,000$$

The land will cost Kurt \$28,000.

$$51. 25\frac{7}{10} \div 25 = \frac{257}{10} \div 25 = \frac{257}{10} \overline{) 25} = 642\frac{1}{2}$$

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

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

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

52. $6^{\frac{2}{3}} \cdot 15^{\frac{3}{4}} = \frac{5}{\cancel{20}^1} \cdot \frac{21}{\cancel{63}^1} = \frac{105}{1 \cdot 1} = 105$

Kayla is paid \$105.

Chapter 2 Fractions and Mixed Numbers: Multiplication and Division

53. (a) $\frac{1}{4} \div \frac{1}{4} = \frac{1}{4} \div \frac{1}{4} = \frac{1}{4} \cdot \frac{4}{1} = 1$
 weeks old

(b) $2 \frac{1}{8} \div \frac{1}{4} = \frac{17}{8} \div \frac{1}{4} = \frac{17}{8} \cdot \frac{4}{1} = \frac{17}{2} = 8 \frac{1}{2}$ weeks old

54. $1 \frac{3}{4} \div 3 = \frac{7}{4} \div 3 = \frac{7}{4} \cdot \frac{1}{3} = \frac{7}{12}$
 Each child will inherit \$ $\frac{7}{12}$ million.

55. $28 \div 1 \frac{17}{24} = \frac{28}{1} \div \frac{41}{24} = \frac{28}{1} \cdot \frac{24}{41} = \frac{672}{41}$
 The roll is $16 \frac{16}{41}$ ft long.

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

Ricky: $42 \frac{1}{2} \cdot 10 = \frac{85}{2} \cdot \frac{10}{1} = 425$

$497 - 425 = 72$
 Lucy earned \$72 more than Ricky.

(b) $497 + 425 = 922$
 Together they earned \$922.

57. $2 \frac{1}{11} \div 1 = \frac{23}{11} \div 1 = \frac{23}{11} \cdot \frac{1}{1} = 2 \frac{1}{11}$

59. $6 \div 1 \frac{1}{8} = 6 \div \frac{9}{8} = 6 \cdot \frac{8}{9} = 8$

60. $8 \div 2 \frac{1}{3} = 8 \div \frac{7}{3} = 8 \cdot \frac{3}{7} = 3 \frac{4}{7}$

61. $\frac{2}{3} \cdot 2 \frac{1}{10} = \frac{2}{3} \cdot \frac{21}{10} = \frac{14}{15} = 1 \frac{1}{15}$

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

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

64. $5 \frac{1}{3} \cdot 6 = \frac{16}{3} \cdot \frac{6}{1} = 32$

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

66. $2 \frac{1}{7} \cdot 9 = \frac{15}{7} \cdot \frac{9}{1} = 15 \frac{3}{7}$

67. $0 \div 9 \frac{1}{3} = 0$

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

$$5 \quad 10 \quad 5 \quad 10 \quad \frac{5}{1} \quad \frac{11}{1}$$

$$58. \quad 3 \frac{3}{4} \cdot 1 \frac{5}{6} = \frac{15}{4} \cdot \frac{11}{2} = \frac{55}{8} = 6 \frac{7}{8}$$

$$69. \quad 12 \frac{1}{8} = \frac{12}{1} \cdot \frac{1}{8} = \frac{3}{2} = 1 \frac{1}{2}$$

$$70. \quad 20 \frac{2}{15} = \frac{20}{1} \cdot \frac{2}{15} = \frac{8}{3} = 2 \frac{2}{3}$$

83

Section 2.6 Multiplication and Division of Mixed Numbers

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

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

$!2\exists!7\exists!3\exists \quad 1 \quad 7 \quad 3 \quad 21$

73. $\frac{\#3}{5\%} \cdot \frac{\&\#}{34\%} \cdot \frac{\&\#}{4\%} = \frac{11}{5} \cdot \frac{15}{34} = \frac{165}{170} = \frac{33}{34}$

74. $\frac{!1\exists!4\exists!14\exists}{\#5\&\#1\&\#33\&} = \frac{31}{6} \cdot \frac{11}{7} \cdot \frac{14}{33} = \frac{62}{9} = 6\frac{8}{9}$

75. $7\frac{1}{8} \div 1\frac{2}{3} = \frac{57}{8} \div \frac{5}{3} = \frac{57}{8} \cdot \frac{3}{5} = \frac{171}{40} = 4\frac{11}{40}$

76. $3\frac{1}{8} \cdot 5\frac{5}{7} \cdot 1\frac{5}{16} \cdot 2\frac{25}{8} \cdot 4\frac{40}{7} \cdot 2\frac{21}{16} = \frac{25}{8} \cdot \frac{7}{40} \cdot \frac{16}{21} = \frac{10}{24} = \frac{5}{12}$

77. The perimeter of the garden is $2(20) + 2(15) = 40 + 30 = 70$ ft.
 $70 \div 1\frac{1}{4} = \frac{70}{4} \div \frac{5}{4} = \frac{70}{4} \cdot \frac{4}{5} = 56$

56 bricks will be needed.
 $56 \times \$3 = \168
 The total cost is \$168.

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

$64\frac{1}{2} \div 21\frac{1}{2} = \frac{129}{2} \div \frac{43}{2} = \frac{129}{2} \cdot \frac{2}{43} = 3$

It takes 3 gallons of gas for Sara to get to and from work.
 $3 \times \$5 = \15

It costs Sara \$15 each day.

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

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

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

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

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

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

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

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

Chapter 2 Review Exercises

Section 2.1

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

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

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

(b) Improper
1

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

(b) Proper

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

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

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

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

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

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

11. $9\overline{)47} = 5\frac{2}{9}$

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



16. $7\overline{)941} = 134\frac{3}{7}$

$$\begin{array}{r} 24 \\ \underline{!21} \\ 31 \\ \underline{!28} \\ 3 \end{array}$$

17. $26\overline{)1582} = 60\frac{22}{26} = 60\frac{11}{13}$

$$\begin{array}{r} \underline{!0} \\ 22 \end{array}$$

Section 2.2

18. 21, 51, 1200

19. 55, 140, 260, 1200

20. 58, 124, 140, 260, 1200

21. Prime

22. Composite
 $44 = 4 \times 11$

23. Neither

24. Neither

2

25. $2\overline{)4} = 2\frac{1}{2}$

$2! \cdot 2! \cdot 2! \cdot 2! \cdot 2! \cdot 2! \cdot 2! = 2^6 = 64$

26. $5\overline{)55} = 11$

$$2 \cdot 3 \cdot 5 \cdot 11 = 330$$

85

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

$$2!2!3!3!5!5 = 2^2 3^2 5^2 = 900$$

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

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

Section 2.3

30. $3!9!6!5$
18 " 30

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

31. $15!14!21!10$
 $210 = 210$

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

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

33. $\frac{14}{24} = \frac{2!7}{3!8} = \frac{2}{3}$

$$\frac{49}{24} = \frac{7!}{3!8} = \frac{7}{3}$$

34. $\frac{16}{27} = \frac{2!8}{3!9} = \frac{2}{9}$

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

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

40. $\frac{42}{45} = \frac{2!14}{3!15} = \frac{14}{15}$

$$45 - 42 = 3$$

$$\frac{3}{45} = \frac{1}{3!15} = \frac{1}{15}$$

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

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

Section 2.4

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

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

44. $14! \frac{9}{2} = \frac{9!}{1!2!} = 63$

45. $33! \frac{5}{11} = \frac{3!5}{4!11} = 15$

46. $\frac{2}{9}! \frac{5}{8}! \frac{36}{25} = \frac{1}{5}$

47. $\frac{1}{7}! \frac{5}{10}! \frac{6}{63} = \frac{12}{7}$

$$37. \frac{42}{21} = \frac{2 \cancel{!} 2 \cancel{1}}{\cancel{2} 1} = 2$$

$$38. \frac{120}{150} = \frac{12}{15} = \frac{3 \cancel{!} 4}{\cancel{3} \cancel{!} 5} = \frac{4}{5}$$

$$39. \frac{1400}{2000} = \frac{14}{20} = \frac{\cancel{2} \cancel{!} 7}{\cancel{2} \cancel{!} 10} = \frac{7}{10}$$

$$1 \quad 5 \quad 7$$

$$48. \frac{1}{10} = \frac{1}{10} = \frac{1}{10} = \frac{1}{10} = \frac{1}{10,000}$$

Chapter 2 Fractions and Mixed Numbers: Multiplication and Division

$$49. \frac{1}{5} \times \frac{3}{10} = \frac{3}{50}$$

$$\frac{1}{5} \times \frac{3}{10} = \frac{3}{50}$$

$$\frac{4}{25} \times \frac{1}{100} = \frac{4}{2500}$$

$$= \frac{1}{625}$$

$$625$$

$$50. \frac{1}{3} \times \frac{1}{2} = \frac{1}{6}$$

$$\frac{1}{3} \times \frac{1}{2} = \frac{1}{6}$$

$$10 \times 1$$

$$51. \frac{1}{10} \times \frac{1}{1000} = \frac{1}{10000}$$

$$\frac{1}{10} \times \frac{1}{1000} = \frac{1}{10000}$$

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

$$53. A = lw$$

$$54. A = \frac{1}{2}(12) \times 17 = 6 \times 17 = 102 \text{ ft}^2$$

$$55. A = lw = \frac{5}{3} \times \frac{8}{3} = \frac{40}{9} \text{ or } 4 \frac{4}{9} \text{ m}^2$$

$$56. A = \frac{20}{3} + \frac{1}{6} = \frac{40}{6} + \frac{1}{6} = \frac{41}{6}$$

$$\frac{3}{1} \times \frac{2}{3} = \frac{6}{3} = 2$$

$$58. \frac{1}{4} \times 3600 = \frac{3600}{4} = 900$$

There are 900 African American students.

$$59. \frac{1}{12} \times 3600 = \frac{3600}{12} = 300$$

There are 300 Asian American students.

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

There are 300 Hispanic female students.

$$\frac{1}{5} \times \frac{1}{3} \times 3600 = \frac{3600}{15} = 240$$

$$61. \frac{3600}{2} \times \frac{1}{12} = 150 \times \frac{1}{12} = 12.5$$

There are 750 Caucasian male students.

Section 2.5

$$62. \frac{3}{4} \times \frac{4}{3} = 1$$

$$63. \frac{1}{12} \times 12 = \frac{12}{12} = 1$$

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

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

$$= \frac{20}{1} \cancel{!} + \frac{1}{1} \cancel{!} \frac{20}{1} \cancel{!}$$

$$= \frac{\cancel{!}}{1} 1 \frac{\cancel{!}}{1} \frac{\cancel{!}}{1} 1$$

$$= 20 + 20$$

$$= 40 \text{ yd}^2$$

$$7 \frac{1}{4} 7 7 1$$

57. $4! = \frac{4!}{8} = \frac{1!}{1} = \frac{1}{2}$ or $3 \frac{1}{2}$

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

66. Reciprocal does not exist.

67. 6

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

69. Multiplying

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

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

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

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

$$74. \frac{200}{51} \div \frac{25}{17} = \frac{200}{51} \cdot \frac{17}{25} = \frac{2 \cdot 2 \cdot 2 \cdot 5 \cdot 4}{3 \cdot 17 \cdot 5} = \frac{8}{3}$$

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

$$75. 12 \div \frac{1}{7} = 12 \cdot 7 = 84$$

$$76. \frac{1}{2} \div \frac{8}{19} = \frac{1}{2} \cdot \frac{19}{8} = \frac{19}{16}$$

$$\frac{\#}{19} \cdot \frac{\&}{19} = \frac{\# \&}{19 \cdot 19} = \frac{\# \&}{361}$$

$$77. \frac{\#}{5} \div \frac{\&}{5} = \frac{\#}{5} \cdot \frac{5}{\&} = \frac{\#}{\&}$$

$$= \frac{36}{5} \div \frac{36}{5} = 1$$

$$80. \frac{4}{5} \div 20 = \frac{4}{5} \cdot \frac{1}{20} = \frac{1}{25}$$

$$81. 18 \div \frac{2}{3} = 18 \cdot \frac{3}{2} = 27$$

$$82. 24 \div \frac{2}{3} = 24 \cdot \frac{3}{2} = 36$$

36 bags of candy

$$83. \frac{4}{5} \div 40 = \frac{4}{5} \cdot \frac{1}{40} = \frac{1}{50}$$

$32 \times \$18 = \576
Amelia earned \$576.

$$84. \frac{4}{3} \div \frac{4}{3} = 1$$

$$\frac{16}{9} \div \frac{10}{12} = \frac{16}{9} \cdot \frac{12}{10} = \frac{64}{15}$$

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

$$85. 9 \div \frac{3}{8} = 9 \cdot \frac{8}{3} = 24$$

Yes, he will have 24 pieces, which is more

Chapter 2 Fractions and Mixed Numbers: Multiplication and Division

$$87. \quad 1 \overline{) 111} = 111 \div 1 = 111$$

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

$$\frac{34}{71} = \frac{34}{71}$$

$$\frac{71}{71} = 1$$

$$23 \overline{) 3} = 3 \div 23 = \frac{3}{23}$$

$$93. \quad 7 \overline{) 1} = 1 \div 7 = \frac{1}{7}$$

$$9 \overline{) 1} = 1 \div 9 = \frac{1}{9}$$

$$14 \overline{) 9} = 9 \div 14 = \frac{9}{14}$$

$$2 \overline{) 2} = 2 \div 2 = 1$$

$$88. \quad 6 \overline{) 11} = 11 \div 6 = 1 \frac{5}{6}$$

$$13 \overline{) 2} = 2 \div 13 = \frac{2}{13}$$

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

$$\frac{1}{1} = 1$$

$$94. \quad 4 \overline{) 6} = 6 \div 4 = 1 \frac{3}{4}$$

$$11 \overline{) 50} = 50 \div 11 = 4 \frac{6}{11}$$

$$1 \overline{) 25} = 25 \div 1 = 25$$

$$11 \overline{) 2} = 2 \div 11 = \frac{2}{11}$$

$$89. \quad 4 \overline{) 5} = 5 \div 4 = 1 \frac{1}{4}$$

$$14 \overline{) 45} = 45 \div 14 = 3 \frac{3}{14}$$

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

$$95. \quad 10 \overline{) 1} = 1 \div 10 = \frac{1}{10}$$

$$17 \overline{) 51} = 51 \div 17 = 3$$

$$5 \overline{) 1} = 1 \div 5 = \frac{1}{5}$$

$$5 \overline{) 17} = 17 \div 5 = 3 \frac{2}{5}$$

$$90. \quad 45 \overline{) 0} = 0 \div 45 = 0$$

$$96. \quad 0 \div 3 = 0$$

$$91. \quad 4 \overline{) 5} = 5 \div 4 = 1 \frac{1}{4}$$

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

$$\frac{69}{16} \div \frac{23}{8} = \frac{69}{16} \times \frac{8}{23} = \frac{69}{2} \times \frac{1}{23} = \frac{3}{2} = 1 \frac{1}{2}$$

$$97. \quad 2 \overline{) 1} = 1 \div 2 = \frac{1}{2}$$

$$1 \overline{) 1} = 1 \div 1 = 1$$

$$\frac{5}{2} \div \frac{5}{4} = \frac{5}{2} \times \frac{4}{5} = 2$$

$$\frac{25}{8} \div \frac{1}{8} = \frac{25}{8} \times \frac{8}{1} = 25$$

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

$$92. \quad 5 \overline{) 11} = 11 \div 5 = 2 \frac{1}{5}$$

$$11 \overline{) 38} = 38 \div 11 = 3 \frac{5}{11}$$

$$19 \overline{) 5} = 5 \div 19 = \frac{5}{19}$$

$$10 \overline{) 38} = 38 \div 10 = 3 \frac{8}{10} = 3 \frac{4}{5}$$

$$98. \quad 12 \overline{) 1} = 1 \div 12 = \frac{1}{12}$$

$$2 \overline{) 4} = 4 \div 2 = 2$$

$$2 \overline{) 4} = 4 \div 2 = 2$$

$$\frac{25}{1} \div \frac{4}{1} = \frac{25}{4} = 6 \frac{1}{4}$$

There will be 10 pieces.

Chapter 2 Test

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

(b) Proper

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

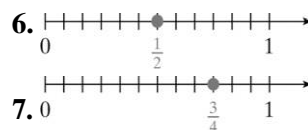
(b) Improper

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

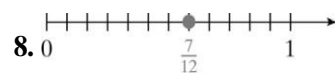
4. $\frac{7}{-}$ is an improper fraction because the

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

$$(b) \quad 3 \overline{) 7} = \frac{3 \cdot 9 + 7}{9} = \frac{34}{9}$$



7
numerator is greater than or equal to the
denominator.



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

(f) Composite $39 = 3 \times 13$

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

(b) 3

$$\begin{array}{r} 9 \\ 3 \overline{) 45} \\ \underline{3} \\ 15 \\ \underline{15} \\ 0 \end{array}$$

$$3 \overline{) 45} = 3^2 \overline{) 15} = 45$$

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

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

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

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

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

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

14. $15 \overline{) 60} \quad 12 \overline{) 60}$

$$\begin{array}{r} 60 = 60 \\ \underline{15} \\ 45 \\ \underline{45} \\ 0 \end{array}$$

$$\begin{array}{r} 12 \\ \underline{12} \\ 0 \end{array}$$

15. $2 \overline{) 50} \quad 5 \overline{) 25}$

$$\begin{array}{r} 50 \div 2 = 25 \end{array}$$

$$\begin{array}{r} 2 \overline{) 50} \\ \underline{4} \\ 10 \\ \underline{10} \\ 0 \end{array}$$

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

17. $\frac{1,200,000}{100,000} = \frac{12}{1} = \frac{2 \overline{) 6}}{1} = 6$

(b) Brad has the greater fractional part completed since $\frac{4}{5} > \frac{3}{5}$.

19. $\frac{2}{9} \approx \frac{57}{46} = \frac{\cancel{2} \overline{) 57}}{\cancel{2} \overline{) 46}} = \frac{19}{13}$

20. $\frac{75}{24} \div \frac{4}{6} = \frac{75}{24} \cdot \frac{6}{4} = \frac{\cancel{3} \overline{) 25}}{\cancel{2} \overline{) 4}} = \frac{25}{2}$

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

22. $\frac{105}{42} \div 5 = \frac{105}{42} \cdot \frac{1}{5} = \frac{21}{14} = \frac{3}{2}$

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

24. $\frac{600}{1200} \div \frac{50}{65} \div \frac{13}{15} = \frac{1}{2} \div \frac{5 \overline{) 10}}{13} \div \frac{13}{15}$

$$= \frac{1}{2} \cdot \frac{\cancel{13}}{10} \cdot \frac{\cancel{15}}{\cancel{13}} = \frac{3}{4}$$

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

$$1,400,000 \quad 14 \quad 2!7 \quad 7$$

18. (a) Christine: $\frac{15}{21} = \frac{3!5}{3!7} = \frac{3}{7}$

Brad: $\frac{16}{20} = \frac{25}{4!5} = \frac{5}{4}$

$$20 \quad 4!5 \quad 5$$

$$= \frac{10}{21} \cdot \frac{1}{25}$$

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

$$= \frac{3!75!5}{4}$$

$$35$$

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

$$\begin{array}{r}
 8\ 244 \\
 \underline{206\ 100} \\
 214,344
 \end{array}$$

$$\begin{array}{r}
 6. \quad 23 \\
 \quad \underline{!81} \\
 \quad 23 \\
 \underline{1840} \\
 1863
 \end{array}$$

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

8. $3,000,000$
 $\frac{!}{000} \frac{40}{120,000,000,000}$

9. 1007
 $\frac{!823}{184}$
 48

10. $\frac{!}{8} = 6$

11. $6 + 2 \cdot 8 = 6 + 16 = 22$

12. $5^2 ! 3^2 = 25 ! 9 = 16$

13. $(5 ! 3)^2 = 2^2 = 4$

14. d

15. c

16. b

17. e

18. a

19. (a) $\frac{4}{7}$
 1

(b) $\frac{7}{3}$ or $\frac{2}{3}$

20. (a) Proper
 (b) Improper
 (c) Improper

21. (a) 1, 2, 3, 5, 6, 10, 15, 30

(b) $\begin{array}{r} 5 \\ 3 \overline{)15} \\ 2 \overline{)30} \end{array}$
 $2 \cdot 3 \cdot 5 = 30$

23. $\frac{35}{27} \frac{51}{95} = \frac{5!7}{3!3!3} \frac{3!17}{5!19} = \frac{119}{171}$

24. $5 \frac{2}{3} \div 6 \frac{4}{5} = \frac{17}{3} \div \frac{34}{5} = \frac{17}{3} \cdot \frac{5}{34} = \frac{5}{6}$

25. Yes; $\frac{8}{13} ! \frac{5}{16} = \frac{5}{26}$ and $\frac{5}{16} \cdot \frac{8}{13} = \frac{5}{26}$

26. Yes; $! 1 \# \frac{2!}{9} \# \frac{5}{3} = 1 \# \frac{5}{9} = \frac{5}{27}$ and

$\frac{1}{2} \# \frac{12}{9} \# \frac{5}{3} = 1 \# \frac{10}{27} = \frac{5}{27}$

27. $\frac{!}{6} \frac{12}{25} \frac{2}{3} \div \frac{1}{3} \frac{2}{5} \frac{2}{3} = \frac{2}{3} \frac{4}{25} \frac{2}{3} = \frac{4}{25} \frac{3}{2} \frac{6}{25}$

28. $A = lw = \frac{11}{9} \frac{5}{9} = \frac{11}{9} \frac{2}{9}$ or $1 \frac{2}{9}$ m

29. $A = \frac{1}{2}bh = \frac{1}{2} \cdot 25 \cdot 8 = \frac{1}{2} \cdot 25 \cdot \frac{2 \cdot 2}{1} = 50 \text{ ft}^2$

$$^{10}P_4 = \frac{10!}{(10-4)!} = \frac{10!}{6!} = \frac{10 \cdot 9 \cdot 8 \cdot 7 \cdot \cancel{6!}}{\cancel{6!}} = 10 \cdot 9 \cdot 8 \cdot 7 = 5040$$

22. (a) $\frac{144}{84} = \frac{2! \cdot 2! \cdot 2! \cdot 2! \cdot \cancel{3!}}{\cancel{2!} \cdot \cancel{2!} \cdot \cancel{3!} \cdot 7} = \frac{12}{7}$ or $1\frac{5}{7}$

of the students are males from out of 40 state.

(b) $\frac{60,000}{150,000} = \frac{6}{15} = \frac{2! \cdot \cancel{3}}{\cancel{5} \cdot 3} = \frac{2}{5}$