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, …}

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.

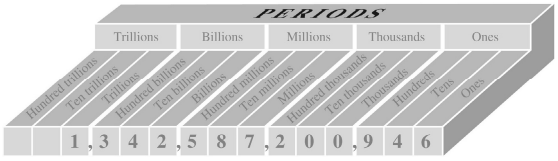
6. Using a process called *graphing* we can represent whole numbers as points on a number line.

7. The symbols < and > are inequality symbols.

8. If we round 627 to the nearest ten, we get 630.

CONCEPTS

9.

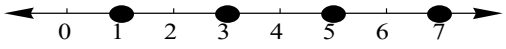


10. a. 5467010 = 5,467,010
b. seventy-two million, four hundred twelve thousand, six hundred thirty-five

11. a. forty
b. ninety
c. sixty-eight
d. fifteen

12. a. 81,692
b. 965,347

13.



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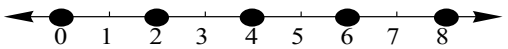

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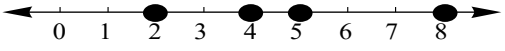

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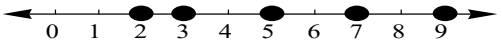

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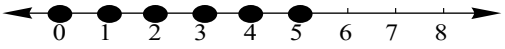

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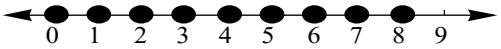

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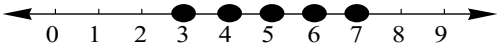

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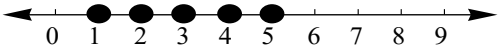


NOTATION

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.

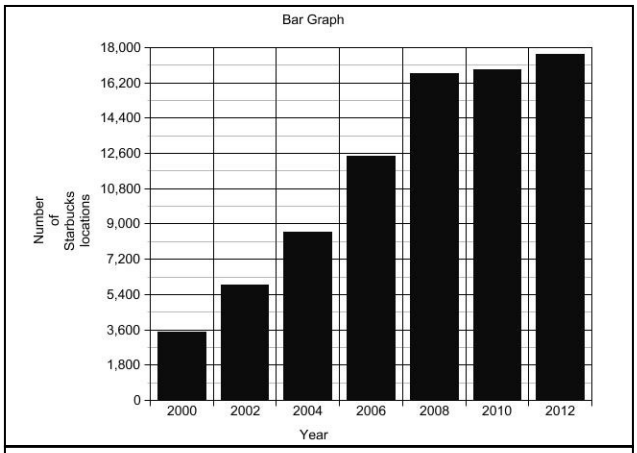
100.

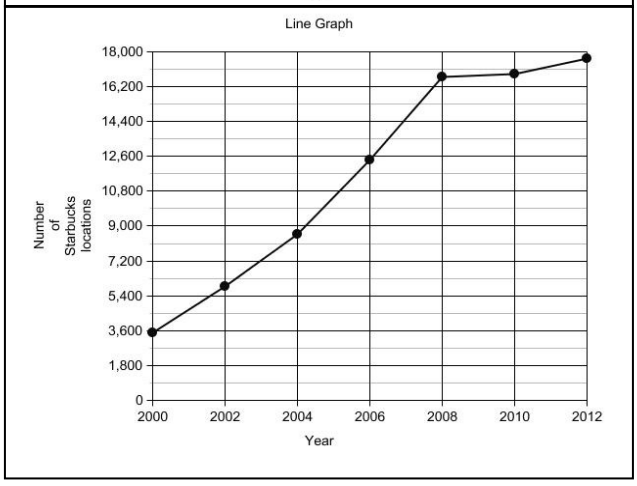
T. Roosevelt 42 yr/ 322 days	G. Cleveland 47 yr/351days
J. Kennedy 43 yr/236 days	F. Pierce 48 yr/101 days
W. Clinton 46 yr/154 days	J. Garfield 49 yr/105 days
U. Grant 46 yr/236 days	J. Polk 49 yr/122 days
B. Obama 47 yr/169 days	M. Filmore 50 yr/184 days

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.

103.





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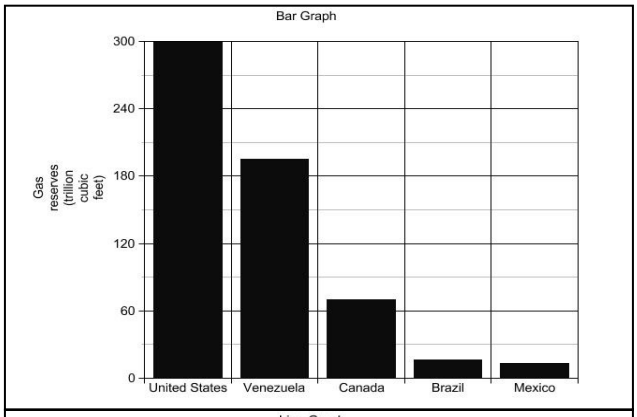
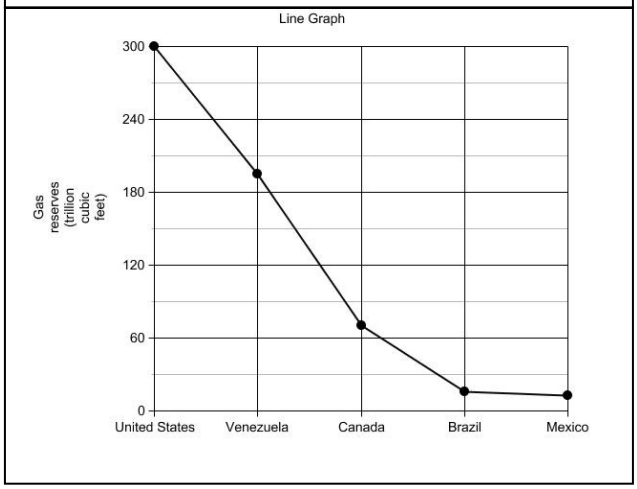




105. Fifteen thousand, six hundred one
Three thousand, four hundred thirty-three

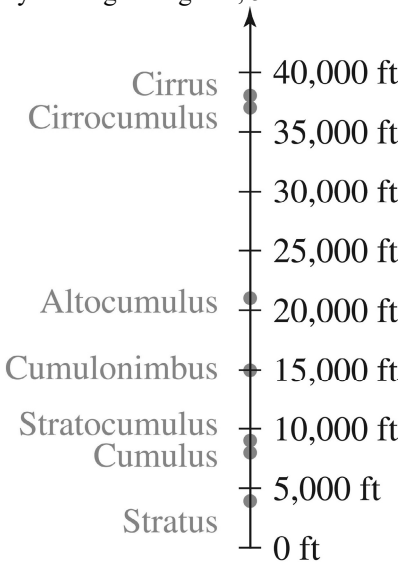
106. a. This diploma awarded this the twenty-seventh day of June, two thousand fourteen.
b. The suggested contribution for the fundraiser is eight hundred fifty dollars a plate, or an entire table may be purchased for five thousand, two hundred fifty dollars.

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

110.



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. $\underset{addend}{10} + \underset{addend}{15} = \underset{sum}{25}$

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.

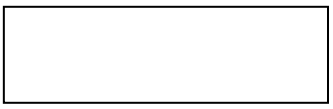
5. To see whether the result of an addition is reasonable, we can round the addends and estimate the sum.

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. $\underset{\text{minuend}}{25} - \underset{\text{subtrahend}}{10} = \underset{\text{difference}}{15}$

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.
$$\begin{aligned} 12+(15+2) &= 12+17 \\ &= 29 \end{aligned}$$

24.
$$\begin{aligned} 36-11+5 &= 25+5 \\ &= 30 \end{aligned}$$

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.
$$\begin{array}{r} {\scriptstyle 1\ \ \ } \\ 156 \\ +305 \\ \hline 461 \end{array}$$

30.
$$\begin{array}{r} {\scriptstyle 1\ \ \ } \\ 647 \\ +138 \\ \hline 785 \end{array}$$

31.
$$\begin{array}{r} {\scriptstyle 1\ 1\ 1} \\ 4,301 \\ 789 \\ +3,847 \\ \hline 8,937 \end{array}$$

32.
$$\begin{array}{r} {\scriptstyle 2\ 1\ 1} \\ 5,576 \\ 649 \\ +1,922 \\ \hline 8,147 \end{array}$$

33.
$$\begin{aligned} (13+8)+12 &= 13+(8+12) = 13+20 \\ &= 33 \end{aligned}$$

34.
$$\begin{aligned} (19+7)+13 &= 19+(7+13) = 19+20 \\ &= 39 \end{aligned}$$

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

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

37.
$$\begin{array}{r} {\scriptstyle 1\ \ \ } \\ 700 \\ 800 \\ 10,000 \\ 20,000 \\ +\ \ 6,000 \\ \hline 37,500 \end{array}$$

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.
$$\begin{array}{r} 7,989 \\ -347 \\ \hline 7,642 \end{array}$$

50.
$$\begin{array}{r} 9,799 \\ -283 \\ \hline 9,516 \end{array}$$

51.
$$\begin{array}{r} 2,967 \\ -405 \\ \hline 2,562 \end{array}$$

52.
$$\begin{array}{r} 1,736 \\ -304 \\ \hline 1,432 \end{array}$$

53.
$$\begin{array}{r} {\scriptstyle 6\ \ 13\ \ 16} \\ 8,\not{7}\not{A}\not{6} \\ -\ 2\ 8\ 9 \\ \hline 8,4\ 5\ 7 \end{array}$$

54.
$$\begin{array}{r} {\scriptstyle 4\ \ 12\ \ 11} \\ 7,\not{5}\not{3}\not{1} \\ -\ 2\ 7\ 6 \\ \hline 7,2\ 5\ 5 \end{array}$$

55.
$$\begin{array}{r} {\scriptstyle 8\ \ 15\ \ 11} \\ 6,\not{9}\not{6}\not{1} \\ -\ 4\ 7\ 8 \\ \hline 6,4\ 8\ 3 \end{array}$$

56.
$$\begin{array}{r} {\scriptstyle 7\ \ 11\ \ 13} \\ 4,\not{8}\not{2}\not{3} \\ -\ 6\ 6\ 7 \\ \hline 4,1\ 5\ 6 \end{array}$$

57.
$$\begin{array}{r} {\scriptstyle 3\ \ 14\ \ 9\ \ 16} \\ 5\not{4},\not{5}\not{0}\not{6} \\ -\ 2,8\ 2\ 9 \\ \hline 5\ 1,6\ 7\ 7 \end{array}$$

58.
$$\begin{array}{r} {\scriptstyle 8\ \ 13\ \ 9\ \ 13} \\ 6\not{9},\not{4}\not{0}\not{3} \\ -\ 4,6\ 3\ 5 \\ \hline 6\ 4,7\ 6\ 8 \end{array}$$

59.
$$\begin{array}{r} {\scriptstyle 7\ \ 13\ \ 9\ \ 12} \\ 4\not{8},\not{4}\not{0}\not{2} \\ -\ 3,9\ 5\ 8 \\ \hline 4\ 4,4\ 4\ 4 \end{array}$$

60.
$$\begin{array}{r} {}^{8}\not{3}\,{}^{14}\not{4}\,{}^{9}\not{,}\not{5}\,{}^{10}\not{0}\,{}^{16}\not{6} \\ -\ 1,7\ 2\ 9 \\ \hline 3\ 7,7\ 7\ 7 \end{array}$$

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

65.
$$\begin{array}{r} 70,000 \\ -\ 4,000 \\ \hline 66,000 \end{array}$$

66.
$$\begin{array}{r} 50,000 \\ -\ 3,000 \\ \hline 47,000 \end{array}$$

67.
$$\begin{array}{r} 80,000 \\ -30,000 \\ \hline 50,000 \end{array}$$

68.
$$\begin{array}{r} 70,000 \\ -40,000 \\ \hline 30,000 \end{array}$$

69.
$$\begin{aligned} 35-12+6 &= 23+6 \\ &= 29 \end{aligned}$$

70.
$$\begin{aligned} 47-23+4 &= 24+4 \\ &= 28 \end{aligned}$$

71.
$$\begin{aligned} 574+47-13 &= 621-13 \\ &= 608 \end{aligned}$$

72.
$$\begin{aligned} 863+39-11 &= 902-11 \\ &= 891 \end{aligned}$$

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.
$$\begin{aligned} 633-598+30 &= 35+30 \\ &= 65 \end{aligned}$$

80.
$$\begin{aligned} 600-497+60 &= 103+60 \\ &= 163 \end{aligned}$$

81.
$$\begin{aligned} (45+16)+4 &= 45+20 \\ &= 65 \end{aligned}$$

82.
$$\begin{aligned} 7+(63+23) &= 70+23 \\ &= 93 \end{aligned}$$

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

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

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

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

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

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

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

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

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

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

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

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

LOOK ALIKES

95. a. 299 + 99 = 398

b. 99 + 299 = 398

96. a. 3,068 + 368 = 3,436
b. 368 + 3,068 = 3,436

97. a. 747 + 252 = 999
b. 252 + 747 = 999

98. a. (913 + 87) +688 = 1,000 + 688
= 1,688
b. 913 + (87 + 688) = 913 + 775
= 1,688

APPLICATIONS

99. 24 + 35 + 16 + 16 = 91 ft.

100. 540 + 230 + 150 + 170 = 990 calories

101. 308,058,000 – 64,511,000 = 243,547,000 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. \$1,947 + 5,358 + 4,442 + 712 + 5,871 + 12,540 + 3,882
= \$34,752

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

105. 64 + 34 + 64 + 34 = 196 inches of fringe

106. 15 + 11 + 15 + 11 = 52 feet of border.

107. 48 – 2(11) = 48 – 22 = 26 inches each side

4(26) = 104 inches total

108. 209 + 209 + 209 + 209 = 836 ft. of fence.

109. 2,623 – 351 = 2,272 lbs.

110. The greatest increase occurred from 2010 to 2011.

7,175 – 6,132 = 1,043 markets

111. 71,649 – 70,154 = 1,495 miles

112. 231 – 197 = 34 lbs. lost

113. 2,662,066 – 1,571,537 = 1,090,529 magazines

114. a. 2006 – 2008: 17,371 – 16,646 = 725 patients

b. 2012 – 2014: 16,795 – 16,391 = 404 patients

115. $1,947 - 183 = 1,764°F$

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

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

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

17.
$$\begin{array}{r} {\scriptstyle 3}\\ 15\\ \times\ \ 7\\ \hline 105 \end{array}$$

18.
$$\begin{array}{r} {\scriptstyle 8}\\ 19\\ \times\ \ 9\\ \hline 171 \end{array}$$

19.
$$\begin{array}{r} {\scriptstyle 3}\\ 34\\ \times\ \ 8\\ \hline 272 \end{array}$$

20.
$$\begin{array}{r} {\scriptstyle 4}\\ 37\\ \times\ \ 6\\ \hline 222 \end{array}$$

21. 100 has 2 zeros : attach 2 zeros : 3,700

22. 1,000 has 3 zeros : attach 3 zeros : 63,000

23. 10 has 1 zero : attach 1 zero : 750

24. 10,000 has 4 zeros : attach 4 zeros : 880,000

25. 10,000 has 4 zeros : attach 4 zeros : 1,070,000

26. 100 has 2 zeros : attach 2 zeros : 32,300

27. 1,000 has 3 zeros : attach 3 zeros : 512,000

28. 10 has 1 zero : attach 1 zero : 6,730

29. $68 \cdot 4 = 272$

$68 \cdot 40 = 2,720$

30. $83 \cdot 3 = 249$

$83 \cdot 30 = 2,490$

31. $56 \cdot 2 = 112$

$56 \cdot 200 = 11,200$

32. $222 \cdot 5 = 1,110$

$222 \cdot 500 = 111,000$

33. $13 \cdot 3 = 39$

$130(3,000) = 390,000$

34. $63 \cdot 7 = 441$

$630(7,000) = 4,410,000$

35. $27 \cdot 4 = 108$

$2,700(40,000) = 108,000,000$

36. $51 \cdot 8 = 408$

$5,100(80,000) = 408,000,000$

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

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

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

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

41. $602 \cdot 679 = 600 \cdot 679 + 2 \cdot 679$

$= 407,400 + 1,358$

$= 408,758$

42. $504 \cdot 729 = 500 \cdot 729 + 4 \cdot 729$
$= 364,500 + 2,916$
$= 367,416$

43. $3,002(5,619) = 3,000(5,619) + 2(5,619)$
$= 16,857,000 + 11,238$
$= 16,868,238$

44. $2,003(1,376) = 2,000(1,376) + 3(1,376)$
$= 2,752,000 + 4,128$
$= 2,756,128$

45. $(18 \cdot 20) \cdot 5 = 18 \cdot (20 \cdot 5) = 18 \cdot 100$
$= 1,800$

46. $(29 \cdot 2) \cdot 50 = 29 \cdot (2 \cdot 50) = 29 \cdot 100$
$= 2,900$

47. $250 \cdot (4 \cdot 135) = (250 \cdot 4) \cdot 135$
$= 1000 \cdot 135$
$= 135,000$

48. $250 \cdot (4 \cdot 289) = (250 \cdot 4) \cdot 289$
$= 1000 \cdot 289$
$= 289,000$

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

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

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

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

53. $6 \cdot 14 = 84$ in^2.

54. $22 \cdot 50 = 1100$ m^2.

55. $12 \cdot 12 = 144$ in^2.

56. $20 \cdot 20 = 400$ cm^2.

TRY IT YOURSELF

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

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

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

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

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

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

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

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

65. $53 \cdot 3 = 159$
$53 \cdot 30 = 1,590$

66. $2 \cdot 78 = 156$
$20 \cdot 78 = 1,560$

67.
$$\begin{array}{r} 754 \\ \times \quad 59 \\ \hline 6\,786 \\ +37\,700 \\ \hline 44,486 \end{array}$$

68.
$$\begin{array}{r} 846 \\ \times \quad 79 \\ \hline 7\,614 \\ +59\,220 \\ \hline 66,834 \end{array}$$

69.
$$\begin{array}{r} 2978 \\ \times 3004 \\ \hline 11\,912 \\ 00\,000 \\ 000\,000 \\ +8\,934\,000 \\ \hline 8,945,912 \end{array}$$

70.
$$\begin{array}{r} 2003 \\ \times 5003 \\ \hline 6\,009 \\ 00\,000 \\ 000\,000 \\ +10\,015\,000 \\ \hline 10,021,009 \end{array}$$

71.
$$\begin{array}{r} 916 \\ \times \quad 409 \\ \hline 8\,244 \\ 00\,000 \\ +366\,400 \\ \hline 374,644 \end{array}$$

72.
$$\begin{array}{r} 889 \\ \times \quad 507 \\ \hline 6\,223 \\ 00\,000 \\ +444\,500 \\ \hline 450,723 \end{array}$$

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

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

75. $48\cdot 5=240$
$4,800\cdot 500=2,400,000$

76. $64\cdot 7=448$
$6,400\cdot 700=4,480,000$

77.
$$\begin{array}{r} 2,779 \\ \times \quad 128 \\ \hline 22\,232 \\ 55\,580 \\ +277\,900 \\ \hline 355,712 \end{array}$$

78.
$$\begin{array}{r} 3,596 \\ \times \quad 136 \\ \hline 21\,576 \\ 107\,880 \\ +359\,600 \\ \hline 489,056 \end{array}$$

79.
$$\begin{array}{r} 370 \\ \times 450 \\ \hline 000 \\ 18\,500 \\ +148\,000 \\ \hline 166,500 \end{array}$$

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

LOOK ALIKES

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

82. a. 50 · 50 = 2,500
b. 50 · 500 = 25,000
c. 50 · 5,000 = 250,000

83. a. 98 · 36 = 3,528
b. 360 · 98 = 35,280

84. a. 41 · 13 = 533
b. 130 · 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 · 413 = $6,195

91. 12 · 5,280 = 63,360 in. in a mile

92. a. 16 · 14 = 224 mi.

b. 16 · 23 = 368 mi.

93. $250 \cdot 308 = 77,000$ words

94. $18 \cdot 450 = \$8,100$ per month

95. 36 · 174,000 = $6,264,000 per year

96. 42 · 19,389,000 = 814,338,000 gal/day

97. $8 \cdot 9 = 72$ entries

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

$96 + 96 + 96 + 96 = 384$ 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 · 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 · 18 = 54 ft^2.

108. 24 · 36 = 864 in^2.

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

Area: 360 · 270 = 97,200 mi^2.

110.

	Area	Perimeter
Square	16 · 16 = 256 ft^2.	4 · 16 = 64 ft.
Rectangle	14 · 17 = 238 ft^2.	2 · 14 + 2 · 17 = 62 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

Section 1.4: Dividing Whole Numbers

VOCABULARY

1. $\underset{\textit{dividend}}{12} \div \underset{\textit{divisor}}{4} = \underset{\textit{quotient}}{3}$

$$\textit{divisor} \rightarrow 4\overline{)12}\ \begin{matrix}3 \leftarrow \textit{quotient} \\ \leftarrow \textit{dividend}\end{matrix}$$

$$\frac{\textit{dividend} \rightarrow 12}{\textit{divisor} \rightarrow 4} = 3 \leftarrow \textit{quotient}$$

2. We call $5 \cdot 8 = 40$ the related multiplication statement for the division $40 \div 8 = 5$.

3. The problem $6\overline{)246}$ is written in long division form.

4. If a division is not exact, the leftover part is called the remainder.

5. One number is divisible by another number if, when we divide them, the remainder is 0.

6. Phrases such as *split equally* and *how many does each* indicate the operation of division.

CONCEPTS

7. a. 7 groups of 3

b. 5 groups of 4, 2 left over

8. a. true

b. true

c. false

d. false

9. a. $\frac{25}{25} = 1$ b. $\frac{6}{1} = 6$

c. $\frac{100}{0}$ is undefined d. $\frac{0}{12} = 0$

10. To perform long division, we follow a four-step process: estimate, multiply, subtract, bring-down.

11. a. $5\overline{)1147}^{\,2}$ b. $9\overline{)587}^{\,6}$

c. $23\overline{)7501}^{\,3}$ d. $16\overline{)892}^{\,5}$

12. a. $\text{Quotient} \cdot \text{divisor} = \text{dividend}$

b. $(\text{Quotient} \cdot \text{divisor}) + \text{remainder} = \text{dividend}$

13.
$$\begin{array}{r} 37 \\ \times\ \ 9 \\ \hline 333 \end{array}$$

14. a. 2

b. sum

c. two

15. a. 0 or 5

b. 2 and 3

c. sum

d. 10

16. We can simplify the division $43{,}800 \div 200$ by removing two zeros from the dividend and the divisor.

NOTATION

17. $\div$, $\overline{)}$, $-$

18. In a division, 35 R 4 means "a quotient of 35 and a remainder of 4".

GUIDED PRACTICE

19. $9\overline{)45}^{\,5}$ because $5 \cdot 9 = 45$.

20. $6\overline{)54}^{\,9}$ because $9 \cdot 6 = 54$.

21. $44 \div 11 = 4$ because $4 \cdot 11 = 44$.

22. $120 \div 12 = 10$ 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.
$$\begin{array}{r} 16 \\ 6\overline{)96} \\ -\underline{6} \\ 36 \\ -\underline{36} \\ 0 \end{array}$$
Check: $6(16) = 96$

28.
$$\begin{array}{r} 18 \\ 4\overline{)72} \\ -\underline{4} \\ 32 \\ -\underline{32} \\ 0 \end{array}$$
Check: $4(18) = 72$

29.
$$\begin{array}{r} 29 \\ 3\overline{)87} \\ -\underline{6} \\ 27 \\ -\underline{27} \\ 0 \end{array}$$
Check: $3(29) = 87$

30.
$$\begin{array}{r} 14 \\ 7\overline{)98} \\ -\underline{7} \\ 28 \\ -\underline{28} \\ 0 \end{array}$$
Check: $7(14) = 98$

31.
$$\begin{array}{r} 325 \\ 7\overline{)2275} \\ -\underline{21} \\ 17 \\ -\underline{14} \\ 35 \\ -\underline{35} \\ 0 \end{array}$$
Check: $7(325) = 2275$

32.
$$\begin{array}{r} 216 \\ 8\overline{)1728} \\ -\underline{16} \\ 12 \\ -\underline{8} \\ 48 \\ -\underline{48} \\ 0 \end{array}$$
Check: $8(216) = 1728$

33.
$$\begin{array}{r} 218 \\ 9\overline{)1962} \\ -\underline{18} \\ 16 \\ -\underline{9} \\ 72 \\ -\underline{72} \\ 0 \end{array}$$
Check: $9(218) = 1962$

34.
$$\begin{array}{r} 327 \\ 5\overline{)1635} \\ -\underline{15} \\ 13 \\ -\underline{10} \\ 35 \\ -\underline{35} \\ 0 \end{array}$$
Check: $5(327) = 1635$

35.
$$\begin{array}{r} 504 \\ 62\overline{)31248} \\ -310 \\ \hline 24 \\ -0 \\ \hline 248 \\ -248 \\ \hline 0 \end{array}$$
Check: $62(504) = 31,248$

36.
$$\begin{array}{r} 403 \\ 71\overline{)28613} \\ -284 \\ \hline 21 \\ -0 \\ \hline 213 \\ -213 \\ \hline 0 \end{array}$$
Check: $71(403) = 28,613$

37.
$$\begin{array}{r} 602 \\ 37\overline{)22274} \\ -222 \\ \hline 07 \\ -0 \\ \hline 74 \\ -74 \\ \hline 0 \end{array}$$
Check: $37(602) = 22,274$

38.
$$\begin{array}{r} 704 \\ 28\overline{)19712} \\ -196 \\ \hline 11 \\ -0 \\ \hline 112 \\ -112 \\ \hline 0 \end{array}$$
Check: $28(704) = 19,712$

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

Check : $39 \cdot 24 + 15 = 951$

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

Check : $28 \cdot 33 + 19 = 943$

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

Check : $21 \cdot 46 + 33 = 999$

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

Check : $19 \cdot 49 + 48 = 979$

43.
$$524\overline{)24714}\quad 47$$
$$-2096$$
$$3754$$
$$-3668$$
$$86$$
Check : $47 \cdot 524 + 86 = 24,714$

44.
$$531\overline{)29773}\quad 56$$
$$-2655$$
$$3223$$
$$-3186$$
$$37$$
Check : $56 \cdot 531 + 37 = 29,773$

45.
$$178\overline{)3514}\quad 19$$
$$-178$$
$$1734$$
$$-1602$$
$$132$$
Check : $19 \cdot 178 + 132 = 3,514$

46.
$$164\overline{)2929}\quad 17$$
$$-164$$
$$1289$$
$$-1148$$
$$141$$
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.
$$45\overline{)990}\quad 22$$
$$-90$$
$$90$$
$$-90$$
$$0$$

58. Begin by cancelling a zero from each.
$$26\overline{)910}\quad 35$$
$$-78$$
$$130$$
$$-130$$
$$0$$

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

LOOK ALIKES

87. a. 368,000 ÷ 10 = 36,800
b. 368,000 ÷ 100 = 3,680
c. 368,000 ÷ 1,000 = 368

88. a. 475,000 ÷ 1,000 = 475
b. 475,000 ÷ 100 = 4,750
c. 475,000 ÷ 10 = 47,500

89. a. 607 ÷ 12 = 50 R 7
b. 608 ÷ 12 = 50 R 8
c. 606 ÷ 12 = 50 R 6

90. a. 453 ÷ 23 = 19 R 16
b. 452 ÷ 23 = 19 R 15
c. 454 ÷ 23 = 19 R 17

APPLICATIONS

91. $2500 \div 4 = 625$ tickets

92. $371 \div 7 = 53$ days

93. $405 \div 15 = 27$ trips

94. $288 \div 36 = 8$ shelves

95. $50 \div 23 = 2R4$ Each student got 2 cartons, with 4 left over.

96. $200 \div 11 = 18R2$ They can wrap 18 lamps with 2 ft. left.

97. $640 \div 68 = 9R28$ It can be filled 9 times with 28 oz. left.

98. $896 \div 6 = 149R2$ 149 cups with 2 oz. remaining.

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

100. $10,282,800 \div 22 = \$467,400$ each

101. $25,200 \div 240 = \$105$ per book

102. $950,000 \div 20 = 47,500$ gallons each hour

103. $700 \div 140 = 5$ miles per gallon

104. 33,750,000 · 45 = 750,000 gallons

105. $156 \div 12 = 13$ They should order 13 dozen donuts.

106. $1,000 \div 10 = 100$ decades per millennium

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

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

$216 \div 9 = 24$ GOOD CHOICE

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

There are 24 teams with 9 girls each.

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

109. Divide each by 12: Health Sciences: $4,059; Business: $4,353; Social Sciences: $3,882

110. Divide column 2 by column 3: AZ: 60; OK: 57; RI: 1,058; SC: 165

WRITING

111. Find out how many times you must subtract 6 from 24 to get 0.

112. Because 0 of anything will be equal to 0, but no number of zeros can give a non-zero number.

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

Since 14 is divisible by 7, 308 is also.

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

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

LOOK ALIKES

115. a. 272 + 4 = 276
b. 272 – 4 = 268
c. 272 · 4 = 1,088
d. 272 ÷ 4 = 68

116. a. 430 + 55 = 485
b. 430 – 55 = 375
c. 430 · 55 = 23,650
d. 430 ÷ 55 = 7 R 45

117. a. 1,104 + 46 = 1,150
b. 1,104 – 46 = 1,058
c. 1,104 · 46 = 50,784
d. 1,104 ÷ 46 = 24

118. a. 3,024 + 378 = 3,402
b. 3,024 – 378 = 2,646
c. 3,024 · 378 = 1,143,072
d. 3,024 ÷ 378 = 8

Section 1.5: Prime Factors and Exponents

VOCABULARY

1. Numbers that are multiplied together are called factors.

2. To factor a whole number means to express it as the product of other whole numbers.

3. A prime number is a whole number greater than 1 that has only 1 and itself as factors.

4. Whole numbers greater than 1 that are not prime numbers are called composite numbers.

5. To prime factor a number means to write it as a product of only prime numbers.

6. An exponent is used to represent repeated multiplication. It tells how many times the base is used as a factor.

7. In the exponential expression 6^4, the number 6 is the base and 4 is the exponent.

8. 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. $1 \cdot 45 = 45 \quad 3 \cdot 15 = 45 \quad 5 \cdot 9 = 45$

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

10. $1 \cdot 28 = 28 \quad 2 \cdot 14 = 28 \quad 4 \cdot 7 = 28$

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.
$$\begin{array}{r|l} 2 & 150 \\ 3 & 75 \\ 5 & 25 \\ & 5 \end{array}$$

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

65. $99 = 9 \cdot 11$
$= 3 \cdot 3 \cdot 11$
$= 3^2 \cdot 11$

66. $400 = 16 \cdot 25$
$= 4 \cdot 4 \cdot 5 \cdot 5$
$= 2 \cdot 2 \cdot 2 \cdot 2 \cdot 5 \cdot 5$
$= 2^4 \cdot 5^2$

67. $162 = 2 \cdot 81$
$= 2 \cdot 9 \cdot 9$
$= 2 \cdot 3 \cdot 3 \cdot 3 \cdot 3$
$= 2 \cdot 3^4$

68. $98 = 2 \cdot 49$
$= 2 \cdot 7 \cdot 7$
$= 2 \cdot 7^2$

69. $64 = 8 \cdot 8$
$= 2 \cdot 4 \cdot 2 \cdot 4$
$= 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2$
$= 2^6$

70. $243 = 3 \cdot 81$
$= 3 \cdot 9 \cdot 9$
$= 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3$
$= 3^5$

71. $147 = 3 \cdot 49$
$= 3 \cdot 7 \cdot 7$
$= 3 \cdot 7^2$

72. $140 = 4 \cdot 35$
$= 2 \cdot 2 \cdot 5 \cdot 7$
$= 2^2 \cdot 5 \cdot 7$

73. $220 = 22 \cdot 10$
$= 2 \cdot 11 \cdot 2 \cdot 5$
$= 2^2 \cdot 5 \cdot 11$

74. $385 = 5 \cdot 77$
$= 5 \cdot 7 \cdot 11$

75. $102 = 2 \cdot 51$
$= 2 \cdot 3 \cdot 17$

76. $114 = 2 \cdot 57$
$= 2 \cdot 3 \cdot 19$

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

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

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

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

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

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

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

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

85. a. $3^4 = 3 \cdot 3 \cdot 3 \cdot 3$
$= 81$

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

86. a. $5^3 = 5 \cdot 5 \cdot 5$
$= 125$

b. $3^5 = 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3$
$= 243$

87. a. $2^5 = 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2$
$= 32$

b. $5^2 = 5 \cdot 5$
$= 25$

88. a. $4^5 = 4 \cdot 4 \cdot 4 \cdot 4 \cdot 4$
$= 1,024$

b. $5^4 = 5 \cdot 5 \cdot 5 \cdot 5$
$= 625$

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 · 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. $\text{LCM} = 2 \cdot 2 \cdot 3 \cdot 3 \cdot 5$
$= 180$

10. a. 2 appears twice with 140.

b. 5 appears once with 140 and with 70.

c. 7 appears once in all 3.

d. $\text{LCM} = 2 \cdot 2 \cdot 5 \cdot 7$
$= 140$

11. a. 2 appears twice with 12.

b. 3 appears three times with 54.

c. $\text{LCM} = 2^2 \cdot 3^3$
$= 108$

12. a. 1, 3, and 9 are common to both.

b. GCF = 9

13. a. 2, 3, and 5 are common to both.

b. $\text{GCF} = 2 \cdot 3 \cdot 5$
$= 30$

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.
$$\begin{aligned} 16 &= 2^4 \\ 20 &= 2^2 \cdot 5 \\ LCM &= 2^4 \cdot 5 \\ &= 16 \cdot 5 \\ &= 80 \end{aligned}$$

38.
$$\begin{aligned} 14 &= 2 \cdot 7 \\ 21 &= 3 \cdot 7 \\ LCM &= 2 \cdot 3 \cdot 7 \\ &= 42 \end{aligned}$$

39.
$$\begin{aligned} 30 &= 2 \cdot 3 \cdot 5 \\ 50 &= 2 \cdot 5^2 \\ LCM &= 2 \cdot 3 \cdot 5^2 \\ &= 6 \cdot 25 \\ &= 150 \end{aligned}$$

40.
$$\begin{aligned} 21 &= 3 \cdot 7 \\ 27 &= 3^3 \\ LCM &= 3^3 \cdot 7 \\ &= 27 \cdot 7 \\ &= 189 \end{aligned}$$

41.
$$35 = 5 \cdot 7$$
$$45 = 3^2 \cdot 5$$
$$LCM = 3^2 \cdot 5 \cdot 7$$
$$= 9 \cdot 35$$
$$= 315$$

42.
$$36 = 2^2 \cdot 3^2$$
$$48 = 2^4 \cdot 3$$
$$LCM = 2^4 \cdot 3^2$$
$$= 16 \cdot 9$$
$$= 144$$

43.
$$100 = 2^2 \cdot 5^2$$
$$120 = 2^3 \cdot 3 \cdot 5$$
$$LCM = 2^3 \cdot 3 \cdot 5^2$$
$$= 600$$

44.
$$120 = 2^3 \cdot 3 \cdot 5$$
$$180 = 2^2 \cdot 3^2 \cdot 5$$
$$LCM = 2^3 \cdot 3^2 \cdot 5$$
$$= 360$$

45.
$$6 = 2 \cdot 3$$
$$24 = 2^3 \cdot 3$$
$$36 = 2^2 \cdot 3^2$$
$$LCM = 2^3 \cdot 3^2$$
$$= 72$$

46.
$$6 = 2 \cdot 3$$
$$10 = 2 \cdot 5$$
$$18 = 2 \cdot 3^2$$
$$LCM = 2 \cdot 3^2 \cdot 5$$
$$= 90$$

47.
$$5 = 5$$
$$12 = 2^2 \cdot 3$$
$$15 = 3 \cdot 5$$
$$LCM = 2^2 \cdot 3 \cdot 5$$
$$= 60$$

48.
$$8 = 2^3$$
$$12 = 2^2 \cdot 3$$
$$16 = 2^4$$
$$LCM = 2^4 \cdot 3$$
$$= 48$$

49.
$$4 = \underline{2} \cdot 2$$
$$6 = \underline{2} \cdot 3$$
$$GCF = 2$$

50.
$$6 = 2 \cdot \underline{3}$$
$$15 = \underline{3} \cdot 5$$
$$GCF = 3$$

51.
$$9 = 3 \cdot \underline{3}$$
$$12 = 2 \cdot 2 \cdot \underline{3}$$
$$GCF = 3$$

52.
$$10 = \underline{2} \cdot 5$$
$$12 = \underline{2} \cdot 2 \cdot 3$$
$$GCF = 2$$

53.
$$22 = 2 \cdot \underline{11}$$
$$33 = 3 \cdot \underline{11}$$
$$GCF = 11$$

54.
$$14 = 2 \cdot \underline{7}$$
$$21 = 3 \cdot \underline{7}$$
$$GCF = 7$$

55.
$$15 = \underline{3} \cdot \underline{5}$$
$$30 = 2 \cdot \underline{3} \cdot \underline{5}$$
$$GCF = 3 \cdot 5$$
$$= 15$$

56.
$$15 = \underline{3} \cdot \underline{5}$$
$$75 = \underline{3} \cdot \underline{5} \cdot 5$$
$$GCF = 3 \cdot 5$$
$$= 15$$

57.
$$18 = \underline{2} \cdot \underline{3} \cdot 3$$
$$96 = \underline{2} \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot \underline{3}$$
$$GCF = 2 \cdot 3$$
$$= 6$$

58.
$$30 = \underline{2} \cdot \underline{3} \cdot 5$$
$$48 = \underline{2} \cdot 2 \cdot 2 \cdot 2 \cdot \underline{3}$$
$$GCF = 2 \cdot 3$$
$$= 6$$

59.
$$28 = \underline{2} \cdot 2 \cdot \underline{7}$$
$$42 = \underline{2} \cdot 3 \cdot \underline{7}$$
$$GCF = 2 \cdot 7$$
$$= 14$$

60.
$$63 = 3 \cdot \underline{3} \cdot \underline{7}$$
$$84 = 2 \cdot 2 \cdot \underline{3} \cdot \underline{7}$$
$$GCF = 3 \cdot 7$$
$$= 21$$

61.
$$16 = 2 \cdot 2 \cdot 2 \cdot 2$$
$$51 = 3 \cdot 17$$
$$GCF = 1$$

62.
$$27 = 3 \cdot 3 \cdot 3$$
$$64 = 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2$$
$$GCF = 1$$

63.
$$81 = 3 \cdot 3 \cdot 3 \cdot 3$$
$$125 = 5 \cdot 5 \cdot 5$$
$$GCF = 1$$

64.
$$57 = 3 \cdot 19$$
$$125 = 5 \cdot 5 \cdot 5$$
$$GCF = 1$$

65.
$$12 = 2 \cdot 2 \cdot 3$$
$$68 = 2 \cdot 2 \cdot 17$$
$$92 = 2 \cdot 2 \cdot 23$$
$$GCF = 2 \cdot 2$$
$$= 4$$

66.
$$24 = 2 \cdot 2 \cdot 2 \cdot 3$$
$$36 = 2 \cdot 2 \cdot 3 \cdot 3$$
$$40 = 2 \cdot 2 \cdot 2 \cdot 5$$
$$GCF = 2 \cdot 2$$
$$= 4$$

67.
$$72 = 2 \cdot 2 \cdot 2 \cdot 3 \cdot 3$$
$$108 = 2 \cdot 2 \cdot 3 \cdot 3 \cdot 3$$
$$144 = 2 \cdot 2 \cdot 2 \cdot 2 \cdot 3 \cdot 3$$
$$GCF = 2 \cdot 2 \cdot 3 \cdot 3$$
$$= 36$$

68.
$$81 = 3 \cdot 3 \cdot 3 \cdot 3$$
$$108 = 2 \cdot 2 \cdot 3 \cdot 3 \cdot 3$$
$$162 = 2 \cdot 3 \cdot 3 \cdot 3 \cdot 3$$
$$GCF = 3 \cdot 3 \cdot 3$$
$$= 27$$

TRY IT YOURSELF

69.
$$100 = 2 \cdot 2 \cdot 5 \cdot 5$$
$$120 = 2 \cdot 2 \cdot 2 \cdot 3 \cdot 5$$
$$LCM = 2 \cdot 2 \cdot 2 \cdot 3 \cdot 5 \cdot 5$$
$$= 600$$
$$GCF = 2 \cdot 2 \cdot 5$$
$$= 20$$

70.
$$120 = 2 \cdot 2 \cdot 2 \cdot 3 \cdot 5$$
$$180 = 2 \cdot 2 \cdot 3 \cdot 3 \cdot 5$$
$$LCM = 2 \cdot 2 \cdot 2 \cdot 3 \cdot 3 \cdot 5$$
$$= 360$$
$$GCF = 2 \cdot 2 \cdot 3 \cdot 5$$
$$= 60$$

71.
$$14 = 2 \cdot 7$$
$$140 = 2 \cdot 2 \cdot 5 \cdot 7$$
$$LCM = 2 \cdot 2 \cdot 5 \cdot 7$$
$$= 140$$
$$GCF = 2 \cdot 7$$
$$= 14$$

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

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

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

75.
$$\begin{aligned} 8 &= 2\cdot 2\cdot 2 \\ 9 &= 3\cdot 3 \\ 49 &= 7\cdot 7 \\ LCM &= 2\cdot 2\cdot 2\cdot 3\cdot 3\cdot 7\cdot 7 \\ &= 3{,}538 \\ GCF &= 1 \end{aligned}$$

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

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

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

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

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

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

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

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

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.

1st	**2nd**	**3rd**
7,500 mi.	15,000 mi.	22,500 mi.
4th	**5th**	**6th**
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. $\text{LCM}(23, 28, 33) = 23 \cdot 28 \cdot 33$

$= 21,252$ 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 $9+6\left[8+6(4-1)\right]$, 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. $2\left[12-(5+4)\right]$

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.
$$\begin{aligned}7\cdot 4-5(2)^2 &= 7\cdot 4-5(4)\\ &= 28-20\\ &= 8\end{aligned}$$

16.
$$\begin{aligned}2+(5+6\cdot 2) &= 2+(5+12)\\ &= 2+17\\ &= 19\end{aligned}$$

17.
$$\begin{aligned}\left[4(2+7)\right]-4^2 &= \left[4(9)\right]-4^2\\ &= 36-4^2\\ &= 36-16\\ &= 20\end{aligned}$$

18.
$$\begin{aligned}\frac{12+5\cdot 3}{3^2-2\cdot 3} &= \frac{12+15}{9-6}\\ &= \frac{27}{3}\\ &= 9\end{aligned}$$

GUIDED PRACTICE

19.
$$\begin{aligned}3\cdot 5^2-28 &= 3\cdot 25-28\\ &= 75-28\\ &= 47\end{aligned}$$

20.
$$\begin{aligned}4\cdot 2^2-11 &= 4\cdot 4-11\\ &= 16-11\\ &= 5\end{aligned}$$

21.
$$\begin{aligned}6\cdot 3^2-41 &= 6\cdot 9-41\\ &= 54-41\\ &= 13\end{aligned}$$

22.
$$\begin{aligned}5\cdot 4^2-32 &= 5\cdot 16-32\\ &= 80-32\\ &= 48\end{aligned}$$

23.
$$\begin{aligned}52-6\cdot 3+4 &= 52-18+4\\ &= 34+4\\ &= 38\end{aligned}$$

24.
$$\begin{aligned}66-8\cdot 7+16 &= 66-56+16\\ &= 10+16\\ &= 26\end{aligned}$$

25.
$$\begin{aligned}32-9\cdot 3+31 &= 32-27+31\\ &= 5+31\\ &= 36\end{aligned}$$

26. $62-5\cdot 8+27=62-40+27$
$=22+27$
$=49$

27. $192\div 4-4(2)3=48-24$
$=24$

28. $455\div 7-3(4)5=65-60$
$=5$

29. $252\div 3-6(2)6=84-72$
$=12$

30. $264\div 4-7(4)2=66-56$
$=10$

31. a. $26-2+9=24+9$
$=33$

b. $26-(2+9)=26-11$
$=15$

32. a. $37-4+11=33+11$
$=44$

b. $37-(4+11)=37-15$
$=22$

33. a. $51-16+8=35+8$
$=43$

b. $51-(16+8)=51-24$
$=27$

34. a. $73-35+9=38+9$
$=47$

b. $73-(35+9)=73-44$
$=29$

35. $(4+6)^2=10^2$
$=100$

36. $(3+4)^2=7^2$
$=49$

37. $(3+5)^3=8^3$
$=512$

38. $(5+2)^3=7^3$
$=343$

39. $8+4(29-5\cdot 3)=8+4(29-15)$
$=8+4(14)$
$=8+56$
$=64$

40. $33+6(56-9\cdot 6)=33+6(56-54)$
$=33+6(2)$
$=33+12$
$=45$

41. $77+9(38-4\cdot 6)=77+9(38-24)$
$=77+9(14)$
$=77+126$
$=203$

42. $162+7(47-6\cdot 7)=162+7(47-42)$
$=162+7(5)$
$=162+35$
$=197$

43. $46+3\left[5^2-4(9-5)\right]=46+3\left[25-4(4)\right]$
$=46+3[25-16]$
$=46+3[9]$
$=46+27$
$=73$

44. $53+5\left[6^2-5(8-1)\right]=53+5\left[36-5(7)\right]$
$=53+5[36-35]$
$=53+5[1]$
$=58$

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

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

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

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

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

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

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

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

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

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

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

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

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

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

TRY IT YOURSELF

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

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

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

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

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

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

65. $(7-4)^2+1=3^2+1$
$=9+1$
$=10$

66. $(9-5)^3+8=4^3+8$
$=64+8$
$=72$

67. $\dfrac{10+5}{52-47}=\dfrac{15}{5}$
$=3$

68. $\dfrac{18+12}{61-55}=\dfrac{30}{6}$
$=5$

69. $5\cdot10^3+2\cdot10^2+3\cdot10^1+9$
$=5\cdot1000+2\cdot100+3\cdot10+9$
$=5,000+200+30+9$
$=5,239$

70. $8\cdot10^3+0\cdot10^2+7\cdot10^1+4$
$=8\cdot1000+7\cdot10+4$
$=8,000+70+4$
$=8,074$

71. $20-10+5=10+5$
$=15$

72. $80-5+4=75+4$
$=79$

73. $25\div5\cdot5=5\cdot5$
$=25$

74. $6\div2\cdot3=3\cdot3$
$=9$

75. $150-2(2\cdot6-4)^2=150-2(12-4)^2$
$=150-2\cdot8^2$
$=150-2\cdot64$
$=150-128$
$=22$

76. $760-2(2\cdot3-4)^2=760-2(6-4)^2$
$=760-2\cdot2^2$
$=760-2\cdot4$
$=760-8$
$=752$

77. $190-2\left[10^2-\left(5+2^2\right)\right]+45$
$=190-2\left[100-(5+4)\right]+45$
$=190-2[100-9]+45$
$=190-2[91]+45$
$=190-182+45$
$=53$

78. $161-8\left[6(6)-6^2\right]+2^2(5)$
$=161-8[36-36]+4(5)$
$=161-8[0]+20$
$=181$

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

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

81. $\dfrac{(5-3)^2+2}{4^2-(8+2)}=\dfrac{2^2+2}{4^2-10}$
$=\dfrac{4+2}{16-10}$
$=\dfrac{6}{6}$
$=1$

82. $\dfrac{\left(4^3-2\right)+7}{5(2+4)-7}=\dfrac{(64-2)+7}{5(6)-7}$
$=\dfrac{62+7}{30-7}$
$=\dfrac{69}{23}$
$=3$

83. $4^2+3^2=16+9$
$=25$

84. $12^2+5^2=144+25$
$=169$

85. $3+2\cdot 3^4\cdot 5=3+2\cdot 81\cdot 5$
$=3+810$
$=813$

86. $3\cdot 2^3\cdot 4-12=3\cdot 8\cdot 4-12$
$=96-12$
$=84$

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

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

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

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

91. $(18-12)^3-5^2=6^3-5^2$
$=216-25$
$=191$

92. $(9-2)^2-3^3=7^2-3^3$
$=49-27$
$=22$

93. $30(1)^2-4(2)+12=30-8+12$
$=34$

94. $5(1)^3+(1)^2+2(1)-6=5+1+2-6$
$=2$

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

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

97. $\frac{3^2-2^2}{(3-3)^2}=\frac{9-4}{0^2}$
$=\frac{5}{0}$: undefined

98. $\frac{5^2+17}{4-2^2}=\frac{25+17}{4-4}$
$=\frac{42}{0}$: undefined

99. $3\left(\frac{18}{3}\right)-2(2)=18-4$
$=14$

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

101. $4\left[50-\left(3^3-5^2\right)\right]=4\left[50-(27-25)\right]$
$=4[50-2]$
$=4[48]$
$=192$

102. $6\left[15+\left(5\cdot 2^2\right)\right]=6\left[15+\left(5\cdot 4\right)\right]$
$=6[15+20]$
$=6[35]$
$=210$

103. $80-2\left[12-\left(5+4\right)\right]=80-2[12-9]$
$=80-2[3]$
$=80-6$
$=74$

104. $15+5\left[12-\left(2^2+4\right)\right]=15+5\left[12-\left(4+4\right)\right]$
$=15+5[12-8]$
$=15+5[4]$
$=15+20=35$

LOOK ALIKES

105. a. $50 \div 5 \div 5 = 10 \div 5$
$= 2$
b. $50 \div (5 \div 5) = 50 \div 1$
$= 50$
c. $50 \div 5 \cdot 5 = 10 \cdot 5$
$= 50$
d. $50 \div (5 \cdot 5) = 50 \div 25$
$= 2$

106. a. $25 - 5^2 = 25 - 25$
$= 0$
b. $(25 - 5)^2 = 20^2$
$= 400$

107. a. $(4 - 2^2)/(50 - 32) = (4 - 4)/18 = 0/18$
$= 0$
b. $(50 - 32)/(4 - 2^2) = 18/(4 - 4)$
$= 18/0$
$=$ Undefined

108. a. $100 - 53 + 18 = 47 + 18$
$= 65$
b. $100 - (53 + 18) = 100 - 71$
$= 29$
c. $(100 - 53) + 18 = 47 + 18$
$= 65$

APPLICATIONS

109. $3\cdot 7+4\cdot 4+2\cdot 3=21+16+6$
$=\$43$

110. $24\cdot 1+6\cdot 5+10\cdot 10$
$+12\cdot 20+2\cdot 50+1\cdot 100=\$594$

111. $3\left(8+7+8+8+7\right)=3\left(38\right)$
$=114$

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

113. brick: $3\cdot 3+1+1+3+3\cdot 5=29$

aphid: $3\left[1+2\left(3\right)+4+1+2\right]=42$

114. $1776+4\cdot 20+7=1776+80+7$
$=1863$

115. $2^2+3^2+5^2+7^2=4+9+25+49$
$=87$

116. $27\cdot 19-125=513-125$
$=388\text{ ft}^2.$

117. $\dfrac{75+80+83+80+77+72+86}{7}$
$=\dfrac{553}{7}$
$=79°$

118. $\dfrac{94+85+81+77+89+0}{6}$
$=\dfrac{426}{6}$
$=71$

119. $\dfrac{39+40+\cdots+42}{12}=\dfrac{372}{12}$
$=31\text{therms}$

120. $\dfrac{1+2+\cdots+9}{9}=\dfrac{45}{9}$
$=5$

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

122. (19,368,000 + … + 40,044,000)/7

= 22,847,000 viewers per game

123. a. $1+4+35+85=125$

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

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

124. a. $4+1+5+1+4=15$

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: $a-20=50$

$$70-20\overset{?}{=}50$$

$$50=50$$

The solution checks.

28. $z-31=60$

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

$$z=91$$

Check: $z-31=60$

$$91-31\overset{?}{=}60$$

$$60=60$$

The solution checks.

29. $1=b-2$

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

$$3=b$$

Check: $1=b-2$

$$1\overset{?}{=}3-2$$

$$1=1$$

The solution checks.

30. $0=t-1$

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

$$1=t$$

Check: $0=t-1$

$$0\overset{?}{=}1-1$$

$$0=0$$

The solution checks.

31. $19=n-42$

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

$$61=n$$

Check: $19=n-42$

$$19\overset{?}{=}61-42$$

$$19=19$$

The solution checks.

32. $17=m-16$

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

$$33=m$$

Check: $17=m-16$

$$17\overset{?}{=}33-16$$

$$17=17$$

The solution checks.

33. $x+9=12$

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

$$x=3$$

Check: $x+9=12$

$$3+9\overset{?}{=}12$$

$$12=12$$

The solution checks.

34. $x+3=9$

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

$$x=6$$

Check: $x+3=9$

$$6+3\overset{?}{=}9$$

$$9=9$$

The solution checks.

35. $y+7=12$

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

$$y=5$$

Check: $y+7=12$

$$5+7\overset{?}{=}12$$

$$12=12$$

The solution checks.

36. $c+11=22$

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

$$c=11$$

Check: $c+11=22$

$$11+11\overset{?}{=}22$$

$$22=22$$

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.

$$\begin{array}{r} 1,275 \\ +\ 425 \\ \hline 1,700 \end{array}$$

Check

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

$$x - 1,500 = 750$$
$$x - 1,500 + 750 = 1,500 + 750$$
$$x = 2,250$$

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

$$\begin{array}{r} 2,250 \\ -\ 1,500 \\ \hline 750 \end{array}$$

Check

The result checks.

TRY IT YOURSELF

39. $s + 55 = 100$
$$s + 55 - 55 = 100 - 55$$
$$x = 45$$
Check: $s + 55 = 100$
$$45 + 55 \stackrel{?}{=} 100$$
$$100 = 100$$
The solution checks.

40. $n + 37 = 200$
$$n + 37 - 37 = 200 - 37$$
$$n = 163$$
Check: $n + 37 = 200$
$$163 + 37 \stackrel{?}{=} 200$$
$$200 = 200$$
The solution checks.

41. $x - 4 = 0$
$$x - 4 + 4 = 0 + 4$$
$$x = 4$$
Check: $x - 4 = 0$
$$4 - 4 \stackrel{?}{=} 0$$
$$0 = 0$$
The solution checks.

42. $c - 3 = 0$
$$c - 3 + 3 = 0 + 3$$
$$c = 3$$

Check: $c-3=0$

$3-3\stackrel{?}{=}0$

$0=0$

The solution checks.

43. $y-7=6$

$y-7+7=6+7$

$y=13$

Check: $y-7=6$

$13-7\stackrel{?}{=}6$

$6=6$

The solution checks.

44. $a-2=4$

$a-2+2=4+2$

$a=6$

Check: $a-2=4$

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

$4=4$

The solution checks.

45. $70=x-5$

$70+5=x-5+5$

$75=x$

Check: $70=x-5$

$70\stackrel{?}{=}75-5$

$75=75$

The solution checks.

46. $66=b-6$

$66+6=b-6+6$

$72=b$

Check: $66=b-6$

$66\stackrel{?}{=}72-66$

$66=66$

The solution checks.

47. $312=x-428$

$312+428=x-428+428$

$740=x$

Check: $312=x-428$

$312\stackrel{?}{=}740-428$

$312=312$

The solution checks.

48. $113=x-307$

$113+307=x-307+307$

$420=x$

Check: $113=x-307$

$113\stackrel{?}{=}420-307$

$113=113$

The solution checks.

49. $x-117=222$

$x-117+117=222+117$

$x=339$

Check: $x-117=222$

$339-117\stackrel{?}{=}222$

$222=222$

The solution checks.

50. $y-27=317$

$y-27+27=317+27$

$y=344$

Check: $y-27=317$

$344-27\stackrel{?}{=}317$

$317=317$

The solution checks.

51. $t+19=28$

$t+19-19=28-19$

$t=9$

Check: $t+19=28$

$9+19\stackrel{?}{=}28$

$28=28$

The solution checks.

52. $s+45=84$

$s+45-45=84-45$

$s=39$

Check: $s+45=84$

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

The solution checks.

53. $23+x=33$

$23+x-23=33-23$

$x=10$

Check $23+x=33$

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

The solution checks.

54. $34+y=34$

$34+y-34=34-34$

$y=0$

Check: $34+y=34$

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

The solution checks.

55. $5=4+c$

$5-4=4+c-4$

$1=c$

Check: $5=4+c$

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

The solution checks.

56. $41=23+x$

$41-23=23+x-23$

$18=x$

Check: $41=23+x$

$$41\overset{?}{=}23+18$$
$$43=43$$

The solution checks.

57. $99=r+43$

$99-43=r+43-43$

$56=r$

Check: $99=r+43$

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

The solution checks.

58. $92=r+37$

$92-37=r+37-37$

$55=r$

Check: $92=r+37$

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

The solution checks.

59. $512=428+x$

$512-428=428+x-428$

$84=x$

Check: $512=428+x$

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

The solution checks.

60. $513=307+x$

$513-307=307+x-307$

$206=x$

Check: $513=307+x$

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

The solution checks.

61. $x+117=222$

$x+117-117=222-117$

$x=105$

Check: $x+117=222$

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

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. $8 - 2\left(2^2 - 1\right) + 1^3 = 8 - 2(4 - 1) + 1$
$= 8 - 2(3) + 1$
$= 8 - 6 + 1$
$= 2 + 1$
$= 3$

100. one thousand fifty – five

Section 1.9: Solving Equations Using Multiplication and Division

VOCABULARY

1. To solve an equation means to find all values of the variable that make the equation true.

2. A number that makes an equation true when substituted for the variable is called a solution of the equation.

3. To solve an equation, we isolate the variable on one side of the equal symbol.

4. In this section, we used the multiplication and division properties of equality to solve the equations.

CONCEPTS

5. a. The multiplication property of equality: Multiplying both sides of an equation by the same nonzero number does not change its solution.

b. If $a = b$, then $ca = cb$. (provided c is not 0)

6. a. The division property of equality: Dividing both sides of an equation by the same nonzero number does not change its solution.

b. If $a = b$, then $\frac{a}{c} = \frac{b}{c}$. (provided c is not 0)

7. a. If we multiply x by 6 and then divide that product by 6, the result is x.

b. If we divide x by 8 and then multiply that quotient by 8, the result is x.

8. 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.
$$\frac{x}{5}=9$$
$$5\cdot\frac{x}{5}=5\cdot 9$$
$$x=45$$
Check: $\frac{x}{5}=9$
$$\frac{45}{5}\stackrel{?}{=}9$$
$$9=9 \quad \text{True}$$
45 is the solution.

12.
$$3x=12$$
$$\frac{3x}{3}=\frac{12}{3}$$
$$x=4$$
Check: $3x=12$
$$3\cdot 4\stackrel{?}{=}12$$
$$12=12 \quad \text{True}$$
4 is the solution.

GUIDED PRACTICE

13.
$$\frac{x}{7}=2$$
$$7\cdot\frac{x}{7}=7\cdot 2$$
$$x=14$$
Check: $\frac{x}{7}=2$
$$\frac{14}{7}\stackrel{?}{=}2$$
$$2=2$$
The solution checks.

14.
$$\frac{x}{12}=4$$
$$12\cdot\frac{x}{12}=12\cdot 4$$
$$x=48$$
Check: $\frac{x}{12}=4$
$$\frac{48}{12}\stackrel{?}{=}4$$
$$4=4$$
The solution checks.

15.
$$\frac{y}{14}=3$$
$$14\cdot\frac{y}{14}=14\cdot 3$$
$$y=42$$
Check: $\frac{y}{14}=3$
$$\frac{42}{14}\stackrel{?}{=}3$$
$$3=3$$
The solution checks.

16.
$$\frac{y}{13}=5$$
$$13\cdot\frac{y}{13}=13\cdot 5$$
$$y=65$$
Check: $\frac{y}{13}=5$
$$\frac{65}{13}\stackrel{?}{=}5$$
$$5=5$$
The solution checks.

17.
$$16 = \frac{x}{24}$$
$$24 \cdot 16 = 24 \cdot \frac{x}{24}$$
$$384 = x$$
Check: $16 = \frac{x}{24}$
$$16 \stackrel{?}{=} \frac{384}{24}$$
$$16 = 16$$
The solution checks.

18.
$$22 = \frac{x}{18}$$
$$18 \cdot 22 = 18 \cdot \frac{x}{18}$$
$$396 = x$$
Check: $22 = \frac{x}{18}$
$$22 \stackrel{?}{=} \frac{396}{18}$$
$$22 = 22$$
The solution checks.

19.
$$31 = \frac{t}{11}$$
$$11 \cdot 31 = 11 \cdot \frac{t}{11}$$
$$341 = t$$
Check: $31 = \frac{x}{11}$
$$31 \stackrel{?}{=} \frac{341}{11}$$
$$31 = 31$$
The solution checks.

20.
$$33 = \frac{m}{19}$$
$$19 \cdot 33 = 19 \cdot \frac{m}{19}$$
$$627 = m$$
Check: $33 = \frac{m}{19}$
$$33 \stackrel{?}{=} \frac{627}{19}$$
$$33 = 33$$
The solution checks.

21.
$$3x = 3$$
$$\frac{3x}{3} = \frac{3}{3}$$
$$x = 1$$
Check: $3x = 3$
$$3 \cdot 1 \stackrel{?}{=} 3$$
$$3 = 3$$
The solution checks.

22.
$$5x = 5$$
$$\frac{5x}{5} = \frac{5}{5}$$
$$x = 1$$
Check: $5x = 5$
$$5 \cdot 1 \stackrel{?}{=} 5$$
$$5 = 5$$
The solution checks.

23.
$$9z = 90$$
$$\frac{9z}{9} = \frac{90}{9}$$
$$z = 10$$
Check: $9z = 90$
$$9 \cdot 10 \stackrel{?}{=} 90$$
$$90 = 90$$
The solution checks.

24.
$$3z = 60$$
$$\frac{3z}{3} = \frac{60}{3}$$
$$z = 20$$
Check: $3z = 60$
$$3 \cdot 20 \stackrel{?}{=} 60$$
$$60 = 60$$
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.

$x \quad \div \quad 3 \quad = \quad 311{,}000$

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.

$2 \quad \cdot \quad x \quad = \quad 748$

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. $100 = 100x$

$$\frac{100}{100} = \frac{100x}{100}$$

$$1 = x$$

Check: $100 = 100x$

$$100 \stackrel{?}{=} 100 \cdot 1$$

$$100 = 100$$

The solution checks.

28. $35 = 35y$

$$\frac{35}{35} = \frac{35y}{35}$$

$$1 = y$$

Check: $35 = 35y$

$$35 \stackrel{?}{=} 35 \cdot 1$$

$$35 = 35$$

The solution checks.

29. $$\frac{a}{15} = 5$$

$$15 \cdot \frac{a}{15} = 15 \cdot 5$$

$$a = 75$$

Check: $\frac{a}{15} = 5$

$$\frac{75}{15} \stackrel{?}{=} 5$$

$$5 = 5$$

The solution checks.

30.
$$\frac{b}{25}=5$$
$$25\cdot\frac{b}{25}=25\cdot 5$$
$$b=125$$
Check: $\frac{b}{25}=5$
$$\frac{125}{25}\stackrel{?}{=}5$$
$$5=5$$
The solution checks.

31.
$$16=8r$$
$$\frac{16}{8}=\frac{8r}{8}$$
$$2=r$$
Check: $16=8r$
$$16\stackrel{?}{=}8\cdot 2$$
$$16=16$$
The solution checks.

32.
$$44=11m$$
$$\frac{44}{11}=\frac{11m}{11}$$
$$4=m$$
Check: $44=11m$
$$44\stackrel{?}{=}11\cdot 4$$
$$44=44$$
The solution checks.

33.
$$21s=210$$
$$\frac{21s}{21}=\frac{210}{21}$$
$$s=10$$
Check: $21s=210$
$$21\cdot 10\stackrel{?}{=}210$$
$$210=210$$
The solution checks.

34.
$$155=31x$$
$$\frac{155}{31}=\frac{31x}{31}$$
$$5=x$$
Check: $155=31x$
$$155\stackrel{?}{=}31\cdot 5$$
$$155=155$$
The solution checks.

35.
$$\frac{c}{1,000}=3$$
$$1,000\cdot\frac{c}{1,000}=1,000\cdot 3$$
$$c=3,000$$
Check: $\frac{c}{1,000}=3$
$$\frac{3,000}{1,000}\stackrel{?}{=}3$$
$$3=3$$
The solution checks.

36.
$$\frac{d}{100}=11$$
$$100\cdot\frac{d}{100}=100\cdot 11$$
$$d=1,100$$
Check: $\frac{d}{100}=11$
$$\frac{1,100}{100}\stackrel{?}{=}11$$
$$11=11$$
The solution checks.

37.
$$1=\frac{x}{50}$$
$$50\cdot 1=50\cdot\frac{x}{50}$$
$$50=x$$

Check: $1 = \frac{x}{50}$

$1 \stackrel{?}{=} \frac{50}{50}$

$1 = 1$

The solution checks.

38. $1 = \frac{x}{25}$

$25 \cdot 1 = 25 \cdot \frac{x}{25}$

$25 = x$

Check: $1 = \frac{x}{25}$

$1 \stackrel{?}{=} \frac{25}{25}$

$1 = 1$

The solution checks.

39. $7 = \frac{t}{7}$

$7 \cdot 7 = 7 \cdot \frac{t}{7}$

$49 = t$

Check: $7 = \frac{t}{7}$

$7 \stackrel{?}{=} \frac{49}{7}$

$7 = 7$

The solution checks.

40. $4 = \frac{m}{4}$

$4 \cdot 4 = 4 \cdot \frac{m}{4}$

$16 = m$

Check: $4 = \frac{m}{4}$

$4 \stackrel{?}{=} \frac{16}{4}$

$4 = 4$

The solution checks.

41. $7x = 21$

$\frac{7x}{7} = \frac{21}{7}$

$x = 3$

Check: $7x = 21$

$7 \cdot 3 \stackrel{?}{=} 21$

$21 = 21$

The solution checks.

42. $13x = 52$

$\frac{13x}{13} = \frac{52}{13}$

$x = 4$

Check: $13x = 52$

$13 \cdot x \stackrel{?}{=} 52$

$52 = 52$

The solution checks.

43. $172 = 43t$

$\frac{172}{43} = \frac{43t}{43}$

$4 = t$

Check: $172 = 43t$

$172 \stackrel{?}{=} 43 \cdot 4$

$172 = 172$

The solution checks.

44. $288 = 96t$

$\frac{288}{96} = \frac{96t}{96}$

$3 = t$

Check: $288 = 96t$

$288 \stackrel{?}{=} 96 \cdot 3$

$288 = 288$

The solution checks.

45. $\frac{d}{20} = 201$

$20 \cdot \frac{d}{20} = 20 \cdot 201$

$d = 4,020$

Check: $\frac{d}{20}=201$

$\frac{4,020}{20}\stackrel{?}{=}201$

$201=201$

The solution checks.

46. $\frac{x}{60}=106$

$60\cdot\frac{x}{60}=60\cdot106$

$x=6,360$

Check: $\frac{x}{60}=106$

$\frac{6,360}{60}\stackrel{?}{=}106$

$106=106$

The solution checks.

47. $417=\frac{t}{3}$

$3\cdot417=3\cdot\frac{t}{3}$

$1,251=t$

Check:

$417=\frac{t}{3}$

$417=\frac{1,251}{3}$

$417=417$

The solution checks.

48. $259=\frac{y}{7}$

$7\cdot259=7\cdot\frac{y}{7}$

$1,813=y$

Check:

$259=\frac{y}{7}$

$259\stackrel{?}{=}\frac{1,813}{7}$

$259=259$

The solution checks.

49. $170y=5,100$

$\frac{170y}{170}=\frac{5,100}{170}$

$y=30$

Check:

$170y=5,100$

$170\cdot30\stackrel{?}{=}5,100$

$5,100=5,100$

The solution checks.

50. $190y=7,600$

$\frac{190y}{190}=\frac{7,600}{190}$

$y=40$

Check: $190y=7,600$

$190\cdot40\stackrel{?}{=}7,600$

$7,600=7,600$

The solution checks.

51. $\frac{t}{3}=47$

$3\cdot\frac{t}{3}=3\cdot47$

$t=141$

Check: $\frac{t}{3}=47$

$\frac{141}{3}\stackrel{?}{=}47$

$47=47$

The solution checks.

52. $\frac{d}{9} = 83$

$9 \cdot \frac{d}{9} = 9 \cdot 83$

$d = 747$

Check: $\frac{d}{9} = 83$

$\frac{747}{9} \stackrel{?}{=} 83$

$83 = 83$

The solution checks.

53. $34y = 204$

$\frac{34y}{34} = \frac{204}{34}$

$y = 6$

Check: $34y = 204$

$34 \cdot 6 \stackrel{?}{=} 204$

$204 = 204$

The solution checks.

54. $18y = 162$

$\frac{18y}{18} = \frac{162}{18}$

$y = 9$

Check: $18y = 162$

$18 \cdot 9 \stackrel{?}{=} 162$

$162 = 162$

The solution checks.

LOOK ALIKES

55. a. $d + 32 = 96$

$d + 32 - 32 = 96 - 32$

$d = 64$

b. $d - 32 = 96$

$d - 32 + 32 = 96 + 32$

$d = 128$

c. $32d = 96$

$32d \div 32 = 96 \div 32$

$d = 3$

d. $d \div 32 = 96$

$(d \div 32) \cdot 32 = 96 \cdot 32$

$d = 3{,}072$

56. a. $17x = 68$

$17x \div 17 = 68 \div 17$

$x = 4$

b. $x \div 17 = 68$

$(x \div 17) \cdot 17 = 68 \cdot 17$

$x = 1{,}156$

c. $x + 17 = 68$

$x + 17 - 17 = 68 - 17$

$x = 51$

d. $x - 17 = 68$

$x - 17 + 17 = 68 + 17$

$x = 85$

57. a. $b \div 40 = 80$

$(b \div 40) \cdot 40 = 80 \cdot 40$

$b = 3200$

b. $b - 40 = 80$

$b - 40 + 40 = 80 + 40$

$b = 120$

c. $b + 40 = 80$

$b + 40 - 40 = 80 - 40$

$b = 40$

d. $40b = 80$

$40b \div 40 = 80 \div 40$

$b = 2$

58. a. $t - 9 = 108$

$t - 9 + 9 = 108 + 9$

$t = 117$

b. $9t = 108$

$9t \div 9 = 108 \div 9$

$t = 12$

c. $t \div 9 = 108$

$(t \div 9) \cdot 9 = 108 \cdot 9$

$t = 972$

d. $t + 9 = 108$

$t + 9 - 9 = 108 - 9$

$t = 99$

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

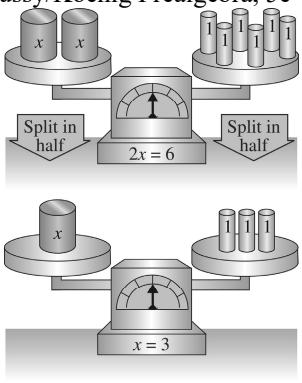
$$40j = 320,000$$
$$\frac{40j}{40} = \frac{320,000}{40}$$
$$j = 8,000$$

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

75. $P = 2l + 2w$
$= 2 \cdot 8 + 2 \cdot 16$
$= 16 + 32$
$= 48 \text{ cm}.$

76. $A = l \cdot w$
$= 23 \cdot 37$
$= 851 \text{ in}^2.$

77. $120 = 4 \cdot 30$
$= 2 \cdot 2 \cdot 3 \cdot 10$
$= 2 \cdot 2 \cdot 3 \cdot 2 \cdot 5$
$= 2^3 \cdot 3 \cdot 5$

78. $150 = 3 \cdot 50$
$= 3 \cdot 2 \cdot 25$
$= 3 \cdot 2 \cdot 5 \cdot 5$
$= 2 \cdot 3 \cdot 5^2$

79. $3^2 \cdot 2^3 = 9 \cdot 8$
$= 72$

80. $5 + 6 \cdot 3 = 5 + 18$
$= 23$

81. $\frac{0}{12} = 0$

82. $\frac{50}{0}$ 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

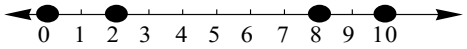
b. 23,253,412

4. 61,204

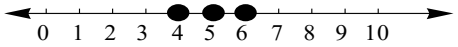
5. 500,000+70,000+300+2

6. 30,000,000+7,000,000+300,000
+9,000+100+50+4

7.



8.



9. $9 > 7$

10. $301 < 310$

11. a. 2,507,300

b. 2,510,000

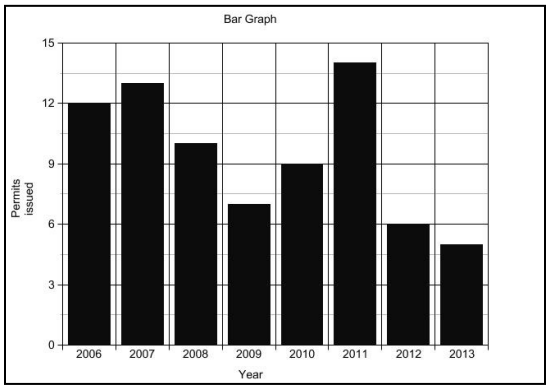
c. 2,507,350

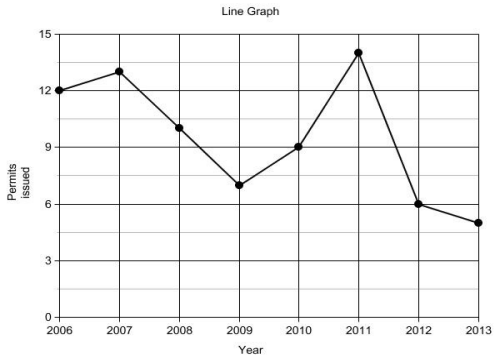
d. 3,000,000

12. a. 970,000

b. 1,000,000

13.





14. Nile, Amazon, Yangtze, Mississippi-Missouri, Ob-Irtysh

15.
$$\begin{array}{r} {\scriptstyle 1}\\ 436\\ +27\\ \hline 463 \end{array}$$

16.
$$\begin{aligned} 4+(36+19) &= 4+(55)\\ &= 59 \end{aligned}$$

17.
$$\begin{array}{r} {\scriptstyle 1\ 1\ 1}\\ 5,345\\ +\ 655\\ \hline 6,000 \end{array}$$

18.
$$\begin{aligned} 2+1+38+3+6 &= 3+38+3+6\\ &= 41+3+6\\ &= 44+6\\ &= 50 \end{aligned}$$

19.
$$\begin{array}{r} {\scriptstyle 1\ 2\ 2}\\ 4,447\\ 7,478\\ +\ 676\\ \hline 12,601 \end{array}$$

20.
$$\begin{array}{r} {\scriptstyle 1\ 1}\\ 32,812\\ 65,034\\ +54,323\\ \hline 152,169 \end{array}$$

21.
$$\begin{aligned} &600+800+10,000+40,000+8,000\\ &= 1,400+50,000+8,000\\ &= 51,400+8,000\\ &= 59,400 \end{aligned}$$

22. a. $24+61=61+24$

b. $9+(91+29)=(9+91)+29$

23. 101,491,106 + 76,949,504 + 74,937,004

= 253,377,614 passengers

24.
$$\begin{array}{r} {\scriptstyle 2\ 2}\\ 226\\ 859\\ 345\\ +1,291\\ \hline 2,721 \end{array}$$

It is not correct.

25.
$$\begin{array}{r} {\scriptstyle 1\quad 1}\\ 10,955\\ +3,706\\ \hline 14,661 \end{array}$$

26.
$$\begin{array}{r} {\scriptstyle \quad 1\ 1}\\ 327,891\\ +451,775\\ \hline 779,666 \end{array}$$

27. 1,695 + 772 = 2,467 sq ft

28.
$$\begin{array}{r} {\scriptstyle 1}\\ 642\\ 731\\ 642\\ +731\\ \hline 2,746 \end{array}\ \text{ft}$$

29.
$$\begin{array}{r} 148\\ -87\\ \hline 61 \end{array}$$

30.
$$\begin{array}{r} {\scriptstyle 2}\ {\scriptstyle 15}\\ 10,4\not{3}\ \not{5}\\ -10,218\\ \hline 217 \end{array}$$

31. $750-259+14=491+14$
$=505$

32.
$$\begin{array}{r} {\scriptstyle 7}\ {\scriptstyle 9}\ {\scriptstyle 10}\ {\scriptstyle 10}\\ 7,\not{8}\ \not{0}\ \not{0}\\ -5,725\\ \hline 2,075 \end{array}$$

33.
$$\begin{array}{r} {\scriptstyle 1}\ {\scriptstyle 1}\ {\scriptstyle 1}\\ 1,168\\ +6,949\\ \hline 8,117 \end{array}$$
The subtraction is incorrect.

34. $20-8=12$ because $12+8=20$.

35. $200,000-40,000=160,000$

36.
$$\begin{array}{r} {\scriptstyle 5}\ {\scriptstyle 12}\ {\scriptstyle 12}\qquad {\scriptstyle 7}\ {\scriptstyle 12}\\ \not{6},\not{3}\not{2}3,4\not{8}\not{2}\\ -3,551,023\\ \hline 2,772,459 \end{array}\ \text{mi}^2.$$

37. $12,975-3,800+4,270=9,175+4,270$
$=\$13,445$

38.
$$\begin{array}{r} {\scriptstyle 13}\\ {\scriptstyle 14}\ {\scriptstyle 12}\\ \not{2}\not{4}\not{2}\\ -188\\ \hline 54 \end{array}\ \text{days}$$

39.
$$\begin{array}{r} {\scriptstyle 6}\\ 47\\ \times 9\\ \hline 423 \end{array}$$

40. $5\cdot(7\cdot6)=5\cdot42$
$=210$

41. $72\cdot10,000$: 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. $7,000\cdot400=2,800,000$

46. a. $7+7+7+7+7=5\cdot7$

b. $2\cdot t=2t$

c. $m\cdot n=mn$

47. a. $8\cdot0=0$ b. $7\cdot1=7$

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. $365 \cdot 7 = 2,555$ hr.

b. $365 \cdot 9 = 3,285$ 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. $\frac{72}{4} = \frac{\cancel{4} \cdot 18}{\cancel{4}} = 18$

56.
$$\begin{array}{r} 37 \\ 39\overline{)1443} \\ -117 \\ \hline 273 \\ -273 \\ \hline 0 \end{array}$$

57.
$$\begin{array}{r} 307 \\ 68\overline{)20876} \\ -204 \\ \hline 47 \\ -0 \\ \hline 476 \\ -476 \\ \hline 0 \end{array}$$

58.
$$\begin{array}{r} 19 \\ 21\overline{)405} \\ -21 \\ \hline 195 \\ -189 \\ \hline 6 \end{array}$$

$19R6$

59. $\frac{0}{10} = 0$

60. $\frac{165}{0}$ is undefined

61.
$$\begin{array}{r} 42 \\ 127\overline{)5347} \\ -508 \\ \hline 267 \\ -254 \\ \hline 13 \end{array}$$

$42R13$

62. Begin by dividing both by 100 to eliminate two zeros:

$$\begin{array}{r} 380 \\ 39\overline{)14820} \\ -117 \\ \hline 312 \\ -312 \\ \hline 0 \end{array}$$

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.

87.
$$4 = 2 \cdot 2$$
$$6 = 2 \cdot 2 \cdot 3$$
$$LCM(4,6) = 2 \cdot 2 \cdot 3$$
$$= 12$$

88.
$$3 = 3$$
$$4 = 2 \cdot 2$$
$$LCM(3,4) = 2 \cdot 2 \cdot 3$$
$$= 12$$

89.
$$9 = 3 \cdot 3$$
$$15 = 3 \cdot 5$$
$$LCM(9,15) = 3 \cdot 3 \cdot 5$$
$$= 45$$

90.
$$12 = 2 \cdot 2 \cdot 3$$
$$18 = 2 \cdot 3 \cdot 3$$
$$LCM(12,18) = 2 \cdot 2 \cdot 3 \cdot 3$$
$$= 36$$

91.
$$18 = 2 \cdot 3 \cdot 3$$
$$21 = 3 \cdot 7$$
$$LCM(18,21) = 2 \cdot 3 \cdot 3 \cdot 7$$
$$= 126$$

92.
$$24 = 2 \cdot 2 \cdot 2 \cdot 3$$
$$45 = 3 \cdot 3 \cdot 5$$
$$LCM(24,45) = 2 \cdot 2 \cdot 2 \cdot 3 \cdot 3 \cdot 5$$
$$= 360$$

93.
$$4 = 2 \cdot 2$$
$$14 = 2 \cdot 7$$
$$20 = 2 \cdot 2 \cdot 5$$
$$LCM(4,14,20) = 2 \cdot 2 \cdot 5 \cdot 7$$
$$= 140$$

94.
$$21 = 3 \cdot 7$$
$$28 = 2 \cdot 2 \cdot 7$$
$$42 = 2 \cdot 3 \cdot 7$$
$$LCM(21,28,42) = 2 \cdot 2 \cdot 3 \cdot 7$$
$$= 84$$

95.
$$8 = 2 \cdot 2 \cdot 2$$
$$12 = 2 \cdot 2 \cdot 3$$
$$GCF(8,12) = 2 \cdot 2$$
$$= 4$$

96.
$$9 = 3 \cdot 3$$
$$12 = 2 \cdot 2 \cdot 3$$
$$GCF(9,12) = 3$$

97.
$$30 = 2 \cdot 3 \cdot 5$$
$$40 = 2 \cdot 2 \cdot 2 \cdot 5$$
$$GCF(30,40) = 2 \cdot 5$$
$$= 10$$

98.
$$30 = 2 \cdot 3 \cdot 5$$
$$45 = 3 \cdot 3 \cdot 5$$
$$GCF(30,45) = 3 \cdot 5$$
$$= 15$$

99.
$$63 = 3 \cdot 3 \cdot 7$$
$$84 = 2 \cdot 2 \cdot 3 \cdot 7$$
$$GCF(63,84) = 3 \cdot 7$$
$$= 21$$

100.
$$112 = 2 \cdot 2 \cdot 2 \cdot 2 \cdot 7$$
$$196 = 2 \cdot 2 \cdot 7 \cdot 7$$
$$GCF(112,196) = 2 \cdot 2 \cdot 7$$
$$= 28$$

101.
$$48 = 2 \cdot 2 \cdot 2 \cdot 2 \cdot 3$$
$$72 = 2 \cdot 2 \cdot 2 \cdot 3 \cdot 3$$
$$120 = 2 \cdot 2 \cdot 2 \cdot 3 \cdot 5$$
$$GCF(48,72,120) = 2 \cdot 2 \cdot 2 \cdot 3$$
$$= 24$$

102.
$$88 = 2 \cdot 2 \cdot 2 \cdot 11$$
$$132 = 2 \cdot 2 \cdot 3 \cdot 11$$
$$176 = 2 \cdot 2 \cdot 2 \cdot 2 \cdot 11$$
$$GCF(88,132,176) = 2 \cdot 2 \cdot 11$$
$$= 44$$

103.
$$14 = 2 \cdot 7$$
$$21 = 3 \cdot 7$$
$$LCM(14,21) = 2 \cdot 3 \cdot 7$$
$$= 42$$

They will meet on the same day 42 days later.

104.
$$32 = 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2$$
$$24 = 2 \cdot 2 \cdot 2 \cdot 3$$
$$16 = 2 \cdot 2 \cdot 2 \cdot 2$$
$$GCF(32,24,16) = 2 \cdot 2 \cdot 2$$
$$= 8$$

a. 8 arrangements

b. 4 red, 3 white, 2 blue (the 'remainder' when the GCF is taken out)

105.
$$3^2 + 12 \cdot 3 = 9 + 36$$
$$= 45$$

106.
$$35 - 5 \cdot 3 + 3 = 35 - 15 + 3$$
$$= 20 + 3$$
$$= 23$$

107.
$$(6 \div 2 \cdot 3)^2 \cdot 3 = (3 \cdot 3)^2 \cdot 3$$
$$= 9^2 \cdot 3$$
$$= 81 \cdot 3$$
$$= 243$$

108.
$$(35 - 5 \cdot 3) \div 5 = (35 - 15) \div 5$$
$$= 20 \div 5$$
$$= 4$$

109.
$$2^3 \cdot 5 - 4 \div 2 \cdot 4 = 8 \cdot 5 - 2 \cdot 4$$
$$= 40 - 8$$
$$= 32$$

110.
$$8 \cdot (5 - 4 \div 2)^2 = 8 \cdot (5 - 2)^2$$
$$= 8 \cdot 3^2$$
$$= 8 \cdot 9$$
$$= 72$$

111.
$$2 + 3\left(\frac{100}{10} - 2^2 \cdot 2\right) = 2 + 3(10 - 4 \cdot 2)$$
$$= 2 + 3(10 - 8)$$
$$= 2 + 3(2)$$
$$= 2 + 6 = 8$$

112.
$$4(4^2 - 5 \cdot 3 + 2) - 4 = 4(16 - 15 + 2) - 4$$
$$= 4(1 + 2) - 4$$
$$= 4(3) - 4$$
$$= 12 - 4$$
$$= 8$$

113.
$$\frac{4(6) - 6}{2(3^2)} = \frac{24 - 6}{2(9)}$$
$$= \frac{18}{18}$$
$$= 1$$

114.
$$\frac{6 \cdot 2 + 3 \cdot 7}{5^2 - 2(7)} = \frac{12 + 21}{25 - 14}$$
$$= \frac{33}{11}$$
$$= 3$$

115.
$$7 + 3\left[3^3 - 10(4 - 2)\right] = 7 + 3\left[27 - 10(2)\right]$$
$$= 7 + 3[27 - 20]$$
$$= 7 + 3[7]$$
$$= 7 + 21$$
$$= 28$$

116.
$$5 + 2\left[\left(2^4 - 3 \cdot \frac{8}{2}\right) - 2\right] = 5 + 2\left[(16 - 3 \cdot 4) - 2\right]$$
$$= 5 + 2\left[(16 - 12) - 2\right]$$
$$= 5 + 2[4 - 2]$$
$$= 5 + 2[2]$$
$$= 5 + 4$$
$$= 9$$

117.
$$\frac{80 + 74 + 66 + 88}{4} = \frac{308}{4}$$
$$= 77$$

118. $$\frac{73+77+81+0+69}{5}=\frac{300}{5}$$
$$=60$$

119. $x+2=13$
$5+2\overset{?}{=}13$
$7=13$
5 is not a solution.

120. $x-3=1$
$4-3\overset{?}{=}1$
$1=1$
4 is a solution.

121. $x-7=2$
$x-7+7=2+7$
$x=9$
Check: $x-7=2$
$9-7\overset{?}{=}2$
$2=2$
The solution checks.

122. $x-11=20$
$x-11+11=20+11$
$x=31$
Check: $x-11=20$
$31-11\overset{?}{=}20$
$20=20$
The solution checks.

123. $225=y-115$
$225+115=y-115+115$
$340=y$
Check: $225=y-115$
$225\overset{?}{=}340-115$
$225=225$
The solution checks.

124. $101=p-32$
$101+32=p-32+32$
$133=p$
Check: $101=p-32$
$101\overset{?}{=}133-32$
$101=101$
The solution checks.

125. $x+9=18$
$x+9-9=18-9$
$x=9$
Check: $x+9=18$
$9+9\overset{?}{=}18$
$18=18$
The solution checks.

126. $b+12=26$
$b+12-12=26-12$
$b=14$
Check: $b+12=26$
$14+12\overset{?}{=}26$
$26=26$
The solution checks.

127. $175=p+55$
$175-55=p+55-55$
$120=p$
Check: $175=p+55$
$175\overset{?}{=}120+55$
$175=175$
The solution checks.

128. $212=m+207$
$212-207=m+207-207$
$5=m$
Check: $212=m+207$
$212\overset{?}{=}5+207$
$212=212$
The solution checks.

129. x = 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: $3x=12$

$$3\cdot 4\stackrel{?}{=}12$$
$$12=12$$

The solution checks.

132. $15y=45$

$$\frac{15y}{15}=\frac{45}{15}$$
$$y=3$$

Check: $15y=45$

$$15\cdot 3\stackrel{?}{=}45$$
$$45=45$$

The solution checks.

133. $105=5r$

$$\frac{105}{5}=\frac{5r}{5}$$
$$21=r$$

Check: $105=5r$

$$105\stackrel{?}{=}5\cdot 21$$
$$105=105$$

The solution checks.

134. $224=16q$

$$\frac{224}{16}=\frac{16q}{16}$$
$$14=q$$

Check: $224=16q$

$$224\stackrel{?}{=}16\cdot 14$$
$$224=224$$

The solution checks.

135. $\frac{x}{7}=3$

$$7\cdot\frac{x}{7}=7\cdot 3$$
$$x=21$$

Check: $\frac{x}{7}=3$

$$\frac{21}{7}\stackrel{?}{=}3$$
$$3=3$$

The solution checks.

136. $\frac{a}{3}=12$

$$3\cdot\frac{a}{3}=3\cdot 12$$
$$a=36$$

Check: $\frac{a}{3}=12$

$$\frac{36}{3}\stackrel{?}{=}12$$
$$12=12$$

The solution checks.

137. $15=\frac{s}{21}$

$$15\cdot 21=\frac{s}{21}\cdot 21$$
$$315=s$$

Check: $15=\frac{s}{21}$

$$15\stackrel{?}{=}\frac{315}{21}$$
$$15=15$$

The solution checks.

138. $25=\frac{d}{17}$

$$25\cdot 17=\frac{d}{17}\cdot 17$$
$$425=d$$

Check: $25 = \frac{d}{17}$

$25 \stackrel{?}{=} \frac{425}{17}$

$25 = 25$

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 $\{0, 1, 2, 3, 4, 5, \ldots\}$.

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

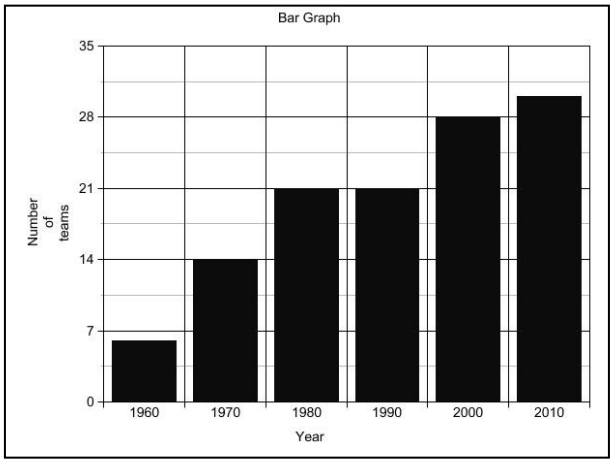
5. a. $15 > 10$ b. $1,247 < 1,427$

6. a. 35,000,000

b. 34,800,000

c. 34,760,000

7.



8.

$$\begin{array}{r} {\scriptstyle 4}\not{5}\,{\scriptstyle 12}\not{3}\,{\scriptstyle 15}\not{5} \\ -\,2\ 8\ 7 \\ \hline 2\ 4\ 8 \end{array}$$

Check: $248 + 287 = 535$

9.

$$\begin{array}{r} {\scriptstyle 1\,1\,1\ \ 1\,1} \\ 136,231 \\ 82,574 \\ +\ \ 6,359 \\ \hline 225,164 \end{array}$$

10.
$$\begin{array}{r} {}^{3}\cancel{4},{}^{14}\cancel{5}\,{}^{11}\cancel{2}\,{}^{1}\cancel{1} \\ -3,5\;7\;9 \\ \hline 9\;4\;2 \end{array}$$

11.
$$\begin{array}{r} {}^{2}5\,3 \\ \times\;\;8 \\ \hline 424 \end{array}$$

12.
$$\begin{array}{r} 562 \\ \times\quad 74 \\ \hline 2,248 \\ +39,340 \\ \hline 41,588 \end{array}$$

13.
$$6\overline{)432}\quad 72$$
$$\begin{array}{r} -42 \\ \hline 12 \\ -12 \\ \hline 0 \end{array}$$

14.
$$73\overline{)8379}\quad 114$$
$$\begin{array}{r} -73 \\ \hline 107 \\ -73 \\ \hline 349 \\ -292 \\ \hline 57 \end{array}$$
$114R57$

Check: $(73\cdot 114)+57$
$= 8,322+57$
$= 8,379$

15. $23\cdot 6 = 138$, now attach 5 zeros: $13,800,000$

16. Begin by dividing out 2 zeros from each:
$$5\overline{)1250}\quad 250$$
$$\begin{array}{r} -10 \\ \hline 25 \\ -25 \\ \hline 0 \end{array}$$

17. $50,000 - 7,000 = 43,000$

18. $327+757+327+757 = 1,084+1,084$
$= 2,168$ in.

19. $23\cdot 23 = 529$ in^2.

20. a. 1, 2, 3, 4, 6, 12

b. 4, 8, 12, 16, 20, 24

c. $8\cdot 5$

21. $1260 = 10\cdot 126$
$= 2\cdot 5\cdot 9\cdot 14$
$= 2\cdot 5\cdot 3\cdot 3\cdot 2\cdot 7$
$= 2^2\cdot 3^2\cdot 5\cdot 7$

22. $10,000 - 5,067 = 4,933$ tails

23. $12\cdot 8 = 96$ students

24. $12,255 \div 3 = 4,085$ ft^2.

25. $23\cdot 18 = 414$ mi.

26. a. Associative Property of Multiplication

b. Commutative Property of Addition

27. a. 0

b. 0

c. 1

d. undefined

28.
$$15 = 3 \cdot 5$$
$$18 = 2 \cdot 3 \cdot 3$$
$$LCM(15,18) = 2 \cdot 3 \cdot 3 \cdot 5$$
$$= 90$$

29.
$$8 = 2 \cdot 2 \cdot 2$$
$$9 = 3 \cdot 3$$
$$12 = 2 \cdot 2 \cdot 3$$
$$LCM(8,9,12) = 2 \cdot 2 \cdot 2 \cdot 3 \cdot 3$$
$$= 72$$

30.
$$30 = 2 \cdot 3 \cdot 5$$
$$54 = 2 \cdot 3 \cdot 3 \cdot 3$$
$$GCF(30,54) = 2 \cdot 3$$
$$= 6$$

31.
$$24 = 2 \cdot 2 \cdot 2 \cdot 3$$
$$28 = 2 \cdot 2 \cdot 7$$
$$36 = 2 \cdot 2 \cdot 3 \cdot 3$$
$$GCF(24,28,36) = 2 \cdot 2$$
$$= 4$$

32.
$$8 = 2 \cdot 2 \cdot 2$$
$$10 = 2 \cdot 5$$
$$LCM(8,10) = 2 \cdot 2 \cdot 2 \cdot 5$$
$$= 40$$

a. 40 inches

b. 5 boxes of rice, 4 boxes of potatoes

33. It is divisible by 2, 3, 4, 5, 6, and 10.

34.
$$\frac{73+52+95+70+0}{5} = \frac{290}{5}$$
$$= 58$$

35.
$$9 + 4 \cdot 5 = 9 + 20$$
$$= 29$$

36.
$$3^4 \cdot 10 - 2(6)(4) = 81 \cdot 10 - 12(4)$$
$$= 810 - 48$$
$$= 762$$

37.
$$20 + 2\left[4^2 - 2\left(6 - 2^2\right)\right] = 20 + 2\left[16 - 2(6-4)\right]$$
$$= 20 + 2\left[16 - 2(2)\right]$$
$$= 20 + 2[16 - 4]$$
$$= 20 + 2[12]$$
$$= 20 + 24$$
$$= 44$$

38.
$$\frac{3^3 - 2(15-14)^2}{33-9+1} = \frac{27 - 2(1)^2}{24+1}$$
$$= \frac{27-2}{24+1}$$
$$= \frac{25}{25}$$
$$= 1$$

39.
$$x + 13 = 16$$
$$3 + 13 \stackrel{?}{=} 16$$
$$16 = 16$$

3 is a solution.

40. To solve an equation means to find all the values of the variable that, when substituted into the equation, make a true statement.

41.
$$100 = x + 1$$
$$100 - 1 = x + 1 - 1$$
$$99 = x$$

Check: $100 = x + 1$
$$100 \stackrel{?}{=} 99 + 1$$
$$100 = 100$$

The solution checks.

42.
$$y - 12 = 18$$
$$y - 12 + 12 = 18 + 12$$
$$y = 30$$

Check: $y - 12 = 18$
$$30 - 12 \stackrel{?}{=} 18$$
$$18 = 18$$

The solution checks.

43. $5m = 55$

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

$$m = 11$$

Check: $5m = 55$

$$5 \cdot 11 \stackrel{?}{=} 55$$

$$55 = 55$$

The solution checks.

44. $\frac{q}{3} = 27$

$$3 \cdot \frac{q}{3} = 3 \cdot 27$$

$$q = 81$$

Check: $\frac{q}{3} = 27$

$$\frac{81}{3} \stackrel{?}{=} 27$$

$$27 = 27$$

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.