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SKU: 9780135229910-SOLUTIONS

Chapter 1

Whole Numbers

Exercise Set 1.1

RC2. In 615,702, the number 615 is in the thousands period.

RC4. The number 721 is written in standard notation.

CC2. A word name for 42,000,000 is forty-two million.

CC4. A word name for 18,000,000,000 is eighteen billion.

CC6. A word name for 40,000,000,000,000 is forty trillion.

2. 5 ten thousands

4. 5 hundred thousands

6. 9

8. 3

10. 6 thousands + 6 hundreds + 8 tens + 8 ones

12. 1 thousand + 7 hundreds + 8 tens + 6 ones

14. 3 ten thousands + 8 thousands + 4 hundreds + 5 tens + 3 ones

16. 1 hundred thousand + 3 ten thousands + 5 thousands + 0 hundreds + 8 tens + 0 ones, or 1 hundred thousand + 3 ten thousands + 5 thousands + 8 tens

18. 1 billion + 2 hundred millions + 6 ten millions + 6 millions + 8 hundred thousands + 8 ten thousands + 3 thousands + 5 hundreds + 9 tens + 8 ones

20. 3 hundred millions + 2 ten millions + 3 millions + 9 hundred thousands + 9 ten thousands + 5 thousands + 5 hundreds + 2 tens + 8 ones

22. Forty-eight

24. Forty-five thousand, nine hundred eighty-seven

26. One hundred eleven thousand, thirteen

28. Forty-three billion, five hundred fifty million, six hundred fifty-one thousand, eight hundred eight

30. Ninety-nine thousand, eight hundred fifty-three

32. Two hundred twenty-six million, one thousand, two hundred eighty-eight

34. 354,702

36. 17,112

38. 19,610,439

40. 700,000,000

42. 26,000,000,000

44. 200,017

46. 2,793,000,000

48. $32 > 0$

50. $28 > 18$

52. $77 < 117$

54. $999 > 997$

56. $345 < 456$

58. $12 < 32$

60. $1,014,023 > 758,708$, or $758,708 < 1,014,023$

62. $843,393 > 842,583$, or $842,583 < 843,393$

64. All digits are 9's. Answers may vary. For an 8-digit readout, for example, it would be 99,999,999. This number has three periods.

Exercise Set 1.2

RC2. In the subtraction $18 - 5 = 13$, the number 5 is the subtrahend.

RC4. The distance around an object is its perimeter.

CC2.
$$\begin{array}{r} {\scriptstyle 9\ 10} \\ \cancel{1}\,\cancel{0}\,0 \\ -\quad 7 \\ \hline 9\ 3 \end{array}$$

CC4.
$$\begin{array}{r} {\scriptstyle 10} \\ \cancel{1}\,\cancel{0}\,0\,0 \\ -\quad 4\,0\,0 \\ \hline 6\,0\,0 \end{array}$$

CC6.
$$\begin{array}{r} {\scriptstyle 9\ 9\ 10} \\ \cancel{1}\,\cancel{0}\,\cancel{0}\,0 \\ -\quad 9\,9\,9 \\ \hline 1 \end{array}$$

2.
$$\begin{array}{r} 1\,5\,2\,1 \\ +\quad 3\,4\,8 \\ \hline 1\,8\,6\,9 \end{array}$$

4.
$$\begin{array}{r} {\scriptstyle 1} \\ 7\,3 \\ +\,6\,9 \\ \hline 1\,4\,2 \end{array}$$

6.
$$\begin{array}{r} {\scriptstyle 1} \\ 7\,5\,0\,3 \\ +\,2\,6\,8\,3 \\ \hline 1\,0,1\,8\,6 \end{array}$$

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8.
$$\begin{array}{r} {\scriptstyle 1} \\ 3\,6\,5\,4 \\ +\,2\,7\,0\,0 \\ \hline 6\,3\,5\,4 \end{array}$$

10.
$$\begin{array}{r} {\scriptstyle 1} \\ 2\,7\,1 \\ +\,3\,3\,3\,8 \\ \hline 3\,6\,0\,9 \end{array}$$

12.
$$\begin{array}{r} {\scriptstyle 1} \\ 2\,8\,0 \\ +\,3\,4,\,9\,0\,2 \\ \hline 3\,5,\,1\,8\,2 \end{array}$$

14.
$$\begin{array}{r} {\scriptstyle 1\;1\;1} \\ 4\,5,\,8\,7\,9 \\ +\,2\,1,\,7\,8\,6 \\ \hline 6\,7,\,6\,6\,5 \end{array}$$

16.
$$\begin{array}{r} {\scriptstyle 1\;1\;1\;1} \\ 9\,9,\,9\,9\,9 \\ +\qquad 1\,1\,2 \\ \hline 1\,0\,0,\,1\,1\,1 \end{array}$$

18.
$$\begin{array}{r} {\scriptstyle 1\;1\;1\;1} \\ 4\,2,\,4\,8\,7 \\ 8\,3,\,1\,4\,1 \\ +\,3\,6,\,7\,1\,2 \\ \hline 1\,6\,2,\,3\,4\,0 \end{array}$$

20.
$$\begin{array}{r} {\scriptstyle 2\;2} \\ 9\,8\,9 \\ 5\,6\,6 \\ 8\,3\,4 \\ 9\,2\,0 \\ +\,7\,0\,3 \\ \hline 4\,0\,1\,2 \end{array}$$

22. Perimeter = 14 mi + 13 mi + 8 mi + 10 mi + 47 mi + 22 mi

We carry out the addition.

$$\begin{array}{r} {\scriptstyle 2} \\ 1\,4 \\ 1\,3 \\ 8 \\ 1\,0 \\ 4\,7 \\ +\,2\,2 \\ \hline 1\,1\,4 \end{array}$$

The perimeter of the figure is 114 mi.

24. 90 ft + 90 ft + 90 ft + 90 ft = Perimeter

We carry out the addition.

$$\begin{array}{r} 9\,0 \\ 9\,0 \\ 9\,0 \\ +\,9\,0 \\ \hline 3\,6\,0 \end{array}$$

The batter travels 360 ft when a home run is hit.

26.
$$\begin{array}{r} 8\,7 \\ -\,3\,4 \\ \hline 5\,3 \end{array}$$

28.
$$\begin{array}{r} 5\,2\,6 \\ -\,3\,2\,3 \\ \hline 2\,0\,3 \end{array}$$

30.
$$\begin{array}{r} {\scriptstyle 6\;\not{8}\;15} \\ \not{7}\;\not{9}\;\not{5} \\ -\,3\,9\,8 \\ \hline 3\,9\,7 \end{array}$$

32.
$$\begin{array}{r} {\scriptstyle 2\;\not{9}\;16} \\ \not{3}\;\not{1}\;\not{6} \\ -\,2\,4\,7 \\ \hline 6\,9 \end{array}$$

34.
$$\begin{array}{r} {\scriptstyle 7\;\not{7}\;17} \\ \not{8}\;\not{8}\;\not{7} \\ -\,6\,9\,8 \\ \hline 1\,8\,9 \end{array}$$

36.
$$\begin{array}{r} {\scriptstyle 3\;12} \\ 3\,\not{4}\;\not{2} \\ -\,2\,1\,7 \\ \hline 1\,2\,5 \end{array}$$

38.
$$\begin{array}{r} {\scriptstyle 5\;\not{3}\;\not{2}\;11} \\ \not{6}\;\not{4}\;\not{3}\;\not{1} \\ -\,2\,8\,9\,6 \\ \hline 3\,5\,3\,5 \end{array}$$

40.
$$\begin{array}{r} {\scriptstyle 7\;\not{2}\;\not{5}\;14} \\ \not{8}\;\not{3}\;\not{6}\;\not{4} \\ -\,5\,3\,7\,5 \\ \hline 2\,9\,8\,9 \end{array}$$

42.
$$\begin{array}{r} {\scriptstyle 8\;\not{1}\;\not{3}\;11} \\ \not{9}\;\not{2}\;\not{4}\;\not{1} \\ -\,5\,6\,4\,3 \\ \hline 3\,5\,9\,8 \end{array}$$

44.
$$\begin{array}{r} {\scriptstyle 6\;15} \\ 7\;\not{5}\;8\,3 \\ -\,3\,6\,4\,1 \\ \hline 3\,9\,4\,2 \end{array}$$

46.
$$\begin{array}{r} {\scriptstyle 5\;\not{1}\;\not{1}\;\not{1}\;12} \\ 1\,\not{6},\,\not{2}\;\not{2}\;\not{2} \\ -\quad 5,\,8\,8\,8 \\ \hline 1\,0,\,3\,3\,4 \end{array}$$

48.
$$\begin{array}{r} {\scriptstyle 2\;\not{1}\;11\;8\;14} \\ \not{3}\;\not{2},\,\not{1}\;\not{9}\;\not{4} \\ -\,2\,9,\,2\,3\,6 \\ \hline 2\,9\,5\,8 \end{array}$$

50.
$$\begin{array}{r} {\scriptstyle 8\;10} \\ \not{9}\;\not{0} \\ -\,7\,8 \\ \hline 1\,2 \end{array}$$

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52.
$$\begin{array}{r} {\scriptstyle 7\ 9\ 13} \\ \cancel{8}\ \cancel{0}\ 3 \\ -\ 4\ 1\ 8 \\ \hline 3\ 8\ 5 \end{array}$$

54.
$$\begin{array}{r} {\scriptstyle 3\ 9\ 15} \\ 9\ \cancel{4}\ \cancel{0}\ \cancel{5} \\ -\quad 2\ 5\ 8 \\ \hline 9\ 1\ 4\ 7 \end{array}$$

56.
$$\begin{array}{r} {\scriptstyle 14} \\ {\scriptstyle 6\ \cancel{4}\ 9\ 10} \\ \cancel{7}\ \cancel{5}\ 0\ \cancel{0} \\ -\ 3\ 6\ 0\ 4 \\ \hline 3\ 8\ 9\ 6 \end{array}$$

58.
$$\begin{array}{r} {\scriptstyle 6\ 9\ 13} \\ 8\ 4,\ \cancel{7}\ 0\ \cancel{3} \\ -\quad\ 2\ 9\ 8 \\ \hline 8\ 4,\ 4\ 0\ 5 \end{array}$$

60.
$$\begin{array}{r} {\scriptstyle 14} \\ {\scriptstyle \cancel{4}\ 10\ 0\ 17} \\ \cancel{1}\ \cancel{5},\ \cancel{0}\ \cancel{1}\ \cancel{7} \\ -\ 7\ 8\ 0\ 9 \\ \hline 7\ 2\ 0\ 8 \end{array}$$

62.
$$\begin{array}{r} {\scriptstyle 7\ 9\ 9\ 13} \\ \cancel{8}\ 0\ 0\ \cancel{3} \\ -\quad 5\ 9\ 9 \\ \hline 7\ 4\ 0\ 4 \end{array}$$

64.
$$\begin{array}{r} {\scriptstyle 6\ 9\ 9\ 10} \\ 1\ \cancel{7},\ 0\ 0\ \cancel{0} \\ -1\ 1,\ 5\ 9\ 8 \\ \hline 5\ 4\ 0\ 2 \end{array}$$

66.
$$\begin{array}{r} {\scriptstyle 3\ 9\ 9\ 9\ 16} \\ \cancel{4\ 0},\ 0\ 0\ \cancel{0} \\ -\quad\ 1\ 4\ 7 \\ \hline 3\ 9,\ 8\ 5\ 9 \end{array}$$

68.
$$\begin{array}{r} {\scriptstyle 2\ 9\ 9\ 9\ 14} \\ \cancel{3\ 0},\ 0\ 0\ \cancel{4} \\ -\quad 6\ 7\ 4\ 9 \\ \hline 2\ 3,\ 2\ 5\ 5 \end{array}$$

70. Nine billion, three hundred forty-six million, three hundred ninety-nine thousand, four hundred sixty-eight

72. One method is described in the answer section in the text. Another method is: $1 + 100 = 101$, $2 + 99 = 101$, ..., $50 + 51 = 101$. Then the sum of 50 101's is 5050.

Exercise Set 1.3

RC2. In the multiplication $4 \times 3 = 12$, 12 is the product.

RC4. The product of 1 and any number a is a.

RC6. dividend

RC8. divisor

CC2. 1000

2.
$$\begin{array}{r} {\scriptstyle 2} \\ 8\ 7 \\ \times\quad 4 \\ \hline 3\ 4\ 8 \end{array}$$

4.
$$\begin{array}{r} 2\ 3\ 4\ 0 \\ \times\ 1\ 0\ 0\ 0 \\ \hline 2,\ 3\ 4\ 0,\ 0\ 0\ 0 \end{array}$$

6.
$$\begin{array}{r} {\scriptstyle 4} \\ 8\ 0\ 6 \\ \times\quad 7 \\ \hline 5\ 6\ 4\ 2 \end{array}$$

8.
$$\begin{array}{r} {\scriptstyle 3\ 2\ 2} \\ 7\ 8\ 6\ 7 \\ \times\qquad 4 \\ \hline 3\ 1,\ 4\ 6\ 8 \end{array}$$

10.
$$\begin{array}{r} {\scriptstyle 4} \\ 7\ 8 \\ \times\ 6\ 0 \\ \hline 4\ 6\ 8\ 0 \end{array}$$

12.
$$\begin{array}{r} {\scriptstyle 2} \\ {\scriptstyle 2} \\ 8\ 7 \\ \times\ 3\ 4 \\ \hline 3\ 4\ 8 \\ 2\ 6\ 1\ 0 \\ \hline 2\ 9\ 5\ 8 \end{array}$$

14.
$$\begin{array}{r} {\scriptstyle 5\ 4} \\ {\scriptstyle 5\ 4} \\ 7\ 7\ 7 \\ \times\quad 7\ 7 \\ \hline 5\ 4\ 3\ 9 \\ 5\ 4\ 3\ 9\ 0 \\ \hline 5\ 9,\ 8\ 2\ 9 \end{array}$$

16.
$$\begin{array}{r} {\scriptstyle 3\ 7} \\ {\scriptstyle 3\ 7} \\ 5\ 4\ 9 \\ \times\quad 8\ 8 \\ \hline 4\ 3\ 9\ 2 \\ 4\ 3\ 9\ 2\ 0 \\ \hline 4\ 8,\ 3\ 1\ 2 \end{array}$$

18.
$$\begin{array}{r} {\scriptstyle 2\ 1} \\ {\scriptstyle 1\ 1} \\ 4\ 3\ 2 \\ \times\ 3\ 7\ 5 \\ \hline 2\ 1\ 6\ 0 \\ 3\ 0\ 2\ 4\ 0 \\ 1\ 2\ 9\ 6\ 0\ 0 \\ \hline 1\ 6\ 2,\ 0\ 0\ 0 \end{array}$$

20.
$$\begin{array}{r} {\scriptstyle 2\ 3} \\ {\scriptstyle 2\ 3} \\ {\scriptstyle 4\ 5} \\ 3\ 4\ 6 \\ \times\ 6\ 5\ 9 \\ \hline 3\ 1\ 1\ 4 \\ 1\ 7\ 3\ 0\ 0 \\ 2\ 0\ 7\ 6\ 0\ 0 \\ \hline 2\ 2\ 8,\ 0\ 1\ 4 \end{array}$$

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22.
$$\begin{array}{r} {\scriptstyle 2\ \ 2} \\ {\scriptstyle 6\ 1\ 5} \\ {\scriptstyle 1\ \ 1} \\ 8\,9\,2\,8 \\ \times\ 3\,1\,7\,2 \\ \hline 1\,7\,8\,5\,6 \\ 6\,2\,4\,9\,6\,0 \\ 8\,9\,2\,8\,0\,0 \\ 2\,6\,7\,8\,4\,0\,0\,0 \\ \hline 2\,8,3\,1\,9,6\,1\,6 \end{array}$$

24.
$$\begin{array}{r} {\scriptstyle 2\ \ 4} \\ {\scriptstyle 2\ \ 4} \\ {\scriptstyle 1\ \ 3} \\ 6\,4\,0\,8 \\ \times\ 6\,0\,6\,4 \\ \hline 2\,5\,6\,3\,2 \\ 3\,8\,4\,4\,8\,0 \\ 3\,8\,4\,4\,8\,0\,0\,0 \\ \hline 3\,8,8\,5\,8,1\,1\,2 \end{array}$$

26.
$$\begin{array}{r} {\scriptstyle 1\ \ 1} \\ {\scriptstyle 4\ \ 4} \\ {\scriptstyle 4\ \ 4} \\ 3\,5\,5 \\ \times\ 2\,9\,9 \\ \hline 3\,1\,9\,5 \\ 3\,1\,9\,5\,0 \\ 7\,1\,0\,0\,0 \\ \hline 1\,0\,6,1\,4\,5 \end{array}$$

28.
$$\begin{array}{r} {\scriptstyle 1} \\ {\scriptstyle 2} \\ {\scriptstyle 2} \\ {\scriptstyle 4\ \ 1} \\ 6\,5\,2\,1 \\ \times\ 3\,4\,4\,9 \\ \hline 5\,8\,6\,8\,9 \\ 2\,6\,0\,8\,4\,0 \\ 2\,6\,0\,8\,4\,0\,0 \\ 1\,9\,5\,6\,3\,0\,0\,0 \\ \hline 2\,2,4\,9\,0,9\,2\,9 \end{array}$$

30.
$$\begin{array}{r} {\scriptstyle 3\ \ 4} \\ {\scriptstyle 4\ \ 4} \\ 4\,5\,0\,6 \\ \times\ 7\,8\,0\,0 \\ \hline 3\,6\,0\,4\,8\,0\,0 \\ 3\,1\,5\,4\,2\,0\,0\,0 \\ \hline 3\,5,1\,4\,6,8\,0\,0 \end{array}$$

32.
$$\begin{array}{r} {\scriptstyle 1} \\ {\scriptstyle 2} \\ 6\,0\,0\,9 \\ \times\ 2\,0\,0\,3 \\ \hline 1\,8\,0\,2\,7 \\ 1\,2\,0\,1\,8\,0\,0\,0 \\ \hline 1\,2,0\,3\,6,0\,2\,7 \end{array}$$

34. $A = l \times w = 129 \text{ yd} \times 65 \text{ yd} = 8385 \text{ sq yd}$

36. $A = l \times w = 200 \text{ ft} \times 85 \text{ ft} = 17,000 \text{ sq ft}$

38. $54 \div 9 = 6$ because $54 = 9 \cdot 6$.

40. $\dfrac{37}{37} = 1$ Any nonzero number divided by itself is 1.

42. $\dfrac{56}{1} = 56$ Any number divided by 1 is that same number.

44. $\dfrac{0}{32} = 0$ Zero divided by any nonzero number is 0.

46. $74 \div 0$ is not defined, because division by 0 is not defined.

48. $\dfrac{20}{4} = 5$ because $20 = 4 \cdot 5$.

50.
$$\begin{array}{r} 2\,3\,3 \\ 3\overline{)\,6\,9\,9} \\ \underline{6} \\ 9 \\ \underline{9} \\ 9 \\ \underline{9} \\ 0 \end{array}$$

The answer is 233.

52.
$$\begin{array}{r} 1\,0\,8 \\ 8\overline{)\,8\,6\,9} \\ \underline{8} \\ 6\,9 \\ \underline{6\,4} \\ 5 \end{array}$$

The answer is 108 R 5.

54.
$$\begin{array}{r} 7\,0\,8 \\ 3\overline{)\,2\,1\,2\,4} \\ \underline{2\,1} \\ 2\,4 \\ \underline{2\,4} \\ 0 \end{array}$$

The answer is 708.

56.
$$\begin{array}{r} 1\,0\,1\,2 \\ 9\overline{)\,9\,1\,1\,0} \\ \underline{9} \\ 1\,1 \\ \underline{9} \\ 2\,0 \\ \underline{1\,8} \\ 2 \end{array}$$

The answer is 1012 R 2.

58.
$$\begin{array}{r} 1\,9\,4 \\ 2\overline{)\,3\,8\,9} \\ \underline{2} \\ 1\,8 \\ \underline{1\,8} \\ 9 \\ \underline{8} \\ 1 \end{array}$$

The answer is 194 R 1.

60.
$$\begin{array}{r} 1\,4\,6 \\ 6\overline{)\,8\,8\,1} \\ \underline{6} \\ 2\,8 \\ \underline{2\,4} \\ 4\,1 \\ \underline{3\,6} \\ 5 \end{array}$$

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The answer is 146 R 5.

62.
$$\begin{array}{r} 2009 \\ 3\overline{)6027} \\ \underline{6} \\ 27 \\ \underline{27} \\ 0 \end{array}$$

The answer is 2009.

64.
$$\begin{array}{r} 517 \\ 8\overline{)4139} \\ \underline{40} \\ 13 \\ \underline{8} \\ 59 \\ \underline{56} \\ 3 \end{array}$$

The answer is 517 R 3.

66.
$$\begin{array}{r} 1270 \\ 100\overline{)127,000} \\ \underline{100} \\ 270 \\ \underline{200} \\ 700 \\ \underline{700} \\ 0 \\ \underline{0} \\ 0 \end{array}$$

The answer is 1270.

68.
$$\begin{array}{r} 426 \\ 10\overline{)4260} \\ \underline{40} \\ 26 \\ \underline{20} \\ 60 \\ \underline{60} \\ 0 \end{array}$$

The answer is 426.

70.
$$\begin{array}{r} 289 \\ 20\overline{)5798} \\ \underline{40} \\ 179 \\ \underline{160} \\ 198 \\ \underline{180} \\ 18 \end{array}$$

The answer is 289 R 18.

72.
$$\begin{array}{r} 24 \\ 40\overline{)987} \\ \underline{80} \\ 187 \\ \underline{160} \\ 27 \end{array}$$

The answer is 24 R 27.

74.
$$\begin{array}{r} 40 \\ 23\overline{)942} \\ \underline{92} \\ 22 \end{array}$$

The answer is 40 R 22.

76.
$$\begin{array}{r} 50 \\ 54\overline{)2729} \\ \underline{270} \\ 29 \end{array}$$

The answer is 50 R 29.

78.
$$\begin{array}{r} 55 \\ 102\overline{)5612} \\ \underline{510} \\ 512 \\ \underline{510} \\ 2 \end{array}$$

The answer is 55 R 2.

80.
$$\begin{array}{r} 107 \\ 7\overline{)749} \\ \underline{7} \\ 49 \\ \underline{49} \\ 0 \end{array}$$

The answer is 107.

82.
$$\begin{array}{r} 808 \\ 9\overline{)7273} \\ \underline{72} \\ 73 \\ \underline{72} \\ 1 \end{array}$$

The answer is 808 R 1.

84.
$$\begin{array}{r} 1010 \\ 7\overline{)7074} \\ \underline{70} \\ 7 \\ \underline{7} \\ 4 \end{array}$$

The answer is 1010 R 4.

86.
$$\begin{array}{r} 301 \\ 24\overline{)7242} \\ \underline{72} \\ 42 \\ \underline{24} \\ 18 \end{array}$$

The answer is 301 R 18.

88.
$$\begin{array}{r} 102 \\ 48\overline{)4899} \\ \underline{48} \\ 99 \\ \underline{96} \\ 3 \end{array}$$

The answer is 102 R 3.

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90.
$$\begin{array}{r} 2\,1\,0 \\ 3\,6\overline{)\,7\,5\,6\,3} \\ \underline{7\,2} \\ 3\,6 \\ \underline{3\,6} \\ 3 \end{array}$$

The answer is 210 R 3.

92.
$$\begin{array}{r} 8\,0\,3 \\ 3\,6\overline{)\,2\,8,9\,2\,9} \\ \underline{2\,8\,8} \\ 1\,2\,9 \\ \underline{1\,0\,8} \\ 2\,1 \end{array}$$

The answer is 803 R 21.

94.
$$\begin{array}{r} 9\,8\,4 \\ 9\,0\overline{)\,8\,8,5\,6\,0} \\ \underline{8\,1\,0} \\ 7\,5\,6 \\ \underline{7\,2\,0} \\ 3\,6\,0 \\ \underline{3\,6\,0} \\ 0 \end{array}$$

The answer is 984.

96.
$$\begin{array}{r} 2\,9\,0\,4 \\ 3\,0\,6\overline{)\,8\,8\,8,8\,8\,8} \\ \underline{6\,1\,2} \\ 2\,7\,6\,8 \\ \underline{2\,7\,5\,4} \\ 1\,4\,8\,8 \\ \underline{1\,2\,2\,4} \\ 2\,6\,4 \end{array}$$

The answer is 2904 R 264.

98.
$$\begin{array}{r} 7\,0\,0\,2 \\ 8\,0\,3\overline{)\,5,6\,2\,2,6\,0\,6} \\ \underline{5\,6\,2\,1} \\ 1\,6\,0\,6 \\ \underline{1\,6\,0\,6} \\ 0 \end{array}$$

The answer is 7002.

100. 530

102. 8950

104. 50

106. 800

108. 900

110. 700

112. 4600

114. 198,400

116. 5000

118. 2000

120. 736,000

122. 6,713,000

124.
$$\begin{array}{r} 6\,2 \\ 9\,7 \\ 4\,6 \\ +\,8\,1 \\ \hline \end{array} \qquad \begin{array}{r} 6\,0 \\ 1\,0\,0 \\ 5\,0 \\ +\quad 8\,0 \\ \hline 2\,9\,0 \end{array}$$

126.
$$\begin{array}{r} 6\,7\,3 \\ -\quad 2\,8 \\ \hline \end{array} \qquad \begin{array}{r} 6\,7\,0 \\ -\quad 3\,0 \\ \hline 6\,4\,0 \end{array}$$

128.
$$\begin{array}{r} 5\,6\,8 \\ 4\,7\,2 \\ 9\,3\,8 \\ +\,4\,0\,2 \\ \hline \end{array} \qquad \begin{array}{r} 6\,0\,0 \\ 5\,0\,0 \\ 9\,0\,0 \\ +\,4\,0\,0 \\ \hline 2\,4\,0\,0 \end{array}$$

130.
$$\begin{array}{r} 9\,4\,3\,8 \\ -\,2\,7\,8\,7 \\ \hline \end{array} \qquad \begin{array}{r} 9\,4\,0\,0 \\ -\,2\,8\,0\,0 \\ \hline 6\,6\,0\,0 \end{array}$$

132.
$$\begin{array}{r} 7\,6\,4\,8 \\ 9\,3\,4\,8 \\ 7\,8\,4\,2 \\ +\,2\,2\,2\,2 \\ \hline \end{array} \qquad \begin{array}{r} 8\,0\,0\,0 \\ 9\,0\,0\,0 \\ 8\,0\,0\,0 \\ +\,2\,0\,0\,0 \\ \hline 2\,7,0\,0\,0 \end{array}$$

134.
$$\begin{array}{r} 8\,4,8\,9\,0 \\ -\,1\,1,1\,1\,0 \\ \hline \end{array} \qquad \begin{array}{r} 8\,5,0\,0\,0 \\ -\,1\,1,0\,0\,0 \\ \hline 7\,4,0\,0\,0 \end{array}$$

136.
$$\begin{array}{r} 5\,1 \\ \times\,7\,8 \\ \hline \end{array} \qquad \begin{array}{r} 5\,0 \\ \times\,8\,0 \\ \hline 4\,0\,0\,0 \end{array}$$

138.
$$\begin{array}{r} 6\,3 \\ \times\,5\,4 \\ \hline \end{array} \qquad \begin{array}{r} 6\,0 \\ \times\,5\,0 \\ \hline 3\,0\,0\,0 \end{array}$$

140.
$$\begin{array}{r} 3\,5\,5 \\ \times\,2\,9\,9 \\ \hline \end{array} \qquad \begin{array}{r} 4\,0\,0 \\ \times\,3\,0\,0 \\ \hline 1\,2\,0,0\,0\,0 \end{array}$$

142.
$$\begin{array}{r} 7\,8\,9 \\ \times\,4\,3\,4 \\ \hline \end{array} \qquad \begin{array}{r} 8\,0\,0 \\ \times\,4\,0\,0 \\ \hline 3\,2\,0,0\,0\,0 \end{array}$$

144. $454 \div 87 \approx 450 \div 90 = 5$

146. $1263 \div 29 \approx 1260 \div 30 = 42$

148. $3641 \div 571 \approx 3600 \div 600 = 6$

150. $32,854 \div 748 \approx 32,900 \div 700 = 47$

152.
$$\begin{array}{r} \$\;4\,9\,8 \\ 2\,8\,9 \\ +\,1\,4\,5 \\ \hline \end{array} \qquad \begin{array}{r} \$\;5\,0\,0 \\ 3\,0\,0 \\ +\,1\,0\,0 \\ \hline \$\;9\,0\,0 \end{array}$$

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154.
$$\begin{array}{r} \$\ 4\ 9\ 8 \\ 2\ 8\ 9 \\ 6\ 2 \\ 1\ 5\ 9 \\ +\ 3\ 2\ 0 \\ \hline \end{array} \qquad \begin{array}{r} \$\ 5\ 0\ 0 \\ 3\ 0\ 0 \\ 1\ 0\ 0 \\ 2\ 0\ 0 \\ +\quad 3\ 0\ 0 \\ \hline \$\ 1\ 4\ 0\ 0 \end{array}$$

The budget covers the choices.

156. Answers will vary depending on the options chosen.

158. a) Total cost of attending:

$$\$250 \cdot 490 = \$122,500$$

Total cost of hotel rooms:

$$\$170 \cdot 2 \cdot 320 = \$108,800$$

Total amount spent:

$$\$122,500 + \$108,800 = \$231,300$$

b) Total cost of attending:

$$\$200 \cdot 500 = \$100,000$$

Total cost of hotel rooms:

$$\$200 \cdot 2 \cdot 300 = \$120,000$$

Total amount spent:

$$\$100,000 + \$120,000 = \$220,000$$

160.
$$\begin{array}{r} 9\ 0\ 0\ 2 \\ +\ 4\ 5\ 8\ 7 \\ \hline 1\ 3,5\ 8\ 9 \end{array}$$

162.
$$\begin{array}{r} {\scriptstyle 2}\ {\scriptstyle 13}\ {\scriptstyle 10}\quad {\scriptstyle 8}\ {\scriptstyle 18} \\ 3\ \not{4}\ \not{0},7\ \not{9}\ \not{8} \\ -\quad 8\ 6,6\ 7\ 9 \\ \hline 2\ 5\ 4,1\ 1\ 9 \end{array}$$

164. 1 ten thousand + 2 thousands + 8 hundreds + 4 tens + 7 ones

166. Perimeter = 62 yd + 39 yd + 54 yd + 46 yd + 28 yd

We carry out the addition.

$$\begin{array}{r} {\scriptstyle 2} \\ 6\ 2 \\ 3\ 9 \\ 5\ 4 \\ 4\ 6 \\ +\ 2\ 8 \\ \hline 2\ 2\ 9 \end{array}$$

The perimeter of the figure is 229 yd.

168. Pairs of factors whose product is 36 are:

1 and 36
2 and 18
3 and 12
4 and 9
6 and 6

a) The pair above whose sum is 13 is 4 and 9.

b) The pair above whose difference is 0 is 6 and 6.

c) The pair above whose sum is 20 is 2 and 18.

d) The pair above whose difference is 9 is 3 and 12.

170. $34,584,132 \div 76__ = 4__,386$

Consider the related multiplication sentence:

$$4__,386 \cdot 76__ = 34,584,132$$

Since the ones digit of the product is 2, the missing ones digit must be either 2 or 7 ($6 \cdot 2 = 12$ and $6 \cdot 7 = 42$).

We try 2:

$34,584,132 \div 762 = 45,386$

We see that the missing ones digit is 2 and the missing thousands digit is 5.

Exercise Set 1.4

RC2. (a)

RC4. (b)

CC2. $672 = 6 \cdot n$

$672 \stackrel{?}{=} 6 \cdot 112$

672 TRUE

112 is a solution.

CC4. $5462 = 3189 + t$

$5462 \stackrel{?}{=} 3189 + 2327$

5516 FALSE

2327 is not a solution.

2. 25

4. 8

6. $t = 5678 + 9034 = 14,712$

8. $m = 9007 - 5667 = 3340$

10. $z = 34 \cdot 15 = 510$

12. $w = 256 \div 16 = 16$

14. $t = 22 - 15 = 7$

16. $t = 16 - 16 = 0$

18. $x = 57 - 20 = 37$

20. $w = 53 - 17 = 36$

22. $x = \dfrac{42}{6} = 7$

24. $m = \dfrac{162}{9} = 18$

26. $y = \dfrac{96}{4} = 24$

28. $t = \dfrac{741}{3} = 247$

30. $y = 9281 - 8322 = 959$

32. $p = 92 - 56 = 36$

34. $y = 23 \times 78 = 1794$

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36. $z = 133 - 67 = 66$

38. $w = \dfrac{3404}{4} = 851$

40. $x = 807 - 438 = 369$

42. $q = 10,534 \div 458 = 23$

44. $x = \dfrac{6080}{19} = 320$

46. $x = \dfrac{1500}{20} = 75$

48. $t = 9281 - 8322 = 959$

50. $n = 3004 - 1745 = 1259$

52. $n = \dfrac{660}{12} = 55$

54. $x = \dfrac{22,135}{233} = 95$

56. $z = 512 - 63 = 449$

58.
$$\begin{array}{r} 1\,4\,2 \\ 9\overline{)\,1\,2\,7\,8} \\ \underline{9} \\ 3\,7 \\ \underline{3\,6} \\ 1\,8 \\ \underline{1\,8} \\ 0 \end{array}$$

The answer is 142.

60.
$$\begin{array}{r} 3\,3\,4 \\ 1\,7\overline{)\,5\,6\,8\,9} \\ \underline{5\,1} \\ 5\,8 \\ \underline{5\,1} \\ 7\,9 \\ \underline{6\,8} \\ 1\,1 \end{array}$$

The answer is 334 R 11.

62. $342 > 339$

64. $0 < 11$

66. 6,375,600

68. $x = \dfrac{14,332,388}{48,916} = 293$

Chapter 1 Mid-Chapter Review

1. The statement is false. For example, $8 - 5 = 3$, but 5 is not equal to $8 + 3$.

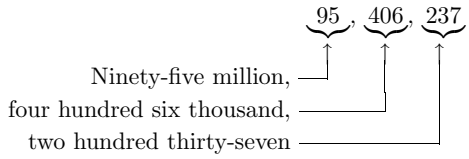
2. True

3. The statement is false. For example, $3 \cdot 0 = 0$ and 0 is not greater than 3. Also, $1 \cdot 1 = 1$ and 1 is not greater than 1.

4. It is true that zero divided by any nonzero number is 0.

5. The statement is false. Any number divided by 1 is the number itself. For example, $\dfrac{27}{1} = 27$.

6.



7.
$$\begin{array}{r} {\scriptstyle 5\ \ 9\ 14} \\ \cancel{6}\,\cancel{0}\,\cancel{4} \\ -\ 4\,9\,7 \\ \hline 1\,0\,7 \end{array}$$

8. 2 $\boxed{6}$ 9 8

The digit 6 names the number of hundreds.

9. $\boxed{6}$ 1, 2 0 4

The digit 6 names the number of ten thousands.

10. 1 4 $\boxed{6}$, 2 3 7

The digit 6 names the number of thousands.

11. 5 8 $\boxed{6}$

The digit 6 names the number of ones.

12. 3 0 6, 4 5 8, 1 $\boxed{2}$ 9

The digit 2 names the number of tens.

13. 3 0 $\boxed{6}$, 4 5 8, 1 2 9

The digit 6 names the number of millions.

14. 3 0 6, 4 $\boxed{5}$ 8, 1 2 9

The digit 5 names the number of ten thousands.

15. 3 0 6, 4 5 8, $\boxed{1}$ 2 9

The digit 1 names the number of hundreds.

16. 5602 = 5 thousands + 6 hundreds + 0 tens + 2 ones, or 5 thousands + 6 hundreds + 2 ones

17. 69,345 = 6 ten thousands + 9 thousands + 3 hundreds + 4 tens + 5 ones

18. A word name for 136 is one hundred thirty-six.

19. A word name for 64,325 is sixty-four thousand, three hundred twenty-five.

20. Standard notation for three hundred eight thousand, seven hundred sixteen is 308,716.

21. Standard notation for four million, five hundred sixty-seven thousand, two hundred ninety-one is 4,567,291.

22. Since 61 is to the right of 16 on the number line, $61 > 16$.

23. Since 100 is to the left of 101 on the number line, $100 < 101$.

24. Since 0 is to the left of 18 on the number line, $0 < 18$.

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25. Since 380 is to the right of 327 on the number line, $380 > 327$.

26. $4 \cdot b = 72$

$$\frac{4 \cdot b}{4} = \frac{72}{4}$$

$$b = 18$$

The number 18 checks. It is the solution.

27. $45 = 23 + x$

$$45 - 23 = 23 + x - 23$$

$$22 = x$$

The number 22 checks. It is the solution.

28. $t = 725 \div 25$

$t = 29$ Doing the division

The number 29 checks. It is the solution.

29. $3902 - 260 = y$

$3642 = y$ Doing the subtraction

The number 3642 checks. It is the solution.

30.
$$\begin{array}{r} 3\,1\,6 \\ +\,4\,8\,2 \\ \hline 7\,9\,8 \end{array}$$

31.
$$\begin{array}{r} {\scriptstyle 1\ 1\ \ } \\ 5\,9\,3 \\ +\,4\,3\,7 \\ \hline 1\,0\,3\,0 \end{array}$$

32.
$$\begin{array}{r} {\scriptstyle \ 1\ 1\ } \\ 2\,6\,3\,8 \\ +\,5\,2\,8\,4 \\ \hline 7\,9\,2\,2 \end{array}$$

33.
$$\begin{array}{r} {\scriptstyle 1\ 1\ 1\ } \\ 4\,6\,1\,7 \\ 2\,4\,3\,6 \\ +\quad 4\,8\,1 \\ \hline 7\,5\,3\,4 \end{array}$$

34.
$$\begin{array}{r} 7\,8\,6 \\ -\,3\,2\,1 \\ \hline 4\,6\,5 \end{array}$$

35.
$$\begin{array}{r} {\scriptstyle 5\ \ 11\ 14} \\ 6\,\not{2}\,\not{4} \\ -\,2\,8\,5 \\ \hline 3\,3\,9 \end{array}$$

36.
$$\begin{array}{r} {\scriptstyle 2\ \not{5}\ 9\ 12\ \ 15} \\ \not{3}\,\not{6}\,\not{0}\,\not{2} \\ -\,1\,7\,4\,8 \\ \hline 1\,8\,5\,4 \end{array}$$

37.
$$\begin{array}{r} {\scriptstyle 4\ \ 9\ \ 9\ 14} \\ \not{5}\,0\,0\,\not{4} \\ -\quad 6\,7\,6 \\ \hline 4\,3\,2\,8 \end{array}$$

38.
$$\begin{array}{r} {\scriptstyle 3\ \ } \\ 3\,6 \\ \times\quad 6 \\ \hline 2\,1\,6 \end{array}$$

39.
$$\begin{array}{r} {\scriptstyle 1\ 1\ \ } \\ {\scriptstyle 5\ 5\ \ } \\ 5\,6\,7 \\ \times\quad 2\,8 \\ \hline 4\,5\,3\,6 \\ 1\,1\,3\,4\,0 \\ \hline 1\,5,\!8\,7\,6 \end{array}$$

40.
$$\begin{array}{r} {\scriptstyle 2\ \ } \\ {\scriptstyle 1\ \ } \\ {\scriptstyle 3\ \ } \\ 4\,0\,7 \\ \times\,3\,2\,5 \\ \hline 2\,0\,3\,5 \\ 8\,1\,4\,0 \\ 1\,2\,2\,1\,0\,0 \\ \hline 1\,3\,2,\!2\,7\,5 \end{array}$$

41.
$$\begin{array}{r} {\scriptstyle \ 2\ 2\ 3\ } \\ {\scriptstyle \ \ \ \ 1\ } \\ 9\,4\,3\,5 \\ \times\quad 6\,0\,2 \\ \hline 1\,8\,8\,7\,0 \\ 5\,6\,6\,1\,0\,0\,0 \\ \hline 5,\!6\,7\,9,\!8\,7\,0 \end{array}$$

42.
$$\begin{array}{r} 2\,5\,3 \\ 4\overline{)\,1\,0\,1\,2} \\ \underline{\ 8\ \ } \\ 2\,1 \\ \underline{2\,0} \\ 1\,2 \\ \underline{1\,2} \\ 0 \end{array}$$

The answer is 253.

43.
$$\begin{array}{r} 1\,1\,2 \\ 3\,8\overline{)\,4\,2\,6\,1} \\ \underline{3\,8} \\ 4\,6 \\ \underline{3\,8} \\ 8\,1 \\ \underline{7\,6} \\ 5 \end{array}$$

The answer is 112 R 5.

44.
$$\begin{array}{r} 2\,3 \\ 6\,0\overline{)\,1\,3\,9\,9} \\ \underline{1\,2\,0} \\ 1\,9\,9 \\ \underline{1\,8\,0} \\ 1\,9 \end{array}$$

The answer is 23 R 19.

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45.
$$\begin{array}{r} 1\,4\,4 \\ 5\,6\overline{)\,8\,0\,9\,5} \\ \underline{5\,6} \\ 2\,4\,9 \\ \underline{2\,2\,4} \\ 2\,5\,5 \\ \underline{2\,2\,4} \\ 3\,1 \end{array}$$

The answer is 144 R 31.

46. Perimeter = 10 m + 4 m + 8 m + 3 m = 25 m

47. $A = 4$ in. $\times$ 2 in. = 8 sq in.

48. Round 647 to the nearest hundred.

$6\,\boxed{4}\,7$
$\uparrow$

The digit 6 is in the hundreds place. Consider the next digit to the right. Since the digit, 4, is 4 or lower, round down, meaning that 6 hundreds stays as 6 hundreds. Then change the digits to the right of the hundreds digit to zeros.

The answer is 600.

49. Round 823,502 to the nearest thousand.

$8\,2\,3,\,\boxed{5}\,0\,2$
$\uparrow$

The digit 3 is in the thousands place. Consider the next digit to the right. Since the digit, 5, is 5 or higher, round 3 thousands up to 4 thousands. Then change the the digits to the right of the thousands digit to zeros.

The answer is 824,000.

50.

	Rounded to the nearest hundred
$2\,1\,8$	$9\,0\,0$
$\times\ 8\,6\,5$	$\times\ 2\,0\,0$
	$1\,8\,0,\,0\,0\,0 \leftarrow$ Estimated answer

51. By rounding prices and estimating their sum a shopper can estimate the total grocery bill while shopping. This is particularly useful if the shopper wants to spend no more than a certain amount.

52. Commas separate the periods and make the numbers easier to read.

53. Answers will vary. Suppose one coat costs \$150. Then the multiplication $4 \cdot \$150$ gives the cost of four coats.

Suppose one ream of copy paper costs \$4. Then the multiplication $\$4 \cdot 150$ gives the cost of 150 reams.

54. Using the definition of division, $0 \div 0 = a$ such that $a \cdot 0 = 0$. We see that a could be *any* number since $a \cdot 0 = 0$ for any number a. Thus, we cannot say that $0 \div 0 = 0$. This is why we agree not to allow division by 0.

Exercise Set 1.5

RC2. Translate.

RC4. Check.

CC2. Let x = the number of miles by which Wednesday's drive exceeded Thursday's drive. Then we have $500 = x + 125$. The correct answer is (b).

CC4. Let x = the total amount spent on groceries in May and June. Then we have $500 + 125 = x$. The correct answer is (a).

2. Let w = the number of pounds by which the waste generated annually per capita in the United States exceeds the waste generated in Denmark.

Solve: $1473 + w = 1606$

$w = 123$ lb

4. Let w = the number of pounds of waste generated annually per capita in Iceland.

Solve: $w + 531 = 1713$

$w = 1182$ lb

6. Let n = the number of entries in each row.

Solve: $504 \div 36 = n$

$n = 14$ entries

8. Let r = the number of active rotary oil rigs in 2007.

Solve: $r + 687 = 984$

$r = 297$ rigs

10. Let n = the number of miles by which the length of the Nile exceeds the length of the Missouri-Mississippi.

Solve: $3860 + n = 4135$

$n = 275$ mi

12. Let p = the total number of squares in the puzzle.

Solve: $15 \cdot 15 = p$

$p = 225$ squares

14. Let c = the number of milligrams of caffeine in a 20-oz bottle of Coca Cola.

Solve: $25 + 32 = c$

$c = 57$ milligrams

16. Let m = the number of minutes in a day.

Solve: $60 \cdot 24 = m$

$m = 1440$ minutes

18. Let r = the amount by which the average monthly rent in Atlanta exceeds the average monthly rent in Indianapolis.

Solve: $905 + r = 1401$

$r = \$496$ per month

20. Let r = the amount of rent each sister pays.

Solve: $2r = 936$

$r = \$468$ per month

22. Let r = the amount of rent a tenant would pay for a one-bedroom apartment, on average, in Seattle during a 6-month period.

Solve: $6 \cdot 2063 = r$

$r = \$12,378$

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24. Let s = the speed limit for trucks.

Solve: $s + 10 = 75$

$s = 65$ mph

26. Let q = the number of quires in a ream.

Solve: $25 \cdot q = 500$

$q = 20$ quires

28. Let s = the amount by which spending by visitors to the United States exceeded spending by Americans traveling abroad.

Solve: $110,500,000,000 + s = 153,700,000,000$

$s = \$43,200,000,000$

30. Let c = the total cost of the purchase.

Solve: $96 \cdot 88 = c$

$c = \$8448$

32. Let w = the number of full weeks that will pass before the station must begin re-airing episodes.

Solve: $5 \cdot w = 208$

$w = 41$ R 3, so 41 full weeks will pass and 3 episodes will be shown the following week before previously aired episodes are rerun.

34. Let l = the number of labels on each sheet.

Solve: $25 \cdot l = 750$

$l = 30$ labels

36. Let g = the number of gallons required for 3795 mi of city driving.

Solve: $3795 \div 23 = g$

$g = 165$ gal

38. a) Let A = the area of the court, in square feet.

Solve: $A = 94 \cdot 50$

$A = 4700$ square feet

b) Let P = the perimeter of the court, in feet.

Solve: $P = 94 + 50 + 94 + 50$

$P = 288$ ft

c) Let a = the amount by which the area of a college court exceeds the area of a high school court, in square feet.

Solve: $4200 + a = 4700$

$a = 500$ square feet

40. Let c = the number of cartons needed.

Solve: $528 \div 12 = c$

$c = 44$ cartons

42. Let m = the distance on the map, in inches, between two cities that, in reality, are 2016 mi apart.

Solve: $2016 \div 288 = m$

$m = 7$ in.

Let r = the distance in miles, in reality, between two cities that are 8 in. apart on the map.

Solve: $288 \cdot 8 = r$

$r = 2304$ mi

44. Let m = the number of months required to pay off the loan.

Solve: $7824 \div 163 = m$

$m = 48$ months

46. Let n = the number of 100's in 3500.

Solve: $3500 \div 100 = n$

$n = 35$

Let t = the number of minutes you must golf, walking, in order to lose one pound.

Solve: $t = 35 \cdot 20$

$t = 700$ min; we could also express this as 11 hr, 40 min.

48. Let n = the number of new jobs that will be created for marketing managers and accountants.

$n = 19,700 + 142,400 = 162,100$

Let s = the number of new jobs that will be created for sales managers.

Solve: $s + 143,100 = 162,100$

$s = 19,000$ jobs

50. Let F = the number of seats in first class, E = the number of seats in economy class, and T = the total number of seats.

Solve: $3 \cdot 4 = F$, $23 \cdot 6 = E$, and $T = F + E$

$F = 12$, $E = 138$, $T = 12 + 138 = 150$ seats

52. Let c = the total cost of the 5 video games.

Solve: $5 \cdot 64 = c$

$c = \$320$

Then let n = the number of \$20 bills required.

Solve: $320 \div 20 = n$

$n = 16$ \$20 bills

54. Let b = the new balance.

Solve: $749 - 34 - 65 + 123 = b$

$b = \$773$

56. Let l = the total length of the bookshelves, in feet.

Solve: $6 \cdot 3 = l$

$l = 18$ ft

Since the total length of the bookshelves is greater than 16 ft, the shelves cannot be put side by side on the 16-ft wall.

58.
$$\begin{array}{r} {\scriptstyle 15} \\ {\scriptstyle 8\ \cancel{5}\ \ 9\ 12} \\ \cancel{9}\ \cancel{6}\ 0\ \cancel{2} \\ -\ 1\ 8\ 4\ 3 \\ \hline 7\ 7\ 5\ 9 \end{array}$$

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60.
$$\begin{array}{r} 1\,4\,7 \\ 3\,2\overline{)\,4\,7\,0\,8} \\ \underline{3\,2} \\ 1\,5\,0 \\ \underline{1\,2\,8} \\ 2\,2\,8 \\ \underline{2\,2\,4} \\ 4 \end{array}$$

The answer is 147 R 4.

62. $A = l \times w = 211 \text{ ft} \times 46 \text{ ft} = 9706 \text{ sq ft}$

64. $x = 81 - 15 = 66$

66. Consider one student taking one class a "student-class unit." Then let $s =$ the total number of student-class units and $p =$ the number of students taught by each instructor.

Solve: $1200 \cdot 5 = s$, $4 \cdot 30 = p$

$s = 6000$, $p = 120$

Now let $n =$ the number of instructors.

Solve: $6000 \div 120 = n$

$n = 50$ instructors

Exercise Set 1.6

RC2. The expression 9^2 can be read "nine squared."

RC4. To find the average of 7, 8, and 9, we add the numbers and divide the sum by 3.

CC2. Division

CC4. Multiplication

2. 2^5

4. 13^3

6. 9^2

8. 1^4

10. 125

12. 64

14. 100,000

16. 64

18. $(12+6)+18 = 18+18$
$= 36$

20. $(52-40)-8 = 12-8$
$= 4$

22. $(1000 \div 100) \div 10 = 10 \div 10$
$= 1$

24. $256 \div (64 \div 4) = 256 \div 16$
$= 16$

26. $2^2 + 5^2 = 4 + 25$
$= 29$

28. $(32-27)^3 + (19+1)^3 = 5^3 + 20^3$
$= 125 + 8000$
$= 8125$

30. $23 + 18 \cdot 20 = 23 + 360$
$= 383$

32. $10 \cdot 7 - 4 = 70 - 4$
$= 66$

34. $90 - 5 \cdot 5 \cdot 2 = 90 - 50$
$= 40$

36. $8^2 - 8 \cdot 2 = 64 - 8 \cdot 2$
$= 64 - 16$
$= 48$

38. $1000 \div 25 - (15+5) = 1000 \div 25 - 20$
$= 40 - 20$
$= 20$

40. $3 \cdot 8 + 5 \cdot 8 = 24 + 40$
$= 64$

42. $144 \div 4 - 2 = 36 - 2$
$= 34$

44. $7 \cdot (10-3)^2 - 2 \cdot (3+1)^2 = 7 \cdot 7^2 - 2 \cdot 4^2$
$= 7 \cdot 49 - 2 \cdot 16$
$= 343 - 32$
$= 311$

46. $6^2 - 3^4 \div 3^3 = 36 - 81 \div 27$
$= 36 - 3$
$= 33$

48. $7^2 + 20 \cdot 4 - (28 + 9 \cdot 2)$
$= 7^2 + 20 \cdot 4 - (28 + 18)$
$= 7^2 + 20 \cdot 4 - 46$
$= 49 + 20 \cdot 4 - 46$
$= 49 + 80 - 46$
$= 83$

50. $8 \times 9 - (12-8) \div 4 - (10-7)$
$= 8 \times 9 - 4 \div 4 - 3$
$= 72 - 1 - 3$
$= 68$

52. $80 - 2^4 \cdot 15 \div (7 \cdot 5 - 45 \div 3)$
$= 80 - 2^4 \cdot 15 \div (35 - 15)$
$= 80 - 2^4 \cdot 15 \div 20$
$= 80 - 16 \cdot 15 \div 20$
$= 80 - 240 \div 20$
$= 80 - 12$
$= 68$

54. $2^7 \div 2^5 \cdot 2^4 \div 2^2$
$= 128 \div 32 \cdot 16 \div 4$
$= 4 \cdot 16 \div 4$
$= 64 \div 4$
$= 16$

56. $\dfrac{86+92+80+78}{4} = \dfrac{336}{4} = 84$

58. $\dfrac{\$1025 + \$775 + \$2062 + \$942 + \$3721}{5} = \dfrac{\$8525}{5} = \$1705$

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60. $72 \div 6 - \{2 \times [9 - (4 \times 2)]\}$
$= 72 \div 6 - \{2 \times [9 - 8]\}$
$= 72 \div 6 - \{2 \times 1\}$
$= 72 \div 6 - 2$
$= 12 - 2$
$= 10$

62. $[92 \times (6 - 4) \div 8] + [7 \times (8 - 3)]$
$= [92 \times 2 \div 8] + [7 \times 5]$
$= [184 \div 8] + 35$
$= 23 + 35$
$= 58$

64. $(18 \div 2) \cdot \{[(9 \cdot 9 - 1) \div 2] - [5 \cdot 20 - (7 \cdot 9 - 2)]\}$
$= 9 \cdot \{[(81 - 1) \div 2] - [5 \cdot 20 - (63 - 2)]\}$
$= 9 \cdot \{[80 \div 2] - [5 \cdot 20 - 61]\}$
$= 9 \cdot \{40 - [100 - 61]\}$
$= 9 \cdot \{40 - 39\}$
$= 9 \cdot \{1\}$
$= 9$

66. $15(23 - 4 \cdot 2)^3 \div (3 \cdot 25)$

$= 15(23 - 8)^3 \div 75$	Multiplying inside parentheses
$= 15 \cdot 15^3 \div 75$	Subtracting inside parentheses
$= 15 \cdot 3375 \div 75$	Evaluating the exponential expression
$= 50,625 \div 75$	Doing all multiplication and
$= 675$	divisions in order from left to right

68. $(19 - 2^4)^5 - (141 \div 47)^2$
$= (19 - 16)^5 - 3^2$
$= 3^5 - 3^2$
$= 243 - 9$
$= 234$

70. $x = 5032 - 4197 = 835$

72. $y = \dfrac{1554}{42} = 37$

74. $t = \dfrac{10,000}{100} = 100$

76. Let g = the total number of gallons of gasoline purchased.
Solve: $23 + 24 + 26 + 25 = g$
$g = 98$ gallons

78. $12 \div 4 + 2 \cdot 3 - 2 = 3 + 6 - 2$
$= 7$ Correct answer
$12 \div (4 + 2) \cdot (3 - 2) = 2$

80. Answers may vary. One correct answer is
$9 \cdot 8 + 7 \cdot 6 - 5 \cdot 4 + 3 \cdot 2 \cdot 1 = 100$.

Exercise Set 1.7

RC2. 6 is a factor of 42.

RC4. 42 is a multiple of 3.

RC6. One factorization of 42 is $2 \cdot 21$.

CC2. True; $30 = 2 \cdot 15$.

CC4. The number 1 is not prime because it does not have two different factors. The statement is false.

CC6. The number 10 is not prime ($10 = 2 \cdot 5$), so the statement is false.

2.
$$\begin{array}{r} 4 \\ 13\overline{)52} \\ 52 \\ \hline 0 \end{array}$$
The remainder is 0, so 13 is a factor of 52.

4.
$$\begin{array}{r} 42 \\ 16\overline{)680} \\ 64 \\ \hline 40 \\ 32 \\ \hline 8 \end{array}$$
The remainder is not 0, so 16 is not a factor of 680.

6. 1, 2, 4, 8, 16

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

10. 1, 3, 9

12. 1, 13

14. 1, 2, 4, 5, 10, 20, 25, 50, 100

16. 1, 2, 3, 4, 5, 6, 8, 10, 12, 15, 20, 24, 30, 40, 60, 120

18. 11, 22, 33, 44, 55, 66, 77, 88, 99, 110

20. 50, 100, 150, 200, 250, 300, 350, 400, 450, 500

22. 5, 10, 15, 20, 25, 30, 35, 40, 45, 50

24. 13, 26, 39, 52, 65, 78, 91, 104, 117, 130

26. 6, 12, 18, 24, 30, 36, 42, 48, 54, 60

28. 14, 28, 42, 56, 70, 84, 98, 112, 126, 140

30.
$$\begin{array}{r} 6 \\ 8\overline{)48} \\ 48 \\ \hline 0 \end{array}$$
48 is divisible by 8.

32.
$$\begin{array}{r} 1409 \\ 3\overline{)4227} \\ 3 \\ \hline 12 \\ 12 \\ \hline 27 \\ 27 \\ \hline 0 \end{array}$$
4227 is divisible by 3.

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34.
$$\begin{array}{r} 25 \\ 4\overline{)102} \\ \underline{8} \\ 22 \\ \underline{20} \\ 2 \end{array}$$

102 is not divisible by 4.

36.
$$\begin{array}{r} 591 \\ 7\overline{)4143} \\ \underline{35} \\ 64 \\ \underline{63} \\ 13 \\ \underline{7} \\ 6 \end{array}$$

4143 is not divisible by 7.

38. The number 2 is prime. It has only the factors 1 and 2.

40. The number 19 is prime. It has only the factors 1 and 19.

42. The number 27 has factors 1, 3, 9, and 27. It is composite.

44. The number 49 has factors 1, 7, and 49. It is composite.

46. $2 \cdot 2 \cdot 2 \cdot 2$

48. $3 \cdot 5$

50. $2 \cdot 2 \cdot 2 \cdot 2 \cdot 2$

52. $2 \cdot 2 \cdot 2 \cdot 5$

54. $2 \cdot 31$

56. $2 \cdot 2 \cdot 5 \cdot 7$

58. $2 \cdot 5 \cdot 11$

60. $2 \cdot 5 \cdot 7$

62. $2 \cdot 43$

64. $3 \cdot 3 \cdot 11$

66. $2 \cdot 2 \cdot 11 \cdot 11$

68. $7 \cdot 13$

70. $2 \cdot 2 \cdot 2 \cdot 3 \cdot 3 \cdot 5 \cdot 5$

72. $3 \cdot 3 \cdot 3 \cdot 5 \cdot 5$

74. $3 \cdot 3 \cdot 5 \cdot 11 \cdot 13$

76. 4 millions

78. 4 ten thousands

80. 34,600

82. 2,428,500

Exercise Set 1.8

RC2. A number is divisible by 3 if the sum of its digits is divisible by 3. The correct answer is (a).

RC4. A number is divisible by 5 if its ones digit is 0 or 5. The correct answer is (d).

RC6. A number is divisible by 8 if the number named by its last three digits is divisible by 8. The correct answer is (h).

RC8. A number is divisible by 10 if its ones digit is 0. The correct answer is (e).

2. Because $4 + 6 + 7 = 17$ and 17 is not divisible by 9, 467 is not divisible by 9.

4. The ones digit is even; $2 + 0 + 0 + 4 = 6$ and 6 is divisible by 3. Thus 2004 is divisible by 6.

6. 6120 is divisible by 5 because the ones digit is 0.

8. Because $3 + 2 + 8 + 6 = 19$ and 19 is not divisible by 3, 3286 is not divisible by 3.

10. 64,091 is not divisible by 10 because the ones digit is not 0.

12. 9840 is divisible by 2 because the ones digit is even.

14. Because the number named by the last three digits, 106, is not divisible by 8, the number 546,106 is not divisible by 8.

16. Because the number named by the last two digits, 36, is divisible by 4, the number 298,736 is divisible by 4.

18. 12,600 is divisible by 2 because the ones digit is even.

Because $1 + 2 + 6 + 0 + 0 = 9$ and 9 is divisible by 3, then 12,600 is divisible by 3.

12,600 is divisible by 4 because the number named by its last two digits, 00, is divisible by 4.

12,600 is divisible by 5 because the ones digit is 0.

12,600 is divisible by 2 and by 3 (see above), so it is divisible by 6.

12,600 is divisible by 8 because the number named by its last three digits, 600, is divisible by 8.

Because the sum of the digits is divisible by 9 (see above), 12,600 is divisible by 9.

12,600 is divisible by 10 because the ones digit is 0.

20. 2916 is divisible by 2 because the ones digit is even.

Because $2 + 9 + 1 + 6 = 18$ and 18 is divisible by 3, 2916 is divisible by 3.

2916 is divisible by 4 because the number named by its last two digits, 16, is divisible by 4.

2916 is not divisible by 5 because the ones digit is neither 0 nor 5.

2916 is divisible by 2 and by 3 (see above), so it is divisible by 6.

2916 is not divisible by 8 because the number named by its last three digits, 916, is not divisible by 8.

Because the sum of the digits is divisible by 9 (see above), 2916 is divisible by 9.

2916 is not divisible by 10 because the ones digit is not 0.

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22. 25,088 is divisible by 2 because the ones digit is even.

Because $2+5+0+8+8=23$ and 23 is not divisible by 3, then 25,088 is not divisible by 3.

25,088 is divisible by 4 because the number named by its last 2 digits, 88, is divisible by 4.

25,088 is not divisible by 5 because the ones digit is neither 0 nor 5.

25,088 is not divisible by 6 because it is not divisible by 3 (see above).

25,088 is divisible by 8 because the number named by its last three digits, 088, is divisible by 8.

25,088 is not divisible by 9 because the sum of the digits is not divisible by 9 (see above).

25,088 is not divisible by 10 because the ones digit is not 0.

24. 143,507 is not divisible by 2 because the ones digit is not even.

Because $1+4+3+5+0+7=20$ and 20 is not divisible by 3, then 143,507 is not divisible by 3.

143,507 is not divisible by 4 because the number named by its last two digits, 07, is not divisible by 4.

143,507 is not divisible by 5 because the ones digit is neither 0 nor 5.

143,507 is not divisible by 6 because it is not even.

143,507 is not divisible by 8 because the number named by its last three digits, 507, is not divisible by 8.

143,507 is not divisible by 9 because the sum of the digits is not divisible by 9 (see above).

143,507 is not divisible by 10 because the ones digit is not 0.

26. The numbers for which the ones digit is even are 56, 324, 784, 200, 42, 812, and 402. These numbers are divisible by 2.

28. The numbers for which the last two digits are divisible by 4 are 56, 324, 784, 200, and 812. These numbers are divisible by 4.

30. The numbers that are divisible by both 2 and 3 are 324, 42, and 402. These numbers are divisible by 6.

32. The only number for which the sum of the digits is divisible by 9 is 324. This number is divisible by 9.

34. The numbers for which the sum of the digits is divisible by 3 are 1101, 313,332, 111,126, 876, 1110, 9990, and 126,111.

36. The numbers for which the ones digit is 0 or 5 are 305, 13,025, 1110, 64,000, and 9990.

38. The numbers for which the last three digits are divisible by 8 are 7624, 5128, and 64,000.

40. The numbers for which the last two digits are divisible by 4 are 313,332, 7624, 876, 5128, and 64,000.

42. $y+124=263$

$y=263-124=139$

44. $18\cdot t=1008$

$t=\dfrac{1008}{18}=56$

46. $338=a\cdot 26$

$\dfrac{338}{26}=a$

$13=a$

48. Let m = the number of minutes in 72 hours.

Solve: $60\cdot 72=m$

$m=4320$ minutes.

50. 2520 is divisible by 2: $2520=2\cdot 1260$; 1260 is divisible by 2: $2520=2\cdot 2\cdot 630$; 630 is divisible by 2: $2520=2\cdot 2\cdot 2\cdot 315$; 315 is not divisible by 2, but it is divisible by 3: $2520=2\cdot 2\cdot 2\cdot 3\cdot 105$; 105 is divisible by 3: $2520=2\cdot 2\cdot 2\cdot 3\cdot 3\cdot 35$; 35 is not divisible by 3, but it is divisible by 5: $2520=2\cdot 2\cdot 2\cdot 3\cdot 3\cdot 5\cdot 7$. Since 7 is a prime number, the last factorization is the prime factorization.

52. 1998 is divisible by 2: $1998=2\cdot 999$; 999 is not divisible by 2, but it is divisible by 3: $1998=2\cdot 3\cdot 333$; 333 is divisible by 3: $1998=2\cdot 3\cdot 3\cdot 111$; 111 is divisible by 3: $1998=2\cdot 3\cdot 3\cdot 3\cdot 37$. Since 37 is a prime number, the last factorization is the prime factorization.

54. The number must be a multiple of 11. We try numbers of the form $11\cdot n$ where n is a prime number greater than 5. The smallest multiple that meets the criteria is $11\cdot 11$, or 121. This is the number.

Exercise Set 1.9

RC2. True

RC4. False

CC2. $20=2\cdot 2\cdot 5$,

$24=2\cdot 2\cdot 2\cdot 3$

The LCM is $2\cdot 2\cdot 2\cdot 3\cdot 5$, or 120.

CC4. $36=2\cdot 2\cdot 3\cdot 3$,

$600=2\cdot 2\cdot 2\cdot 3\cdot 5\cdot 5$

The LCM is $2\cdot 2\cdot 2\cdot 3\cdot 3\cdot 5\cdot 5$, or 1800.

CC6. $15=3\cdot 5$,

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

$28=2\cdot 2\cdot 7$

$125=5\cdot 5\cdot 5$

The LCM is $2\cdot 2\cdot 2\cdot 3\cdot 5\cdot 5\cdot 5\cdot 7$, or 21,000.

In this section we will find the LCM using the list of multiples method in Exercises 2 - 20 and the prime factorization method in Exercises 22 - 50.

2. a) 15 is a multiple of 3, so it is the LCM.

c) The LCM = 15.

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4. a) 15 is not a multiple of 10.

b) Check multiples:

$2 \cdot 15 = 30$ A multiple of 10

c) The LCM = 30.

6. a) 12 is not a multiple of 8.

b) Check multiples:

$2 \cdot 12 = 24$ A multiple of 8

c) The LCM = 24.

8. a) We notice at the outset that 9 and 11 have no common prime factor. Therefore, the LCM is the product of the two numbers.

c) The LCM = $9 \cdot 11$, or 99.

10. a) 36 is not a multiple of 24.

b) Check multiples:

$2 \cdot 36 = 72$ A multiple of 24

c) The LCM = 72.

12. a) 27 is not a multiple of 21.

b) Check multiples:

$2 \cdot 27 = 54$ Not a multiple of 21
$3 \cdot 27 = 81$ Not a multiple of 21
$4 \cdot 27 = 108$ Not a multiple of 21
$5 \cdot 27 = 135$ Not a multiple of 21
$6 \cdot 27 = 162$ Not a multiple of 21
$7 \cdot 27 = 189$ A multiple of 21

c) The LCM = 189.

14. a) 18 is not a multiple of 12.

b) Check multiples:

$2 \cdot 18 = 36$ A multiple of 12

c) The LCM = 36.

16. a) 45 is not a multiple of 35.

b) Check multiples:

$2 \cdot 45 = 90$ Not a multiple of 35
$3 \cdot 45 = 135$ Not a multiple of 35
$4 \cdot 45 = 180$ Not a multiple of 35
$5 \cdot 45 = 225$ Not a multiple of 35
$6 \cdot 45 = 270$ Not a multiple of 35
$7 \cdot 45 = 315$ A multiple of 35

c) The LCM = 315.

18. a) 20 is not a multiple of 18.

b) Check multiples:

$2 \cdot 20 = 40$ Not a multiple of 18
$3 \cdot 20 = 60$ Not a multiple of 18
$4 \cdot 20 = 80$ Not a multiple of 18
$5 \cdot 20 = 100$ Not a multiple of 18
$6 \cdot 20 = 120$ Not a multiple of 18
$7 \cdot 20 = 140$ Not a multiple of 18
$8 \cdot 20 = 160$ Not a multiple of 18
$9 \cdot 20 = 180$ A multiple of 18

c) The LCM = 180.

20. a) 48 is not a multiple of 36.

b) Check multiples:

$2 \cdot 48 = 96$ Not a multiple of 36
$3 \cdot 48 = 144$ A multiple of 36

c) The LCM = 144.

22. Note that each of the numbers 3, 5, and 7 is prime. They have no common prime factor. When this happens, the LCM is just the product of the numbers.

The LCM is $3 \cdot 5 \cdot 7$, or 105.

24. a) $6 = 2 \cdot 3$
$12 = 2 \cdot 2 \cdot 3$
$18 = 2 \cdot 3 \cdot 3$

b) The LCM is $2 \cdot 2 \cdot 3 \cdot 3$, or 36.

26. a) $8 = 2 \cdot 2 \cdot 2$
$16 = 2 \cdot 2 \cdot 2 \cdot 2$
$22 = 2 \cdot 11$

b) The LCM is $2 \cdot 2 \cdot 2 \cdot 2 \cdot 11$, or 176.

28. a) $12 = 2 \cdot 2 \cdot 3$
$18 = 2 \cdot 3 \cdot 3$
$40 = 2 \cdot 2 \cdot 2 \cdot 5$

b) The LCM is $2 \cdot 2 \cdot 2 \cdot 3 \cdot 3 \cdot 5$, or 360.

30. a) $8 = 2 \cdot 2 \cdot 2$
$16 = 2 \cdot 2 \cdot 2 \cdot 2$
$12 = 2 \cdot 2 \cdot 3$

b) The LCM is $2 \cdot 2 \cdot 2 \cdot 2 \cdot 3$, or 48.

32. a) $18 = 2 \cdot 3 \cdot 3$
$30 = 2 \cdot 3 \cdot 5$
$50 = 2 \cdot 5 \cdot 5$
$48 = 2 \cdot 2 \cdot 2 \cdot 2 \cdot 3$

b) The LCM is $2 \cdot 2 \cdot 2 \cdot 2 \cdot 3 \cdot 3 \cdot 5 \cdot 5$, or 3600.

34. 16 is a factor of 32, so the LCM is 32.

36. 12 is a factor of 72, so the LCM is 72.

38. 13 and 14 have no common prime factor, so the LCM is $13 \cdot 14$, or 182.

40. 23 and 25 have no common prime factor, so the LCM is $23 \cdot 25$, or 575.

42. a) $56 = 2 \cdot 2 \cdot 2 \cdot 7$
$72 = 2 \cdot 2 \cdot 2 \cdot 3 \cdot 3$

b) The LCM is $2 \cdot 2 \cdot 2 \cdot 3 \cdot 3 \cdot 7$, or 504.

44. a) $75 = 3 \cdot 5 \cdot 5$
$100 = 2 \cdot 2 \cdot 5 \cdot 5$

b) The LCM is $2 \cdot 2 \cdot 3 \cdot 5 \cdot 5$, or 300.

46. a) $22 = 2 \cdot 11$
$42 = 2 \cdot 3 \cdot 7$
$51 = 3 \cdot 17$

b) The LCM is $2 \cdot 3 \cdot 7 \cdot 11 \cdot 17$, or 7854.

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48. a) $625 = 5 \cdot 5 \cdot 5 \cdot 5$
$75 = 3 \cdot 5 \cdot 5$
$500 = 2 \cdot 2 \cdot 5 \cdot 5 \cdot 5$
$25 = 5 \cdot 5$

b) The LCM is $2 \cdot 2 \cdot 3 \cdot 5 \cdot 5 \cdot 5 \cdot 5$, or 7500.

50. a) $300 = 2 \cdot 2 \cdot 3 \cdot 5 \cdot 5$
$4000 = 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 5 \cdot 5 \cdot 5$

b) The LCM is $2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 3 \cdot 5 \cdot 5 \cdot 5$, or 12,000.

52. The time it takes Uranus to make a complete revolution, 84 yr, is a multiple of the time it takes Jupiter, 12 yr, so Jupiter and Uranus appear in the same direction in the night sky once every 84 years.

54. Jupiter: $12 = 2 \cdot 2 \cdot 3$

Saturn: $30 = 2 \cdot 3 \cdot 5$

Uranus: $84 = 2 \cdot 2 \cdot 3 \cdot 7$

The LCM is $2 \cdot 2 \cdot 3 \cdot 5 \cdot 7$, or 420. Thus, Jupiter, Saturn, and Uranus will appear in the same direction in the night sky once every 420 years.

56. 1, 2, 4, 23, 46, 92

58. 1, 2, 4, 5, 10, 22, 44, 55, 110, 220

60. $64 \div (16 \div 4) = 64 \div 4 = 16$

62.
$$\begin{array}{r} {\scriptstyle 7\ \ 9\ \ 9\ \ 9\ 14} \\ \cancel{8}\ 0,\ \cancel{0}\ \cancel{0}\ \cancel{4} \\ -\quad 2\ 3\ 0\ 5 \\ \hline 7\ 7,\ 6\ 9\ 9 \end{array}$$

64. $8 = 2 \cdot 2 \cdot 2$
$12 = 2 \cdot 2 \cdot 3$

a) No; the LCM has one more 2 and one less 3.

b) No; the LCM needs one more 2.

c) No; the LCM needs two more 2's and one less 3.

d) Yes; the LCM has three 2's and one 3.

Chapter 1 Vocabulary Reinforcement

1. The distance around an object is its perimeter.

2. Since $20 = 4 \cdot 5$, we say that $4 \cdot 5$ is a factorization of 20.

3. In the sentence $10 \times 1000 = 10,000$, 10 and 1000 are called factors and 10,000 is called the product.

4. The number 0 is called the additive identity.

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

6. The least common multiple of two numbers is the smallest number that is a multiple of both numbers.

7. Since $20 = 4 \cdot 5$, we say that 20 is a multiple of 5.

Chapter 1 Concept Reinforcement

1. $a \div a = \dfrac{a}{a} = 1$, $a \neq 0$; the statement is true.

2. True

3. False; the average of three numbers is the sum of the numbers divided by 3.

4. The statement is false. For example, $1 + 2 = 5$ is not a true equation.

5. The statement is true. If one number is a multiple of the other, the LCM is the larger number. If one number is not a multiple of the other, then the LCM contains each prime factor that appears in either number the greatest number of times it occurs in any one factorization and, thus, is larger than both numbers.

Chapter 1 Study Guide

1. 4 3 $\boxed{2}$, 0 7 9

The digit 2 names the number of thousands.

2. Since 78 is to the left of 81 on the number line, $78 < 81$.

3.
$$\begin{array}{r} {\scriptstyle 1\quad\ \ 1\ 1} \\ 3\ 6,\ 0\ 4\ 7 \\ +\ 2\ 9,\ 2\ 5\ 5 \\ \hline 6\ 5,\ 3\ 0\ 2 \end{array}$$

4.
$$\begin{array}{r} {\scriptstyle 7\ \ 9\ 15} \\ 4\ \cancel{8}\ 0\ \cancel{5} \\ -1\ 5\ 6\ 8 \\ \hline 3\ 2\ 3\ 7 \end{array}$$

5.
$$\begin{array}{rl} {\scriptstyle 2\ 1} & \\ {\scriptstyle 1\ \ \ } & \\ {\scriptstyle 7\ 3} & \\ 6\ 8\ 4 & \\ \times\ 3\ 2\ 9 & \\ \hline 6\ 1\ 5\ 6 & \text{Multiplying by 9} \\ 1\ 3\ 6\ 8\ 0 & \text{Multiplying by 20} \\ 2\ 0\ 5\ 2\ 0\ 0 & \text{Multiplying by 300} \\ \hline 2\ 2\ 5,\ 0\ 3\ 6 & \end{array}$$

6.
$$\begin{array}{r} 3\ 1\ 5 \\ 2\ 7\overline{)\,8\ 5\ 1\ 9} \\ \underline{\ 8\ 1\ \ } \\ \quad 4\ 1 \\ \quad \underline{2\ 7} \\ \quad 1\ 4\ 9 \\ \quad \underline{1\ 3\ 5} \\ \quad\quad 1\ 4 \end{array}$$

The answer is 315 R 14.

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7. Round 36,468 to the nearest thousand.

3 6, $\boxed{4}$ 6 8
↑

The digit 6 is in the thousands place. Consider the next digit to the right. Since the digit, 4, is 4 or lower, round down, meaning that 6 thousands stays as 6 thousands. Then change the digits to the right of the thousands digit to zeros.

The answer is 36,000.

8. $24 \cdot x = 864$

$\frac{24 \cdot x}{24} = \frac{864}{24}$ Dividing by 24

$x = 36$

Check: $24 \cdot x = 864$

$24 \cdot 36 \stackrel{?}{=} 864$

$864 \mid$ TRUE

The solution is 36.

9. $6^3 = 6 \cdot 6 \cdot 6 = 216$

10. We find as many two-factor factorizations as we can.

$104 = 1 \cdot 104$ $104 = 4 \cdot 26$

$104 = 2 \cdot 52$ $104 = 8 \cdot 13$

Factors: 1, 2, 4, 8, 13, 26, 52, 104

11.
$$\begin{array}{r} 1\ 3 \leftarrow 13 \text{ is prime} \\ 2\overline{)\ 2\ 6} \\ 2\overline{)\ 5\ 2} \\ 2\overline{)\ 1\ 0\ 4} \end{array}$$

$104 = 2 \cdot 2 \cdot 2 \cdot 13$

12. $52 = 2 \cdot 2 \cdot 13$

$78 = 2 \cdot 3 \cdot 13$

The LCM is $2 \cdot 2 \cdot 3 \cdot 13$, or 156.

Chapter 1 Review Exercises

1. 4, 6 7 $\boxed{8}$, 9 5 2

The digit 8 means 8 thousands.

2. 1 $\boxed{3}$, 7 6 8, 9 4 0

The digit 3 names the number of millions.

3. 2793 = 2 thousands + 7 hundreds + 9 tens + 3 ones

4. 56,078 = 5 ten thousands + 6 thousands + 0 hundreds + 7 tens + 8 ones, or 5 ten thousands + 6 thousands + 7 tens + 8 ones

5. 4,007,101 = 4 millions + 0 hundred thousands + 0 ten thousands + 7 thousands + 1 hundred + 0 tens + 1 one, or 4 millions + 7 thousands + 1 hundred + 1 one

6. 67 ,819

Sixty-seven thousand,
eight hundred nineteen

7. 2 , 781, 427

Two million,
seven hundred eighty-one thousand,
four hundred twenty-seven

8. Four hundred seventy-six thousand,
five hundred eighty-eight

Standard notation is 476, 588.

9. One billion,
five hundred million,

Standard notation is 1 ,500 ,000,000.

10. Since 67 is to the right of 56 on the number line, $67 > 56$.

11. Since 1 is to the left of 23 on the number line, $1 < 23$.

12.
$$\begin{array}{r} {\scriptstyle 1\quad 1} \\ 7\ 3\ 0\ 4 \\ +\ 6\ 9\ 6\ 8 \\ \hline 1\ 4, 2\ 7\ 2 \end{array}$$

13.
$$\begin{array}{r} {\scriptstyle 1\ 1\quad 1} \\ 2\ 7, 6\ 0\ 9 \\ +\ 3\ 8, 4\ 1\ 5 \\ \hline 6\ 6, 0\ 2\ 4 \end{array}$$

14.
$$\begin{array}{r} {\scriptstyle 1\quad 1} \\ 2\ 7\ 0\ 3 \\ 4\ 1\ 2\ 5 \\ 6\ 0\ 0\ 4 \\ +\ 8\ 9\ 5\ 6 \\ \hline 2\ 1, 7\ 8\ 8 \end{array}$$

15.
$$\begin{array}{r} {\scriptstyle 1\ 1} \\ 9\ 1, 4\ 2\ 6 \\ +\quad 7, 4\ 9\ 5 \\ \hline 9\ 8, 9\ 2\ 1 \end{array}$$

16.
$$\begin{array}{r} {\scriptstyle 13} \\ {\scriptstyle 7\ \ 9\ \ \not{3}\ 15} \\ \not{8}\ 0\ \not{4}\ \not{5} \\ -\ 2\ 8\ 9\ 7 \\ \hline 5\ 1\ 4\ 8 \end{array}$$

17.
$$\begin{array}{r} {\scriptstyle 8\ \ 9\ \ 9\ 11} \\ \not{9}\ 0\ 0\ \not{1} \\ -\ 7\ 3\ 1\ 2 \\ \hline 1\ 6\ 8\ 9 \end{array}$$

18.
$$\begin{array}{r} {\scriptstyle 5\ \ 9\ \ 9\ 13} \\ \not{6}\ 0\ 0\ \not{3} \\ -\ 3\ 7\ 2\ 9 \\ \hline 2\ 2\ 7\ 4 \end{array}$$

19.
$$\begin{array}{r} {\scriptstyle 16\ 13} \\ {\scriptstyle 2\ \not{6}\ \not{3}\ \ 9\ 15} \\ \not{3}\ 7, \not{4}\ 0\ \not{5} \\ -\ 1\ 9, 6\ 4\ 8 \\ \hline 1\ 7, 7\ 5\ 7 \end{array}$$

20.
$$\begin{array}{r} {\scriptstyle 2} \\ 1\ 7, 0\ 0\ 0 \\ \times\quad 3\ 0\ 0 \\ \hline 5, 1\ 0\ 0, 0\ 0\ 0 \end{array}$$

Multiplying by 300
(Write 00 and then
multiply 17,000 by 3.)

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21.
$$\begin{array}{r} {\scriptstyle 6\ 3\ 4} \\ 7\,8\,4\,6 \\ \times\quad 8\,0\,0 \\ \hline 6,2\,7\,6,8\,0\,0 \end{array}$$
Multiplying by 800 (Write 00 and then multiply 7846 by 8.)

22.
$$\begin{array}{r} {\scriptstyle 1\ 3} \\ {\scriptstyle 2\ 5} \\ {\scriptstyle 2\ 4} \\ 7\,2\,6 \\ \times\,6\,9\,8 \\ \hline 5\,8\,0\,8 \\ 6\,5\,3\,4\,0 \\ 4\,3\,5\,6\,0\,0 \\ \hline 5\,0\,6,7\,4\,8 \end{array}$$
Multiplying by 8
Multiplying by 90
Multiplying by 600

23.
$$\begin{array}{r} {\scriptstyle 3\ 2} \\ {\scriptstyle 6\ 4} \\ 5\,8\,7 \\ \times\quad 4\,7 \\ \hline 4\,1\,0\,9 \\ 2\,3\,4\,8\,0 \\ \hline 2\,7,5\,8\,9 \end{array}$$
Multiplying by 7
Multiplying by 40

24.
$$\begin{array}{r} 8\,3\,0\,5 \\ \times\quad 6\,4\,2 \\ \hline 1\,6\,6\,1\,0 \\ 3\,3\,2\,2\,0\,0 \\ 4\,9\,8\,3\,0\,0\,0 \\ \hline 5,3\,3\,1,8\,1\,0 \end{array}$$

25.
$$\begin{array}{r} 1\,2 \\ 5\overline{)\,6\,3} \\ \underline{5} \\ 1\,3 \\ \underline{1\,0} \\ 3 \end{array}$$
The answer is 12 R 3.

26.
$$\begin{array}{r} 5 \\ 1\,6\overline{)\,8\,0} \\ \underline{8\,0} \\ 0 \end{array}$$
The answer is 5.

27.
$$\begin{array}{r} 9\,1\,3 \\ 7\overline{)\,6\,3\,9\,4} \\ \underline{6\,3} \\ 9 \\ \underline{7} \\ 2\,4 \\ \underline{2\,1} \\ 3 \end{array}$$
The answer is 913 R 3.

28.
$$\begin{array}{r} 3\,8\,4 \\ 8\overline{)\,3\,0\,7\,3} \\ \underline{2\,4} \\ 6\,7 \\ \underline{6\,4} \\ 3\,3 \\ \underline{3\,2} \\ 1 \end{array}$$
The answer is 384 R 1.

29.
$$\begin{array}{r} 4 \\ 6\,0\overline{)\,2\,8\,6} \\ \underline{2\,4\,0} \\ 4\,6 \end{array}$$
The answer is 4 R 46.

30.
$$\begin{array}{r} 5\,4 \\ 7\,9\overline{)\,4\,2\,6\,6} \\ \underline{3\,9\,5} \\ 3\,1\,6 \\ \underline{3\,1\,6} \\ 0 \end{array}$$
The answer is 54.

31.
$$\begin{array}{r} 4\,5\,2 \\ 3\,8\overline{)\,1\,7,1\,7\,6} \\ \underline{1\,5\,2} \\ 1\,9\,7 \\ \underline{1\,9\,0} \\ 7\,6 \\ \underline{7\,6} \\ 0 \end{array}$$
The answer is 452.

32.
$$\begin{array}{r} 5\,0\,0\,8 \\ 1\,4\overline{)\,7\,0,1\,1\,2} \\ \underline{7\,0} \\ 1\,1\,2 \\ \underline{1\,1\,2} \\ 0 \end{array}$$
The answer is 5008.

33.
$$\begin{array}{r} 4\,3\,8\,9 \\ 1\,2\overline{)\,5\,2,6\,6\,8} \\ \underline{4\,8} \\ 4\,6 \\ \underline{3\,6} \\ 1\,0\,6 \\ \underline{9\,6} \\ 1\,0\,8 \\ \underline{1\,0\,8} \\ 0 \end{array}$$
The answer is 4389.

34. Round 345,759 to the nearest hundred.

$3\,4\,5,7\,\boxed{5}\,9$
$\uparrow$

The digit 7 is in the hundreds place. Consider the next digit to the right. Since the digit, 5, is 5 or higher, round 7 hundreds up to 8 hundreds. Then change the digits to the right of the hundreds digit to zero.

The answer is 345,800.

35. Round 345,759 to the nearest ten.

$3\,4\,5,7\,5\,\boxed{9}$
$\uparrow$

The digit 5 is in the tens place. Consider the next digit to the right. Since the digit, 9, is 5 or higher, round 5 tens up to 6 tens. Then change the digit to the right of the tens digit to zero.

The answer is 345,760.

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36. Round 345,759 to the nearest thousand.

$$3\ 4\ 5,\ \boxed{7}\ 5\ 9$$
$$\uparrow$$

The digit 5 is in the thousands place. Consider the next digit to the right. Since the digit, 7, is 5 or higher, round 5 thousands up to 6 thousands. Then change the digits to the right of the thousands digit to zero.

The answer is 346,000.

37. Round 345,759 to the nearest hundred thousand.

$$3\ \boxed{4}\ 5,\ 7\ 5\ 9$$
$$\uparrow$$

The digit 3 is in the hundred thousands place. Consider the next digit to the right. Since the digit, 4, is 4 or lower, round down, meaning that 3 hundred thousands stays as 3 hundred thousands. Then change the digits to the right of the hundred thousands digit to zero.

The answer is 300,000.

38.

	Rounded to the nearest hundred
$41,348$	$41,300$
$+\ 19,749$	$+\ 19,700$
	$61,000 \leftarrow$ Estimated answer

39.

	Rounded to the nearest hundred
$38,652$	$38,700$
$-\ 24,549$	$-\ 24,500$
	$14,200 \leftarrow$ Estimated answer

40.

	Rounded to the nearest hundred
396	400
$\times\ 748$	$\times\ 700$
	$280,000 \leftarrow$ Estimated answer

41. $46 \cdot n = 368$

$$\frac{46 \cdot n}{46} = \frac{368}{46}$$
$$n = 8$$

Check:

$$\begin{array}{r|l} 46 \cdot n = 368 & \\ \hline 46 \cdot 8\ ?\ 368 & \\ 368 & \text{TRUE} \end{array}$$

The solution is 8.

42. $47 + x = 92$

$$47 + x - 47 = 92 - 47$$
$$x = 45$$

Check:

$$\begin{array}{r|l} 47 + x = 92 & \\ \hline 47 + 45\ ?\ 92 & \\ 92 & \text{TRUE} \end{array}$$

The solution is 45.

43. $1 \cdot y = 58$

$$y = 58 \qquad (1 \cdot y = y)$$

The number 58 checks. It is the solution.

44. $24 = x + 24$

$$24 - 24 = x + 24 - 24$$
$$0 = x$$

The number 0 checks. It is the solution.

45. Exponential notation for $4 \cdot 4 \cdot 4$ is 4^3.

46. $10^4 = 10 \cdot 10 \cdot 10 \cdot 10 = 10,000$

47. $6^2 = 6 \cdot 6 = 36$

48.

$$\begin{aligned} 8 \cdot 6 + 17 &= 48 + 17 && \text{Multiplying} \\ &= 65 && \text{Adding} \end{aligned}$$

49.

$$\begin{aligned} & 10 \cdot 24 - (18 + 2) \div 4 - (9 - 7) \\ &= 10 \cdot 24 - 20 \div 4 - 2 && \text{Doing the calculations inside the parentheses} \\ &= 240 - 5 - 2 && \text{Multiplying and dividing} \\ &= 235 - 2 && \text{Subtracting from} \\ &= 233 && \text{left to right} \end{aligned}$$

50.

$$\begin{aligned} & (80 \div 16) \times [(20 - 56 \div 8) + (8 \cdot 8 - 5 \cdot 5)] \\ &= 5 \times [(20 - 7) + (64 - 25)] \\ &= 5 \times [13 + 39] \\ &= 5 \times 52 \\ &= 260 \end{aligned}$$

51. We add the numbers and divide by the number of addends.

$$\frac{157 + 170 + 168}{3} = \frac{495}{3} = 165$$

52. ***Familiarize***. Let x = the additional amount of money, in dollars, Natasha needs to buy the desk.

Translate.

$$\underbrace{\text{Money available}}_{\downarrow\ 196} \quad \underbrace{\text{plus}}_{\downarrow\ +} \quad \underbrace{\text{Additional amount}}_{\downarrow\ x} \quad \underbrace{\text{is}}_{\downarrow\ =} \quad \underbrace{\text{Price of desk}}_{\downarrow\ 698}$$

Solve. We subtract 196 on both sides of the equation.

$$196 + x = 698$$
$$196 + x - 196 = 698 - 196$$
$$x = 502$$

Check. We can estimate.

$$196 + 502 \approx 200 + 500 \approx 700 \approx 698$$

The answer checks.

State. Natasha needs $502 dollars.

53. ***Familiarize***. Let b = the balance in Toni's account after the deposit.

Translate.

$$\underbrace{\text{Original balance}}_{\downarrow\ 406} \quad \underbrace{\text{plus}}_{\downarrow\ +} \quad \underbrace{\text{Deposit}}_{\downarrow\ 78} \quad \underbrace{\text{is}}_{\downarrow\ =} \quad \underbrace{\text{New balance}}_{\downarrow\ b}$$

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Solve. We add on the left side.

$$406 + 78 = b$$
$$484 = b$$

Check. We can repeat the calculation. The answer checks.

State. The new balance is \$484.

54. ***Familiarize***. Let $y =$ the year in which the copper content of pennies was reduced.

Original year	plus	73 yr	is	Year of copper reduction
1909	+	73	=	y

Solve. We add on the left side.

$$1909 + 73 = y$$
$$1982 = y$$

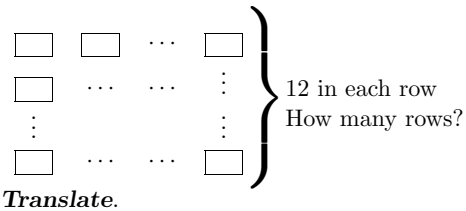
Check. We can estimate.

$$1909 + 73 \approx 1910 + 70 \approx 1980 \approx 1982$$

The answer checks.

State. The copper content of pennies was reduced in 1982.

55. ***Familiarize***. We first make a drawing. Let $c =$ the number of cartons filled.



Translate.

Number of cans	divided by	Number per carton	is	Number of cartons
228	÷	12	=	c

Solve. We carry out the division.

$$\begin{array}{r} 19 \\ 12\overline{)228} \\ 12 \\ \hline 108 \\ 108 \\ \hline 0 \end{array}$$

Thus, $19 = c$, or $c = 19$.

Check. We can check by multiplying: $12 \cdot 19 = 228$. Our answer checks.

State. 19 cartons were filled.

56. ***Familiarize***. This is a multistep problem. Let $s =$ the cost of 13 stoves, $r =$ the cost of 13 refrigerators, and $t =$ the total cost of the stoves and refrigerators.

Translate.

Number of stoves	times	Price per stove	is	Total cost of stoves
13	·	425	=	s

Number of refrigerators	times	Price per refrigerator	is	Total cost of refrigerators
13	·	620	=	r

Cost of stoves	plus	Cost of refrigerators	is	Total cost
s	+	r	=	t

Solve. We first carry out the multiplications in the first two equations.

$$13 \cdot 425 = s \qquad 13 \cdot 620 = r$$
$$5525 = s \qquad 8060 = r$$

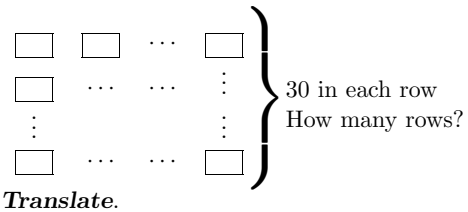
Now we substitute 5525 for s and 8060 for r in the third equation and then add on the left side.

$$s + r = t$$
$$5525 + 8060 = t$$
$$13,585 = t$$

Check. We repeat the calculations. The answer checks.

State. The total cost was \$13,585.

57. ***Familiarize***. Let $b =$ the number of beehives the farmer needs.



Translate.

Number of trees	divided by	Number of trees pollinated by each hive	is	Number of hives needed
420	÷	30	=	b

Solve. We carry out the division.

$$\begin{array}{r} 14 \\ 30\overline{)420} \\ 30 \\ \hline 120 \\ 120 \\ \hline 0 \end{array}$$

Thus, $14 = b$, or $b = 14$.

Check. We can check by multiplying: $30 \cdot 14 = 420$. The answer checks.

State. The farmer needs 14 beehives.

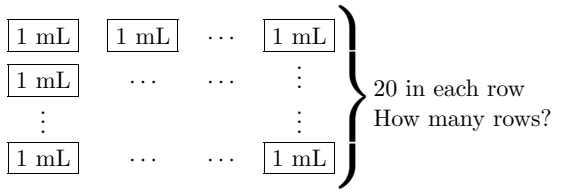
58. $A = l \cdot w = 14 \text{ ft} \cdot 7 \text{ ft} = 98 \text{ square ft}$

$\text{Perimeter} = 14 \text{ ft} + 7 \text{ ft} + 14 \text{ ft} + 7 \text{ ft} = 42 \text{ ft}$

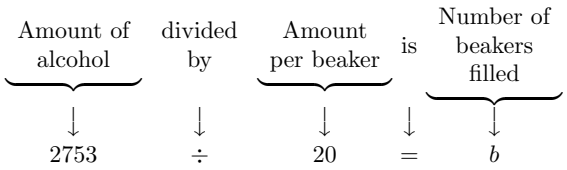
59. ***Familiarize***. We make a drawing. Let $b =$ the number of beakers that will be filled.

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Translate.



Solve. We carry out the division.

$$\begin{array}{r} 137 \\ 20\overline{)2753} \\ 20 \\ \hline 75 \\ 60 \\ \hline 153 \\ 140 \\ \hline 13 \end{array}$$

Thus, 137 R 13 $= b$.

Check. We can check by multiplying the number of beakers by 137 and then adding the remainder, 13.

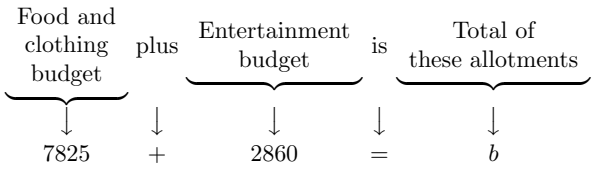
$137 \cdot 20 = 2740$ and $2740 + 13 = 2753$

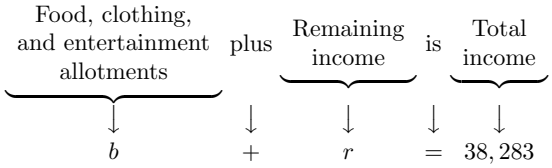
The answer checks.

State. 137 beakers can be filled; 13 mL will be left over.

60. ***Familiarize***. This is a multistep problem. Let $b =$ the total amount budgeted for food, clothing, and entertainment and let $r =$ the income remaining after these allotments.

Translate.





Solve. We add on the left side to solve the first equation.

$$7825 + 2860 = b$$
$$10,685 = b$$

Now we substitute 10,685 for b in the second equation and solve for r.

$$b + r = 38,283$$
$$10,685 + r = 38,283$$
$$10,685 + r - 10,685 = 38,283 - 10,685$$
$$r = 27,598$$

Check. We repeat the calculations. The answer checks.

State. After the allotments for food, clothing, and entertainment, \$27,598 remains.

61. We find as many two-factor factorizations as we can:

$60 = 1 \cdot 60$ $\quad$ $60 = 4 \cdot 15$
$60 = 2 \cdot 30$ $\quad$ $60 = 5 \cdot 12$
$60 = 3 \cdot 20$ $\quad$ $60 = 6 \cdot 10$

Factors: 1, 2, 3, 4, 5, 6, 10, 12, 15, 20, 30, 60

62. We find as many two-factor factorizations as we can:

$176 = 1 \cdot 176$ $\quad$ $176 = 8 \cdot 22$
$176 = 2 \cdot 88$ $\quad$ $176 = 11 \cdot 16$
$176 = 4 \cdot 44$

Factors: 1, 2, 4, 8, 11, 16, 22, 44, 88, 176

63.

$1 \cdot 8 = 8$ $\quad$ $6 \cdot 8 = 48$
$2 \cdot 8 = 16$ $\quad$ $7 \cdot 8 = 56$
$3 \cdot 8 = 24$ $\quad$ $8 \cdot 8 = 64$
$4 \cdot 8 = 32$ $\quad$ $9 \cdot 8 = 72$
$5 \cdot 8 = 40$ $\quad$ $10 \cdot 8 = 80$

64.

$$\begin{array}{r} 84 \\ 11\overline{)924} \\ 88 \\ \hline 44 \\ 44 \\ \hline 0 \end{array}$$

Since the remainder is 0, 924 is divisible by 11.

65.

$$\begin{array}{r} 112 \\ 16\overline{)1800} \\ 16 \\ \hline 20 \\ 16 \\ \hline 40 \\ 32 \\ \hline 8 \end{array}$$

Since the remainder is not 0, 1800 is not divisible by 16.

66. The only factors of 37 are 1 and 37, so 37 is prime.

67. 1 is neither prime nor composite.

68. The number 91 has factors 1, 7, 13, and 91, so it is composite.

69.

$$\begin{array}{rl} 7 & \leftarrow \text{ 7 is prime.} \\ 5\overline{)35} & \\ 2\overline{)70} & \end{array}$$

$70 = 2 \cdot 5 \cdot 7$

70.

$$\begin{array}{rl} 5 & \leftarrow \text{ 5 is prime.} \\ 3\overline{)15} & \\ 2\overline{)30} & \end{array}$$

$30 = 2 \cdot 3 \cdot 5$

71.

$$\begin{array}{rl} 5 & \leftarrow \text{ 5 is prime.} \\ 3\overline{)15} & \\ 3\overline{)45} & \end{array}$$

$45 = 3 \cdot 3 \cdot 5$

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72.
$$\begin{array}{r|l} & 5 \quad \leftarrow \text{ 5 is prime.} \\ 5 & 2\,5 \\ 3 & 7\,5 \\ 2 & 1\,5\,0 \end{array}$$
$150 = 2 \cdot 3 \cdot 5 \cdot 5$

73.
$$\begin{array}{r|l} & 3 \quad \leftarrow \text{ 3 is prime.} \\ 3 & 9 \\ 3 & 2\,7 \\ 3 & 8\,1 \\ 2 & 1\,6\,2 \\ 2 & 3\,2\,4 \\ 2 & 6\,4\,8 \end{array}$$
$648 = 2 \cdot 2 \cdot 2 \cdot 3 \cdot 3 \cdot 3 \cdot 3$

74.
$$\begin{array}{r|l} & 7 \quad \leftarrow \text{ 7 is prime.} \\ 5 & 3\,5 \\ 5 & 1\,7\,5 \\ 5 & 8\,7\,5 \\ 3 & 2\,6\,2\,5 \\ 2 & 5\,2\,5\,0 \end{array}$$
$5250 = 2 \cdot 3 \cdot 5 \cdot 5 \cdot 5 \cdot 7$

75. A number is divisible by 3 if the sum of its digits is divisible by 3. The numbers whose digits add to a multiple of 3 are 4344, 600, 93, 330, 255,555, 780, 2802, and 711.

76. A number is divisible by 2 if its ones digit is even. Thus, the numbers 140, 182, 716, 2432, 4344, 600, 330, 780, and 2802 are divisible by 2.

77. A number is divisible by 4 if the number named by its last two digits is divisible by 4. Thus, the numbers 140, 716, 2432, 4344, 600, and 780 are divisible by 4.

78. A number is divisible by 8 if the number named by its last three digits is divisible by 8. Thus, the numbers 2432, 4344, and 600 are divisible by 8.

79. A number is divisible by 5 if its ones digit is 0 or 5. Thus, the numbers 140, 95, 475, 600, 330, 255,555, and 780 are divisible by 5.

80. A number is divisible by 6 if its one digit is even and the sum of the digits is divisible by 3. The numbers whose ones digits are even are given in Exercise 73 above. Of these numbers, the ones whose digits add to a multiple of 3 are 4344, 600, 330, 780, and 2802.

81. A number is divisible by 9 if the sum of its digits is divisible by 9. The numbers whose digits add to a multiple of 9 are 255,555 and 711.

82. A number is divisible by 10 if its ones digit is 0. Thus, the numbers 140, 600, 330, and 780 are divisible by 10.

83. a) 18 is not a multiple of 12.

b) Check multiples:

$2 \cdot 18 = 36$ A multiple of 12

c) The LCM is 36.

84. a) 45 is not a multiple of 18.

b) Check multiples:

$2 \cdot 45 = 90$ A multiple of 18

c) The LCM is 90.

85. Note that 3 and 6 are factors of 30. Since the largest number, 30, has the other two numbers as factors, it is the LCM.

86. a) Find the prime factorization of each number.

$26 = 2 \cdot 13$
$36 = 2 \cdot 2 \cdot 3 \cdot 3$
$54 = 2 \cdot 3 \cdot 3 \cdot 3$

b) Create a product by writing each factor the greatest number of times it occurs in any one factorization.

The greatest number of times 2 occurs in any one factorization is two times.

The greatest number of times 3 occurs in any one factorization is three times.

The greatest number of times 13 occurs in any one factorization is one time.

Since there are no other prime factors in any of the factorizations, the LCM is $2 \cdot 2 \cdot 3 \cdot 3 \cdot 3 \cdot 13$, or 1404.

87.
$$\begin{aligned} 7 + (4+3)^2 &= 7 + 7^2 \\ &= 7 + 49 \\ &= 56 \end{aligned}$$
Answer B is correct.

88.
$$\begin{aligned} 7 + 4^2 + 3^2 &= 7 + 16 + 9 \\ &= 23 + 9 \\ &= 32 \end{aligned}$$
Answer A is correct.

89.
$$\begin{aligned} & [46 - (4-2) \cdot 5] \div 2 + 4 \\ &= [46 - 2 \cdot 5] \div 2 + 4 \\ &= [46 - 10] \div 2 + 4 \\ &= 36 \div 2 + 4 \\ &= 18 + 4 \\ &= 22 \end{aligned}$$
Answer D is correct.

90.
$$\begin{array}{r|l} & 9\ a\ 1 \\ 2\ b\ 1 & 2\,3\,6{,}4\,2\,1 \end{array}$$
Since $250 \times 1000 = 250,000 \approx 236,421$ we deduce that $2b1 \approx 250$ and $9a1 \approx 1000$. By trial we find that $a = 8$ and $b = 4$.

91. 13 and 31 are both prime numbers, so 13 is a palindrome prime.

19 is prime but 91 is not ($91 = 7 \cdot 13$), so 19 is not a palindrome prime.

16 is not prime ($16 = 2 \cdot 8 = 4 \cdot 4$), so it is not a palindrome prime.

11 is prime and when its digits are reversed we have 11 again, so 11 is a palindrome prime.

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15 is not prime ($15 = 3 \cdot 5$), so it is not a palindrome prime.

24 is not prime ($24 = 2 \cdot 12 = 3 \cdot 8 = 4 \cdot 6$), so it is not a palindrome prime.

29 is prime but 92 is not ($92 = 2 \cdot 46 = 4 \cdot 23$), so 29 is not a palindrome prime.

101 is prime and when its digits are reversed we get 101 again, so 101 is a palindrome prime.

201 is not prime ($201 = 3 \cdot 67$), so it is not a palindrome prime.

37 and 73 are both prime numbers, so 37 is a palindrome prime.

92. At the beginning of each day the tunnel reaches 500 ft − 200 ft, or 300 ft, farther into the mountain than it did the day before. We calculate how far the tunnel reaches into the mountain at the beginning of each day, starting with Day 2.

Day 2: 300 ft

Day 3: 300 ft + 300 ft = 600 ft

Day 4: 600 ft + 300 ft = 900 ft

Day 5: 900 ft + 300 ft = 1200 ft

Day 6: 1200 ft + 300 ft = 1500 ft

We see that the tunnel reaches 1500 ft into the mountain at the beginning of Day 6. On Day 6 the crew tunnels an additional 500 ft, so the tunnel reaches 1500 ft + 500 ft, or 2000 ft, into the mountain. Thus, it takes 6 days to reach the copper deposit.

Chapter 1 Discussion and Writing Exercises

1. $9432 = 9 \cdot 1000 + 4 \cdot 100 + 3 \cdot 10 + 2 \cdot 1 = 9(999 + 1) + 4(99 + 1) + 3(9 + 1) + 2 \cdot 1 = 9 \cdot 999 + 9 \cdot 1 + 4 \cdot 99 + 4 \cdot 1 + 3 \cdot 9 + 3 \cdot 1 + 2 \cdot 1$. Since 999, 99, and 9 are each a multiple of 9, $9 \cdot 999$, $4 \cdot 99$, and $3 \cdot 9$ are multiples of 9. This leaves $9 \cdot 1 + 4 \cdot 1 + 3 \cdot 1 + 2 \cdot 1$, or $9 + 4 + 3 + 2$. If $9 + 4 + 3 + 2$, the sum of the digits, is divisible by 9, then 9432 is divisible by 9.

2. Find the product of two prime numbers.

3. Answers will vary. Anthony is driving from Kansas City to Minneapolis, a distance of 512 miles. He stops for gas after driving 183 miles. How much farther must he drive?

4. The parentheses are not necessary in the expression $9 - (4 \cdot 2)$. Using the rules for order of operations, the multiplication would be performed before the subtraction even if the parentheses were not present.

The parentheses are necessary in the expression $(3 \cdot 4)^2$; $(3 \cdot 4)^2 = 12^2 = 144$, but $3 \cdot 4^2 = 3 \cdot 16 = 48$.

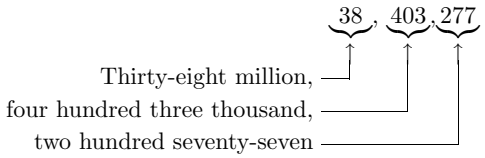
Chapter 1 Test

1. $\boxed{5}\,4\,6,\,7\,8\,9$

The digit 5 tells the number of hundred thousands.

2. 8843 = 8 thousands + 8 hundreds + 4 tens + 3 ones

3.



4.
$$\begin{array}{r} 6\,8\,1\,1 \\ +\,3\,1\,7\,8 \\ \hline 9\,9\,8\,9 \end{array}$$
Add ones, add tens, add hundreds, and then add thousands.

5.
$$\begin{array}{r} {\scriptstyle 1\ 1\ \ \ 1} \\ 4\,5,\,8\,8\,9 \\ +\,1\,7,\,9\,0\,2 \\ \hline 6\,3,\,7\,9\,1 \end{array}$$

6.
$$\begin{array}{r} {\scriptstyle 2\ 1\ 1} \\ 1\,2\,3\,9 \\ \ \ 8\,4\,3 \\ \ \ 3\,0\,1 \\ +\ \ 7\,8\,2 \\ \hline 3\,1\,6\,5 \end{array}$$

7.
$$\begin{array}{r} 6\,2\,0\,3 \\ +\ \ 4\,3\,1\,2 \\ \hline 1\,0,\,5\,1\,5 \end{array}$$

8.
$$\begin{array}{r} 7\,9\,8\,3 \\ -\,4\,3\,5\,3 \\ \hline 3\,6\,3\,0 \end{array}$$
Subtract ones, subtract tens, subtract hundreds, and then subtract thousands.

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

10.
$$\begin{array}{r} {\scriptstyle \ 8\ \ 9\ 17} \\ 8\,\not{9}\,\not{0}\ 7 \\ -\,2\,0\,5\,9 \\ \hline 6\,8\,4\,8 \end{array}$$

11.
$$\begin{array}{r} {\scriptstyle \ \ \ \ 12} \\ {\scriptstyle 1\ \ 2\ \ 9\ 16} \\ 2\,\not{3},\,\not{0}\,\not{6}\ 7 \\ -\,1\,7,\,8\,9\,2 \\ \hline 5\,1\,7\,5 \end{array}$$

12.
$$\begin{array}{r} {\scriptstyle 5\ 6\ 7} \\ 4\,5\,6\,8 \\ \times\ \ \ \ \ 9 \\ \hline 4\,1,\,1\,1\,2 \end{array}$$

13.
$$\begin{array}{r} {\scriptstyle 5\ 4\ 3} \\ 8\,8\,7\,6 \\ \times\,6\,0\,0 \\ \hline 5,\,3\,2\,5,\,6\,0\,0 \end{array}$$
Multiply by 6 hundreds (We write 00 and then multiply 8876 by 6.)

14.
$$\begin{array}{r} 6\,5 \\ \times\,3\,7 \\ \hline 4\,5\,5 \\ 1\,9\,5\,0 \\ \hline 2\,4\,0\,5 \end{array}$$
Multiplying by 7
Multiplying by 30
Adding

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15.
$$\begin{array}{r} 6\,7\,8 \\ \times\ 7\,8\,8 \\ \hline 5\,4\,2\,4 \\ 5\,4\,2\,4\,0 \\ 4\,7\,4\,6\,0\,0 \\ \hline 5\,3\,4,\,2\,6\,4 \end{array}$$

16.
$$4\overline{)\,1\,5}\quad 3,\ 1\,2,\ 3$$

The answer is 3 R 3.

17.
$$6\overline{)\,4\,2\,0}\quad 7\,0,\ 4\,2,\ 0,\ 0$$

The answer is 70.

18.
$$8\,9\overline{)\,8\,6\,3\,3}\quad 9\,7,\ 8\,0\,1,\ 6\,2\,3,\ 6\,2\,3,\ 0$$

The answer is 97.

19.
$$4\,4\overline{)\,3\,5,\,4\,2\,8}\quad 8\,0\,5,\ 3\,5\,2,\ 2\,2\,8,\ 2\,2\,0,\ 8$$

The answer is 805 R 8.

20. Round 34,528 to the nearest thousand.

$$3\,4,\,\boxed{5}\,2\,8$$
$$\uparrow$$

The digit 4 is in the thousands place. Consider the next digit to the right, 5. Since 5 is 5 or higher, round 4 thousands up to 5 thousands. Then change all digits to the right of thousands to zeros.

The answer is 35,000.

21. Round 34,528 to the nearest ten.

$$3\,4,\,5\,2\,\boxed{8}$$
$$\uparrow$$

The digit 2 is in the tens place. Consider the next digit to the right, 8. Since 8 is 5 or higher, round 2 tens up to 3 tens. Then change the digit to the right of tens to zero.

The answer is 34,530.

22. Round 34,528 to the nearest hundred.

$$3\,4,\,5\,\boxed{2}\,8$$
$$\uparrow$$

The digit 5 is in the hundreds place. Consider the next digit to the right, 2. Since 2 is 4 or lower, round down, meaning that 5 hundreds stays as 5 hundreds. Then change all digits to the right of hundreds to zero.

The answer is 34,500.

23.

	Rounded to the nearest hundred
$2\,3,\,6\,4\,9$	$2\,3,\,6\,0\,0$
$+\,5\,4,\,7\,4\,6$	$+\ \ 5\,4,\,7\,0\,0$
	$7\,8,\,3\,0\,0 \leftarrow$ Estimated answer

24.

	Rounded to the nearest hundred
$5\,4,\,7\,5\,1$	$5\,4,\,8\,0\,0$
$-\,2\,3,\,6\,4\,9$	$-\ \ 2\,3,\,6\,0\,0$
	$3\,1,\,2\,0\,0 \leftarrow$ Estimated answer

25.

	Rounded to the nearest hundred
$8\,2\,4$	$8\,0\,0$
$\times\,4\,8\,9$	$\times\,5\,0\,0$
	$4\,0\,0,\,0\,0\,0 \leftarrow$ Estimated answer

26. Since 34 is to the right of 17 on the number line, $34 > 17$.

27. Since 117 is to the left of 157 on the number line, $117 < 157$.

28.
$$28 + x = 74$$
$$28 + x - 28 = 74 - 28 \quad \text{Subtracting 28 on both sides}$$
$$x = 46$$

Check:
$$\begin{array}{r|l} 28 + x = 74 & \\ \hline 28 + 46\ ?\ 74 & \\ 74 & \text{TRUE} \end{array}$$

The solution is 46.

29. $169 \div 13 = n$

We carry out the division.

$$13\overline{)\,1\,6\,9}\quad 1\,3,\ 1\,3,\ 3\,9,\ 3\,9,\ 0$$

The solution is 13.

30.
$$38 \cdot y = 532$$
$$\frac{38 \cdot y}{38} = \frac{532}{38} \quad \text{Dividing by 38 on both sides}$$
$$y = 14$$

Check:
$$\begin{array}{r|l} 38 \cdot y = 532 & \\ \hline 38 \cdot 14\ ?\ 532 & \\ 532 & \text{TRUE} \end{array}$$

The solution is 14.

31.
$$381 = 0 + a$$
$$381 = a \quad \text{Adding on the right side}$$

The solution is 381.

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32. ***Familiarize***. Let s = the number of calories in an 8-oz serving of skim milk.

Translate.

Number of calories in skim milk	plus	How many more calories	is	Number of calories in whole milk
$\downarrow$	$\downarrow$	$\downarrow$	$\downarrow$	$\downarrow$
s	$+$	63	$=$	146

Solve. We subtract 63 on both sides of the equation.

$$s + 63 = 146$$
$$s + 63 - 63 = 146 - 63$$
$$s = 83$$

Check. Since 63 calories more than 83 calories is $83 + 63$, or 146 calories, the answer checks.

State. An 8-oz serving of skim milk contains 83 calories.

33. ***Familiarize***. Let s = the number of staplers that can be filled. We can think of this as repeated subtraction, taking successive sets of 250 staples and putting them into s staplers.

Translate.

Number of staples	divided by	Number in each stapler	is	Number of staplers filled
$\downarrow$	$\downarrow$	$\downarrow$	$\downarrow$	$\downarrow$
5000	$\div$	250	$=$	s

Solve. We carry out the division.

$$\begin{array}{r} 20 \\ 250\overline{)5000} \\ \underline{500} \\ 0 \\ \underline{0} \\ 0 \end{array}$$

Then $20 = s$.

Check. We can multiply the number of staplers filled by the number of staples in each one.

$$20 \cdot 250 = 5000$$

The answer checks.

State. 20 staplers can be filled from a box of 5000 staples.

34. ***Familiarize***. This a multistep problem. Let b = the total cost of the black cartridges, p = the total cost of the photo cartridges, and t = the total cost of the entire purchase.

Translate.

For the black ink cartridges:

Number of black cartridges	times	Price per cartridge	is	Total cost of black cartridges
$\downarrow$	$\downarrow$	$\downarrow$	$\downarrow$	$\downarrow$
3	$\cdot$	15	$=$	b

For the photo cartridges:

Number of photo cartridges	times	Price per cartridge	is	Total cost of photo cartridges
$\downarrow$	$\downarrow$	$\downarrow$	$\downarrow$	$\downarrow$
2	$\cdot$	25	$=$	p

For the total cost of the order:

Cost of black cartridges	plus	Cost of photo cartridges	is	Total cost of purchase
$\downarrow$	$\downarrow$	$\downarrow$	$\downarrow$	$\downarrow$
b	$+$	p	$=$	t

Solve. We solve the first two equations and then add the solutions.

$$3 \cdot 15 = b$$
$$45 = b$$
$$2 \cdot 25 = p$$
$$50 = p$$
$$b + p = t$$
$$45 + 50 = t$$
$$95 = t$$

Check. We repeat the calculations. The answer checks.

State. The total cost of the purchase was \$95.

35. a) We will use the formula Perimeter $= 2 \cdot$ length $+ 2 \cdot$ width to find the perimeter of each pool table in inches. We will use the formula Area $=$ length $\cdot$ width to find the area of each pool table, in sq in.

For the 50 in. by 100 in. table:

$$\text{Perimeter} = 2 \cdot 100 \text{ in.} + 2 \cdot 50 \text{ in.}$$
$$= 200 \text{ in.} + 100 \text{ in.}$$
$$= 300 \text{ in.}$$
$$\text{Area} = 100 \text{ in.} \cdot 50 \text{ in.} = 5000 \text{ sq in.}$$

For the 44 in. by 88 in. table:

$$\text{Perimeter} = 2 \cdot 88 \text{ in.} + 2 \cdot 44 \text{ in.}$$
$$= 176 \text{ in.} + 88 \text{ in.}$$
$$= 264 \text{ in.}$$
$$\text{Area} = 88 \text{ in.} \cdot 44 \text{ in.} = 3872 \text{ sq in.}$$

For the 38 in. by 76 in. table:

$$\text{Perimeter} = 2 \cdot 76 \text{ in.} + 2 \cdot 38 \text{ in.}$$
$$= 152 \text{ in.} + 76 \text{ in.}$$
$$= 228 \text{ in.}$$
$$\text{Area} = 76 \text{ in.} \cdot 38 \text{ in.} = 2888 \text{ sq in.}$$

b) Let a = the number of square inches by which the area of the largest table exceeds the area of the smallest table. We subtract to find a.

$$a = 5000 \text{ sq in.} - 2888 \text{ sq in.} = 2112 \text{ sq in.}$$

36. Exponential notation for $12 \cdot 12 \cdot 12 \cdot 12$ is 12^4.

37. $7^3 = 7 \cdot 7 \cdot 7 = 343$

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38. $10^5 = 10 \cdot 10 \cdot 10 \cdot 10 \cdot 10 = 100,000$

39.
$35 - 1 \cdot 28 \div 4 + 3$
$= 35 - 28 \div 4 + 3$ Doing all multiplications and
$= 35 - 7 + 3$ divisions in order from left to right
$= 28 + 3$ Doing all additions and subtractions
$= 31$ in order from left to right

40.
$10^2 - 2^2 \div 2$
$= 100 - 4 \div 2$ Evaluating the exponential expressions
$= 100 - 2$ Dividing
$= 98$ Subtracting

41.
$(25 - 15) \div 5$
$= 10 \div 5$ Doing the calculation inside the parentheses
$= 2$ Dividing

42.
$2^4 + 24 \div 12$
$= 16 + 24 \div 12$ Evaluating the exponential expression
$= 16 + 2$ Dividing
$= 18$ Adding

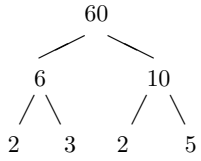
43.
$8 \times \{(20 - 11) \cdot [(12 + 48) \div 6 - (9 - 2)]\}$
$= 8 \times \{9 \cdot [60 \div 6 - 7]\}$
$= 8 \times \{9 \cdot [10 - 7]\}$
$= 8 \times \{9 \cdot 3\}$
$= 8 \times 27$
$= 216$

44. The number 41 is prime. It has only the factors 41 and 1.

45. The number 14 is composite. It has the factors 1, 2, 7, and 14.

46.
$$\begin{array}{r|l} & 3 \\ 3 & 9 \\ 2 & 18 \end{array} \quad \leftarrow \text{ 3 is prime.}$$
$18 = 2 \cdot 3 \cdot 3$

47. We use a factor tree.



$60 = 2 \cdot 3 \cdot 2 \cdot 5$, or $2 \cdot 2 \cdot 3 \cdot 5$

48. 1$\underline{784}$ is divisible by 8 because $\underline{784}$ is divisible by 8.

49. $7 + 8 + 4 = 19$; since 19 is not divisible by 9, 784 is not divisible by 9.

50. 555$\underline{2}$ is not divisible by 5 because the ones digit (2) is not 0 or 5.

51. The ones digit (2) is even; the sum of the digits 2+3+2+2, or 9 is divisible by 3. Thus, 2322 is divisible by 6.

52. We find the LCM using a list of multiples.

a) 16 is not a multiple of 12.

b) Check multiples of 16:

$1 \cdot 16 = 16$ Not a multiple of 12
$2 \cdot 16 = 32$ Not a multiple of 12
$3 \cdot 16 = 48$ A multiple of 12

The LCM = 48.

53. We will find the LCM using prime factorizations.

a) Find the prime factorization of each number.

$15 = 3 \cdot 5$
$40 = 2 \cdot 2 \cdot 2 \cdot 5$
$50 = 2 \cdot 5 \cdot 5$

b) Create a product by writing factors that appear in the factorizations of 15, 40, and 50, using each the greatest number of times it occurs in any one factorization.

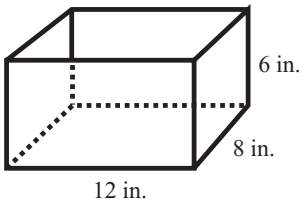
The LCM is $2 \cdot 2 \cdot 2 \cdot 3 \cdot 5 \cdot 5$, or 600.

54. We add the numbers and then divide by the number of addends.

$$\frac{97 + 99 + 87 + 89}{4} = \frac{372}{4} = 93$$

Answer A is correct.

55. ***Familiarize***. We make a drawing.



Observe that the dimensions of two sides of the container are 8 in. by 6 in. The area of each is 8 in. $\cdot$ 6 in. and their total area is $2 \cdot 8$ in. $\cdot$ 6 in. The dimensions of the other two sides are 12 in. by 6 in. The area of each is 12 in. $\cdot$ 6 in. and their total area is $2 \cdot 12$ in. $\cdot$ 6 in. The dimensions of the bottom of the box are 12 in. by 8 in. and its area is 12 in. $\cdot$ 8 in. Let c = the number of square inches of cardboard that are used for the container.

Translate. We add the areas of the sides and the bottom of the container.

$$2 \cdot 8 \text{ in.} \cdot 6 \text{ in.} + 2 \cdot 12 \text{ in.} \cdot 6 \text{ in.} + 12 \text{ in.} \cdot 8 \text{ in.} = c$$

Solve. We carry out the calculation.

$$2 \cdot 8 \text{ in.} \cdot 6 \text{ in.} + 2 \cdot 12 \text{ in.} \cdot 6 \text{ in.} + 12 \text{ in.} \cdot 8 \text{ in.} = c$$
$$96 \text{ sq in.} + 144 \text{ sq in.} + 96 \text{ sq in.} = c$$
$$336 \text{ sq in.} = c$$

Check. We can repeat the calculations. The answer checks.

State. 336 sq in. of cardboard are used for the container.

56. We can reduce the number of trials required by simplifying the expression on the left side of the equation and then using the addition principle.

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$$
\begin{aligned}
359 - 46 + a \div 3 \times 25 - 7^2 &= 339 \\
359 - 46 + a \div 3 \times 25 - 49 &= 339 \\
359 - 46 + \frac{a}{3} \times 25 - 49 &= 339 \\
359 - 46 + \frac{25 \cdot a}{3} - 49 &= 339 \\
313 + \frac{25 \cdot a}{3} - 49 &= 339 \\
264 + \frac{25 \cdot a}{3} &= 339 \\
264 + \frac{25 \cdot a}{3} - 264 &= 339 - 264 \\
\frac{25 \cdot a}{3} &= 75
\end{aligned}
$$

We see that when we multiply a by 25 and divide by 3, the result is 75. By trial, we find that $\frac{25 \cdot 9}{3} = \frac{225}{3} = 75$, so $a = 9$. We could also reason that since $75 = 25 \cdot 3$ and $9/3 = 3$, we have $a = 9$.

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