

Prealgebra 6th edition Tussy Solutions Manual

SKU: 9781337615808-SOLUTIONS

CHAPTER 1 Whole Numbers

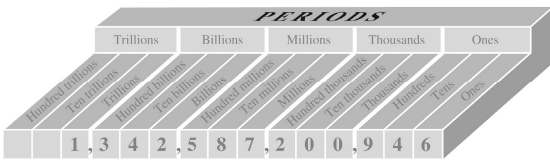
Section 1.1: An Introduction to the Whole Numbers

VOCABULARY

1. The numbers 0, 1, 2, 3, 4, 5, 6, 7, 8, and 9 are the digits.
2. The set of whole numbers is $\{0, 1, 2, 3, 4, 5, \dots\}$
3. When we write five thousand eighty-nine as 5,089, we are writing the number in standard form.
4. To make large whole numbers easier to read, we use commas to separate their digits into groups of three, called periods.
5. When 297 is written as $200 + 90 + 7$, we are writing 297 in expanded form.
6. Using a process called *graphing* we can represent whole numbers as points on a number line.
7. The symbols $<$ and $>$ are inequality symbols.
8. If we round 627 to the nearest ten, we get 630.

CONCEPTS

9.



10.
 - a. $5467010 = 5,467,010$
 - b. seventy-two million, four hundred twelve thousand, six hundred thirty-five
11.
 - a. forty
 - b. ninety
 - c. sixty-eight
 - d. fifteen
12.
 - a. 81,692
 - b. 965,347

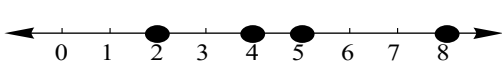
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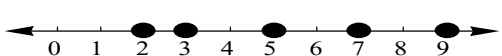
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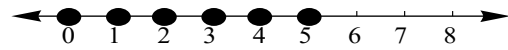
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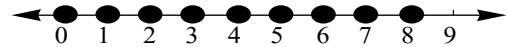
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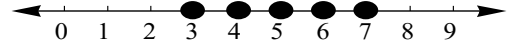
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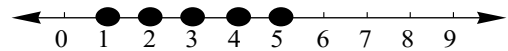
18.



19.



20.



NOTATION

21. The symbols $\{ \}$, called braces, are used when writing a set.
22. The symbol $>$ means is greater than, and the symbol $<$ means is less than.

GUIDED PRACTICE

23. a. 3 tens
b. 7
c. 6 hundreds
d. 5
24. a. 8 thousands
b. 9
c. 2 ten thousands
d. 1
25. a. 6 millions
b. 7
c. 3 ten millions
d. 9
26. a. 5 hundreds
b. 8
c. 2 billions
d. 7
27. 93 = ninety-three
28. 48 = forty-eight
29. 732 = seven hundred thirty-two
30. 259 = two hundred fifty-nine
31. 154,302 = one hundred fifty-four thousand, three hundred two
32. 615,019 = six hundred fifteen thousand, nineteen
33. 14,432,500 = fourteen million, four hundred thirty-two thousand, five hundred
34. 104,052,005 = one hundred four million, fifty-two thousand, five

35. 970,031,500,104 = nine hundred seventy billion, thirty-one million, five hundred thousand, one hundred four
36. 5,800,010,700 = five billion, eight hundred million, ten thousand, seven hundred
37. 82,000,415 = eighty-two million, four hundred fifteen
38. 51,000,201,078 = fifty-one billion, two hundred one thousand, seventy-eight
39. 3,737
40. 15,492
41. 930
42. 640
43. 7,021
44. 4,500
45. 26,000,432
46. 92,000,018,399
47. $245 = 200 + 40 + 5$
48. $518 = 500 + 10 + 8$
49. $3,609 = 3,000 + 600 + 9$
50. $3,961 = 3,000 + 900 + 60 + 1$
51. $72,533 = 70,000 + 2,000 + 500 + 30 + 3$
52. $73,009 = 70,000 + 3,000 + 9$
53. $104,401 = 100,000 + 4,000 + 400 + 1$
54. $570,003 = 500,000 + 70,000 + 3$
55. $8,403,613 = 8,000,000 + 400,000 + 3,000 + 600 + 10 + 3$
56. $3,519,807 = 3,000,000 + 500,000 + 10,000 + 9,000 + 800 + 7$
57. $26,000,156 = 20,000,000 + 6,000,000 + 100 + 50 + 6$
58. $48,000,061 = 40,000,000 + 8,000,000 + 60 + 1$
59. a. $11 > 8$ b. $29 < 54$
60. a. $410 < 609$ b. $3,206 < 3,231$
61. a. $12,321 > 12,209$ b. $23,223 < 23,231$
62. a. $178,989 > 178,898$ b. $850,234 < 850,342$
63. 98,150, since $4 < 5$
64. 26,740, since $2 < 5$
65. 512,970, since $7 \geq 5$
66. 621,120, since $6 \geq 5$
67. 8,400, since $5 \geq 5$
68. 1,800, since $4 < 5$
69. 32,400, since $3 < 5$
70. 73,900, since $3 < 5$
71. 66,000, (since $8 \geq 5$, 981 rounds to 1,000)
72. 5,347,000, (since $7 \geq 5$, 975 rounds to 1,000)
73. 2,581,000, (since $5 \geq 5$, 952 rounds to 1,000)
74. 3,429,000, (since $6 \geq 5$, 961 rounds to 1,000)
75. 53,000 ; 50,000
76. 85,000 ; 90,000
77. 77,000 ; 80,000
78. 34,000 ; 30,000
79. 816,000 ; 820,000
80. 536,000 ; 540,000
81. 297,000 ; 300,000
82. 499,000 ; 500,000
83. a. 79,590 b. 79,600
- c. 80,000 d. 80,000
84. a. 5,926,000 b. 5,930,000
- c. 5,900,000 d. 6,000,000
85. a. \$419,160 b. \$419,200
- c. \$419,000 d. \$420,000
86. a. 5,436,480 ft. b. 5,436,500 ft.
- c. 5,436,000 ft. d. 5,440,000 ft.
87. 40,025
88. 7,000,077
89. 202,036
90. 7,000,000,350
91. 27,598
92. 7,452,860
93. 10,700,506
94. 86,412
- LOOK ALIKES**
95. a. 1,000,600,000,000
- b. 1,000,600,000
- c. 1,000,600
96. a. 99,000,000,099
- b. 88,000,088
- c. 77,077
97. a. 9,000,000,000
- b. 9,000,000,000
98. a. 1,001,001,001
- b. 1,001,001,001

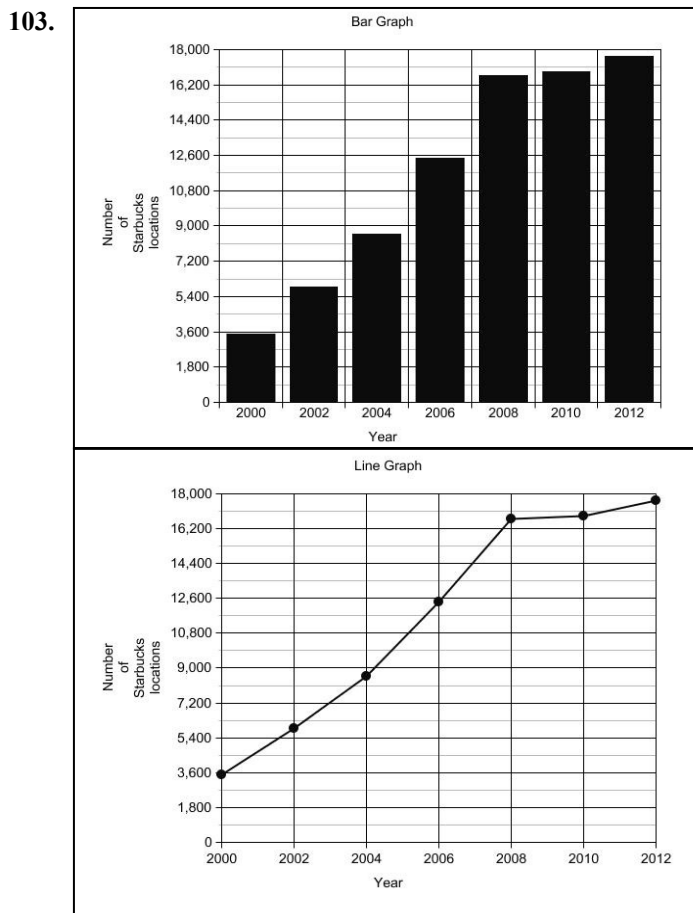
APPLICATIONS

99. Aisha is the closest to \$4,745 without being over.

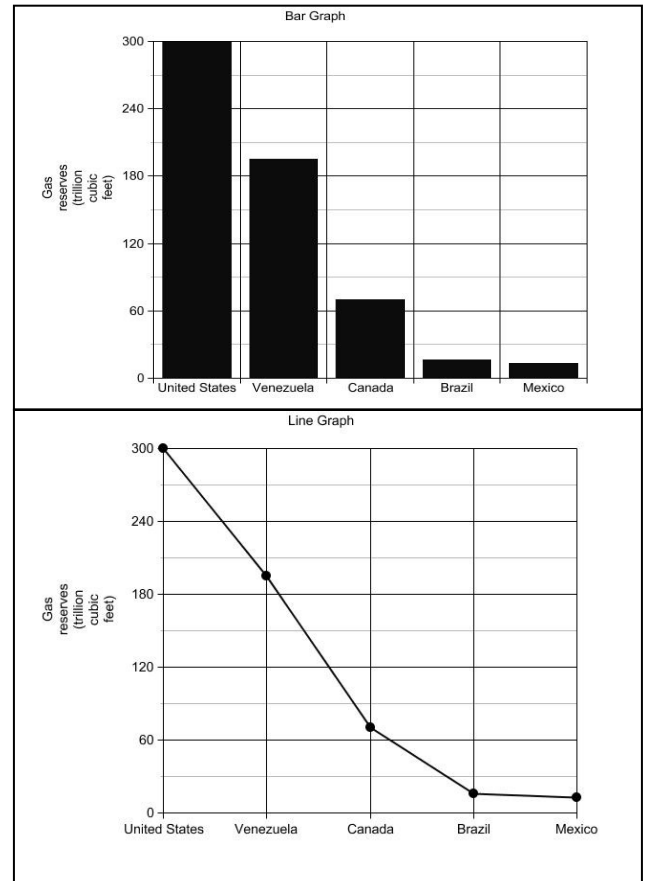
100. T. Roosevelt 42 yr/ 322 days	G. Cleveland 47 yr/351 days
J. Kennedy 43 yr/236 days	F. Pierce 48 yr/101 days
W. Clinton 46 yr/154 days	J. Garfield 49 yr/105 days
U. Grant 46 yr/236 days	J. Polk 49 yr/122 days
B. Obama 47 yr/169 days	M. Filmore 50 yr/184 days

101. a. Under \$25,000
b. \$100,000 and Over
c. 17 million renter households
d. 5 million renter households

102. a. Golf, at 205mph.
b. Ping-Pong, at 70mph.
c. Tennis, at about 155mph.



104.



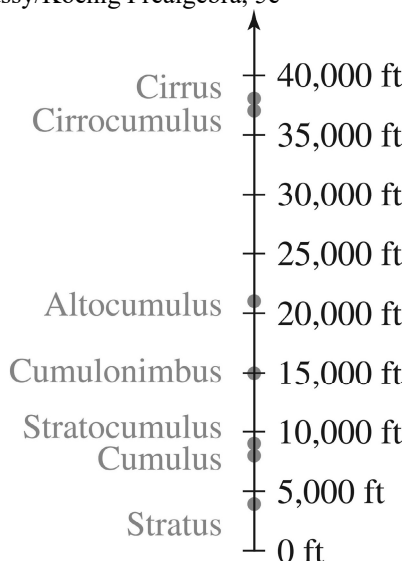
105. Fifteen thousand, six hundred one
Three thousand, four hundred thirty-three

106. a. This diploma awarded this the twenty-seventh day of June, two thousand fourteen.
b. The suggested contribution for the fundraiser is eight hundred fifty dollars a plate, or an entire table may be purchased for five thousand, two hundred fifty dollars.

107. 1,865,593 ; 482,880; 1,503; 269; 43,449

108. 6,504 kwh used.

109. a. hundred thousands
b. 980,000,000; 900,000,000+80,000,000
c. 1,000,000,000; one billion



WRITING

111. To round 687 to the nearest ten, look to the right of the tens place. Since this digit is 7, increase the 8 in the tens place to 9 and make the ones place a zero. So, to the nearest ten, 687 is approximately 690.
112. The lower priced homes are roughly \$130,000.
113. Because 1,000 (3 zeros) is a thousand 1s, so 1,000,000 is a thousand thousands.
114. A 6 figure income is any income between \$100,000 and \$999,999.
115. 2, 10, 0, 1,000, 80
12, 3, 100, 2, 0
116. Because “and” is used to represent decimals and mixed numbers.
117. Two hours is too long to wait!
118. a. Two thousand, sixteen is less than two thousand, one hundred six.
b. Seven million, eighty thousand, eight is greater than seven million, eight thousand, eight hundred

Section 1.2: Adding and Subtracting Whole Numbers

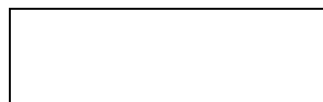
VOCABULARY

1.
$$\begin{array}{ccc} 10 & + & 15 \\ \text{addend} & & \text{addend} \end{array} = 25$$

$$\text{sum}$$
2. When using the vertical form to add whole numbers, if the addition of the digits in any one column produces a sum greater than 9, we must carry.
3. The commutative property of addition states that the order in which whole numbers are added does not change their sum.

4. The associative property of addition states that the way in which whole numbers are grouped does not change their sum.
5. To see whether the result of an addition is reasonable, we can round the addends and estimate the sum.
6. The words *rise*, *gain*, *total*, and *increase* are often used to indicate the operation of addition. The words *fall*, *lose*, *reduce*, and *decrease* often indicate the operation of subtraction.
7. The figure on the left is an example of a rectangle. The figure on the right is an example of a square.
8. Together the length and width of a rectangle are called its dimensions.

Length



Width

9. When all the sides of a rectangle are the same length, we call the rectangle a square.
10. The distance around a rectangle is called its perimeter.
11.
$$\begin{array}{ccccc} 25 & - & 10 & = & 15 \\ \text{minuend} & & \text{subtrahend} & & \text{difference} \end{array}$$
12. If the subtraction of the digits in any place value column requires that we subtract a larger digit from a smaller digit, we must borrow or regroup.
13. Every subtraction has a related addition statement. For example $7 - 2 = 5$ because $5 + 2 = 7$.
14. To *evaluate* an expression such as $58 - 33 + 9$ means to find its value.

CONCEPTS

15. a. commutative property of addition
b. associative property of addition
c. associative property of addition
d. commutative property of addition
16. a. $19 + 33 = 33 + 19$
b. $3 + (97 + 16) = (3 + 97) + 16$

17. The subtraction $7 - 3 = 4$ is related to the addition statement $4 + 3 = 7$.
18. The operation of addition can be used to check the result of a subtraction. If a subtraction is done correctly, the sum of the difference and the subtrahend will always equal the minuend.
19. To *evaluate* (find the value of) an expression that contains both addition and subtraction, we perform the operations as they occur from left to right.
20. To answer questions about *how much more*, or *how many more*, we can use subtraction.

NOTATION

21. The symbols () are called parentheses. It is standard practice to perform the operations within them first.
22. $83 - 30$ is correct.
23. $12 + (15 + 2) = 12 + 17$
 $= 29$
24. $36 - 11 + 5 = 25 + 5$
 $= 30$

GUIDED PRACTICE

25.
$$\begin{array}{r} 25 \\ +13 \\ \hline 38 \end{array}$$
26.
$$\begin{array}{r} 47 \\ +12 \\ \hline 59 \end{array}$$
27.
$$\begin{array}{r} 406 \\ +283 \\ \hline 689 \end{array}$$
28.
$$\begin{array}{r} 213 \\ +751 \\ \hline 964 \end{array}$$
29.
$$\begin{array}{r} 156 \\ +305 \\ \hline 461 \end{array}$$

30.
$$\begin{array}{r} 647 \\ +138 \\ \hline 785 \end{array}$$
31.
$$\begin{array}{r} 4,301 \\ 789 \\ +3,847 \\ \hline 8,937 \end{array}$$
32.
$$\begin{array}{r} 5,576 \\ 649 \\ +1,922 \\ \hline 8,147 \end{array}$$

$$33. \quad (13 + 8) + 12 = 13 + (8 + 12) = 13 + 20 = 33$$

$$34. \quad (19 + 7) + 13 = 19 + (7 + 13) = 19 + 20 = 39$$

$$35. \quad \begin{aligned} 94 + (6 + 37) &= (94 + 6) + 37 \\ &= 100 + 37 \\ &= 137 \end{aligned}$$

$$36. \quad \begin{aligned} 92 + (8 + 88) &= (92 + 8) + 88 \\ &= 100 + 88 \\ &= 188 \end{aligned}$$

$$37. \quad \begin{array}{r} 700 \\ 800 \\ 10,000 \\ 20,000 \\ + 6,000 \\ \hline 37,500 \end{array}$$

38.

$$\begin{array}{r}
 400 \\
 400 \\
 10,000 \\
 40,000 \\
 + 8,000 \\
 \hline
 58,800
 \end{array}$$

39.

$$\begin{array}{r}
 600,000 \\
 20,000 \\
 300,000 \\
 + 100,000 \\
 \hline
 1,020,000
 \end{array}$$

40.

$$\begin{array}{r}
 800,000 \\
 20,000 \\
 300,000 \\
 + 100,000 \\
 \hline
 1,220,000
 \end{array}$$

41. $32 + 12 + 32 + 12 = 88$ ft.

42. $127 + 91 + 127 + 91 = 436$ m.

43. $17 + 17 + 17 + 17 = 68$ in.

44. $5 + 5 + 5 + 5 = 20$ yd.

45. $94 + 94 + 94 + 94 = 376$ mi.

46. $56 + 56 + 56 + 56 = 224$ ft.

47. $87 + 6 + 87 + 6 = 186$ cm.

48. $77 + 76 + 77 + 76 = 306$ in.

49. 7,989

-347

7,642

50. 9,799

-283

9,516

51. 2,967

-405

2,562

52. 1,736

-304

1,432

53.

$$\begin{array}{r}
 \overset{13}{6} \overset{16}{\cancel{8}} \overset{16}{\cancel{4}} \overset{16}{\cancel{6}} \\
 8, \cancel{7} \cancel{4} \cancel{6} \\
 - 289 \\
 \hline
 8,457
 \end{array}$$

54.

$$\begin{array}{r}
 \overset{12}{4} \overset{11}{\cancel{7}} \overset{11}{\cancel{2}} \overset{11}{\cancel{1}} \\
 7, \cancel{2} \cancel{7} \cancel{6} \\
 - 276 \\
 \hline
 7,255
 \end{array}$$

55.

$$\begin{array}{r}
 \overset{15}{8} \overset{11}{\cancel{6}} \overset{11}{\cancel{8}} \overset{11}{\cancel{1}} \\
 6, \cancel{8} \cancel{7} \cancel{8} \\
 - 478 \\
 \hline
 6,483
 \end{array}$$

56.

$$\begin{array}{r}
 \overset{11}{7} \overset{13}{\cancel{4}} \overset{13}{\cancel{8}} \overset{13}{\cancel{2}} \overset{13}{\cancel{6}} \\
 4, \cancel{8} \cancel{2} \cancel{6} \\
 - 667 \\
 \hline
 4,156
 \end{array}$$

57.

$$\begin{array}{r}
 \overset{14}{3} \overset{9}{\cancel{5}} \overset{10}{\cancel{4}} \overset{16}{\cancel{10}} \overset{16}{\cancel{6}} \\
 5, \cancel{4} \cancel{10} \cancel{6} \\
 - 2,829 \\
 \hline
 51,677
 \end{array}$$

58.

$$\begin{array}{r}
 \overset{13}{8} \overset{9}{\cancel{6}} \overset{10}{\cancel{4}} \overset{13}{\cancel{10}} \overset{13}{\cancel{6}} \\
 6, \cancel{4} \cancel{10} \cancel{6} \\
 - 4,635 \\
 \hline
 64,768
 \end{array}$$

59.

$$\begin{array}{r}
 \overset{13}{7} \overset{9}{\cancel{4}} \overset{10}{\cancel{8}} \overset{12}{\cancel{10}} \overset{12}{\cancel{2}} \\
 4, \cancel{8} \cancel{10} \cancel{2} \\
 - 3,958 \\
 \hline
 44,444
 \end{array}$$

$$\begin{array}{r}
 \overset{8}{3} \overset{14}{\cancel{8}} \overset{9}{\cancel{10}} \overset{16}{\cancel{16}} \\
 - 1,729 \\
 \hline
 37,777
 \end{array}$$

61. $123 + 175 = 298$ correct

62. $132 + 237 = 369$ incorrect

63. $1,364 + 3,275 = 4,629$ incorrect

64. $1,129 + 1,569 = 2,698$ correct

$$\begin{array}{r}
 70,000 \\
 - 4,000 \\
 \hline
 66,000
 \end{array}$$

$$\begin{array}{r}
 50,000 \\
 - 3,000 \\
 \hline
 47,000
 \end{array}$$

$$\begin{array}{r}
 80,000 \\
 - 30,000 \\
 \hline
 50,000
 \end{array}$$

$$\begin{array}{r}
 70,000 \\
 - 40,000 \\
 \hline
 30,000
 \end{array}$$

69. $35 - 12 + 6 = 23 + 6$
 $= 29$

70. $47 - 23 + 4 = 24 + 4$
 $= 28$

71. $574 + 47 - 13 = 621 - 13$
 $= 608$

72. $863 + 39 - 11 = 902 - 11$
 $= 891$

TRY IT YOURSELF

73.
$$\begin{array}{r}
 8,539 \\
 + 7,368 \\
 \hline
 15,907
 \end{array}$$

74.
$$\begin{array}{r}
 5,799 \\
 + 6,879 \\
 \hline
 12,678
 \end{array}$$

75.
$$\begin{array}{r}
 3,430 \\
 - 529 \\
 \hline
 2,901
 \end{array}$$

76.
$$\begin{array}{r}
 2,470 \\
 - 863 \\
 \hline
 1,607
 \end{array}$$

77.
$$\begin{array}{r}
 51,246 \\
 578 \\
 37 \\
 + 4,599 \\
 \hline
 56,460
 \end{array}$$

78.
$$\begin{array}{r}
 4,689 \\
 73,422 \\
 26 \\
 + 433 \\
 \hline
 78,570
 \end{array}$$

79. $633 - 598 + 30 = 35 + 30$
 $= 65$

80. $600 - 497 + 60 = 103 + 60$
 $= 163$

81. $(45 + 16) + 4 = 45 + 20$
 $= 65$

82. $7 + (63 + 23) = 70 + 23$
 $= 93$

83. $20,007 - 78 = 19,929$

$$84. \quad 70,006 - 48 = 69,958$$

$$85. \quad 852 - 695 + 40 = 157 + 40 \\ = 197$$

$$86. \quad 397 - 348 + 65 = 49 + 65 \\ = 114$$

$$87. \quad \begin{array}{r} 632 \\ +347 \\ \hline 979 \end{array}$$

$$88. \quad \begin{array}{r} 423 \\ +570 \\ \hline 993 \end{array}$$

$$89. \quad \begin{array}{r} 15,700 \\ -15,397 \\ \hline 303 \end{array}$$

$$90. \quad \begin{array}{r} 35,600 \\ -34,799 \\ \hline 801 \end{array}$$

$$91. \quad 16,427 + 13,573 = 30,000$$

$$92. \quad 18,788 + 13,567 = 32,355$$

$$93. \quad \begin{array}{r} 50,009 \\ - 1,249 \\ \hline 48,760 \end{array}$$

$$94. \quad \begin{array}{r} 20,020 \\ - 2,198 \\ \hline 17,822 \end{array}$$

LOOK ALIKES

$$95. \quad \text{a. } 299 + 99 = 398$$

$$\text{b. } 99 + 299 = 398$$

$$96. \quad \text{a. } 3,068 + 368 = 3,436$$

$$\text{b. } 368 + 3,068 = 3,436$$

$$97. \quad \text{a. } 747 + 252 = 999$$

$$\text{b. } 252 + 747 = 999$$

$$98. \quad \text{a. } (913 + 87) + 688 = 1,000 + 688 \\ = 1,688$$

$$\text{b. } 913 + (87 + 688) = 913 + 775 \\ = 1,688$$

APPLICATIONS

$$99. \quad 24 + 35 + 16 + 16 = 91 \text{ ft.}$$

$$100. \quad 540 + 230 + 150 + 170 = 990 \text{ calories}$$

$$101. \quad 308,058,000 - 64,511,000 = 243,547,000 \text{ visitors}$$

102.

Number of safe bridges	Number of bridges that need repair	Number of outdated bridges that should be replaced	Total number of bridges
464,859	61,365	84,525	610,749

$$103. \quad \$1,947 + 5,358 + 4,442 + 712 + 5,871 + 12,540 + 3,882 \\ = \$34,752$$

$$104. \quad \$681,386,586 + 1,228,600,498 + 547,887,386 + 1,049,539,593 \\ = \$3,507,414,063$$

$$105. \quad 64 + 34 + 64 + 34 = 196 \text{ inches of fringe}$$

$$106. \quad 15 + 11 + 15 + 11 = 52 \text{ feet of border.}$$

$$107. \quad 48 - 2(11) = 48 - 22 = 26 \text{ inches each side}$$

$$4(26) = 104 \text{ inches total}$$

$$108. \quad 209 + 209 + 209 + 209 = 836 \text{ ft. of fence.}$$

$$109. \quad 2,623 - 351 = 2,272 \text{ lbs.}$$

$$110. \quad \text{The greatest increase occurred from 2010 to 2011.}$$

$$7,175 - 6,132 = 1,043 \text{ markets}$$

$$111. \quad 71,649 - 70,154 = 1,495 \text{ miles}$$

$$112. \quad 231 - 197 = 34 \text{ lbs. lost}$$

$$113. \quad 2,662,066 - 1,571,537 = 1,090,529 \text{ magazines}$$

$$114. \quad \text{a. } 2006 - 2008: 17,371 - 16,646 = 725 \text{ patients}$$

$$\text{b. } 2012 - 2014: 16,795 - 16,391 = 404 \text{ patients}$$

115. $1,947 - 183 = 1,764^\circ F$

116. $67 - 33 = 34$ cm. for the motor

117. a. \$49,565

b. $50,887 - 49,565 = \$1,322$

118. a. \$50,751

b. $53,531 - 50,751 = \$2,780$

WRITING

119. Benefit : faster ; Tradeoff : less accurate

120. Something is wrong – he needs to check his work

121. Because taking 2 things from 3 things is not equivalent to taking 3 things from 2 things.

122. By adding the difference to the subtrahend, you should get the minuend.

REVIEW

123. a. $3,000 + 100 + 20 + 5$

b. $60,000 + 30 + 7$

124. a. 6,354,780

b. 6,354,800

c. 6,350,000

d. 6,400,000

125. a. 5,370,650

b. 5,370,000

c. 5,400,000

126. a. seventy-two million, one thousand fifteen

b. $70,000,000 + 2,000,000 + 1,000 + 10 + 5$

Section 1.3: Multiplying Whole Numbers**VOCABULARY**

1. $\underset{\text{factor}}{5} \cdot \underset{\text{factor}}{10} = \underset{\text{product}}{50}$

2. Multiplication is repeated addition.3. The commutative property of multiplication states that the order in which whole numbers are multiplied does not change their product. The associative property of multiplication states that the way in which whole numbers are grouped does not change their product.4. Letters that are used to represent numbers are called variables.5. If a square measures 1 inch on a side, its area is 1 square inch.6. The area of a rectangle is a measure of the amount of surface it encloses.**CONCEPTS**

7. a. $4 \cdot 8$

b. $15 + 15 + 15 + 15 + 15 + 15 + 15$

8. a. A rectangular array of red squares is shown below.

b. $5 \cdot 12 = 60$

9. a. 3

b. 5

10. a. $xy = yx$

b. $(xy)z = x(yz)$

11. a. area

b. perimeter

c. area

d. perimeter

12. a. $1 \cdot 25 = 25$ b. $62(1) = 62$

c. $10 \cdot 0 = 0$ d. $0(4) = 0$

NOTATION

13. $\times$, $\cdot$, $()$

14. square feet

15. $A = l \cdot w$ or $A = lw$

16. a. $8x$ b. ab

GUIDED PRACTICE

$$\begin{array}{r} 17. \quad \begin{array}{r} 15 \\ \times 7 \\ \hline 105 \end{array} \end{array}$$

$$\begin{array}{r} 18. \quad \begin{array}{r} 19 \\ \times 9 \\ \hline 171 \end{array} \end{array}$$

$$\begin{array}{r} 19. \quad \begin{array}{r} 34 \\ \times 8 \\ \hline 272 \end{array} \end{array}$$

$$\begin{array}{r} 20. \quad \begin{array}{r} 37 \\ \times 6 \\ \hline 222 \end{array} \end{array}$$

$$21. \quad 100 \text{ has 2 zeros : attach 2 zeros : } 3,700$$

$$22. \quad 1,000 \text{ has 3 zeros : attach 3 zeros : } 63,000$$

$$23. \quad 10 \text{ has 1 zero : attach 1 zero : } 750$$

$$24. \quad 10,000 \text{ has 4 zeros : attach 4 zeros : } 880,000$$

$$25. \quad 10,000 \text{ has 4 zeros : attach 4 zeros : } 1,070,000$$

$$26. \quad 100 \text{ has 2 zeros : attach 2 zeros : } 32,300$$

$$27. \quad 1,000 \text{ has 3 zeros : attach 3 zeros : } 512,000$$

$$28. \quad 10 \text{ has 1 zero : attach 1 zero : } 6,730$$

$$\begin{array}{l} 29. \quad 68 \cdot 4 = 272 \\ 68 \cdot 40 = 2,720 \end{array}$$

$$\begin{array}{l} 30. \quad 83 \cdot 3 = 249 \\ 83 \cdot 30 = 2,490 \end{array}$$

$$\begin{array}{l} 31. \quad 56 \cdot 2 = 112 \\ 56 \cdot 200 = 11,200 \end{array}$$

$$\begin{array}{l} 32. \quad 222 \cdot 5 = 1,110 \\ 222 \cdot 500 = 111,000 \end{array}$$

$$\begin{array}{l} 33. \quad 13 \cdot 3 = 39 \\ 130(3,000) = 390,000 \end{array}$$

$$\begin{array}{l} 34. \quad 63 \cdot 7 = 441 \\ 630(7,000) = 4,410,000 \end{array}$$

$$\begin{array}{l} 35. \quad 27 \cdot 4 = 108 \\ 2,700(40,000) = 108,000,000 \end{array}$$

$$\begin{array}{l} 36. \quad 51 \cdot 8 = 408 \\ 5,100(80,000) = 408,000,000 \end{array}$$

$$\begin{array}{r} 37. \quad \begin{array}{r} 128 \\ \times 73 \\ \hline 384 \\ 8,960 \\ \hline 9,344 \end{array} \end{array}$$

$$\begin{array}{r} 38. \quad \begin{array}{r} 173 \\ \times 54 \\ \hline 692 \\ 8,650 \\ \hline 9,342 \end{array} \end{array}$$

$$\begin{array}{r} 39. \quad \begin{array}{r} 287 \\ \times 64 \\ \hline 1,148 \\ 17,220 \\ \hline 18,368 \end{array} \end{array}$$

$$\begin{array}{r} 40. \quad \begin{array}{r} 461 \\ \times 72 \\ \hline 922 \\ 32,270 \\ \hline 33,192 \end{array} \end{array}$$

$$\begin{array}{l} 41. \quad 602 \cdot 679 = 600 \cdot 679 + 2 \cdot 679 \\ \quad \quad = 407,400 + 1,358 \\ \quad \quad = 408,758 \end{array}$$

$$\begin{aligned}
 42. \quad 504 \cdot 729 &= 500 \cdot 729 + 4 \cdot 729 \\
 &= 364,500 + 2,916 \\
 &= 367,416
 \end{aligned}$$

$$\begin{aligned}
 43. \quad 3,002(5,619) &= 3,000(5,619) + 2(5,619) \\
 &= 16,857,000 + 11,238 \\
 &= 16,868,238
 \end{aligned}$$

$$\begin{aligned}
 44. \quad 2,003(1,376) &= 2,000(1,376) + 3(1,376) \\
 &= 2,752,000 + 4,128 \\
 &= 2,756,128
 \end{aligned}$$

$$\begin{aligned}
 45. \quad (18 \cdot 20) \cdot 5 &= 18 \cdot (20 \cdot 5) = 18 \cdot 100 \\
 &= 1,800
 \end{aligned}$$

$$\begin{aligned}
 46. \quad (29 \cdot 2) \cdot 50 &= 29 \cdot (2 \cdot 50) = 29 \cdot 100 \\
 &= 2,900
 \end{aligned}$$

$$\begin{aligned}
 47. \quad 250 \cdot (4 \cdot 135) &= (250 \cdot 4) \cdot 135 \\
 &= 1000 \cdot 135 \\
 &= 135,000
 \end{aligned}$$

$$\begin{aligned}
 48. \quad 250 \cdot (4 \cdot 289) &= (250 \cdot 4) \cdot 289 \\
 &= 1000 \cdot 289 \\
 &= 289,000
 \end{aligned}$$

$$49. \quad 90 \cdot 200 = 18,000$$

$$50. \quad 60 \cdot 600 = 36,000$$

$$51. \quad 200 \cdot 2,000 = 400,000$$

$$52. \quad 400 \cdot 4,000 = 1,600,000$$

$$53. \quad 6 \cdot 14 = 84 \text{ in}^2.$$

$$54. \quad 22 \cdot 50 = 1100 \text{ m}^2.$$

$$55. \quad 12 \cdot 12 = 144 \text{ in}^2.$$

$$56. \quad 20 \cdot 20 = 400 \text{ cm}^2.$$

TRY IT YOURSELF

$$\begin{array}{r}
 57. \quad \begin{array}{r} 2 \\ 213 \\ \times \quad 7 \\ \hline 1,491 \end{array}
 \end{array}$$

$$\begin{array}{r}
 58. \quad \begin{array}{r} 5 \ 2 \\ 863 \\ \times \quad 9 \\ \hline 7,767 \end{array}
 \end{array}$$

$$\begin{array}{r}
 59. \quad \begin{array}{r} 1 \\ 34,474 \\ \times \quad 2 \\ \hline 68,948 \end{array}
 \end{array}$$

$$\begin{array}{r}
 60. \quad \begin{array}{r} 1 \ 3 \\ 54,912 \\ \times \quad 4 \\ \hline 219,648 \end{array}
 \end{array}$$

$$\begin{array}{r}
 61. \quad \begin{array}{r} 99 \\ \times \quad 77 \\ \hline 693 \\ 6,930 \\ \hline 7,623 \end{array}
 \end{array}$$

$$\begin{array}{r}
 62. \quad \begin{array}{r} 73 \\ \times \quad 59 \\ \hline 657 \\ 3,650 \\ \hline 4,307 \end{array}
 \end{array}$$

$$63. \quad 44(55)(0) = 0$$

$$64. \quad 81 \cdot 679 \cdot 0 \cdot 5 = 0$$

$$\begin{aligned}
 65. \quad 53 \cdot 3 &= 159 \\
 53 \cdot 30 &= 1,590
 \end{aligned}$$

$$\begin{aligned}
 66. \quad 2 \cdot 78 &= 156 \\
 20 \cdot 78 &= 1,560
 \end{aligned}$$

$$\begin{array}{r}
 67. \quad 754 \\
 \times \quad 59 \\
 \hline
 6786 \\
 +37700 \\
 \hline
 44,486
 \end{array}$$

$$\begin{array}{r}
 68. \quad 846 \\
 \times \quad 79 \\
 \hline
 7614 \\
 +59220 \\
 \hline
 66,834
 \end{array}$$

$$\begin{array}{r}
 69. \quad 2978 \\
 \times 3004 \\
 \hline
 11912 \\
 00000 \\
 000000 \\
 +8934000 \\
 \hline
 8,945,912
 \end{array}$$

$$\begin{array}{r}
 70. \quad 2003 \\
 \times 5003 \\
 \hline
 6009 \\
 00000 \\
 000000 \\
 +10015000 \\
 \hline
 10,021,009
 \end{array}$$

$$\begin{array}{r}
 71. \quad 916 \\
 \times \quad 409 \\
 \hline
 8244 \\
 00000 \\
 +366400 \\
 \hline
 374,644
 \end{array}$$

$$\begin{array}{r}
 72. \quad 889 \\
 \times \quad 507 \\
 \hline
 6223 \\
 00000 \\
 +444500 \\
 \hline
 450,723
 \end{array}$$

$$73. \quad 25 \cdot (4 \cdot 99) = (25 \cdot 4) \cdot 99 = 100 \cdot 99 = 9,900$$

$$74. \quad (41 \cdot 5) \cdot 20 = 41 \cdot (5 \cdot 20) = 41 \cdot 100 = 4,100$$

$$75. \quad 48 \cdot 5 = 240$$

$$4,800 \cdot 500 = 2,400,000$$

$$76. \quad 64 \cdot 7 = 448$$

$$6,400 \cdot 700 = 4,480,000$$

$$\begin{array}{r}
 77. \quad 2,779 \\
 \times \quad 128 \\
 \hline
 22232 \\
 55580 \\
 +277900 \\
 \hline
 355,712
 \end{array}$$

$$\begin{array}{r}
 78. \quad 3,596 \\
 \times \quad 136 \\
 \hline
 21576 \\
 107880 \\
 +359600 \\
 \hline
 489,056
 \end{array}$$

$$\begin{array}{r}
 79. \quad 370 \\
 \times 450 \\
 \hline
 000 \\
 18500 \\
 +148000 \\
 \hline
 166,500
 \end{array}$$

$$\begin{array}{r}
 80. \quad 280 \\
 \times 340 \\
 \hline
 000 \\
 11\ 200 \\
 +84\ 000 \\
 \hline
 95,200
 \end{array}$$

LOOK ALIKES

81. a. $76 \cdot 20 = 1,520$
 b. $76 \cdot 200 = 15,200$
 c. $76 \cdot 2,000 = 152,000$

82. a. $50 \cdot 50 = 2,500$
 b. $50 \cdot 500 = 25,000$
 c. $50 \cdot 5,000 = 250,000$

83. a. $98 \cdot 36 = 3,528$
 b. $360 \cdot 98 = 35,280$

84. a. $41 \cdot 13 = 533$
 b. $130 \cdot 410 = 53,300$

APPLICATIONS

85. $2 \cdot 36 = 72$ cups of raisins
86. $4 \cdot 180 = 720$ peanut M&Ms
87. $12 \cdot 17 = 204$ grams of fat
88. $13 \cdot 24 = 312$ oranges
89. $60 \cdot 65 = 3,900$ times per minute
90. $15 \cdot 413 = \$6,195$
91. $12 \cdot 5,280 = 63,360$ in. in a mile
92. a. $16 \cdot 14 = 224$ mi.
 b. $16 \cdot 23 = 368$ mi.
93. $250 \cdot 308 = 77,000$ words
94. $18 \cdot 450 = \$8,100$ per month
95. $36 \cdot 174,000 = \$6,264,000$ per year
96. $42 \cdot 19,389,000 = 814,338,000$ gal/day
97. $8 \cdot 9 = 72$ entries

98. $24 + 24 + 24 + 24 = 96$ ft around once

$$96 + 96 + 96 + 96 = 384 \text{ ft around four times}$$

99. $17 \cdot 33 = 561$: There are 561 students and 1 instructor, so since $562 < 570$ they are O.K.

100. $14 \cdot 150 = 2,100$ lbs. They are overloaded.

101. $3 \cdot 6 = 18$ hours asleep

102. $8 \cdot 10 = 80$ inch jump

103. $6 \cdot 27,000 = 162,000$ attacks

104. $8 \cdot 11 = 88$ months.

105. $2 \cdot 3 \cdot 14 = 6 \cdot 14 = 84$ pills

106. a. $60 \cdot 60 \cdot 24 = 86,400$ beats
 b. $100 \cdot 60 \cdot 24 = 144,000$ beats

107. $3 \cdot 18 = 54 \text{ ft}^2$.

108. $24 \cdot 36 = 864 \text{ in}^2$.

109. Perimeter: $360 + 270 + 360 + 270 = 1,260$ mi.

$$\text{Area: } 360 \cdot 270 = 97,200 \text{ mi}^2.$$

	Area	Perimeter
Square	$16 \cdot 16 = 256 \text{ ft}^2$.	$4 \cdot 16 = 64 \text{ ft}$.
Rectangle	$14 \cdot 17 = 238 \text{ ft}^2$.	$2 \cdot 14 + 2 \cdot 17 = 62 \text{ ft}$.

The square is larger in both cases.

WRITING

111. 1 foot is a unit of length, while 1 square foot is a unit of area.

112. At least one of the numbers has to be 0.

REVIEW

113. $10,357 + 9,809 + 476 = 20,642$

114. $367 - 179 = \$188$ discount

VOCABULARY

- $$\begin{array}{ccc} 12 & \div & 4 = 3 \\ \text{dividend} & \text{divisor} & \text{quotient} \end{array}$$

$$\begin{array}{r} 3 \leftarrow \text{quotient} \\ \text{divisor} \rightarrow 4 \overline{)12} \leftarrow \text{dividend} \end{array}$$

$$\frac{\text{dividend} \rightarrow 12}{\text{divisor} \rightarrow 4} = 3 \leftarrow \text{quotient}$$
- We call $5 \cdot 8 = 40$ the related multiplication statement for the division $40 \div 8 = 5$.
- The problem $6 \overline{)246}$ is written in long division form.
- If a division is not exact, the leftover part is called the remainder.
- One number is divisible by another number if, when we divide them, the remainder is 0.
- Phrases such as *split equally* and *how many does each* indicate the operation of division.

CONCEPTS

- 7 groups of 3
 - 5 groups of 4, 2 left over
- true
 - true
 - false
 - false
- $\frac{25}{25} = 1$
 - $\frac{6}{1} = 6$
 - $\frac{100}{0}$ is undefined
 - $\frac{0}{12} = 0$
- To perform long division, we follow a four-step process: estimate, multiply, subtract, bring-down.

- $\begin{array}{r} 2 \\ 5 \overline{)1147} \end{array}$
 - $\begin{array}{r} 6 \\ 9 \overline{)587} \end{array}$
 - $\begin{array}{r} 3 \\ 23 \overline{)7501} \end{array}$
 - $\begin{array}{r} 5 \\ 16 \overline{)892} \end{array}$
- Quotient $\cdot$ divisor = dividend
 - (Quotient $\cdot$ divisor) + remainder = dividend
- $$\begin{array}{r} 37 \\ \times 9 \\ \hline 333 \end{array}$$
- 2
 - sum
 - two
- 0 or 5
 - 2 and 3
 - sum
 - 10
- We can simplify the division $43,800 \div 200$ by removing two zeros from the dividend and the divisor.

NOTATION

- $\div$, $\overline{)}$, $-$
- In a division, 35 R 4 means “a quotient of 35 and a remainder of 4”.

GUIDED PRACTICE

- $\begin{array}{r} 5 \\ 9 \overline{)45} \end{array}$ because $5 \cdot 9 = 45$.
- $\begin{array}{r} 9 \\ 6 \overline{)54} \end{array}$ because $9 \cdot 6 = 54$.
- $44 \div 11 = 4$ because $4 \cdot 11 = 44$.
- $120 \div 12 = 10$ because $10 \cdot 12 = 120$.

23. $7 \cdot 3 = 21$

24. $8 \cdot 4 = 32$

25. $6 \cdot 12 = 72$

26. $5 \cdot 15 = 75$

27.
$$\begin{array}{r} 16 \\ 6 \overline{)96} \end{array}$$

$$\begin{array}{r} -6 \\ 36 \end{array}$$

$$\begin{array}{r} -36 \\ 0 \end{array}$$

Check: $6(16) = 96$

28.
$$\begin{array}{r} 18 \\ 4 \overline{)72} \end{array}$$

$$\begin{array}{r} -4 \\ 32 \end{array}$$

$$\begin{array}{r} -32 \\ 0 \end{array}$$

Check: $4(18) = 72$

29.
$$\begin{array}{r} 29 \\ 3 \overline{)87} \end{array}$$

$$\begin{array}{r} -6 \\ 27 \end{array}$$

$$\begin{array}{r} -27 \\ 0 \end{array}$$

Check: $3(29) = 87$

30.
$$\begin{array}{r} 14 \\ 7 \overline{)98} \end{array}$$

$$\begin{array}{r} -7 \\ 28 \end{array}$$

$$\begin{array}{r} -28 \\ 0 \end{array}$$

Check: $7(14) = 98$

31.
$$\begin{array}{r} 325 \\ 7 \overline{)2275} \end{array}$$

$$\begin{array}{r} -21 \\ 17 \end{array}$$

$$\begin{array}{r} -14 \\ 35 \end{array}$$

$$\begin{array}{r} -35 \\ 0 \end{array}$$

Check: $7(325) = 2275$

32.
$$\begin{array}{r} 216 \\ 8 \overline{)1728} \end{array}$$

$$\begin{array}{r} -16 \\ 12 \end{array}$$

$$\begin{array}{r} -8 \\ 48 \end{array}$$

$$\begin{array}{r} -48 \\ 0 \end{array}$$

Check: $8(216) = 1728$

33.
$$\begin{array}{r} 218 \\ 9 \overline{)1962} \end{array}$$

$$\begin{array}{r} -18 \\ 16 \end{array}$$

$$\begin{array}{r} -9 \\ 72 \end{array}$$

$$\begin{array}{r} -72 \\ 0 \end{array}$$

Check: $9(218) = 1962$

34.
$$\begin{array}{r} 327 \\ 5 \overline{)1635} \end{array}$$

$$\begin{array}{r} -15 \\ 13 \end{array}$$

$$\begin{array}{r} -10 \\ 35 \end{array}$$

$$\begin{array}{r} -35 \\ 0 \end{array}$$

Check: $5(327) = 1635$

$$\begin{array}{r}
 35. \quad \begin{array}{r} 504 \\ 62 \overline{)31248} \\ \underline{-310} \\ 24 \\ \underline{-0} \\ 248 \\ \underline{-248} \\ 0 \end{array}
 \end{array}$$

$$\text{Check: } 62(504) = 31,248$$

$$\begin{array}{r}
 36. \quad \begin{array}{r} 403 \\ 71 \overline{)28613} \\ \underline{-284} \\ 21 \\ \underline{-0} \\ 213 \\ \underline{-213} \\ 0 \end{array}
 \end{array}$$

$$\text{Check: } 71(403) = 28,613$$

$$\begin{array}{r}
 37. \quad \begin{array}{r} 602 \\ 37 \overline{)22274} \\ \underline{-222} \\ 07 \\ \underline{-0} \\ 74 \\ \underline{-74} \\ 0 \end{array}
 \end{array}$$

$$\text{Check: } 37(602) = 22,274$$

$$\begin{array}{r}
 38. \quad \begin{array}{r} 704 \\ 28 \overline{)19712} \\ \underline{-196} \\ 11 \\ \underline{-0} \\ 112 \\ \underline{-112} \\ 0 \end{array}
 \end{array}$$

$$\text{Check: } 28(704) = 19,712$$

$$\begin{array}{r}
 39. \quad \begin{array}{r} 39 \\ 24 \overline{)951} \\ \underline{-72} \\ 231 \\ \underline{-216} \\ 15 \end{array}
 \end{array}$$

$$39 \text{ R } 15$$

$$\text{Check: } 39 \cdot 24 + 15 = 951$$

$$\begin{array}{r}
 40. \quad \begin{array}{r} 28 \\ 33 \overline{)943} \\ \underline{-66} \\ 283 \\ \underline{-264} \\ 19 \end{array}
 \end{array}$$

$$28 \text{ R } 19$$

$$\text{Check: } 28 \cdot 33 + 19 = 943$$

$$\begin{array}{r}
 41. \quad \begin{array}{r} 21 \\ 46 \overline{)999} \\ \underline{-92} \\ 79 \\ \underline{-46} \\ 33 \end{array}
 \end{array}$$

$$21 \text{ R } 33$$

$$\text{Check: } 21 \cdot 46 + 33 = 999$$

$$\begin{array}{r}
 42. \quad \begin{array}{r} 19 \\ 49 \overline{)979} \\ \underline{-49} \\ 489 \\ \underline{-441} \\ 48 \end{array}
 \end{array}$$

$$19 \text{ R } 48$$

$$\text{Check: } 19 \cdot 49 + 48 = 979$$

43.
$$\begin{array}{r} 47 \\ 524 \overline{)24714} \\ \underline{-2096} \\ 3754 \\ \underline{-3668} \\ 86 \end{array}$$

Check : $47 \cdot 524 + 86 = 24,714$

44.
$$\begin{array}{r} 56 \\ 531 \overline{)29773} \\ \underline{-2655} \\ 3223 \\ \underline{-3186} \\ 37 \end{array}$$

Check : $56 \cdot 531 + 37 = 29,773$

45.
$$\begin{array}{r} 19 \\ 178 \overline{)3514} \\ \underline{-178} \\ 1734 \\ \underline{-1602} \\ 132 \end{array}$$

Check : $19 \cdot 178 + 132 = 3,514$

46.
$$\begin{array}{r} 17 \\ 164 \overline{)2929} \\ \underline{-164} \\ 1289 \\ \underline{-1148} \\ 141 \end{array}$$

Check : $17 \cdot 164 + 141 = 2,929$

	Divisible by	2	3	4	5	6	9	10
47.	2,940	Y	Y	Y	Y	Y		Y
48.	5,850	Y	Y		Y	Y	Y	Y
49.	43,785		Y		Y		Y	
50.	72,954	Y	Y			Y	Y	
51.	181,223							
52.	379,157							
53.	9,499,200	Y	Y	Y	Y	Y		Y
54.	6,653,100	Y	Y	Y	Y	Y		Y

55. 10 has 1 zero : take away 1 zero : 70

56. 10 has 1 zero : take away 1 zero : 90

57. Begin by cancelling a zero from each.

$$\begin{array}{r} 22 \\ 45 \overline{)990} \\ \underline{-90} \\ 90 \\ \underline{-90} \\ 0 \end{array}$$

58. Begin by cancelling a zero from each.

$$\begin{array}{r} 35 \\ 26 \overline{)910} \\ \underline{-78} \\ 130 \\ \underline{-130} \\ 0 \end{array}$$

59. $360,000 \div 40 = 9,000$

60. $240,000 \div 60 = 4,000$

61. $50,000 \div 1,000 = 50$

62. $100,000 \div 500 = 200$

TRY IT YOURSELF

$$\begin{array}{r}
 63. \quad \begin{array}{r} 4325 \\ 6 \overline{)25950} \\ \underline{-24} \\ 19 \\ \underline{-18} \\ 15 \\ \underline{-12} \\ 30 \\ \underline{-30} \\ 0 \end{array}
 \end{array}$$

$$\begin{array}{r}
 64. \quad \begin{array}{r} 3363 \\ 7 \overline{)23541} \\ \underline{-21} \\ 25 \\ \underline{-21} \\ 44 \\ \underline{-42} \\ 21 \\ \underline{-21} \\ 0 \end{array}
 \end{array}$$

$$\begin{array}{r}
 65. \quad \begin{array}{r} 6 \\ 9 \overline{)54} \\ \underline{-54} \\ 0 \end{array}
 \end{array}$$

$$\begin{array}{r}
 66. \quad \begin{array}{r} 9 \\ 8 \overline{)72} \\ \underline{-72} \\ 0 \end{array}
 \end{array}$$

$$\begin{array}{r}
 67. \quad \begin{array}{r} 8 \\ 31 \overline{)273} \\ \underline{-248} \\ 25 \end{array} \\
 8 \text{ R } 25
 \end{array}$$

$$\begin{array}{r}
 68. \quad \begin{array}{r} 8 \\ 35 \overline{)295} \\ \underline{-280} \\ 15 \end{array} \\
 8 \text{ R } 15
 \end{array}$$

69. Begin by cancelling 2 zeros from each.

$$\begin{array}{r}
 160 \\
 4 \overline{)640} \\
 \underline{-4} \\
 24 \\
 \underline{-24} \\
 0
 \end{array}$$

70. Begin by cancelling 3 zeros from each.

$$\begin{array}{r}
 25 \\
 5 \overline{)125} \\
 \underline{-10} \\
 25 \\
 \underline{-25} \\
 0
 \end{array}$$

$$\begin{array}{r}
 71. \quad \begin{array}{r} 106 \\ 7 \overline{)745} \\ \underline{-7} \\ 04 \\ \underline{-0} \\ 45 \\ \underline{-42} \\ 3 \end{array} \\
 106 \text{ R } 3
 \end{array}$$

$$\begin{array}{r}
 72. \quad \begin{array}{r} 103 \\ 9 \overline{)931} \\ \underline{-9} \\ 03 \\ \underline{-0} \\ 31 \\ \underline{-27} \\ 4 \end{array} \\
 103 \text{ R } 4
 \end{array}$$

$$\begin{array}{r}
 73. \quad \begin{array}{r} 509 \\ 29 \overline{)14761} \\ \underline{-145} \\ 26 \\ \underline{-0} \\ 261 \\ \underline{-261} \\ 0 \end{array}
 \end{array}$$

$$\begin{array}{r}
 74. \quad \begin{array}{r} 407 \\ 27 \overline{)10989} \\ \underline{-108} \\ 18 \\ \underline{-0} \\ 189 \\ \underline{-189} \\ 0 \end{array}
 \end{array}$$

$$\begin{array}{r}
 75. \quad \begin{array}{r} 3080 \\ 175 \overline{)539000} \\ \underline{-525} \\ 140 \\ \underline{-0} \\ 1400 \\ \underline{-1400} \\ 0 \end{array}
 \end{array}$$

$$\begin{array}{r}
 76. \quad \begin{array}{r} 4050 \\ 185 \overline{)749250} \\ \underline{-740} \\ 92 \\ \underline{-0} \\ 925 \\ \underline{-925} \\ 0 \end{array}
 \end{array}$$

$$\begin{array}{r}
 77. \quad \begin{array}{r} 5 \\ 15 \overline{)75} \\ \underline{-75} \\ 0 \end{array}
 \end{array}$$

$$\begin{array}{r}
 78. \quad \begin{array}{r} 6 \\ 16 \overline{)96} \\ \underline{-96} \\ 0 \end{array}
 \end{array}$$

$$\begin{array}{r}
 79. \quad \begin{array}{r} 23 \\ 212 \overline{)5087} \\ \underline{-424} \\ 847 \\ \underline{-636} \\ 211 \\ 23 \text{ R } 211 \end{array}
 \end{array}$$

$$\begin{array}{r}
 80. \quad \begin{array}{r} 26 \\ 214 \overline{)5777} \\ \underline{-428} \\ 1497 \\ \underline{-1284} \\ 213 \\ 26 \text{ R } 213 \end{array}
 \end{array}$$

$$\begin{array}{r}
 81. \quad \begin{array}{r} 30 \\ 42 \overline{)1273} \\ \underline{-126} \\ 13 \\ \underline{-0} \\ 13 \\ 30 \text{ R } 13 \end{array}
 \end{array}$$

$$\begin{array}{r}
 82. \quad \begin{array}{r} 40 \\ 83 \overline{)3363} \\ \underline{-332} \\ 43 \\ \underline{-0} \\ 43 \\ 40 \text{ R } 43 \end{array}
 \end{array}$$

83. 1,000 has 3 zeros : remove 3 zeros : 89

84. 1,000 has 3 zeros : remove 3 zeros : 930

$$\begin{array}{r}
 85. \quad \begin{array}{r} 7 \\ 8 \overline{)57} \\ \underline{-56} \\ 1 \end{array} \\
 7 \text{ R } 1
 \end{array}$$

$$\begin{array}{r}
 86. \quad \begin{array}{r} 9 \\ 9 \overline{)82} \\ \underline{-81} \\ 1 \end{array} \\
 9 \text{ R } 1
 \end{array}$$

LOOK ALIKES

$$\begin{array}{l}
 87. \quad \begin{array}{l} \text{a. } 368,000 \div 10 = 36,800 \\ \text{b. } 368,000 \div 100 = 3,680 \\ \text{c. } 368,000 \div 1,000 = 368 \end{array}
 \end{array}$$

$$\begin{array}{l}
 88. \quad \begin{array}{l} \text{a. } 475,000 \div 1,000 = 475 \\ \text{b. } 475,000 \div 100 = 4,750 \\ \text{c. } 475,000 \div 10 = 47,500 \end{array}
 \end{array}$$

$$\begin{array}{l}
 89. \quad \begin{array}{l} \text{a. } 607 \div 12 = 50 \text{ R } 7 \\ \text{b. } 608 \div 12 = 50 \text{ R } 8 \\ \text{c. } 606 \div 12 = 50 \text{ R } 6 \end{array}
 \end{array}$$

$$\begin{array}{l}
 90. \quad \begin{array}{l} \text{a. } 453 \div 23 = 19 \text{ R } 16 \\ \text{b. } 452 \div 23 = 19 \text{ R } 15 \\ \text{c. } 454 \div 23 = 19 \text{ R } 17 \end{array}
 \end{array}$$

APPLICATIONS

$$91. \quad 2500 \div 4 = 625 \text{ tickets}$$

$$92. \quad 371 \div 7 = 53 \text{ days}$$

$$93. \quad 405 \div 15 = 27 \text{ trips}$$

$$94. \quad 288 \div 36 = 8 \text{ shelves}$$

$$95. \quad 50 \div 23 = 2 \text{ R } 4 \text{ Each student got 2 cartons, with 4 left over.}$$

$$96. \quad 200 \div 11 = 18 \text{ R } 2 \text{ They can wrap 18 lamps with 2 ft. left.}$$

$$97. \quad 640 \div 68 = 9 \text{ R } 28 \text{ It can be filled 9 times with 28 oz. left.}$$

$$98. \quad 896 \div 6 = 149 \text{ R } 2 \text{ 149 cups with 2 oz. remaining.}$$

$$99. \quad 58,000 \div 4 = 14,500 \text{ There are 14,500 lbs. on each jack.}$$

$$100. \quad 10,282,800 \div 22 = \$467,400 \text{ each}$$

$$101. \quad 25,200 \div 240 = \$105 \text{ per book}$$

$$102. \quad 950,000 \div 20 = 47,500 \text{ gallons each hour}$$

$$103. \quad 700 \div 140 = 5 \text{ miles per gallon}$$

$$104. \quad 33,750,000 \cdot 45 = 750,000 \text{ gallons}$$

$$105. \quad 156 \div 12 = 13 \text{ They should order 13 dozen donuts.}$$

$$106. \quad 1,000 \div 10 = 100 \text{ decades per millennium}$$

$$107. \quad 216 \div 7 \approx 30.86 \text{ - teams won't have the same number}$$

$$216 \div 8 = 27 \text{ - not an even number of teams}$$

$$216 \div 9 = 24 \text{ GOOD CHOICE}$$

$$216 \div 10 = 21.6 \text{ - teams won't have the same number}$$

There are 24 teams with 9 girls each.

$$108. \quad 744 \div 12 = 62 \text{ . Putting one tree on the far end gives 63 trees.}$$

$$109. \quad \text{Divide each by 12: Health Sciences: \$4,059; Business: \$4,353; Social Sciences: \$3,882}$$

$$110. \quad \text{Divide column 2 by column 3: AZ: 60; OK: 57; RI: 1,058; SC: 165}$$

WRITING

$$111. \quad \text{Find out how many times you must subtract 6 from 24 to get 0.}$$

$$112. \quad \text{Because 0 of anything will be equal to 0, but no number of zeros can give a non-zero number.}$$

$$113. \quad 30 - 2 \cdot 8 = 30 - 16 = 14$$

Since 14 is divisible by 7, 308 is also.

$$114. \quad 8 - 4 + 8 - 1 = 11$$

Since 11 is divisible by 11, 1,848 is also.

LOOK ALIKES

115. a. $272 + 4 = 276$
 b. $272 - 4 = 268$
 c. $272 \cdot 4 = 1,088$
 d. $272 \div 4 = 68$
116. a. $430 + 55 = 485$
 b. $430 - 55 = 375$
 c. $430 \cdot 55 = 23,650$
 d. $430 \div 55 = 7 \text{ R } 45$
117. a. $1,104 + 46 = 1,150$
 b. $1,104 - 46 = 1,058$
 c. $1,104 \cdot 46 = 50,784$
 d. $1,104 \div 46 = 24$
118. a. $3,024 + 378 = 3,402$
 b. $3,024 - 378 = 2,646$
 c. $3,024 \cdot 378 = 1,143,072$
 d. $3,024 \div 378 = 8$

Section 1.5: Prime Factors and Exponents**VOCABULARY**

- Numbers that are multiplied together are called factors.
- To factor a whole number means to express it as the product of other whole numbers.
- A prime number is a whole number greater than 1 that has only 1 and itself as factors.
- Whole numbers greater than 1 that are not prime numbers are called composite numbers.
- To prime factor a number means to write it as a product of only prime numbers.
- An exponent is used to represent repeated multiplication. It tells how many times the base is used as a factor.
- In the exponential expression 6^4 , the number 6 is the base and 4 is the exponent.
- We can read 5^2 as “5 to the second power” or as “5 squared”. We can read 7^3 as “7 to the third power” or as “7 cubed”.

CONCEPTS

9. $1 \cdot 45 = 45$ $3 \cdot 15 = 45$ $5 \cdot 9 = 45$
 The factors of 45, in order from least to greatest, are 1, 3, 5, 9, 15, 45.

10. $1 \cdot 28 = 28$ $2 \cdot 14 = 28$ $4 \cdot 7 = 28$
 The factors of 28, in order from least to greatest, are 1, 2, 4, 7, 14, 28.

11. yes
12. yes
13. a. even, odd
 b. 0, 2, 4, 6, 8, 10, 12, 14, 16, 18
 c. 1, 3, 5, 7, 9, 11, 13, 15, 17, 19
14. a. 2, 3, 5, 7, 11, 13, 17, 19, 23, 29
 b. 4, 6, 8, 9, 10, 12, 14, 15, 16, 18
15. The blank should be a 6.
 The prime factorization of 150 is $2 \cdot 3 \cdot 5 \cdot 5$.

16. 4, 6, 9, 10

17.
$$\begin{array}{r} 2 \overline{)150} \\ 3 \overline{)75} \\ 5 \overline{)25} \\ 5 \end{array}$$

The prime factorization of 150 is $2 \cdot 3 \cdot 5 \cdot 5$.

18. a. 2
 b. 3, 5, 7, 11, 13, ...

NOTATION

19. a. base 7; exponent 6
 b. base 15; exponent 1
20. a. 3 factors of 2
 b. 2 factors of 3

GUIDED PRACTICE

21. 1, 2, 5, 10
22. 1, 2, 3, 6
23. 1, 2, 4, 5, 8, 10, 20, 40
24. 1, 3, 5, 15, 25, 75
25. 1, 2, 3, 6, 9, 18

26. $1, 2, 4, 8, 16, 32$

27. $1, 2, 4, 11, 22, 44$

28. $1, 5, 13, 65$

29. $1, 7, 11, 77$

30. $1, 3, 9, 27, 81$

31. $1, 2, 4, 5, 10, 20, 25, 50, 100$

32. $1, 3, 7, 9, 21, 49, 63, 147, 441$

33. $2 \cdot 4$

34. $3 \cdot 3$

35. $3 \cdot 9$

36. $5 \cdot 7$

37. $7 \cdot 7$

38. $5 \cdot 5$

39. $2 \cdot 10$ or $4 \cdot 5$

40. $2 \cdot 8$ or $4 \cdot 4$

41. $30 = 2 \cdot 15$
 $= 2 \cdot 3 \cdot 5$

42. $28 = 2 \cdot 14$
 $= 2 \cdot 2 \cdot 7$

43. $63 = 3 \cdot 21$
 $= 3 \cdot 3 \cdot 7$

44. $50 = 2 \cdot 25$
 $= 2 \cdot 5 \cdot 5$

45. $54 = 6 \cdot 9$
 $= 2 \cdot 3 \cdot 9$ or $3 \cdot 3 \cdot 6$

46. $56 = 4 \cdot 14$
 $= 2 \cdot 2 \cdot 14$ or $2 \cdot 4 \cdot 7$

47. $60 = 2 \cdot 3 \cdot 10$
 $= 2 \cdot 5 \cdot 6$
 $= 2 \cdot 2 \cdot 15$
 $= 3 \cdot 4 \cdot 5$

48. $64 = 2 \cdot 4 \cdot 8$
 $= 2 \cdot 2 \cdot 16$
 $= 4 \cdot 4 \cdot 4$

49. $11 : 1$ and 11

50. $29 : 1$ and 29

51. $37 : 1$ and 37

52. $41 : 1$ and 41

53. Yes

54. Yes

55. No $(3 \cdot 3 \cdot 11)$

56. No $(3 \cdot 3 \cdot 3)$

57. No $(3 \cdot 17)$

58. No $(7 \cdot 13)$

59. Yes

60. Yes

61. $30 = 6 \cdot 5$
 $= 2 \cdot 3 \cdot 5$

62. $20 = 4 \cdot 5$
 $= 2 \cdot 2 \cdot 5$
 $= 2^2 \cdot 5$

63. $39 = 3 \cdot 13$

64. $105 = 15 \cdot 7$
 $= 3 \cdot 5 \cdot 7$

$$\begin{aligned} 65. \quad 99 &= 9 \cdot 11 \\ &= 3 \cdot 3 \cdot 11 \\ &= 3^2 \cdot 11 \end{aligned}$$

$$\begin{aligned} 66. \quad 400 &= 16 \cdot 25 \\ &= 4 \cdot 4 \cdot 5 \cdot 5 \\ &= 2 \cdot 2 \cdot 2 \cdot 2 \cdot 5 \cdot 5 \\ &= 2^4 \cdot 5^2 \end{aligned}$$

$$\begin{aligned} 67. \quad 162 &= 2 \cdot 81 \\ &= 2 \cdot 9 \cdot 9 \\ &= 2 \cdot 3 \cdot 3 \cdot 3 \cdot 3 \\ &= 2 \cdot 3^4 \end{aligned}$$

$$\begin{aligned} 68. \quad 98 &= 2 \cdot 49 \\ &= 2 \cdot 7 \cdot 7 \\ &= 2 \cdot 7^2 \end{aligned}$$

$$\begin{aligned} 69. \quad 64 &= 8 \cdot 8 \\ &= 2 \cdot 4 \cdot 2 \cdot 4 \\ &= 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \\ &= 2^6 \end{aligned}$$

$$\begin{aligned} 70. \quad 243 &= 3 \cdot 81 \\ &= 3 \cdot 9 \cdot 9 \\ &= 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 \\ &= 3^5 \end{aligned}$$

$$\begin{aligned} 71. \quad 147 &= 3 \cdot 49 \\ &= 3 \cdot 7 \cdot 7 \\ &= 3 \cdot 7^2 \end{aligned}$$

$$\begin{aligned} 72. \quad 140 &= 4 \cdot 35 \\ &= 2 \cdot 2 \cdot 5 \cdot 7 \\ &= 2^2 \cdot 5 \cdot 7 \end{aligned}$$

$$\begin{aligned} 73. \quad 220 &= 22 \cdot 10 \\ &= 2 \cdot 11 \cdot 2 \cdot 5 \\ &= 2^2 \cdot 5 \cdot 11 \end{aligned}$$

$$\begin{aligned} 74. \quad 385 &= 5 \cdot 77 \\ &= 5 \cdot 7 \cdot 11 \end{aligned}$$

$$\begin{aligned} 75. \quad 102 &= 2 \cdot 51 \\ &= 2 \cdot 3 \cdot 17 \end{aligned}$$

$$\begin{aligned} 76. \quad 114 &= 2 \cdot 57 \\ &= 2 \cdot 3 \cdot 19 \end{aligned}$$

$$77. \quad 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 = 2^5$$

$$78. \quad 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 = 3^6$$

$$79. \quad 5 \cdot 5 \cdot 5 \cdot 5 = 5^4$$

$$80. \quad 9 \cdot 9 \cdot 9 = 9^3$$

$$81. \quad 4(4)(8)(8)(8) = 4^2(8^3)$$

$$82. \quad 12(12)(12)(16) = 12^3(16)$$

$$83. \quad 7 \cdot 7 \cdot 7 \cdot 9 \cdot 9 \cdot 7 \cdot 7 \cdot 7 \cdot 7 = 7^7 \cdot 9^2$$

$$84. \quad 6 \cdot 6 \cdot 6 \cdot 5 \cdot 5 \cdot 6 \cdot 6 \cdot 6 = 5^2 \cdot 6^6$$

$$\begin{aligned} 85. \quad \text{a. } 3^4 &= 3 \cdot 3 \cdot 3 \cdot 3 \\ &= 81 \end{aligned}$$

$$\begin{aligned} \text{b. } 4^3 &= 4 \cdot 4 \cdot 4 \\ &= 64 \end{aligned}$$

$$\begin{aligned} 86. \quad \text{a. } 5^3 &= 5 \cdot 5 \cdot 5 \\ &= 125 \end{aligned}$$

$$\begin{aligned} \text{b. } 3^5 &= 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 \\ &= 243 \end{aligned}$$

$$\begin{aligned} 87. \quad \text{a. } 2^5 &= 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \\ &= 32 \end{aligned}$$

$$\begin{aligned} \text{b. } 5^2 &= 5 \cdot 5 \\ &= 25 \end{aligned}$$

$$\begin{aligned} 88. \quad \text{a. } 4^5 &= 4 \cdot 4 \cdot 4 \cdot 4 \cdot 4 \\ &= 1,024 \end{aligned}$$

$$\begin{aligned} \text{b. } 5^4 &= 5 \cdot 5 \cdot 5 \cdot 5 \\ &= 625 \end{aligned}$$

89. a. $7^3 = 7 \cdot 7 \cdot 7$
 $= 343$

b. $3^7 = 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3$
 $= 2,187$

90. a. $8^2 = 8 \cdot 8$
 $= 64$

b. $2^8 = 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2$
 $= 256$

91. a. $9^1 = 9$
 b. $1^9 = 1$

92. a. $20^1 = 20$
 b. $1^{20} = 1$

93. $2 \cdot 3 \cdot 3 \cdot 5 = 90$

94. $2 \cdot 2 \cdot 2 \cdot 7 = 56$

95. $7 \cdot 11^2 = 7 \cdot 121$
 $= 847$

96. $2 \cdot 3^4 = 2 \cdot 81$
 $= 162$

97. $3^2 \cdot 5^2 = 9 \cdot 25$
 $= 225$

98. $3^3 \cdot 5^3 = 27 \cdot 125$
 $= 3,375$

99. $2^3 \cdot 3^3 \cdot 13 = 8 \cdot 27 \cdot 13$
 $= 2,808$

100. $2^3 \cdot 3^2 \cdot 11 = 8 \cdot 9 \cdot 11$
 $= 792$

APPLICATIONS

101. Factors of 28: 1, 2, 4, 7, 14, 28

$$1 + 2 + 4 + 7 + 14 = 28$$

102. 79 and 97 are factors of 7,663.

103. 2^2 square units, 3^2 square units, 4^2 square units

104. a. $2 \cdot 2 \cdot 2 \cdot 2 = 2^4$
 $= 16$ cells

b. base = 2

c. $2^{12} = 4,096$ cells

WRITING

105. Multiply the factors together to verify you get the original number.

106. Factors are any whole number that divides the number. Prime factors must be prime. 4 and 7 are factors of 28, but 2, 2, and 7 are the prime factors of 28.

107. $1^2 = 1^3 = 1^4 = 1$. Any power of 1 is 1.

108. There are infinitely many prime numbers that exist.

REVIEW

109. $8 \cdot 15 + 5 = 120 + 5$
 $= 125$ band members

110. $33,480 - 9,650 = \$23,830$ per year
 $23,830 \cdot 4 = \$95,320$ for 4 years

Section 1.6: The Least Common Multiple and the Greatest Common Factor

VOCABULARY

1. The multiples of a number are the products of that number and 1, 2, 3, 4, 5, and so on.
2. Because 12 is the smallest number that is a multiple of both 3 and 4, it is the least common multiple of 3 and 4.
3. One number is divisible by another number if, when dividing them, we get a remainder of 0.
4. Because 6 is the largest number that is a factor of both 18 and 24, it is the greatest common factor of 18 and 24.

CONCEPTS

5. a. 12
- b. In general, the LCM of two whole numbers is the smallest whole number that is divisible by both numbers.
6. a. 6 and 12
- b. 6
7. a. 20
- b. 20
8. The blank should be a 6.
9. a. 2 appears twice with 36.
- b. 3 appears twice with 90 and with 36.
- c. 5 appears once with 90.
- d. $LCM = 2 \cdot 2 \cdot 3 \cdot 3 \cdot 5$
 $= 180$
10. a. 2 appears twice with 140.
- b. 5 appears once with 140 and with 70.
- c. 7 appears once in all 3.
- d. $LCM = 2 \cdot 2 \cdot 5 \cdot 7$
 $= 140$
11. a. 2 appears twice with 12.
- b. 3 appears three times with 54.
- c. $LCM = 2^2 \cdot 3^3$
 $= 108$
12. a. 1, 3, and 9 are common to both.
- b. $GCF = 9$
13. a. 2, 3, and 5 are common to both.
- b. $GCF = 2 \cdot 3 \cdot 5$
 $= 30$
14. a. 2, 2, and 3 are common to all.
- b. $GCF = 2 \cdot 2 \cdot 3 = 12$

NOTATION

15. a. The abbreviation for the greatest common factor is GCF.
- b. The abbreviation for the least common multiple is LCM.
16. a. We read $LCM(2, 15) = 30$ as “The least common multiple of 2 and 15 is 30.”
- b. We read $GCF(18, 24) = 6$ as “The greatest common factor of 18 and 24 is 6.”

GUIDED PRACTICE

17. 4, 8, 12, 16, 20, 24, 28, 32
18. 2, 4, 6, 8, 10, 12, 14, 16
19. 11, 22, 33, 44, 55, 66, 77, 88
20. 10, 20, 30, 40, 50, 60, 70, 80
21. 8, 16, 24, 32, 40, 48, 56, 64
22. 9, 18, 27, 36, 45, 54, 63, 72
23. 20, 40, 60, 80, 100, 120, 140, 160
24. 30, 60, 90, 120, 150, 180, 210, 240
25. 5 is not divisible by 3.
- 10 is not divisible by 3.
- 15 is divisible by 3.
- $LCM(3, 5) = 15$
26. 9 is not divisible by 6.
- 18 is divisible by 6.
- $LCM(6, 9) = 18$
27. 12 is not divisible by 8.
- 24 is divisible by 8.
- $LCM(8, 12) = 24$
28. 25 is not divisible by 10.
- 50 is divisible by 10.
- $LCM(10, 25) = 50$

29. 11 is not divisible by 5.

22 is not divisible by 5.

33 is not divisible by 5.

44 is not divisible by 5.

55 is divisible by 5.

$LCM(5,11) = 55$

30. 11 is not divisible by 7.

22 is not divisible by 7.

33 is not divisible by 7.

44 is not divisible by 7.

55 is not divisible by 7.

66 is not divisible by 7.

77 is divisible by 7.

$LCM(7,11) = 77$

31. 7 is not divisible by 4.

14 is not divisible by 4.

21 is not divisible by 4.

28 is divisible by 4.

$LCM(4,7) = 28$

32. 8 is not divisible by 5.

16 is not divisible by 5.

24 is not divisible by 5.

32 is not divisible by 5.

40 is divisible by 5.

$LCM(5,8) = 40$

33. 6 is not divisible by 3 and 4.

12 is divisible by 3 and 4.

$LCM(3,4,6) = 12$

34. 8 is not divisible by 2 and 3.

16 is not divisible by 2 and 3.

24 is divisible by 2 and 3.

$LCM(2,3,8) = 24$

35. 10 is not divisible by 2 and 3.

20 is not divisible by 2 and 3.

30 is divisible by 2 and 3.

$LCM(2,3,10) = 30$

36. 15 is not divisible by 3 and 6.

30 is divisible by 3 and 6.

$LCM(3,6,15) = 30$

37. $16 = 2^4$

$20 = 2^2 \cdot 5$

$LCM = 2^4 \cdot 5$

$= 16 \cdot 5$

$= 80$

38. $14 = 2 \cdot 7$

$21 = 3 \cdot 7$

$LCM = 2 \cdot 3 \cdot 7$

$= 42$

39. $30 = 2 \cdot 3 \cdot 5$

$50 = 2 \cdot 5^2$

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

$= 6 \cdot 25$

$= 150$

40. $21 = 3 \cdot 7$

$27 = 3^3$

$LCM = 3^3 \cdot 7$

$= 27 \cdot 7$

$= 189$

$$\begin{aligned}
 41. \quad 35 &= 5 \cdot 7 \\
 45 &= 3^2 \cdot 5 \\
 LCM &= 3^2 \cdot 5 \cdot 7 \\
 &= 9 \cdot 35 \\
 &= 315
 \end{aligned}$$

$$\begin{aligned}
 42. \quad 36 &= 2^2 \cdot 3^2 \\
 48 &= 2^4 \cdot 3 \\
 LCM &= 2^4 \cdot 3^2 \\
 &= 16 \cdot 9 \\
 &= 144
 \end{aligned}$$

$$\begin{aligned}
 43. \quad 100 &= 2^2 \cdot 5^2 \\
 120 &= 2^3 \cdot 3 \cdot 5 \\
 LCM &= 2^3 \cdot 3 \cdot 5^2 \\
 &= 600
 \end{aligned}$$

$$\begin{aligned}
 44. \quad 120 &= 2^3 \cdot 3 \cdot 5 \\
 180 &= 2^2 \cdot 3^2 \cdot 5 \\
 LCM &= 2^3 \cdot 3^2 \cdot 5 \\
 &= 360
 \end{aligned}$$

$$\begin{aligned}
 45. \quad 6 &= 2 \cdot 3 \\
 24 &= 2^3 \cdot 3 \\
 36 &= 2^2 \cdot 3^2 \\
 LCM &= 2^3 \cdot 3^2 \\
 &= 72
 \end{aligned}$$

$$\begin{aligned}
 46. \quad 6 &= 2 \cdot 3 \\
 10 &= 2 \cdot 5 \\
 18 &= 2 \cdot 3^2 \\
 LCM &= 2 \cdot 3^2 \cdot 5 \\
 &= 90
 \end{aligned}$$

$$\begin{aligned}
 47. \quad 5 &= 5 \\
 12 &= 2^2 \cdot 3 \\
 15 &= 3 \cdot 5 \\
 LCM &= 2^2 \cdot 3 \cdot 5 \\
 &= 60
 \end{aligned}$$

$$\begin{aligned}
 48. \quad 8 &= 2^3 \\
 12 &= 2^2 \cdot 3 \\
 16 &= 2^4 \\
 LCM &= 2^4 \cdot 3 \\
 &= 48
 \end{aligned}$$

$$\begin{aligned}
 49. \quad 4 &= \underline{2} \cdot 2 \\
 6 &= \underline{2} \cdot 3 \\
 GCF &= 2
 \end{aligned}$$

$$\begin{aligned}
 50. \quad 6 &= 2 \cdot \underline{3} \\
 15 &= \underline{3} \cdot 5 \\
 GCF &= 3
 \end{aligned}$$

$$\begin{aligned}
 51. \quad 9 &= 3 \cdot \underline{3} \\
 12 &= 2 \cdot 2 \cdot \underline{3} \\
 GCF &= 3
 \end{aligned}$$

$$\begin{aligned}
 52. \quad 10 &= \underline{2} \cdot 5 \\
 12 &= \underline{2} \cdot 2 \cdot 3 \\
 GCF &= 2
 \end{aligned}$$

$$\begin{aligned}
 53. \quad 22 &= 2 \cdot \underline{11} \\
 33 &= 3 \cdot \underline{11} \\
 GCF &= 11
 \end{aligned}$$

$$\begin{aligned}
 54. \quad 14 &= 2 \cdot \underline{7} \\
 21 &= 3 \cdot \underline{7} \\
 GCF &= 7
 \end{aligned}$$

$$\begin{aligned}
 55. \quad 15 &= \underline{3} \cdot \underline{5} \\
 30 &= 2 \cdot \underline{3} \cdot \underline{5} \\
 GCF &= 3 \cdot 5 \\
 &= 15
 \end{aligned}$$

$$\begin{aligned}
 56. \quad 15 &= \underline{3} \cdot \underline{5} \\
 75 &= \underline{3} \cdot \underline{5} \cdot 5 \\
 GCF &= 3 \cdot 5 \\
 &= 15
 \end{aligned}$$

$$57. \quad 18 = \underline{2} \cdot \underline{3} \cdot \underline{3}$$

$$96 = \underline{2} \cdot \underline{2} \cdot \underline{2} \cdot \underline{2} \cdot \underline{2} \cdot \underline{3}$$

$$GCF = 2 \cdot 3$$

$$= 6$$

$$58. \quad 30 = \underline{2} \cdot \underline{3} \cdot \underline{5}$$

$$48 = \underline{2} \cdot \underline{2} \cdot \underline{2} \cdot \underline{2} \cdot \underline{3}$$

$$GCF = 2 \cdot 3$$

$$= 6$$

$$59. \quad 28 = \underline{2} \cdot \underline{2} \cdot \underline{7}$$

$$42 = \underline{2} \cdot \underline{3} \cdot \underline{7}$$

$$GCF = 2 \cdot 7$$

$$= 14$$

$$60. \quad 63 = 3 \cdot \underline{3} \cdot \underline{7}$$

$$84 = 2 \cdot \underline{2} \cdot \underline{3} \cdot \underline{7}$$

$$GCF = 3 \cdot 7$$

$$= 21$$

$$61. \quad 16 = 2 \cdot 2 \cdot 2 \cdot 2$$

$$51 = 3 \cdot 17$$

$$GCF = 1$$

$$62. \quad 27 = 3 \cdot 3 \cdot 3$$

$$64 = 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2$$

$$GCF = 1$$

$$63. \quad 81 = 3 \cdot 3 \cdot 3 \cdot 3$$

$$125 = 5 \cdot 5 \cdot 5$$

$$GCF = 1$$

$$64. \quad 57 = 3 \cdot 19$$

$$125 = 5 \cdot 5 \cdot 5$$

$$GCF = 1$$

$$65. \quad 12 = 2 \cdot 2 \cdot 3$$

$$68 = 2 \cdot 2 \cdot 17$$

$$92 = 2 \cdot 2 \cdot 23$$

$$GCF = 2 \cdot 2$$

$$= 4$$

$$66. \quad 24 = 2 \cdot 2 \cdot 2 \cdot 3$$

$$36 = 2 \cdot 2 \cdot 3 \cdot 3$$

$$40 = 2 \cdot 2 \cdot 2 \cdot 5$$

$$GCF = 2 \cdot 2$$

$$= 4$$

$$67. \quad 72 = 2 \cdot 2 \cdot 2 \cdot 3 \cdot 3$$

$$108 = 2 \cdot 2 \cdot 3 \cdot 3 \cdot 3$$

$$144 = 2 \cdot 2 \cdot 2 \cdot 2 \cdot 3 \cdot 3$$

$$GCF = 2 \cdot 2 \cdot 3 \cdot 3$$

$$= 36$$

$$68. \quad 81 = 3 \cdot 3 \cdot 3 \cdot 3$$

$$108 = 2 \cdot 2 \cdot 3 \cdot 3 \cdot 3$$

$$162 = 2 \cdot 3 \cdot 3 \cdot 3 \cdot 3$$

$$GCF = 3 \cdot 3 \cdot 3$$

$$= 27$$

TRY IT YOURSELF

$$69. \quad 100 = 2 \cdot 2 \cdot 5 \cdot 5$$

$$120 = 2 \cdot 2 \cdot 2 \cdot 3 \cdot 5$$

$$LCM = 2 \cdot 2 \cdot 2 \cdot 3 \cdot 5 \cdot 5$$

$$= 600$$

$$GCF = 2 \cdot 2 \cdot 5$$

$$= 20$$

$$70. \quad 120 = 2 \cdot 2 \cdot 2 \cdot 3 \cdot 5$$

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

$$LCM = 2 \cdot 2 \cdot 2 \cdot 3 \cdot 3 \cdot 5$$

$$= 360$$

$$GCF = 2 \cdot 2 \cdot 3 \cdot 5$$

$$= 60$$

$$71. \quad 14 = 2 \cdot 7$$

$$140 = 2 \cdot 2 \cdot 5 \cdot 7$$

$$LCM = 2 \cdot 2 \cdot 5 \cdot 7$$

$$= 140$$

$$GCF = 2 \cdot 7$$

$$= 14$$

$$\begin{aligned}
 72. \quad & 15 = 3 \cdot 5 \\
 & 300 = 2 \cdot 2 \cdot 3 \cdot 5 \cdot 5 \\
 & LCM = 2 \cdot 2 \cdot 3 \cdot 5 \cdot 5 \\
 & \quad = 300 \\
 & GCF = 3 \cdot 5 \\
 & \quad = 15
 \end{aligned}$$

$$\begin{aligned}
 73. \quad & 66 = 2 \cdot 3 \cdot 11 \\
 & 198 = 2 \cdot 3 \cdot 3 \cdot 11 \\
 & 242 = 2 \cdot 11 \cdot 11 \\
 & LCM = 2 \cdot 3 \cdot 3 \cdot 11 \cdot 11 \\
 & \quad = 2,178 \\
 & GCF = 2 \cdot 11 \\
 & \quad = 22
 \end{aligned}$$

$$\begin{aligned}
 74. \quad & 52 = 2 \cdot 2 \cdot 13 \\
 & 78 = 2 \cdot 3 \cdot 13 \\
 & 130 = 2 \cdot 5 \cdot 13 \\
 & LCM = 2 \cdot 2 \cdot 3 \cdot 5 \cdot 13 \\
 & \quad = 780 \\
 & GCF = 2
 \end{aligned}$$

$$\begin{aligned}
 75. \quad & 8 = 2 \cdot 2 \cdot 2 \\
 & 9 = 3 \cdot 3 \\
 & 49 = 7 \cdot 7 \\
 & LCM = 2 \cdot 2 \cdot 2 \cdot 3 \cdot 3 \cdot 7 \cdot 7 \\
 & \quad = 3,528 \\
 & GCF = 1
 \end{aligned}$$

$$\begin{aligned}
 76. \quad & 9 = 3 \cdot 3 \\
 & 16 = 2 \cdot 2 \cdot 2 \cdot 2 \\
 & 25 = 5 \cdot 5 \\
 & LCM = 3 \cdot 3 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 5 \cdot 5 \\
 & \quad = 3,600 \\
 & GCF = 1
 \end{aligned}$$

$$\begin{aligned}
 77. \quad & 120 = 2 \cdot 2 \cdot 2 \cdot 3 \cdot 5 \\
 & 125 = 5 \cdot 5 \cdot 5 \\
 & LCM = 2 \cdot 2 \cdot 2 \cdot 3 \cdot 5 \cdot 5 \cdot 5 \\
 & \quad = 3,000 \\
 & GCF = 5
 \end{aligned}$$

$$\begin{aligned}
 78. \quad & 98 = 2 \cdot 7 \cdot 7 \\
 & 102 = 2 \cdot 3 \cdot 17 \\
 & LCM = 2 \cdot 3 \cdot 7 \cdot 7 \cdot 17 \\
 & \quad = 4,998 \\
 & GCF = 2
 \end{aligned}$$

$$\begin{aligned}
 79. \quad & 34 = 2 \cdot 17 \\
 & 68 = 2 \cdot 2 \cdot 17 \\
 & 102 = 2 \cdot 3 \cdot 17 \\
 & LCM = 2 \cdot 2 \cdot 3 \cdot 17 \\
 & \quad = 204 \\
 & GCF = 2 \cdot 17 = 34
 \end{aligned}$$

$$\begin{aligned}
 80. \quad & 26 = 2 \cdot 13 \\
 & 39 = 3 \cdot 13 \\
 & 65 = 5 \cdot 13 \\
 & LCM = 2 \cdot 3 \cdot 5 \cdot 13 \\
 & \quad = 390 \\
 & GCF = 13
 \end{aligned}$$

$$\begin{aligned}
 81. \quad & 46 = 2 \cdot 23 \\
 & 69 = 3 \cdot 23 \\
 & LCM = 2 \cdot 3 \cdot 23 \\
 & \quad = 138 \\
 & GCF = 23
 \end{aligned}$$

$$\begin{aligned}
 82. \quad & 38 = 2 \cdot 19 \\
 & 57 = 3 \cdot 19 \\
 & LCM = 2 \cdot 3 \cdot 19 \\
 & \quad = 114 \\
 & GCF = 19
 \end{aligned}$$

$$\begin{aligned}
 83. \quad & 50 = 2 \cdot 5 \cdot 5 \\
 & 81 = 3 \cdot 3 \cdot 3 \cdot 3 \\
 & LCM = 2 \cdot 3 \cdot 3 \cdot 3 \cdot 3 \cdot 5 \cdot 5 \\
 & \quad = 4,050 \\
 & GCF = 1
 \end{aligned}$$

84. $65 = 5 \cdot 13$

$81 = 3 \cdot 3 \cdot 3 \cdot 3$

$LCM = 3 \cdot 3 \cdot 3 \cdot 3 \cdot 5 \cdot 13$

$= 5,265$

$GCF = 1$

LOOK ALIKES

85. a. $6 = 2 \cdot 3$

$8 = 2 \cdot 2 \cdot 2$

$GCF = 2$

b. $GCF = 2 \cdot 10$

$= 20$

86. a. $3 = 3$

$9 = 3 \cdot 3$

$GCF = 3$

b. $GCF = 3 \cdot 10$

$= 30$

87. a. $4 = 2 \cdot 2$

$6 = 2 \cdot 3$

$GCF = 2$

b. $GCF = 2$

88. a. $10 = 2 \cdot 5$

$15 = 3 \cdot 5$

$GCF = 5$

b. $GCF = 5$

APPLICATIONS

89.	1 st	2 nd	3 rd
	7,500 mi.	15,000 mi.	22,500 mi.
	4 th	5 th	6 th
	30,000 mi.	37,500 mi.	45,000 mi.

90. \$20, \$40, \$60, \$80, \$100, \$120, \$140, \$160, \$180, \$200

91. $LCM(45,60) = 180$ minutes, or 3 hours

92. $LCM(23,28,33) = 23 \cdot 28 \cdot 33$

$= 21,252$ days

(23, 28, and 33 have no common factors other than 1.)

93. LCM of 10 and 12 = 60

5 packs of buns, 6 packs of hot dogs

94. Husband has a day off every 7 days.

Wife has a day off every 8 days.

$LCM(8,7) = 56$ – every 56 days together.

95. $LCM(6,8) = 24$

s4 sheets wide by 3 sheets tall = 12 sheets

96. a. $GCF(12,21,18) = 3$

The ladle should hold 3 ounces.

b. 4 ladles, 7 ladles, 6 ladles

97. a. $GCF(28,21,63) = 7$

The most that the art supplies cost a student is \$7.

b. 4 students, 3 students, 9 students

98. GCF of 135, 105, and 30 = 15 bears

WRITING

99. Find the prime factorization of both 8 and 28, then multiply each factor present the largest number of times it appears.

100. Find the prime factorization of both 8 and 28, then look for each factor common to all the smallest number of times it appears.

101. Since each factor has only one 3, the LCM should only have one 3.102. If there are no common factors in the prime factorizations, then the GCF is 1.**REVIEW**

103. $9,999 + 1,111 = 11,110$

104. $10,000 - 7,989 = 2,011$

105. $305 \cdot 50 = 15,250$

106. $2,100 \div 105 = 20$

Section 1.7: Order of Operations**VOCABULARY**1. Numbers are combined with the operations of addition, subtraction, multiplication, and division to create expressions.2. To *evaluate* the expression $2 + 5 \cdot 4$ means to find its value.

3. The grouping symbols $()$ are called parentheses, and the symbols $[]$ are called brackets.
4. The rule for the order of operations guarantees that an evaluation of a numerical expression will result in a single answer.
5. In the expression $9 + 6[8 + 6(4 - 1)]$, the parentheses are the inner most grouping symbols and the brackets are the outer most grouping symbols.
6. To find the mean (average) of a set of values, we add the values and divide by the number of values.

CONCEPTS

7. a. $5(2)^2 - 1$: square, multiply, subtract
 b. $15 + 90 - (2 \cdot 2)^3$: multiply, cube, add, subtract
 c. $7 \cdot 4^2$: square, multiply
 d. $(7 \cdot 4)^2$: multiply, square
8. a. $50 + 8 - 40$: add, subtract
 b. $50 - 40 + 8$: subtract, add
 c. $16 \cdot 2 \div 4$: multiply, divide
 d. $16 \div 4 \cdot 2$: divide, multiply
9. multiply; square
10. 7

NOTATION

11. The fraction bar groups the numerator and denominator.
12. $2[12 - (5 + 4)]$
13. We read the expression $16 - (4 + 9)$ as “16 minus the quantity of 4 plus 9.”
14. We read the expression $(8 - 3)^3$ as “The cube of the quantity of 8 minus 3.”
15. $7 \cdot 4 - 5(2)^2 = 7 \cdot 4 - 5(4)$
 $= 28 - 20$
 $= 8$

16. $2 + (5 + 6 \cdot 2) = 2 + (5 + 12)$
 $= 2 + 17$
 $= 19$
17. $[4(2 + 7)] - 4^2 = [4(9)] - 4^2$
 $= 36 - 4^2$
 $= 36 - 16$
 $= 20$
18. $\frac{12 + 5 \cdot 3}{3^2 - 2 \cdot 3} = \frac{12 + 15}{9 - 6}$
 $= \frac{27}{3}$
 $= 9$

GUIDED PRACTICE

19. $3 \cdot 5^2 - 28 = 3 \cdot 25 - 28$
 $= 75 - 28$
 $= 47$
20. $4 \cdot 2^2 - 11 = 4 \cdot 4 - 11$
 $= 16 - 11$
 $= 5$
21. $6 \cdot 3^2 - 41 = 6 \cdot 9 - 41$
 $= 54 - 41$
 $= 13$
22. $5 \cdot 4^2 - 32 = 5 \cdot 16 - 32$
 $= 80 - 32$
 $= 48$
23. $52 - 6 \cdot 3 + 4 = 52 - 18 + 4$
 $= 34 + 4$
 $= 38$
24. $66 - 8 \cdot 7 + 16 = 66 - 56 + 16$
 $= 10 + 16$
 $= 26$
25. $32 - 9 \cdot 3 + 31 = 32 - 27 + 31$
 $= 5 + 31$
 $= 36$

$$\begin{aligned}
 26. \quad 62 - 5 \cdot 8 + 27 &= 62 - 40 + 27 \\
 &= 22 + 27 \\
 &= 49
 \end{aligned}$$

$$\begin{aligned}
 27. \quad 192 \div 4 - 4(2)3 &= 48 - 24 \\
 &= 24
 \end{aligned}$$

$$\begin{aligned}
 28. \quad 455 \div 7 - 3(4)5 &= 65 - 60 \\
 &= 5
 \end{aligned}$$

$$\begin{aligned}
 29. \quad 252 \div 3 - 6(2)6 &= 84 - 72 \\
 &= 12
 \end{aligned}$$

$$\begin{aligned}
 30. \quad 264 \div 4 - 7(4)2 &= 66 - 56 \\
 &= 10
 \end{aligned}$$

$$\begin{aligned}
 31. \quad \text{a. } 26 - 2 + 9 &= 24 + 9 \\
 &= 33 \\
 \text{b. } 26 - (2 + 9) &= 26 - 11 \\
 &= 15
 \end{aligned}$$

$$\begin{aligned}
 32. \quad \text{a. } 37 - 4 + 11 &= 33 + 11 \\
 &= 44 \\
 \text{b. } 37 - (4 + 11) &= 37 - 15 \\
 &= 22
 \end{aligned}$$

$$\begin{aligned}
 33. \quad \text{a. } 51 - 16 + 8 &= 35 + 8 \\
 &= 43 \\
 \text{b. } 51 - (16 + 8) &= 51 - 24 \\
 &= 27
 \end{aligned}$$

$$\begin{aligned}
 34. \quad \text{a. } 73 - 35 + 9 &= 38 + 9 \\
 &= 47 \\
 \text{b. } 73 - (35 + 9) &= 73 - 44 \\
 &= 29
 \end{aligned}$$

$$\begin{aligned}
 35. \quad (4 + 6)^2 &= 10^2 \\
 &= 100
 \end{aligned}$$

$$\begin{aligned}
 36. \quad (3 + 4)^2 &= 7^2 \\
 &= 49
 \end{aligned}$$

$$\begin{aligned}
 37. \quad (3 + 5)^3 &= 8^3 \\
 &= 512
 \end{aligned}$$

$$\begin{aligned}
 38. \quad (5 + 2)^3 &= 7^3 \\
 &= 343
 \end{aligned}$$

$$\begin{aligned}
 39. \quad 8 + 4(29 - 5 \cdot 3) &= 8 + 4(29 - 15) \\
 &= 8 + 4(14) \\
 &= 8 + 56 \\
 &= 64
 \end{aligned}$$

$$\begin{aligned}
 40. \quad 33 + 6(56 - 9 \cdot 6) &= 33 + 6(56 - 54) \\
 &= 33 + 6(2) \\
 &= 33 + 12 \\
 &= 45
 \end{aligned}$$

$$\begin{aligned}
 41. \quad 77 + 9(38 - 4 \cdot 6) &= 77 + 9(38 - 24) \\
 &= 77 + 9(14) \\
 &= 77 + 126 \\
 &= 203
 \end{aligned}$$

$$\begin{aligned}
 42. \quad 162 + 7(47 - 6 \cdot 7) &= 162 + 7(47 - 42) \\
 &= 162 + 7(5) \\
 &= 162 + 35 \\
 &= 197
 \end{aligned}$$

$$\begin{aligned}
 43. \quad 46 + 3[5^2 - 4(9 - 5)] &= 46 + 3[25 - 4(4)] \\
 &= 46 + 3[25 - 16] \\
 &= 46 + 3[9] \\
 &= 46 + 27 \\
 &= 73
 \end{aligned}$$

$$\begin{aligned}
 44. \quad 53 + 5[6^2 - 5(8 - 1)] &= 53 + 5[36 - 5(7)] \\
 &= 53 + 5[36 - 35] \\
 &= 53 + 5[1] \\
 &= 58
 \end{aligned}$$

$$\begin{aligned}
 45. \quad 81+9[7^2-7(11-4)] &= 81+9[49-7(7)] \\
 &= 81+9[49-49] \\
 &= 81+9[0] \\
 &= 81
 \end{aligned}$$

$$\begin{aligned}
 46. \quad 81+3[8^2-7(13-5)] &= 81+3[64-7(8)] \\
 &= 81+3[64-56] \\
 &= 81+3[8] \\
 &= 81+24 \\
 &= 105
 \end{aligned}$$

$$\begin{aligned}
 47. \quad \frac{2(50)-4}{2(4^2)} &= \frac{100-4}{2 \cdot 16} \\
 &= \frac{96}{32} \\
 &= 3
 \end{aligned}$$

$$\begin{aligned}
 48. \quad \frac{4(34)-1}{5(3^2)} &= \frac{136-1}{5 \cdot 9} \\
 &= \frac{135}{45} \\
 &= 3
 \end{aligned}$$

$$\begin{aligned}
 49. \quad \frac{25(8)-8}{6(2^3)} &= \frac{200-8}{6 \cdot 8} \\
 &= \frac{192}{48} \\
 &= 4
 \end{aligned}$$

$$\begin{aligned}
 50. \quad \frac{6(31)-26}{4(2^3)} &= \frac{186-26}{4(8)} \\
 &= \frac{160}{32} \\
 &= 5
 \end{aligned}$$

$$\begin{aligned}
 51. \quad \frac{6+9+4+3+8}{5} &= \frac{30}{5} \\
 &= 6
 \end{aligned}$$

$$\begin{aligned}
 52. \quad \frac{7+1+8+2+2}{5} &= \frac{20}{5} \\
 &= 4
 \end{aligned}$$

$$\begin{aligned}
 53. \quad \frac{3+5+9+1+7+5}{6} &= \frac{30}{6} \\
 &= 5
 \end{aligned}$$

$$\begin{aligned}
 54. \quad \frac{8+7+7+2+4+8}{6} &= \frac{36}{6} \\
 &= 6
 \end{aligned}$$

$$\begin{aligned}
 55. \quad \frac{19+15+17+13}{4} &= \frac{64}{4} \\
 &= 16
 \end{aligned}$$

$$\begin{aligned}
 56. \quad \frac{11+14+12+11}{4} &= \frac{48}{4} \\
 &= 12
 \end{aligned}$$

$$\begin{aligned}
 57. \quad \frac{5+8+7+0+3+1}{6} &= \frac{24}{6} \\
 &= 4
 \end{aligned}$$

$$\begin{aligned}
 58. \quad \frac{9+3+4+11+14+1}{6} &= \frac{42}{6} \\
 &= 7
 \end{aligned}$$

TRY IT YOURSELF

$$\begin{aligned}
 59. \quad (8-6)^2 + (4-3)^2 &= 2^2 + 1^2 \\
 &= 4 + 1 \\
 &= 5
 \end{aligned}$$

$$\begin{aligned}
 60. \quad (2+1)^2 + (3+2)^2 &= 3^2 + 5^2 \\
 &= 9 + 25 \\
 &= 34
 \end{aligned}$$

$$\begin{aligned}
 61. \quad 2 \cdot 3^4 &= 2 \cdot 81 \\
 &= 162
 \end{aligned}$$

$$\begin{aligned}
 62. \quad 3^3 \cdot 5 &= 27 \cdot 5 \\
 &= 135
 \end{aligned}$$

$$\begin{aligned}
 63. \quad 7+4 \cdot 5 &= 7+20 \\
 &= 27
 \end{aligned}$$

$$\begin{aligned}
 64. \quad 6 \cdot 8 - 3 &= 48 - 3 \\
 &= 45
 \end{aligned}$$

$$\begin{aligned}
 65. \quad (7-4)^2 + 1 &= 3^2 + 1 \\
 &= 9 + 1 \\
 &= 10
 \end{aligned}$$

$$\begin{aligned}
 66. \quad (9-5)^3 + 8 &= 4^3 + 8 \\
 &= 64 + 8 \\
 &= 72
 \end{aligned}$$

$$\begin{aligned}
 67. \quad \frac{10+5}{52-47} &= \frac{15}{5} \\
 &= 3
 \end{aligned}$$

$$\begin{aligned}
 68. \quad \frac{18+12}{61-55} &= \frac{30}{6} \\
 &= 5
 \end{aligned}$$

$$\begin{aligned}
 69. \quad 5 \cdot 10^3 + 2 \cdot 10^2 + 3 \cdot 10^1 + 9 \\
 &= 5 \cdot 1000 + 2 \cdot 100 + 3 \cdot 10 + 9 \\
 &= 5,000 + 200 + 30 + 9 \\
 &= 5,239
 \end{aligned}$$

$$\begin{aligned}
 70. \quad 8 \cdot 10^3 + 0 \cdot 10^2 + 7 \cdot 10^1 + 4 \\
 &= 8 \cdot 1000 + 7 \cdot 10 + 4 \\
 &= 8,000 + 70 + 4 \\
 &= 8,074
 \end{aligned}$$

$$\begin{aligned}
 71. \quad 20 - 10 + 5 &= 10 + 5 \\
 &= 15
 \end{aligned}$$

$$\begin{aligned}
 72. \quad 80 - 5 + 4 &= 75 + 4 \\
 &= 79
 \end{aligned}$$

$$\begin{aligned}
 73. \quad 25 \div 5 \cdot 5 &= 5 \cdot 5 \\
 &= 25
 \end{aligned}$$

$$\begin{aligned}
 74. \quad 6 \div 2 \cdot 3 &= 3 \cdot 3 \\
 &= 9
 \end{aligned}$$

$$\begin{aligned}
 75. \quad 150 - 2(2 \cdot 6 - 4)^2 &= 150 - 2(12 - 4)^2 \\
 &= 150 - 2 \cdot 8^2 \\
 &= 150 - 2 \cdot 64 \\
 &= 150 - 128 \\
 &= 22
 \end{aligned}$$

$$\begin{aligned}
 76. \quad 760 - 2(2 \cdot 3 - 4)^2 &= 760 - 2(6 - 4)^2 \\
 &= 760 - 2 \cdot 2^2 \\
 &= 760 - 2 \cdot 4 \\
 &= 760 - 8 \\
 &= 752
 \end{aligned}$$

$$\begin{aligned}
 77. \quad 190 - 2[10^2 - (5 + 2^2)] + 45 \\
 &= 190 - 2[100 - (5 + 4)] + 45 \\
 &= 190 - 2[100 - 9] + 45 \\
 &= 190 - 2[91] + 45 \\
 &= 190 - 182 + 45 \\
 &= 53
 \end{aligned}$$

$$\begin{aligned}
 78. \quad 161 - 8[6(6) - 6^2] + 2^2(5) \\
 &= 161 - 8[36 - 36] + 4(5) \\
 &= 161 - 8[0] + 20 \\
 &= 181
 \end{aligned}$$

$$79. \quad 2 + 3(0) = 2$$

$$80. \quad 5(0) + 8 = 8$$

$$\begin{aligned}
 81. \quad \frac{(5-3)^2 + 2}{4^2 - (8+2)} &= \frac{2^2 + 2}{4^2 - 10} \\
 &= \frac{4 + 2}{16 - 10} \\
 &= \frac{6}{6} \\
 &= 1
 \end{aligned}$$

$$\begin{aligned}
 82. \quad \frac{(4^3 - 2) + 7}{5(2 + 4) - 7} &= \frac{(64 - 2) + 7}{5(6) - 7} \\
 &= \frac{62 + 7}{30 - 7} \\
 &= \frac{69}{23} \\
 &= 3
 \end{aligned}$$

$$\begin{aligned}
 83. \quad 4^2 + 3^2 &= 16 + 9 \\
 &= 25
 \end{aligned}$$

$$\begin{aligned} 84. \quad 12^2 + 5^2 &= 144 + 25 \\ &= 169 \end{aligned}$$

$$\begin{aligned} 85. \quad 3 + 2 \cdot 3^4 \cdot 5 &= 3 + 2 \cdot 81 \cdot 5 \\ &= 3 + 810 \\ &= 813 \end{aligned}$$

$$\begin{aligned} 86. \quad 3 \cdot 2^3 \cdot 4 - 12 &= 3 \cdot 8 \cdot 4 - 12 \\ &= 96 - 12 \\ &= 84 \end{aligned}$$

$$\begin{aligned} 87. \quad 60 - \left(6 + \frac{40}{2^3} \right) &= 60 - \left(6 + \frac{40}{8} \right) \\ &= 60 - (6 + 5) \\ &= 60 - 11 \\ &= 49 \end{aligned}$$

$$\begin{aligned} 88. \quad 7 + \left(5^3 - \frac{200}{2} \right) &= 7 + (125 - 100) \\ &= 7 + 25 \\ &= 32 \end{aligned}$$

$$\begin{aligned} 89. \quad \frac{(3+5)^2 + 2}{2(8-5)} &= \frac{8^2 + 2}{2(3)} \\ &= \frac{64 + 2}{6} \\ &= \frac{66}{6} \\ &= 11 \end{aligned}$$

$$\begin{aligned} 90. \quad \frac{25 - (2 \cdot 3 - 1)}{2 \cdot 9 - 8} &= \frac{25 - (6 - 1)}{18 - 8} \\ &= \frac{25 - 5}{10} \\ &= \frac{20}{10} \\ &= 2 \end{aligned}$$

$$\begin{aligned} 91. \quad (18 - 12)^3 - 5^2 &= 6^3 - 5^2 \\ &= 216 - 25 \\ &= 191 \end{aligned}$$

$$\begin{aligned} 92. \quad (9 - 2)^2 - 3^3 &= 7^2 - 3^3 \\ &= 49 - 27 \\ &= 22 \end{aligned}$$

$$\begin{aligned} 93. \quad 30(1)^2 - 4(2) + 12 &= 30 - 8 + 12 \\ &= 34 \end{aligned}$$

$$\begin{aligned} 94. \quad 5(1)^3 + (1)^2 + 2(1) - 6 &= 5 + 1 + 2 - 6 \\ &= 2 \end{aligned}$$

$$\begin{aligned} 95. \quad 16^2 - \frac{25}{5} + 6(3)4 &= 256 - 5 + 72 \\ &= 323 \end{aligned}$$

$$\begin{aligned} 96. \quad 15^2 - \frac{24}{6} + 8(2)(3) &= 225 - 4 + 48 \\ &= 269 \end{aligned}$$

$$\begin{aligned} 97. \quad \frac{3^2 - 2^2}{(3 - 3)^2} &= \frac{9 - 4}{0^2} \\ &= \frac{5}{0} : \text{undefined} \end{aligned}$$

$$\begin{aligned} 98. \quad \frac{5^2 + 17}{4 - 2^2} &= \frac{25 + 17}{4 - 4} \\ &= \frac{42}{0} : \text{undefined} \end{aligned}$$

$$\begin{aligned} 99. \quad 3\left(\frac{18}{3}\right) - 2(2) &= 18 - 4 \\ &= 14 \end{aligned}$$

$$\begin{aligned} 100. \quad 2\left(\frac{12}{3}\right) + 3(5) &= 8 + 15 \\ &= 23 \end{aligned}$$

$$\begin{aligned} 101. \quad 4[50 - (3^3 - 5^2)] &= 4[50 - (27 - 25)] \\ &= 4[50 - 2] \\ &= 4[48] \\ &= 192 \end{aligned}$$

$$\begin{aligned}
 102. \quad 6[15 + (5 \cdot 2^2)] &= 6[15 + (5 \cdot 4)] \\
 &= 6[15 + 20] \\
 &= 6[35] \\
 &= 210
 \end{aligned}$$

$$\begin{aligned}
 103. \quad 80 - 2[12 - (5 + 4)] &= 80 - 2[12 - 9] \\
 &= 80 - 2[3] \\
 &= 80 - 6 \\
 &= 74
 \end{aligned}$$

$$\begin{aligned}
 104. \quad 15 + 5[12 - (2^2 + 4)] &= 15 + 5[12 - (4 + 4)] \\
 &= 15 + 5[12 - 8] \\
 &= 15 + 5[4] \\
 &= 15 + 20 = 35
 \end{aligned}$$

LOOK ALIKES

$$\begin{aligned}
 105. \quad \text{a. } 50 \div 5 \div 5 &= 10 \div 5 \\
 &= 2 \\
 \text{b. } 50 \div (5 \div 5) &= 50 \div 1 \\
 &= 50 \\
 \text{c. } 50 \div 5 \cdot 5 &= 10 \cdot 5 \\
 &= 50 \\
 \text{d. } 50 \div (5 \cdot 5) &= 50 \div 25 \\
 &= 2
 \end{aligned}$$

$$\begin{aligned}
 106. \quad \text{a. } 25 - 5^2 &= 25 - 25 \\
 &= 0 \\
 \text{b. } (25 - 5)^2 &= 20^2 \\
 &= 400
 \end{aligned}$$

$$\begin{aligned}
 107. \quad \text{a. } (4 - 2^2)/(50 - 32) &= (4 - 4)/18 = 0/18 \\
 &= 0 \\
 \text{b. } (50 - 32)/(4 - 2^2) &= 18/(4 - 4) \\
 &= 18/0 \\
 &= \text{Undefined}
 \end{aligned}$$

$$\begin{aligned}
 108. \quad \text{a. } 100 - 53 + 18 &= 47 + 18 \\
 &= 65 \\
 \text{b. } 100 - (53 + 18) &= 100 - 71 \\
 &= 29 \\
 \text{c. } (100 - 53) + 18 &= 47 + 18 \\
 &= 65
 \end{aligned}$$

APPLICATIONS

$$\begin{aligned}
 109. \quad 3 \cdot 7 + 4 \cdot 4 + 2 \cdot 3 &= 21 + 16 + 6 \\
 &= \$43
 \end{aligned}$$

$$\begin{aligned}
 110. \quad 24 \cdot 1 + 6 \cdot 5 + 10 \cdot 10 \\
 + 12 \cdot 20 + 2 \cdot 50 + 1 \cdot 100 &= \$594
 \end{aligned}$$

$$\begin{aligned}
 111. \quad 3(8 + 7 + 8 + 8 + 7) &= 3(38) \\
 &= 114
 \end{aligned}$$

$$\begin{aligned}
 112. \quad 2 \cdot 9 + 2 \cdot 16 + 4 \cdot 4 + 15 \\
 = 18 + 32 + 16 + 15 \\
 = 81 \text{ in.}
 \end{aligned}$$

$$113. \quad \text{brick: } 3 \cdot 3 + 1 + 1 + 3 + 3 \cdot 5 = 29$$

$$\text{aphid: } 3[1 + 2(3) + 4 + 1 + 2] = 42$$

$$\begin{aligned}
 114. \quad 1776 + 4 \cdot 20 + 7 &= 1776 + 80 + 7 \\
 &= 1863
 \end{aligned}$$

$$\begin{aligned}
 115. \quad 2^2 + 3^2 + 5^2 + 7^2 &= 4 + 9 + 25 + 49 \\
 &= 87
 \end{aligned}$$

$$\begin{aligned}
 116. \quad 27 \cdot 19 - 125 &= 513 - 125 \\
 &= 388 \text{ ft}^2.
 \end{aligned}$$

$$\begin{aligned}
 117. \quad &\frac{75 + 80 + 83 + 80 + 77 + 72 + 86}{7} \\
 &= \frac{553}{7} \\
 &= 79^\circ
 \end{aligned}$$

$$\begin{aligned}
 118. \quad &\frac{94 + 85 + 81 + 77 + 89 + 0}{6} \\
 &= \frac{426}{6} \\
 &= 71
 \end{aligned}$$

$$\begin{aligned}
 119. \quad &\frac{39 + 40 + \cdots + 42}{12} = \frac{372}{12} \\
 &= 31 \text{ therms}
 \end{aligned}$$

$$\begin{aligned}
 120. \quad &\frac{1 + 2 + \cdots + 9}{9} = \frac{45}{9} \\
 &= 5
 \end{aligned}$$

$$121. \quad \frac{230 + 280 + \cdots + 375}{8} = \frac{2400}{8} \\ = 300 \text{ calories}$$

$$122. \quad (19,368,000 + \cdots + 40,044,000)/7 \\ = 22,847,000 \text{ viewers per game}$$

$$123. \quad \text{a. } 1 + 4 + 35 + 85 = 125 \\ \text{b. } 1 \cdot 2,500 + 4 \cdot 500 + 35 \cdot 150 + 85 \cdot 25 \\ = 2,500 + 2,000 + 5,250 + 2,125 \\ = 11,875$$

$$\text{c. } \frac{11,875}{125} = \$95$$

$$124. \quad \text{a. } 4 + 1 + 5 + 1 + 4 = 15 \\ \text{b. } 1 \cdot 4 + 2 \cdot 1 + 3 \cdot 5 + 4 \cdot 1 + 5 \cdot 4 \\ = 4 + 2 + 15 + 4 + 20 \\ = 45 \\ \frac{45}{15} = 3$$

WRITING

125. Order of operations is necessary so that different people don't come up with different answers to the same problem.
126. Reading the problem from left to right, perform the first operation you come to, regardless of whether it is addition or subtraction.
127. The multiplication of 2 and 3 takes precedence over the addition.
128. Working left to right, subtraction should have been done first.

REVIEW

129. Two hundred fifty-four thousand, three hundred nine
130. Five hundred four million, fifty-two thousand, forty

Section 1.8: Solving Equations Using Addition and Subtraction

VOCABULARY

1. An equation is a statement indicating that two expressions are equal. All equations contain an = symbol.

2. A number that makes an equation true when substituted for the variable is called a solution of the equation. Such numbers are said to satisfy the equation.
3. To solve an equation means to find all values of the variable that make the equation true.
4. To solve an equation, we isolate the variable on one side of the equal symbol.
5. Equations with the same solutions are called equivalent equations.
6. To check the solution of an equation, we substitute the value for the variable in the original equation and determine whether the result is a true statement.

CONCEPTS

7. a. $x + 6$
b. neither
c. $5 + 6 \neq 12$, so no.
d. $6 + 6 = 12$, so yes.
8. a. no b. yes
c. no d. no
9. a. The addition property of equality: Adding the same number to both sides of an equation does not change its solution.
b. If $a = b$, then $a + c = b + c$.
10. a. The subtraction property of equality: Subtracting the same number from both sides of an equation does not change its solution.
b. If $a = b$, then $a - c = b - c$.
11. a. To solve $x - 8 = 24$, we add 8 to both sides of the equation.
b. To solve $x + 4 = 11$, we subtract 4 from both sides of the equation.
12. a. $x + 7 - 7 = x$
b. $y - 2 + 2 = y$

NOTATION

13. $x - 5 = 45$

$x - 5 + 5 = 45 + 5$

$x = 50$

Check: $x - 5 = 45$

$50 - 5 \stackrel{?}{=} 45$

$45 = 45$ True

50 is the solution.

14. $y + 11 = 12$

$y + 11 - 11 = 12 - 11$

$y = 1$

Check: $y + 11 = 12$

$1 + 11 \stackrel{?}{=} 12$

$12 = 12$ True

1 is the solution.

15. is possibly equal to

16. yes

GUIDED PRACTICE

17. $x + 2 = 3$

$1 + 2 \stackrel{?}{=} 3$

$3 = 3$

1 is a solution.

18. $x + 2 = 6$

$4 + 2 \stackrel{?}{=} 6$

$6 = 6$

4 is a solution.

19. $a - 7 = 0$

$7 - 7 \stackrel{?}{=} 0$

$0 = 0$

7 is a solution.

20. $x - 8 = 8$

$16 - 8 \stackrel{?}{=} 8$

$8 = 8$

16 is a solution.

21. $50 = y - 8$

$50 \stackrel{?}{=} 40 - 8$

$50 = 32$

40 is not a solution.

22. $16 = 10 + c$

$16 \stackrel{?}{=} 10 + 5$

$16 = 15$

5 is not a solution.

23. $1 = x + 2$

$1 \stackrel{?}{=} 2 + 2$

$1 = 4$

2 is not a solution.

24. $8 = x + 1$

$8 \stackrel{?}{=} 4 + 1$

$8 = 5$

4 is not a solution.

25. $x - 7 = 3$

$x - 7 + 7 = 3 + 7$

$x = 10$

Check: $x - 7 = 3$

$10 - 7 \stackrel{?}{=} 3$

$3 = 3$

The solution checks.

26. $y - 11 = 7$

$y - 11 + 11 = 7 + 11$

$y = 18$

Check: $y - 11 = 7$

$18 - 11 \stackrel{?}{=} 7$

$7 = 7$

The solution checks.

27. $a - 20 = 50$

$a - 20 + 20 = 50 + 20$

$a = 70$

Check: $a - 20 = 50$

$$70 - 20 = 50$$

$$50 = 50$$

The solution checks.

28. $z - 31 = 60$

$$z - 31 + 31 = 60 + 31$$

$$z = 91$$

Check: $z - 31 = 60$

$$91 - 31 = 60$$

$$60 = 60$$

The solution checks.

29. $1 = b - 2$

$$1 + 2 = b - 2 + 2$$

$$3 = b$$

Check: $1 = b - 2$

$$1 = 3 - 2$$

$$1 = 1$$

The solution checks.

30. $0 = t - 1$

$$0 + 1 = t - 1 + 1$$

$$1 = t$$

Check: $0 = t - 1$

$$0 = 1 - 1$$

$$0 = 0$$

The solution checks.

31. $19 = n - 42$

$$19 + 42 = n - 42 + 42$$

$$61 = n$$

Check: $19 = n - 42$

$$19 = 61 - 42$$

$$19 = 19$$

The solution checks.

32. $17 = m - 16$

$$17 + 16 = m - 16 + 16$$

$$33 = m$$

Check: $17 = m - 16$

$$17 = 33 - 16$$

$$17 = 17$$

The solution checks.

33. $x + 9 = 12$

$$x + 9 - 9 = 12 - 9$$

$$x = 3$$

Check: $x + 9 = 12$

$$3 + 9 = 12$$

$$12 = 12$$

The solution checks.

34. $x + 3 = 9$

$$x + 3 - 3 = 9 - 3$$

$$x = 6$$

Check: $x + 3 = 9$

$$6 + 3 = 9$$

$$9 = 9$$

The solution checks.

35. $y + 7 = 12$

$$y + 7 - 7 = 12 - 7$$

$$y = 5$$

Check: $y + 7 = 12$

$$5 + 7 = 12$$

$$12 = 12$$

The solution checks.

36. $c + 11 = 22$

$$c + 11 - 11 = 22 - 11$$

$$c = 11$$

Check: $c + 11 = 22$

$$11 + 11 = 22$$

$$22 = 22$$

The solution checks.

37. **Analyze**

* The scroll is 1,700 years old.

* The scroll is 425 years older than the jar.

* How old is the jar?

Assign Let x = the age of the jar.

Form Now we look for a key word or phrase in the problem.

Key phrase: older than

Translation: addition

Scroll's age is 425 years plus jar's age

$$1,700 = 425 + x$$

Solve

$$1,700 = 425 + x$$

$$1,700 - 425 = 425 + x - 425$$

$$1,275 = x$$

State The jar is 1,275 years old.

$$1,275$$

Check + 425

$$1,700$$

The result checks.

38. Analyze

* A \$1,500 check was written.

* The new balance in the account was \$750.

* What was the balance before he wrote the check?

Assign Let x = the account balance before he wrote the check.

Form Now we look for a key word or phrase in the problem.

Key phrase: wrote a check

Translation: subtraction

Previous balance minus check amount is the new balance.

$$x - 1,500 = 750$$

Solve

$$x - 1,500 = 750$$

$$x - 1,500 + 1,500 = 1,500 + 750$$

$$x = 2,250$$

State The account balance before he wrote the check was \$2,250.

$$2,250$$

Check -1,500

$$750$$

The result checks.

TRY IT YOURSELF

39. $s + 55 = 100$

$$s + 55 - 55 = 100 - 55$$

$$x = 45$$

Check: $s + 55 = 100$

$$45 + 55 = 100$$

$$100 = 100$$

The solution checks.

40. $n + 37 = 200$

$$n + 37 - 37 = 200 - 37$$

$$n = 163$$

Check: $n + 37 = 200$

$$163 + 37 = 200$$

$$200 = 200$$

The solution checks.

41. $x - 4 = 0$

$$x - 4 + 4 = 0 + 4$$

$$x = 4$$

Check: $x - 4 = 0$

$$4 - 4 = 0$$

$$0 = 0$$

The solution checks.

42. $c - 3 = 0$

$$c - 3 + 3 = 0 + 3$$

$$c = 3$$

Check: $c - 3 = 0$

$$3 - 3 = 0$$

$$0 = 0$$

The solution checks.

43. $y - 7 = 6$

$$y - 7 + 7 = 6 + 7$$

$$y = 13$$

Check: $y - 7 = 6$

$$13 - 7 = 6$$

$$6 = 6$$

The solution checks.

44. $a - 2 = 4$

$$a - 2 + 2 = 4 + 2$$

$$a = 6$$

Check: $a - 2 = 4$

$$6 - 2 = 4$$

$$4 = 4$$

The solution checks.

45. $70 = x - 5$

$$70 + 5 = x - 5 + 5$$

$$75 = x$$

Check: $70 = x - 5$

$$70 = 75 - 5$$

$$75 = 75$$

The solution checks.

46. $66 = b - 6$

$$66 + 6 = b - 6 + 6$$

$$72 = b$$

Check: $66 = b - 6$

$$66 = 72 - 6$$

$$66 = 66$$

The solution checks.

47. $312 = x - 428$

$$312 + 428 = x - 428 + 428$$

$$740 = x$$

Check: $312 = x - 428$

$$312 = 740 - 428$$

$$312 = 312$$

The solution checks.

48. $113 = x - 307$

$$113 + 307 = x - 307 + 307$$

$$420 = x$$

Check: $113 = x - 307$

$$113 = 420 - 307$$

$$113 = 113$$

The solution checks.

49. $x - 117 = 222$

$$x - 117 + 117 = 222 + 117$$

$$x = 339$$

Check: $x - 117 = 222$

$$339 - 117 = 222$$

$$222 = 222$$

The solution checks.

50. $y - 27 = 317$

$$y - 27 + 27 = 317 + 27$$

$$y = 344$$

Check: $y - 27 = 317$

$$344 - 27 = 317$$

$$317 = 317$$

The solution checks.

51. $t + 19 = 28$

$$t + 19 - 19 = 28 - 19$$

$$t = 9$$

Check: $t + 19 = 28$

$$9 + 19 = 28$$

$$28 = 28$$

The solution checks.

52. $s + 45 = 84$

$$s + 45 - 45 = 84 - 45$$

$$s = 39$$

Check: $s + 45 = 84$

$$39 + 45 \stackrel{?}{=} 84$$

$$84 = 84$$

The solution checks.

53. $23 + x = 33$

$$23 + x - 23 = 33 - 23$$

$$x = 10$$

Check: $23 + x = 33$

$$23 + 10 \stackrel{?}{=} 33$$

$$33 = 33$$

The solution checks.

54. $34 + y = 34$

$$34 + y - 34 = 34 - 34$$

$$y = 0$$

Check: $34 + y = 34$

$$34 + 0 \stackrel{?}{=} 34$$

$$34 = 34$$

The solution checks.

55. $5 = 4 + c$

$$5 - 4 = 4 + c - 4$$

$$1 = c$$

Check: $5 = 4 + c$

$$5 \stackrel{?}{=} 4 + 1$$

$$5 = 5$$

The solution checks.

56. $41 = 23 + x$

$$41 - 23 = 23 + x - 23$$

$$18 = x$$

Check: $41 = 23 + x$

$$41 \stackrel{?}{=} 23 + 18$$

$$43 = 43$$

The solution checks.

57. $99 = r + 43$

$$99 - 43 = r + 43 - 43$$

$$56 = r$$

Check: $99 = r + 43$

$$99 \stackrel{?}{=} 56 + 43$$

$$99 = 99$$

The solution checks.

58. $92 = r + 37$

$$92 - 37 = r + 37 - 37$$

$$55 = r$$

Check: $92 = r + 37$

$$92 \stackrel{?}{=} 55 + 37$$

$$92 = 92$$

The solution checks.

59. $512 = 428 + x$

$$512 - 428 = 428 + x - 428$$

$$84 = x$$

Check: $512 = 428 + x$

$$512 \stackrel{?}{=} 428 + 84$$

$$512 = 512$$

The solution checks.

60. $513 = 307 + x$

$$513 - 307 = 307 + x - 307$$

$$206 = x$$

Check: $513 = 307 + x$

$$513 \stackrel{?}{=} 307 + 206$$

$$513 = 513$$

The solution checks.

61. $x + 117 = 222$

$$x + 117 - 117 = 222 - 117$$

$$x = 105$$

Check: $x + 117 = 222$

$$105 + 117 \stackrel{?}{=} 222$$

$$222 = 222$$

The solution checks.

62. $y + 38 = 321$

$$y + 38 - 38 = 321 - 38$$

$$y = 283$$

Check: $y + 38 = 321$

$$283 + 38 \stackrel{?}{=} 321$$

$$321 = 321$$

The solution checks.

63. $3 + x = 7$

$$3 + x - 3 = 7 - 3$$

$$x = 4$$

Check: $3 + x = 7$

$$3 + 4 \stackrel{?}{=} 7$$

$$7 = 7$$

The solution checks.

64. $4 + b = 8$

$$4 + b - 4 = 8 - 4$$

$$b = 4$$

Check: $4 + b = 8$

$$4 + 4 \stackrel{?}{=} 8$$

$$8 = 8$$

The solution checks.

65. $y - 5 = 7$

$$y - 5 + 5 = 7 + 5$$

$$y = 12$$

Check: $y - 5 = 7$

$$12 - 5 \stackrel{?}{=} 7$$

$$7 = 7$$

The solution checks.

66. $z - 9 = 23$

$$z - 9 + 9 = 23 + 9$$

$$z = 32$$

Check: $z - 9 = 23$

$$32 - 9 \stackrel{?}{=} 23$$

$$23 = 23$$

The solution checks.

67. $4 + a = 12$

$$4 + a - 4 = 12 - 4$$

$$a = 8$$

Check: $4 + a = 12$

$$4 + 8 \stackrel{?}{=} 12$$

$$12 = 12$$

The solution checks.

68. $5 + x = 13$

$$5 + x - 5 = 13 - 5$$

$$x = 8$$

Check: $5 + x = 13$

$$5 + 8 \stackrel{?}{=} 13$$

$$13 = 13$$

The solution checks.

69. $x - 13 = 34$

$$x - 13 + 13 = 34 + 13$$

$$x = 47$$

Check: $x - 13 = 34$

$$47 - 13 \stackrel{?}{=} 34$$

$$34 = 34$$

The solution checks.

70. $x - 23 = 19$

$$x - 23 + 23 = 19 + 23$$

$$x = 42$$

Check: $x - 23 = 19$

$$42 - 23 \stackrel{?}{=} 19$$

$$19 = 19$$

The solution checks.

LOOK ALIKES

71. a. $x + 89 = 243$

$$x + 89 - 89 = 243 - 89$$

$$x = 154$$

b. $x - 89 = 243$

$$x - 89 + 89 = 243 + 89$$

$$x = 332$$

c. $243 = x - 89$

$$243 + 89 = x - 89 + 89$$

$$332 = x$$

d. $243 = x + 89$

$$243 - 89 = x + 89 - 89$$

$$154 = x$$

72. a. $n - 47 = 108$

$$n - 47 + 47 = 108 + 47$$

$$n = 155$$

b. $n + 47 = 108$

$$n + 47 - 47 = 108 - 47$$

$$n = 61$$

c. $108 = n + 47$

$$108 - 47 = n + 47 - 47$$

$$61 = n$$

d. $108 = n - 47$

$$108 + 47 = n - 47 + 47$$

$$155 = n$$

73. a. $t + 91 = 91$

$$t + 91 - 91 = 91 - 91$$

$$t = 0$$

b. $t - 91 = 0$

$$t - 91 + 91 = 0 + 91$$

$$t = 91$$

74. a. $a - 503 = 0$

$$a - 503 + 503 = 0 + 503$$

$$a = 503$$

b. $a + 503 = 503$

$$a + 503 - 503 = 503 - 503$$

$$a = 0$$

APPLICATIONS

75. x = the amount of money she needs to borrow

$$68,500 + x = 316,500$$

$$68,500 + x - 68,500 = 316,500 - 68,500$$

$$x = 248,000$$

She needs to borrow \$248,000.

76. x = the number of invitations sent

$$x - 3 = 59$$

$$x - 3 + 3 = 59 + 3$$

$$x = 62$$

Mia sent out 62 invitations.

77. x = The amount that Diddy earned in 2016

$$x - 8 = 54$$

$$x - 8 + 8 = 54 + 8$$

$$x = 62$$

Diddy earned \$62 million in 2016.

78. x = how much more money the man needs

$$317 + x = 345$$

$$317 + x - 317 = 345 - 317$$

$$x = 28$$

The man needs only an additional \$28.

79. r = the amount of reduction

$$81 + r = 110$$

$$81 + r - 81 = 110 - 81$$

$$r = 29$$

The earplugs reduce the noise by 29 decibels.

80. x = the amount of money in benefits

$$45 + x = 52$$

$$45 + x - 45 = 52 - 45$$

$$x = 7$$

The benefits package is valued at \$7,000.

81. x = the amount of increase that will shut down the system

$$60 + x = 85$$

$$60 + x - 60 = 85 - 60$$

$$x = 25$$

There must be an increase of 25 units to trigger a shutdown.

82. s = the score on the first game

$$s + 77,420 = 105,880$$

$$s + 77,420 - 77,420 = 105,880 - 77,420$$

$$s = 28,460$$

His score for the first game was 28,460 points.

83. g = the amount she would have paid at the gas station

$$g - 29 = 190$$

$$g - 29 + 29 = 190 + 29$$

$$g = 219$$

The gas station would have charged \$219.

84. w = the length of his wait three days ago

$$20 + 15 = w$$

$$35 = w$$

Three days ago he waited for 35 minutes.

85. j = Jimmy's age when he had the number one single

$$j + 55 = 67$$

$$j + 55 - 55 = 67 - 55$$

$$j = 12$$

Jimmy was 12 years old when he had the hit single.

86. r = the original sticker price
 $r - 1,550 = 16,727$
 $r - 1,550 + 1,550 = 16,727 + 1,550$
 $r = 18,277$
 The original cost was \$18,277.

86. r = the original sticker price
 $r - 1,550 = 17,190$
 $r - 1,550 + 1,550 = 17,190 + 1,550$
 $r = 18,740$
 The original cost was \$18,740.

WRITING

87. It means that the number makes the equation true when substituted for the variable.
88. Substitute the number in the variable and simplify. A solution will result in a true statement.
89. They are showing that doing the same thing on both sides of an equation preserves the equality.
90. We obtain the same number since addition and subtraction are opposite operations.
91. Bob felt isolated from the rest of the company because of his body odor.
92. Checking the work, because it seems if I'm careful I won't make mistakes.
93. That is true because you must perform the opposite action of the operation given in the problem.
94. Translate means to rewrite an application problem as an equation.

REVIEW

95. 325,780
96. $1^5 = 1 \cdot 1 \cdot 1 \cdot 1 \cdot 1$
 $= 1$
97. $2 \cdot 3^2 \cdot 5 = 2 \cdot 9 \cdot 5$
 $= 18 \cdot 5$
 $= 90$
98. a. $4 + 4 + 4 = 3 \cdot 4$
 b. $4 \cdot 4 \cdot 4 = 4^3$

99. $8 - 2(2^2 - 1) + 1^3 = 8 - 2(4 - 1) + 1$
 $= 8 - 2(3) + 1$
 $= 8 - 6 + 1$
 $= 2 + 1$
 $= 3$

100. one thousand fifty – five

Section 1.9: Solving Equations Using Multiplication and Division

VOCABULARY

- To solve an equation means to find all values of the variable that make the equation true.
- A number that makes an equation true when substituted for the variable is called a solution of the equation.
- To solve an equation, we isolate the variable on one side of the equal symbol.
- In this section, we used the multiplication and division properties of equality to solve the equations.

CONCEPTS

- The multiplication property of equality: Multiplying both sides of an equation by the same nonzero number does not change its solution.
 - If $a = b$, then $ca = cb$. (provided c is not 0)
- The division property of equality: Dividing both sides of an equation by the same nonzero number does not change its solution.
 - If $a = b$, then $\frac{a}{c} = \frac{b}{c}$. (provided c is not 0)
- If we multiply x by 6 and then divide that product by 6, the result is x .
 - If we divide x by 8 and then multiply that quotient by 8, the result is x .
- a. $9 \cdot \frac{x}{9} = x$ b. $\frac{6y}{6} = y$

9.

a. To solve $\frac{x}{5} = 10$, we multiply both sides of the equation by 5.

b. To solve $5x = 10$, we divide both sides of the equation by 5.

c. To solve $x - 5 = 10$, we add 5 to both sides of the equation.

d. To solve $x + 5 = 10$, we subtract 5 from both sides of the equation.

10. a. $16 \neq 8 \cdot 8$, so no.

b. $16 \neq \frac{2}{8}$, so no.

NOTATION

11.

$$\frac{x}{5} = 9$$

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

$$x = 45$$

$$\text{Check: } \frac{x}{5} = 9$$

$$\frac{45}{5} = 9$$

$$9 = 9 \quad \text{True}$$

45 is the solution.

12. $3x = 12$

$$\frac{3x}{3} = \frac{12}{3}$$

$$x = 4$$

$$\text{Check: } 3x = 12$$

$$3 \cdot 4 = 12$$

$$12 = 12 \quad \text{True}$$

4 is the solution.

GUIDED PRACTICE

13.

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

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

$$x = 14$$

$$\text{Check: } \frac{x}{7} = 2$$

$$\frac{14}{7} = 2$$

$$2 = 2$$

The solution checks.

14.

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

$$12 \cdot \frac{x}{12} = 12 \cdot 4$$

$$x = 48$$

$$\text{Check: } \frac{x}{12} = 4$$

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

$$4 = 4$$

The solution checks.

15.

$$\frac{y}{14} = 3$$

$$14 \cdot \frac{y}{14} = 14 \cdot 3$$

$$y = 42$$

$$\text{Check: } \frac{y}{14} = 3$$

$$\frac{42}{14} = 3$$

$$3 = 3$$

The solution checks.

16.

$$\frac{y}{13} = 5$$

$$13 \cdot \frac{y}{13} = 13 \cdot 5$$

$$y = 65$$

$$\text{Check: } \frac{y}{13} = 5$$

$$\frac{65}{13} = 5$$

$$5 = 5$$

The solution checks.

17.

$$16 = \frac{x}{24}$$

$$24 \cdot 16 = 24 \cdot \frac{x}{24}$$

$$384 = x$$

$$\text{Check: } 16 = \frac{x}{24}$$

$$16 = \frac{384}{24}$$

$$16 = 16$$

The solution checks.

18.

$$22 = \frac{x}{18}$$

$$18 \cdot 22 = 18 \cdot \frac{x}{18}$$

$$396 = x$$

$$\text{Check: } 22 = \frac{x}{18}$$

$$22 = \frac{396}{18}$$

$$22 = 22$$

The solution checks.

19.

$$31 = \frac{t}{11}$$

$$11 \cdot 31 = 11 \cdot \frac{t}{11}$$

$$341 = t$$

$$\text{Check: } 31 = \frac{x}{11}$$

$$31 = \frac{341}{11}$$

$$31 = 31$$

The solution checks.

20.

$$33 = \frac{m}{19}$$

$$19 \cdot 33 = 19 \cdot \frac{m}{19}$$

$$627 = m$$

$$\text{Check: } 33 = \frac{m}{19}$$

$$33 = \frac{627}{19}$$

$$33 = 33$$

The solution checks.

21.

$$3x = 3$$

$$\frac{3x}{3} = \frac{3}{3}$$

$$x = 1$$

$$\text{Check: } 3x = 3$$

$$3 \cdot 1 = 3$$

$$3 = 3$$

The solution checks.

22.

$$5x = 5$$

$$\frac{5x}{5} = \frac{5}{5}$$

$$x = 1$$

$$\text{Check: } 5x = 5$$

$$5 \cdot 1 = 5$$

$$5 = 5$$

The solution checks.

23.

$$9z = 90$$

$$\frac{9z}{9} = \frac{90}{9}$$

$$z = 10$$

$$\text{Check: } 9z = 90$$

$$9 \cdot 10 = 90$$

$$90 = 90$$

The solution checks.

24.

$$3z = 60$$

$$\frac{3z}{3} = \frac{60}{3}$$

$$z = 20$$

$$\text{Check: } 3z = 60$$

$$3 \cdot 20 = 60$$

$$60 = 60$$

The solution checks.

25. Analyze

* 3 people shared the cash award equally.

* Each person received \$311,000.

* What was the amount of the Nobel Prize cash award?

Assign

Let x = the amount of the Nobel Prize award.

Form

We now look for a key phrase in the problem.

Key phrase: *shared the prize money equally*

Translation: division

The cash award divided by the number of winners is equal to each person's share.

$$x \div 3 = 311,000$$

Solve

$$x/3 = 311,000$$

$$3 \cdot (x/3) = 3 \cdot 311,000$$

$$x = 933,000$$

State The amount of the Nobel Prize cash award was \$933,000.

Check: $\$933,000/3 = \$311,000$

The result checks.

26. Analyze

* The number of followers doubled.

* The current number of followers is 748.

* What was the number of followers before using hashtags?

Assign

Let x = the number of followers on twitter.

Form

We now look for a key phrase in the problem.

Key phrase: double

Translation: multiply by 2

2 times the original number of followers is equal to the current number of followers.

$$2 \cdot x = 748$$

Solve

$$2x = 748$$

$$2x/2 = 748/2$$

$$x = 374$$

State The number of followers before using hashtags was 374.

Check:

$$374 \cdot 2 = 748$$

The result checks.

TRY IT YOURSELF

$$27. \quad 100 = 100x$$

$$\frac{100}{100} = \frac{100x}{100}$$

$$1 = x$$

$$\text{Check: } 100 = 100x$$

$$100 = 100 \cdot 1$$

$$100 = 100$$

The solution checks.

$$28. \quad 35 = 35y$$

$$\frac{35}{35} = \frac{35y}{35}$$

$$1 = y$$

$$\text{Check: } 35 = 35y$$

$$35 = 35 \cdot 1$$

$$35 = 35$$

The solution checks.

$$29. \quad \frac{a}{15} = 5$$

$$15 \cdot \frac{a}{15} = 15 \cdot 5$$

$$a = 75$$

$$\text{Check: } \frac{a}{15} = 5$$

$$\frac{75}{15} = 5$$

$$5 = 5$$

The solution checks.

$$\begin{aligned}
 30. \quad & \frac{b}{25} = 5 \\
 & 25 \cdot \frac{b}{25} = 25 \cdot 5 \\
 & b = 125 \\
 \text{Check: } & \frac{b}{25} = 5 \\
 & \frac{125}{25} = 5 \\
 & 5 = 5
 \end{aligned}$$

The solution checks.

$$\begin{aligned}
 31. \quad & 16 = 8r \\
 & \frac{16}{8} = \frac{8r}{8} \\
 & 2 = r \\
 \text{Check: } & 16 = 8r \\
 & 16 = 8 \cdot 2 \\
 & 16 = 16
 \end{aligned}$$

The solution checks.

$$\begin{aligned}
 32. \quad & 44 = 11m \\
 & \frac{44}{11} = \frac{11m}{11} \\
 & 4 = m \\
 \text{Check: } & 44 = 11m \\
 & 44 = 11 \cdot 4 \\
 & 44 = 44
 \end{aligned}$$

The solution checks.

$$\begin{aligned}
 33. \quad & 21s = 210 \\
 & \frac{21s}{21} = \frac{210}{21} \\
 & s = 10 \\
 \text{Check: } & 21s = 210 \\
 & 21 \cdot 10 = 210 \\
 & 210 = 210
 \end{aligned}$$

The solution checks.

$$\begin{aligned}
 34. \quad & 155 = 31x \\
 & \frac{155}{31} = \frac{31x}{31} \\
 & 5 = x \\
 \text{Check: } & 155 = 31x \\
 & 155 = 31 \cdot 5 \\
 & 155 = 155 \\
 & \text{The solution checks.}
 \end{aligned}$$

$$\begin{aligned}
 35. \quad & \frac{c}{1,000} = 3 \\
 & 1,000 \cdot \frac{c}{1,000} = 1,000 \cdot 3 \\
 & c = 3,000 \\
 \text{Check: } & \frac{c}{1,000} = 3 \\
 & \frac{3,000}{1,000} = 3 \\
 & 3 = 3
 \end{aligned}$$

The solution checks.

$$\begin{aligned}
 36. \quad & \frac{d}{100} = 11 \\
 & 100 \cdot \frac{d}{100} = 100 \cdot 11 \\
 & d = 1,100 \\
 \text{Check: } & \frac{d}{100} = 11 \\
 & \frac{1,100}{100} = 11 \\
 & 11 = 11
 \end{aligned}$$

The solution checks.

$$\begin{aligned}
 37. \quad & 1 = \frac{x}{50} \\
 & 50 \cdot 1 = 50 \cdot \frac{x}{50} \\
 & 50 = x
 \end{aligned}$$

$$\begin{aligned}\text{Check: } 1 &= \frac{x}{50} \\ 1 &\stackrel{?}{=} \frac{50}{50} \\ 1 &= 1\end{aligned}$$

The solution checks.

$$\begin{aligned}38. \quad 1 &= \frac{x}{25} \\ 25 \cdot 1 &= 25 \cdot \frac{x}{25} \\ 25 &= x \\ \text{Check: } 1 &= \frac{x}{25} \\ 1 &\stackrel{?}{=} \frac{25}{25} \\ 1 &= 1\end{aligned}$$

The solution checks.

$$\begin{aligned}39. \quad 7 &= \frac{t}{7} \\ 7 \cdot 7 &= 7 \cdot \frac{t}{7} \\ 49 &= t \\ \text{Check: } 7 &= \frac{t}{7} \\ 7 &\stackrel{?}{=} \frac{49}{7} \\ 7 &= 7\end{aligned}$$

The solution checks.

$$\begin{aligned}40. \quad 4 &= \frac{m}{4} \\ 4 \cdot 4 &= 4 \cdot \frac{m}{4} \\ 16 &= m \\ \text{Check: } 4 &= \frac{m}{4} \\ 4 &\stackrel{?}{=} \frac{16}{4} \\ 4 &= 4\end{aligned}$$

The solution checks.

$$\begin{aligned}41. \quad 7x &= 21 \\ \frac{7x}{7} &= \frac{21}{7} \\ x &= 3\end{aligned}$$

$$\text{Check: } 7x = 21$$

$$\begin{aligned}7 \cdot 3 &\stackrel{?}{=} 21 \\ 21 &= 21\end{aligned}$$

The solution checks.

$$\begin{aligned}42. \quad 13x &= 52 \\ \frac{13x}{13} &= \frac{52}{13} \\ x &= 4\end{aligned}$$

$$\text{Check: } 13x = 52$$

$$\begin{aligned}13 \cdot x &\stackrel{?}{=} 52 \\ 52 &= 52\end{aligned}$$

The solution checks.

$$\begin{aligned}43. \quad 172 &= 43t \\ \frac{172}{43} &= \frac{43t}{43} \\ 4 &= t\end{aligned}$$

$$\text{Check: } 172 = 43t$$

$$\begin{aligned}172 &\stackrel{?}{=} 43 \cdot 4 \\ 172 &= 172\end{aligned}$$

The solution checks.

$$\begin{aligned}44. \quad 288 &= 96t \\ \frac{288}{96} &= \frac{96t}{96} \\ 3 &= t\end{aligned}$$

$$\text{Check: } 288 = 96t$$

$$\begin{aligned}288 &\stackrel{?}{=} 96 \cdot 3 \\ 288 &= 288\end{aligned}$$

The solution checks.

$$\begin{aligned}45. \quad \frac{d}{20} &= 201 \\ 20 \cdot \frac{d}{20} &= 20 \cdot 201 \\ d &= 4,020\end{aligned}$$

$$\text{Check: } \frac{d}{20} = 201$$

$$\frac{4,020}{20} = 201$$

$$201 = 201$$

The solution checks.

$$46. \quad \frac{x}{60} = 106$$

$$60 \cdot \frac{x}{60} = 60 \cdot 106$$

$$x = 6,360$$

$$\text{Check: } \frac{x}{60} = 106$$

$$\frac{6,360}{60} = 106$$

$$106 = 106$$

The solution checks.

$$47. \quad 417 = \frac{t}{3}$$

$$3 \cdot 417 = 3 \cdot \frac{t}{3}$$

$$1,251 = t$$

Check:

$$417 = \frac{t}{3}$$

$$417 = \frac{1,251}{3}$$

$$417 = 417$$

The solution checks.

$$48. \quad 259 = \frac{y}{7}$$

$$7 \cdot 259 = 7 \cdot \frac{y}{7}$$

$$1,813 = y$$

Check:

$$259 = \frac{y}{7}$$

$$259 = \frac{1,813}{7}$$

$$259 = 259$$

The solution checks.

$$49. \quad 170y = 5,100$$

$$\frac{170y}{170} = \frac{5,100}{170}$$

$$y = 30$$

Check:

$$170y = 5,100$$

$$170 \cdot 30 = 5,100$$

$$5,100 = 5,100$$

The solution checks.

$$50. \quad 190y = 7,600$$

$$\frac{190y}{190} = \frac{7,600}{190}$$

$$y = 40$$

$$\text{Check: } 190y = 7,600$$

$$190 \cdot 40 = 7,600$$

$$7,600 = 7,600$$

The solution checks.

$$51. \quad \frac{t}{3} = 47$$

$$3 \cdot \frac{t}{3} = 3 \cdot 47$$

$$t = 141$$

$$\text{Check: } \frac{t}{3} = 47$$

$$\frac{141}{3} = 47$$

$$47 = 47$$

The solution checks.

$$52. \quad \frac{d}{9} = 83$$

$$9 \cdot \frac{d}{9} = 9 \cdot 83$$

$$d = 747$$

Check: $\frac{d}{9} = 83$

$$\frac{747}{9} = 83$$

$$83 = 83$$

The solution checks.

$$53. \quad 34y = 204$$

$$\frac{34y}{34} = \frac{204}{34}$$

$$y = 6$$

Check: $34y = 204$

$$34 \cdot 6 = 204$$

$$204 = 204$$

The solution checks.

$$54. \quad 18y = 162$$

$$\frac{18y}{18} = \frac{162}{18}$$

$$y = 9$$

Check: $18y = 162$

$$18 \cdot 9 = 162$$

$$162 = 162$$

The solution checks.

LOOK ALIKES

$$55. \quad \text{a.} \quad d + 32 = 96$$

$$d + 32 - 32 = 96 - 32$$

$$d = 64$$

$$\text{b.} \quad d - 32 = 96$$

$$d - 32 + 32 = 96 + 32$$

$$d = 128$$

$$\text{c.} \quad 32d = 96$$

$$32d \div 32 = 96 \div 32$$

$$d = 3$$

$$\text{d.} \quad d \div 32 = 96$$

$$(d \div 32) \cdot 32 = 96 \cdot 32$$

$$d = 3,072$$

$$56. \quad \text{a.} \quad 17x = 68$$

$$17x \div 17 = 68 \div 17$$

$$x = 4$$

$$\text{b.} \quad x \div 17 = 68$$

$$(x \div 17) \cdot 17 = 68 \cdot 17$$

$$x = 1,156$$

$$\text{c.} \quad x + 17 = 68$$

$$x + 17 - 17 = 68 - 17$$

$$x = 51$$

$$\text{d.} \quad x - 17 = 68$$

$$x - 17 + 17 = 68 + 17$$

$$x = 85$$

$$57. \quad \text{a.} \quad b \div 40 = 80$$

$$(b \div 40) \cdot 40 = 80 \cdot 40$$

$$b = 3200$$

$$\text{b.} \quad b - 40 = 80$$

$$b - 40 + 40 = 80 + 40$$

$$b = 120$$

$$\text{c.} \quad b + 40 = 80$$

$$b + 40 - 40 = 80 - 40$$

$$b = 40$$

$$\text{d.} \quad 40b = 80$$

$$40b \div 40 = 80 \div 40$$

$$b = 2$$

$$58. \quad \text{a.} \quad t - 9 = 108$$

$$t - 9 + 9 = 108 + 9$$

$$t = 117$$

$$\text{b.} \quad 9t = 108$$

$$9t \div 9 = 108 \div 9$$

$$t = 12$$

$$\text{c.} \quad t \div 9 = 108$$

$$(t \div 9) \cdot 9 = 108 \cdot 9$$

$$t = 972$$

$$\text{d.} \quad t + 9 = 108$$

$$t + 9 - 9 = 108 - 9$$

$$t = 99$$

APPLICATIONS

59. x = the number of words per minute she could read prior to the course

$$3x = 399$$

$$\frac{3x}{3} = \frac{399}{3}$$

$$x = 133$$

Alicia could read 133 words per minute before the course.

60. x = the number of students in the class

$$\frac{x}{3} = 32$$

$$3 \cdot \frac{x}{3} = 3 \cdot 32$$

$$x = 96$$

There are 96 students in the class.

61. x = the original estimate

$$10x = 540$$

$$\frac{10x}{10} = \frac{540}{10}$$

$$x = 54$$

The original estimate was \$54 million.

62. r = the number of rows per sheet

$$8r = 112$$

$$\frac{8r}{8} = \frac{112}{8}$$

$$r = 14$$

There are 14 rows of stamps per sheet.

63. r = the number of rows in the spreadsheet

$$6r = 294$$

$$\frac{6r}{6} = \frac{294}{6}$$

$$r = 49$$

There are 49 rows in the spreadsheet.

64. a = the amount each received

$$\frac{480,000}{12} = a$$

$$40,000 = a$$

Each employee got \$40,000.

65. s = the number of the shelter's calls after being on the news

$$4 \cdot 8 = s$$

$$32 = s$$

The shelter received 32 calls per day after the news feature.

66. x = the number of people the principal expected

$$\frac{1}{2}x = 120$$

$$2 \cdot \frac{1}{2}x = 2 \cdot 120$$

$$x = 240$$

The principal expected 240 attendees.

67. w = the weight of the object on the moon

$$6w = 330$$

$$\frac{6w}{6} = \frac{330}{6}$$

$$w = 55$$

The scale would register 55 pounds on the moon.

68. x = the number of orders before the celebrity endorsement

$$5x = 175$$

$$\frac{5x}{5} = \frac{175}{5}$$

$$x = 35$$

Before the celebrity was involved they received 35 orders per week.

69. g = the life span of a guinea pig

$$13g = 104$$

$$\frac{13g}{13} = \frac{104}{13}$$

$$g = 8$$

The average life span of a guinea pig is 8 years.

70. j = the Scoville rating of a jalapeño

$$40j = 320,000$$

$$\frac{40j}{40} = \frac{320,000}{40}$$

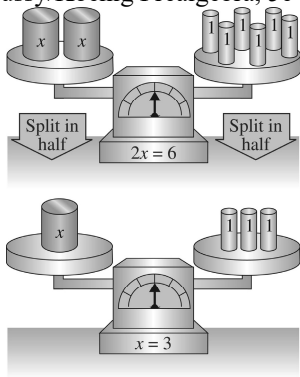
$$j = 8,000$$

The Scoville rating of a jalapeño is 8,000 units.

WRITING

71. They are showing that multiplying both sides by the same thing preserves the balance, or equality.

72.



The figures are showing that dividing both sides by the same number preserves the balance, or equality.

73. It means to find all values of the variable which make the equation true.
74. We obtain the same number since multiplication and division are opposite operations.

REVIEW

$$\begin{aligned} 75. \quad P &= 2l + 2w \\ &= 2 \cdot 8 + 2 \cdot 16 \\ &= 16 + 32 \\ &= 48 \text{ cm.} \end{aligned}$$

$$\begin{aligned} 76. \quad A &= l \cdot w \\ &= 23 \cdot 37 \\ &= 851 \text{ in}^2. \end{aligned}$$

$$\begin{aligned} 77. \quad 120 &= 4 \cdot 30 \\ &= 2 \cdot 2 \cdot 3 \cdot 10 \\ &= 2 \cdot 2 \cdot 3 \cdot 2 \cdot 5 \\ &= 2^3 \cdot 3 \cdot 5 \end{aligned}$$

$$\begin{aligned} 78. \quad 150 &= 3 \cdot 50 \\ &= 3 \cdot 2 \cdot 25 \\ &= 3 \cdot 2 \cdot 5 \cdot 5 \\ &= 2 \cdot 3 \cdot 5^2 \end{aligned}$$

$$\begin{aligned} 79. \quad 3^2 \cdot 2^3 &= 9 \cdot 8 \\ &= 72 \end{aligned}$$

$$\begin{aligned} 80. \quad 5 + 6 \cdot 3 &= 5 + 18 \\ &= 23 \end{aligned}$$

$$81. \quad \frac{0}{12} = 0$$

$$82. \quad \frac{50}{0} \text{ is undefined}$$

Chapter 1 Review

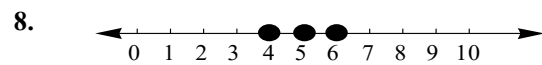
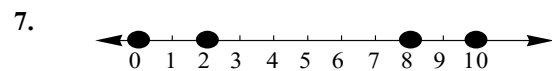
1. a. 6
b. 7
c. 1 billion
d. 8
2. a. ninety-seven thousand, two hundred eighty – three
b. five billion, four hundred forty-four million, sixty thousand, seventeen

3. a. 3,207
b. 23,253,412

4. 61,204

5. $500,000 + 70,000 + 300 + 2$

6. $30,000,000 + 7,000,000 + 300,000$
 $+ 9,000 + 100 + 50 + 4$



9. $9 > 7$

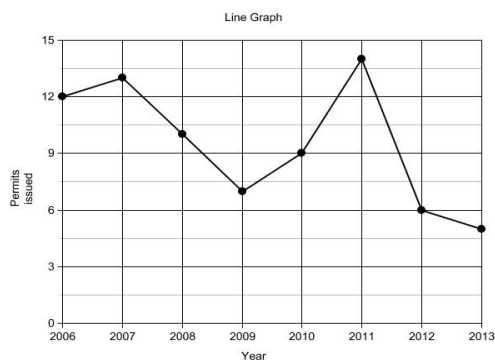
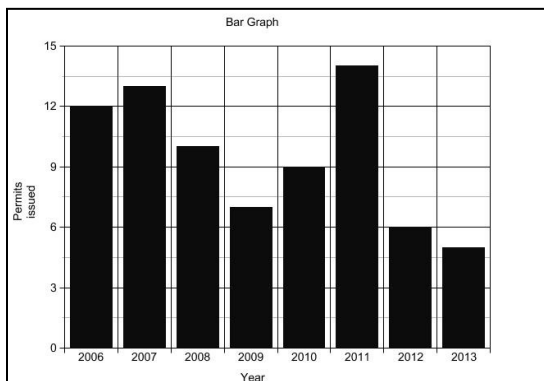
10. $301 < 310$

11. a. 2,507,300
b. 2,510,000
c. 2,507,350
d. 3,000,000

12. a. 970,000

- b. 1,000,000

13.



14. Nile, Amazon, Yangtze, Mississippi-Missouri, Ob-Irtys

$$\begin{array}{r} 436 \\ +27 \\ \hline 463 \end{array}$$

$$\begin{aligned} 16. \quad 4 + (36 + 19) &= 4 + (55) \\ &= 59 \end{aligned}$$

$$\begin{array}{r} 5345 \\ + 655 \\ \hline 6000 \end{array}$$

$$\begin{aligned} 18. \quad 2 + 1 + 38 + 3 + 6 &= 3 + 38 + 3 + 6 \\ &= 41 + 3 + 6 \\ &= 44 + 6 \\ &= 50 \end{aligned}$$

$$\begin{array}{r} 4447 \\ 7478 \\ + 676 \\ \hline 12601 \end{array}$$

$$\begin{array}{r} 32812 \\ 65034 \\ + 54323 \\ \hline 152169 \end{array}$$

$$\begin{aligned} 21. \quad 600 + 800 + 10,000 + 40,000 + 8,000 \\ &= 1,400 + 50,000 + 8,000 \\ &= 51,400 + 8,000 \\ &= 59,400 \end{aligned}$$

$$22. \quad \text{a. } 24 + 61 = 61 + 24$$

$$\text{b. } 9 + (91 + 29) = (9 + 91) + 29$$

$$\begin{aligned} 23. \quad 101,491,106 + 76,949,504 + 74,937,004 \\ &= 253,377,614 \text{ passengers} \end{aligned}$$

$$\begin{array}{r} 226 \\ 859 \\ 345 \\ + 1,291 \\ \hline 2,721 \end{array}$$

It is not correct.

$$\begin{array}{r} 10955 \\ + 3706 \\ \hline 14661 \end{array}$$

$$\begin{array}{r} 327891 \\ + 451775 \\ \hline 779666 \end{array}$$

$$27. \quad 1,695 + 772 = 2,467 \text{ sq ft}$$

28.

$$\begin{array}{r} 1 \\ 642 \\ 731 \\ 642 \\ +731 \\ \hline 2,746 \text{ ft} \end{array}$$

29.

$$\begin{array}{r} 148 \\ -87 \\ \hline 61 \end{array}$$

30.

$$\begin{array}{r} 10,4\cancel{3}^{\cancel{2}/\cancel{15}} \\ -10,218 \\ \hline 217 \end{array}$$

31.

$$750 - 259 + 14 = 491 + 14 \\ = 505$$

32.

$$\begin{array}{r} 7,8\cancel{0}^{\cancel{7}/\cancel{10}/\cancel{10}} \\ -5,725 \\ \hline 2,075 \end{array}$$

33.

$$\begin{array}{r} 111 \\ 1,168 \\ +6,949 \\ \hline 8,117 \end{array}$$

The subtraction is incorrect.

34.

$$20 - 8 = 12 \text{ because } 12 + 8 = 20.$$

35.

$$200,000 - 40,000 = 160,000$$

36.

$$\begin{array}{r} \cancel{5}^{\cancel{12}/\cancel{12}} \cancel{3,4}^{\cancel{7}/\cancel{12}} \\ -3,551,023 \\ \hline 2,772,459 \text{ mi}^2. \end{array}$$

37.

$$12,975 - 3,800 + 4,270 = 9,175 + 4,270 \\ = \$13,445$$

38.

$$\begin{array}{r} \cancel{13}^{\cancel{13}/\cancel{13}} \\ \cancel{2}^{\cancel{13}/\cancel{13}} \cancel{4}^{\cancel{13}/\cancel{13}} \cancel{2}^{\cancel{13}/\cancel{13}} \\ -188 \\ \hline 54 \text{ days} \end{array}$$

39.

$$\begin{array}{r} 6 \\ 47 \\ \times 9 \\ \hline 423 \end{array}$$

40.

$$5 \cdot (7 \cdot 6) = 5 \cdot 42 \\ = 210$$

41.

$72 \cdot 10,000$: Since there are 4 zeros, move the decimal point 4 units to the right: 720,000

42.

$$\begin{array}{r} 157 \\ \times 59 \\ \hline 1,413 \\ +7,850 \\ \hline 9,263 \end{array}$$

43.

$$\begin{array}{r} 5,624 \\ \times 281 \\ \hline 5,624 \\ 449,920 \\ +1,124,800 \\ \hline 1,580,344 \end{array}$$

44.

$$\begin{array}{r} 502 \\ \times 459 \\ \hline 4,518 \\ 25,100 \\ +200,800 \\ \hline 230,418 \end{array}$$

45.

$$7,000 \cdot 400 = 2,800,000$$

46.

a. $7 + 7 + 7 + 7 + 7 = 5 \cdot 7$

b. $2 \cdot t = 2t$

c. $m \cdot n = mn$

47.

a. $8 \cdot 0 = 0$ b. $7 \cdot 1 = 7$

48. a. Associative Property of Multiplication
b. Commutative Property of Multiplication

49. $A = l \cdot w$
 $A = 8 \cdot 4$
 $A = 32 \text{ cm}^2$.

50. $A = l \cdot w$
 $A = 78 \cdot 78$
 $A = 6,084 \text{ in}^2$.

51. a. $365 \cdot 7 = 2,555 \text{ hr.}$
b. $365 \cdot 9 = 3,285 \text{ hr.}$

52.
$$\begin{array}{r} 22 \\ \times 15 \\ \hline 110 \\ +220 \\ \hline 330 \end{array}$$

There were 330 people in the graduating class.

53. Sarah: $12 \cdot 9 = \$108$

Santiago: $14 \cdot 8 = \$112$
Santiago earned more money.

54. $12 \cdot 12 \cdot 100 = 144 \cdot 100$
 $= 14,400 \text{ eggs}$

55. $\frac{72}{4} = \frac{\cancel{A} \cdot 18}{\cancel{A}} = 18$

56.
$$\begin{array}{r} 37 \\ 39 \overline{)1443} \\ \underline{-117} \\ 273 \\ \underline{-273} \\ 0 \end{array}$$

57.
$$\begin{array}{r} 307 \\ 68 \overline{)20876} \\ \underline{-204} \\ 47 \\ \underline{-0} \\ 476 \\ \underline{-476} \\ 0 \end{array}$$

58.
$$\begin{array}{r} 19 \\ 21 \overline{)405} \\ \underline{-21} \\ 195 \\ \underline{-189} \\ 6 \\ 19R6 \end{array}$$

59. $\frac{0}{10} = 0$

60. $\frac{165}{0}$ is undefined

61.
$$\begin{array}{r} 42 \\ 127 \overline{)5347} \\ \underline{-508} \\ 267 \\ \underline{-254} \\ 13 \\ 42R13 \end{array}$$

62. Begin by dividing both by 100 to eliminate two zeros:

$$\begin{array}{r} 380 \\ 39 \overline{)14820} \\ \underline{-117} \\ 312 \\ \underline{-312} \\ 0 \end{array}$$

63. $40 \cdot 4 = 160$

64. $45 \cdot 7 + 6 = 315 + 6$
 $= 321$

It is not correct.

65. 364,545 is divisible by 3, 5, and 9.

66. $200,000 \div 50 = 4,000$

67.

$$\begin{array}{r} 16 \\ 45 \overline{)745} \\ \underline{-45} \\ 295 \\ \underline{-270} \\ 25 \end{array}$$

Each child will get 16 candies, with 25 left over.

68. Begin by cancelling 3 zeros from each number.

$$\begin{array}{r} 34 \\ 25 \overline{)850} \\ \underline{-75} \\ 100 \\ \underline{-100} \\ 0 \end{array}$$

They can purchase 34 cars.

69. 1, 2, 3, 6, 9, 18

70. 1, 3, 5, 15, 25, 75

71. $20 = 2 \cdot 10$
 $= 4 \cdot 5$

72. $54 = 2 \cdot 3 \cdot 9$
 $= 3 \cdot 3 \cdot 6$

73. a. prime
b. composite
c. neither
d. neither
e. composite
f. prime

74. a. odd
b. even
c. even
d. odd

75. $42 = 2 \cdot 21$
 $= 2 \cdot 3 \cdot 7$

76. $75 = 3 \cdot 25$
 $= 3 \cdot 5 \cdot 5$
 $= 3 \cdot 5^2$

77. $220 = 10 \cdot 22$
 $= 2 \cdot 5 \cdot 2 \cdot 11$
 $= 2^2 \cdot 5 \cdot 11$

78. $140 = 10 \cdot 14$
 $= 2 \cdot 5 \cdot 2 \cdot 7$
 $= 2^2 \cdot 5 \cdot 7$

79. $6 \cdot 6 \cdot 6 \cdot 6 = 6^4$

80. $5(5)(5)(13)(13) = 5^3 \cdot 13^2$

81. $5^3 = 5 \cdot 5 \cdot 5$
 $= 25 \cdot 5$
 $= 125$

82. $11^2 = 11 \cdot 11$
 $= 121$

83. $2^4 \cdot 7^2 = 2 \cdot 2 \cdot 2 \cdot 2 \cdot 7 \cdot 7$
 $= 4 \cdot 4 \cdot 49$
 $= 16 \cdot 49$
 $= 784$

84. $2^2 \cdot 3^3 \cdot 5^2 = 4 \cdot 27 \cdot 25$
 $= 108 \cdot 25$
 $= 2,700$

85. 9, 18, 27, 36, 45, 54, 63, 72, 81, 90

86. a. 24 and 48 are in both sets of multiples.
b. 1 and 2 are in both sets of factors.

$$\begin{aligned}
 87. \quad & 4 = 2 \cdot 2 \\
 & 6 = 2 \cdot 2 \cdot 3 \\
 & LCM(4, 6) = 2 \cdot 2 \cdot 3 \\
 & = 12
 \end{aligned}$$

$$\begin{aligned}
 88. \quad & 3 = 3 \\
 & 4 = 2 \cdot 2 \\
 & LCM(3, 4) = 2 \cdot 2 \cdot 3 \\
 & = 12
 \end{aligned}$$

$$\begin{aligned}
 89. \quad & 9 = 3 \cdot 3 \\
 & 15 = 3 \cdot 5 \\
 & LCM(9, 15) = 3 \cdot 3 \cdot 5 \\
 & = 45
 \end{aligned}$$

$$\begin{aligned}
 90. \quad & 12 = 2 \cdot 2 \cdot 3 \\
 & 18 = 2 \cdot 3 \cdot 3 \\
 & LCM(12, 18) = 2 \cdot 2 \cdot 3 \cdot 3 \\
 & = 36
 \end{aligned}$$

$$\begin{aligned}
 91. \quad & 18 = 2 \cdot 3 \cdot 3 \\
 & 21 = 3 \cdot 7 \\
 & LCM(18, 21) = 2 \cdot 3 \cdot 3 \cdot 7 \\
 & = 126
 \end{aligned}$$

$$\begin{aligned}
 92. \quad & 24 = 2 \cdot 2 \cdot 2 \cdot 3 \\
 & 45 = 3 \cdot 3 \cdot 5 \\
 & LCM(24, 45) = 2 \cdot 2 \cdot 2 \cdot 3 \cdot 3 \cdot 5 \\
 & = 360
 \end{aligned}$$

$$\begin{aligned}
 93. \quad & 4 = 2 \cdot 2 \\
 & 14 = 2 \cdot 7 \\
 & 20 = 2 \cdot 2 \cdot 5 \\
 & LCM(4, 14, 20) = 2 \cdot 2 \cdot 5 \cdot 7 \\
 & = 140
 \end{aligned}$$

$$\begin{aligned}
 94. \quad & 21 = 3 \cdot 7 \\
 & 28 = 2 \cdot 2 \cdot 7 \\
 & 42 = 2 \cdot 3 \cdot 7 \\
 & LCM(21, 28, 42) = 2 \cdot 2 \cdot 3 \cdot 7 \\
 & = 84
 \end{aligned}$$

$$\begin{aligned}
 95. \quad & 8 = 2 \cdot 2 \cdot 2 \\
 & 12 = 2 \cdot 2 \cdot 3 \\
 & GCF(8, 12) = 2 \cdot 2 \\
 & = 4
 \end{aligned}$$

$$\begin{aligned}
 96. \quad & 9 = 3 \cdot 3 \\
 & 12 = 2 \cdot 2 \cdot 3 \\
 & GCF(9, 12) = 3
 \end{aligned}$$

$$\begin{aligned}
 97. \quad & 30 = 2 \cdot 3 \cdot 5 \\
 & 40 = 2 \cdot 2 \cdot 2 \cdot 5 \\
 & GCF(30, 40) = 2 \cdot 5 \\
 & = 10
 \end{aligned}$$

$$\begin{aligned}
 98. \quad & 30 = 2 \cdot 3 \cdot 5 \\
 & 45 = 3 \cdot 3 \cdot 5 \\
 & GCF(30, 45) = 3 \cdot 5 \\
 & = 15
 \end{aligned}$$

$$\begin{aligned}
 99. \quad & 63 = 3 \cdot 3 \cdot 7 \\
 & 84 = 2 \cdot 2 \cdot 3 \cdot 7 \\
 & GCF(63, 84) = 3 \cdot 7 \\
 & = 21
 \end{aligned}$$

$$\begin{aligned}
 100. \quad & 112 = 2 \cdot 2 \cdot 2 \cdot 2 \cdot 7 \\
 & 196 = 2 \cdot 2 \cdot 7 \cdot 7 \\
 & GCF(112, 196) = 2 \cdot 2 \cdot 7 \\
 & = 28
 \end{aligned}$$

$$\begin{aligned}
 101. \quad & 48 = 2 \cdot 2 \cdot 2 \cdot 2 \cdot 3 \\
 & 72 = 2 \cdot 2 \cdot 2 \cdot 3 \cdot 3 \\
 & 120 = 2 \cdot 2 \cdot 2 \cdot 3 \cdot 5 \\
 & GCF(48, 72, 120) = 2 \cdot 2 \cdot 2 \cdot 3 \\
 & = 24
 \end{aligned}$$

$$\begin{aligned}
 102. \quad & 88 = 2 \cdot 2 \cdot 2 \cdot 11 \\
 & 132 = 2 \cdot 2 \cdot 3 \cdot 11 \\
 & 176 = 2 \cdot 2 \cdot 2 \cdot 2 \cdot 11 \\
 & GCF(88, 132, 176) = 2 \cdot 2 \cdot 11 \\
 & = 44
 \end{aligned}$$

$$103. \quad 14 = 2 \cdot 7$$

$$21 = 3 \cdot 7$$

$$LCM(14, 21) = 2 \cdot 3 \cdot 7$$

$$= 42$$

They will meet on the same day 42 days later.

$$104. \quad 32 = 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2$$

$$24 = 2 \cdot 2 \cdot 2 \cdot 3$$

$$16 = 2 \cdot 2 \cdot 2 \cdot 2$$

$$GCF(32, 24, 16) = 2 \cdot 2 \cdot 2$$

$$= 8$$

a. 8 arrangements

b. 4 red, 3 white, 2 blue (the 'remainder' when the GCF is taken out)

$$105. \quad 3^2 + 12 \cdot 3 = 9 + 36$$

$$= 45$$

$$106. \quad 35 - 5 \cdot 3 + 3 = 35 - 15 + 3$$

$$= 20 + 3$$

$$= 23$$

$$107. \quad (6 \div 2 \cdot 3)^2 \cdot 3 = (3 \cdot 3)^2 \cdot 3$$

$$= 9^2 \cdot 3$$

$$= 81 \cdot 3$$

$$= 243$$

$$108. \quad (35 - 5 \cdot 3) \div 5 = (35 - 15) \div 5$$

$$= 20 \div 5$$

$$= 4$$

$$109. \quad 2^3 \cdot 5 - 4 \div 2 \cdot 4 = 8 \cdot 5 - 2 \cdot 4$$

$$= 40 - 8$$

$$= 32$$

$$110. \quad 8 \cdot (5 - 4 \div 2)^2 = 8 \cdot (5 - 2)^2$$

$$= 8 \cdot 3^2$$

$$= 8 \cdot 9$$

$$= 72$$

$$111. \quad 2 + 3 \left(\frac{100}{10} - 2^2 \cdot 2 \right) = 2 + 3(10 - 4 \cdot 2)$$

$$= 2 + 3(10 - 8)$$

$$= 2 + 3(2)$$

$$= 2 + 6 = 8$$

$$112. \quad 4(4^2 - 5 \cdot 3 + 2) - 4 = 4(16 - 15 + 2) - 4$$

$$= 4(1 + 2) - 4$$

$$= 4(3) - 4$$

$$= 12 - 4$$

$$= 8$$

$$113. \quad \frac{4(6) - 6}{2(3^2)} = \frac{24 - 6}{2(9)}$$

$$= \frac{18}{18}$$

$$= 1$$

$$114. \quad \frac{6 \cdot 2 + 3 \cdot 7}{5^2 - 2(7)} = \frac{12 + 21}{25 - 14}$$

$$= \frac{33}{11}$$

$$= 3$$

$$115. \quad 7 + 3[3^3 - 10(4 - 2)] = 7 + 3[27 - 10(2)]$$

$$= 7 + 3[27 - 20]$$

$$= 7 + 3[7]$$

$$= 7 + 21$$

$$= 28$$

$$116. \quad 5 + 2 \left[\left(2^4 - 3 \cdot \frac{8}{2} \right) - 2 \right] = 5 + 2[(16 - 3 \cdot 4) - 2]$$

$$= 5 + 2[(16 - 12) - 2]$$

$$= 5 + 2[4 - 2]$$

$$= 5 + 2[2]$$

$$= 5 + 4$$

$$= 9$$

$$117. \quad \frac{80 + 74 + 66 + 88}{4} = \frac{308}{4}$$

$$= 77$$

$$118. \quad \frac{73+77+81+0+69}{5} = \frac{300}{5} \\ = 60$$

$$119. \quad x+2=13$$

$$5+2=13$$

$$7=13$$

5 is not a solution.

$$120. \quad x-3=1$$

$$4-3=1$$

$$1=1$$

4 is a solution.

$$121. \quad x-7=2$$

$$x-7+7=2+7$$

$$x=9$$

$$\text{Check: } x-7=2$$

$$9-7=2$$

$$2=2$$

The solution checks.

$$122. \quad x-11=20$$

$$x-11+11=20+11$$

$$x=31$$

$$\text{Check: } x-11=20$$

$$31-11=20$$

$$20=20$$

The solution checks.

$$123. \quad 225 = y - 115$$

$$225+115 = y-115+115$$

$$340 = y$$

$$\text{Check: } 225 = y - 115$$

$$225 = 340 - 115$$

$$225 = 225$$

The solution checks.

$$124. \quad 101 = p - 32$$

$$101+32 = p-32+32$$

$$133 = p$$

$$\text{Check: } 101 = p - 32$$

$$101 = 133 - 32$$

$$101 = 101$$

The solution checks.

$$125. \quad x+9=18$$

$$x+9-9=18-9$$

$$x=9$$

$$\text{Check: } x+9=18$$

$$9+9=18$$

$$18=18$$

The solution checks.

$$126. \quad b+12=26$$

$$b+12-12=26-12$$

$$b=14$$

$$\text{Check: } b+12=26$$

$$14+12=26$$

$$26=26$$

The solution checks.

$$127. \quad 175 = p + 55$$

$$175-55 = p+55-55$$

$$120 = p$$

$$\text{Check: } 175 = p + 55$$

$$175 = 120 + 55$$

$$175 = 175$$

The solution checks.

$$128. \quad 212 = m + 207$$

$$212-207 = m+207-207$$

$$5 = m$$

$$\text{Check: } 212 = m + 207$$

$$212 = 5 + 207$$

$$212 = 212$$

The solution checks.

$$129. \quad x = \text{how much they needed to borrow}$$

$$x+25,500=122,750$$

$$x+25,500-25,500=122,750-25,500$$

$$x=97,250$$

They had to borrow \$97,250.

- 130.
- x
- = the original number of patients

$$x - 13 = 172$$

$$x - 13 + 13 = 172 + 13$$

$$x = 185$$

He had 185 patients originally.

- 131.
- $3x = 12$

$$\frac{3x}{3} = \frac{12}{3}$$

$$x = 4$$

Check: $3x = 12$

$$3 \cdot 4 = 12$$

$$12 = 12$$

The solution checks.

- 132.
- $15y = 45$

$$\frac{15y}{15} = \frac{45}{15}$$

$$y = 3$$

Check: $15y = 45$

$$15 \cdot 3 = 45$$

$$45 = 45$$

The solution checks.

- 133.
- $105 = 5r$

$$\frac{105}{5} = \frac{5r}{5}$$

$$21 = r$$

Check: $105 = 5r$

$$105 = 5 \cdot 21$$

$$105 = 105$$

The solution checks.

- 134.
- $224 = 16q$

$$\frac{224}{16} = \frac{16q}{16}$$

$$14 = q$$

Check: $224 = 16q$

$$224 = 16 \cdot 14$$

$$224 = 224$$

The solution checks.

- 135.
- $\frac{x}{7} = 3$

$$7 \cdot \frac{x}{7} = 7 \cdot 3$$

$$x = 21$$

Check: $\frac{x}{7} = 3$

$$\frac{21}{7} = 3$$

$$3 = 3$$

The solution checks.

- 136.
- $\frac{a}{3} = 12$

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

$$a = 36$$

Check: $\frac{a}{3} = 12$

$$\frac{36}{3} = 12$$

$$12 = 12$$

The solution checks.

- 137.
- $15 = \frac{s}{21}$

$$15 \cdot 21 = \frac{s}{21} \cdot 21$$

$$315 = s$$

Check: $15 = \frac{s}{21}$

$$15 = \frac{315}{21}$$

$$15 = 15$$

The solution checks.

- 138.
- $25 = \frac{d}{17}$

$$25 \cdot 17 = \frac{d}{17} \cdot 17$$

$$425 = d$$

$$\begin{aligned}\text{Check: } 25 &= \frac{d}{17} \\ 25 &= \frac{425}{17} \\ 25 &= 25\end{aligned}$$

The solution checks.

139. x = the number of orders the previous week

$$2x = 364$$

$$\frac{2x}{2} = \frac{364}{2}$$

$$x = 182$$

They received 182 orders the previous week.

140. x = the total amount cost

$$\frac{x}{4} = 32$$

$$\frac{x}{4} \cdot 4 = 32 \cdot 4$$

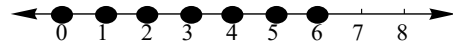
$$x = 128$$

The chain cost \$128.

Chapter 1 Test

1.
 - a. The set of whole numbers is $\{0, 1, 2, 3, 4, 5, \dots\}$.
 - b. The symbols $>$ and $<$ are inequality symbols.
 - c. The area of a rectangle is a measure of the amount of surface it encloses.
 - d. The grouping symbols $()$ are called parentheses, and the symbols $[]$ are called brackets.
 - e. A prime number is a whole number greater than 1 that has only 1 and itself as factors.
 - f. An equation is a statement indicating that two expressions are equal.
 - g. A number that makes an equation true when substituted for a variable is called a solution of the equation.
 - h. In this chapter, we used the addition, subtraction, multiplication, and division properties of equality to solve equations.

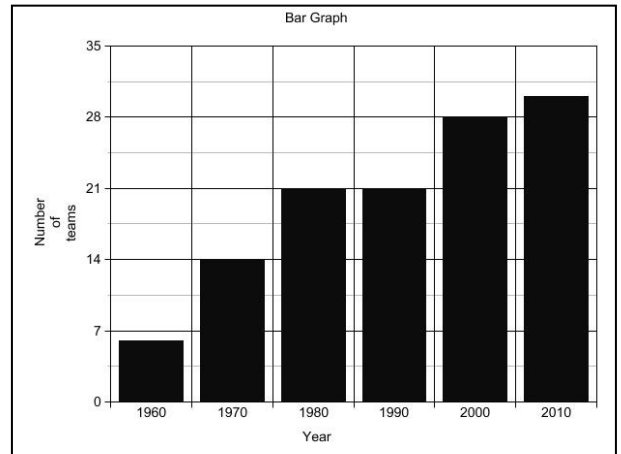
2.



3.
 - a. 1 hundred
 - b. 0
4.
 - a. seven million, eighteen thousand, six hundred forty-one
 - b. 1,385,266
 - c. $90,000 + 2,000 + 500 + 60 + 1$
5.
 - a. $15 > 10$
 - b. $1,247 < 1,427$

6.
 - a. 35,000,000
 - b. 34,800,000
 - c. 34,760,000

7.



8.

$$\begin{array}{r} 4 \overline{) 1287} \\ \underline{8} \\ 48 \\ \underline{48} \\ 0 \end{array}$$

$$\text{Check: } 248 + 287 = 535$$

9.

$$\begin{array}{r} 11111 \\ 136,231 \\ + 82,574 \\ + 6,359 \\ \hline 225,164 \end{array}$$

10.

$$\begin{array}{r} \cancel{3} \cancel{4} \cancel{5} \cancel{2} \cancel{1} \\ -3,579 \\ \hline 942 \end{array}$$

11.

$$\begin{array}{r} 2 \\ 53 \\ \times 8 \\ \hline 424 \end{array}$$

12.

$$\begin{array}{r} 562 \\ \times 74 \\ \hline 2,248 \\ +39,340 \\ \hline 41,588 \end{array}$$

13.

$$\begin{array}{r} 72 \\ 6 \overline{)432} \\ -42 \\ \hline 12 \\ -12 \\ \hline 0 \end{array}$$

14.

$$\begin{array}{r} 114 \\ 73 \overline{)8379} \\ -73 \\ \hline 107 \\ -73 \\ \hline 349 \\ -292 \\ \hline 57 \\ 114R57 \end{array}$$

$$\begin{aligned} \text{Check: } (73 \cdot 114) + 57 \\ = 8,322 + 57 \\ = 8,379 \end{aligned}$$

15. $23 \cdot 6 = 138$, now attach 5 zeros: 13,800,000

16. Begin by dividing out 2 zeros from each:

$$\begin{array}{r} 250 \\ 5 \overline{)1250} \\ -10 \\ \hline 25 \\ -25 \\ \hline 0 \end{array}$$

17. $50,000 - 7,000 = 43,000$

18. $327 + 757 + 327 + 757 = 1,084 + 1,084 = 2,168 \text{ in.}$

19. $23 \cdot 23 = 529 \text{ in}^2$.

20. a. 1, 2, 3, 4, 6, 12

b. 4, 8, 12, 16, 20, 24

c. $8 \cdot 5$

$$\begin{aligned} 21. \quad 1260 &= 10 \cdot 126 \\ &= 2 \cdot 5 \cdot 9 \cdot 14 \\ &= 2 \cdot 5 \cdot 3 \cdot 3 \cdot 2 \cdot 7 \\ &= 2^2 \cdot 3^2 \cdot 5 \cdot 7 \end{aligned}$$

22. $10,000 - 5,067 = 4,933 \text{ tails}$

23. $12 \cdot 8 = 96 \text{ students}$

24. $12,255 \div 3 = 4,085 \text{ ft}^2$.

25. $23 \cdot 18 = 414 \text{ mi.}$

26. a. Associative Property of Multiplication

b. Commutative Property of Addition

27. a. 0

b. 0

c. 1

d. undefined

$$\begin{aligned}
 28. \quad & 15 = 3 \cdot 5 \\
 & 18 = 2 \cdot 3 \cdot 3 \\
 & LCM(15, 18) = 2 \cdot 3 \cdot 3 \cdot 5 \\
 & = 90
 \end{aligned}$$

$$\begin{aligned}
 29. \quad & 8 = 2 \cdot 2 \cdot 2 \\
 & 9 = 3 \cdot 3 \\
 & 12 = 2 \cdot 2 \cdot 3 \\
 & LCM(8, 9, 12) = 2 \cdot 2 \cdot 2 \cdot 3 \cdot 3 \\
 & = 72
 \end{aligned}$$

$$\begin{aligned}
 30. \quad & 30 = 2 \cdot 3 \cdot 5 \\
 & 54 = 2 \cdot 3 \cdot 3 \cdot 3 \\
 & GCF(30, 54) = 2 \cdot 3 \\
 & = 6
 \end{aligned}$$

$$\begin{aligned}
 31. \quad & 24 = 2 \cdot 2 \cdot 2 \cdot 3 \\
 & 28 = 2 \cdot 2 \cdot 7 \\
 & 36 = 2 \cdot 2 \cdot 3 \cdot 3 \\
 & GCF(24, 28, 36) = 2 \cdot 2 \\
 & = 4
 \end{aligned}$$

$$\begin{aligned}
 32. \quad & 8 = 2 \cdot 2 \cdot 2 \\
 & 10 = 2 \cdot 5 \\
 & LCM(8, 10) = 2 \cdot 2 \cdot 2 \cdot 5 \\
 & = 40
 \end{aligned}$$

a. 40 inches

b. 5 boxes of rice, 4 boxes of potatoes

33. It is divisible by 2, 3, 4, 5, 6, and 10.

$$\begin{aligned}
 34. \quad & \frac{73 + 52 + 95 + 70 + 0}{5} = \frac{290}{5} \\
 & = 58
 \end{aligned}$$

$$\begin{aligned}
 35. \quad & 9 + 4 \cdot 5 = 9 + 20 \\
 & = 29
 \end{aligned}$$

$$\begin{aligned}
 36. \quad & 3^4 \cdot 10 - 2(6)(4) = 81 \cdot 10 - 12(4) \\
 & = 810 - 48 \\
 & = 762
 \end{aligned}$$

$$\begin{aligned}
 37. \quad & 20 + 2[4^2 - 2(6 - 2^2)] = 20 + 2[16 - 2(6 - 4)] \\
 & = 20 + 2[16 - 2(2)] \\
 & = 20 + 2[16 - 4] \\
 & = 20 + 2[12] \\
 & = 20 + 24 \\
 & = 44
 \end{aligned}$$

$$\begin{aligned}
 38. \quad & \frac{3^3 - 2(15 - 14)^2}{33 - 9 + 1} = \frac{27 - 2(1)^2}{24 + 1} \\
 & = \frac{27 - 2}{24 + 1} \\
 & = \frac{25}{25} \\
 & = 1
 \end{aligned}$$

$$\begin{aligned}
 39. \quad & x + 13 = 16 \\
 & \quad \quad \quad ? \\
 & 3 + 13 = 16 \\
 & 16 = 16 \\
 & 3 \text{ is a solution.}
 \end{aligned}$$

40. To solve an equation means to find all the values of the variable that, when substituted into the equation, make a true statement.

$$\begin{aligned}
 41. \quad & 100 = x + 1 \\
 & 100 - 1 = x + 1 - 1 \\
 & 99 = x \\
 & \text{Check: } 100 = x + 1 \\
 & \quad \quad \quad ? \\
 & 100 = 99 + 1 \\
 & 100 = 100
 \end{aligned}$$

The solution checks.

$$\begin{aligned}
 42. \quad & y - 12 = 18 \\
 & y - 12 + 12 = 18 + 12 \\
 & y = 30 \\
 & \text{Check: } y - 12 = 18 \\
 & \quad \quad \quad ? \\
 & 30 - 12 = 18 \\
 & 18 = 18 \\
 & \text{The solution checks.}
 \end{aligned}$$

43. $5m = 55$

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

$$m = 11$$

Check: $5m = 55$

$$5 \cdot 11 = 55$$

$$55 = 55$$

The solution checks.

44. $\frac{q}{3} = 27$

$$3 \cdot \frac{q}{3} = 3 \cdot 27$$

$$q = 81$$

Check: $\frac{q}{3} = 27$

$$\frac{81}{3} = 27$$

$$27 = 27$$

The solution checks.

45. $x =$ the original number of spots

$$3x = 6,240$$

$$\frac{3x}{3} = \frac{6,240}{3}$$

$$x = 2,080$$

At the time, the college had 2,080 spaces.

46. $x =$ the unfiltered intensity

$$x - 41 = 73$$

$$x - 41 + 41 = 73 + 41$$

$$x = 114$$

The sound intensity is 114 decibels.

47. $x =$ the size of the class

$$\frac{x}{6} = 12$$

$$6 \cdot \frac{x}{6} = 6 \cdot 12$$

$$x = 72$$

There are 72 students in the class.

48. $x =$ the amount she needs to borrow

$$x + 12,500 = 27,250$$

$$x + 12,500 - 12,500 = 27,250 - 12,500$$

$$x = 14,750$$

She needs to borrow \$14,750.