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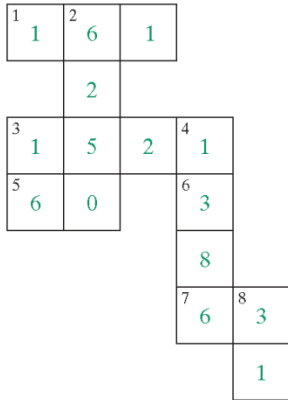
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Chapter 1 Whole Numbers

Chapter Opener Puzzle



Section 1.1 Introduction to Whole Numbers

Section 1.1 Practice Exercises

1. (a) periods
(b) hundreds
(c) thousands
2. 1: ones
9: tens
7: hundreds
6: thousands
3: ten-thousands
3. 8,213,457
7: ones
5: tens
4: hundreds
3: thousands
1: ten-thousands
2: hundred-thousands
8: millions
4. 103,596
6: ones
9: tens
5: hundreds
3: thousands
0: ten-thousands
1: hundred-thousands
5. 321 tens
6. 689 tens
7. 214 ones
8. 738 ones
9. 8,710 hundreds
10. 2,293 hundreds
11. 1,430 thousands
12. 3,101 thousands
13. 452,723 hundred-thousands
14. 655,878 hundred thousands
15. 1,023,676,207 billions
16. 3,111,901,211 billions
17. 22,422 ten-thousands
18. 58,106 ten-thousands
19. 51,033,201 millions
20. 93,971,224 millions

Chapter 1 Whole Numbers

21. 10,677,881 ten-millions
22. 31,820 m² thousands
23. 7,653,468,440 billions
24. 31,000 ten-thousands
25. 5 tens + 8 ones
26. 7 tens + 1 one
27. 5 hundreds + 3 tens + 9 ones
28. 3 hundreds + 8 tens + 2 ones
29. 5 hundreds + 3 ones
30. 8 hundreds + 9 ones
31. 1 ten-thousand + 2 hundreds + 4 tens + 1 one
32. 2 ten-thousands + 8 hundreds + 7 tens + 3 ones
33. 524
34. 318
35. 150
36. 620
37. 1,906
38. 4,201
39. 85,007
40. 26,002
41. ones, thousands, millions, billions
42. ones, tens, hundreds, thousands
43. Two hundred forty-one
44. Three hundred twenty-seven
45. Six hundred three
46. One hundred eight
47. Thirty-one thousand, five hundred thirty
48. Fifty-two thousand, one hundred sixty

49. One hundred thousand, two hundred thirty-four
50. Four hundred thousand, one hundred ninety-nine
51. Nine thousand, five hundred thirty-five
52. Five hundred ninety thousand, seven hundred twelve
53. Twenty thousand, three hundred twenty
54. One thousand, eight hundred
55. One thousand, three hundred seventy-seven

56. Sixty million
57. 6,005

58. 4,004

59. 672,000

60. 248,000

61. 1,484,250

62. 2,647,520



65. Counting on a number line, 10 is 4 units to the right of 6.
66. Counting on a number line, 3 is 8 units to the left of 11.
67. Counting on a number line, 4 is 3 units to the left of 7.
68. Counting on a number line, 5 is 5 units to the right of 0.
69. $8 > 2$
8 is greater than 2, or 2 is less than 8.
70. $6 < 11$
6 is less than 11, or 11 is greater than 6.

- | | |
|---|--|
| 71. $3 < 7$
3 is less than 7, or 7 is greater than 3. | 83. $90 < 91$ |
| 72. $14 > 12$
14 is greater than 12, or 12 is less than 14. | 84. $48 > 47$ |
| 73. $6 < 11$ | 85. False; 12 is made up of the digits 1 and 2. |
| 74. $14 > 13$ | 86. False; 26 is made up of the digits 2 and 6. |
| 75. $21 > 18$ | 87. 99 |
| 76. $5 < 7$ | 88. 999 |
| 77. $3 < 7$ | 89. There is no greatest whole number. |
| 78. $14 < 24$ | 90. 0 is the least whole number. |
| 79. $95 > 89$ | 91. 10,000,000 7 zeros |
| 80. $28 < 30$ | 92. 100,000,000,000 11 zeros |
| 81. $0 < 3$ | 93. 964 |
| 82. $8 > 0$ | 94. 840 |

Section 1.2 Addition of Whole Numbers and Perimeter

Section 1.2 Practice Exercises

- | | |
|--|---------------------------------------|
| 1. (a) addends
(b) sum
(c) commutative
(d) 4; 4
(e) associative
(f) polygon
(g) perimeter | 3. 3 hundreds + 5 tens + 1 one |
| 2. 5 thousands + 2 tens + 4 ones | 4. Three hundred fifty-one |
| | 5. 1 hundred + 7 ones |
| | 6. 2004 |
| | 7. 4012 |
| | 8. 6206 |

9. Fill in the table. Use the number line if necessary.

+	0	1	2	3	4	5	6	7	8	9
0	0	1	2	3	4	5	6	7	8	9
1	1	2	3	4	5	6	7	8	9	10
2	2	3	4	5	6	7	8	9	10	11
3	3	4	5	6	7	8	9	10	11	12
4	4	5	6	7	8	9	10	11	12	13
5	5	6	7	8	9	10	11	12	13	14
6	6	7	8	9	10	11	12	13	14	15
7	7	8	9	10	11	12	13	14	15	16
8	8	9	10	11	12	13	14	15	16	17
9	9	10	11	12	13	14	15	16	17	18

10. $5 + 9 = 14$
Addends: 5, 9
Sum: 14

11. $2 + 8 = 10$
Addends: 2, 8
Sum: 10

12. $12 + 5 = 17$
Addends: 12, 15
Sum: 17

13. $11 + 10 = 21$
Addends: 11, 10
Sum: 21

14. $1 + 13 + 4 = 18$
Addends: 1, 13, 4
Sum: 18

15. $5 + 8 + 2 = 15$
Addends: 5, 8, 2
Sum: 15

16. $42 = 4 \text{ tens} + 2 \text{ ones}$
 $+ 33 = 3 \text{ tens} + 3 \text{ ones}$
75 = 7 tens + 5 ones

17. $21 = 2 \text{ tens} + 1 \text{ one}$
 $+ 53 = 5 \text{ tens} + 3 \text{ ones}$
74 = 7 tens + 4 ones

18. $39 = 3 \text{ tens} + 9 \text{ ones}$
 $+ 20 = 2 \text{ tens} + 0 \text{ ones}$
59 = 5 tens + 9 ones

19. $15 = 1 \text{ ten} + 5 \text{ ones}$
 $+ 43 = 4 \text{ tens} + 3 \text{ ones}$
58 = 5 tens + 8 ones

20. $12 = 1 \text{ ten} + 2 \text{ ones}$
 $15 = 1 \text{ ten} + 5 \text{ ones}$
 $+ 32 = 3 \text{ tens} + 2 \text{ ones}$
59 = 5 tens + 9 ones

21. $10 = 1 \text{ ten} + 0 \text{ ones}$
 $8 = 0 \text{ tens} + 8 \text{ ones}$
30 = 3 tens + 0 ones
 $48 = 4 \text{ tens} + 8 \text{ ones}$

22. $7 = 0 \text{ tens} + 7 \text{ ones}$
 $21 = 2 \text{ tens} + 1 \text{ one}$
 $+ 10 = 1 \text{ ten} + 0 \text{ ones}$
38 = 3 tens + 8 ones

23. $6 = 0 \text{ tens} + 6 \text{ ones}$
 $11 = 1 \text{ ten} + 1 \text{ one}$
 $+ 2 = 0 \text{ tens} + 2 \text{ ones}$
19 = 1 ten + 9 ones

24. 341
 $+ 225$
566

Section 1.2 Addition of Whole Numbers and Perimeter

$$\begin{array}{r} 25. \quad 407 \\ + 181 \\ \hline 588 \end{array}$$

$$\begin{array}{r} 26. \quad 890 \\ + 107 \\ \hline 997 \end{array}$$

$$\begin{array}{r} 27. \quad 444 \\ + 354 \\ \hline 798 \end{array}$$

$$\begin{array}{r} 28. \quad 4 \\ 13 \\ + 102 \\ \hline 119 \end{array}$$

$$\begin{array}{r} 29. \quad 11 \\ 221 \\ + 5 \\ \hline 237 \end{array}$$

$$\begin{array}{r} 30. \quad 31 \\ 7 \\ + 430 \\ \hline 468 \end{array}$$

$$\begin{array}{r} 31. \quad 24 \\ 14 \\ + 160 \\ \hline 198 \end{array}$$

$$\begin{array}{r} 32. \quad 1 \\ 76 \\ + 45 \\ \hline 121 \end{array}$$

$$\begin{array}{r} 33. \quad 1 \\ 25 \\ + 59 \\ \hline 84 \end{array}$$

$$\begin{array}{r} 34. \quad 1 \\ 87 \\ + 24 \\ \hline 111 \end{array}$$

$$\begin{array}{r} 35. \quad 1 \\ 38 \\ + 77 \\ \hline 115 \end{array}$$

$$\begin{array}{r} 36. \quad 658 \\ + 231 \\ \hline 889 \end{array}$$

$$\begin{array}{r} 37. \quad 1 \\ 642 \\ + 295 \\ \hline 937 \end{array}$$

$$\begin{array}{r} 38. \quad 11 \\ 152 \\ + 549 \\ \hline 701 \end{array}$$

$$\begin{array}{r} 39. \quad 11 \\ 462 \\ + 388 \\ \hline 850 \end{array}$$

$$\begin{array}{r} 40. \quad 1 \\ 15 \\ 5 \\ + 9 \\ \hline 29 \end{array}$$

$$\begin{array}{r} 41. \quad 1 \\ 2 \\ 31 \\ + 8 \\ \hline 41 \end{array}$$

$$\begin{array}{r} 42. \quad 2 \\ 14 \\ 9 \\ + 17 \\ \hline 40 \end{array}$$

$$\begin{array}{r} 43. \quad 1 \\ 7 \\ 18 \\ + 4 \\ \hline 29 \end{array}$$

$$\begin{array}{r} 44. \quad 11 \\ 79 \\ 112 \\ + 12 \\ \hline 203 \end{array}$$

$$\begin{array}{r} 45. \quad 11 \\ 62 \\ 907 \\ + 34 \\ \hline 1003 \end{array}$$

$$\begin{array}{r} 1 \\ 46. \quad 331 \\ \quad 422 \\ + 76 \\ \hline 829 \end{array}$$

$$\begin{array}{r} 11 \\ 47. \quad 87 \\ \quad 119 \\ + 630 \\ \hline 836 \end{array}$$

$$\begin{array}{r} 11 \\ 48. \quad 4980 \\ + 10223 \\ \hline 15,203 \end{array}$$

$$\begin{array}{r} 11 \\ 49. \quad 23112 \\ \quad 892 \\ \hline 24,004 \end{array}$$

$$\begin{array}{r} 111 \\ 50. \quad 10223 \\ \quad 25782 \\ \quad 4980 \\ \hline 40,985 \end{array}$$

$$\begin{array}{r} 1111 \\ 51. \quad 92377 \\ \quad 5622 \\ \quad 34659 \\ \hline 132,658 \end{array}$$

52. $12 + 6 = 6 + 12$

53. $30 + 21 = 21 + 30$

54. $101 + 44 = 44 + 101$

55. $8 + 13 = 13 + 8$

56. $(4 + 8) + 13 = 4 + (8 + 13)$

57. $(23 + 9) + 10 = 23 + (9 + 10)$

58. $7 + (12 + 8) = (7 + 12) + 8$

59. $41 + (3 + 22) = (41 + 3) + 22$

60. The commutative property changes the order of the addends, and the associative property changes the grouping.

61. The sum of any number and 0 is that number.

(a) $423 + 0 = 423$

(b) $0 + 25 = 25$

(c) $67 + 0 = 67$

$$\begin{array}{r} 1 \\ 62. \quad 13 + 7 \quad 13 \\ \quad \quad + 7 \\ \hline 20 \end{array}$$

$$\begin{array}{r} 100 \\ 63. \quad 100 + 42 \quad 100 \\ \quad \quad + 42 \\ \hline 142 \end{array}$$

$$\begin{array}{r} 1 \\ 64. \quad 7 + 45 \quad 7 \\ \quad \quad + 45 \\ \hline 52 \end{array}$$

$$\begin{array}{r} 23 \\ 65. \quad 23 + 81 \quad 23 \\ \quad \quad + 81 \\ \hline 104 \end{array}$$

$$\begin{array}{r} 1 \\ 66. \quad 18 + 5 \quad 18 \\ \quad \quad + 5 \\ \hline 23 \end{array}$$

$$\begin{array}{r} 76 \\ 67. \quad 76 + 2 \quad 76 \\ \quad \quad + 2 \\ \hline 78 \end{array}$$

$$\begin{array}{r} 1 \\ 68. \quad 1523 + 90 \quad 1523 \\ \quad \quad + 90 \\ \hline 1,613 \end{array}$$

$$\begin{array}{r} 1320 \\ 69. \quad 1320 + 448 \quad 1320 \\ \quad \quad + 448 \\ \hline 1,768 \end{array}$$

$$\begin{array}{r} 1 \\ 70. \quad 5 + 39 + 81 \quad 5 \\ \quad \quad \quad 39 \\ \quad \quad + 81 \\ \hline 125 \end{array}$$

71. For example: The sum of 54 and 24

72. For example: The sum of 33 and 15

73. For example: 88 added to 12

Section 1.2 Addition of Whole Numbers and Perimeter

74. For example: 15 added to 70

75. For example: The total of 4, 23, and 77

76. For example: The total of 11, 41, and 53

77. For example: 10 increased by 8

78. For example: 25 increased by 14

79.
$$\begin{array}{r} 103 \\ 112 \\ + 61 \\ \hline 276 \end{array}$$

276 people attended the play.

80.
$$\begin{array}{r} 3 \\ 38 \\ 54 \\ 44 \\ 61 \\ 397 \\ 103 \\ + 124 \\ \hline 521 \end{array}$$

521 deliveries were made.

81.
$$\begin{array}{r} 1 \quad 2 \\ 21,209,000 \\ 20,836,000 \\ + 16,448,000 \\ \hline 58,493,000 \end{array}$$

The shows had a total of 58,493,000 viewers.

82.
$$\begin{array}{r} 11 \\ 195 \text{ mi} \\ + 228 \text{ mi} \\ \hline 423 \text{ mi} \end{array}$$

She will travel 423 mi.

83.
$$\begin{array}{r} \$43,000 \\ + 2,500 \\ \hline \$45,500 \end{array}$$

Nora earns \$45,500.

84.
$$\begin{array}{r} 1,205,655 \\ + 1,000 \\ \hline 1,206,655 \end{array}$$

1,206,655 athletes are participating.

85.
$$\begin{array}{r} 1 \\ 60 \\ 52 \\ 75 \\ + 58 \\ \hline 245 \end{array}$$

The total for the checks written is \$245.

86.
$$\begin{array}{r} 11 \\ 115 \\ 104 \\ 93 \\ + 111 \\ \hline 423 \end{array}$$

423 desks were delivered.

87.
$$\begin{array}{r} 5 \quad 3 \quad 3 \\ 2787 \\ 1956 \\ 991 \\ 1817 \\ 1567 \\ 715 \\ + 3705 \\ \hline 13,538 \end{array}$$

There are 13,538 participants.

88.
$$\begin{array}{r} 11 \\ 1494 \\ 155 \\ + 42 \\ \hline 1691 \end{array}$$

There are 1691 thousand teachers.

89.
$$\begin{array}{r} 111 \quad 11 \\ 100,052 \\ 675,038 \\ + 45,934 \\ \hline 821,024 \end{array}$$

There are 821,024 nonteachers.

90.
$$\begin{array}{r} 1 \quad 11 \\ \$7 \quad 329 \\ 9 \quad 560 \\ 1 \quad 248 \\ + 3 \quad 500 \\ \hline \$21,637 \end{array}$$

The total cost is \$21,637.

Chapter 1 Whole Numbers

$$\begin{array}{r} 1 \\ 91. \quad 35 \text{ cm} \\ 35 \text{ cm} \\ + 34 \text{ cm} \\ \hline 104 \text{ cm} \end{array}$$

$$\begin{array}{r} 1 \\ 92. \quad 27 \text{ in.} \\ 13 \text{ in.} \\ + 20 \text{ in.} \\ \hline 60 \text{ in.} \end{array}$$

$$\begin{array}{r} 2 \\ 93. \quad 21 \text{ m} \\ 20 \text{ m} \\ 18 \text{ m} \\ 19 \text{ m} \\ 11 \text{ m} \\ + 21 \text{ m} \\ \hline 110 \text{ m} \end{array}$$

$$\begin{array}{r} 2 \\ 94. \quad 15 \text{ m} \\ 7 \text{ m} \\ 6 \text{ m} \\ + 7 \text{ m} \\ \hline 35 \text{ m} \end{array}$$

$$\begin{array}{r} 2 \\ 95. \quad 6 \text{ yd} \\ 10 \text{ yd} \\ 11 \text{ yd} \\ 3 \text{ yd} \\ 5 \text{ yd} \\ + 7 \text{ yd} \\ \hline 42 \text{ yd} \end{array}$$

$$\begin{array}{r} 96. \quad 200 \text{ yd} \\ 136 \text{ yd} \\ 142 \text{ yd} \\ 98 \text{ yd} \\ 58 \text{ yd} \\ + 38 \text{ yd} \\ \hline 672 \text{ yd} \end{array}$$

$$\begin{array}{r} 97. \quad 94 \text{ ft} \\ 94 \text{ ft} \\ 50 \text{ ft} \\ + 50 \text{ ft} \\ \hline 288 \text{ ft} \end{array}$$

$$\begin{array}{r} 98. \quad 90 \text{ ft} \\ 90 \text{ ft} \\ 90 \text{ ft} \\ + 90 \text{ ft} \\ \hline 360 \text{ ft} \end{array}$$

$$99. \quad 9,084,037 + 452,903 = 9,536,940$$

$$100. \quad 899,382 + 9406 = 908,788$$

$$101. \quad 7,201,529 + 962,411 = 8,163,940$$

$$\begin{array}{r} 102. \quad 45,418 \\ 81,990 \\ 9,063 \\ + 56,309 \\ \hline 192,780 \end{array}$$

$$\begin{array}{r} 103. \quad 9,300,050 \\ 7,803,513 \\ 3,480,009 \\ + 907,822 \\ \hline 21,491,394 \end{array}$$

$$\begin{array}{r} 104. \quad 3,421,019 \\ 822,761 \\ 1,003,721 \\ + 9,678 \\ \hline 5,257,179 \end{array}$$

$$\begin{array}{r} 105. \quad 64,700,000 \\ 36,500,000 \\ 24,100,000 \\ + 23,200,000 \\ \hline \$148,500,000 \end{array}$$

$$\begin{array}{r} 106. \quad 2 \ 211 \ 1 \\ 65,899,660 \\ 60,932,152 \\ 1,275,804 \text{ votes} \\ \hline 128,107,616 \end{array}$$

Section 1.3 Subtraction of Whole Numbers

Section 1.3 Practice Exercises

1. minuend; subtrahend; difference
2. 134
3.
$$\begin{array}{r} 330 \\ + 821 \\ \hline 1151 \end{array}$$
4.
$$\begin{array}{r} 1 \\ 782 \\ 21 \\ + 1046 \\ \hline 1,849 \end{array}$$
5.
$$\begin{array}{r} 1 \\ 46 \\ 804 \\ + 49 \\ \hline 899 \end{array}$$
6. $14 < 21$
7. $0 < 10$
8. Twenty-two is less than twenty-five.
9. $12 - 8 = 4$
minuend: 12
subtrahend: 8
difference: 4
10. $6 - 1 = 5$
minuend: 6
subtrahend: 1
difference: 5
11. $21 - 12 = 9$
minuend: 21
subtrahend: 12
difference: 9
12. $32 - 2 = 30$
minuend: 32
subtrahend: 2
difference: 30
13.
$$\begin{array}{r} 9 \\ - 6 \\ \hline 3 \end{array}$$

minuend: 9
subtrahend: 6
difference: 3
14.
$$\begin{array}{r} 17 \\ - 3 \\ \hline 14 \end{array}$$

minuend: 17
subtrahend: 3
difference: 14
15. $27 - 9 = 18$ because $18 + 9 = 27$.
16. $20 - 8 = 12$ because $12 + 8 = 20$.
17. $102 - 75 = 27$ because $27 + 75 = 102$.
18. $211 - 45 = 166$ because $166 + 45 = 211$.
19. $8 - 3 = 5$ Check: $5 + 3 = 8$
20. $7 - 2 = 5$ Check: $5 + 2 = 7$
21. $4 - 1 = 3$ Check: $3 + 1 = 4$
22. $9 - 1 = 8$ Check: $8 + 1 = 9$
23. $6 - 0 = 6$ Check: $6 + 0 = 6$
24. $3 - 0 = 3$ Check: $3 + 0 = 3$
25.
$$\begin{array}{r} 68 \\ - 23 \\ \hline 45 \end{array}$$
 Check:
$$\begin{array}{r} 45 \\ + 23 \\ \hline 68 \end{array} \checkmark$$
26.
$$\begin{array}{r} 54 \\ - 31 \\ \hline 23 \end{array}$$
 Check:
$$\begin{array}{r} 23 \\ + 31 \\ \hline 54 \end{array} \checkmark$$

Chapter 1 Whole Numbers

$$\begin{array}{r} 27. \quad 88 \\ - 27 \\ \hline 61 \end{array} \quad \begin{array}{l} \text{Check:} \\ + 27 \\ \hline 88 \end{array} \checkmark$$

$$\begin{array}{r} 28. \quad 75 \\ - 50 \\ \hline 25 \end{array} \quad \begin{array}{l} \text{Check:} \\ + 50 \\ \hline 75 \end{array} \checkmark$$

$$\begin{array}{r} 29. \quad 1347 \\ - 221 \\ \hline 1126 \end{array} \quad \begin{array}{l} \text{Check:} \\ + 221 \\ \hline 1347 \end{array} \checkmark$$

$$\begin{array}{r} 30. \quad 4865 \\ - 713 \\ \hline 4152 \end{array} \quad \begin{array}{l} \text{Check:} \\ + 713 \\ \hline 4865 \end{array} \checkmark$$

$$\begin{array}{r} 31. \quad 1525 \\ - 1204 \\ \hline 321 \end{array} \quad \begin{array}{l} \text{Check:} \\ + 321 \\ \hline 1525 \end{array} \checkmark$$

$$\begin{array}{r} 32. \quad 8843 \\ - 5612 \\ \hline 3231 \end{array} \quad \begin{array}{l} \text{Check:} \\ + 5612 \\ \hline 8843 \end{array} \checkmark$$

$$\begin{array}{r} 33. \quad 12\,806 \\ - 2\,802 \\ \hline 10,004 \end{array} \quad \begin{array}{l} \text{Check:} \\ + 2\,802 \\ \hline 12,806 \end{array} \checkmark$$

$$\begin{array}{r} 34. \quad 12,771 \\ - 1\,240 \\ \hline 11,531 \end{array} \quad \begin{array}{l} \text{Check:} \\ + 1\,240 \\ \hline 12,771 \end{array} \checkmark$$

$$\begin{array}{r} 35. \quad 14,356 \\ - 13,253 \\ \hline 1,103 \end{array} \quad \begin{array}{l} \text{Check:} \\ + 13\,253 \\ \hline 14,356 \end{array} \checkmark$$

$$\begin{array}{r} 36. \quad 34,550 \\ - 31,450 \\ \hline 3,100 \end{array} \quad \begin{array}{l} \text{Check:} \\ + 31\,450 \\ \hline 34,550 \end{array} \checkmark$$

$$\begin{array}{r} 37. \quad \begin{array}{r} 616 \\ \cancel{7} \end{array} \\ - 59 \\ \hline 17 \end{array} \quad \begin{array}{l} \text{Check:} \\ + 59 \\ \hline 76 \end{array} \checkmark$$

$$\begin{array}{r} 38. \quad \begin{array}{r} 514 \\ \cancel{6} \end{array} \\ - 48 \\ \hline 16 \end{array} \quad \begin{array}{l} \text{Check:} \\ + 48 \\ \hline 64 \end{array} \checkmark$$

$$\begin{array}{r} 39. \quad \begin{array}{r} 717 \\ \cancel{8} \end{array} \\ - 38 \\ \hline 49 \end{array} \quad \begin{array}{l} \text{Check:} \\ + 38 \\ \hline 87 \end{array} \checkmark$$

$$\begin{array}{r} 40. \quad \begin{array}{r} 814 \\ \cancel{9} \end{array} \\ - 75 \\ \hline 19 \end{array} \quad \begin{array}{l} \text{Check:} \\ + 75 \\ \hline 94 \end{array} \checkmark$$

$$\begin{array}{r} 41. \quad \begin{array}{r} 310 \\ \cancel{2} \end{array} \\ - 136 \\ \hline 104 \end{array} \quad \begin{array}{l} \text{Check:} \\ + 136 \\ \hline 240 \end{array} \checkmark$$

$$\begin{array}{r} 42. \quad \begin{array}{r} 510 \\ \cancel{3} \end{array} \\ - 225 \\ \hline 135 \end{array} \quad \begin{array}{l} \text{Check:} \\ + 225 \\ \hline 360 \end{array} \checkmark$$

$$\begin{array}{r} 43. \quad \begin{array}{r} 10 \\ \cancel{6} \end{array} \\ - 1\,89 \\ \hline 5\,21 \end{array} \quad \begin{array}{l} \text{Check:} \\ + 189 \\ \hline 710 \end{array} \checkmark$$

$$\begin{array}{r} 44. \quad \begin{array}{r} 410 \\ \cancel{8} \end{array} \\ - 30\,3 \\ \hline 54\,7 \end{array} \quad \begin{array}{l} \text{Check:} \\ + 303 \\ \hline 850 \end{array} \checkmark$$

$$\begin{array}{r} 45. \quad \begin{array}{r} 410 \\ \cancel{4} \end{array} \\ - 432\,7 \\ \hline 2\,3 \end{array} \quad \begin{array}{l} \text{Check:} \\ + 4327 \\ \hline 4350 \end{array} \checkmark$$

$$\begin{array}{r} 46. \quad \begin{array}{r} 813 \\ \cancel{7} \end{array} \\ - 725\,5 \\ \hline 3\,8 \end{array} \quad \begin{array}{l} \text{Check:} \\ + 7255 \\ \hline 7293 \end{array} \checkmark$$

$$\begin{array}{r} 47. \quad \begin{array}{r} 9\,9 \\ \cancel{5} \end{array} \\ - 1\,2\,3\,8 \\ \hline 4\,7\,6\,4 \end{array} \quad \begin{array}{l} \text{Check:} \\ + 1238 \\ \hline 6002 \end{array} \checkmark$$

Section 1.3 Subtraction of Whole Numbers

$$\begin{array}{r}
 99 \\
 2\cancel{10}\cancel{10}10 \\
 48. \quad \cancel{3}000 \\
 - 2356 \\
 \hline
 644
 \end{array}
 \quad
 \begin{array}{r}
 11 \\
 \text{Check: } 1644 \\
 + 2356 \\
 \hline
 3000 \checkmark
 \end{array}$$

$$\begin{array}{r}
 99 \\
 7\cancel{10}\cancel{10}10 \\
 56. \quad \cancel{8}\cancel{0}\cancel{0}\cancel{0} \\
 - 3788 \\
 \hline
 4212
 \end{array}
 \quad
 \begin{array}{r}
 111 \\
 \text{Check: } 4212 \\
 + 3788 \\
 \hline
 8000 \checkmark
 \end{array}$$

$$\begin{array}{r}
 010 \\
 \cancel{10},425 \\
 49. \quad - 9022 \\
 \hline
 1,403
 \end{array}
 \quad
 \begin{array}{r}
 1403 \\
 \text{Check: } + 9022 \\
 \hline
 10,425 \checkmark
 \end{array}$$

$$\begin{array}{r}
 13 \\
 1\cancel{3}13 \\
 57. \quad \cancel{32},\cancel{4}\cancel{9} \\
 - 1498 \\
 \hline
 30,941
 \end{array}
 \quad
 \begin{array}{r}
 11 \\
 \text{Check: } 30941 \\
 + 1498 \\
 \hline
 32,439 \checkmark
 \end{array}$$

$$\begin{array}{r}
 9 \\
 1138\cancel{10}11 \\
 50. \quad \cancel{2}\cancel{3},\cancel{0}\cancel{0}\cancel{1} \\
 - 8064 \\
 \hline
 15,837
 \end{array}
 \quad
 \begin{array}{r}
 111 \\
 \text{Check: } 15837 \\
 + 8064 \\
 \hline
 23,901 \checkmark
 \end{array}$$

$$\begin{array}{r}
 111 \\
 \cancel{2}\cancel{1}335 \\
 58. \quad - 4123 \\
 \hline
 17,212
 \end{array}
 \quad
 \begin{array}{r}
 1 \\
 \text{Check: } 17212 \\
 + 4123 \\
 \hline
 21,335 \checkmark
 \end{array}$$

$$\begin{array}{r}
 11 \\
 5\cancel{1}10 \\
 51. \quad \cancel{62}\cancel{0}88 \\
 - 59871 \\
 \hline
 2,217
 \end{array}
 \quad
 \begin{array}{r}
 1 \\
 \text{Check: } 12217 \\
 + 59871 \\
 \hline
 62,088 \checkmark
 \end{array}$$

$$\begin{array}{r}
 9 \\
 7\cancel{10}10 \quad 214 \\
 59. \quad \cancel{8},\cancel{0}\cancel{0}7,\cancel{2}\cancel{3}\cancel{4} \\
 - 2,345,115 \\
 \hline
 5,662,119
 \end{array}
 \quad
 \begin{array}{r}
 111 \\
 \text{Check: } 5662119 \\
 + 2345115 \\
 \hline
 8,007,234 \checkmark
 \end{array}$$

$$\begin{array}{r}
 111010 \\
 2\cancel{1}\cancel{0}\cancel{1}2 \\
 52. \quad \cancel{32},\cancel{1}\cancel{1}\cancel{2} \\
 - 28334 \\
 \hline
 3,778
 \end{array}
 \quad
 \begin{array}{r}
 111 \\
 \text{Check: } 13778 \\
 + 28334 \\
 \hline
 32,112 \checkmark
 \end{array}$$

$$\begin{array}{r}
 9 \\
 2\cancel{10}14 \quad 416 \\
 60. \quad \cancel{3}\cancel{0}\cancel{4}5 \quad \cancel{3}\cancel{0}7 \\
 - 1871495 \\
 \hline
 1,174,072
 \end{array}
 \quad
 \begin{array}{r}
 111 \\
 \text{Check: } 1174072 \\
 + 1871495 \\
 \hline
 3,045,567 \checkmark
 \end{array}$$

$$\begin{array}{r}
 16 \\
 3\cancel{10}10 \\
 53. \quad \cancel{47}\cancel{0} \\
 - 92 \\
 \hline
 378
 \end{array}
 \quad
 \begin{array}{r}
 11 \\
 \text{Check: } 378 \\
 + 92 \\
 \hline
 470 \checkmark
 \end{array}$$

$$\begin{array}{r}
 78 \\
 61. \quad - 23 \\
 \hline
 55
 \end{array}$$

$$\begin{array}{r}
 16 \\
 5\cancel{14}14 \\
 54. \quad \cancel{67}\cancel{4} \\
 - 89 \\
 \hline
 585
 \end{array}
 \quad
 \begin{array}{r}
 11 \\
 \text{Check: } 585 \\
 + 89 \\
 \hline
 674 \checkmark
 \end{array}$$

$$\begin{array}{r}
 315 \\
 62. \quad \cancel{4}\cancel{7} \\
 - 17 \\
 \hline
 28
 \end{array}$$

$$\begin{array}{r}
 16 \\
 2\cancel{10}1010 \\
 55. \quad \cancel{37}\cancel{0}0 \\
 - 2987 \\
 \hline
 713
 \end{array}
 \quad
 \begin{array}{r}
 11 \\
 \text{Check: } 1713 \\
 + 2987 \\
 \hline
 3700 \checkmark
 \end{array}$$

$$\begin{array}{r}
 410 \\
 64. \quad \cancel{3}\cancel{0} \\
 - 12 \\
 \hline
 38
 \end{array}$$

$$\begin{array}{r}
 422 \\
 65. \quad - 100 \\
 \hline
 322
 \end{array}$$

$$\begin{array}{r} 66. \quad 89 \\ - 42 \\ \hline 47 \end{array}$$

$$\begin{array}{r} 67. \quad \begin{array}{r} 8 \ 10 \\ 10\cancel{0}\cancel{0} \\ - 7 \ 2 \\ \hline 101 \ 8 \end{array} \end{array}$$

$$\begin{array}{r} 68. \quad \begin{array}{r} 0 \ 11 \\ 3\cancel{7}\cancel{7}1 \\ - 60 \\ \hline 3051 \end{array} \end{array}$$

$$\begin{array}{r} 69. \quad \begin{array}{r} 4 \ 10 \\ \cancel{5}\cancel{0} \\ - 1 \ 3 \\ \hline 3 \ 7 \end{array} \end{array}$$

$$\begin{array}{r} 70. \quad 405 \\ - 103 \\ \hline 302 \end{array}$$

$$\begin{array}{r} 71. \quad \begin{array}{r} 9 \ 13 \\ 10\cancel{0}\cancel{0} \\ - 3 \ 5 \\ \hline 6 \ 8 \end{array} \end{array}$$

$$\begin{array}{r} 72. \quad \begin{array}{r} 8 \ 11 \\ \cancel{0}\cancel{0} \\ - 1 \ 4 \\ \hline 7 \ 7 \end{array} \end{array}$$

73. For example: 93 minus 27

74. For example: 80 decreased by 20

75. For example: Subtract 85 from 165.

76. For example: 42 less than 171

77. The expression $7 - 4$ means 7 minus 4, yielding a difference of 3. The expression $4 - 7$ means 4 minus 7 which results in a difference of -3 .

78. Subtraction is not associative. For example, $10 - (6 - 2) = 10 - 4 = 6$, and $(10 - 6) - 2 = 4 - 2 = 2$. Therefore $10 - (6 - 2)$ does not equal $(10 - 6) - 2$.

$$\begin{array}{r} 79. \quad \begin{array}{r} 4 \ 10 \\ \cancel{5}\cancel{0} \\ - 1 \ 7 \\ \hline \$3 \ 3 \end{array} \end{array}$$

\$33 change was received.

$$\begin{array}{r} 80. \quad \begin{array}{r} 4 \ 15 \\ \cancel{5}\cancel{0} \\ - 3 \ 9 \\ \hline 1 \ 6 \end{array} \end{array}$$

16 DVDs are left.

$$\begin{array}{r} 81. \quad \begin{array}{r} 0 \ 11 \\ \cancel{7}\cancel{7}8 \\ - 63 \\ \hline 55 \end{array} \end{array}$$

Lennon and McCartney had 55 more hits.

$$\begin{array}{r} 82. \quad \begin{array}{r} 4 \ 10 \\ \cancel{5}\cancel{0}5 \\ - 2 \ 0 \ 0 \\ \hline 3 \ 0 \ 5 \end{array} \end{array}$$

305 ft more

$$\begin{array}{r} 83. \quad \begin{array}{r} 1 \ 16 \\ \cancel{2}\cancel{0} \\ - 1 \ 8 \\ \hline 8 \end{array} \end{array}$$

Lily needs 8 more plants.

$$\begin{array}{r} 84. \quad \$50 \\ - 37 \\ \hline \$13 \end{array}$$

\$13 more is needed.

$$\begin{array}{r} 85. \quad \begin{array}{r} 10 \ 13 \\ 4 \ \cancel{0} \ \cancel{14} \\ \cancel{5}\cancel{0}\cancel{0}9 \\ - 2 \ 6 \ 7 \ 0 \\ \hline 2 \ 4 \ 7 \ 9 \end{array} \end{array}$$

The Lion King had been performed 2,479 more times.

$$\begin{array}{r} 86. \quad \begin{array}{r} 12 \ 13 \\ 1 \ \cancel{2}\cancel{0}\cancel{14} \\ 3 \ \cancel{2}\cancel{0}44 \\ - 3 \ 0 \ 6 \ 4 \ 6 \\ \hline 1 \ 6 \ 9 \ 8 \end{array} \end{array}$$

Brees needs 1698 more yd.

$$\begin{array}{r} 87. \quad 14 \text{ m} \quad 39 \text{ m} \\ + 12 \text{ m} \quad - 26 \text{ m} \\ \hline 26 \text{ m} \quad 13 \text{ m} \end{array}$$

The missing length is 13 m.

$$\begin{array}{r} 88. \quad 139 \text{ cm} \\ 87 \text{ cm} \quad 547 \text{ cm} \\ + 201 \text{ cm} \quad - 427 \text{ cm} \\ \hline 427 \text{ cm} \quad 120 \text{ cm} \end{array}$$

The missing length is 120 cm.

$$\begin{array}{r} 89. \quad 4 \quad 56 \text{ yd} \\ 14 \quad - 46 \text{ yd} \\ 14 \quad \hline 14 \quad 10 \text{ yd} \\ + 10 \\ \hline 46 \text{ yd} \end{array}$$

The missing side is 10 yd long.

$$\begin{array}{r} 90. \quad 6 \\ + 5 \\ \hline 11 \\ 15 \text{ ft} \\ - 11 \text{ ft} \\ \hline 4 \text{ ft} \end{array}$$

The missing side is 4 ft long.

$$\begin{array}{r} 91. \quad 2279000 \\ - 2249000 \\ \hline 30,000 \end{array}$$

The difference is 30,000 marriages.

$$\begin{array}{r} 92. \quad 2, \cancel{2} \cancel{4} 9,000 \\ - 2, 160,000 \\ \hline 89,000 \end{array}$$

The decrease is 89,000 marriages.

$$\begin{array}{r} 93. \quad 2279000 \\ - 2160000 \\ \hline 119,000 \end{array}$$

The difference is 119,000 marriages.

$$\begin{array}{r} 94. \quad 2, \cancel{2} \cancel{0} 5,000 \\ - 2, 160,000 \\ \hline 45,000 \end{array}$$

The greatest increase occurred between Year 5 and Year 6; the increase was 45,000.

$$\begin{array}{r} 95. \quad 4,905,620 \\ - 458,318 \\ \hline 4,447,302 \end{array}$$

$$\begin{array}{r} 96. \quad 953,400,415 \\ - 56,341,902 \\ \hline 897,058,513 \end{array}$$

$$\begin{array}{r} 97. \quad 82,025,160 \\ - 79,118,705 \\ \hline 2,906,455 \end{array}$$

$$\begin{array}{r} 98. \quad 103,718 \text{ mi}^2 \\ - 54,310 \text{ mi}^2 \\ \hline 49,408 \text{ mi}^2 \end{array}$$

$$\begin{array}{r} 99. \quad 41,217 \text{ mi}^2 \\ - 24,078 \text{ mi}^2 \\ \hline 17,139 \text{ mi}^2 \end{array}$$

$$\begin{array}{r} 100. \quad 103,718 \text{ mi}^2 \\ - 1,045 \text{ mi}^2 \\ \hline 102,673 \text{ mi}^2 \end{array}$$

The difference in land area between Colorado and Rhode Island is 102,673 mi².

$$\begin{array}{r} 101. \quad 54,310 \text{ mi}^2 \\ - 41,217 \text{ mi}^2 \\ \hline 13,093 \text{ mi}^2 \end{array}$$

Wisconsin has 13,093 mi² more than Tennessee.

Section 1.4 Rounding and Estimating

Section 1.4 Practice Exercises

1. rounding
2. 30 ft
3.
$$\begin{array}{r} 59 \\ - 33 \\ \hline 26 \end{array}$$
4.
$$\begin{array}{r} 01210 \\ \cancel{1} \cancel{2} \cancel{0} \\ - 98 \\ \hline 32 \end{array}$$
5.
$$\begin{array}{r} 111 \\ 4009 \\ + 998 \\ \hline 5,007 \end{array}$$
6.
$$\begin{array}{r} 12,033 \\ + 23,441 \\ \hline 35,474 \end{array}$$
7. Ten-thousands
8. Hundreds
9. If the digit in the tens place is 0, 1, 2, 3, or 4, then change the tens and ones digits to 0. If the digit in the tens place is 5, 6, 7, 8, or 9, increase the digit in the hundreds place by 1 and change the tens and ones digits to 0.
10. If the digit in the ones place is 0, 1, 2, 3, or 4, then change the ones digits to 0. If the digit in the ones place is 5, 6, 7, 8, or 9, increase the digit in the tens place by 1 and change the ones digit to 0.
11. $34\boxed{2} \approx 340$
12. $83\boxed{4} \approx 830$
13. $72\boxed{5} \approx 730$
14. $44\boxed{5} \approx 450$
15. $93\boxed{8}4 \approx 9400$
16. $83\boxed{6}3 \approx 8400$
17. $85\boxed{3}9 \approx 8500$
18. $98\boxed{1}7 \approx 9800$
19. $34\boxed{9}92 \approx 35,000$
20. $76\boxed{8}31 \approx 77,000$
21. $2\boxed{5}78 \approx 3000$
22. $3\boxed{5}11 \approx 4000$
23. $99\boxed{8}2 \approx 10000$
24. $79\boxed{7}4 \approx 8000$
25. $109\boxed{3}37 \approx 109,000$
26. $437\boxed{2}08 \approx 437,000$
27. $48\boxed{9},090 \approx 490,000$
28. $38\boxed{8},725 \approx 390,000$
29. $\$77\boxed{0}25,481 \approx \$77,000,000$
30. $\$33\boxed{0}50 \approx \$33,000$
31. $238\boxed{8}63 \text{ mi} \approx 239,000 \text{ mi}$
32. $49\boxed{2},000 \text{ m}^2 \approx 500,000 \text{ m}^2$
33.
$$\begin{array}{rcl} 57 & \rightarrow & 60 \\ 82 & \rightarrow & 80 \\ + 21 & \rightarrow & + 20 \\ \hline & & 160 \end{array}$$
34.
$$\begin{array}{rcl} 33 & \rightarrow & 30 \\ 78 & \rightarrow & 80 \\ + 41 & \rightarrow & + 40 \\ \hline & & 150 \end{array}$$
35.
$$\begin{array}{rcl} 41 & \rightarrow & 40 \\ 12 & \rightarrow & 10 \\ + 129 & \rightarrow & + 130 \\ \hline & & 180 \end{array}$$

$$\begin{array}{rcl} 36. & 29 & \rightarrow 130 \\ & 73 & \rightarrow 70 \\ & + 113 & \rightarrow + 110 \\ \hline & & 210 \end{array}$$

$$\begin{array}{rcl} 37. & 898 & \rightarrow 900 \\ & - 422 & \rightarrow - 400 \\ \hline & & 500 \end{array}$$

$$\begin{array}{rcl} 38. & 731 & \rightarrow 700 \\ & - 584 & \rightarrow - 600 \\ \hline & & 100 \end{array}$$

$$\begin{array}{rcl} 39. & 3412 & \rightarrow 3400 \\ & - 1252 & \rightarrow - 1300 \\ \hline & & 2100 \end{array}$$

$$\begin{array}{rcl} 40. & 9771 & \rightarrow 9800 \\ & - 4544 & \rightarrow - 4500 \\ \hline & & 5300 \end{array}$$

$$\begin{array}{rcl} 41. & 97,404,576 & \rightarrow 97,000,000 \\ & + 53,695,428 & \rightarrow + 54,000,000 \\ \hline & & 151,000,000 \end{array}$$

\$151,000,000 was brought in by Mars.

$$\begin{array}{rcl} 42. & 81,296,784 & \rightarrow 81,000,000 \\ & 54,391,268 & \rightarrow 54,000,000 \\ & + 38,168,580 & \rightarrow + 38,000,000 \\ \hline & & 173,000,000 \end{array}$$

\$173,000,000 was brought in by Hershey.

$$\begin{array}{rcl} 43. & 71,339,710 & \rightarrow 71,000,000 \\ & - 59,684,076 & \rightarrow - 60,000,000 \\ \hline & & 11,000,000 \end{array}$$

Neil Diamond earned \$11,000,000 more.

$$\begin{array}{rcl} 44. & 63,640 & \rightarrow 64,000 \\ & - 43,130 & \rightarrow - 43,000 \\ \hline & & 21,000 \end{array}$$

A California teacher makes about \$21,000 more.

$$\begin{array}{rcl} 45. & \$3,316,897 & \rightarrow \$3,300,000 \\ & 3,272,028 & \rightarrow 3,300,000 \\ & + 3,360,289 & \rightarrow + 3,400,000 \\ \hline & & \$10,000,000 \end{array}$$

$$\begin{array}{rcl} 46. & \$3,470,295 & \rightarrow \$3,500,000 \\ & 3,173,050 & \rightarrow 3,200,000 \\ & + 1,970,380 & \rightarrow + 2,000,000 \\ \hline & & \$8,700,000 \end{array}$$

$$47. \text{ (a) Year 4; } \$3,470,295 \rightarrow \$3,500,000$$

$$\text{ (b) Year 6; } \$1,970,380 \rightarrow \$2,000,000$$

$$\begin{array}{rcl} 48. & \$3,500,000 \\ & - 2,000,000 \\ \hline & \$1,500,000 \end{array}$$

$$49. \text{ Massachusetts; } 78,815 \rightarrow 79,000 \text{ students}$$

$$50. \text{ Vermont; } 8059 \rightarrow 8000 \text{ students}$$

$$\begin{array}{rcl} 51. & 79,000 \\ & - 8,000 \\ \hline & 71,000 \end{array}$$

The difference is 71,000 students.

$$\begin{array}{rcl} 52. & 45,879 & \rightarrow 46,000 \\ & 9137 & \rightarrow 9,000 \\ & 16,756 & \rightarrow 17,000 \\ & 78,815 & \rightarrow 79,000 \\ & 17,422 & \rightarrow 17,000 \\ & 13,172 & \rightarrow 13,000 \\ & + 8059 & \rightarrow + 8,000 \\ \hline & & 189,000 \end{array}$$

The total is 189,000 students.

$$53. \text{ Answers may vary.}$$

$$\begin{array}{l} 54. \text{ Thousands place} \\ 4208 - 932 + 1294 \approx 4000 - 1000 + 1000 \\ \approx 3000 + 1000 \\ \approx 4000 \end{array}$$

$$\begin{array}{rcl} 55. & 3045 \text{ mm} & \rightarrow 3000 \text{ mm} \\ & 1892 \text{ mm} & \rightarrow 2000 \text{ mm} \\ & 3045 \text{ mm} & \rightarrow 3000 \text{ mm} \\ & + 1892 \text{ mm} & \rightarrow + 2000 \text{ mm} \\ \hline & & 10,000 \text{ mm} \end{array}$$

$$\begin{array}{rcl} 56. & 1851 \text{ cm} & \rightarrow 2000 \text{ cm} \\ & 1782 \text{ cm} & \rightarrow 2000 \text{ cm} \\ & 1851 \text{ cm} & \rightarrow 2000 \text{ cm} \\ & + 1782 \text{ cm} & \rightarrow + 2000 \text{ cm} \\ \hline & & 8000 \text{ cm} \end{array}$$

$$\begin{array}{rcl}
 57. & 105 \text{ in.} & \rightarrow 110 \text{ in.} \\
 & 57 \text{ in.} & \rightarrow 60 \text{ in.} \\
 & 57 \text{ in.} & \rightarrow 60 \text{ in.} \\
 & 105 \text{ in.} & \rightarrow 110 \text{ in.} \\
 & 57 \text{ in.} & \rightarrow 60 \text{ in.} \\
 & + 57 \text{ in.} & \rightarrow + 60 \text{ in.} \\
 \hline
 & & 460 \text{ in.}
 \end{array}$$

$$\begin{array}{rcl}
 58. & 182 \text{ ft} & \rightarrow 200 \text{ ft} \\
 & 121 \text{ ft} & \rightarrow 100 \text{ ft} \\
 & 182 \text{ ft} & \rightarrow 200 \text{ ft} \\
 & 169 \text{ ft} & \rightarrow 200 \text{ ft} \\
 & + 169 \text{ ft} & \rightarrow + 200 \text{ ft} \\
 \hline
 & & 900 \text{ ft}
 \end{array}$$

Section 1.5 Multiplication of Whole Numbers and Area

Section 1.5 Practice Exercises

1. (a) factors; product

(b) commutative

(c) associative

(d) 0; 0

(e) 7; 7

(f) distributive

(g) area

(h) $l \times w$

2. 13,000

$$\begin{array}{rcl}
 3. & 869,240 & \rightarrow 870,000 \\
 & 34,921 & \rightarrow 30,000 \\
 & + 108,332 & \rightarrow + 110,000 \\
 \hline
 & & 1,010,000
 \end{array}$$

$$\begin{array}{rcl}
 4. & 907,801 & \rightarrow 900,000 \\
 & - 413,560 & \rightarrow - 400,000 \\
 \hline
 & & 500,000
 \end{array}$$

$$\begin{array}{rcl}
 5. & 8821 & \rightarrow 8800 \\
 & - 3401 & \rightarrow - 3400 \\
 \hline
 & & 5400
 \end{array}$$

6.

\times	0	1	2	3	4	5	6	7	8	9
0	0	0	0	0	0	0	0	0	0	0
1	0	1	2	3	4	5	6	7	8	9
2	0	2	4	6	8	10	12	14	16	18
3	0	3	6	9	12	15	18	21	24	27
4	0	4	8	12	16	20	24	28	32	36
5	0	5	10	15	20	25	30	35	40	45
6	0	6	12	18	24	30	36	42	48	54
7	0	7	14	21	28	35	42	49	56	63
8	0	8	16	24	32	40	48	56	64	72
9	0	9	18	27	36	45	54	63	72	81

Section 1.5 Multiplication of Whole Numbers and Area

7. $5 + 5 + 5 + 5 + 5 + 5 = 6 \times 5 = 30$

8. $2 + 2 + 2 + 2 + 2 + 2 + 2 + 2 + 2 = 9 \times 2 = 18$

9. $9 + 9 + 9 = 3 \times 9 = 27$

10. $7 + 7 + 7 + 7 = 4 \times 7 = 28$

11. $13 \times 42 = 546$
factors: 13, 42; product: 546

12. $26 \times 9 = 234$
factors: 26, 9; product: 234

13. $3 \cdot 5 \cdot 2 = 30$
factors: 3, 5, 2; product: 30

14. $4 \cdot 3 \cdot 8 = 96$
factors: 4, 3, 8; product: 96

15. For example: 5×12 ; $5 \cdot 12$; $5(12)$

16. For example: 23×14 ; $23 \cdot 14$; $23(14)$

17. d

18. a

19. e

20. b

21. c

22. a

23. $14 \times 8 = 8 \times 14$

24. $3 \times 9 = 9 \times 3$

25. $6 \times (2 \times 10) = (6 \times 2) \times 10$

26. $(4 \times 15) \times 5 = 4 \times (15 \times 5)$

27. $5(7 + 4) = (5 \times 7) + (5 \times 4)$

28. $3(2 + 6) = (3 \times 2) + (3 \times 6)$

29.
$$\begin{array}{r} 24 \\ \times 6 \\ \hline 24 \\ + 120 \\ \hline 144 \end{array}$$
 Multiply 6×4 .
Multiply 6×20 .
Add.

30.
$$\begin{array}{r} 18 \\ \times 5 \\ \hline 40 \\ + 50 \\ \hline 90 \end{array}$$
 Multiply 5×8 .
Multiply 5×10 .
Add.

31.
$$\begin{array}{r} 26 \\ \times 2 \\ \hline 12 \\ + 40 \\ \hline 52 \end{array}$$
 Multiply 2×6 .
Multiply 2×20 .
Add.

32.
$$\begin{array}{r} 71 \\ \times 3 \\ \hline 3 \\ + 210 \\ \hline 213 \end{array}$$
 Multiply 3×1 .
Multiply 3×70 .
Add.

33.
$$\begin{array}{r} 131 \\ \times 5 \\ \hline 5 \\ 150 \\ + 500 \\ \hline 655 \end{array}$$
 Multiply 5×1 .
Multiply 5×30 .
Multiply 5×100 .
Add.

34.
$$\begin{array}{r} 725 \\ \times 3 \\ \hline 15 \\ 60 \\ + 2100 \\ \hline 2175 \end{array}$$
 Multiply 3×0 .
Multiply 3×20 .
Multiply 3×700 .
Add.

35.
$$\begin{array}{r} 344 \\ \times 4 \\ \hline 16 \\ 160 \\ + 1200 \\ \hline 1376 \end{array}$$
 Multiply 4×4 .
Multiply 4×40 .
Multiply 4×300 .
Add.

36.
$$\begin{array}{r} 105 \\ \times 9 \\ \hline 45 \\ 00 \\ + 900 \\ \hline 945 \end{array}$$
 Multiply 9×5 .
Multiply 9×0 .
Multiply 9×100 .
Add.

37.
$$\begin{array}{r} 3 \\ 1410 \\ \times 8 \\ \hline 11,280 \end{array}$$

$$\begin{array}{r} ^3 \\ 38. \quad 2016 \\ \times 6 \\ \hline 12,096 \end{array}$$

$$\begin{array}{r} ^2 ^1 \\ 39. \quad 3312 \\ \times 7 \\ \hline 23,184 \end{array}$$

$$\begin{array}{r} ^4 \\ 40. \quad 4801 \\ \times 5 \\ \hline 24,005 \end{array}$$

$$\begin{array}{r} ^1 ^{13} \\ 41. \quad 42,014 \\ \times 9 \\ \hline 378,126 \end{array}$$

$$\begin{array}{r} ^4 \\ 42. \quad 51,006 \\ \times 8 \\ \hline 408,048 \end{array}$$

$$\begin{array}{r} 43. \quad 32 \\ \times 14 \\ \hline 128 \\ + 320 \\ \hline 448 \end{array}$$

$$\begin{array}{r} 44. \quad 41 \\ \times 21 \\ \hline 41 \\ + 820 \\ \hline 861 \end{array}$$

$$\begin{array}{r} ^1 ^3 \\ 45. \quad 68 \\ \times 24 \\ \hline 1 \\ 272 \\ + 1360 \\ \hline 1632 \end{array}$$

$$\begin{array}{r} ^2 \\ 46. \quad 55 \\ \times 41 \\ \hline 55 \\ + 2200 \\ \hline 2255 \end{array}$$

$$\begin{array}{r} 47. \quad 72 \\ \times 12 \\ \hline 144 \\ + 720 \\ \hline 864 \end{array}$$

$$\begin{array}{r} ^1 ^1 \\ 48. \quad 13 \\ \times 46 \\ \hline 78 \\ + 520 \\ \hline 598 \end{array}$$

$$\begin{array}{r} ^3 ^2 \\ 49. \quad 143 \\ \times 17 \\ \hline 1001 \\ + 1430 \\ \hline 2431 \end{array}$$

$$\begin{array}{r} ^1 ^1 \\ 50. \quad 722 \\ \times 28 \\ \hline 111 \\ 5776 \\ + 14440 \\ \hline 20,216 \end{array}$$

$$\begin{array}{r} ^4 ^8 \\ 51. \quad 349 \\ \times 19 \\ \hline 3141 \\ + 3490 \\ \hline 6631 \end{array}$$

$$\begin{array}{r} 52. \quad 512 \\ \times 31 \\ \hline 512 \\ + 15360 \\ \hline 15,872 \end{array}$$

$$\begin{array}{r} ^1 ^3 \\ 53. \quad 151 \\ \times 127 \\ \hline 1057 \\ 3020 \\ + 15100 \\ \hline 19,177 \end{array}$$

$$\begin{array}{r}
 54. \quad \begin{array}{r} 1 \\ 1 \\ 703 \\ \times 146 \\ \hline 14\,218 \\ 28\,120 \\ + 70\,300 \\ \hline 102,638 \end{array}
 \end{array}$$

$$\begin{array}{r}
 55. \quad \begin{array}{r} 11 \\ 222 \\ \times 841 \\ \hline 1 \\ 11\,222 \\ 8\,880 \\ + 177\,600 \\ \hline 186,702 \end{array}
 \end{array}$$

$$\begin{array}{r}
 56. \quad \begin{array}{r} 43 \\ 54 \\ 387 \\ \times 506 \\ \hline 2\,322 \\ 0\,000 \\ + 193\,500 \\ \hline 195,822 \end{array}
 \end{array}$$

$$\begin{array}{r}
 57. \quad \begin{array}{r} 311 \\ 21 \\ 3532 \\ \times 6014 \\ \hline 14\,128 \\ 35\,320 \\ 000\,000 \\ + 21\,192\,000 \\ \hline 21,241,448 \end{array}
 \end{array}$$

$$\begin{array}{r}
 58. \quad \begin{array}{r} 2 \\ 7 \\ 2810 \\ \times 1039 \\ \hline 125\,290 \\ 84\,300 \\ 000\,000 \\ + 2\,810\,000 \\ \hline 2,919,590 \end{array}
 \end{array}$$

$$\begin{array}{r}
 59. \quad \begin{array}{r} 111 \\ 11 \\ 4122 \\ \times 982 \\ \hline 8\,244 \\ 329\,760 \\ + 3\,709\,800 \\ \hline 4,047,804 \end{array}
 \end{array}$$

$$\begin{array}{r}
 60. \quad \begin{array}{r} 13 \\ 1 \\ 24 \\ 7026 \\ \times 528 \\ \hline 56\,208 \\ 140\,520 \\ + 3513\,000 \\ \hline 3,709,728 \end{array}
 \end{array}$$

$$61. \quad \begin{array}{r} 600 \rightarrow 6 \mid 00 \\ \times 40 \rightarrow \times 4 \mid 0 \\ \hline 24 \mid 000 = 24,000 \end{array}$$

$$62. \quad \begin{array}{r} 900 \rightarrow 9 \mid 00 \\ \times 50 \rightarrow \times 5 \mid 0 \\ \hline 45 \mid 000 = 45,000 \end{array}$$

$$63. \quad \begin{array}{r} 3000 \rightarrow 3 \mid 000 \\ \times 700 \rightarrow \times 7 \mid 00 \\ \hline 21 \mid 00000 = 2,100,000 \end{array}$$

$$64. \quad \begin{array}{r} 4000 \rightarrow 4 \mid 000 \\ \times 400 \rightarrow \times 4 \mid 00 \\ \hline 16 \mid 00000 = 1,600,000 \end{array}$$

$$65. \quad \begin{array}{r} 8000 \rightarrow 8 \mid 000 \\ \times 9000 \rightarrow \times 9 \mid 000 \\ \hline 72 \mid 000000 = 72,000,000 \end{array}$$

$$66. \quad \begin{array}{r} 1000 \rightarrow 1 \mid 000 \\ \times 2000 \rightarrow \times 2 \mid 000 \\ \hline 2 \mid 000000 = 2,000,000 \end{array}$$

$$67. \quad \begin{array}{r} 90,000 \rightarrow 9 \mid 0000 \\ \times 400 \rightarrow \times 4 \mid 00 \\ \hline 36 \mid 000000 = 36,000,000 \end{array}$$

Chapter 1 Whole Numbers

$$\begin{array}{r} 68. \quad 50,000 \rightarrow \begin{array}{r|l} 5 & 0000 \\ \times 6,000 & \rightarrow \times 6 & 000 \\ \hline 30 & 0000000 \end{array} = \\ 300,000,000 \end{array}$$

$$\begin{array}{r} 69. \quad 11,784 \rightarrow \begin{array}{r} 12,000 \\ \times 5 \ 201 \rightarrow \times \quad 5,000 \\ \hline 60,000,000 \end{array} \end{array}$$

$$\begin{array}{r} 70. \quad 45,046 \rightarrow \begin{array}{r} 4 \\ 45,000 \\ \times 7 \ 812 \rightarrow \times \quad 8,000 \\ \hline 360,000,000 \end{array} \end{array}$$

$$\begin{array}{r} 71. \quad 82,941 \rightarrow \begin{array}{r} 80,000 \\ \times 29,740 \rightarrow \times \quad 30,000 \\ \hline 2,400,000,000 \end{array} \end{array}$$

$$\begin{array}{r} 72. \quad 630,229 \rightarrow \begin{array}{r} 2 \\ 630,000 \\ \times 71,907 \rightarrow \times \quad 70,000 \\ \hline 44,100,000,000 \end{array} \end{array}$$

$$\begin{array}{r} 73. \quad \$189 \rightarrow \begin{array}{r} \$200 \\ \times \ 5 \quad \times \ 5 \\ \hline \$1000 \end{array} \end{array}$$

$$\begin{array}{r} 74. \quad \$129 \rightarrow \begin{array}{r} \$130 \\ \times \ 28 \rightarrow \times \quad 30 \\ \hline \$3,900 \end{array} \end{array}$$

$$\begin{array}{r} 75. \quad 10,256 \rightarrow \begin{array}{r|l} 1 & 0000 \\ \times \$272 \rightarrow \times 272 & \\ \hline 272 & 0000 \end{array} = \\ \$2,720,000 \end{array}$$

$$\begin{array}{r} 76. \quad 48 \rightarrow \begin{array}{r|l} 5 & 0 \\ \times 12 \rightarrow \times 1 & 0 \\ \hline 5 & 00 \end{array} \end{array}$$

$$\begin{array}{r} 500 \\ \times \ 7 \\ \hline \$3500 \text{ per week} \end{array}$$

$$\begin{array}{r} 77. \quad 1000 \\ \times \ 4 \\ \hline 4000 \\ 4000 \text{ minutes can be stored.} \end{array}$$

$$\begin{array}{r} 78. \quad 700 \\ \times \ 15 \\ \hline 3500 \\ + 7000 \\ \hline 10,500 \\ 15 \text{ CDs hold } 10,500 \text{ MB of data} \end{array}$$

$$\begin{array}{r} 79. \quad \begin{array}{r} 1 \\ 3 \end{array} \$45 \\ \times \ 37 \\ \hline 315 \\ + 1 \ 350 \\ \hline \$1,665 \end{array}$$

$$\begin{array}{r} 80. \quad 12 \\ \times \ 12 \\ \hline 24 \\ + 120 \\ \hline 144 \\ \text{A case contains } 144 \text{ fl oz.} \end{array}$$

$$\begin{array}{r} 81. \quad \begin{array}{r} 2 \\ 115 \\ \times \ 5 \\ \hline 575 \end{array} \end{array}$$

$$\begin{array}{r} \begin{array}{r} 3 \ 2 \\ 57 \ 5 \end{array} \begin{array}{r|l} & 00 \\ \times \ 5 & \\ \hline 287,5 & 00 \end{array} \\ 287,500 \text{ sheets of paper are delivered.} \end{array}$$

$$\begin{array}{r} 82. \quad \begin{array}{r} 4 \\ 14 \end{array} \begin{array}{r} 28 \\ \times \ 2 \quad \times \ 6 \\ \hline 28 \quad 168 \end{array} \\ \text{She gets } 168 \text{ g of protein.} \end{array}$$

$$\begin{array}{r} 83. \quad 31 \\ \times \ 12 \\ \hline 62 \\ + 310 \\ \hline 372 \\ \text{He can travel } 372 \text{ miles.} \end{array}$$

$$\begin{array}{r} 84. \quad 23 \\ \times \ 32 \\ \hline 46 \\ + 690 \\ \hline 736 \\ \text{Sherica schedules } 736 \text{ hr.} \end{array}$$

85. $A = l \times w$

$$A = (23 \text{ ft}) \times (12 \text{ ft})$$

$$\begin{array}{r} 23 \\ \times 12 \\ \hline 46 \\ + 230 \\ \hline 276 \end{array}$$

The area is 276 ft^2 .

86. $A = l \times w$

$$A = (31 \text{ m}) \times (2 \text{ m}) = 62 \text{ m}^2$$

87. $A = l \times w$

$$A = (73 \text{ cm}) \times (73 \text{ cm})$$

$$\begin{array}{r} 73 \\ \times 73 \\ \hline 219 \\ + 5110 \\ \hline 5329 \end{array}$$

The area is 5329 cm^2 .

88. $A = l \times w$

$$A = (41 \text{ yd}) \times (41 \text{ yd})$$

$$\begin{array}{r} 41 \\ \times 41 \\ \hline 41 \\ + 1640 \\ \hline 1681 \end{array}$$

The area is 1681 yd^2 .

89. $A = l \times w$

$$A = (390 \text{ mi}) \times (270 \text{ mi})$$

$$\begin{array}{r} 390 \\ \times 270 \\ \hline 000 \\ 27300 \\ + 78000 \\ \hline 105,300 \end{array}$$

The area is $105,300 \text{ mi}^2$.

90. $A = l \times w$

$$A = (130 \text{ yd}) \times (150 \text{ yd})$$

$$\begin{array}{r} 130 \\ \times 150 \\ \hline 000 \\ 6500 \\ + 13000 \\ \hline 19,500 \end{array}$$

The area is $19,500 \text{ yd}^2$.

91. (a) $A = l \times w$

$$A = (40 \text{ in.}) \times (60 \text{ in.})$$

$$\begin{array}{r} 40 \\ \times 60 \\ \hline 00 \\ + 2400 \\ \hline 2400 \text{ in.}^2 \end{array}$$

(b) $\begin{array}{r} 14 \\ \times 3 \\ \hline 42 \end{array}$

There are 42 windows.

(c) $\begin{array}{r} 2400 \\ \times 42 \\ \hline 4800 \\ + 96000 \\ \hline 100,800 \end{array}$

The total area is $100,800 \text{ in.}^2$

92. $A = l \times w$

$$A = (50 \text{ ft.}) \times (30 \text{ ft.})$$

$$\begin{array}{r} 50 \\ \times 30 \\ \hline 000 \\ + 1500 \\ \hline 1500 \end{array}$$

The area is 1500 ft^2 .

$$\begin{array}{r}
 93. \ A = l \times w \\
 A = (8 \text{ ft}) \times (16 \text{ ft}) \\
 \begin{array}{r}
 4 \\
 16 \\
 \times 8 \\
 \hline
 128
 \end{array}
 \end{array}$$

The area is 128 ft^2 .

$$\begin{array}{r}
 94. \ A = l \times w \\
 A = (10 \text{ yd}) \times (15 \text{ yd}) = 150 \text{ yd}^2.
 \end{array}$$

Section 1.6 Division of Whole Numbers

Section 1.6 Practice Exercises

1. (a) dividend; divisor; quotient
 (b) 1
 (c) 5
 (d) 0
 (e) undefined
 (f) remainder

2. (a) $5 + 2$
 (b) $5 \cdot 2$
 (c) $(3 + 10) + 2$
 (d) $(3 \cdot 10) \cdot 2$

$$\begin{array}{r}
 3. \quad \begin{array}{r} \frac{1}{2} \\ 103 \\ \times 48 \\ \hline 824 \\ + 4120 \\ \hline 4,944 \end{array}
 \end{array}$$

$$\begin{array}{r}
 4. \quad \begin{array}{r} 517 \\ \cancel{6}78 \\ - 83 \\ \hline 595 \end{array}
 \end{array}$$

$$\begin{array}{r}
 5. \quad \begin{array}{r} 1 \\ 1008 \\ + 245 \\ \hline 1253 \end{array}
 \end{array}$$

$$\begin{array}{r}
 6. \quad \begin{array}{r} 220 \\ \times 14 \\ \hline 1880 \\ 2200 \\ \hline 3,080 \end{array}
 \end{array}$$

$$\begin{array}{r}
 7. \quad \begin{array}{r} 12 \\ 5230 \\ \times 127 \\ \hline 11 \\ 36610 \\ 104600 \\ + 523000 \\ \hline 664,210 \end{array}
 \end{array}$$

$$\begin{array}{r}
 8. \quad \begin{array}{r} 11 \\ 44 \\ 789 \\ \times 25 \\ \hline 11 \\ 3945 \\ + 15780 \\ \hline 19,725 \end{array}
 \end{array}$$

$$\begin{array}{r}
 9. \quad \begin{array}{r} 318810 \\ \cancel{A} \cancel{8} \cancel{0} \cancel{0} \\ - 3988 \\ \hline 902 \end{array}
 \end{array}$$

$$\begin{array}{r}
 10. \quad \begin{array}{r} 1 \\ 38002 \\ + 3902 \\ \hline 41,904 \end{array}
 \end{array}$$

11. Dividend: 72
 divisor: 8
 quotient: 9

12. Dividend: 32
 divisor: 4
 quotient: 8

13. Dividend: 64
 divisor: 8
 quotient: 8

14. Dividend: 35
divisor: 5
quotient: 7
15. Dividend: 45
divisor: 9
quotient: 5
16. Dividend: 20
divisor: 5
quotient: 4
17. You cannot divide a number by zero (the quotient is undefined). If you divide zero by a number (other than zero), the quotient is always zero.
18. A number divided or multiplied by 1 remains unchanged.
19. $15 \div 1 = 15$ because $15 \times 1 = 15$.
20. $21 \overline{)21} = 1$ because $1 \times 21 = 21$.
21. $0 \div 10 = 0$ because $0 \times 10 = 0$.
22. $\frac{0}{3} = 0$ because $0 \times 3 = 0$.
23. $0 \overline{)9}$ is undefined because division by zero is undefined.
24. $4 \div 0$ is undefined because division by zero is undefined.
25. $\frac{20}{20} = 1$ because $1 \times 20 = 20$.
26. $1 \overline{)9} = 9$ because $9 \times 1 = 9$.
27. $\frac{16}{0}$ is undefined because division by zero is undefined.
28. $\frac{5}{1} = 5$ because $5 \times 1 = 5$.
29. $8 \overline{)0} = 0$ because $0 \times 8 = 0$.
30. $13 \div 13 = 1$ because $13 \times 1 = 13$.

31. $6 \div 3 = 2$ because $2 \times 3 = 6$.
 $3 \div 6 \neq 2$ because $2 \times 6 \neq 3$.
32. $(36 \div 12) \div 3 = 3 \div 3 = 1$ but
 $36 \div (12 \div 3) = 36 \div 4 = 9$.
33. To check a division problem without a remainder you should multiply the quotient and the divisor to get the dividend.
34. To check $0 \div 5 = 0$ we multiply $0 \times 5 = 0$ which is true. If we try to check $5 \div 0 = ?$ we need to find a number to multiply by 0 to get 5. Since no such number exists, the answer to $5 \div 0$ is undefined.

$$\begin{array}{r} 13 \\ 6 \overline{) 78} \\ \underline{-6} \\ 18 \\ \underline{-18} \\ 0 \end{array} \qquad \begin{array}{r} 1 \\ 13 \\ \times 6 \\ \hline 78 \checkmark \end{array}$$

$$\begin{array}{r} 52 \\ 7 \overline{) 364} \\ \underline{-35} \\ 14 \\ \underline{-14} \\ 0 \end{array} \qquad \begin{array}{r} 1 \\ 52 \\ \times 7 \\ \hline 364 \checkmark \end{array}$$

$$\begin{array}{r} 41 \\ 5 \overline{) 205} \\ \underline{-20} \\ 05 \\ \underline{-5} \\ 0 \end{array} \qquad \begin{array}{r} 41 \\ \times 5 \\ \hline 205 \checkmark \end{array}$$

$$\begin{array}{r} 19 \\ 8 \overline{) 152} \\ \underline{-8} \\ 72 \\ \underline{-72} \\ 0 \end{array} \qquad \begin{array}{r} 19 \\ \times 8 \\ \hline 152 \checkmark \end{array}$$

$$\begin{array}{r} 486 \\ 39. \quad 2 \overline{) 972} \\ \underline{-8} \\ 17 \\ \underline{-16} \\ 12 \\ \underline{-12} \\ 0 \end{array}$$

$$\begin{array}{r} 11 \\ 486 \\ \times 2 \\ \hline 972 \quad \checkmark \end{array}$$

$$\begin{array}{r} 822 \\ 45. \quad 6 \overline{) 4932} \\ \underline{-48} \\ 13 \\ \underline{-12} \\ 12 \\ \underline{-12} \\ 0 \end{array}$$

$$\begin{array}{r} 11 \\ 822 \\ \times 6 \\ \hline 4932 \quad \checkmark \end{array}$$

$$\begin{array}{r} 97 \\ 40. \quad 6 \overline{) 582} \\ \underline{-54} \\ 42 \\ \underline{-42} \\ 0 \end{array}$$

$$\begin{array}{r} 4 \\ 97 \\ \times 6 \\ \hline 582 \quad \checkmark \end{array}$$

$$\begin{array}{r} 517 \\ 46. \quad 7 \overline{) 3619} \\ \underline{-35} \\ 11 \\ \underline{-7} \\ 49 \\ \underline{-49} \\ 0 \end{array}$$

$$\begin{array}{r} 14 \\ 517 \\ \times 7 \\ \hline 3619 \quad \checkmark \end{array}$$

$$\begin{array}{r} 409 \\ 41. \quad 3 \overline{) 1227} \\ \underline{-12} \\ 02 \\ \underline{-0} \\ 27 \\ \underline{-27} \\ 0 \end{array}$$

$$\begin{array}{r} 2 \\ 409 \\ \times 3 \\ \hline 1227 \quad \checkmark \end{array}$$

$$\begin{array}{r} 2 \\ 47. \quad 56 \\ \times 4 \\ \hline 224 \quad \text{correct} \end{array}$$

$$\begin{array}{r} 1 \\ 48. \quad 82 \\ \times 7 \\ \hline 574 \quad \text{correct} \end{array}$$

$$\begin{array}{r} 59 \\ 42. \quad 4 \overline{) 236} \\ \underline{-20} \\ 36 \\ \underline{-36} \\ 0 \end{array}$$

$$\begin{array}{r} 3 \\ 59 \\ \times 4 \\ \hline 236 \quad \checkmark \end{array}$$

$$\begin{array}{r} 1 \\ 49. \quad 253 \\ \times 3 \\ \hline 759 \quad \text{incorrect} \end{array}$$

$$\begin{array}{r} 253 \text{ R2} \\ 3 \overline{) 761} \\ \underline{-6} \\ 16 \\ \underline{-15} \\ 11 \\ \underline{-9} \\ 2 \end{array}$$

$$\begin{array}{r} 203 \\ 43. \quad 5 \overline{) 1015} \\ \underline{-10} \\ 01 \\ \underline{-0} \\ 15 \\ \underline{-15} \\ 0 \end{array}$$

$$\begin{array}{r} 1 \\ 203 \\ \times 5 \\ \hline 1015 \quad \checkmark \end{array}$$

$$\begin{array}{r} 1 \\ 50. \quad 120 \\ \times 5 \\ \hline 600 \quad \text{incorrect} \end{array}$$

$$\begin{array}{r} 120 \text{ R4} \\ 5 \overline{) 604} \\ \underline{-5} \\ 10 \\ \underline{-10} \\ 04 \\ \underline{-0} \\ 4 \end{array}$$

$$\begin{array}{r} 407 \\ 44. \quad 5 \overline{) 2035} \\ \underline{-20} \\ 03 \\ \underline{-0} \\ 35 \\ \underline{-35} \\ 0 \end{array}$$

$$\begin{array}{r} 3 \\ 407 \\ \times 5 \\ \hline 2035 \quad \checkmark \end{array}$$

$$\begin{array}{r}
 51. \quad \begin{array}{r} 12 \\ 113 \\ \times 9 \\ \hline 1017 \\ + 4 \end{array} \text{ Add the remainder.} \\
 \hline 1021 \text{ Correct}
 \end{array}$$

$$\begin{array}{r}
 52. \quad \begin{array}{r} 14 \\ 218 \\ \times 6 \\ \hline 1308 \\ + 3 \end{array} \text{ Add the remainder.} \\
 \hline 1311 \text{ Correct}
 \end{array}$$

$$\begin{array}{r}
 53. \quad \begin{array}{r} 4 \\ 25 \\ \times 8 \\ \hline 200 \\ + 6 \end{array} \text{ incorrect} \\
 \hline 206
 \end{array}$$

$$\begin{array}{r}
 25 \text{ R } 3 \\
 8 \overline{) 203} \\
 \underline{-16} \\
 43 \\
 \underline{-40} \\
 3
 \end{array}$$

$$\begin{array}{r}
 54. \quad \begin{array}{r} 14 \\ 117 \\ \times 7 \\ \hline 819 \\ + 5 \end{array} \text{ incorrect} \\
 \hline 824
 \end{array}$$

$$\begin{array}{r}
 117 \text{ R } 2 \\
 7 \overline{) 821} \\
 \underline{-7} \\
 12 \\
 \underline{-7} \\
 51 \\
 \underline{-49} \\
 2
 \end{array}$$

$$\begin{array}{r}
 55. \quad \begin{array}{r} 7 \text{ R } 5 \\ 8 \overline{) 61} \\ \underline{-56} \\ 5 \end{array}
 \end{array}$$

$$\begin{array}{l}
 7 \times 8 + 5 = 56 + 5 \\
 = 61 \checkmark
 \end{array}$$

$$\begin{array}{r}
 56. \quad \begin{array}{r} 29 \text{ R } 2 \\ 3 \overline{) 89} \\ \underline{-6} \\ 29 \\ \underline{-27} \\ 2 \end{array}
 \end{array}$$

$$\begin{array}{l}
 29 \times 3 + 2 = 87 + 2 \\
 = 89 \checkmark
 \end{array}$$

$$\begin{array}{r}
 57. \quad \begin{array}{r} 10 \text{ R } 2 \\ 9 \overline{) 92} \\ \underline{-9} \\ 02 \end{array}
 \end{array}$$

$$\begin{array}{l}
 10 \times 9 + 2 = 90 + 2 \\
 = 92 \checkmark
 \end{array}$$

$$\begin{array}{r}
 58. \quad \begin{array}{r} 14 \text{ R } 4 \\ 5 \overline{) 74} \\ \underline{-5} \\ 24 \\ \underline{-20} \\ 4 \end{array}
 \end{array}$$

$$\begin{array}{l}
 14 \times 5 + 4 = 70 + 4 \\
 = 74 \checkmark
 \end{array}$$

$$\begin{array}{r}
 59. \quad \begin{array}{r} 27 \text{ R } 1 \\ 2 \overline{) 55} \\ \underline{-4} \\ 15 \\ \underline{-14} \\ 1 \end{array}
 \end{array}$$

$$\begin{array}{l}
 27 \times 2 + 1 = 54 + 1 \\
 = 55 \checkmark
 \end{array}$$

$$\begin{array}{r}
 60. \quad \begin{array}{r} 16 \text{ R } 1 \\ 3 \overline{) 49} \\ \underline{-3} \\ 19 \\ \underline{-18} \\ 1 \end{array}
 \end{array}$$

$$\begin{array}{l}
 16 \times 3 + 1 = 48 + 1 \\
 = 49 \checkmark
 \end{array}$$

$$\begin{array}{r}
 61. \quad \begin{array}{r} 197 \text{ R } 2 \\ 3 \overline{) 593} \\ \underline{-3} \\ 29 \\ \underline{-27} \\ 23 \\ \underline{-21} \\ 2 \end{array}
 \end{array}$$

$$\begin{array}{l}
 197 \times 3 + 2 = 591 + 2 \\
 = 593 \checkmark
 \end{array}$$

$$\begin{array}{r}
 62. \quad \begin{array}{r} 200 \text{ R } 1 \\ 4 \overline{) 801} \\ \underline{-8} \\ 001 \end{array}
 \end{array}$$

$$\begin{array}{l}
 200 \times 4 + 1 = 800 + 1 \\
 = 801 \checkmark
 \end{array}$$

$$\begin{array}{r}
 63. \quad \begin{array}{r} 42 \text{ R } 4 \\ 9 \overline{) 382} \\ \underline{-36} \\ 22 \\ \underline{-18} \\ 4 \end{array}
 \end{array}$$

$$\begin{array}{l}
 42 \times 9 + 4 = 378 + 4 \\
 = 382 \checkmark
 \end{array}$$

$$\begin{array}{r}
 64. \quad \begin{array}{r} 53 \text{ R } 4 \\ 8 \overline{) 428} \\ \underline{-40} \\ 28 \\ \underline{-24} \\ 4 \end{array}
 \end{array}$$

$$\begin{array}{l}
 53 \times 8 + 4 = 424 + 4 \\
 = 428 \checkmark
 \end{array}$$

Chapter 1 Whole Numbers

$$65. \begin{array}{r} 1557 \text{ R1} \\ 2 \overline{) 3115} \\ \underline{-2} \\ 11 \\ \underline{-10} \\ 11 \\ \underline{-10} \\ 15 \\ \underline{-14} \\ 1 \end{array}$$

$$\begin{array}{r} 111 \\ 1557 \\ \times 2 \\ \hline 3114 \\ + 1 \\ \hline 3115 \checkmark \end{array}$$

$$70. \begin{array}{r} 550 \text{ R1} \\ 2 \overline{) 1101} \\ \underline{-10} \\ 10 \\ \underline{-10} \\ 01 \\ \underline{00} \\ 1 \end{array}$$

$$\begin{array}{r} 1 \\ 550 \\ \times 2 \\ \hline 1100 \\ + 1 \\ \hline 1101 \checkmark \end{array}$$

$$66. \begin{array}{r} 785 \text{ R5} \\ 6 \overline{) 4715} \\ \underline{-42} \\ 51 \\ \underline{-48} \\ 35 \\ \underline{-30} \\ 5 \end{array}$$

$$\begin{array}{r} 53 \\ 785 \\ \times 6 \\ \hline 4710 \\ + 5 \\ \hline 4715 \checkmark \end{array}$$

$$71. \begin{array}{r} 479 \text{ R9} \\ 19 \overline{) 9110} \\ \underline{-76} \\ 151 \\ \underline{-133} \\ 180 \\ \underline{-171} \\ 9 \end{array}$$

$$67. \begin{array}{r} 751 \text{ R6} \\ 8 \overline{) 6014} \\ \underline{-56} \\ 41 \\ \underline{-40} \\ 14 \\ \underline{-8} \\ 6 \end{array}$$

$$\begin{array}{r} 4 \\ 751 \\ \times 8 \\ \hline 6008 \\ + 6 \\ \hline 6014 \checkmark \end{array}$$

$$72. \begin{array}{r} 269 \text{ R8} \\ 13 \overline{) 3505} \\ \underline{-26} \\ 90 \\ \underline{-78} \\ 125 \\ \underline{-117} \\ 8 \end{array}$$

$$68. \begin{array}{r} 1287 \text{ R4} \\ 7 \overline{) 9013} \\ \underline{-7} \\ 20 \\ \underline{-14} \\ 61 \\ \underline{-56} \\ 53 \\ \underline{-49} \\ 4 \end{array}$$

$$\begin{array}{r} 264 \\ 1287 \\ \times 7 \\ \hline 9009 \\ + 4 \\ \hline 9013 \checkmark \end{array}$$

$$73. \begin{array}{r} 43 \text{ R19} \\ 24 \overline{) 1051} \\ \underline{-96} \\ 91 \\ \underline{-72} \\ 19 \end{array}$$

$$69. \begin{array}{r} 835 \text{ R2} \\ 6 \overline{) 5012} \\ \underline{-48} \\ 21 \\ \underline{-18} \\ 32 \\ \underline{-30} \\ 2 \end{array}$$

$$\begin{array}{r} 23 \\ 835 \\ \times 6 \\ \hline 5010 \\ + 2 \\ \hline 5012 \checkmark \end{array}$$

$$74. \begin{array}{r} 197 \text{ R27} \\ 41 \overline{) 8104} \\ \underline{-41} \\ 400 \\ \underline{-369} \\ 314 \\ \underline{-287} \\ 27 \end{array}$$

$$\begin{array}{r}
 308 \\
 75. \quad 26 \overline{) 8008} \\
 \underline{-78} \\
 20 \\
 \underline{-0} \\
 208 \\
 \underline{-208} \\
 0
 \end{array}$$

$$\begin{array}{r}
 612 \\
 76. \quad 15 \overline{) 9180} \\
 \underline{-90} \\
 18 \\
 \underline{-15} \\
 30 \\
 \underline{-30} \\
 0
 \end{array}$$

$$\begin{array}{r}
 1259 \text{ R26} \\
 77. \quad 54 \overline{) 68012} \\
 \underline{-54} \\
 140 \\
 \underline{-108} \\
 321 \\
 \underline{-270} \\
 512 \\
 \underline{-486} \\
 26
 \end{array}$$

$$\begin{array}{r}
 2628 \text{ R33} \\
 78. \quad 35 \overline{) 92,013} \\
 \underline{-70} \\
 220 \\
 \underline{-210} \\
 101 \\
 \underline{-70} \\
 313 \\
 \underline{-280} \\
 33
 \end{array}$$

$$\begin{array}{r}
 229 \text{ R96} \\
 79. \quad 304 \overline{) 69712} \\
 \underline{-608} \\
 891 \\
 \underline{-608} \\
 2832 \\
 \underline{-2736} \\
 96
 \end{array}$$

$$\begin{array}{r}
 231 \text{ R56} \\
 80. \quad 221 \overline{) 51107} \\
 \underline{-442} \\
 690 \\
 \underline{-663} \\
 277 \\
 \underline{-221} \\
 56
 \end{array}$$

$$\begin{array}{r}
 302 \\
 81. \quad 114 \overline{) 34428} \\
 \underline{-342} \\
 228 \\
 \underline{-228} \\
 0
 \end{array}$$

$$\begin{array}{r}
 209 \\
 82. \quad 421 \overline{) 87989} \\
 \underline{-842} \\
 3789 \\
 \underline{-3789} \\
 0
 \end{array}$$

$$\begin{array}{r}
 497 \div 71 = 7 \\
 71 \overline{) 497} \\
 \underline{-497} \\
 0
 \end{array}$$

$$\begin{array}{r}
 890 \div 45 = 42 \\
 45 \overline{) 1890} \\
 \underline{-180} \\
 90 \\
 \underline{-90} \\
 0
 \end{array}$$

$$\begin{array}{r}
 877 \div 14 = 62 \text{ R9} \\
 14 \overline{) 877} \\
 \underline{-84} \\
 37 \\
 \underline{-28} \\
 9
 \end{array}$$

Chapter 1 Whole Numbers

86. $722 \div 53 = 13 \text{ R}33$

$$\begin{array}{r} 13 \text{ R}33 \\ 53 \overline{) 722} \\ \underline{-53} \\ 192 \\ \underline{-159} \\ 33 \end{array}$$

87. $42 \div 6 = 7$

88. $108 \div 9 = 12$

$$\begin{array}{r} 12 \\ 9 \overline{) 108} \\ \underline{-9} \\ 18 \\ \underline{-18} \\ 0 \end{array}$$

89. $28 \overline{) 392}$ 14 classrooms

$$\begin{array}{r} 14 \text{ classrooms} \\ 28 \overline{) 392} \\ \underline{-28} \\ 112 \\ \underline{-112} \\ 0 \end{array}$$

90. $8 \overline{) 120}$ 15 tables

$$\begin{array}{r} 15 \text{ tables} \\ 8 \overline{) 120} \\ \underline{-8} \\ 40 \\ \underline{-40} \\ 0 \end{array}$$

91. $32 \overline{) 168}$ 5 R8

$$\begin{array}{r} 5 \text{ R}8 \\ 32 \overline{) 168} \\ \underline{-160} \\ 8 \end{array}$$

5 cases; 8 cans left over

92. $52 \overline{) 425}$ 8 R9

$$\begin{array}{r} 8 \text{ R}9 \\ 52 \overline{) 425} \\ \underline{-416} \\ 9 \end{array}$$

Yes; \$9 left over

93. $6 \overline{) 312}$ 52 mph

$$\begin{array}{r} 52 \text{ mph} \\ 6 \overline{) 312} \\ \underline{-30} \\ 12 \\ \underline{-12} \\ 0 \end{array}$$

94. $3 \overline{) 144}$

$$\begin{array}{r} 48 \\ 3 \overline{) 144} \\ \underline{-12} \\ 24 \\ \underline{-24} \\ 0 \end{array}$$

\$48 per room

95. $100 \overline{) 2200}$ 22 lb

$$\begin{array}{r} 22 \text{ lb} \\ 100 \overline{) 2200} \\ \underline{-200} \\ 200 \\ \underline{-200} \\ 0 \end{array}$$

96. $260 \overline{) 7280}$ 28 acres

$$\begin{array}{r} 28 \text{ acres} \\ 260 \overline{) 7280} \\ \underline{-520} \\ 2080 \\ \underline{-2080} \\ 0 \end{array}$$

97. $1200 \div 20 = 60$

$$\begin{array}{r} 60 \\ 20 \overline{) 1200} \\ \underline{-120} \\ 00 \\ \underline{-0} \\ 0 \end{array}$$

Approximately 60 words per minute

98. $2800 \div 400$

$$\begin{array}{r} 7 \\ 400 \overline{) 2800} \\ \underline{-2800} \\ 0 \end{array}$$

Approximately 7 tanks of gas

99. $18 \overline{) 450}$ 25

$$\begin{array}{r} 25 \\ 18 \overline{) 450} \\ \underline{-36} \\ 90 \\ \underline{-90} \\ 0 \end{array}$$

Yes they can all attend if they sit in the second balcony.

$$\begin{array}{r} 3\ 000 \\ 12 \overline{) 36,000} \\ \underline{-36} \\ 0 \end{array}$$

Teacher: \$3000

$$\begin{array}{r} 10,000 \\ 12 \overline{) 120,000} \\ \underline{-12} \\ 0 \end{array}$$

CEO: \$10,000

$$\begin{array}{r} 5\ 000 \\ 12 \overline{) 60,000} \\ \underline{-60} \\ 0 \end{array}$$

Professor: \$5,000

$$\begin{array}{r} 4\ 000 \\ 12 \overline{) 48,000} \\ \underline{-48} \\ 0 \end{array}$$

Programmer: \$4,000

117 cars are waiting in line.

$$\begin{array}{r} 21,000,000 \\ \times \quad 365 \\ \hline 7,665,000,000 \text{ bbl} \end{array}$$

$$\begin{array}{r} 52 \\ \times \quad 5 \\ \hline 260 \\ \times \quad 50 \\ \hline 13,000 \text{ min} \end{array}$$

$$\begin{array}{r} 12 \text{ R}2 \\ 4 \overline{) 50} \\ \underline{-4} \\ 10 \\ \underline{-8} \\ 2 \end{array}$$

12 loads can be done.

(b) 2 ounces of detergent are left over.

$$\begin{array}{r} 3552 \div 4 = 888 \\ \$888 \text{ billion} \end{array}$$

$$\begin{array}{r} 34,080 \\ - 9\ 600 \\ \hline 24,480 \end{array}$$

$$24,480 \div 96 = 255$$

Each crate weighs 255 lb.

$$\begin{array}{r} 26 \div 2 = 13 \\ 2 \\ 13 \\ \times 9 \\ \hline 117 \end{array}$$

Problem Recognition Exercises: Operations on Whole Numbers

$$\begin{array}{r} 52 \\ +13 \\ \hline 65 \end{array}$$

$$\begin{array}{r} 52 \\ \times 13 \\ \hline 156 \\ +520 \\ \hline 676 \end{array}$$

$$\begin{array}{r} 4\ 12 \\ \cancel{8} \cancel{2} \\ - 1\ 3 \\ \hline 39 \end{array}$$

$$\begin{array}{r} 4 \\ 13 \overline{) 52} \\ \underline{52} \\ 0 \end{array}$$

$$\begin{array}{r} 6 \\ 17 \overline{) 102} \\ \underline{102} \\ 0 \end{array}$$

$$\begin{array}{r} 9\ 12 \\ \cancel{1} \cancel{0} \cancel{2} \\ - 1\ 7 \\ \hline 8\ 5 \end{array}$$

$$\begin{array}{r} 1 \\ 102 \\ \times 17 \\ \hline 714 \\ +1020 \\ \hline 1734 \end{array}$$

$$\begin{array}{r} 102 \\ +17 \\ \hline 119 \end{array}$$

$$\begin{array}{r} 3. \text{ (a)} \quad 5064 \\ \times 58 \\ \hline 40512 \\ + 253200 \\ \hline 293,712 \end{array}$$

$$\begin{array}{r} \text{(b)} \quad 5064 \\ + 58 \\ \hline 5122 \end{array}$$

$$\begin{array}{r} \text{(c)} \quad 87 \text{ R}18 \\ 58 \overline{) 5064} \\ \underline{-464} \\ 424 \\ \underline{-406} \\ 18 \end{array}$$

$$\begin{array}{r} \text{(d)} \quad \begin{array}{r} 5 \cancel{0} \cancel{4} \\ - 58 \\ \hline 5006 \end{array} \end{array}$$

$$\begin{array}{r} 4. \text{ (a)} \quad 1226 \\ -114 \\ \hline 1112 \end{array}$$

$$\begin{array}{r} \text{(b)} \quad 10 \text{ R}86 \\ 114 \overline{) 1226} \\ \underline{-114} \\ 86 \\ \underline{0} \\ 86 \end{array}$$

$$\begin{array}{r} \text{(c)} \quad \begin{array}{r} 1 \\ 1226 \\ + 114 \\ \hline 1340 \end{array} \end{array}$$

$$\begin{array}{r} \text{(d)} \quad \begin{array}{r} 1 \\ 1226 \\ \times 114 \\ \hline 4904 \\ 12260 \\ + 122600 \\ \hline 139,764 \end{array} \end{array}$$

$$\begin{array}{r} 5. \text{ (a)} \quad 156 \\ + 41 \\ \hline 197 \end{array}$$

$$\begin{array}{r} \text{(b)} \quad 197 \\ - 41 \\ \hline 156 \end{array}$$

$$\begin{array}{r} 6. \text{ (a)} \quad 6004 \\ + 221 \\ \hline 6225 \end{array}$$

$$\begin{array}{r} \text{(b)} \quad 6004 \\ - 221 \\ \hline 6004 \end{array}$$

7. 4,180

8. 41,800

9. 418,000

10. 4,180,000

11. 35,000

12. 3,500

13. 350

14. 35

15. 246,000

16. 2,820,000

17. 20,000

18. 540,000

Section 1.7 Exponents, Square Roots, and the Order of Operations**Section 1.7 Practice Exercises**

1. (a) base; 4
(b) powers
(c) square root; 81
(d) order; operations
(e) variable; constants
(f) mean
2. False
3. True: $5 + 3 = 8$ and $3 + 5 = 8$
4. False: $5 - 3 = 2$, but $3 - 5 \neq 2$
5. False: $6 \times 0 = 0$
6. True: $0 \div 8 = 0$
7. True: $0 \times 8 = 0$
8. True: $5 \div 0$ is undefined.
9. 9^4
10. 3^8
11. 2^7
12. 6^5
13. $3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 = 3^6$
14. $7 \cdot 7 \cdot 7 \cdot 7 = 7^4$
15. $4 \cdot 4 \cdot 4 \cdot 4 \cdot 2 \cdot 2 \cdot 2 = 4^4 \cdot 2^3$
16. $5 \cdot 5 \cdot 5 \cdot 10 \cdot 10 \cdot 10 = 5^3 \cdot 10^3$
17. $8^4 = 8 \cdot 8 \cdot 8 \cdot 8$
18. $2^6 = 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2$
19. $4^8 = 4 \cdot 4 \cdot 4 \cdot 4 \cdot 4 \cdot 4 \cdot 4 \cdot 4$
20. $6^2 = 6 \cdot 6$
21. $2^3 = 2 \cdot 2 \cdot 2 = 4 \cdot 2 = 8$
22. $4^2 = 4 \cdot 4 = 16$
23. $3^2 = 3 \cdot 3 = 9$
24. $5^2 = 5 \cdot 5 = 25$
25. $3^3 = 3 \cdot 3 \cdot 3 = 9 \cdot 3 = 27$
26. $11^2 = 11 \cdot 11 = 121$
27. $5^3 = 5 \cdot 5 \cdot 5 = 25 \cdot 5 = 125$
28. $4^3 = 4 \cdot 4 \cdot 4 = 16 \cdot 4 = 64$
29. $2^5 = 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 = 4 \cdot 4 \cdot 2 = 16 \cdot 2 = 32$
30. $6^3 = 6 \cdot 6 \cdot 6 = 36 \cdot 6 = 216$
31. $3^4 = 3 \cdot 3 \cdot 3 \cdot 3 = 9 \cdot 9 = 81$
32. $5^4 = 5 \cdot 5 \cdot 5 \cdot 5 = 25 \cdot 25 = 625$
33. $1^2 = 1 \cdot 1 = 1$
34. $1^3 = 1 \cdot 1 \cdot 1 = 1$
35. $1^4 = 1 \cdot 1 \cdot 1 \cdot 1 = 1$
36. $1^5 = 1 \cdot 1 \cdot 1 \cdot 1 \cdot 1 = 1$
37. The number 1 raised to any power equals 1.
38. $10^2 = 10 \cdot 10 = 100$
39. $10^3 = 10 \cdot 10 \cdot 10 = 1000$
40. $10^4 = 10 \cdot 10 \cdot 10 \cdot 10 = 10,000$
41. $10^5 = 10 \cdot 10 \cdot 10 \cdot 10 \cdot 10 = 100,000$

42. 10^9 simplifies to a 1 followed by 9 zeros:
1,000,000,000.

43. $\sqrt{4} = 2$ because $2 \cdot 2 = 4$.

44. $\sqrt{9} = 3$ because $3 \cdot 3 = 9$.

45. $\sqrt{36} = 6$ because $6 \cdot 6 = 36$.

46. $\sqrt{81} = 9$ because $9 \cdot 9 = 81$.

47. $\sqrt{100} = 10$ because $10 \cdot 10 = 100$.

48. $\sqrt{49} = 7$ because $7 \cdot 7 = 49$.

49. $\sqrt{0} = 0$ because $0 \cdot 0 = 0$.

50. $\sqrt{16} = 4$ because $4 \cdot 4 = 16$.

51. No, addition and subtraction should be performed in the order in which they appear from left to right.

52. No, multiplication and division should be performed in the order in which they appear from left to right.

53. $6 + 10 \cdot 2 = 6 + 20 = 26$

54. $4 + 3 \cdot 7 = 4 + 21 = 25$

55. $10 - 3^2 = 10 - 9 = 1$

56. $11 - 2^2 = 11 - 4 = 7$

57. $(10 - 3)^2 = 7^2 = 49$

58. $(11 - 2)^2 = 9^2 = 81$

59. $36 \div 2 \div 6 = 18 \div 6 = 3$

60. $48 \div 4 \div 2 = 12 \div 2 = 6$

61. $15 - (5 + 8) = 15 - 13 = 2$

62. $41 - (13 + 8) = 41 - 21 = 20$

63. $(13 - 2) \cdot 5 - 2 = 11 \cdot 5 - 2 = 55 - 2 = 53$

64. $(8 + 4) \cdot 6 + 8 = 12 \cdot 6 + 8 = 72 + 8 = 80$

65. $4 + 12 \div 3 = 4 + 4 = 8$

66. $9 + 15 \div \sqrt{25} = 9 + 15 \div 5 = 9 + 3 = 12$

67. $30 \div 2 \cdot \sqrt{9} = 30 \div 2 \cdot 3 = 15 \cdot 3 = 45$

68. $55 \div 11 \cdot 5 = 5 \cdot 5 = 25$

69. $7^2 - 5^2 = 49 - 25 = 24$

70. $3^3 - 2^3 = 27 - 8 = 19$

71. $(7 - 5)^2 = 2^2 = 4$

72. $(3 - 2)^3 = 1^3 = 1$

73. $100 \div 5 \cdot 2 = 20 \cdot 2 = 40$

74. $60 \div 3 \cdot 2 = 20 \cdot 2 = 40$

75. $90 \div 3 \cdot 3 = 30 \cdot 3 = 90$

76. $80 \div 2 \cdot 2 = 40 \cdot 2 = 80$

77. $\sqrt{81} + 2(9 - 1) = \sqrt{81} + 2 \cdot 8$
 $= 9 + 2 \cdot 8$
 $= 9 + 16$
 $= 25$

78. $\sqrt{121} + 3(8 - 3) = \sqrt{121} + 3 \cdot 5$
 $= 11 + 3 \cdot 5$
 $= 11 + 15$
 $= 26$

79. $36 \div (2^2 + 5) = 36 \div (4 + 5) = 36 \div 9 = 4$

80. $42 \div (3^2 - 2) = 42 \div (9 - 2) = 42 \div 7 = 6$

81. $80 - (20 \div 4) + 6 = 80 - 5 + 6 = 75 + 6 = 81$

82. $120 - (48 \div 8) - 40 = 120 - 6 - 40$
 $= 114 - 40$
 $= 74$

$$\begin{aligned} 83. (43-26) \cdot 2 - 4^2 &= 17 \cdot 2 - 4^2 \\ &= 17 \cdot 2 - 16 \\ &= 34 - 16 \\ &= 18 \end{aligned}$$

$$\begin{aligned} 84. (51-48) \cdot 3 + 7^2 &= 3 \cdot 3 + 7^2 \\ &= 3 \cdot 3 + 49 \\ &= 9 + 49 \\ &= 58 \end{aligned}$$

$$\begin{aligned} 85. (18-5) - (23 - \sqrt{100}) &= 13 - (23 - 10) \\ &= 13 - 13 \\ &= 0 \end{aligned}$$

$$\begin{aligned} 86. (\sqrt{36} + 11) - (31 - 16) &= (6 + 11) - 15 \\ &= 17 - 15 \\ &= 2 \end{aligned}$$

$$\begin{aligned} 87. 80 \div (9^2 - 7 \cdot 11)^2 &= 80 \div (81 - 7 \cdot 11)^2 \\ &= 80 \div (81 - 77)^2 \\ &= 80 \div 4^2 \\ &= 80 \div 16 \\ &= 5 \end{aligned}$$

$$\begin{aligned} 88. 108 \div (3^3 - 6 \cdot 4)^2 &= 108 \div (27 - 6 \cdot 4)^2 \\ &= 108 \div (27 - 24)^2 \\ &= 108 \div 3^2 \\ &= 108 \div 9 \\ &= 12 \end{aligned}$$

$$\begin{aligned} 89. 22 - 4(\sqrt{25} - 3)^2 &= 22 - 4(5 - 3)^2 \\ &= 22 - 4(2)^2 \\ &= 22 - 4 \cdot 4 \\ &= 22 - 16 \\ &= 6 \end{aligned}$$

$$\begin{aligned} 90. 17 + 3(7 - \sqrt{9})^2 &= 17 + 3(7 - 3)^2 \\ &= 17 + 3(4)^2 \\ &= 17 + 3 \cdot 16 \\ &= 17 + 48 \\ &= 65 \end{aligned}$$

$$\begin{aligned} 91. 96 - 3(42 \div 7 \cdot 6 - 5) &= 96 - 3(6 \cdot 6 - 5) \\ &= 96 - 3(36 - 5) \\ &= 96 - 3(31) \\ &= 96 - 93 \\ &= 3 \end{aligned}$$

$$\begin{aligned} 92. 50 - 2(36 \div 12 \cdot 2 - 4) &= 50 - 2(3 \cdot 2 - 4) \\ &= 50 - 2(6 - 4) \\ &= 50 - 2(2) \\ &= 50 - 4 \\ &= 46 \end{aligned}$$

$$\begin{aligned} 93. 16 + 5(20 \div 4 \cdot 8 - 3) &= 16 + 5(5 \cdot 8 - 3) \\ &= 16 + 5(40 - 3) \\ &= 16 + 5(37) \\ &= 16 + 185 \\ &= 201 \end{aligned}$$

$$94. \text{Mean} = \frac{19 + 21 + 18 + 21 + 16}{5} = \frac{95}{5} = 19$$

$$\begin{aligned} 95. \text{Mean} &= \frac{105 + 114 + 123 + 101 + 100 + 111}{6} \\ &= \frac{654}{6} = 109 \end{aligned}$$

$$\begin{aligned} 96. \text{Mean} &= \frac{1480 + 1102 + 1032 + 1002}{4} \\ &= \frac{4616}{4} = 1154 \end{aligned}$$

$$\begin{aligned} 97. \text{Average} &= \frac{19 + 20 + 18 + 19 + 18 + 14}{6} \\ &= \frac{108}{6} = 18 \end{aligned}$$

$$98. \text{Average} = \frac{83 + 95 + 87 + 91}{4} = \frac{356}{4} = 89$$

$$\begin{aligned} 99. \text{Average} &= \frac{69 + 74 + 49}{3} \\ &= \frac{192}{3} = 64¢ \text{ per pound} \end{aligned}$$

$$\begin{aligned} 100. \text{Average} &= \frac{7 + 10 + 8 + 7}{4} = \frac{32}{4} \\ &= \$8 \text{ per wash} \end{aligned}$$

$$\begin{aligned} 101. \text{Average} &= \frac{118 + 123 + 122}{3} \\ &= \frac{363}{3} = 121 \text{ mm per month} \end{aligned}$$

$$\begin{aligned} 102. \text{ Average} &= \frac{9 + 20 + 22 + 16 + 13}{5} \\ &= \frac{80}{5} = 16 \text{ in. per month} \end{aligned}$$

$$\begin{aligned} 103. \quad 3[4 + (6 - 3)^2] - 15 &= 3[4 + 3^2] - 15 \\ &= 3[4 + 9] - 15 \\ &= 3[13] - 15 \\ &= 39 - 15 \\ &= 24 \end{aligned}$$

$$\begin{aligned} 104. \quad 2[5(4 - 1) + 3] \div 6 &= 2[5(3) + 3] \div 6 \\ &= 2[15 + 3] \div 6 \\ &= 2[18] \div 6 \\ &= 36 \div 6 \\ &= 6 \end{aligned}$$

$$\begin{aligned} 105. \quad 5\{21 - [3^2 - (4 - 2)]\} &= 5\{21 - [3^2 - 2]\} \\ &= 5\{21 - [9 - 2]\} \\ &= 5\{21 - 7\} \\ &= 5\{14\} \\ &= 70 \end{aligned}$$

$$\begin{aligned} 106. \quad 4\{18 - [(10 - 8) + 2^3]\} &= 4\{18 - [2 + 2^3]\} \\ &= 4\{18 - [2 + 8]\} \\ &= 4\{18 - 10\} \\ &= 4\{8\} \\ &= 32 \end{aligned}$$

$$107. \quad 156^2 = 24,336$$

$$108. \quad 418^2 = 174,724$$

$$109. \quad 12^5 = 248,832$$

$$110. \quad 35^4 = 1,500,625$$

$$111. \quad 43^3 = 79,507$$

$$112. \quad 71^3 = 357,911$$

$$113. \quad 8126 - 54,978 \div 561 = 8126 - 98 = 8028$$

$$\begin{aligned} 114. \quad 92,168 + 6954 \times 29 &= 92,168 + 201,666 \\ &= 293,834 \end{aligned}$$

$$115. \quad (3548 - 3291)^2 = 257^2 = 66,049$$

$$116. \quad (7500 \div 625)^3 = 12^3 = 1728$$

$$117. \quad \frac{89,880}{384 + 2184} = \frac{89,880}{2568} = 35$$

$$118. \quad \frac{54,137}{3393 - 2134} = \frac{54,137}{1259} = 43$$

Section 1.8 Problem-Solving Strategies

Section 1.8 Practice Exercises

1. $4 \div 0$

2. $89 - 66 = 23$

3. $71 + 14 = 85$

4. $42 + 16 = 58$

5. $2 \cdot 14 = 28$

6. $93 - 79 = 14$

7. $102 - 32 = 70$

8. $60 \div 12 = 5$

9. $10 \cdot 13 = 130$

10. $12 + 14 + 15 = 41$

11. $24 \div 6 = 4$

12. $78 - 41 = 37$

13. $5 + 13 + 25 = 43$

14. Answers may vary.

15. For example: sum, added to, increased by, more than, total of, plus

16. For example: product, times, multiply

17. For example: difference, minus, decreased by, less, subtract

18. For example: quotient, divide, per, distributed equally, shared equally

19. *Given:* The height of each mountain
Find: The difference in height

Operation: Subtract

$$\begin{array}{r} 110 \ 21110 \\ \cancel{20}, \cancel{8} \cancel{2} \cancel{0} \\ - 14,246 \\ \hline 6,074 \end{array}$$

Denali is 6,074 ft higher than White Mountain Peak.

20. *Given:* The number of yearly subscriptions
Find: The difference in subscriptions

Operation: Subtract

$$\begin{array}{r} 011 \ 11101110 \\ \cancel{12}, \cancel{2} \cancel{1} \cancel{2}, \cancel{000} \\ - 3,252,900 \\ \hline 8,959,100 \end{array}$$

Reader's Digest has 8,959,100 more subscriptions than *Sports Illustrated*.

21. *Given:* Oil consumption by country.
Find: Total oil consumption for 4 countries.

Operation: Addition

$$\begin{array}{r} 8,220,000 \\ 4,360,000 \\ 4,210,000 \\ + 2,170,000 \\ \hline 18,960,000 \end{array}$$

The oil consumption of China, Japan, Russia, and Canada is 18,960,000 barrels per day.

22. *Given:* Population of each country.
Find: Total population of 4 countries.

Operation: Addition

$$\begin{array}{r} 11 \\ 1,339,000,000 \\ 127,000,000 \\ 140,000,000 \\ + 33,000,000 \\ \hline 1,639,000,000 \end{array}$$

The population of China, Japan, Russia, and Canada is 1,639,000,000 people.

23. *Given:* The number of rows of pixels and the number of pixels in each row.
Find: The number of pixels on the whole screen.

Operation: Multiply

$$\begin{array}{r} 5 \\ 213 \\ 126 \\ \times 96 \\ \hline 1756 \\ 11340 \\ \hline 12,096 \end{array}$$

There are 12,096 pixels on the whole screen.

24. *Given:* The number of rows of tiles and the number of tiles in each row.
Find: The number of tiles on the whole floor.

Operation: Multiply

$$\begin{array}{r} 1 \\ 62 \\ \times 38 \\ \hline 11 \\ 496 \\ 1860 \\ 2356 \end{array}$$

There are 2,356 tiles.

- 25.** *Given:* Number of students and the average class size.

Find: Number of classes offered

Operation: Division

$$\begin{array}{r} 120 \\ 25 \overline{) 3000} \\ \underline{-25} \\ 50 \\ \underline{-50} \\ 00 \end{array}$$

There will be 120 classes of Prealgebra.

- 26.** *Given:* Inheritance amount and number of people to share equally

Find: Amount per person

Operation: Division

$$\begin{array}{r} 10\,560 \\ 8 \overline{) 84,480} \\ \underline{-8} \\ 04\,4 \\ \underline{-4\,0} \\ 48 \\ \underline{-48} \\ 00 \end{array}$$

Each person will receive \$10,560.

- 27.** *Given:* 45 miles per gallon and driving 405 miles

Find: How many gallons used

Operation: Division

$$\begin{array}{r} 9 \\ 45 \overline{) 405} \\ \underline{-405} \\ 0 \end{array}$$

There will be 9 gal used.

- 28.** *Given:* 52 mph; 1352 mi

Find: How many hours

Operation: Divide

$$\begin{array}{r} 26 \\ 52 \overline{) 1352} \\ \underline{-104} \\ 312 \\ \underline{-312} \\ 0 \end{array}$$

They will travel for 26 hours.

- 29.** *Given:* Yearly tuition for two schools

Find: Total tuition paid

Operation: Addition

$$\begin{array}{r} 1 \\ 39,212 \\ + 3,024 \\ \hline 42,236 \end{array}$$

Jeannette will pay \$42,236 for one year.

- 30.** *Given:* Distances traveled in opposite directions

Find: Total distance traveled

Operation: Addition

$$\begin{array}{r} 11 \\ 138 \\ + 96 \\ \hline 234 \end{array}$$

They are 234 mi apart.

- 31.** *Given:* Miles per gallon and number of gallons

Find: How many miles

Operation: Multiplication

$$\begin{array}{r} 1 \\ 55 \\ \times 20 \\ \hline 1,100 \end{array}$$

The Prius can go 1100 mi.

- 32.** *Given:* Hours per week and number of weeks.

Find: Total number of hours

Operation: Multiplication

$$\begin{array}{r} 1 \\ 16 \\ \times 3 \\ \hline 48 \end{array}$$

The class will meet for 48 hr during the semester.

- 33.** *Given:* Number of rows and number of seats in each row.

Find: Total number of seats

Operation: Multiplication

$$\begin{array}{r} 3 \\ 45 \\ \times 70 \\ \hline 3150 \end{array}$$

The maximum capacity is 3150 seats.

- 34.** *Given:* Number of rows and number of boxes in each row

Find: Total number of boxes

Operation: Multiplication

$$\begin{array}{r} 8 \\ \times 8 \\ \hline 64 \end{array}$$

There are 64 boxes in a checkerboard.

- 35.** *Given:* total price: \$16,540
down payment: \$2500

payment plan: 36 months

Find: Amount of monthly payments

Operations

- (1) Subtract

$$\begin{array}{r} 16,540 \\ - 2,500 \\ \hline 14,040 \end{array}$$

- (2) Divide

$$\begin{array}{r} 390 \\ 36 \overline{) 14040} \\ \underline{- 108} \\ 324 \\ \underline{- 324} \\ 00 \end{array}$$

Jackson's monthly payments were \$390.

- 36.** *Given:* total cost: 1170

down payment: 150

payment plan: 12 months

Find: Amount of monthly payments

Operations:

- (1) Subtract

$$\begin{array}{r} 1170 \\ - 150 \\ \hline 1020 \end{array}$$

- (2) Divide

$$\begin{array}{r} 85 \\ 12 \overline{) 1020} \\ \underline{- 96} \\ 60 \\ \underline{- 60} \\ 0 \end{array}$$

Lucio's monthly payment was \$85.

- 37.** *Given:* Distance for each route and speed traveled

Find: Time required for each route

Operations

- (1) Watertown to Utica direct

$$\text{Divide } 80 \div 40 = 2 \text{ hr}$$

- (2) Watertown to Syracuse to Utica

$$\text{Add distances } 70 + 50 = 120 \text{ mi}$$

$$\text{Divide } 120 \div 60 = 2 \text{ hr}$$

Each trip will take 2 hours.

- 38.** *Given:* Distance for each route and speed traveled

Find: Time required for each route

Operations

- (1) Interstate:

$$\text{Divide } 220 \div 55 = 4 \text{ hr}$$

- (2) Back roads:

$$\text{Divide } 200 \div 40 = 5 \text{ hr}$$

The interstate will take 4 hours and the back roads will take 5 hours. The interstate will take less time.

- 39.** The distance around a figure is the perimeter.

- 40.** The amount of space covered is the area.

- 41.** *Given:* The dimensions of a room and cost per foot of molding

Find: Total cost

Operations:

- (1) Add to find the perimeter, subtract doorway.

$$\begin{array}{r} 11 \\ 12 \\ 11 \\ + 12 \\ \hline 46 \end{array} \qquad \begin{array}{r} 46 \\ - 3 \\ \hline 43 \text{ ft} \end{array}$$

- (2) Multiply to find the total cost.

$$\begin{array}{r} 43 \\ \times 2 \\ \hline 86 \end{array}$$

The cost will be \$86.

- 42.** *Given:* The dimensions of a yard and the cost per foot of fence

Find: Total cost

Operations

- (1) Add to find perimeter

$$\begin{array}{r} 1 \\ 75 \\ 90 \\ 75 \\ + 90 \\ \hline 330 \text{ ft} \end{array}$$

- (2) Multiply the perimeter by cost per foot.

$$\begin{array}{r} 330 \\ \times 5 \\ \hline 1650 \end{array}$$

It will cost \$1650.

- 43.** *Given:* dimensions of room and cost per square yard

Find: total cost

Operations

- (1) Multiply to find area

$$6 \times 5 = 30 \text{ yd}^2$$

- (2) Multiply to find total cost

$$\begin{array}{r} 1 \\ 34 \\ \times 30 \\ \hline 1020 \end{array}$$

The total cost is \$1020.

- 44.** *Given:* Dimensions of room and cost per foot

Find: Total cost

Operations

- (1) Multiply to find area.

$$\begin{array}{r} 12 \\ \times 20 \\ \hline 240 \end{array}$$

- (2) Multiply to find total cost.

$$\begin{array}{r} 240 \\ \times 3 \\ \hline 720 \end{array}$$

The total cost is \$720.

- 45.** *Given:* Starting balance in account and individual checks written

Find: Remaining balance in account

Operations

- (1) Add the individual checks

$$\begin{array}{r} 1 \\ 82 \\ 159 \\ + 101 \\ \hline \$242 \end{array}$$

- (2) Subtract \$242 from the initial balance

$$\begin{array}{r} 278 \\ - 242 \\ \hline 36 \end{array}$$

There will be \$36 left in Gina's account.

- 46.** *Given:* Initial balance in account and individual checks written

Find: The remaining balance

Operations

- (1) Add the individual checks.

$$\begin{array}{r} 11 \\ 587 \\ 36 \\ + 156 \\ \hline \$779 \end{array}$$

- (2) Subtract \$779 from the initial balance.

$$\begin{array}{r} 2 \text{ } 13 \text{ } 14 \text{ } 15 \\ \cancel{2} \cancel{1} \cancel{3} \cancel{4} \cancel{5} \\ - 7 \text{ } 7 \text{ } 9 \\ \hline 2 \text{ } 6 \text{ } 7 \text{ } 6 \end{array}$$

There will be \$2676 left in Jose's account.

- 47.** *Given:* Number of computers and printers purchased and the cost of each

Find: The total bill

Operations

- (1) Multiply to find the amount spent on computers, then printers.

$$\begin{array}{r} 115 \\ 2118 \\ \times 72 \\ \hline 4236 \\ 148260 \\ \hline \$152,496 \end{array} \quad \begin{array}{r} 33 \\ 256 \\ \times 6 \\ \hline \$1536 \end{array}$$

- (2) Add to find the total bill.

$$\begin{array}{r} 1 \text{ } 11 \\ 152,496 \\ + 1536 \\ \hline 154,032 \end{array}$$

The total bill was \$154,032.

- 48.** *Given:* Price for children and adults, and the number of children and adults

Find: Total cost for the trip

Operations

- (1) Multiply to find the amount for children and for adults.

$$\begin{array}{r} 2 \\ 33 \\ \times 27 \\ \hline 231 \\ + 660 \\ \hline \$891 \end{array} \quad \begin{array}{r} 4 \\ 37 \\ \times 6 \\ \hline \$222 \end{array}$$

- (2) Add to find the total.

$$\begin{array}{r} \$ 891 \\ + 222 \\ \hline \$1113 \end{array}$$

The amount of money required is \$1,113.

- 49.** *Given:* Amount to sell used CDs, amount to buy used CDs and number of CDs sold

- (a) *Find:* Money from selling 16 CDs

Operation: Multiply

$$\begin{array}{r} 16 \\ \times 3 \\ \hline 48 \end{array}$$

Latayne will receive \$48.

- (b) *Find:* Number of used CDs to buy for \$48.

Operation: Division

$$48 \div 8 = 6$$

She can buy 6 CDs.

- 50.** *Given:* Wage per hour and number of hours worked

- (a) *Find:* Amount of weekly paycheck

Operation: Multiply

$$\begin{array}{r} 40 \\ \times 12 \\ \hline 80 \\ + 400 \\ \hline \$480 \end{array}$$

Shevona's paycheck is worth \$480.

- (b) *Given:* Ticket price and number of tickets

Find: Amount left over from paycheck

Operations

$$\begin{array}{r} (1) \text{ Multiply } 89 \quad (2) \text{ Subtract } \begin{array}{r} 7 \ 10 \\ 4 \ 8 \ 0 \\ - 1 \ 7 \ 8 \\ \hline 3 \ 0 \ 2 \end{array} \\ \times 2 \\ \hline 178 \end{array}$$

She will have \$302 left.

- 51.** *Given:* Number of field goals, three-point shots and free throws and point values

Find: Total points scored

Operations

- (1) Multiply

$$\begin{array}{r} \text{field goals} \quad \text{three-point shots} \\ 1 \quad 2 \\ 12,192 \quad 581 \\ \times 2 \quad \times 3 \\ \hline 24,384 \quad 1,743 \end{array}$$

- (2) Add

$$\begin{array}{r} 1 \ 1 \ 11 \\ 24 \ 384 \\ 1 \ 743 \\ + 7 \ 327 \\ \hline 33,454 \end{array}$$

Michael Jordan scored 33,454 points with the Bulls.

- 52.** *Given:* Width of each picture and width of the matte frame

Find: Space between each picture

Operations

(1) Multiply $5 \times 5 = 25$

(2) Subtract $37 - 25 = 12$

(3) Divide $12 \div 6 = 2$

There will be 2 in of matte between the pictures.

- 53.** *Given:* Number of milliliters in the bottle and the dosage

- (a) *Find:* Days the bottle will last

Operation: Divide

$$60 \div 2 = 30$$

One bottle will last for 30 days.

- (b) *Find:* Date to reorder

Operation: Subtract

$$30 - 2 = 28$$

The owner should order a refill no later than September 28.

- 54. Given:** Number of male and female doctors

(a) Find: Difference between male and female doctors

Operation: Subtract

$$\begin{array}{r} 9 \\ 2\cancel{10}^{13} \\ 6\cancel{3}^{\cancel{0}},300 \\ - 205,900 \\ \hline 424,400 \end{array}$$

The difference between male and female doctors is 424,400.

(b) Find: The total number of doctors

Operation: Add

$$\begin{array}{r} 1 \\ 630,300 \\ + 205,900 \\ \hline 836,200 \end{array}$$

The total number of doctors is 836,200.

- 55. Given:** Scale on a map

(a) Find: Actual distance between Las Vegas and Salt Lake City

Operation: Multiply

$$\begin{array}{r} 60 \\ \times 6 \\ \hline 360 \end{array}$$

The distance is 360 mi.

(b) Find: Distance on map between Madison and Dallas

Operation: Divide

$$\begin{array}{r} 14 \\ 60 \overline{) 840} \\ \underline{-60} \\ 240 \\ \underline{-240} \\ 0 \end{array}$$

14 in. represents 840 mi.

- 56. Given:** Scale on a map

(a) Find: Actual distance between Wichita and Des Moines

Operation: Multiply

$$\begin{array}{r} 40 \\ \times 8 \\ \hline 320 \end{array}$$

The distance is 320 mi.

(b) Find: The distance between Seattle and Sacramento on the map.

Operation: Divide

$$\begin{array}{r} 15 \\ 40 \overline{) 600} \\ \underline{-40} \\ 200 \\ \underline{-200} \\ 0 \end{array}$$

15 in. represents 600 mi.

- 57. Given:** Number of books per box and number of books ordered

Find: Number of boxes completely filled and number of books left over

Operation: Divide and find remainder

$$\begin{array}{r} 104 \text{ R } 2 \\ 12 \overline{) 1250} \\ \underline{-12} \\ 050 \\ \underline{-48} \\ 2 \end{array}$$

104 boxes will be filled completely with 2 books left over.

- 58. Given:** Number of eggs in a container and total number of eggs

Find: Number of containers filled and number of eggs left over

Operation: Divide and find remainder

$$\begin{array}{r} 354 \text{ R } 9 \\ 12 \overline{) 4257} \\ \underline{-36} \\ 65 \\ \underline{-60} \\ 57 \\ \underline{-48} \\ 9 \end{array}$$

354 containers will be filled completely with 9 eggs left over.

59. *Given:* Total cost of dinner and type of bill used

(a) *Find:* Number of \$20 bills needed

Operation: Division

$$\begin{array}{r} 4 \text{ R } 4 \\ 20 \overline{) 84} \\ \underline{-80} \\ 4 \end{array}$$

Four \$20 bills are not enough so Marc needs five \$20 bills.

(b) *Find:* How much change

Operations: Multiply and subtract

$$\begin{array}{r} 20 \qquad 100 \\ \times 5 \qquad - 84 \\ \hline 100 \qquad 16 \end{array}$$

He will receive \$16 in change.

60. *Given:* total cost of CDs and type of bill used

(a) *Find:* How many \$10 bills needed

Operation: Divide

$$\begin{array}{r} 5 \text{ R } 4 \\ 10 \overline{) 54} \\ \underline{-50} \\ 4 \end{array}$$

Five \$10 bills are not enough so Shawn needs six \$10 bills.

(b) *Find:* How much change

Operations: Multiply and subtract

$$\begin{array}{r} 10 \qquad 60 \\ \times 6 \qquad - 54 \\ \hline 60 \qquad 6 \end{array}$$

He will receive \$6 in change.

61. *Given:* Hourly wage and number of hours worked

Find: Amount earned per week

Operations

(1) Multiply to find amount per job.

$$30 \times 4 = 120$$

$$10 \times 16 = 160$$

$$8 \times 30 = 240$$

(2) Add to find total.

$$\begin{array}{r} 1 \\ 120 \\ 160 \\ + 240 \\ \hline 520 \end{array}$$

He earned \$520.

62. *Given:* Hourly wage and number of hours worked

Find: Total paid to all four workers

Operations

(1) Multiply to find amount per worker

$$36 \times 18 = 648$$

$$26 \times 24 = 624$$

$$28 \times 15 = 420$$

$$22 \times 48 = 1056$$

(2) Add to find total paid.

$$\begin{array}{r} 1 \ 11 \\ 648 \\ 420 \\ 624 \\ + 1056 \\ \hline 2748 \end{array}$$

The total amount paid was \$2748.

Chapter 1 Review Exercises

Section 1.1

1. 10,024 Ten-thousands
2. 821,811 Hundred-thousands
3. 92,046
4. 503,160
5. 3 millions + 4 hundred-thousands
+ 8 hundreds + 2 tens
6. 3 ten-thousands + 5 hundreds + 5 tens
+ 4 ones

7. Two hundred forty-five

8. Thirty-thousand, eight hundred sixty-one

9. 3602

10. 800,039

11. 2; 

12. 7; 

13. $3 < 10$ True

14. $10 > 12$ False

Section 1.2

15. Addends: 105, 119; sum: 224

16. Addends: 53, 21; sum: 74

$$\begin{array}{r} 2 \\ 17. \quad 18 \\ \quad 24 \\ + 29 \\ \hline 71 \end{array}$$

$$\begin{array}{r} 2 \\ 18. \quad 27 \\ \quad 9 \\ + 18 \\ \hline 54 \end{array}$$

$$\begin{array}{r} 1 \\ 19. \quad 8 \, 403 \\ + 9 \, 007 \\ \hline 17,410 \end{array}$$

$$\begin{array}{r} 20. \quad 68,421 \\ + 2,221 \\ \hline 70,642 \end{array}$$

21. (a) The order changed, so it is the commutative property.
 (b) The grouping changed, so it is the associative property.
 (c) The order changed, so it is the commutative property.

$$\begin{array}{r} 22. \quad 403 + 79; 482 \\ \quad 1 \\ \quad 403 \\ + 79 \\ \hline 482 \end{array}$$

$$\begin{array}{r} 23. \quad 44 + 92; 136 \\ \quad 92 \\ + 44 \\ \hline 136 \end{array}$$

24. $36 + 7 = 43$

25. $23 + 6 = 29$

26. (a) Add the numbers for AA Auto.

$$\begin{array}{r} 31 \\ 25 \\ + 40 \\ \hline 96 \text{ cars} \end{array}$$

(b) Add the numbers of Fords.

$$\begin{array}{r} 21 \\ 25 \\ + 20 \\ \hline 66 \text{ Fords} \end{array}$$

$$\begin{array}{r} 27. \quad 35,377 \\ + 10,420 \\ \hline 45,797 \text{ thousand seniors} \end{array}$$

$$\begin{array}{r} 28. \quad 1 \\ \quad 30 \\ \quad 44 \\ \quad 25 \\ \quad 53 \\ + 25 \\ \hline 177 \text{ m} \end{array}$$

Section 1.3

29. minuend: 14
 subtrahend: 8
 difference: 6

30. minuend: 102
 subtrahend: 78
 difference: 24

$$\begin{array}{r} 31. \quad 37 \\ \quad - 11 \\ \hline 26 \end{array} \quad \underline{26} + 11 = 37$$

$$\begin{array}{r} 32. \quad 61 \\ \quad - 41 \\ \hline 20 \end{array} \quad \underline{20} + 41 = 61$$

$$\begin{array}{r} 33. \quad 9 \\ \quad 1 \cancel{1} \cancel{0} 10 \\ \quad \cancel{2} \cancel{0} \cancel{0} 5 \\ \quad - 1 \, 8 \, 84 \\ \hline 1 \, 21 \end{array}$$

$$\begin{array}{r} 34. \quad 2 \, 18 \\ \quad 1 \cancel{3} \cancel{0} 9 \\ \quad - 2 \, 99 \\ \hline 10 \, 90 \end{array}$$

$$\begin{array}{r}
 99 \\
 5\cancel{10}\cancel{10} \\
 35. \quad \cancel{8}\cancel{0},\cancel{0}\cancel{0} \\
 - 54981 \\
 \hline
 31,019
 \end{array}$$

$$\begin{array}{r}
 99 \\
 6\cancel{10}\cancel{10} \\
 36. \quad \cancel{6}\cancel{7},\cancel{0}\cancel{0} \\
 - 32812 \\
 \hline
 34,188
 \end{array}$$

$$\begin{array}{r}
 38 - 31; 7 \\
 38 \\
 - 31 \\
 \hline
 7
 \end{array}$$

$$\begin{array}{r}
 111 - 15; 96 \\
 10 \\
 0\cancel{11} \\
 \cancel{1}\cancel{1}1 \\
 - 15 \\
 \hline
 96
 \end{array}$$

$$\begin{array}{r}
 251 - 42; 209 \\
 411 \\
 2\cancel{5}\cancel{1} \\
 - 42 \\
 \hline
 209
 \end{array}$$

$$\begin{array}{r}
 90 - 52; 38 \\
 810 \\
 \cancel{9}\cancel{0} \\
 - 52 \\
 \hline
 38
 \end{array}$$

$$\begin{array}{r}
 1018 \\
 4\cancel{0}\cancel{11}511 \\
 41. \quad \cancel{9}\cancel{3},\cancel{1}\cancel{0}\cancel{1},\cancel{7}\cancel{0}\cancel{1} \\
 - 23,299,323 \\
 \hline
 71,892,438 \text{ tons}
 \end{array}$$

$$\begin{array}{r}
 115 \\
 \cancel{2}\cancel{3},800,000 \\
 - 18,600,000 \\
 \hline
 \$7,200,000
 \end{array}$$

$$\begin{array}{r}
 9 \\
 7\cancel{10}13 \\
 43. \quad \cancel{4}\cancel{8}\cancel{0}\cancel{3} \\
 - 2467 \\
 \hline
 2,336 \text{ thousand visitors}
 \end{array}$$

Section 1.4

$$\begin{array}{r}
 5,234,446 \\
 44. \quad 5,000,000
 \end{array}$$

$$\begin{array}{r}
 9,332,945 \\
 45. \quad 9,330,000
 \end{array}$$

$$\begin{array}{r}
 894,004 \rightarrow 900,000 \\
 - 123,883 \rightarrow 100,000 \\
 \hline
 800,000
 \end{array}$$

$$\begin{array}{r}
 330 \rightarrow 300 \\
 489 \rightarrow 500 \\
 123 \rightarrow 100 \\
 + 571 \rightarrow 600 \\
 \hline
 1500
 \end{array}$$

$$\begin{array}{r}
 140,041,247 \rightarrow 140,000,000 \\
 48. \quad 140,041,247 \rightarrow 140,000,000 \\
 - 127,078,679 \rightarrow 127,000,000 \\
 \hline
 13,000,000 \text{ people}
 \end{array}$$

$$\begin{array}{r}
 96,050 \rightarrow 96,000 \\
 + 66,517 \rightarrow 67,000 \\
 \hline
 163,000 \text{ m}^3
 \end{array}$$

Section 1.5

$$\begin{array}{l}
 50. \text{ Factors: } 32, 12 \\
 \text{Product: } 384
 \end{array}$$

$$\begin{array}{l}
 51. \text{ Factors: } 33, 40 \\
 \text{Product: } 1320
 \end{array}$$

$$\begin{array}{l}
 52. \text{ (a) Yes} \\
 \text{ (b) Yes} \\
 \text{ (c) No}
 \end{array}$$

$$53. \text{ c}$$

$$54. \text{ e}$$

$$55. \text{ d}$$

56. a

57. b

$$\begin{array}{r} 1 \\ 1 \\ 58. \quad 142 \\ \times 43 \\ \hline 11 \\ 426 \\ + 5680 \\ \hline 6106 \end{array}$$

$$\begin{array}{r} 12 \\ 59. \quad 1024 \\ \times 51 \\ \hline 1024 \\ + 51200 \\ \hline 52,224 \end{array}$$

$$\begin{array}{r} 6 \overline{) 000} \\ 5 \overline{) 00} \\ 30 \overline{) 00000} \\ \hline 3,000,000 \end{array}$$

$$\begin{array}{r} 26 \\ + 13 \\ \hline 39 \end{array} \quad \begin{array}{r} 39 \\ \times 11 \\ \hline 39 \\ 390 \\ \hline \$429 \end{array}$$

$$\begin{array}{r} 3 \\ 62. \quad 551 \\ \times 7 \\ \hline 3857 \end{array} \quad \begin{array}{r} 111 \\ 3857 \\ \times 2 \\ \hline 7714 \text{ lb} \end{array}$$

Section 1.6

63. $42 \div 6 = 7$
divisor: 6, dividend: 42, quotient: 7

64. $4 \overline{) 52} = 13$
divisor: 4, dividend: 52, quotient: 13

65. $3 \div 1 = 3$ because $1 \times 3 = 3$.

66. $3 \div 3 = 1$ because $1 \times 3 = 3$.

67. $3 \div 0$ is undefined.

68. $0 \div 3 = 0$ because $0 \times 3 = 0$.

69. To check a division problem with no remainder you multiply the quotient by the divisor to get the dividend.

70. To check a division problem with a remainder you multiply the whole number part of the quotient by the divisor and add the remainder to get the dividend.

$$\begin{array}{r} 58 \\ 71. \quad 6 \overline{) 348} \\ \underline{-30} \\ 48 \\ \underline{-48} \\ 0 \end{array} \quad \begin{array}{r} 3 \\ 58 \\ \times 6 \\ \hline 348 \checkmark \end{array}$$

$$\begin{array}{r} 41 \text{ R } 7 \\ 72. \quad 11 \overline{) 458} \\ \underline{-44} \\ 18 \\ \underline{-11} \\ 7 \end{array} \quad \begin{array}{r} 41 \\ \times 11 \\ \hline 41 \\ 410 \\ \hline 451 \\ + 7 \\ \hline 458 \checkmark \end{array}$$

$$\begin{array}{r} 52 \text{ R } 3 \\ 73. \quad 20 \overline{) 1043} \\ \underline{-100} \\ 43 \\ \underline{-40} \\ 3 \end{array} \quad \begin{array}{r} 52 \\ \times 20 \\ \hline 1040 \\ + 3 \\ \hline 1043 \checkmark \end{array}$$

$$74. \quad \frac{72}{4} = 18$$

$$\begin{array}{r} 12 \\ 75. \quad 9 \overline{) 108} \\ \underline{-9} \\ 18 \\ \underline{-18} \\ 0 \end{array}$$

76. Divide 105 by 4.

$$\begin{array}{r} 26 \text{ R } 1 \\ 4 \overline{) 105} \\ \underline{-8} \\ 25 \\ \underline{-24} \\ 1 \end{array}$$

26 photos with 1 left over

77. (a) Divide 60 by 15.
 $60 \div 15 = 4$ T-shirts

(b) Divide 60 by 12.
 $60 \div 12 = 5$ hats

Section 1.7

78. $8 \cdot 8 \cdot 8 \cdot 8 \cdot 8 = 8^5$

79. $2 \cdot 2 \cdot 2 \cdot 2 \cdot 5 \cdot 5 \cdot 5 = 2^4 \cdot 5^3$

80. $5^3 = 5 \times 5 \times 5 = 25 \times 5 = 125$

81. $4^4 = 4 \times 4 \times 4 \times 4 = 16 \times 16 = 256$

82. $1^7 = 1 \cdot 1 \cdot 1 \cdot 1 \cdot 1 \cdot 1 \cdot 1 = 1$

83. $10^6 = 10 \times 10 \times 10 \times 10 \times 10 \times 10 = 1,000,000$

84. $\sqrt{64} = 8$ because $8 \times 8 = 64$.

85. $\sqrt{144} = 12$ because $12 \times 12 = 144$.

86. $14 \div 7 \cdot 4 - 1 = 2 \cdot 4 - 1 = 8 - 1 = 7$

87. $10^2 - 5^2 = 100 - 25 = 75$

88. $90 - 4 + 6 \div 3 \cdot 2 = 90 - 4 + 2 \cdot 2$
 $= 90 - 4 + 4$
 $= 86 + 4$
 $= 90$

89. $2 + 3 \cdot 12 \div 2 - \sqrt{25} = 2 + 3 \cdot 12 \div 2 - 5$
 $= 2 + 36 \div 2 - 5$
 $= 2 + 18 - 5$
 $= 20 - 5$
 $= 15$

90. $6^2 - 4^2 + (9 - 7)^3 = 6^2 - 4^2 + 2^3$
 $= 36 - 16 + 8$
 $= 20 + 8$
 $= 28$

91. $26 - 2(10 - 1) + (3 + 4 \cdot 11)$
 $= 26 - 2(9) + (3 + 44)$
 $= 26 - 2(9) + 47$
 $= 26 - 18 + 47$
 $= 8 + 47$
 $= 55$

92. $\text{mean} = \frac{7 + 6 + 12 + 5 + 7 + 6 + 13}{7} = \frac{56}{7} = 8$

93. $\text{Average} = \frac{80 + 78 + 101 + 92 + 94}{5}$
 $= \frac{445}{5}$
 $= \$89$

94. $\frac{6 + 9 + 11 + 13 + 5 + 4}{6} = 8$ houses per month

Section 1.8

95. *Given:* Number of animals and species at two zoos

(a) *Find:* Which zoo has more animals and how many more

Operation: Subtraction

$$\begin{array}{r} 17,000 \\ - 4,000 \\ \hline 13,000 \end{array}$$

The Cincinnati Zoo has 13,000 more animals than the San Diego Zoo.

(b) *Find:* Which zoo has the most species, and how many more

Operation: Subtract

$$\begin{array}{r} 710 \\ \cancel{800} \\ - 750 \\ \hline 50 \end{array}$$

The San Diego Zoo has 50 more species than the Cincinnati Zoo.

96. *Given:* The distance traveled and the number of trips

(a) *Find:* Number of miles traveled in one week

Operations: Multiplication and addition

$$\begin{array}{r} 5 \qquad 15 \\ \times 3 \qquad + 6 \\ \hline 15 \qquad 21 \text{ miles per week} \end{array}$$

(b) *Find:* Number of miles traveled in 10 months with 4 weeks a month

Operation: Multiplication

$$\begin{array}{r} 21 \qquad 84 \\ \times 4 \qquad \times 10 \\ \hline 84 \text{ miles/month} \qquad 840 \text{ miles/year} \end{array}$$

97. *Given:* Contract: 252,000,000

Time period: 9 years

taxes: 75,600,000

Find: Amount per year after taxes

Operations

(1) Subtract

$$\begin{array}{r} 252,000,000 \\ - 75,600,000 \\ \hline 176,400,000 \end{array}$$

(2) Divide

$$\begin{array}{r} 19,600,000 \\ 9 \overline{)176,400,000} \\ \underline{-9} \\ 86 \\ \underline{-81} \\ 54 \\ \underline{-54} \\ 0 \end{array}$$

He will receive \$19,600,000 per year.

98. *Given:* dimensions of a rectangular garden and size of division for plants

(a) *Find:* Number of plants

Operations

(1) Multiply

$$12 \times 8 = 96$$

(2) Divide

$$96 \div 2 = 48$$

She should purchase 48 plants.

(b) *Find:* Cost of plants for \$3 each

Operation: Multiply

$$\begin{array}{r} 48 \\ \times 3 \\ \hline 144 \end{array}$$

The plants will cost \$144.

(c) *Find:* Perimeter of garden and cost of fence

Operations

(1) Add

$$12 + 8 + 12 + 8 = 40$$

(2) Multiply

$$40 \times 2 = \$80$$

The fence costs \$80.

(d) *Find:* Total cost of garden

Operations: Add

$$\begin{array}{r} 144 \\ + 80 \\ \hline 224 \end{array}$$

Aletha's total cost will be \$224.

Chapter 1 Test

1. (a) 492 hundreds
 (b) 23,441 thousands
 (c) 2,340,711 millions
 (d) 340,592 ten-thousands

2. (a) 4,065,000
 (b) Twenty-one million, three hundred twenty-five thousand
 (c) Twelve million, two hundred eighty-seven thousand
 (d) 729,000
 (e) Eleven million, four hundred ten thousand

3. (a) $14 > 6$
 (b) $72 < 81$

$$\begin{array}{r} 51 \\ + 78 \\ \hline 129 \end{array}$$

$$\begin{array}{r} 82 \\ \times 4 \\ \hline 328 \end{array}$$

$$\begin{array}{r} 154 \\ - 41 \\ \hline 113 \end{array}$$

$$\begin{array}{r} 227 \\ 4 \overline{) 908} \\ \underline{-8} \\ 10 \\ \underline{-8} \\ 28 \\ \underline{-28} \\ 0 \end{array}$$

$$\begin{array}{r} 3 \\ 7 \\ 8. \quad 58 \\ \times 49 \\ \hline 522 \\ 2320 \\ \hline 2,842 \end{array}$$

$$\begin{array}{r} 11 \\ 9. \quad 149 \\ + 298 \\ \hline 447 \end{array}$$

$$\begin{array}{r} 21 \text{ R}9 \\ 10. \quad 15 \overline{) 324} \\ \underline{-30} \\ 24 \\ \underline{-15} \\ 9 \end{array}$$

$$\begin{array}{r} 9 9 \\ 11. \quad 2 \cancel{0} \cancel{0} 12 \\ \cancel{0} \cancel{0} \cancel{0} \\ \underline{-2456} \\ 546 \end{array}$$

$$\begin{array}{r} 010 \\ 12. \quad \cancel{0} \cancel{0},984 \\ \underline{-2881} \\ 8103 \end{array}$$

$$\begin{array}{r} 20 \\ 13. \quad 42 \overline{) 840} \\ \underline{-84} \\ 00 \end{array}$$

$$\begin{array}{r} 5 \\ \times 3 \\ \hline 1,500,000,000 \end{array}$$

$$\begin{array}{r} 21 \\ 15. \quad 34 \\ 89 \\ 191 \\ + 22 \\ \hline 336 \end{array}$$

16. $403(0) = 0$

17. $0\overline{)16}$ is undefined.

18. (a) $(11 \cdot 6) \cdot 3 = 11 \cdot (6 \cdot 3)$
 The associative property of multiplication; the expression shows a change in grouping.

- (b) $(11 \cdot 6) \cdot 3 = 3 \cdot (11 \cdot 6)$
The commutative property of multiplication; the expression shows a change in the order of the factors.

19. (a) $4,850 \rightarrow 4,900$
(b) $12,493 \rightarrow 12,000$
(c) $7,963,126 \rightarrow 8,000,000$

$$\begin{array}{r} 690,951 \rightarrow 690,000 \\ + 739,117 \rightarrow 740,000 \\ \hline 1,430,000 \end{array}$$

There were approximately 1,430,000 people.

21. $8^2 \div 2^4 = 64 \div 16 = 4$
22. $26 \cdot \sqrt{4} - 4(8 - 1) = 26 \cdot \sqrt{4} - 4 \cdot 7$
 $= 26 \cdot 2 - 4 \cdot 7$
 $= 52 - 28$
 $= 24$
23. $36 \div 3(14 - 10) = 36 \div 3(4) = 12(4) = 48$
24. $65 - 2(5 \cdot 3 - 11)^2 = 65 - 2(15 - 11)^2$
 $= 65 - 2(4)^2$
 $= 65 - 2 \cdot 16$
 $= 65 - 32$
 $= 33$

25. *Given:* Quiz scores and number of quizzes for Brittany and Jennifer
Find: Who has the higher average
Operations: Find the average of each group.

Brittany:

$$\frac{29 + 28 + 24 + 27 + 30 + 30}{6} = \frac{168}{6} = 28$$

Jennifer:

$$\frac{30 + 30 + 29 + 28 + 28}{5} = \frac{145}{5} = 29$$

Jennifer has the higher average of 29.

Brittany has an average of 28.

26. (a) Subtract to find the change from year 2 to year 3.

$$\begin{array}{r} 2911 \\ 21\cancel{3},\cancel{0}\cancel{1}5 \\ - 212,573 \\ \hline 442 \text{ thousand subscribers} \end{array}$$

- (b) The largest increase was from year 3 to year 4. The increase was 15,430 thousand.

27. Divide the number of calls by the number of weeks.

$$\text{North: } 80 \div 16 = 5$$

$$\text{South: } 72 \div 18 = 4$$

$$\text{East: } 84 \div 28 = 3$$

The North Side Fire Department is the busiest with an average of 5 calls per week.

28. Add the sides.

$$\begin{array}{r} 1 \\ 15 \\ 31 \\ 32 \\ 15 \\ 32 \\ + 31 \\ \hline 156 \text{ mm} \end{array}$$

29. Add to find the perimeter.

$$\begin{array}{r} 13 \\ 47 \\ 128 \\ 47 \\ + 128 \\ \hline 350 \text{ ft} \end{array}$$

Multiply to find the area.

$$\begin{array}{r} 128 \\ \times 47 \\ \hline 896 \\ 5120 \\ \hline 6016 \text{ ft}^2 \end{array}$$

30. $2379 \rightarrow 2400$
 $\times 1872 \rightarrow \times 1900$
- $$\begin{array}{r} 2400 \\ \times 1900 \\ \hline 2160000 \\ 2400000 \\ \hline 4,560,000 \text{ m}^2 \end{array}$$

Chapter 2 Fractions and Mixed Numbers: Multiplication and Division

Chapter Opener Puzzle

3	5	6	^A 1	2	4
^B 1	2	3	^C 4	^D 6	^E 5
6	4	2	5	3	1
2	1	^F 4	6	5	3
^G 5	3	1	^H 2	4	^I 6
4	6	5	3	^J 1	2

Section 2.1 Introduction to Fractions and Mixed Numbers

Section 2.1 Practice Exercises

- (a) fractions
(b) numerator; denominator
(c) proper
(d) improper
(e) mixed
- $\frac{2}{7}$
- Numerator: 2; denominator: 3
- Numerator: 8; denominator: 9
- Numerator: 12; denominator: 11
- Numerator 1; denominator: 2
- $6 \div 1; 6$
- $9 \div 1; 9$
- $2 \div 2; 1$
- $8 \div 8; 1$
- $0 \div 3; 0$
- $0 \div 7; 0$
- $2 \div 0; \text{undefined}$
- $11 \div 0; \text{undefined}$
- $\frac{3}{4}$
- $\frac{1}{2}$
- $\frac{5}{9}$
- $\frac{3}{5}$
- $\frac{1}{6}$
- $\frac{4}{7}$
- $\frac{3}{8}$
- $\frac{2}{3}$

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

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

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

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

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

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

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

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

31. Proper

32. Proper

33. Improper

34. Improper

35. Improper

36. Improper

37. Proper

38. Proper

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

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

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

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

43. $\frac{9}{8}$

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

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

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

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

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

49. $1\frac{3}{4} = \frac{4 \times 1 + 3}{4} = \frac{7}{4}$

50. $6\frac{1}{3} = \frac{6 \times 3 + 1}{3} = \frac{19}{3}$

51. $4\frac{2}{9} = \frac{4 \times 9 + 2}{9} = \frac{38}{9}$

52. $3\frac{1}{5} = \frac{3 \times 5 + 1}{5} = \frac{16}{5}$

53. $3\frac{3}{7} = \frac{3 \times 7 + 3}{7} = \frac{24}{7}$

54. $8\frac{2}{3} = \frac{8 \times 3 + 2}{3} = \frac{26}{3}$

55. $7\frac{1}{4} = \frac{7 \times 4 + 1}{4} = \frac{29}{4}$

56. $10\frac{3}{5} = \frac{10 \times 5 + 3}{5} = \frac{53}{5}$

57. $11\frac{5}{12} = \frac{11 \times 12 + 5}{12} = \frac{137}{12}$

58. $12\frac{1}{6} = \frac{12 \times 6 + 1}{6} = \frac{73}{6}$

$$59. 21\frac{3}{8} = \frac{21 \times 8 + 3}{8} = \frac{171}{8}$$

$$60. 15\frac{1}{2} = \frac{15 \times 2 + 1}{2} = \frac{31}{2}$$

$$61. 2\frac{3}{8} = \frac{2 \times 8 + 3}{8} = \frac{19}{8}$$

19 eighths

$$62. 2\frac{3}{5} = \frac{2 \times 5 + 3}{5} = \frac{13}{5}$$

13 fifths

$$63. 1\frac{3}{4} = \frac{1 \times 4 + 3}{4} = \frac{7}{4}$$

7 fourths

$$64. 5\frac{2}{3} = \frac{5 \times 3 + 2}{3} = \frac{17}{3}$$

17 thirds

$$65. 8 \overline{) 37} \quad 4\frac{5}{8}$$

$$66. 7 \overline{) 13} \quad 1\frac{6}{7}$$

$$67. 5 \overline{) 39} \quad 7\frac{4}{5}$$

$$68. 4 \overline{) 19} \quad 4\frac{3}{4}$$

$$69. 10 \overline{) 27} \quad 2\frac{7}{10}$$

$$70. 18 \overline{) 43} \quad 2\frac{7}{18}$$

$$71. 9 \overline{) 52} \quad 5\frac{7}{9}$$

$$72. 12 \overline{) 67} \quad 5\frac{7}{12}$$

$$73. 11 \overline{) 133} \quad 12\frac{1}{11}$$

$$74. 10 \overline{) 51} \quad 5\frac{1}{10}$$

$$75. 6 \overline{) 23} \quad 3\frac{5}{6}$$

$$76. 7 \overline{) 115} \quad 16\frac{3}{7}$$

$$77. 7 \overline{) 309} \quad 44\frac{1}{7}$$

$$78. \begin{array}{r} 230 \\ 4 \overline{) 921} \\ \underline{-8} \\ 12 \\ \underline{-12} \\ 1 \\ \underline{-0} \\ 1 \end{array} \quad 230\frac{1}{4}$$

$$79. \begin{array}{r} 1056 \\ 5 \overline{) 5281} \\ \underline{-5} \\ 2 \\ \underline{-0} \\ 28 \\ \underline{-25} \\ 31 \\ \underline{-30} \\ 1 \end{array} \quad 1056\frac{1}{5}$$

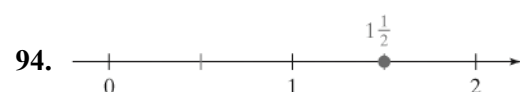
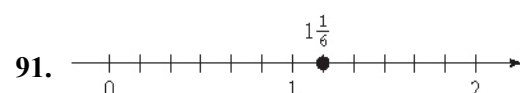
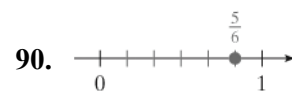
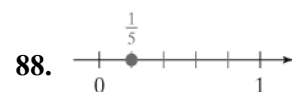
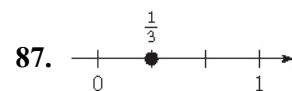
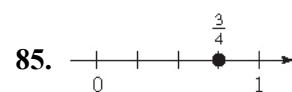
$$80. \begin{array}{r} 901 \\ 8 \overline{) 7213} \\ \underline{-72} \\ 1 \\ \underline{-0} \\ 13 \\ \underline{-8} \\ 5 \end{array} \quad 901\frac{5}{8}$$

$$81. \begin{array}{r} 810 \\ 11 \overline{) 8913} \\ \underline{-88} \\ 11 \\ \underline{-11} \\ 3 \\ \underline{-0} \\ 3 \end{array} \quad 810\frac{3}{11}$$

$$82. \begin{array}{r} 185 \\ 23 \overline{) 4257} \\ \underline{-23} \\ 195 \\ \underline{-184} \\ 117 \\ \underline{-115} \\ 2 \end{array} \quad 185\frac{2}{23}$$

$$83. \begin{array}{r} 12 \\ 15 \overline{) 187} \\ \underline{-15} \\ 37 \\ \underline{-30} \\ 7 \end{array} \quad 12\frac{7}{15}$$

$$84. \begin{array}{r} 20 \\ 34 \overline{) 695} \\ \underline{-68} \\ 15 \\ \underline{-0} \\ 15 \end{array} \quad 20\frac{15}{34}$$



95. False

97. True

96. True

98. True

Section 2.2 Prime Numbers and Factorization

Section 2.2 Practice Exercises

1. (a) factor
(b) prime
(c) composite
(d) prime

2. c. Between 2 and 3

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

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

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

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

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

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

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

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

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

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

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

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

15.

Product	36	42	30	15	81
Factor	12	7	30	15	27
Factor	3	6	1	1	3
Sum	15	13	31	16	30

16.

Product	36	42	45	72	24
Factor	9	7	15	18	8
Factor	4	6	3	4	3
Difference	5	13	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.

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

Yes, 84 is divisible by 28.

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

Yes, 110 is divisible by 22.

31. Prime

32. Prime

33. Composite $2 \cdot 5 = 10$

34. Composite $3 \cdot 7 = 21$

35. Composite $3 \cdot 17 = 51$

36. Composite $3 \cdot 19 = 57$

37. Prime

38. Prime

39. Neither

40. Neither

41. Composite $11 \cdot 11 = 121$

42. Composite $3 \cdot 23 = 69$

43. Prime

44. Prime

45. Composite $3 \cdot 13 = 39$

46. Composite $7 \cdot 7 = 49$

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

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

49. False; 9 is not prime.

50. False; 2 is not composite.

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

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

53. No, 9 is not a prime number.

54. No, 8 is not a prime number.

55. Yes

56. Yes

$$\begin{array}{r} 7 \\ 5 \overline{)35} \\ \underline{25} \\ 10 \\ 2 \overline{)70} \end{array} \quad 2 \cdot 5 \cdot 7 = 70$$

$$\begin{array}{r} 11 \\ 5 \overline{)55} \\ \underline{35} \\ 20 \\ 3 \overline{)165} \\ \underline{120} \\ 45 \\ 3 \overline{)495} \end{array} \quad 3 \cdot 3 \cdot 5 \cdot 11 = 3^2 \cdot 5 \cdot 11 = 495$$

$$\begin{array}{r} 13 \\ 5 \overline{)65} \\ \underline{25} \\ 40 \\ 2 \overline{)130} \\ \underline{104} \\ 26 \\ 2 \overline{)260} \end{array} \quad 2 \cdot 2 \cdot 5 \cdot 13 = 2^2 \cdot 5 \cdot 13 = 260$$

$$\begin{array}{r} 7 \\ 5 \overline{)35} \\ \underline{15} \\ 20 \\ 5 \overline{)175} \end{array} \quad 5 \cdot 5 \cdot 7 = 5^2 \cdot 7 = 175$$

$$\begin{array}{r} 7 \\ 7 \overline{)49} \\ \underline{21} \\ 28 \\ 3 \overline{)147} \end{array} \quad 3 \cdot 7 \cdot 7 = 3 \cdot 7^2 = 147$$

$$\begin{array}{r} 17 \\ 3 \overline{)51} \\ \underline{34} \\ 17 \\ 2 \overline{)102} \end{array} \quad 2 \cdot 3 \cdot 17 = 51$$

$$\begin{array}{r} 23 \\ 3 \overline{)69} \\ \underline{46} \\ 23 \\ 2 \overline{)138} \end{array} \quad 2 \cdot 3 \cdot 23 = 138$$

$$\begin{array}{r} 11 \\ 7 \overline{)77} \\ \underline{70} \\ 7 \\ 3 \overline{)231} \end{array} \quad 3 \cdot 7 \cdot 11 = 231$$

$$\begin{array}{r} 11 \\ 7 \overline{)77} \\ \underline{70} \\ 7 \\ 2 \overline{)154} \\ \underline{140} \\ 14 \\ 2 \overline{)308} \\ \underline{280} \\ 28 \\ 2 \overline{)616} \end{array} \quad 2 \cdot 2 \cdot 2 \cdot 7 \cdot 11 = 2^3 \cdot 7 \cdot 11 = 616$$

$$\begin{array}{r} 13 \\ 7 \overline{)91} \\ \underline{49} \\ 42 \\ 2 \overline{)182} \\ \underline{164} \\ 18 \\ 2 \overline{)364} \end{array} \quad 2 \cdot 2 \cdot 7 \cdot 13 = 2^2 \cdot 7 \cdot 13 = 364$$

67. 47 is prime.

68. 41 is prime.

69. 1, 2, 3, 4, 6, 12

70. 1, 2, 3, 6, 9, 18

71. 1, 2, 4, 8, 16, 32

72. 1, 5, 11, 55

73. 1, 3, 9, 27, 81

74. 1, 2, 3, 4, 5, 6, 10, 12, 15, 20, 30, 60

75. 1, 2, 3, 4, 6, 8, 12, 16, 24, 48

76. 1, 2, 3, 4, 6, 8, 9, 12, 18, 24, 36, 72

77. No; 30 is not divisible by 4.

78. No; 46 is not divisible by 4.

79. Yes; 16 is divisible by 4.

80. Yes; 64 is divisible by 4.

81. Yes; 32 is divisible by 8.

82. Yes; 520 is divisible by 8.

83. No; 126 is not divisible by 8.

84. No; 58 is not divisible by 8.

85. Yes; $3 + 9 + 6 = 18$ is divisible by 9.

86. Yes; $4 + 1 + 4 = 9$ is divisible by 9.

87. No; $8 + 4 + 5 + 3 = 20$ is not divisible by 9.

88. No; $1 + 5 + 8 + 7 = 21$ is not divisible by 9.

89. Yes; 522 is even and $5 + 2 + 2 = 9$ is divisible by 3.

90. Yes; 546 is even and $5 + 4 + 6 = 15$ is divisible by 3.

91. No; 5917 is not even.

92. No; $6 + 3 + 9 + 4 = 22$ is not divisible by 3.

Section 2.3 Simplifying Fractions to Lowest Terms

Section 2.3 Practice Exercises

1. lowest

2. (a) No
(b) Yes
(c) Yes
(d) No

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

4. $3 \overline{)57}$ $2 \cdot 3 \cdot 19 = 114$
 $2 \overline{)114}$

5. $2 \overline{)46}$ $2 \cdot 2 \cdot 23 = 2^2 \cdot 23 = 92$
 $2 \overline{)92}$

6. $3 \overline{)51}$ $3 \cdot 3 \cdot 17 = 3^2 \cdot 17 = 153$
 $3 \overline{)153}$

7. $5 \overline{)85}$ $5 \cdot 17 = 85$

8. $3 \overline{)15}$ $2 \cdot 2 \cdot 2 \cdot 3 \cdot 5 = 2^3 \cdot 3 \cdot 5 = 120$

$2 \overline{)30}$

$2 \overline{)60}$

$2 \overline{)120}$

9. $5 \overline{)65}$ $3 \cdot 5 \cdot 13 = 195$

$3 \overline{)195}$

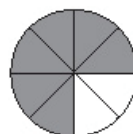
10. $3 \overline{)15}$ $2 \cdot 2 \cdot 3 \cdot 3 \cdot 5 = 2^2 \cdot 3^2 \cdot 5 = 180$

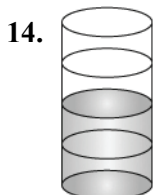
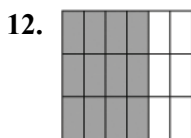
$3 \overline{)45}$

$2 \overline{)90}$

$2 \overline{)180}$

11.





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. $2 \times 5 \square 3 \times 3$ $\frac{2}{3} \neq \frac{3}{5}$
 $10 \neq 9$

18. $1 \times 9 \square 4 \times 2$
 $9 \neq 8$
 $\frac{1}{4} \neq \frac{2}{9}$

19. $1 \times 6 \square 2 \times 3$
 $6 = 6$
 $\frac{1}{2} = \frac{3}{6}$

20. $6 \times 8 \square 16 \times 3$
 $48 = 48$
 $\frac{6}{16} = \frac{3}{8}$

21. $12 \times 4 \square 16 \times 3$
 $48 = 48$
 $\frac{12}{16} = \frac{3}{4}$

22. $4 \times 15 \square 5 \times 12$
 $60 = 60$
 $\frac{4}{5} = \frac{12}{15}$

23. $8 \times 27 \square 9 \times 20$
 $216 \neq 180$
 $\frac{8}{9} \neq \frac{20}{27}$

24. $5 \times 18 \square 6 \times 12$
 $90 \neq 72$
 $\frac{5}{6} \neq \frac{12}{18}$

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

$$60. \frac{15+3}{15-3} = \frac{18}{12} = \frac{\cancel{6} \cdot 3}{\cancel{6} \cdot 2} = \frac{3}{2}$$

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

(b) Jared sold the greater fractional part

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

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

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

(b) Lisa has completed more of her course

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

75. (a) Raymond:

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

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

(b) Raymond read the greater fractional

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

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

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

77. (a) 300,000,000

(b) 36,000,000

$$(c) \frac{36,000,000}{300,000,000} = \frac{36}{300} = \frac{\cancel{2} \cdot \cancel{3} \cdot \cancel{2} \cdot 3}{\cancel{2} \cdot \cancel{2} \cdot \cancel{3} \cdot 5 \cdot 5} = \frac{3}{25}$$

78. (a) 300,000,000

(b) 75,000,000

$$(c) \frac{300,000,000}{75,000,000} = \frac{300}{75} = \frac{2 \cdot 2 \cdot \cancel{3} \cdot \cancel{3} \cdot \cancel{3}}{\cancel{3} \cdot \cancel{3} \cdot \cancel{3}} = \frac{4}{1}$$

(d) 4 times greater

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

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

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

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

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

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

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

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

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

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

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

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

Section 2.4 Multiplication of Fractions and Applications

Section 2.4 Practice Exercises

1. (a) one-tenth

(b) $\frac{1}{2}bh$

2. (a) $3\frac{2}{5}$

(b) $\frac{33}{8}$

3. Numerator: 10; denominator: 14

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

4. Numerator: 32; denominator: 36

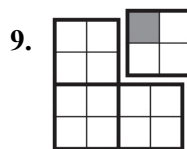
$$\frac{32}{36} = \frac{\cancel{2} \cdot \cancel{2} \cdot 2 \cdot 2 \cdot 2}{\cancel{2} \cdot \cancel{2} \cdot 3 \cdot 3} = \frac{8}{9}$$

5. Numerator: 25; denominator: 15

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

6. Numerator: 2100; denominator: 7000

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



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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

$$61. \left(\frac{1}{\cancel{5} \cdot \frac{1}{3}}\right)^2 = \left(\frac{1}{15}\right)^2 = \frac{1}{15} \cdot \frac{1}{15} = \frac{1}{225}$$

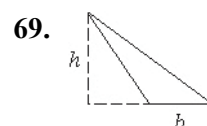
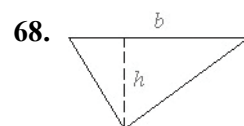
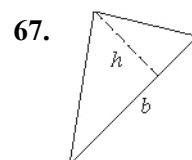
$$62. \left(\frac{\frac{1}{\cancel{30}}}{3} \cdot \frac{1}{\frac{100}{10}}\right)^2 = \left(\frac{1}{30}\right)^2 = \frac{1}{30} \cdot \frac{1}{30} = \frac{1}{900}$$

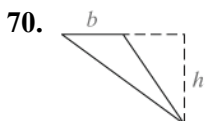
$$63. \frac{1}{3} \cdot \left(\frac{\frac{3}{\cancel{9}}}{1} \cdot \frac{\frac{2}{\cancel{4}}}{1}\right) = \frac{1}{\cancel{3}} \cdot \frac{\cancel{2}}{1} = 2$$

$$64. \frac{1}{6} \cdot \left(\frac{\frac{3}{\cancel{24}}}{1} \cdot \frac{\frac{6}{\cancel{30}}}{1}\right) = \frac{1}{\cancel{6}} \cdot \frac{\cancel{6}}{1} = 3$$

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

$$66. \frac{28}{6} \cdot \left(\frac{3}{2}\right)^2 = \frac{28}{\cancel{2}} \cdot \frac{\frac{3}{\cancel{4}}}{1} = \frac{21}{2}$$





$$71. A = \frac{1}{2}bh = \frac{1}{2}(11)(8) = \frac{1}{\cancel{2}} \cdot \frac{11}{1} \cdot \frac{\cancel{8}^4}{1} = 44 \text{ cm}^2$$

$$72. A = \frac{1}{2}bh = \frac{1}{2}(15)(12) = \frac{1}{\cancel{2}} \cdot \frac{15}{1} \cdot \frac{\cancel{12}^6}{1} = 90 \text{ in.}^2$$

$$73. A = \frac{1}{2}bh = \frac{1}{2}(8)(8) = \frac{1}{\cancel{2}} \cdot \frac{\cancel{8}^4}{1} \cdot \frac{8}{1} = 32 \text{ m}^2$$

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

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

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

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

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

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

$$80. A = l \times w = \frac{23}{\cancel{24}^8} \cdot \frac{\cancel{1}}{4} = \frac{23}{32} \text{ ft}^2$$

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

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

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

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

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

The amount left is 10 gal.

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

The cost is \$8250.

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

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

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

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

$$89. \frac{3}{4} \cdot 5\frac{1}{2} = \frac{3}{4} \cdot \frac{11}{2} = \frac{33}{8} = 4\frac{1}{8} \text{ Corrine will}$$

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

$$90. \frac{3}{8} \cdot 140\frac{2}{3} = \frac{3}{8} \cdot \frac{422}{3} = \frac{1}{4} \cdot \frac{211}{1} = \frac{211}{8} = 52\frac{3}{4};$$

$52\frac{3}{4}$ lb must be destroyed.

$$91. \frac{2}{3} \cdot 9,825,000 = \frac{2}{3} \cdot \frac{9,825,000}{1} = 6,550,000$$

There are 6,550,000 viewers.

$$92. 3 \cdot \frac{3}{4} = \frac{3}{1} \cdot \frac{3}{4} = \frac{9}{4} \text{ or } 2\frac{1}{4}$$

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

$$93. \text{ First place: } \frac{2}{3} \cdot 1200 = \frac{2}{3} \cdot \frac{1200}{1} = \$800$$

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

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

$$94. \frac{2}{3} \cdot (40)(36) = \frac{2}{3} \cdot \frac{40}{1} \cdot \frac{36}{1} = 960$$

$$40 \times 36 = 1440$$

$$1440 - 960 = 480$$

Frankie mowed 960 yd^2 . He has 480 yd^2 left to mow.

$$95. (a) \left(\frac{1}{6}\right)^2 = \frac{1}{6} \cdot \frac{1}{6} = \frac{1}{36}$$

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

$$96. (a) \left(\frac{2}{7}\right)^2 = \frac{2}{7} \cdot \frac{2}{7} = \frac{4}{49}$$

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

$$97. \sqrt{\frac{1}{25}} = \sqrt{\frac{1}{5} \cdot \frac{1}{5}} = \frac{1}{5}$$

$$98. \sqrt{\frac{1}{100}} = \sqrt{\frac{1}{10} \cdot \frac{1}{10}} = \frac{1}{10}$$

$$99. \sqrt{\frac{64}{81}} = \sqrt{\frac{8}{9} \cdot \frac{8}{9}} = \frac{8}{9}$$

$$100. \sqrt{\frac{9}{4}} = \sqrt{\frac{3}{2} \cdot \frac{3}{2}} = \frac{3}{2}$$

$$101. \frac{1}{2}, \frac{1}{4} = \frac{1}{2 \cdot 2}, \frac{1}{8} = \frac{1}{4 \cdot 2}, \frac{1}{16} = \frac{1}{8 \cdot 2}$$

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

$$102. \frac{2}{3}, \frac{2}{9} = \frac{2}{3 \cdot 3}, \frac{2}{27} = \frac{2}{9 \cdot 3}$$

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

$$103. \frac{1}{2} \left(\frac{1}{8}\right) = \frac{1}{16}$$

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

They are the same.

$$104. \frac{2}{3} \left(\frac{1}{4}\right) = \frac{2}{12} = \frac{1}{6}$$

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

They are the same.

Section 2.5 Division of Fractions and Applications

Section 2.5 Practice Exercises

1. reciprocals

2. $2^2 \cdot 3^3$

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

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

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

6. $3 \cdot \left(\frac{7}{6}\right) = \frac{\cancel{7}_1}{1} \cdot \frac{7}{\cancel{2}_2} = \frac{7}{2}$

7. $8 \cdot \left(\frac{5}{24}\right) = \frac{\cancel{8}_1}{1} \cdot \frac{5}{\cancel{24}_3} = \frac{5}{3}$

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

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

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

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

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

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

19. No reciprocal exists.

20. No reciprocal exists.

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

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

23. multiplying

24. multiplying

25. $\frac{2}{15} \div \frac{5}{12} = \frac{2}{15} \cdot \frac{12}{5} = \frac{2}{\cancel{5}_5} \cdot \frac{\cancel{2} \cdot \cancel{2} \cdot \cancel{3}}{5} = \frac{8}{25}$

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

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

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

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

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

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

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

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

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

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

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

$$37. \frac{12}{5} \div 4 = \frac{\cancel{12}^3}{5} \cdot \frac{1}{\cancel{4}_1} = \frac{3}{5}$$

$$38. \frac{20}{6} \div 5 = \frac{\cancel{20}^4}{6} \cdot \frac{1}{\cancel{5}_1} = \frac{4}{6} = \frac{2}{3}$$

$$39. \frac{9}{50} \div \frac{18}{25} = \frac{\cancel{9}^1}{50} \cdot \frac{\cancel{25}^1}{\cancel{18}_2} = \frac{1}{4}$$

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

$$41. \frac{10}{9} \div \frac{1}{18} = \frac{10}{\cancel{9}_1} \cdot \frac{\cancel{18}^2}{1} = 20$$

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

$$43. 12 \cdot \frac{4}{3} = \frac{\cancel{12}^4}{1} \cdot \frac{4}{\cancel{3}_1} = 16$$

$$44. 24 \cdot \frac{5}{8} = \frac{\cancel{24}^3}{1} \cdot \frac{5}{\cancel{8}_1} = 15$$

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

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

$$47. \frac{\cancel{36}^4}{\cancel{8}_1} \cdot \frac{\cancel{25}^5}{\cancel{5}_1} = 20$$

$$48. \frac{13}{\cancel{8}_1} \cdot \frac{\cancel{10}^2}{17} = \frac{26}{17}$$

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

multiplies 8 by $\frac{3}{2}$. So $8 \cdot \frac{2}{3} = \frac{8}{1} \cdot \frac{2}{3} = \frac{16}{3}$

and $8 \div \frac{2}{3} = \frac{\cancel{8}^4}{1} \cdot \frac{3}{\cancel{2}_1} = 12.$

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

$$= \frac{\cancel{27}^3}{7} \cdot \frac{1}{\cancel{9}_1} = \frac{3}{7}$$

$$68. \frac{48}{56} \div \frac{3}{8} \div 8 = \frac{\cancel{48}^{16}}{\cancel{56}_7} \cdot \frac{\cancel{8}^1}{\cancel{3}_1} \div 8 = \frac{16}{7} \div 8$$

$$= \frac{\cancel{16}^2}{7} \cdot \frac{1}{\cancel{8}_1} = \frac{2}{7}$$

$$69. \frac{3}{5} \div \frac{6}{7} \cdot \frac{5}{3} = \frac{\cancel{3}^1}{5} \cdot \frac{7}{\cancel{6}_2} \cdot \frac{5}{3} = \frac{7}{\cancel{10}_2} \cdot \frac{\cancel{5}^1}{3} = \frac{7}{6}$$

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

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

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

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

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

$$75. \left(\frac{63}{8} \div \frac{9}{4}\right)^2 \cdot 4 = \left(\frac{\cancel{63}^7}{\cancel{8}_2} \cdot \frac{\cancel{4}^1}{\cancel{9}_3}\right)^2 \cdot 4 = \left(\frac{7}{2}\right)^2 \cdot 4 \\ = \frac{7}{2} \cdot \frac{7}{2} \cdot \frac{4}{1} = \frac{49}{\cancel{4}_1} \cdot \frac{\cancel{4}^1}{1} = 49$$

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

$$77. \frac{15}{16} \cdot \left(\frac{2}{3}\right)^2 \div \frac{20}{21} = \frac{15}{16} \cdot \left(\frac{2}{3} \cdot \frac{2}{3}\right) \div \frac{20}{21} \\ = \frac{15}{16} \cdot \frac{4}{9} \div \frac{20}{21} = \frac{\cancel{15}^3 \cdot \cancel{4}^2}{\cancel{16}_4 \cdot 9} \cdot \frac{\cancel{21}^7}{\cancel{20}_4} \div \frac{20}{21} \\ = \frac{5}{12} \div \frac{20}{21} = \frac{5}{12} \cdot \frac{21}{20} \\ = \frac{\cancel{5}^1}{\cancel{4} \cdot 3} \cdot \frac{\cancel{7}^1 \cdot 3}{4 \cdot \cancel{2}} = \frac{7}{16}$$

$$78. \frac{8}{27} \cdot \left(\frac{3}{4}\right)^2 \div \frac{13}{18} = \frac{8}{27} \cdot \left(\frac{3}{4} \cdot \frac{3}{4}\right) \div \frac{13}{18} \\ = \frac{8}{27} \cdot \frac{9}{16} \div \frac{13}{18} = \frac{\cancel{8}^2 \cdot \cancel{9}^3}{\cancel{27}_3 \cdot \cancel{16}_4} \cdot \frac{\cancel{18}^6}{\cancel{13}_1} \div \frac{13}{18} \\ = \frac{1}{6} \div \frac{13}{18} = \frac{1}{6} \cdot \frac{18}{13} = \frac{\cancel{1}^1 \cdot \cancel{18}^2}{\cancel{6}_2 \cdot 13} = \frac{3}{13}$$

$$79. \frac{9}{4} \div \frac{1}{8} = \frac{9}{\cancel{4}_1} \cdot \frac{\cancel{8}^2}{1} = 18$$

$$80. \frac{4}{3} \div \frac{1}{6} = \frac{4}{\cancel{3}_1} \cdot \frac{\cancel{6}^2}{1} = 8$$

$$81. 36 \div \frac{2}{3} = \frac{\cancel{36}^{18}}{\cancel{2}_1} \cdot \frac{3}{\cancel{3}_1} = 54$$

Li wrapped 54 packages.

$$82. 60 \div \frac{3}{4} = \frac{\cancel{60}^{20}}{\cancel{3}_1} \cdot \frac{4}{\cancel{4}_1} = 80$$

She can sell 80 parcels of land.

$$83. \frac{3}{2} \div \frac{1}{16} = \frac{3}{\cancel{2}_1} \cdot \frac{\cancel{16}^8}{1} = 24 \text{ cups of juice}$$

$$84. \frac{5}{4} \div \frac{1}{100} = \frac{5}{\cancel{4}_1} \cdot \frac{\cancel{100}^{25}}{1} = 125 \text{ cm}$$

$$85. 16 \cdot \frac{3}{4} = \frac{\cancel{16}^4}{1} \cdot \frac{3}{\cancel{4}_1} = 12$$

The stack will be 12 in. high.

$$86. 24 \cdot \frac{5}{4} = \frac{\cancel{24}^6}{1} \cdot \frac{5}{\cancel{4}_1} = 30$$

Yes, the books will take up only 30 in.

$$87. (a) 18 \div \frac{2}{3} = \frac{\cancel{18}^9}{1} \cdot \frac{3}{\cancel{2}_1} = 27$$

27 commercials in 1 hr

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

648 commercials in 1 day

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

40 commercials in 1 hr

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

960 commercials in 1 day

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

The down payment is \$24,000.

$$\frac{2}{3} \cdot 24,000 = \frac{2}{\cancel{3}_1} \cdot \frac{\cancel{24,000}^{8000}}{1} = 16,000$$

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

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

Ricardo will have to pay \$8000.

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

He will have to finance \$216,000.

$$90. (a) \frac{1}{12} \cdot 19,560 = \frac{1}{12} \cdot \frac{19,560}{1} = \frac{\cancel{19,560}^{1630}}{12} = 1630$$

The down payment is \$1630.

$$(b) \frac{1}{2} \cdot 1630 = \frac{1}{\cancel{2}_1} \cdot \frac{\cancel{1630}^{815}}{1} = 815$$

\$815 = \$815

Althea will have to pay \$815.

$$(c) \$19,560 - \$1630 = \$17,930$$

She will have to finance \$17,930.

$$91. (a) \frac{1}{\cancel{2}_1} \cdot \frac{\cancel{3}}{\cancel{4}_1} = \frac{3}{4}$$

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

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

$$\frac{\cancel{1}}{\cancel{2}_1} \cdot \frac{\cancel{3}}{\cancel{4}_2} = \frac{3}{2} \text{ or } 1\frac{1}{2} \text{ acres}$$

$$92. (a) \frac{1}{6} \cdot (24 + 18) = \frac{1}{6} \cdot (42) = \frac{1}{\cancel{6}_1} \cdot \frac{\cancel{42}^7}{1} = 7$$

Josh has read 7 pages.

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

He still must read 35 pages.

$$93. \frac{7}{4} \div \frac{1}{8} = \frac{7}{\cancel{4}_1} \cdot \frac{\cancel{8}^2}{1} = 14$$

She can prepare 14 samples.

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

Tony must make 14 strikes.

95. The length is 12 ft, because

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

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

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

97. The product will be less than 47 because $\frac{3}{5}$ is less than one.

98. The product will be less than 81 because $\frac{4}{7}$ is less than one.

99. The quotient will be more than 25 because $\frac{2}{3}$ is between zero and one.

100. The quotient will be more than 41 because $\frac{2}{11}$ is between zero and one.

Problem Recognition Exercises: Multiplication and Division of Fractions

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

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

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

$$(d) \frac{6}{5} \div \frac{8}{3} = \frac{6}{5} \cdot \frac{3}{8} = \frac{\cancel{6}^3 \cdot 3}{5 \cdot \cancel{8}_4 \cdot 2} = \frac{9}{20}$$

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

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

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

$$(d) \frac{12}{7} \div \frac{10}{3} = \frac{12}{7} \cdot \frac{3}{10} = \frac{\cancel{12}^6 \cdot 3}{7 \cdot \cancel{10}_5 \cdot 2} = \frac{18}{35}$$

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

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

$$(c) 12 \div \frac{9}{8} = \frac{12}{1} \cdot \frac{8}{9} = \frac{\cancel{12}^4 \cdot 8}{1 \cdot \cancel{9}_3 \cdot 3} = \frac{32}{3}$$

$$(d) \frac{9}{8} \div 12 = \frac{9}{8} \cdot \frac{1}{12} = \frac{\cancel{9}^3 \cdot 1}{8 \cdot \cancel{12}_4 \cdot 3} = \frac{3}{32}$$

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

$$(b) \frac{3}{5} \cdot 15 = \frac{3}{5} \cdot \frac{15}{1} = \frac{3 \cdot \cancel{15}_3 \cdot 1}{\cancel{5}_1 \cdot 1} = \frac{9}{1} = 9$$

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

$$(d) \frac{3}{5} \div 15 = \frac{3}{5} \cdot \frac{1}{15} = \frac{\cancel{3} \cdot 1}{5 \cdot \cancel{15}_3 \cdot 5} = \frac{1}{25}$$

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

(c) $6 \cdot 10 = 60$

(d) $10 \cdot 6 = 60$

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

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

(c) $8 \div 4 = 2$

(d) $8 \cdot 4 = 32$

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

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

- (c) $\frac{1}{7} \cdot \frac{1}{2} = \frac{1}{14}$
- (d) $\frac{1}{7} \div \frac{1}{2} = \frac{1}{7} \cdot \frac{2}{1} = \frac{2}{7}$
15. (a) $4^2 \cdot \frac{1}{6} = 4 \cdot 4 \cdot \frac{1}{6} = 16 \cdot \frac{1}{6} = \frac{\cancel{2} \cdot 8}{1 \cdot \cancel{3}} = \frac{8}{3}$
- (b) $4^2 \div \frac{1}{6} = 4 \cdot 4 \div \frac{1}{6} = 16 \cdot \frac{6}{1} = 16 \cdot 6 = 96$
- (c) $4 \cdot \left(\frac{1}{6}\right)^2 = \frac{4}{1} \cdot \frac{1}{6} \cdot \frac{1}{6} = \frac{4}{36} = \frac{\cancel{4}}{\cancel{4} \cdot 9} = \frac{1}{9}$
- (d) $4 \div \left(\frac{1}{6}\right)^2 = \frac{4}{1} \div \left(\frac{1}{6} \cdot \frac{1}{6}\right) = \frac{4}{1} \div \left(\frac{1}{36}\right) = \frac{4}{1} \cdot \frac{36}{1} = 144$
16. (a) $\left(\frac{1}{2}\right)^2 \cdot \frac{2}{3} = \frac{1}{2} \cdot \frac{1}{\cancel{2}} \cdot \frac{\cancel{2}}{3} = \frac{1}{6}$
- (b) $\left(\frac{1}{2}\right)^2 \div \frac{2}{3} = \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{3}{2} = \frac{3}{8}$
- (c) $\frac{1}{2} \cdot \left(\frac{2}{3}\right)^2 = \frac{1}{\cancel{2}} \cdot \frac{\cancel{2}}{3} \cdot \frac{\cancel{2}}{3} = \frac{2}{9}$
- (d) $\frac{1}{2} \div \left(\frac{2}{3}\right)^2 = \frac{1}{2} \div \left(\frac{2}{3} \cdot \frac{2}{3}\right) = \frac{1}{2} \div \frac{4}{9} = \frac{1}{2} \cdot \frac{9}{4} = \frac{9}{8}$

Section 2.6 Multiplication and Division of Mixed Numbers

Section 2.6 Practice Exercises

1. improper

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

$$\begin{array}{r} 72 \\ 2 \overline{) 145} \\ \underline{-14} \\ 5 \\ \underline{-4} \\ 1 \end{array} = 72\frac{1}{2}$$

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

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

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

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

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

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

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

$$33. 1\frac{7}{10} \div 2\frac{3}{4} = \frac{17}{10} \div \frac{11}{4} = \frac{17}{\cancel{10}_5} \cdot \frac{\cancel{4}^2}{11} = \frac{34}{55}$$

$$34. 5\frac{1}{10} \div \frac{3}{4} = \frac{51}{10} \div \frac{3}{4} = \frac{\cancel{51}^{17}}{\cancel{10}_5} \cdot \frac{\cancel{4}^2}{\cancel{3}_1} = \frac{34}{5} = 6\frac{4}{5}$$

$$35. 5\frac{8}{9} \div 1\frac{1}{3} = \frac{53}{9} \div \frac{4}{3} = \frac{53}{\cancel{9}_3} \cdot \frac{\cancel{3}^1}{4} = \frac{53}{12} = 4\frac{5}{12}$$

$$36. 12\frac{4}{5} \div 2\frac{3}{5} = \frac{64}{5} \div \frac{13}{5} = \frac{64}{\cancel{5}_1} \cdot \frac{\cancel{5}^1}{13} = \frac{64}{13} = 4\frac{12}{13}$$

$$37. 2\frac{1}{2} \div 1\frac{1}{16} = \frac{5}{2} \div \frac{17}{16} = \frac{5}{\cancel{2}_1} \cdot \frac{\cancel{16}^8}{17} = \frac{40}{17} = 2\frac{6}{17}$$

$$38. 7\frac{3}{5} \div 1\frac{7}{12} = \frac{38}{5} \div \frac{19}{12} = \frac{\cancel{38}^2}{5} \cdot \frac{12}{\cancel{19}_1} = \frac{24}{5} = 4\frac{4}{5}$$

$$39. 4\frac{1}{2} \div 2\frac{1}{4} = \frac{9}{2} \div \frac{9}{4} = \frac{\cancel{9}^1}{\cancel{2}_1} \cdot \frac{\cancel{4}^2}{\cancel{9}_1} = 2$$

$$40. 5\frac{5}{6} \div 2\frac{1}{3} = \frac{35}{6} \div \frac{7}{3} = \frac{\cancel{35}^5}{\cancel{6}_2} \cdot \frac{\cancel{3}^1}{\cancel{7}_1} = \frac{5}{2} = 2\frac{1}{2}$$

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

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

$$43. 2\frac{5}{6} \div \frac{1}{6} = \frac{17}{6} \div \frac{1}{6} = \frac{17}{\cancel{6}_1} \cdot \frac{\cancel{6}^1}{1} = 17$$

$$44. 6\frac{1}{2} \div \frac{1}{2} = \frac{13}{2} \div \frac{1}{2} = \frac{13}{\cancel{2}_1} \cdot \frac{\cancel{2}^1}{1} = 13$$

$$45. 1\frac{1}{3} \div \frac{2}{7} = \frac{4}{3} \div \frac{2}{7} = \frac{\cancel{4}^2}{\cancel{3}_1} \cdot \frac{\cancel{7}^1}{\cancel{2}_1} = \frac{14}{3} = 4\frac{2}{3}$$

$$46. 2\frac{1}{7} \div \frac{5}{13} = \frac{15}{7} \div \frac{5}{13} = \frac{15}{7} \cdot \frac{13}{\cancel{5}_1} = \frac{39}{7} = 5\frac{4}{7}$$

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

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

$$49. 4\frac{3}{4} \cdot 8 = \frac{19}{\cancel{4}_1} \cdot \frac{\cancel{8}^2}{1} = 38$$

Tabitha earned \$38.

$$50. 2\frac{2}{3} \cdot 10,500 = \frac{8}{\cancel{3}_1} \cdot \frac{\cancel{10,500}^{3500}}{1} = 28,000$$

The land will cost Kurt \$28,000.

$$51. 25\frac{7}{10} \cdot 25 = \frac{257}{\cancel{10}_2} \cdot \frac{\cancel{25}^5}{1} = \frac{1285}{2} = 642\frac{1}{2}$$

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

$$52. 12 \div \frac{3}{4} = \frac{12}{1} \cdot \frac{\cancel{4}^4}{\cancel{3}_1} = \frac{16}{1} = 16$$

Kayla will have 16 doses.

$$53. (a) 1\frac{3}{4} \div \frac{1}{4} = \frac{7}{4} \div \frac{1}{4} = \frac{7}{\cancel{4}_1} \cdot \frac{\cancel{4}^1}{1} = 7 \text{ weeks old}$$

$$(b) 2\frac{1}{8} \div \frac{1}{4} = \frac{17}{8} \div \frac{1}{4} = \frac{17}{\cancel{8}_2} \cdot \frac{\cancel{4}^1}{\cancel{1}_1} = \frac{17}{2} = 8\frac{1}{2} \text{ weeks old}$$

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

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

$$55. (a) \text{ Lucy: } 35\frac{1}{2} \times 14 = \frac{71}{\cancel{2}_1} \cdot \frac{\cancel{14}^7}{1} = 497$$

$$\text{Ricky: } 42\frac{1}{2} \times 10 = \frac{85}{\cancel{2}_1} \cdot \frac{\cancel{10}^5}{1} = 425$$

$$497 - 425 = 72$$

Lucy earned \$72 more than Ricky.

$$(b) 497 + 425 = 922$$

Together they earned \$922.

$$56. 28 \div 1\frac{17}{24} = \frac{28}{1} \div \frac{41}{24} = \frac{28}{1} \cdot \frac{24}{41} = \frac{672}{41} = 16\frac{16}{41}$$

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

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

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

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

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

$$61. \frac{2}{3} \cdot 2\frac{7}{10} = \frac{\cancel{2}_1}{\cancel{3}_1} \cdot \frac{\cancel{27}^9}{\cancel{10}_5} = \frac{9}{5} = 1\frac{4}{5}$$

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

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

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

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

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

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

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

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

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

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

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

$$73. \left(3\frac{2}{5}\right)\left(\frac{7}{34}\right)\left(3\frac{3}{4}\right) = \frac{\cancel{17}^1}{\cancel{5}_1} \cdot \frac{7}{\cancel{34}_{\cancel{2}_2}} \cdot \frac{\cancel{15}^3}{4} = \frac{21}{8}$$

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

$$74. \left(5\frac{1}{6}\right)\left(1\frac{4}{7}\right)\left(\frac{14}{33}\right) = \frac{31}{6} \cdot \frac{\cancel{14}^1}{\cancel{7}_1} \cdot \frac{\cancel{14}^2}{\cancel{33}_3}$$

$$= \frac{62}{18} = \frac{31}{9} = 3\frac{4}{9}$$

$$75. 7\frac{1}{8} \div 1\frac{1}{3} \div 2\frac{1}{4} = \frac{57}{8} \div \frac{4}{3} \div \frac{9}{4}$$

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

$$76. 3\frac{1}{8} \div 5\frac{5}{7} \div 1\frac{5}{16} = \frac{25}{8} \div \frac{40}{7} \div \frac{21}{16}$$

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

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

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

56 bricks will be needed.

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

The total cost is \$168.

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

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

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

It costs Sara \$15 each day.

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

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

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

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

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

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

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

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

Chapter 2 Review Exercises

Section 2.1

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

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

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

(b) Improper

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

(b) Proper

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

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

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

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

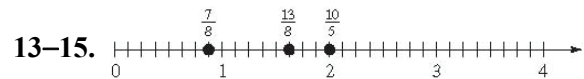
$$9. 11\frac{2}{5} = \frac{11 \times 5 + 2}{5} = \frac{57}{5}$$

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

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

$$\begin{array}{r} 47 \\ -45 \\ \hline 2 \end{array}$$

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



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

$$\begin{array}{r} 134 \\ -7 \\ \hline 24 \\ -21 \\ \hline 31 \\ -28 \\ \hline 3 \end{array}$$

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

$$\begin{array}{r} 60 \\ -156 \\ \hline 22 \\ -0 \\ \hline 22 \end{array}$$

Section 2.2

$$18. 21, 51, 1200$$

$$19. 55, 140, 260, 1200$$

$$20. 58, 124, 140, 260, 1200$$

$$21. \text{ Prime}$$

22. Composite $44 = 4 \times 11$

23. Neither

24. Neither

25. $2 \overline{)4}$

$2 \overline{)8}$

$2 \overline{)16}$

$2 \overline{)32}$

$2 \overline{)64}$

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

26. $5 \overline{)11}$

$3 \overline{)165}$

$2 \overline{)330}$

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

27. $3 \overline{)9}$

$5 \overline{)45}$

$5 \overline{)225}$

$2 \overline{)450}$

$2 \overline{)900}$

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

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

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

Section 2.3

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

$18 \neq 30$

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

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

$210 = 210$

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

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

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

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

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

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

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

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

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

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

$45 - 42 = 3$

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

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

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

Section 2.4

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

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

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

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

$$46. \frac{\frac{1}{\cancel{2}_1} \cdot \frac{1}{\cancel{8}_4} \cdot \frac{\cancel{26}^1}{\cancel{25}_5}}{\frac{1}{\cancel{8}_4} \cdot \frac{1}{\cancel{2}_1} \cdot \frac{\cancel{25}_5}} = \frac{1}{5}$$

$$47. \frac{\frac{\cancel{45}^1}{\cancel{7}_1} \cdot \frac{\cancel{6}^3}{\cancel{10}_2} \cdot \frac{\cancel{28}^4}{\cancel{63}_7}}{\frac{\cancel{7}_1}{\cancel{7}_1} \cdot \frac{\cancel{10}_2}{\cancel{10}_2} \cdot \frac{\cancel{63}_7}} = \frac{12}{7}$$

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

$$49. \left(\frac{2}{5}\right)^2 \cdot \left(\frac{1}{10}\right)^2 = \left(\frac{2}{5} \cdot \frac{2}{5}\right) \cdot \left(\frac{1}{10} \cdot \frac{1}{10}\right) \\ = \frac{\cancel{2}^1}{25} \cdot \frac{1}{\cancel{100}_{25}} \\ = \frac{1}{625}$$

$$50. \left(\frac{\frac{1}{\cancel{20}_{10}} \cdot \frac{1}{\cancel{2}_1}}{\frac{1}{\cancel{20}_{10}} \cdot \frac{1}{\cancel{2}_1}}\right)^3 = \left(\frac{1}{10}\right)^3 = \frac{1}{10} \cdot \frac{1}{10} \cdot \frac{1}{10} = \frac{1}{1000}$$

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

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

$$53. A = lw$$

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

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

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

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

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

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

There are 900 African American students.

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

There are 300 Asian American students.

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

There are 300 Hispanic female students.

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

There are 750 Caucasian male students.

Section 2.5

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

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

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

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

66. Reciprocal does not exist.

$$67. 6$$

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

69. multiplying

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

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

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

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

$$74. \frac{200}{51} \div \frac{25}{17} = \frac{200}{51} \cdot \frac{17}{25} = \frac{\cancel{25}^1 \cdot 8}{\cancel{17}_1 \cdot 3} \cdot \frac{\cancel{17}^1}{\cancel{25}_1} = \frac{8}{3}$$

$$75. 12 \div \frac{6}{7} = \frac{\cancel{12}^2}{1} \cdot \frac{7}{\cancel{6}_1} = 14$$

$$76. \left(\frac{2}{19} \div \frac{8}{19} \right)^3 = \left(\frac{\cancel{2}^1}{\cancel{19}_1} \cdot \frac{\cancel{19}^1}{\cancel{8}_4} \right)^3 = \left(\frac{1}{4} \right)^3 \\ = \frac{1}{4} \cdot \frac{1}{4} \cdot \frac{1}{4} = \frac{1}{64}$$

$$77. \left(\frac{12}{5} \right)^2 \div \frac{36}{5} = \frac{144}{25} \div \frac{36}{5} = \frac{144}{25} \cdot \frac{5}{36} \\ = \frac{\cancel{36}^1 \cdot 4}{\cancel{36}_1 \cdot 5} \cdot \frac{\cancel{5}^1}{\cancel{36}_1} = \frac{4}{5}$$

$$78. \frac{81}{55} \div \frac{3}{11} \div \frac{3}{2} = \frac{\cancel{81}^9}{\cancel{55}_5} \cdot \frac{\cancel{11}^1}{\cancel{3}_1} \cdot \frac{2}{\cancel{3}_1} = \frac{18}{5}$$

$$79. \frac{4}{13} \cdot \left(\frac{1}{2} \right)^3 \div 2 = \frac{\cancel{4}^1}{13} \cdot \frac{1}{\cancel{8}_2} \div 2 = \frac{1}{26} \div 2 \\ = \frac{1}{26} \cdot \frac{1}{2} = \frac{1}{52}$$

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

$$81. 18 \div \frac{2}{3} = \frac{\cancel{18}^9}{1} \cdot \frac{3}{\cancel{2}_1} = 27$$

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

36 bags of candy

$$83. \frac{4}{5} \cdot 40 = \frac{4}{\cancel{5}_1} \cdot \frac{\cancel{40}^8}{1} = 32 \text{ hr}$$

$32 \times \$18 = \576

Amelia earned \$576.

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

$$\frac{16}{9} \cdot 10 \cdot 12 = \frac{16}{\cancel{9}_3} \cdot \frac{10}{1} \cdot \frac{\cancel{12}^4}{1} = \frac{640}{3}$$

The area is $\frac{640}{3}$ or $213\frac{1}{3}$ ft².

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

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

Section 2.6

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

$$\begin{array}{r} 15 \overline{) 352} \\ \underline{-30} \\ 52 \\ \underline{-45} \\ 7 \end{array} = 23\frac{7}{15}$$

$$87. \left(11\frac{1}{3}\right)\left(2\frac{3}{34}\right) = \frac{\cancel{34}^1}{3} \cdot \frac{71}{\cancel{34}_1} = \frac{71}{3} = 23\frac{2}{3}$$

$$88. 6\frac{1}{2} \cdot 1\frac{3}{13} = \frac{\cancel{13}^1}{2} \cdot \frac{\cancel{16}^8}{\cancel{13}_1} = 8$$

$$89. 4 \cdot \left(5\frac{5}{8}\right) = \frac{\cancel{8}^1}{1} \cdot \frac{45}{\cancel{8}_2} = \frac{45}{2} = 22\frac{1}{2}$$

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

$$91. 4\frac{5}{16} \div 2\frac{7}{8} = \frac{69}{16} \div \frac{23}{8} = \frac{\cancel{69}^3}{\cancel{16}_2} \cdot \frac{\cancel{8}^1}{\cancel{23}_1} = \frac{3}{2} = 1\frac{1}{2}$$

$$92. 3\frac{5}{11} \div 3\frac{4}{5} = \frac{38}{11} \div \frac{19}{5} = \frac{\cancel{38}^2}{\cancel{11}_1} \cdot \frac{5}{\cancel{19}_1} = \frac{10}{11}$$

$$93. 7 \div 1\frac{5}{9} = \frac{7}{1} \div \frac{14}{9} = \frac{\cancel{7}^1}{1} \cdot \frac{9}{\cancel{14}_2} = \frac{9}{2} = 4\frac{1}{2}$$

$$94. 4\frac{6}{11} \div 2 = \frac{50}{11} \div \frac{2}{1} = \frac{\cancel{50}^{25}}{\cancel{11}_1} \cdot \frac{1}{\cancel{2}_1} = \frac{25}{11} = 2\frac{3}{11}$$

$$95. 10\frac{1}{5} \div 17 = \frac{51}{5} \div \frac{17}{1} = \frac{\cancel{51}^3}{\cancel{5}_1} \cdot \frac{1}{\cancel{17}_1} = \frac{3}{5}$$

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

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

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

$$98. 12\frac{1}{2} \div 1\frac{1}{4} = \frac{25}{2} \div \frac{5}{4} = \frac{\cancel{25}^5}{\cancel{2}_1} \cdot \frac{\cancel{4}^2}{\cancel{5}_1} = 10$$

There will be 10 pieces.

Chapter 2 Test

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

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