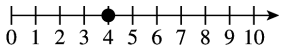
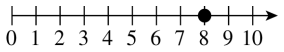
CHAPTER 1 REVIEW OF REAL NUMBERS

1.1 QUICK CHECK

1. a) 

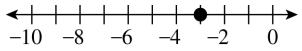
b) 

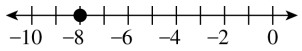
2. a) $8 > 3$

b) $19 < 23$

3. a) $7 < 10$

b) $13 > 11$

4. a) 

b) 

5. a) The opposite of 9 is -9.

b) The opposite of 2 is -2.

6. a) The opposite of -12 is 12.

b) The opposite of -8 is 8.

7. a) $4 > -6$

b) $-9 < 7$

8. a) $-14 < -11$

b) $-5 > -9$

9. a) $|8| = 8$

b) $|32| = 8$

10. a) $|-9| = 9$

b) $|-40| = 40$

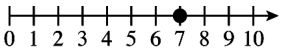
1.1 INTEGERS, OPPOSITES, AND ABSOLUTE VALUE

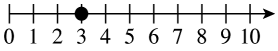
1. empty set

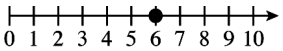
2. less

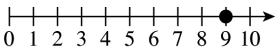
3. infinity

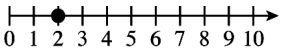
4. right

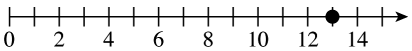
5. 

6. 

7. 

8. 

9. 

10. 

11. $3 < 13$

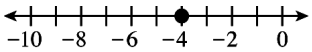
12. $7 < 9$

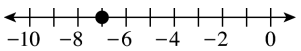
13. $8 > 6$

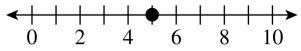
14. $12 > 5$

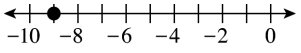
15. $45 > 42$

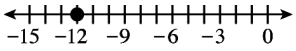
16. $33 < 37$

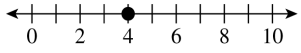
17. 

18. 

19. 

20. 

21. 

22. 

23. 7

24. −5

25. −22

26. 13

27. 0

28. 39

29. $-6 > -10$

30. $-8 < -7$

31. $-18 < -12$

32. $-13 > -20$

33. $-14 < 4$

34. $3 > -15$

35. $22 > -26$

36. $-9 < 5$

37. $|-19| = 19$

38. $|0| = 0$

39. $|12| = 12$

40. $|-8| = 8$

41. $|-5| = 5$

42. $|-9| = 9$

43. $-|5| = -5$

44. $-|9| = -9$

45. $-|-23| = -23$

46. $-|-34| = -34$

47. Since $|-8| = 8$, $|-8| > 4$.

48. Since $|-13| = 13$ $-13 < |-13|$.

49. Since $|10| = 10$ and $|-15| = 15$, $|10| < |-15|$.

50. Since $|-19| = 19$ and $|12| = 12$, $|-19| > |12|$.

51. Since $-|-30| = -30$ and $|-22| = 22$, $-|-30| < |-22|$.

52. Since $|-16| = 16$ and $-|16| = -16$, $|-16| > -|16|$.

53. A, B, C, D

54. C, D

55. B, C, D

56. D

57. C, D

58. A, B, C, D

59. $|-6| = 6$ and $|6| = 6$, so -6 and 6 both work.

60. $|-13| = 13$ and $|13| = 13$, so -13 and 13 both work.

61. No number works.

62. $|0| = 0$, so 0 works.

63. $|-8| + 5 = 8 + 5 = 13$ and $|8| + 5 = 8 + 5 = 13$, so -8 and 8 both work.

64. $2 \cdot |-10| - 3 = 2 \cdot 10 - 3 = 17$ and $2 \cdot |10| - 3 = 2 \cdot 10 - 3 = 17$ so -10 and 10 both work.

65. No, the absolute value of 0 is not positive.

66. True. Answers will vary. Example: Since the opposite of a positive number is negative and the opposite of a negative number is positive, the opposite of the opposite of a number is the number itself.

67. Negative. Explanations will vary. Example: The opposite of a negative number is positive. Also, the absolute value of a negative number is positive.

68. Negative. Explanations will vary. Example: The opposite of a negative number is positive and all positive numbers are larger than all negative numbers.

69. Positive integers are graphed to the right of 0, while negative integers are graphed to the left of 0.

70. The opposite of a number is the number on the opposite side of 0 on the number line that is the same distance away from 0, while the absolute value of a number is simply the number's distance from 0 on the number line.

71. -7 is to the left of -2 on a number line.

72. The set of whole numbers is the same as the set of integers, but with no negative numbers.

1.2 QUICK CHECK

1. a) $14+(-6)=|14|-|-6|=14-6=8$

b) $-5+11=|11|-|-5|=11-5=6$

2. a) $4+(-17)=|4|-|-17|=4-17=-13$

b) $-8+20=|20|-|-8|=20-8=12$

3. a) $-2+(-9)=-(2+9)=-11$

b) $-6+(-8)=-(6+8)=-14$

4. a) $11-(-7)=11+7=18$

b) $15-(-10)=15+10=25$

5. a)
$$\begin{aligned}&14-9-(-22)-6+(-30)+5\\&=14-9+22-6-30+5\\&=41-45\\&=-4\end{aligned}$$

b)
$$\begin{aligned}&-7-20+6-(-19)+4+(-16)\\&=-7-20+6+19+4-16\\&=29-43\\&=-14\end{aligned}$$

6. a) $10(-6)=-60$

b) $-9(8)=-72$

7. a) $(-7)(-9)=63$

b) $(-5)(-14)=70$

8. a)
$$\begin{aligned}-4(-10)(5)(-2)&=40(5)(-2)\\&=200(-2)\\&=-400\end{aligned}$$

b)
$$\begin{aligned}&6(-4)(-3)(5)(-2)(-4)\\&=-24(-3)(5)(-2)(-4)\\&=72(5)(-2)(-4)\\&=360(-2)(-4)\\&=-720(-4)\\&=2880\end{aligned}$$

9. a) $(-88)\div(-11)=8$

b) $(-56)\div(-8)=7$

10. a) $72\div(-8)=-9$

b) $(-40)\div 4=-10$

1.2 OPERATIONS WITH INTEGERS

1. larger

2. negative

3. positive

4. negative

5. positive

6. odd

7. divisor

8. undefined

9. $5+(-9)=5-9=-4$

10. $10+(-7)=10-7=3$

11. $17+(-24)=17-24=-7$

12. $38+(-62)=38-62=-24$

13. $(-8)+3=-8+3=-5$

14. $(-6)+12=-6+12=6$

15. $-13+45=32$

16. $-21+17=-4$

17. $7+(-10)=7-10=-3$

18. $-14+(-14)=-14-14=-28$

19. $8-6=2$

20. $13-9=4$

21. $5-11=-6$

22. $4-12=-8$

23. $(-5)-3=-5-3=-8$

24. $(-9)-6=-9-6=-15$

25. $-9-13=-22$

26. $-47-16=-63$

27. $36-(-25)=36+25=61$

28. $64-(-19)=64+19=83$

29. $-42-(-33)=-42+33=-9$

30. $-27-(-60)=-27+60=33$

31. $5-7-17=5-24=-19$

32. $-9+11-30=11-39=-28$

33. $-8+4-11=4-19=-15$

34. $-13-9+40=40-22=18$

35. $6-(-16)+5=6+16+5=27$

36. $18-21-(-62)=18-21+62=80-21=59$

37. $4+(-15)-13-(-25)=4-15-13+25$
$=29-28$
$=1$

38. $-13+(-12)-(-1)-29=-13-12+1-29$
$=1-54$
$=-53$

39. $\$30-\$22=\$8$

40. $\$60-\$85=-\$25$

41. $-8^{\circ}\text{C}+12^{\circ}\text{C}=4^{\circ}\text{C}$

42. $-4+(-2)+3+(-6)=-4-2+3-6=3-12=-9$

43. $1750-(-400)=1750+400=2150$ feet

44. $\$374+\$80=\$454$

45. $9(-3)=-27$

46. $-7(8)=-56$

47. $-6\cdot 11=-66$

48. $-9(-6)=54$

49. $-14(-17)=238$

50. $-13\cdot 12=-156$

51. $82(-1)=-82$

52. $-1\cdot 19=-19$

53. $-6\cdot 0=0$

54. $0(-240)=0$

55. $-6(-3)(5)=18(5)=90$

56. $-2(-4)(-8)=8(-8)=-64$

57. $5\cdot 3(-2)(-6)=15(-2)(-6)=(-30)(-6)=180$

58. $-7\cdot 2(-7)(-2)=-14(-7)(-2)=98(-2)=-196$

59. $36\div(-4)=-9$

60. $49\div(-7)=-7$

61. $-54\div 6=-9$

62. $-84\div 4=-21$

63. $-56\div(-8)=7$

64. $-91\div(-13)=7$

65. $126\div(-9)=-14$

66. $-420\div 14=-30$

67. $0\div(-13)=0$

68. $0\div 11=0$

69. $29\div 0$ undefined

70. $-15\div 0$ undefined

71. $-11(-12)=132$

72. $126 \div (-6) = -21$

73. $5 - 13 = -8$

74. $5(-13) = -65$

75. $17 - (-11) - 49 = 17 + 11 - 49 = 28 - 49 = -21$

76. $8(-7)(-6) = (-56)(-6) = 336$

77. $-432 \div 3 = -144$

78. $-5 \cdot 17 = -85$

79. $9(-24) = -216$

80. $9 + (-24) = 9 - 24 = -15$

81. $5 \cdot 3(-17)(-29)(0) = 0$

82. $-16 + (-11) - 42 - (-58) = -16 - 11 - 42 + 58$
$= 58 - 69$
$= -11$

83. $4(23) = 92$
The total bill was \$92.

84. $13{,}500 \div 3 = 4500$
Each person lost \$4500.

85. $700(-5) + 800(4) = -3500 + 3200 = -300$
Tina's net income is $-\$300$.

86. $-3(30 + 20) = -3(50) = -150$
The company lost \$150 million in 2014.

87. $? + (-21) = -19$
$? - 21 = -19$
Since $2 - 21 = -19$, 2 is the integer.

88. $? - 44 = -18$
Since $26 - 44 = -18$, 26 is the integer.

89. $? \div (-7) = 19$
Since $-133 \div (-7) = 19$, -133 is the integer.

90. $? \cdot (-2) + 33 = -87$
$? \cdot (-2) = -120$
Since $60 \cdot (-2) = -120$, 60 is the integer.

91. True

92. True

93. True

94. False. Answers will vary. Example:
$3 - 5 = -2$; -2 is not a whole number.

95. Explanations will vary. Example:
Taking away the negative number -5 from 11 is equivalent to adding the positive number 5 to 11.

96. Explanations will vary. Example:
Multiplying a positive times a negative is like taking the opposite of a positive, which results in a negative.

97. Explanations will vary. Example:
It is the opposite of the product of a positive integer and a negative integer.

98. Explanations will vary. Example:
Suppose $7 \div 0 = a$ for some real number a. In that case $a \cdot 0 = 7$, but there is no real number that can by multiplied by 0 to equal 7. So we say division by 0 is undefined.

99. Find the sum of the absolute values of the numbers. The result is negative.

100. The sign of the sum is the same as the sign of the number with the larger absolute value.

101. If the two numbers have opposite signs we find the difference of the absolute values of the two numbers. If both numbers have the same sign we find the sum of their absolute values.

102. b, e

1.3 QUICK CHECK

1. a) $1 \cdot 36 = 36$
$2 \cdot 18 = 36$
$3 \cdot 12 = 36$
$4 \cdot 9 = 36$
$6 \cdot 6 = 36$
$\{1, 2, 3, 4, 6, 9, 12, 18, 36\}$

b) $1 \cdot 40 = 40$
$2 \cdot 20 = 40$
$4 \cdot 10 = 40$
$5 \cdot 8 = 40$
$\{1, 2, 4, 5, 8, 10, 20, 40\}$

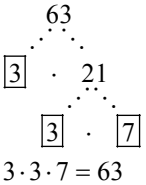
2. a) i) Composite, since $3 \cdot 19 = 57$.

ii) Prime

b) i) Prime

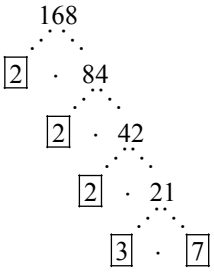
ii) Composite, since $4 \cdot 12 = 48$.

3. a)



$3 \cdot 3 \cdot 7 = 63$

b)



$2 \cdot 2 \cdot 2 \cdot 3 \cdot 7 = 168$

4. a) $\dfrac{45}{210} = \dfrac{\cancel{3}^{1} \cdot 3 \cdot \cancel{5}^{1}}{2 \cdot \cancel{3}_{1} \cdot \cancel{5}_{1} \cdot 7} = \dfrac{3}{14}$

b) $\dfrac{105}{350} = \dfrac{3 \cdot \cancel{5}^{1} \cdot \cancel{7}^{1}}{2 \cdot \cancel{5}_{1} \cdot 5 \cdot \cancel{7}_{1}} = \dfrac{3}{10}$

5. a) $\dfrac{12}{168} = \dfrac{\cancel{2}^{1} \cdot \cancel{2}^{1} \cdot \cancel{3}^{1}}{\cancel{2}_{1} \cdot \cancel{2}_{1} \cdot 2 \cdot \cancel{3}_{1} \cdot 7} = \dfrac{1}{14}$

b) $\dfrac{24}{384} = \dfrac{\cancel{2}^{1} \cdot \cancel{2}^{1} \cdot \cancel{2}^{1} \cdot \cancel{3}^{1}}{\cancel{2}_{1} \cdot \cancel{2}_{1} \cdot \cancel{2}_{1} \cdot 2 \cdot 2 \cdot 2 \cdot \cancel{3}_{1}} = \dfrac{1}{16}$

6. a) $\dfrac{121}{13}$ $\quad 13\overline{)121}$ $\quad \dfrac{121}{13} = 9\dfrac{4}{13}$

$\underline{-117}$

4

b) $\dfrac{89}{12}$ $\quad 12\overline{)89}$ $\quad \dfrac{89}{12} = 7\dfrac{5}{12}$

$\underline{-84}$

5

7. a) $8\dfrac{1}{6} = \dfrac{6 \cdot 8 + 1}{6} = \dfrac{48 + 1}{6} = \dfrac{49}{6}$

b) $9\dfrac{3}{8} = \dfrac{8 \cdot 9 + 3}{8} = \dfrac{72 + 3}{8} = \dfrac{75}{8}$

1.3 FRACTIONS

1. factor set

2. prime

3. composite

4. The prime factorization of a natural number is its expression as a product of prime numbers.

5. top

6. bottom

7. common factors

8. proper

9. improper

10. mixed number

11. No, since there is no number x such that $7 \cdot x = 247$.

12. Yes, since $13 \cdot 21 = 273$.

13. Yes, since $6 \cdot 806 = 4836$.

14. No, since there is no number x such that $9 \cdot x = 32,057$.

15. Yes, since $15 \cdot 189 = 2835$.

16. No, since there is no number x such that $103 \cdot x = 1754$.

17. $1 \cdot 48 = 48$
$2 \cdot 24 = 48$
$3 \cdot 16 = 48$
$4 \cdot 12 = 48$
$6 \cdot 8 = 48$
$\{1, 2, 3, 4, 6, 8, 12, 16, 24, 48\}$

18. $1 \cdot 60 = 60$
$2 \cdot 30 = 60$
$3 \cdot 20 = 60$
$4 \cdot 15 = 60$
$5 \cdot 12 = 60$
$6 \cdot 10 = 60$
$\{1, 2, 3, 4, 5, 6, 10, 12, 15, 20, 30, 60\}$

19. $1 \cdot 27 = 27$
$3 \cdot 9 = 27$
$\{1, 3, 9, 27\}$

20. $1 \cdot 15 = 15$
$3 \cdot 5 = 15$
$\{1, 3, 5, 15\}$

21. $1 \cdot 20 = 20$
$2 \cdot 10 = 20$
$4 \cdot 5 = 20$
$\{1, 2, 4, 5, 10, 20\}$

22. $1 \cdot 16 = 16$
$2 \cdot 8 = 16$
$4 \cdot 4 = 16$
$\{1, 2, 4, 8, 16\}$

23. $1 \cdot 96 = 96$
$2 \cdot 48 = 96$
$3 \cdot 32 = 96$
$4 \cdot 24 = 96$
$6 \cdot 16 = 96$
$8 \cdot 12 = 96$
$\{1, 2, 3, 4, 6, 8, 12, 16, 24, 32, 48, 96\}$

24. $1 \cdot 75 = 75$
$3 \cdot 25 = 75$
$5 \cdot 15 = 75$
$\{1, 3, 5, 15, 25, 75\}$

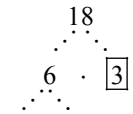
25. $1 \cdot 107 = 107$
$\{1, 107\}$

26. $1 \cdot 37 = 37$
$\{1, 37\}$

27. $1 \cdot 143 = 143$
$11 \cdot 13 = 143$
$\{1, 11, 13, 143\}$

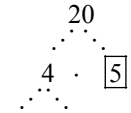
28. $1 \cdot 91 = 91$
$7 \cdot 13 = 91$
$\{1, 7, 13, 91\}$

29.



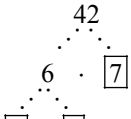
$2 \cdot 3 \cdot 3 = 18$

30.



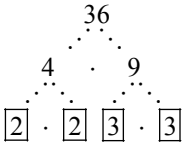
$2 \cdot 2 \cdot 5 = 20$

31.



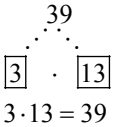
$2 \cdot 3 \cdot 7 = 42$

32.



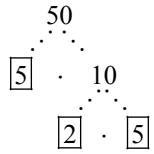
$2 \cdot 2 \cdot 3 \cdot 3 = 36$

33.



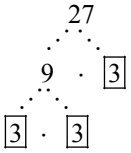
$3 \cdot 13 = 39$

34.



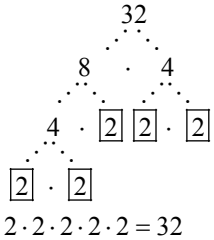
$2 \cdot 5 \cdot 5 = 50$

35.



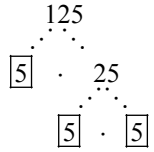
$3 \cdot 3 \cdot 3 = 27$

36.



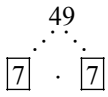
$2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 = 32$

37.



$5 \cdot 5 \cdot 5 = 125$

38.

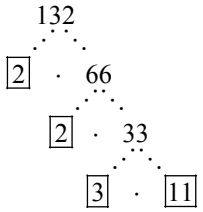


$7 \cdot 7 = 49$

39. 103 is prime.

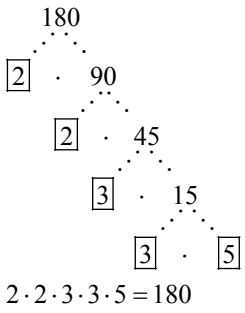
40. 79 is prime.

41.



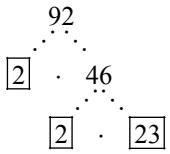
$2 \cdot 2 \cdot 3 \cdot 11 = 132$

42.



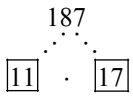
$2 \cdot 2 \cdot 3 \cdot 3 \cdot 5 = 180$

43.



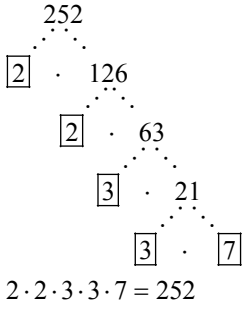
$2 \cdot 2 \cdot 23 = 92$

44.



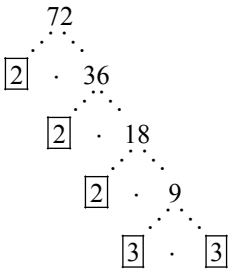
$11 \cdot 17 = 187$

45.



$2 \cdot 2 \cdot 3 \cdot 3 \cdot 7 = 252$

46.



$2 \cdot 2 \cdot 2 \cdot 3 \cdot 3 = 72$

47. $\dfrac{10}{16} = \dfrac{\cancel{2}^{1} \cdot 5}{\cancel{2}_{1} \cdot 2 \cdot 2 \cdot 2} = \dfrac{5}{8}$

48. $\dfrac{35}{42} = \dfrac{5 \cdot \cancel{7}^{1}}{2 \cdot 3 \cdot \cancel{7}_{1}} = \dfrac{5}{6}$

49. $\dfrac{9}{45} = \dfrac{\cancel{3}^{1} \cdot \cancel{3}^{1}}{\cancel{3}_{1} \cdot \cancel{3}_{1} \cdot 5} = \dfrac{1}{5}$

50. $\dfrac{38}{2} = \dfrac{\cancel{2}^{1} \cdot 19}{\cancel{2}_{1}} = \dfrac{19}{1} = 19$

51. $\dfrac{168}{378} = \dfrac{\cancel{2}^{1} \cdot 2 \cdot 2 \cdot \cancel{3}^{1} \cdot \cancel{7}^{1}}{\cancel{2}_{1} \cdot 3 \cdot 3 \cdot \cancel{3}_{1} \cdot \cancel{7}_{1}} = \dfrac{4}{9}$

52. $\dfrac{60}{84} = \dfrac{\cancel{2}^{1} \cdot \cancel{2}^{1} \cdot \cancel{3}^{1} \cdot 5}{\cancel{2}_{1} \cdot \cancel{2}_{1} \cdot \cancel{3}_{1} \cdot 7} = \dfrac{5}{7}$

53. $\dfrac{45}{56}$ does not simplify further.

54. $\dfrac{60}{126} = \dfrac{\cancel{2}^{1} \cdot 2 \cdot \cancel{3}^{1} \cdot 5}{\cancel{2}_{1} \cdot \cancel{3}_{1} \cdot 3 \cdot 7} = \dfrac{10}{21}$

55. $\dfrac{88}{104} = \dfrac{\cancel{2}^{1} \cdot \cancel{2}^{1} \cdot \cancel{2}^{1} \cdot 11}{\cancel{2}_{1} \cdot \cancel{2}_{1} \cdot \cancel{2}_{1} \cdot 13} = \dfrac{11}{13}$

56. $\dfrac{105}{132} = \dfrac{\cancel{3}^{1} \cdot 5 \cdot 7}{2 \cdot 2 \cdot \cancel{3}_{1} \cdot 11} = \dfrac{35}{44}$

57. $\dfrac{35}{119} = \dfrac{5 \cdot \cancel{7}^{1}}{\cancel{7}_{1} \cdot 17} = \dfrac{5}{17}$

58. $\dfrac{84}{360} = \dfrac{\cancel{2}^{1} \cdot \cancel{2}^{1} \cdot \cancel{3}^{1} \cdot 7}{\cancel{2}_{1} \cdot \cancel{2}_{1} \cdot 2 \cdot \cancel{3}_{1} \cdot 3 \cdot 5} = \dfrac{7}{30}$

59. $9\dfrac{2}{3} = \dfrac{3 \cdot 9 + 2}{3} = \dfrac{27 + 2}{3} = \dfrac{29}{3}$

60. $8\dfrac{4}{7} = \dfrac{7 \cdot 8 + 4}{7} = \dfrac{56 + 4}{7} = \dfrac{60}{7}$

61. $6\dfrac{15}{19} = \dfrac{19 \cdot 6 + 15}{19} = \dfrac{114 + 15}{19} = \dfrac{129}{19}$

62. $5\dfrac{1}{18} = \dfrac{18 \cdot 5 + 1}{18} = \dfrac{90 + 1}{18} = \dfrac{91}{18}$

63. $15\dfrac{11}{12} = \dfrac{12 \cdot 15 + 11}{12} = \dfrac{180 + 11}{12} = \dfrac{191}{12}$

64. $14\dfrac{19}{21} = \dfrac{21 \cdot 14 + 19}{21} = \dfrac{294 + 19}{21} = \dfrac{313}{21}$

65. $\dfrac{53}{4}$

$$4\overline{)53}\quad \begin{array}{r} 13 \\ -4 \\ \hline 13 \\ -12 \\ \hline 1 \end{array}$$

$\dfrac{53}{4} = 13\dfrac{1}{4}$

66. $\dfrac{97}{8}$

$$8\overline{)97}\quad \begin{array}{r} 12 \\ -8 \\ \hline 17 \\ -16 \\ \hline 1 \end{array}$$

$\dfrac{97}{8} = 12\dfrac{1}{8}$

67. $\dfrac{65}{5}$

$$5\overline{)65}\quad \begin{array}{r} 13 \\ -5 \\ \hline 15 \\ -15 \\ \hline 0 \end{array}$$

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

68. $\dfrac{162}{9}$

$$9\overline{)162}\quad \begin{array}{r} 18 \\ -9 \\ \hline 72 \\ -72 \\ \hline 0 \end{array}$$

$\dfrac{162}{9} = 18$

69. $\dfrac{192}{17}$

$$17\overline{)192}\quad \begin{array}{r} 11 \\ -17 \\ \hline 22 \\ -17 \\ \hline 5 \end{array}$$

$\dfrac{192}{17} = 11\dfrac{5}{17}$

70. $\dfrac{204}{13}$

$$13\overline{)204}\quad \begin{array}{r} 15 \\ -13 \\ \hline 74 \\ -65 \\ \hline 9 \end{array}$$

$\dfrac{204}{13} = 15\dfrac{9}{13}$

71. Answers will vary. Example:

$\dfrac{3}{4} \cdot \dfrac{2}{2} = \dfrac{6}{8}$

$\dfrac{3}{4} \cdot \dfrac{3}{3} = \dfrac{9}{12}$

$\dfrac{3}{4} \cdot \dfrac{4}{4} = \dfrac{12}{16}$

$\dfrac{3}{4} \cdot \dfrac{5}{5} = \dfrac{15}{20}$

$\dfrac{6}{8}, \dfrac{9}{12}, \dfrac{12}{16}, \dfrac{15}{20}$

72. Answers will vary. Example:

$1\dfrac{2}{3} = \dfrac{5}{3}$

$\dfrac{5}{3} \cdot \dfrac{2}{2} = \dfrac{10}{6}$

$\dfrac{5}{3} \cdot \dfrac{3}{3} = \dfrac{15}{9}$

$\dfrac{5}{3} \cdot \dfrac{4}{4} = \dfrac{20}{12}$

$\dfrac{5}{3}, \dfrac{10}{6}, \dfrac{15}{9}, \dfrac{20}{12}$

73. Answers will vary. Example: 30, 42, 70, 105

74. Answers will vary. Example: 101, 103, 107, 109

75. Answers will vary. Example:
A real-world situation involving a fraction is cooking with $\frac{1}{3}$ cup of oil. A real-world situation involving a mixed number is sawing $4\frac{1}{2}$ inches from the length of a board.

76. Answers will vary. Example:
It is much easier for a carpenter to measure $9\frac{1}{2}$ feet as opposed to $\frac{19}{2}$ feet.

77. The factor set is a list of all of that number's factors, while the prime factorization is a product of prime numbers that is equal to the natural number.

78. If there are no natural numbers other than 1 and the number that divide evenly into the number, then it is prime.

79. Divide the numerator and denominator of the fraction by their common factors.

80. $\frac{5}{1}$, because $\frac{5}{1}$ is equivalent to $5 \div 1$ or 5.

1.4 QUICK CHECK

1. a) $\frac{\cancel{10}^{5}}{\cancel{63}_{7}} \cdot \frac{\cancel{9}^{1}}{\cancel{16}_{8}} = \frac{5}{7} \cdot \frac{1}{8} = \frac{5}{56}$

b) $\frac{\cancel{8}^{2}}{\cancel{45}_{5}} \cdot \frac{\cancel{27}^{3}}{\cancel{28}_{7}} = \frac{2}{5} \cdot \frac{3}{7} = \frac{6}{35}$

2. a) $2\frac{2}{3} \cdot 8\frac{5}{8} = \frac{8}{3} \cdot \frac{69}{8} = \frac{\cancel{8}^{1}}{\cancel{3}_{1}} \cdot \frac{\cancel{69}^{23}}{\cancel{8}_{1}} = 23$

b) $7\frac{1}{5} \cdot 3\frac{3}{4} = \frac{36}{5} \cdot \frac{15}{4} = \frac{\cancel{36}^{9}}{\cancel{5}_{1}} \cdot \frac{\cancel{15}^{3}}{\cancel{4}_{1}} = 27$

3. a) $\frac{12}{25} \div \frac{63}{10} = \frac{12}{25} \cdot \frac{10}{63} = \frac{\cancel{12}^{4}}{\cancel{25}_{5}} \cdot \frac{\cancel{10}^{2}}{\cancel{63}_{21}} = \frac{8}{105}$

b) $\frac{9}{32} \div \frac{21}{20} = \frac{9}{32} \cdot \frac{20}{21} = \frac{\cancel{9}^{3}}{\cancel{32}_{8}} \cdot \frac{\cancel{20}^{5}}{\cancel{21}_{7}} = \frac{15}{56}$

4. a)
$$\begin{aligned} \frac{20}{21} \div 2\frac{2}{3} &= \frac{20}{21} \div \frac{8}{3} \\ &= \frac{20}{21} \cdot \frac{3}{8} \\ &= \frac{\cancel{20}^{5}}{\cancel{21}_{7}} \cdot \frac{\cancel{3}^{1}}{\cancel{8}_{2}} \\ &= \frac{5}{14} \end{aligned}$$

b)
$$\begin{aligned} 4\frac{1}{5} \div 3\frac{3}{10} &= \frac{21}{5} \div \frac{33}{10} \\ &= \frac{21}{5} \cdot \frac{10}{33} \\ &= \frac{\cancel{21}^{7}}{\cancel{5}_{1}} \cdot \frac{\cancel{10}^{2}}{\cancel{33}_{11}} \\ &= \frac{14}{11} \\ &= 1\frac{3}{11} \end{aligned}$$

5. a) $\frac{17}{20} - \frac{5}{20} = \frac{12}{20} = \frac{3}{5}$

b) $\frac{5}{12} + \frac{11}{12} = \frac{16}{12} = \frac{4}{3} = 1\frac{1}{3}$

6. a) $6\frac{1}{8} + 5\frac{5}{8} = \frac{49}{8} + \frac{45}{8} = \frac{94}{8} = 11\frac{6}{8} = 11\frac{3}{4}$

b) $7\frac{7}{12} - 2\frac{5}{12} = \frac{91}{12} - \frac{29}{12} = \frac{62}{12} = 5\frac{2}{12} = 5\frac{1}{6}$

7. a)
$18 = 2 \cdot 3 \cdot 3$
$42 = 2 \cdot 3 \cdot 7$
$\text{LCM} = 2 \cdot 3 \cdot 3 \cdot 7 = 126$

b)
$32 = 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2$
$36 = 2 \cdot 2 \cdot 3 \cdot 3$
$\text{LCM} = 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 3 \cdot 3 = 288$

8. a) $\frac{4}{9} + \frac{2}{15} = \frac{4}{9} \cdot \frac{5}{5} + \frac{2}{15} \cdot \frac{3}{3} = \frac{20}{45} + \frac{6}{45} = \frac{26}{45}$

b) $\frac{7}{12} - \frac{5}{16} = \frac{7}{12} \cdot \frac{4}{4} - \frac{5}{16} \cdot \frac{3}{3} = \frac{28}{48} - \frac{15}{48} = \frac{13}{48}$

9. a)
$$\begin{aligned} 5\frac{1}{5} - 3\frac{5}{6} &= \frac{26}{5} - \frac{23}{6} \\ &= \frac{26}{5} \cdot \frac{6}{6} - \frac{23}{6} \cdot \frac{5}{5} \\ &= \frac{156}{30} - \frac{115}{30} \\ &= \frac{41}{30} \\ &= 1\frac{11}{30} \end{aligned}$$

b) $8\frac{3}{4}+7\frac{5}{6}=\frac{35}{4}+\frac{47}{6}$

$=\frac{35}{4}\cdot\frac{3}{3}+\frac{47}{6}\cdot\frac{2}{2}$

$=\frac{105}{12}+\frac{94}{12}$

$=\frac{199}{12}$

$=16\frac{7}{12}$

1.4 OPERATIONS WITH FRACTIONS

1. improper fraction

2. reciprocal

3. To divide a number by a fraction, invert the divisor and then multiply.

4. denominator

5. least common multiple

6. a

7. $\frac{\cancel{3}^{1}}{\cancel{8}_{2}}\cdot\frac{\cancel{4}^{1}}{\cancel{27}_{9}}=\frac{1}{18}$

8. $\frac{6}{\cancel{35}_{7}}\cdot\frac{\cancel{25}^{5}}{29}=\frac{30}{203}$

9. $\frac{\cancel{20}^{2}}{\cancel{21}_{3}}\cdot\left(-\frac{\cancel{77}^{11}}{\cancel{90}_{9}}\right)=-\frac{22}{27}$

10. $-\frac{\cancel{9}^{3}}{\cancel{30}_{10}}\cdot\frac{\cancel{28}^{2}}{\cancel{42}_{3}}=-\frac{\cancel{3}^{1}}{\cancel{10}_{5}}\cdot\frac{\cancel{2}^{1}}{\cancel{3}_{1}}=-\frac{1}{5}$

11. $-7\frac{1}{5}\cdot\frac{7}{18}=-\frac{\cancel{36}^{2}}{5}\cdot\frac{7}{\cancel{18}_{1}}=-\frac{2}{5}\cdot\frac{7}{1}=-\frac{14}{5}=-2\frac{4}{5}$

12. $2\frac{7}{9}\cdot4\frac{1}{5}=-\frac{\cancel{25}^{5}}{\cancel{9}_{3}}\cdot\frac{\cancel{21}^{7}}{\cancel{5}_{1}}=\frac{5}{3}\cdot\frac{7}{1}=\frac{35}{3}=11\frac{2}{3}$

13. $10\cdot\frac{9}{14}=\frac{\cancel{10}^{5}}{1}\cdot\frac{9}{\cancel{14}_{7}}=\frac{5}{1}\cdot\frac{9}{7}=\frac{45}{7}=6\frac{3}{7}$

14. $8\cdot5\frac{1}{12}=\frac{\cancel{8}^{2}}{1}\cdot\frac{61}{\cancel{12}_{3}}=\frac{2}{1}\cdot\frac{61}{3}=\frac{122}{3}=40\frac{2}{3}$

15. $-\frac{\cancel{9}^{3}}{\cancel{8}_{4}}\cdot\frac{\cancel{14}^{7}}{\cancel{15}_{5}}=-\frac{3}{4}\cdot\frac{7}{5}=-\frac{21}{20}=-1\frac{1}{20}$

16. $-\frac{\cancel{11}^{1}}{\cancel{42}_{6}}\cdot\left(-\frac{\cancel{35}^{5}}{\cancel{99}_{9}}\right)=-\frac{1}{6}\cdot\left(-\frac{5}{9}\right)=\frac{5}{54}$

17. $\frac{6}{25}\div\frac{8}{45}=\frac{\cancel{6}^{3}}{\cancel{25}_{5}}\cdot\frac{\cancel{45}^{9}}{\cancel{8}_{4}}=\frac{27}{20}$

18. $\frac{15}{32}\div\frac{9}{20}=\frac{\cancel{15}^{5}}{\cancel{32}_{8}}\cdot\frac{\cancel{20}^{5}}{\cancel{9}_{3}}=\frac{25}{24}$

19. $-\frac{22}{56}\div\frac{33}{147}=-\frac{\cancel{22}^{2}}{\cancel{56}_{8}}\cdot\frac{\cancel{147}^{21}}{\cancel{33}_{3}}$

$=-\frac{\cancel{2}^{1}}{\cancel{8}_{4}}\cdot\frac{\cancel{21}^{7}}{\cancel{3}_{1}}$

$=-\frac{7}{4}$

20. $-\frac{24}{91}\div\left(-\frac{9}{39}\right)=-\frac{\cancel{24}^{8}}{\cancel{91}_{7}}\cdot\left(-\frac{\cancel{39}^{3}}{\cancel{9}_{3}}\right)$

$=-\frac{8}{7}\cdot\left(-\frac{\cancel{3}^{1}}{\cancel{3}_{1}}\right)$

$=\frac{8}{7}$

21. $\frac{11}{36}\div\frac{1}{3}=\frac{11}{\cancel{36}_{12}}\cdot\frac{\cancel{3}^{1}}{1}=\frac{11}{12}$

22. $\frac{11}{18}\div\left(-\frac{1}{6}\right)=\frac{11}{\cancel{18}_{3}}\cdot\left(-\frac{\cancel{6}^{1}}{1}\right)=-\frac{11}{3}=-3\frac{2}{3}$

23. $\frac{6}{7}\div4\frac{4}{5}=\frac{6}{7}\div\frac{24}{5}=\frac{\cancel{6}^{1}}{7}\cdot\frac{5}{\cancel{24}_{4}}=\frac{5}{28}$

24. $5\frac{3}{5}\div7=\frac{28}{5}\div\frac{7}{1}=\frac{\cancel{28}^{4}}{5}\cdot\frac{1}{\cancel{7}_{1}}=\frac{4}{5}$

25. $-3\frac{1}{5} \div 2\frac{2}{15} = -\frac{16}{5} \div \frac{32}{15}$

$= -\frac{\cancel{16}^{1}}{\cancel{5}_{1}} \cdot \frac{\cancel{15}^{3}}{\cancel{32}_{2}}$

$= -\frac{3}{2}$

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

26. $-5\frac{4}{9} \div \left(-4\frac{1}{12}\right) = -\frac{49}{9} \div \left(-\frac{49}{12}\right)$

$= -\frac{\cancel{49}^{1}}{\cancel{9}_{3}} \cdot \left(-\frac{\cancel{12}^{4}}{\cancel{49}_{1}}\right)$

$= \frac{4}{3}$

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

27. $\frac{7}{12} + \frac{1}{12} = \frac{8}{12} = \frac{2}{3}$

28. $\frac{5}{16} + \frac{7}{16} = \frac{12}{16} = \frac{3}{4}$

29. $\frac{13}{20} + \frac{17}{20} = \frac{30}{20} = \frac{3}{2} = 1\frac{1}{2}$

30. $\frac{7}{10} + \frac{3}{10} = \frac{10}{10} = 1$

31. $\frac{8}{25} - \frac{18}{25} = -\frac{10}{25} = -\frac{2}{5}$

32. $\frac{17}{24} - \frac{11}{24} = \frac{6}{24} = \frac{1}{4}$

33. $\frac{23}{30} - \frac{7}{30} = \frac{16}{30} = \frac{8}{15}$

34. $\frac{9}{56} - \frac{41}{56} = -\frac{32}{56} = -\frac{4}{7}$

35. $12 = 2 \cdot 2 \cdot 3$
$16 = 2 \cdot 2 \cdot 2 \cdot 2$
$\text{LCM} = 2 \cdot 2 \cdot 2 \cdot 2 \cdot 3 = 48$

36. $15 = 3 \cdot 5$
$20 = 2 \cdot 2 \cdot 5$
$\text{LCM} = 2 \cdot 2 \cdot 3 \cdot 5 = 60$

37. $15 = 3 \cdot 5$
$35 = 5 \cdot 7$
$\text{LCM} = 3 \cdot 5 \cdot 7 = 105$

38. $20 = 2 \cdot 2 \cdot 5$
$36 = 2 \cdot 2 \cdot 3 \cdot 3$
$\text{LCM} = 2 \cdot 2 \cdot 3 \cdot 3 \cdot 5 = 180$

39. $14 = 2 \cdot 7$
$25 = 5 \cdot 5$
$\text{LCM} = 2 \cdot 5 \cdot 5 \cdot 7 = 350$

40. $24 = 2 \cdot 2 \cdot 2 \cdot 3$
$72 = 2 \cdot 2 \cdot 2 \cdot 3 \cdot 3$
$\text{LCM} = 2 \cdot 2 \cdot 2 \cdot 3 \cdot 3 = 72$

41. $18 = 2 \cdot 3 \cdot 3$
$27 = 3 \cdot 3 \cdot 3$
$45 = 3 \cdot 3 \cdot 5$
$\text{LCM} = 2 \cdot 3 \cdot 3 \cdot 3 \cdot 5 = 270$

42. $12 = 2 \cdot 2 \cdot 3$
$20 = 2 \cdot 2 \cdot 5$
$36 = 2 \cdot 2 \cdot 3 \cdot 3$
$\text{LCM} = 2 \cdot 2 \cdot 3 \cdot 3 \cdot 5 = 180$

43. $\frac{4}{5} + \frac{3}{4}$ LCM = 20

$\frac{4}{5} + \frac{3}{4} = \frac{4}{5} \cdot \frac{4}{4} + \frac{3}{4} \cdot \frac{5}{5} = \frac{16}{20} + \frac{15}{20} = \frac{31}{20}$

44. $\frac{4}{7} + \frac{1}{4}$ LCM = 28

$\frac{4}{7} + \frac{1}{4} = \frac{4}{7} \cdot \frac{4}{4} + \frac{1}{4} \cdot \frac{7}{7} = \frac{16}{28} + \frac{7}{28} = \frac{23}{28}$

45. $\frac{7}{10} + \frac{5}{8}$ LCM = 40

$\frac{7}{10} + \frac{5}{8} = \frac{7}{10} \cdot \frac{4}{4} + \frac{5}{8} \cdot \frac{5}{5} = \frac{28}{40} + \frac{25}{40} = \frac{53}{40}$

46. $\frac{3}{4} + \frac{5}{6}$ LCM = 12

$\frac{3}{4} + \frac{5}{6} = \frac{3}{4} \cdot \frac{3}{3} + \frac{5}{6} \cdot \frac{2}{2} = \frac{9}{12} + \frac{10}{12} = \frac{19}{12}$

47. $6\frac{1}{5} + 5 = 11\frac{1}{5}$

48. $3 + 8\frac{3}{7} = 11\frac{3}{7}$

49. $6\frac{2}{3}+5\frac{1}{6}=\frac{20}{3}+\frac{31}{6}$ LCM = 6

$\frac{20}{3}+\frac{31}{6}=\frac{20}{3}\cdot\frac{2}{2}+\frac{31}{6}=\frac{40}{6}+\frac{31}{6}=\frac{71}{6}=11\frac{5}{6}$

50. $11\frac{4}{9}+5\frac{1}{3}=\frac{103}{9}+\frac{16}{3}$ LCM = 9

$\frac{103}{9}+\frac{16}{3}=\frac{103}{9}+\frac{16}{3}\cdot\frac{3}{3}$

$=\frac{103}{9}+\frac{48}{9}$

$=\frac{151}{9}$

$=16\frac{7}{9}$

51. $\frac{2}{3}-\frac{7}{15}$ LCM = 15

$\frac{2}{3}-\frac{7}{15}=\frac{2}{3}\cdot\frac{5}{5}-\frac{7}{15}=\frac{10}{15}-\frac{7}{15}=\frac{3}{15}=\frac{1}{5}$

52. $\frac{1}{2}-\frac{7}{9}$ LCM = 18

$\frac{1}{2}-\frac{7}{9}=\frac{1}{2}\cdot\frac{9}{9}-\frac{7}{9}\cdot\frac{2}{2}=\frac{9}{18}-\frac{14}{18}=-\frac{5}{18}$

53. $\frac{3}{4}-\frac{2}{7}$ LCM = 28

$\frac{3}{4}-\frac{2}{7}=\frac{3}{4}\cdot\frac{7}{7}-\frac{2}{7}\cdot\frac{4}{4}=\frac{21}{28}-\frac{8}{28}=\frac{13}{28}$

54. $\frac{5}{8}-\frac{5}{6}$ LCM = 24

$\frac{5}{8}-\frac{5}{6}=\frac{5}{8}\cdot\frac{3}{3}-\frac{5}{6}\cdot\frac{4}{4}=\frac{15}{24}-\frac{20}{24}=-\frac{5}{24}$

55. $7\frac{1}{2}-3\frac{1}{4}=\frac{15}{2}-\frac{13}{4}$ LCM = 4

$\frac{15}{2}-\frac{13}{4}=\frac{15}{2}\cdot\frac{2}{2}-\frac{13}{4}=\frac{30}{4}-\frac{13}{4}=\frac{17}{4}=4\frac{1}{4}$

56. $12\frac{2}{3}-6\frac{2}{5}=\frac{38}{3}-\frac{32}{5}$ LCM = 15

$\frac{38}{3}-\frac{32}{5}=\frac{38}{3}\cdot\frac{5}{5}-\frac{32}{5}\cdot\frac{3}{3}$

$=\frac{190}{15}-\frac{96}{15}$

$=\frac{94}{15}$

$=6\frac{4}{15}$

57. $12\frac{3}{10}-9=\frac{123}{10}-9$ LCM = 10

$\frac{123}{10}-9=\frac{123}{10}-\frac{9}{1}\cdot\frac{10}{10}=\frac{123}{10}-\frac{90}{10}=\frac{33}{10}=3\frac{3}{10}$

58. $6-4\frac{3}{4}=\frac{6}{1}-\frac{19}{4}$ LCM = 4

$\frac{6}{1}-\frac{19}{4}=\frac{6}{1}\cdot\frac{4}{4}-\frac{19}{4}=\frac{24}{4}-\frac{19}{4}=\frac{5}{4}=1\frac{1}{4}$

59. $-\frac{5}{9}-\frac{7}{12}=-\frac{20}{36}-\frac{21}{36}=-\frac{41}{36}$

60. $-\frac{9}{10}-\frac{11}{14}=-\frac{63}{70}-\frac{55}{70}=-\frac{118}{70}=-\frac{59}{35}$

61. $-\frac{9}{16}+\frac{5}{24}=-\frac{27}{48}+\frac{10}{48}=-\frac{17}{48}$

62. $-\frac{3}{8}+\frac{13}{24}=-\frac{9}{24}+\frac{13}{24}=\frac{4}{24}=\frac{1}{6}$

63. $\frac{6}{7}-\left(-\frac{8}{15}\right)=\frac{6}{7}+\frac{8}{15}=\frac{90}{105}+\frac{56}{105}=\frac{146}{105}$

64. $\frac{1}{12}-\left(-\frac{19}{30}\right)=\frac{1}{12}+\frac{19}{30}=\frac{5}{60}+\frac{38}{60}=\frac{43}{60}$

65. $-\frac{4}{15}+\left(-\frac{13}{18}\right)=-\frac{4}{15}-\frac{13}{18}=-\frac{24}{90}-\frac{65}{90}=-\frac{89}{90}$

66. $-\frac{17}{24}+\left(-\frac{25}{42}\right)=-\frac{17}{24}-\frac{25}{42}$

$=-\frac{119}{168}-\frac{100}{168}$

$=-\frac{219}{168}$

$=-\frac{73}{56}$

67. $\frac{3}{16}+\frac{9}{20}-\frac{11}{12}=\frac{45}{240}+\frac{108}{240}-\frac{220}{240}$

$=\frac{153}{240}-\frac{220}{240}$

$=-\frac{67}{240}$

68. $\frac{10}{21}-\frac{13}{18}+\frac{8}{15}=\frac{300}{630}-\frac{455}{630}+\frac{336}{630}$
$=\frac{636}{630}-\frac{455}{630}$
$=\frac{181}{630}$

69. $\frac{8}{\cancel{9}_{3}}\cdot\frac{\cancel{3}^{1}}{5}=\frac{8}{15}$

70. $\frac{3}{4}+\frac{7}{10}$ LCM = 20
$\frac{3}{4}+\frac{7}{10}=\frac{3}{4}\cdot\frac{5}{5}+\frac{7}{10}\cdot\frac{2}{2}=\frac{15}{20}+\frac{14}{20}=\frac{29}{20}$

71. $\frac{7}{30}\div\frac{35}{48}=\frac{\cancel{7}^{1}}{\cancel{30}_{5}}\cdot\frac{\cancel{48}^{8}}{\cancel{35}_{5}}=\frac{8}{25}$

72. $\frac{\cancel{12}^{4}}{\cancel{35}_{5}}\cdot\frac{\cancel{14}^{2}}{\cancel{27}_{9}}=\frac{8}{45}$

73. $\frac{1}{6}-\frac{7}{8}$ LCM = 24
$\frac{1}{6}-\frac{7}{8}=\frac{1}{6}\cdot\frac{4}{4}-\frac{7}{8}\cdot\frac{3}{3}=\frac{4}{24}-\frac{21}{24}=-\frac{17}{24}$

74. $\frac{7}{24}-\frac{29}{40}$ LCM = 120
$\frac{7}{24}-\frac{29}{40}=\frac{7}{24}\cdot\frac{5}{5}-\frac{29}{40}\cdot\frac{3}{3}$
$=\frac{35}{120}-\frac{87}{120}$
$=-\frac{52}{120}$
$=-\frac{13}{30}$

75. $\frac{19}{30}+\frac{11}{18}$ LCM = 90
$\frac{19}{30}+\frac{11}{18}=\frac{19}{30}\cdot\frac{3}{3}+\frac{11}{18}\cdot\frac{5}{5}=\frac{57}{90}+\frac{55}{90}=\frac{112}{90}=\frac{56}{45}$

76. $3\frac{1}{5}\cdot 4\frac{3}{8}=\frac{16}{5}\cdot\frac{35}{8}=\frac{\cancel{16}^{2}}{\cancel{5}_{1}}\cdot\frac{\cancel{35}^{7}}{\cancel{8}_{1}}=14$

77. $13\div\frac{1}{8}=\frac{13}{1}\cdot\frac{8}{1}=13\cdot 8=104$

78. $\frac{3}{5}-\frac{2}{3}-\frac{7}{10}$ LCM = 30
$\frac{3}{5}-\frac{2}{3}-\frac{7}{10}=\frac{3}{5}\cdot\frac{6}{6}-\frac{2}{3}\cdot\frac{10}{10}-\frac{7}{10}\cdot\frac{3}{3}$
$=\frac{18}{30}-\frac{20}{30}-\frac{21}{30}$
$=\frac{18}{30}-\frac{41}{30}$
$=-\frac{23}{30}$

79. $3\frac{4}{7}+6\frac{3}{5}-8=\frac{25}{7}+\frac{33}{5}-\frac{8}{1}$ LCM = 35
$\frac{25}{7}+\frac{33}{5}-\frac{8}{1}=\frac{25}{7}\cdot\frac{5}{5}+\frac{33}{5}\cdot\frac{7}{7}-\frac{8}{1}\cdot\frac{35}{35}$
$=\frac{125}{35}+\frac{231}{35}-\frac{280}{35}$
$=\frac{356}{35}-\frac{280}{35}$
$=\frac{76}{35}$
$=2\frac{6}{35}$

80. $12\frac{1}{3}+7\frac{1}{6}-5\frac{1}{2}=\frac{37}{3}+\frac{43}{6}-\frac{11}{2}$ LCM = 6
$\frac{37}{3}+\frac{43}{6}-\frac{11}{2}=\frac{37}{3}\cdot\frac{2}{2}+\frac{43}{6}-\frac{11}{2}\cdot\frac{3}{3}$
$=\frac{74}{6}+\frac{43}{6}-\frac{33}{6}$
$=\frac{117}{6}-\frac{33}{6}$
$=\frac{84}{6}=14$

81. $\frac{15}{56}+\left(-\frac{16}{21}\right)=\frac{15}{56}-\frac{16}{21}$ LCM = 168
$\frac{15}{56}-\frac{16}{21}=\frac{15}{56}\cdot\frac{3}{3}-\frac{16}{21}\cdot\frac{8}{8}=\frac{45}{168}-\frac{128}{168}=-\frac{83}{168}$

82. $\frac{7}{12}-\left(-\frac{23}{30}\right)=\frac{7}{12}+\frac{23}{30}$ LCM = 60
$\frac{7}{12}+\frac{23}{30}=\frac{7}{12}\cdot\frac{5}{5}+\frac{23}{30}\cdot\frac{2}{2}=\frac{35}{60}+\frac{46}{60}=\frac{81}{60}=\frac{27}{20}$

83. $-\frac{9}{13}+\frac{19}{36}$ LCM $= 13\cdot 36 = 468$

$$-\frac{9}{13}+\frac{19}{36} = -\frac{9}{13}\cdot\frac{36}{36}+\frac{19}{36}\cdot\frac{13}{13}$$
$$= -\frac{324}{468}+\frac{247}{468}$$
$$= -\frac{77}{468}$$

84. $-\frac{3}{8}-\frac{81}{100}$ LCM $= 200$

$$-\frac{3}{8}-\frac{81}{100} = -\frac{3}{8}\cdot\frac{25}{25}-\frac{81}{100}\cdot\frac{2}{2}$$
$$= -\frac{75}{200}-\frac{162}{200}$$
$$= -\frac{237}{200}$$

85. $\frac{11}{24}+\frac{5}{?}=\frac{13}{12}\cdot\frac{2}{2}$

$$\frac{11}{24}+\frac{5}{?}\cdot\frac{3}{3}=\frac{26}{24}$$

Since $?\cdot 3 = 24$, 8 is the missing number.

86. $\frac{?}{10}-\frac{1}{3}=\frac{1}{6}$

$$\frac{?}{10}\cdot\frac{3}{3}-\frac{1}{3}\cdot\frac{10}{10}=\frac{1}{6}\cdot\frac{5}{5}$$
$$\frac{?\cdot 3}{30}-\frac{10}{30}=\frac{5}{30}$$

Since $?\cdot 3 - 10 = 5$, 5 is the missing number.

87. $\frac{\cancel{10}^{2}}{21}\cdot\frac{?}{\cancel{75}_{15}}=\frac{4}{45}$

$$\frac{2}{21}\cdot\frac{?}{15}=\frac{4}{45}$$
$$\frac{2\cdot ?}{315}=\frac{4}{45}\cdot\frac{7}{7}$$
$$\frac{2\cdot ?}{315}=\frac{28}{315}$$

Since $2\cdot ? = 28$, 14 is the missing number.

88. $\frac{11}{40}+\frac{?}{40}=\frac{9}{10}$

$$\frac{11+?}{40}=\frac{9}{10}\cdot\frac{4}{4}$$
$$\frac{11+?}{40}=\frac{36}{40}$$

Since $11+? = 36$, 25 is the missing number.

89. $\frac{1}{2}+\frac{3}{4}+\frac{1}{3}$ LCM $= 12$

$$\frac{1}{2}+\frac{3}{4}+\frac{1}{3} = \frac{1}{2}\cdot\frac{6}{6}+\frac{3}{4}\cdot\frac{3}{3}+\frac{1}{3}\cdot\frac{4}{4}$$
$$= \frac{6}{12}+\frac{9}{12}+\frac{4}{12}$$
$$= \frac{19}{12}$$
$$= 1\frac{7}{12} \text{ cups}$$

90. $4\frac{7}{8}+5\frac{1}{4}=\frac{39}{8}+\frac{21}{4}$ LCM $= 8$

$$\frac{39}{8}+\frac{21}{4} = \frac{39}{8}+\frac{21}{4}\cdot\frac{2}{2}$$
$$= \frac{39}{8}+\frac{42}{8}$$
$$= \frac{81}{8}$$
$$= 10\frac{1}{8} \text{ pounds}$$

91. $3\frac{3}{16}-1\frac{7}{8}$ LCM $= 16$

$$3\frac{3}{16}-1\frac{7}{8} = \frac{51}{16}-\frac{15}{8}\cdot\frac{2}{2}$$
$$= \frac{51}{16}-\frac{30}{16}$$
$$= \frac{21}{16}$$
$$= 1\frac{5}{16} \text{ fluid ounces}$$

92. $7\frac{1}{4}-4\frac{5}{8}$ LCM $= 8$

$$7\frac{1}{4}-4\frac{5}{8} = \frac{29}{4}\cdot\frac{2}{2}-\frac{37}{8}$$
$$= \frac{58}{8}-\frac{37}{8}$$
$$= \frac{21}{8}$$
$$= 2\frac{5}{8} \text{ cups}$$

93. $8\cdot 2\frac{1}{2} = \frac{\cancel{8}^{4}}{1}\cdot\frac{5}{\cancel{2}_{1}} = 20$ tablespoons

94. $6\cdot\frac{3}{4} = \frac{\cancel{6}^{3}}{1}\cdot\frac{3}{\cancel{4}_{2}} = \frac{9}{2} = 4\frac{1}{2}$ pounds

95. $64\frac{3}{8} \div 5 = \frac{515}{8} \div \frac{5}{1}$

$= \frac{\cancel{515}^{103}}{8} \cdot \frac{1}{\cancel{5}_{1}}$

$= \frac{103}{8}$

$= 12\frac{7}{8}$ inches

96. $255 \div 6\frac{3}{8} = \frac{255}{1} \div \frac{51}{8}$

$= \frac{\cancel{255}^{5}}{1} \cdot \frac{8}{\cancel{51}_{1}}$

$= 40$ bottles

97. You are making four times the recipe.

$4 \cdot 1\frac{1}{3} = \frac{4}{1} \cdot \frac{4}{3} = \frac{16}{3} = 5\frac{1}{3}$ cups

98. You are only making half the recipe.

$\frac{1}{2} \cdot 1\frac{1}{3} = \frac{1}{\cancel{2}_{1}} \frac{\cancel{4}^{2}}{3} = \frac{2}{3}$ cup

99. Explanations will vary. Example:
Dividing a number in half means $x \div 2$.
Dividing a number by one half means
$x \div \frac{1}{2}$ or $x \cdot \frac{2}{1} = 2x$.
So, dividing a number in half means dividing by 2, while dividing a number by one half actually means multiplying by 2.

100. Explanations will vary. Example:
You cannot divide by 2 from 4 and 6 in the expression $\frac{4}{7} \cdot \frac{6}{11}$ because 4 and 6 are both in the numerator.

101. No, a common denominator is only required when adding or subtracting fractions.

102. To divide by a fraction you have to invert the divisor and then multiply.

103. Find the prime factorization of both numbers, and then multiply the common factors of the two numbers by the remaining factors. You could also list out the multiples of each number until you find one that they have in common.

104. Find the LCM of the denominators. Rewrite each fraction as an equivalent fraction with that LCM as its denominator. Add (or subtract) the numerators; keep the denominator. Simplify to lowest terms.

1.5 QUICK CHECK

1. a) $\frac{3}{4}$

$$\begin{array}{r} .75 \\ 4\overline{)3.00} \\ \underline{-2.8} \\ 20 \\ \underline{-20} \\ 0 \end{array}$$

$\frac{3}{4} = 0.75$

b) $\frac{7}{20}$

$$\begin{array}{r} .35 \\ 20\overline{)7.00} \\ \underline{-6.0} \\ 100 \\ \underline{-100} \\ 0 \end{array}$$

$\frac{7}{20} = 0.35$

2. a) $\frac{5}{18}$

$$\begin{array}{r} .277 \\ 18\overline{)5.000} \\ \underline{-3.6} \\ 140 \\ \underline{-126} \\ 140 \end{array}$$

$\frac{5}{18} = 0.2\overline{7}$

b) $\frac{7}{11}$

$$\begin{array}{r} .63 \\ 11\overline{)7.00} \\ \underline{-6.6} \\ 40 \\ \underline{-33} \\ 7 \end{array}$$

$\frac{7}{11} = 0.\overline{63}$

3. a) $0.425 = \frac{425}{1000} = \frac{17}{40}$

b) $0.1864 = \frac{1864}{10{,}000} = \frac{233}{1250}$

4. a) i) $\frac{7}{10} \cdot 100\% = \frac{7}{\cancel{10}_{1}} \cdot \frac{\cancel{100}^{10}}{1}\% = 70\%$

ii) $\frac{21}{40}\cdot 100\% = \frac{21}{\cancel{40}_{2}}\cdot\frac{\cancel{100}^{5}}{1}\%$
$= \frac{105}{2}\%$
$= 52\frac{1}{2}\%$

b) i) $\frac{13}{20}\cdot 100\% = \frac{13}{\cancel{20}_{1}}\cdot\frac{\cancel{100}^{5}}{1}\% = 65\%$

ii) $\frac{9}{16}\cdot 100\% = \frac{9}{\cancel{16}_{4}}\cdot\frac{\cancel{100}^{25}}{1}\%$
$= \frac{225}{4}\%$
$= 56\frac{1}{4}\%$

5. a) $0.42\cdot 100\% = 42\%$

b) $0.326\cdot 100\% = 32.6\%$

6. a) i) $35\% = \frac{\cancel{35}^{7}}{1}\cdot\frac{1}{\cancel{100}_{20}} = \frac{7}{20}$

ii) $12\% = \frac{\cancel{12}^{3}}{1}\cdot\frac{1}{\cancel{100}_{25}} = \frac{3}{25}$

b) i) $11\frac{2}{3}\% = \frac{35}{3}\%$
$= \frac{35}{3}\cdot\frac{1}{100}$
$= \frac{\cancel{35}^{7}}{3}\cdot\frac{1}{\cancel{100}_{20}}$
$= \frac{7}{60}$

ii) $17\frac{3}{5}\% = \frac{88}{5}\%$
$= \frac{88}{5}\cdot\frac{1}{100}$
$= \frac{\cancel{88}^{22}}{5}\cdot\frac{1}{\cancel{100}_{25}}$
$= \frac{22}{125}$

7. a) i) $8\% = 8\div 100 = 0.08$

ii) $240\% = 240\div 100 = 2.4$

b) i) $5\% = 5\div 100 = 0.05$

ii) $300\% = 300\div 100 = 3$

1.5 DECIMALS AND PERCENTS

1. tenths

2. thousandths

3. numerator; denominator

4. multiply

5. divide

6. 100

7.
$$\begin{array}{r} 4.23 \\ +3.62 \\ \hline 7.85 \end{array}$$

8.
$$\begin{array}{r} 13.89 \\ -2.54 \\ \hline 11.35 \end{array}$$

9.
$$\begin{array}{r} 5.2 \\ \times\ \ 7 \\ \hline 36.4 \end{array}$$
so, $-7(5.2) = -36.4$

10.
$$\begin{array}{r} 11.59 \\ 6\overline{)69.54} \\ -6 \\ \hline 09 \\ -6 \\ \hline 35 \\ -30 \\ \hline 54 \\ -54 \\ \hline 0 \end{array}$$
11.59

11.
$$\begin{array}{r} 8.4 \\ -3.7 \\ \hline 4.7 \end{array}$$

12. $-7.9 + (-4.5) = -7.9 - 4.5$, so add.
$$\begin{array}{r} 7.9 \\ +4.5 \\ \hline 12.4 \end{array}$$
Then add the negative sign to get –12.4.

13. $0.4\overline{)13.568}$

$$\begin{array}{r} 33.92 \\ 4\overline{)135.68} \\ -12 \\ \hline 15 \\ -12 \\ \hline 36 \\ -36 \\ \hline 08 \\ -08 \\ \hline 0 \end{array}$$

33.92

14. $3.6(4.7)$

$$\begin{array}{r} 3.6 \\ \times\ 4.7 \\ \hline 252 \\ 1440 \\ \hline 1692 \end{array}$$

$= 16.92$

15.

$$\begin{array}{r} 3.65 \\ \times\ -2.2 \\ \hline 730 \\ 7300 \\ \hline -8030 \end{array}$$

$= -8.03$

16.

$$\begin{array}{r} -15.9 \\ +\ 6.2 \\ \hline -9.7 \end{array}$$

$6.2 - 15.9 = -9.7$

17.

$$\begin{array}{r} -23.190 \\ +16.023 \\ \hline -7.167 \end{array}$$

18.

$$\begin{array}{r} 18.304 \\ +45.696 \\ \hline 64.000 \end{array}$$

19. $0.25\overline{)7.176}$

$$\begin{array}{r} 28.704 \\ 25\overline{)717.600} \\ -50 \\ \hline 217 \\ -200 \\ \hline 176 \\ -175 \\ \hline 100 \\ -100 \\ \hline 0 \end{array}$$

28.704

20. Dividing an odd number of negative values gives a negative answer. $0.024\overline{)1.5168}$

$$\begin{array}{r} 63.2 \\ 24\overline{)1516.8} \\ -144 \\ \hline 76 \\ -72 \\ \hline 48 \\ -48 \\ \hline 0 \end{array}$$

-63.2

21. Multiplying an even number of negative values gives a positive answer.

$$\begin{array}{r} 7.2 \\ \times 2.1 \\ \hline 72 \\ 1440 \\ \hline 15.12 \end{array}$$

$$\begin{array}{r} 15.12 \\ \times 3.06 \\ \hline 9072 \\ 453600 \\ \hline 46.2672 \end{array}$$

22. $-9.34 + 12.543 - 31.8$

Combine the negative values.

$$\begin{array}{r} 9.34 \\ +\ 31.80 \\ \hline 41.14 \end{array}$$

Combine 12.543 and (−41.14).

$$\begin{array}{r} -41.140 \\ +\ 12.543 \\ \hline -28.597 \end{array}$$

23. $10\overline{)9.0}$

$$\begin{array}{r} 0.9 \\ 10\overline{)9.0} \\ -90 \\ \hline 0 \end{array}$$

$\frac{9}{10} = 0.9$

24. $5\overline{)2.0}$

$$\begin{array}{r} 0.4 \\ 5\overline{)2.0} \\ -20 \\ \hline 0 \end{array}$$

$\frac{2}{5} = 0.4$

25.
$$8\overline{)23.000}\quad 2.875$$
$$-16$$
$$70$$
$$-64$$
$$60$$
$$-56$$
$$40$$
$$-40$$
$$0$$
$$-\frac{23}{8} = -2.875$$

26.
$$4\overline{)59.00}\quad 14.75$$
$$-4$$
$$19$$
$$-16$$
$$30$$
$$-28$$
$$20$$
$$-20$$
$$0$$
$$\frac{59}{4} = 14.75$$

27.
$$25\overline{)13.00}\quad 0.52$$
$$-125$$
$$50$$
$$-50$$
$$0$$
$$\frac{13}{25} = 0.52$$

28.
$$16\overline{)11.0000}\quad 0.6875$$
$$-96$$
$$140$$
$$-128$$
$$120$$
$$-112$$
$$80$$
$$-80$$
$$0$$
$$-\frac{11}{16} = -0.6875$$

29.
$$24\frac{29}{50} = \frac{1229}{50}$$
$$50\overline{)1229.00}\quad 24.58$$
$$-100$$
$$229$$
$$-200$$
$$290$$
$$-250$$
$$400$$
$$-400$$
$$0$$
$$24\frac{29}{50} = 24.58$$

30.
$$7\frac{3}{20} = \frac{143}{20}$$
$$20\overline{)143.00}\quad 7.15$$
$$-140$$
$$30$$
$$-20$$
$$100$$
$$-100$$
$$0$$
$$7\frac{3}{20} = 7.15$$

31. $0.2 = \frac{2}{10} = \frac{1}{5}$

32. $0.5 = \frac{5}{10} = \frac{1}{2}$

33. $0.85 = \frac{85}{100} = \frac{17}{20}$

34. $0.36 = \frac{36}{100} = \frac{9}{25}$

35. $-0.74 = -\frac{74}{100} = -\frac{37}{50}$

36. $-0.56 = -\frac{56}{100} = -\frac{14}{25}$

37. $0.375 = \frac{375}{1000} = \frac{3}{8}$

38. $0.204 = \frac{204}{1000} = \frac{51}{250}$

39. $98.6 + 2.8$

$$\begin{array}{r} 98.6 \\ +\ 2.8 \\ \hline 101.4^\circ\text{F} \end{array}$$

40. Add the gift amounts.

$$\begin{array}{r} 32.95 \\ 16.99 \\ 47.50 \\ 12.37 \\ +285.00 \\ \hline \$394.81 \end{array}$$

41. Subtract the checks from the balance.

$$\begin{array}{r} 427.36 \\ -\ 19.95 \\ \hline 407.41 \\ -\ 34.40 \\ \hline 373.01 \\ -148.68 \\ \hline \$224.33 \end{array}$$

42. Add and subtract the price changes.

$$\begin{array}{r} 426.17 \\ -\ 9.63 \\ \hline 416.54 \\ +\ 14.08 \\ \hline 430.62 \\ -\ 7.84 \\ \hline \$422.78 \end{array}$$

43.

$$\begin{array}{r} 21.47 \\ \times\ 12 \\ \hline 4294 \\ \underline{21470} \\ 25764 \\ \$257.64 \end{array}$$

44.

$$\begin{array}{r} 7. \\ 265\overline{)2000.} \\ \underline{-1855} \\ 145 \end{array}$$

7 packages and \$1.45 change

45. $\frac{3}{4} \cdot 100\% = \frac{3}{\cancel{4}_1} \cdot \frac{\cancel{100}^{25}}{1}\% = 75\%$

46. $\frac{3}{5} \cdot 100\% = \frac{3}{\cancel{5}_1} \cdot \frac{\cancel{100}^{20}}{1}\% = 60\%$

47. $\frac{4}{5} \cdot 100\% = \frac{4}{\cancel{5}_1} \cdot \frac{\cancel{100}^{20}}{1}\% = 80\%$

48. $\frac{5}{8} \cdot 100\% = \frac{5}{\cancel{8}_2} \cdot \frac{\cancel{100}^{25}}{1}\% = \frac{125}{2}\% = 62\frac{1}{2}\%$

49. $\frac{3}{8} \cdot 100\% = \frac{3}{\cancel{8}_2} \cdot \frac{\cancel{100}^{25}}{1}\% = \frac{75}{2}\% = 37\frac{1}{2}\%$

50. $\frac{7}{12} \cdot 100\% = \frac{7}{\cancel{12}_3} \cdot \frac{\cancel{100}^{25}}{1}\% = \frac{175}{3}\% = 58\frac{1}{3}\%$

51. $\frac{37}{5} \cdot 100\% = \frac{37}{\cancel{5}_1} \cdot \frac{\cancel{100}^{20}}{1}\% = 740\%$

52. $\frac{19}{4} \cdot 100\% = \frac{19}{\cancel{4}_1} \cdot \frac{\cancel{100}^{25}}{1}\% = 475\%$

53. $0.3 \cdot 100\% = 30\%$

54. $0.9 \cdot 100\% = 90\%$

55. $0.47 \cdot 100\% = 47\%$

56. $0.21 \cdot 100\% = 21\%$

57. $0.09 \cdot 100\% = 9\%$

58. $0.03 \cdot 100\% = 3\%$

59. $3.2 \cdot 100\% = 320\%$

60. $2.75 \cdot 100\% = 275\%$

61. $\frac{40}{1} \cdot \frac{1}{100} = \frac{\cancel{80}^{2}}{1} \cdot \frac{1}{\cancel{100}_5} = \frac{2}{5}$

62. $\frac{76}{1} \cdot \frac{1}{100} = \frac{\cancel{76}^{19}}{1} \cdot \frac{1}{\cancel{100}_{25}} = \frac{19}{25}$

63. $\frac{6}{1} \cdot \frac{1}{100} = \frac{\cancel{6}^{3}}{1} \cdot \frac{1}{\cancel{100}_{50}} = \frac{3}{50}$

64. $\frac{4}{1}\cdot\frac{1}{100}=\frac{\cancel{4}^{1}}{1}\cdot\frac{1}{\cancel{100}_{25}}=\frac{1}{25}$

65. $4\frac{8}{23}\cdot\frac{1}{100}=\frac{100}{23}\cdot\frac{1}{100}=\frac{\cancel{100}^{1}}{23}\cdot\frac{1}{\cancel{100}_{1}}=\frac{1}{23}$

66. $42\frac{6}{7}\cdot\frac{1}{100}=\frac{300}{7}\cdot\frac{1}{100}=\frac{\cancel{300}^{3}}{7}\cdot\frac{1}{\cancel{100}_{1}}=\frac{3}{7}$

67. $\frac{405}{1}\cdot\frac{1}{100}=\frac{\cancel{405}^{81}}{1}\cdot\frac{1}{\cancel{100}_{20}}=\frac{81}{20}=4\frac{1}{20}$

68. $\frac{360}{1}\cdot\frac{1}{100}=\frac{\cancel{360}^{18}}{1}\cdot\frac{1}{\cancel{100}_{5}}=\frac{18}{5}=3\frac{3}{5}$

69. $35\div100=0.35$

70. $83\div100=0.83$

71. $22\div100=0.22$

72. $30\div100=0.3$

73. $5\div100=0.05$

74. $8\div100=0.08$

75. $21.3\div100=0.213$

76. $0.5\div100=0.005$

77. $960\div100=9.6$

78. $300\div100=3$

79. Answers will vary. Example:

$0.375=\frac{375\div125}{1000\div125}=\frac{3}{8}$

$\frac{3}{8}\cdot\frac{2}{2}=\frac{6}{16}$

$\frac{3}{8}\cdot\frac{3}{3}=\frac{9}{24}$

$\frac{3}{8},\frac{6}{16},\frac{9}{24}$

80. Answers will vary. Example:

$0.4=\frac{4}{10}=\frac{4\div2}{10\div2}=\frac{2}{5}$

$\frac{2}{5}\cdot\frac{3}{3}=\frac{6}{15}$

$\frac{2}{5},\frac{4}{10},\frac{6}{15}$

81. $0.4=\frac{\cancel{4}^{2}}{\cancel{10}_{5}}=\frac{2}{5}$

$\frac{2}{5}=0.4\cdot100\%=40\%$

82.
$$\begin{array}{r}0.45\\ 20\overline{)\,9.00}\\ \underline{-8.0}\\ 100\\ \underline{-100}\\ 0\end{array}$$

$\frac{9}{20}=0.45\cdot100\%=45\%$

83. $\frac{44}{1}\cdot\frac{1}{100}=\frac{\cancel{44}^{11}}{1}\cdot\frac{1}{\cancel{100}_{25}}=\frac{11}{25}$

$\frac{11}{25}=44\div100=0.44=44\%$

84. $\frac{75}{1}\cdot\frac{1}{100}=\frac{\cancel{75}^{3}}{1}\cdot\frac{1}{\cancel{100}_{4}}=\frac{3}{4}$

$\frac{3}{4}=75\div100=0.75=75\%$

85.
$$\begin{array}{r}1.1875\\ 16\overline{)\,19.0000}\\ \underline{-16}\\ 30\\ \underline{-16}\\ 140\\ \underline{-128}\\ 120\\ \underline{-112}\\ 80\\ \underline{-80}\\ 0\end{array}$$

$\frac{19}{16}=1.1875\cdot100\%=118.75\%$

86. $0.28 = \frac{\cancel{28}^{7}}{\cancel{100}_{25}} = \frac{7}{25}$

$\frac{7}{25} = 0.28 \cdot 100\% = 28\%$

87. Answers will vary. Example:
This was a good idea because they now match U.S. currency – dollars and cents.

88. Answers will vary. Example:
Track and field races are measured in decimals.

89. Divide the numerator by the denominator.

90. The numerator is the decimal number written as a whole number and the denominator is found by looking at the place value of the last digit. Simplify to lowest terms if possible.

91. Multiply by 100%.

92. Divide by 100 and omit the percent sign. To rewrite as a fraction, simplify to lowest terms after dividing by 100 and omitting the percent sign.

1.6 QUICK CHECK

1. a) \$850, \$1020, \$970, \$635, \$795
The total of these values is \$4270.

$\text{Mean} = \frac{4270}{5} = \$854$

b) 40, 16, 20, 0, 15, 35
The total of these values is 126 hours.

$\text{Mean} = \frac{126}{6} = 21 \text{ hours}$

2. a) i) 85, 37, 70, 55, 86
Write the values in ascending order.
37 55 70 85 86
↑
Median = 70

ii) 39, 66, 88, 21, 99, 57, 45
Write the values in ascending order.
21 39 45 57 66 88 99
↑
Median = 57

b) i) 32, 59, 62, 3, 20, 46, 26, 101
Write the values in ascending order.
3 20 26 (32 46) 59 62 101
↑
$\text{Median} = \frac{32+46}{2} = \frac{78}{2} = 39$

ii) 52, 75, 71, 56, 68, 58
Write the values in ascending order.
52 56 (58 68) 71 75
↑
$\text{Median} = \frac{58+68}{2} = \frac{126}{2} = 63$

3. a) 56, 65, 66, 66, 65, 66, 65, 60, 61, 65
The value 65 is repeated the most times.
The mode is 65 inches.

b) 100, 92, 105, 115, 105, 96, 130
The value 105 is repeated the most times.
The mode is 105 points.

4. a) 165, 168, 174, 179, 182, 159, 171, 180
The largest value is 182; the smallest value is 159.
Range = 182 – 159 = 23 centimeters

b) 87, 75, 90, 78, 99
The largest value is 99; the smallest value is 75.
Range = 99 – 75 = 24 points

1.6 BASIC STATISTICS

1. center

2. spread

3. mean

4. median

5. mode

6. range

7. 63, 98, 21, 42, 71
The total of these values is 295.

$\text{Mean} = \frac{295}{5} = 59$

8. 84, 37, 29, 46, 15, 65
The total of these values is 276.

$$\text{Mean} = \frac{276}{6} = 46$$

9. 5, 17, 21, 35, 42, 59, 89, 106
The total of these values is 374.

$$\text{Mean} = \frac{374}{8} = 46.75$$

10. 30, 70, 74, 82, 95, 113, 128, 140
The total of these values is 732.

$$\text{Mean} = \frac{732}{8} = 91.5$$

11. 97, 76, 22, 103, 80, 45, 66
Write the values in ascending order.

22 45 66 76 80 97 103

Median = 76

12. 87, 3, 20, 62, 55, 73, 101, 49, 75
Write the values in ascending order.

3 20 49 55 62 73 75 87 101

Median = 62

13. 68, 47, 32, 90, 85, 40, 83, 39, 50, 77
Write the values in ascending order.

32 39 40 47 50 68 77 83 85 90

$$\text{Median} = \frac{50 + 68}{2} = \frac{118}{2} = 59$$

14. 123, 304, 290, 175, 260, 209, 321, 275
Write the values in ascending order.

123 175 209 260 275 290 304 321

$$\text{Median} = \frac{260 + 275}{2} = \frac{535}{2} = 267.5$$

15. 70, 56, 63, 35, 56, 63, 36, 56, 19
The value 56 is repeated the most times. The mode is 56.

16. 80, 50, 70, 80, 50, 70, 80, 40, 60
The value 80 is repeated the most times. The mode is 80.

17. 7, 41, 32, 56, 41, 19, 8, 32, 25
The values 32 and 41 are repeated. The modes are 32 and 41.

18. 61, 47, 47, 17, 29, 16, 25, 92, 16
The values 16 and 47 are repeated. The modes are 16 and 47.

19. 5, 35, 89, 106, 42, 17, 59, 21
No value is repeated. There is no mode.

20. 88, 45, 6, 99, 32, 75, 16, 100, 42
No value is repeated. There is no mode.

21. 70, 140, 87, 62, 196, 125, 155
The largest value is 196; the smallest value is 62.
Range = 196 – 62 = 134

22. 93, 47, 28, 80, 94, 60, 93
The largest value is 94; the smallest value is 28.
Range = 94 – 28 = 66

23. 406, 354, 509, 427, 516, 379
The largest value is 516; the smallest value is 354.
Range = 516 – 354 = 162

24. 165, 82, 97, 155, 79, 203, 121, 99
The largest value is 203; the smallest value is 79.
Range = 203 – 79 = 124

25. 22, 13, 16, 30, 32, 19, 24, 30, 21

a) The total of these values is 207.

$$\text{Mean} = \frac{207}{9} = 23$$

b) Write the values in ascending order.

13 16 19 21 22 24 30 30 32

Median = 22

c) The value 30 is repeated. The mode is 30.

d) The largest value is 32; the smallest value is 13.
Range = 32 – 13 = 19

26. 59, 41, 46, 62, 41, 50, 65

a) The total of these values is 364.

$$\text{Mean} = \frac{364}{7} = 52$$

b) Write the values in ascending order.

41 41 46 50 59 62 65

Median = 50

c) The value 41 is repeated. The mode is 41.

d) The largest value is 65; the smallest value is 41.
Range = 65 − 41 = 24

27. 48, 45, 63, 36, 50, 38, 73, 63

a) The total of these values is 416.

$$\text{Mean} = \frac{416}{8} = 52$$

b) Write the values in ascending order.

36 38 45 48 50 63 63 73

$$\text{Median} = \frac{48+50}{2} = \frac{98}{2} = 49$$

c) The value 63 is repeated. The mode is 63.

d) The largest value is 73; the smallest value is 36.
Range = 73 − 36 = 37

28. 98, 84, 44, 40, 50, 82, 43, 84, 46, 70

a) The total of these values is 641.

$$\text{Mean} = \frac{641}{10} = 64.1$$

b) Write the values in ascending order.

40 43 44 46 50 70 82 84 84 98

$$\text{Median} = \frac{50+70}{2} = \frac{120}{2} = 60$$

c) The value 84 is repeated. The mode is 84.

d) The largest value is 98; the smallest value is 40.
Range = 98 − 40 = 58

29. 63, 86, 76, 85, 59, 71, 34, 44, 30, 67, 44, 77, 50, 83, 76

a) The total of these values is 945.

$$\text{Mean} = \frac{945}{15} = 63$$

b) Write the values in ascending order.

30 34 44 44 50 59 63 67 71 76 76 77 83 85 86

Median = 67

c) The values 44 and 76 are repeated. The modes are 44 and 76.

d) The largest value is 86; the smallest value is 30.
Range = 86 − 30 = 56

30. 48, 91, 38, 101, 93, 66, 31, 57, 84, 47, 73, 41, 86, 90, 96, 86, 62

a) The total of these values is 1190.

$$\text{Mean} = \frac{1190}{17} = 70$$

b) Write the values in ascending order.

31 38 41 47 48 57 62 66 73 84 86 86 90 91 93 96 101

Median = 73

c) The value 86 is repeated. The mode is 86.

d) The largest value is 101; the smallest value is 31.
Range = 101 − 31 = 70

31. 196, 295, 213, 69, 371, 77, 253, 210, 298, 210, 426, 327, 270, 323, 262, 70, 459, 481, 278, 192

a) The total of these values is 5280.

$$\text{Mean} = \frac{5280}{20} = 264$$

b) Write the values in ascending order.

69 70 77 192 196 210 210 213 253 262 270 278 295 298 323 327 371 426 459 481

$$\text{Median} = \frac{262+270}{2} = \frac{532}{2} = 266$$

c) The value 210 is repeated. The mode is 210.

d) The largest value is 481; the smallest value is 69.
Range = 481 − 69 = 412

32. 257, 50, 23, 223, 125, 249, 197, 191, 99, 194, 239, 227, 192, 96, 50, 147, 259, 296

a) The total of these values is 3114.

$$\text{Mean} = \frac{3114}{18} = 173$$

b) Write the values in ascending order.

23 50 50 96 99 125 147 191 192 194 197 223 227 239 249 257 259 296

$$\text{Median} = \frac{192+194}{2} = \frac{386}{2} = 193$$

c) The value 50 is repeated. The mode is 50.

d) The largest value is 296; the smallest value is 23.
Range = 296 − 23 = 273

33. 95, 82, 104, 119, 118, 126, 82, 96, 116, 85, 90, 90
The total of these values is 1203.

$$\text{Mean} = \frac{1203}{12} = 100.25$$

34. 198, 177, 238, 222, 199, 192, 166, 173
The total of these values is 1565.

$$\text{Mean} = \frac{1565}{8} = 195.625$$

35. 133, 112, 142, 154, 102, 139, 149
The total of these values is 931.

$$\text{Mean} = \frac{931}{7} = 133$$

36. 119, 160, 121, 92, 109, 95, 114, 112, 122
The total of these values is 1044.

$$\text{Mean} = \frac{1044}{9} = 116$$

37. 101, 110, 125, 120, 106, 113, 102, 108, 132, 135
The total of these values is 1152.

$$\text{Mean} = \frac{1152}{10} = 115.2$$

38. \$61,800, \$54,200, \$43,500, \$39,400, \$36,700
The total of these values is \$235,600.

$$\text{Mean} = \frac{\$235{,}600}{5} = \$47{,}120$$

39. 243, 18, 21, 152, 93, 125
Write the values in ascending order.

18 21 93 125 152 243

$$\text{Median} = \frac{93+125}{2} = \frac{218}{2} = 109$$

40. 90, 91, 94, 122, 113, 142, 59, 92
Write the values in ascending order.

59 90 91 92 94 113 122 142

$$\text{Median} = \frac{92+94}{2} = \frac{186}{2} = 93$$

41. 80, 96, 100, 89, 74, 96, 95, 98, 87
Write the values in ascending order.

74 80 87 89 95 96 96 98 100

Median = 95

42. 267, 255, 263, 261, 265, 273, 264, 267, 268, 275, 273
Write the values in ascending order.

255 261 263 264 265 267 267 268 273 273 275

Median = 267

43. 25, 12, 17, 3, 20, 20, 16, 34, 1, 9
Write the values in ascending order.

1 3 9 12 16 17 20 20 25 34

$$\text{Median} = \frac{16+17}{2} = \frac{33}{2} = 16.5$$

44. 8, 4, 20, 0, 12, 32, 8, 40, 20, 16
Write the values in ascending order.

0 4 8 8 (12 16) 20 20 32 40

$$\text{Median} = \frac{12+16}{2} = \frac{28}{2} = 14$$

45. \$219, \$259, \$127, \$199, \$259, \$169, \$219, \$229, \$299, \$199

a) The total of these values is \$2178.

$$\text{Mean} = \frac{\$2178}{10} = \$217.80$$

b) Write the values in ascending order.

\$127 \$169 \$199 \$199 (\$219 \$219) \$229 \$259 \$259 \$299

$$\text{Median} = \frac{\$219+\$219}{2} = \frac{\$438}{2} = \$219$$

c) The values \$199, \$219 and \$259 are repeated. The modes are \$199, \$219 and \$259.

d) The largest value is \$299; the smallest value is \$127.
Range = \$299 – \$127 = \$172

46. 1, 15, 19, 17, 26, 28, 27, 8, 31, 18, 26, 26, 0, 2, 13, 16

a) The total of these values is 273.

$$\text{Mean} = \frac{273}{16} = 17.0625$$

b) Write the values in ascending order.

0 1 2 8 13 15 16 (17 18) 19 26 26 26 27 28 31

$$\text{Median} = \frac{17+18}{2} = \frac{35}{2} = 17.5$$

c) The value 26 is repeated. The mode is 26.

d) The largest value is 31; the smallest value is 0.
Range = 31 – 0 = 31

47. 289, 191, 180, 390, 271, 270, 198, 574

a) The total of these values is 2363.

$$\text{Mean} = \frac{2363}{8} = 295.375$$

b) Write the values in ascending order.

180 191 198 (270 271) 289 390 574

$$\text{Median} = \frac{270+271}{2} = \frac{541}{2} = 270.5$$

c) No value is repeated. There is no mode.

d) The largest value is 574; the smallest value is 180.
Range = 574 – 180 = 394

48. 188, 166, 163, 165, 149, 209, 135, 150, 96, 145, 170, 124, 158, 110, 314, 94

a) The total of these values is 2536.

$$\text{Mean} = \frac{2536}{16} = 158.5$$

b) Write the values in ascending order.

94 96 110 124 135 145 149 (150 158) 163 165 166 170 188 209 314

$$\text{Median} = \frac{150+158}{2} = \frac{308}{2} = 154$$

c) No value is repeated. There is no mode.

d) The largest value is 314; the smallest value is 94.
Range = 314 – 94 = 220

49. 636, 754, 662, 884, 1346, 659, 1006, 1357, 1129, 904, 1747, 1336, 1234, 388

a) The total of these values is 14,042.

$$\text{Mean} = \frac{14{,}042}{14} = 1003$$

b) Write the values in ascending order.

388 636 659 662 754 884 904 1006 1129
1234 1336 1346 1357 1747

$$\text{Median} = \frac{904 + 1006}{2} = \frac{1910}{2} = 955$$

c) No value is repeated. There is no mode.

d) The largest value is 1747; the smallest value is 388.
Range = 1747 – 388 = 1359

50. 110, 118, 137, 127, 134, 163, 129, 102, 102, 136, 150, 130, 113

a) The total of these values is 1651.

$$\text{Mean} = \frac{1651}{13} = 127$$

b) Write the values in ascending order.

102 102 110 113 118 127 129 130 134 136
137 150 163

Median = 129

c) The value 102 is repeated. The mode is 102.

d) The largest value is 163; the smallest value is 102.
Range = 163 – 102 = 61

51. 80, 86, 100, 81, 30, 57, 90, x
The total of these values is $524 + x$.

$$\text{Mean} = \frac{524 + x}{8} = 75$$
$$524 + x = 600$$
$$x = 76$$

52. 43, 96, 90, x, 81, 104, 111, 72, 66, 89
The total of these values is $752 + x$.

$$\text{Mean} = \frac{752 + x}{10} = 82.5$$
$$752 + x = 825$$
$$x = 73$$

53. 112, 98, 121, 72, x, 65
Since there are an even number of values, the median is the average of the two middle values. Write the values in ascending order. If the median is 101.5, the missing value must follow 98.

65 72 98 x 112 121

$$\text{Median} = \frac{98 + x}{2} = 101.5$$
$$98 + x = 203$$
$$x = 105$$

54. 97, x, 81, 100, 104, 88, 121, 79
Since there are an even number of values, the median is the average of the two middle values. Write the values in ascending order. If the median is 93, the missing value must follow 88.

79 81 88 x 97 100 104 121

$$\text{Median} = \frac{x + 97}{2} = 93$$
$$x + 97 = 186$$
$$x = 89$$

55. Add all of the values and then divide by how many values there are.

56. Write the values in ascending order. The median is the middle value.

57. Write the values in ascending order. The median is the average of the two middle values.

58. Median; it only uses central values while the other measures use all values.

1.7 QUICK CHECK

1. a) $4^3 = 4 \cdot 4 \cdot 4 = 64$

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

2. a) $\left(\frac{1}{8}\right)^4 = \frac{1}{8} \cdot \frac{1}{8} \cdot \frac{1}{8} \cdot \frac{1}{8} = \frac{1}{4096}$

b) $\left(\frac{5}{6}\right)^2 = \frac{5}{6} \cdot \frac{5}{6} = \frac{25}{36}$

3. a) $-2\cdot 7+11-3^4 = -2\cdot 7+11-81$
$= -14+11-81$
$= 11-95$
$= -84$

b) $8-10(7)-5^3 = 8-10(7)-125$
$= 8-70-125$
$= -187$

4. a) $9^2-4(-2)(-10) = 81-4(-2)(-10)$
$= 81+8(-10)$
$= 81-80$
$= 1$

b) $(-7)^2-4(3)(-8) = 49-4(3)(-8)$
$= 49+96$
$= 145$

5. a) $20\div 5\cdot 10(3\cdot 6-9) = 20\div 5\cdot 10(18-9)$
$= 20\div 5\cdot 10(9)$
$= 4\cdot 10(9)$
$= 40(9)$
$= 360$

b) $-4+3(8-6\cdot 7) = -4+3(-34)$
$= -4-102$
$= -106$

6. a) $4\left[3^2+5(2-8)\right] = 4\left[3^2+5(-6)\right]$
$= 4\left[9+5(-6)\right]$
$= 4[9-30]$
$= 4[-21]$
$= -84$

b) $2+3\left[7-3\left(4-5^2\right)\right] = 2+3\left[7-3(4-25)\right]$
$= 2+3\left[7-3(-21)\right]$
$= 2+3[7+63]$
$= 2+3[70]$
$= 2+210$
$= 212$

1.7 EXPONENTS AND ORDER OF OPERATIONS

1. base

2. base; factor

3. squared

4. cubed

5. grouping

6. exponents

7. $2\cdot 2\cdot 2 = 2^3$

8. $9\cdot 9\cdot 9\cdot 9\cdot 9 = 9^5$

9. $(-2)(-2)(-2)(-2) = (-2)^4$

10. $(-6)(-6)(-6)(-6)(-6) = (-6)^5$

11. $-3\cdot 3\cdot 3\cdot 3\cdot 3 = -3^5$

12. $-8\cdot 8\cdot 8\cdot 8 = -8^4$

13. 5^3

14. 7^2

15. $7^4 = 7\cdot 7\cdot 7\cdot 7 = 2401$

16. $6^3 = 6\cdot 6\cdot 6 = 216$

17. $2^7 = 2\cdot 2\cdot 2\cdot 2\cdot 2\cdot 2\cdot 2 = 128$

18. $3^8 = 3\cdot 3\cdot 3\cdot 3\cdot 3\cdot 3\cdot 3\cdot 3 = 6561$

19. $10^4 = 10\cdot 10\cdot 10\cdot 10 = 10,000$

20. $10^8 = 10\cdot 10\cdot 10\cdot 10\cdot 10\cdot 10\cdot 10\cdot 10$
$= 100,000,000$

21. $1^{200} = 1$

22. $0^{17} = 0$

23. $\left(\frac{2}{5}\right)^4 = \frac{2}{5}\cdot\frac{2}{5}\cdot\frac{2}{5}\cdot\frac{2}{5} = \frac{16}{625}$

24. $\left(\frac{1}{8}\right)^3 = \frac{1}{8}\cdot\frac{1}{8}\cdot\frac{1}{8} = \frac{1}{512}$

25. $0.2^5\,(0.2)(0.2)(0.2)(0.2)(0.2) = 0.00032$

26. $0.5^4\,(0.5)(0.5)(0.5)(0.5) = 0.0625$

27. $(-3)^4 = (-3)(-3)(-3)(-3) = 81$

28. $-3^4 = -3 \cdot 3 \cdot 3 \cdot 3 = -81$

29. $-2^7 = -2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 = -128$

30. $(-2)^7 = (-2)(-2)(-2)(-2)(-2)(-2)(-2)$
$= -128$

31. $2^3 \cdot 5^2 = 2 \cdot 2 \cdot 2 \cdot 5 \cdot 5 = 8 \cdot 25 = 200$

32. $9^2 \cdot 4^4 = 9 \cdot 9 \cdot 4 \cdot 4 \cdot 4 \cdot 4 = 81 \cdot 256 = 20,736$

33. $-6^2 \cdot (-2)^2 = -6 \cdot 6 \cdot (-2)(-2)$
$= -36 \cdot (4)$
$= -144$

34. $-3^2 \cdot (-8)^2 = -3 \cdot 3 \cdot (-8)(-8) = -9 \cdot 64 = -576$

35. $6 + 5(4) = 6 + 20 = 26$

36. $7 - 3 \cdot 9 = 7 - 27 = -20$

37. $42 \div 6 \cdot 3^3 = 42 \div 6 \cdot 27 = 7 \cdot 27 = 189$

38. $64 - 32 \div 2^4 = 64 - 32 \div 16 = 64 - 2 = 62$

39. $10 \cdot 6 - 8 \cdot 9 = 60 - 72 = -12$

40. $10(6 - 8 \cdot 9) = 10(6 - 72) = 10(-66) = -660$

41. $6.3 + 3.7(-3.4) = 6.3 - 12.58 = -6.28$

42. $6.3 + 3.7 - 3.4 = 6.6$

43. $-22.3 + 8.32 \div 2.6 = -22.3 + 3.2 = -19.1$

44. $1.2 \cdot 10.8 - 3.6^2 = 1.2 \cdot 10.8 - 12.96$
$= 12.96 - 12.96$
$= 0$

45. $(-8)^2 - 4(2)(-9) = 64 - 4(2)(-9)$
$= 64 + 72$
$= 136$

46. $(-7)^2 - 4(-5)(-6) = 49 - 4(-5)(-6)$
$= 49 - 120$
$= -71$

47. $5^2 + 12^2 = 25 + 144 = 169$

48. $(5 + 12)^2 = (17)^2 = 289$

49. $-4 - 5(7 - 3 \cdot 6) = -4 - 5(7 - 18)$
$= -4 - 5(-11)$
$= -4 + 55$
$= 51$

50. $3 - 6\left(5^2 - 4 + 2 \cdot 7\right) = 3 - 6(25 - 4 + 2 \cdot 7)$
$= 3 - 6(25 - 4 + 14)$
$= 3 - 6(21 + 14)$
$= 3 - 6(35)$
$= 3 - 210$
$= -207$

51. $\frac{1}{2} + \frac{1}{2} \cdot \frac{4}{7} = \frac{1}{2} + \frac{1}{\cancel{2}_1} \cdot \frac{\cancel{4}^2}{7}$
$= \frac{1}{2} + \frac{2}{7}$
$= \frac{7}{14} + \frac{4}{14}$
$= \frac{11}{14}$

52. $\frac{3}{5} \cdot \frac{2}{3} + \frac{15}{7} \cdot \frac{21}{20} = \frac{\cancel{3}^1}{5} \cdot \frac{2}{\cancel{3}_1} + \frac{\cancel{15}^3}{\cancel{7}_1} \cdot \frac{\cancel{21}^3}{\cancel{20}_4}$
$= \frac{2}{5} + \frac{9}{4}$
$= \frac{8}{20} + \frac{45}{20}$
$= \frac{53}{20}$

53. $\frac{2}{9} \div \frac{5}{3} \cdot \frac{33}{50} = \frac{2}{9} \cdot \frac{3}{5} \cdot \frac{33}{50}$
$= \frac{\cancel{2}^1}{\cancel{9}_3} \cdot \frac{\cancel{3}^1}{5} \cdot \frac{33}{\cancel{50}_{25}}$
$= \frac{1}{\cancel{3}_1} \cdot \frac{1}{5} \cdot \frac{\cancel{33}^{11}}{25}$
$= \frac{11}{125}$

54. $4\cdot\frac{3}{8}-\left(\frac{7}{6}\right)^2=\frac{\cancel{4}^{1}}{1}\cdot\frac{3}{\cancel{8}_{2}}-\left(\frac{7}{6}\right)\left(\frac{7}{6}\right)$
$=\frac{3}{2}-\frac{49}{36}$
$=\frac{54}{36}-\frac{49}{36}$
$=\frac{5}{36}$

55. $\frac{1}{9}\left(\frac{19}{28}-\frac{1}{4}\right)=\frac{1}{9}\left(\frac{19}{28}-\frac{7}{28}\right)$
$=\frac{1}{9}\left(\frac{12}{28}\right)$
$=\frac{1}{9}\left(\frac{3}{7}\right)$
$=\frac{1}{\cancel{9}_{3}}\cdot\frac{\cancel{3}^{1}}{7}$
$=\frac{1}{21}$

56. $\frac{8}{25}\div\left(\frac{4}{15}-\frac{1}{3}+\frac{3}{5}\right)\cdot\frac{7}{18}$
$=\frac{8}{25}\div\left(\frac{4}{15}-\frac{5}{15}+\frac{9}{15}\right)\cdot\frac{7}{18}$
$=\frac{8}{25}\div\left(\frac{8}{15}\right)\cdot\frac{7}{18}$
$=\frac{8}{25}\cdot\frac{15}{8}\cdot\frac{7}{18}$
$=\frac{\cancel{8}^{1}}{\cancel{25}_{5}}\cdot\frac{\cancel{15}^{3}}{\cancel{8}_{1}}\cdot\frac{7}{18}$
$=\frac{1}{5}\cdot\frac{\cancel{3}^{1}}{1}\cdot\frac{7}{\cancel{18}_{6}}$
$=\frac{7}{30}$

57. $\frac{2^2-9}{3^3-7}=\frac{4-9}{27-7}=\frac{-5}{20}=-\frac{1}{4}$

58. $\frac{3+5\cdot7-4\cdot2}{1+2\cdot17}=\frac{3+35-8}{1+34}$
$=\frac{38-8}{35}$
$=\frac{30}{35}$
$=\frac{6}{7}$

59. $\frac{(3+5)\cdot6-8}{1+3^2+2}=\frac{(8)\cdot6-8}{1+3^2+2}$
$=\frac{(8)\cdot6-8}{1+9+2}$
$=\frac{48-8}{1+9+2}$
$=\frac{40}{12}$
$=\frac{10}{3}$

60. $\frac{10^3+9^3}{1^3+12^3}=\frac{1000+729}{1+1728}=\frac{1729}{1729}=1$

61. $3-\left[4\left(5-6\cdot7\right)\right]=3-\left[4\left(5-42\right)\right]$
$=3-\left[4\left(-37\right)\right]$
$=3-\left(-148\right)$
$=151$

62. $18+\left[9-\left(4-5\cdot8\right)\right]\div3^2$
$=18+\left[9-\left(4-5\cdot8\right)\right]\div9$
$=18+\left[9-\left(4-40\right)\right]\div9$
$=18+\left[9-\left(-36\right)\right]\div9$
$=18+45\div9$
$=18+5$
$=23$

63. $-4\cdot9-\left|-7\left(3+5\right)\right|-2^3$
$=-4\cdot9-\left|-7\left(3+5\right)\right|-8$
$=-4\cdot9-\left|-7\left(8\right)\right|-8$
$=-36-\left|-56\right|-8$
$=-36-56-8$
$=-100$

64. $-6^2+2\left|\left(7-49\right)\div\left(2\cdot3\right)\right|$
$=-6^2+2\left|\left(-42\right)\div6\right|$
$=-36+2\left|-7\right|$
$=-36+14$
$=-22$

65. $9-\left|3^2+2^3-10\cdot9\right|=9-\left|9+8-10\cdot9\right|$
$=9-\left|9+8-90\right|$
$=9-\left|17-90\right|$
$=9-\left|-73\right|$
$=9-73$
$=-64$

66. $\left|-4^2+19\right|-\left|(-7)^2+5(10)\right|$
$=\left|-16+19\right|-\left|49+5(10)\right|$
$=\left|3\right|-\left|49+50\right|$
$=3-\left|99\right|$
$=3-99$
$=-96$

67. $-21\left(\left|4-3\cdot 9\right|+\left|8(13-4)\right|\right)$
$=-21\left(\left|4-27\right|+\left|8(9)\right|\right)$
$=-21\left(\left|-23\right|+\left|72\right|\right)$
$=-21(23+72)$
$=-21(95)$
$=-1995$

68. $(6\cdot 5+40\div 20)\left(\left|8^2-2\cdot 17\right|-\left|10^2-2\cdot 51\right|\right)$
$=(30+2)\left(\left|64-2\cdot 17\right|-\left|100-2\cdot 51\right|\right)$
$=(32)\left(\left|64-34\right|-\left|100-102\right|\right)$
$=(32)\left(\left|30\right|-\left|-2\right|\right)$
$=(32)(30-2)$
$=(32)(28)$
$=896$

69. Answers will vary. Example:
$8\cdot 3+8\cdot 2+1=41$

70. Answers will vary. Example:
$5\cdot(3+4-7)^2=0$

71. Answers will vary. Example:
$-4^2+9-2\cdot 3=-13$

72. Answers will vary. Example:
$2^2-6^2+5\cdot 2+3=-19$

73. 1 kilobyte $=2^{10}$ bytes $=1024$ bytes

74. 1 megabyte $=2^{20}$ bytes $=1,048,576$ bytes

75. 1 gigabyte $=2^{30}$ bytes $=1,073,741,824$ bytes

76. 1 terabyte $=2^{40}$ bytes
$=1,099,511,627,776$ bytes

77. Since $4\cdot 4\cdot 4\cdot 4\cdot 4=1024$, the missing number is 5.

78. Since $7\cdot 7\cdot 7\cdot 7=2401$, the missing number is 4.

79. Since $9\cdot 9\cdot 9\cdot 9=6561$, the missing number is 9.

80. Since $5\cdot 5\cdot 5\cdot 5\cdot 5=3125$, the missing number is 5.

81. Since $\frac{2\cdot 2\cdot 2\cdot 2\cdot 2}{7\cdot 7\cdot 7\cdot 7\cdot 7}=\frac{32}{16,807}$, the missing number is 7.

82. Since $\left(\frac{3}{4}\right)\left(\frac{3}{4}\right)\left(\frac{3}{4}\right)\left(\frac{3}{4}\right)=\frac{81}{256}$, the missing number is 4.

83. $7\cdot 2-9+5=14-9+5=10$

84. $6\cdot 5-4\cdot 7=30-28=2$

85. $(3+7)\cdot 9\div 2=10\cdot 9\div 2=90\div 2=45$

86. $(8+2\cdot 3+14)\div 4+7=(8+6+14)\div 4+7$
$=28\div 4+7$
$=7+7$
$=14$

87. Explanations will vary. Example:
The base of $(-2)^6$ is (-2), while the base of -2^6 is just 2. Therefore, the former would be positive and the latter would be negative.

88. Answers will vary.

89. 3; -3; -3^4 is negative.

90. **1.** Remove grouping symbols. **2.** Perform any operations involving exponents. **3.** Multiply and divide. **4.** Add and subtract.

91. No, those operations have equal priority and are performed in the order they appear in from left to right.

92. These are grouping symbols that are inside another set of grouping symbols.

1.8 QUICK CHECK

1. a) $x+9$

b) $x+8$

2. a) $x-25$

b) $x-20$

3. a) $2x$

b) $7x$

4. a) $\frac{x}{20}$

b) $\frac{x}{6}$

5. a) $5(11)+2=55+2=57$

b) $7(-9)-4=-63-4=-67$

6. a) $(-8)^2-13(-8)-40=64-13(-8)-40$
$=64+104-40$
$=128$

b) $(-9)^2+3(-9)+10=81+3(-9)+10$
$=81-27+10$
$=64$

7. a) $(5)^2-4(-1)(18)=25-4(-1)(18)$
$=25-(-72)$
$=25+72$
$=97$

b) $(-7)^2-4(-3)(-8)=49-4(-3)(-8)$
$=49-96$
$=-47$

8. a) $7(5x-4)=7\cdot 5x-7\cdot 4=35x-28$

b) $3(6-5x)=3\cdot 6-3\cdot 5x=18-15x$

9. a) $12(x-2y+3z)=12\cdot x-12\cdot 2y+12\cdot 3z$
$=12x-24y+36z$

b) $5(4a+7b-2c)=5\cdot 4a+5\cdot 7b-5\cdot 2c$
$=20a+35b-10c$

10. a) $-6(4x+11)=-6\cdot 4x+(-6)\cdot 11$
$=-24x-66$

b) $-9(3x-7)=-9\cdot 3x-(-9)\cdot 7$
$=-27x-(-63)$
$=-27x+63$

11. a) The expression has 4 terms: x^3, $-x^2$, $23x$, and -59. The coefficients are 1, -1, 23, and -59.

b) The expression has 3 terms: $8x^3$, $-x$, and $-17x$ The coefficients are 8, -1, and -17.

12. a) $3x+7y+y-5x=-2x+8y$

b) $-8a+3b-5a-7b=-13a-4b$

13. a) $5(2x+3)+9x-8=10x+15+9x-8$
$=19x+7$

b) $7(6x-7)-15=42x-49-15=42x-64$

14. a) $3(2x-7)-8(x-9)=6x-21-8x+72$
$=-2x+51$

b) $-5(3x+4)-9(2x-11)$
$=-15x-20-18x+99$
$=-33x+79$

1.8 INTRODUCTION TO ALGEBRA

1. variable

2. variable

3. evaluate

4. commutative

5. associative

6. distributive

7. term

8. coefficient

9. like terms

10. coefficients

11. $x-13$

12. $x+40$

13. $x+9$

14. $x-17$

15. $10x$

16. $\frac{x}{6}$

17. $5x+20$

18. $2x-9$

19. $x+y$

20. $\frac{x}{y}$

21. $7(x-y)$

22. $\frac{1}{2}(x+25)$

23. $325c$

24. $92.50p$

25. $25,000+22a$

26. $200d+425$

27. Nine less than a number

28. Sixteen more than a number

29. Seven times a number

30. Five more than six times a number

31. Ten less than eight times a number

32. Seven less than twice a number

33. $8x+31$ for $x=8$
$8(8)+31=64+31=95$

34. $-2x+19$ for $x=5$
$-2(5)+19=-10+19=9$

35. $4a-5b$ for $a=7$ and $b=-3$
$4(7)-5(-3)=28+15=43$

36. $6a+7b$ for $a=5$ and $b=-8$
$6(5)+7(-8)=30-56=-26$

37. $4(2x-7)$ for $x=9$
$4[2(9)-7]=4(18-7)=4(11)=44$

38. $8x-28$ for $x=9$
$8(9)-28=72-28=44$

39. $x^2-3x-20$ for $x=6$
$$\begin{aligned}(6)^2-3(6)-20&=36-3(6)-20\\&=36-18-20\\&=-2\end{aligned}$$

40. $x^2+2x+24$ for $x=12$
$$\begin{aligned}(12)^2+2(12)+24&=144+2(12)+24\\&=144+24+24\\&=192\end{aligned}$$

41. $y^2+2y-30$ for $y=-4$
$$\begin{aligned}(-4)^2+2(-4)-30&=16+2(-4)-30\\&=16-8-30\\&=-22\end{aligned}$$

42. $y^2-8y-10$ for $y=-8$
$$\begin{aligned}(-8)^2-8(-8)-10&=64+-8(-8)-10\\&=64+64-10\\&=118\end{aligned}$$

43. x^2-36 for $x=-6$
$(-6)^2-36=36-36=0$

44. $19-x^2$ for $x=4$
$19-(4)^2=19-16=3$

45. b^2-4ac for $a=2,\ b=5,$ and $c=-3$
$(5)^2-4(2)(-3)=25-4(2)(-3)=25+24=49$

46. b^2-4ac for $a=-5,\ b=7,$ and $c=-4$
$$\begin{aligned}(7)^2-4(-5)(-4)&=49-4(-5)(-4)\\&=49-80\\&=-31\end{aligned}$$

47. $b^2 - 4ac$ for $a = -1,\ b = -2,$ and $c = 10$

$$\begin{aligned}(-2)^2 - 4(-1)(10) &= 4 - 4(-1)(10)\\ &= 4 + 40\\ &= 44\end{aligned}$$

48. $b^2 - 4ac$ for $a = 15,\ b = -6,$ and $c = 9$

$$\begin{aligned}(-6)^2 - 4(15)(9) &= 36 - 4(15)(9)\\ &= 36 - 540\\ &= -504\end{aligned}$$

49. $5(x+h) - 17$ for $x = -3$ and $h = 0.01$

$$\begin{aligned}5(-3 + 0.01) - 17 &= 5(-2.99) - 17\\ &= -14.95 - 17\\ &= -31.95\end{aligned}$$

50. $-3(x+h) + 4$ for $x = -6$ and $h = 0.001$

$$\begin{aligned}-3(-6 + 0.001) + 4 &= -3(-5.999) + 4\\ &= 17.997 + 4\\ &= 21.997\end{aligned}$$

51. $(x+h)^2 - 5(x+h) - 14$ for $x = -3$ and $h = 0.1$

$$\begin{aligned}&(-3 + 0.1)^2 - 5(-3 + 0.1) - 14\\ &= (-2.9)^2 - 5(-2.9) - 14\\ &= 8.41 - 5(-2.9) - 14\\ &= 8.41 + 14.5 - 14\\ &= 8.91\end{aligned}$$

52. $(x+h)^2 + 4(x+h) - 28$ for $x = 6$ and $h = 1$

$$\begin{aligned}(6+1)^2 + 4(6+1) - 28 &= (7)^2 + 4(7) - 28\\ &= 49 + 4(7) - 28\\ &= 49 + 28 - 28\\ &= 49\end{aligned}$$

53. a) $3 - 5 \neq 5 - 3$

b) Yes, a and b must be equal, such as $7 - 7 = 7 - 7$.

54. a) $\dfrac{4}{7} \neq \dfrac{7}{4}$

b) Yes, a and b must be equal or opposites, such as $\dfrac{-5}{-5} = \dfrac{-5}{-5}$.

55. $8(x-6) = 8x - 48$

56. $3(x+7) = 3x + 21$

57. $4(5 - 3x) = 20 - 12x$

58. $13(2x - 9) = 26x - 117$

59. $-4(6x + 11) = -24x - 44$

60. $-5(3x + 17) = -15x - 85$

61. $-3(9x - 2) = -27x + 6$

62. $-6(-5x - 3) = 30x + 18$

63. $4x + 13x = 17x$

64. $7x + 22x = 29x$

65. $5n - 16n = -11n$

66. $24n - 7n = 17n$

67. $8x - 3 + 7x + 13 = 15x + 10$

68. $16x - 21 - 3x - 20 = 13x - 41$

69. $7a - 6b - 6a + 15b = a + 9b$

70. $4a + 9b + 8a - 11b = 12a - 2b$

71. $3(2x - 5) + 4x + 7 = 6x - 15 + 4x + 7 = 10x - 8$

72. $8 - 19k + 6(3k - 5) = 8 - 19k + 18k - 30 = -k - 22$

73. $2(4x - 9) - 11 = 8x - 18 - 11 = 8x - 29$

74. $3(2a + 11b) - 13a = 6a + 33b - 13a = -7a + 33b$

75. $6y - 5(3y - 17) = 6y - 15y + 85 = -9y + 85$

76. $5 - 9(3 - 4x) = 5 - 27 + 36x = 36x - 22$

77. $3(4z - 7) + 9(2z + 3) = 12z - 21 + 18z + 27 = 30z + 6$

78. $-6(5x - 9) - 7(13 - 12x)$

$$\begin{aligned}&= -30x + 54 - 91 + 84x\\ &= 54x - 37\end{aligned}$$

79. $-2(5a+4b-13c)+3b = -10a-8b+26c+3b$
$= -10a-5b+26c$

80. $-7(-2x+3y-17z)-5(3x-11)$
$= 14x-21y+119z-15x+55$
$= -x-21y+119z+55$

81. $5x^3+3x^2-7x-15$

a) 4

b) $5x^3, 3x^2, -7x, -15$

c) $5, 3, -7, -15$

82. $-3a^2-7a-10$

a) 3

b) $-3a^2, -7a, -10$

c) $-3, -7, -10$

83. $3x-17$

a) 2

b) $3x, -17$

c) $3, -17$

84. $9x^4-10x^3+13x^2-17x+329$

a) 5

b) $9x^4, -10x^3, 13x^2, 7x, 329$

c) $9, -10, 13, -17, 329$

85. $5(3x^2-7x+11)-6x = 15x^2-35x+55-6x$
$= 15x^2-41x+55$

a) 3

b) $15x^2, -41x, 55$

c) $15, -41, 55$

86. $4(3a-5b-7c-11)-2(6b-5c)$
$= 12a-20b-28c-44-12b+10c$
$= 12a-32b-18c-44$

a) 4

b) $12a, -32b, -18c, -44$

c) $12, -32, -18, -44$

87. $5(-7a-3b+5c)-3(6b-9c-23)$
$= -35a-15b+25c-18b+27c+69$
$= -35a-33b+52c+69$

a) 4

b) $-35a, -33b, 52c, 69$

c) $-35, -33, 52, 69$

88. $2(-4x+7y)-(3x+9y) = -8x+14y-3x-9y$
$= -11x+5y$

a) 2

b) $-11x, 5y$

c) $-11, 5$

89. Answers will vary. Example:
A store sells DVD players for \$60 each and x is the number of DVD players sold. Then $60x$ represents the amount of money earned from the sale of DVD players.

90. Answers will vary. Example:
Let x be the number of guests attending a wedding reception. If it costs \$20 per meal plus a \$35 service fee, then $20x+35$ is the total cost of the reception.

91. Answers will vary. Example:
$4(2x-5)-3(3x-8)-7x$
$= 8x-20-9x+24-7x$ Distribute.
$= -8x+4$ Combine like terms.

92. No, the difference is listed in the wrong order. "*5 less than twice a number*" can be represented by $2x-5$.

93. Substitute the appropriate value for the variable and then simplify the resulting expression using the order of operations.

94. -6

95. The three terms are not like terms and cannot be combined.

CHAPTER 1 REVIEW

1. $-10 < -7$

2. $3 > -12$

3. $|8| = 8$

4. $|-13| = 13$

5. 6

6. -12

7. $9 + (-16) = 9 - 16 = -7$

8. $-10 + 7 = -3$

9. $-22 - 19 = -41$

10. $4 - (-23) = 4 + 23 = 27$

11. $3 - 16 - 24 = 3 - 40 = -37$

12. $8 - (-19) - 7 = 8 + 19 - 7 = 27 - 7 = 20$

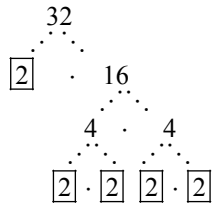
13. $9(-6) = -54$

14. $-144 \div (-9) = 16$

15. $1 \cdot 42 = 42$
$2 \cdot 21 = 42$
$3 \cdot 14 = 42$
$6 \cdot 7 = 42$
$\{1, 2, 3, 6, 7, 14, 21, 42\}$

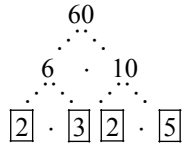
16. $1 \cdot 108 = 108$
$2 \cdot 54 = 108$
$3 \cdot 36 = 108$
$4 \cdot 27 = 108$
$6 \cdot 18 = 108$
$9 \cdot 12 = 108$
$\{1, 2, 3, 4, 6, 9, 12, 18, 27, 36, 54, 108\}$

17.



$32 = 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2$

18.



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

19. $\dfrac{24}{42} = \dfrac{\cancel{2}^{1} \cdot 2 \cdot 2 \cdot \cancel{3}^{1}}{\cancel{2}_{1} \cdot \cancel{3}_{1} \cdot 7} = \dfrac{4}{7}$

20. $\dfrac{9}{72} = \dfrac{\cancel{3}^{1} \cdot \cancel{3}^{1}}{2 \cdot 2 \cdot 2 \cdot \cancel{3}_{1} \cdot \cancel{3}_{1}} = \dfrac{1}{8}$

21. $\dfrac{40}{234} = \dfrac{\cancel{2}^{1} \cdot 2 \cdot 2 \cdot 5}{\cancel{2}_{1} \cdot 3 \cdot 3 \cdot 13} = \dfrac{20}{117}$

22. $\dfrac{98}{7} = \dfrac{2 \cdot \cancel{7}^{1} \cdot 7}{\cancel{7}_{1}} = 14$

23. $5\dfrac{2}{3}$
Multiply $5 \cdot 3 = 15$.
Add $15 + 2 = 17$.
$5\dfrac{2}{3} = \dfrac{17}{3}$

24. $12\dfrac{7}{25}$
Multiply $12 \cdot 25 = 300$.
Add $300 + 7 = 307$.
$12\dfrac{7}{25} = \dfrac{307}{25}$

25. $\dfrac{38}{10}$ $\qquad$ $10\overline{)38}$ $\qquad$ $\dfrac{38}{10} = 3\dfrac{8}{10} = 3\dfrac{4}{5}$

3
-30
8

26. $\frac{55}{6}$ $\quad 6\overline{)55}$ $\quad \begin{array}{r} 9 \\ -54 \\ \hline 1 \end{array}$ $\quad \frac{55}{6} = 9\frac{1}{6}$

27. $\frac{\cancel{9}^{3}}{\cancel{16}_{4}} \cdot \frac{\cancel{28}^{7}}{\cancel{75}_{25}} = \frac{21}{100}$

28. $5\frac{1}{2} \cdot \frac{14}{33} = \frac{\cancel{11}^{1}}{\cancel{2}_{1}} \cdot \frac{\cancel{14}^{7}}{\cancel{33}_{3}} = \frac{7}{3} = 2\frac{1}{3}$

29. $\frac{8}{15} \div \frac{20}{21} = \frac{8}{15} \cdot \frac{21}{20} = \frac{\cancel{8}^{2}}{\cancel{15}_{5}} \cdot \frac{\cancel{21}^{7}}{\cancel{20}_{5}} = \frac{14}{25}$

30. $3\frac{1}{5} \div 7\frac{1}{2} = \frac{16}{5} \div \frac{15}{2} = \frac{16}{5} \cdot \frac{2}{15} = \frac{32}{75}$

31. $\frac{5}{8} + \frac{7}{12}$ LCM = 24

$\frac{5}{8} + \frac{7}{12} = \frac{5}{8} \cdot \frac{3}{3} + \frac{7}{12} \cdot \frac{2}{2} = \frac{15}{24} + \frac{14}{24} = \frac{29}{24}$

32. $\frac{13}{20} + \frac{5}{6}$ LCM = 60

$\frac{13}{20} + \frac{5}{6} = \frac{13}{20} \cdot \frac{3}{3} + \frac{5}{6} \cdot \frac{10}{10} = \frac{39}{60} + \frac{50}{60} = \frac{89}{60}$

33. $\frac{11}{18} - \frac{4}{9}$ LCM = 18

$\frac{11}{18} - \frac{4}{9} = \frac{11}{18} - \frac{4}{9} \cdot \frac{2}{2} = \frac{11}{18} - \frac{8}{18} = \frac{3}{18} = \frac{1}{6}$

34. $\frac{7}{36} - \frac{13}{42}$ LCM = 252

$\frac{7}{36} - \frac{13}{42} = \frac{7}{36} \cdot \frac{7}{7} - \frac{13}{42} \cdot \frac{6}{6} = \frac{49}{252} - \frac{78}{252} = -\frac{29}{252}$

35. $\frac{\cancel{30}^{5}}{\cancel{49}_{7}} \cdot \frac{\cancel{35}^{5}}{\cancel{66}_{11}} = \frac{5}{7} \cdot \frac{5}{11} = \frac{25}{77}$

36. $\frac{7}{16} - \frac{11}{48}$ LCM = 48

$\frac{7}{16} - \frac{11}{48} = \frac{7}{16} \cdot \frac{3}{3} - \frac{11}{48} = \frac{21}{48} - \frac{11}{48} = \frac{10}{48} = \frac{5}{24}$

37. $\frac{9}{40} \div \frac{39}{35} = \frac{9}{40} \cdot \frac{35}{39} = \frac{\cancel{9}^{3}}{\cancel{40}_{8}} \cdot \frac{\cancel{35}^{7}}{\cancel{39}_{13}} = \frac{21}{104}$

38. $\frac{7}{20} + \frac{1}{15}$ LCM = 60

$\frac{7}{20} + \frac{1}{15} = \frac{7}{20} \cdot \frac{3}{3} + \frac{1}{15} \cdot \frac{4}{4} = \frac{21}{60} + \frac{4}{60} = \frac{25}{60} = \frac{5}{12}$

39.
$$\begin{array}{r} 8.70 \\ +3.92 \\ \hline 12.62 \end{array}$$

40.
$$\begin{array}{r} 24.308 \\ -15.490 \\ \hline 8.818 \end{array}$$

41.
$$\begin{array}{r} 8.4 \\ \times\ 3.6 \\ \hline 504 \\ +\ 2520 \\ \hline 3024 \end{array} = 30.24$$

42. $4.65\overline{)40.92}$

$$\begin{array}{r} 8.8 \\ 465\overline{)4092.0} \\ -3720 \\ \hline 3720 \\ -3720 \\ \hline 0 \end{array}$$

8.8

43.
$$\begin{array}{r} .32 \\ 25\overline{)8.00} \\ -75 \\ \hline 50 \\ -50 \\ \hline 0 \end{array}$$

$\frac{8}{25} = 0.32$

44.
$$\begin{array}{r} .9375 \\ 16\overline{)15.0000} \\ -144 \\ \hline 60 \\ -48 \\ \hline 120 \\ -112 \\ \hline 80 \\ -80 \\ \hline 0 \end{array}$$

$\frac{15}{16} = 0.9375$

45. $0.75 = \frac{75}{100} = \frac{3}{4}$

46. $0.28 = \frac{28}{100} = \frac{7}{25}$

47. $\frac{2}{5} \cdot 100\% = \frac{2}{\cancel{5}_1} \cdot \frac{\cancel{100}^{20}}{1}\% = 40\%$

48. $\frac{7}{25} \cdot 100\% = \frac{7}{\cancel{25}_1} \cdot \frac{\cancel{100}^{4}}{1}\% = 28\%$

49. $0.9 \cdot 100\% = 90\%$

50. $0.45 \cdot 100\% = 45\%$

51. $30\% = \frac{30}{100} = \frac{3}{10}$

52. $55\% = \frac{55}{100} = \frac{11}{20}$

53. $90\% = 90 \div 100 = 0.9$

54. $4\% = 4 \div 100 = 0.04$

55. $40 - 23 = 17$
$17

56. $78 - 125 = -47$
$-47

57.
$$\begin{array}{r} 12600 \\ 3\overline{)37800} \\ -3 \\ \hline 07 \\ -6 \\ \hline 18 \\ -18 \\ \hline 00 \\ -00 \\ \hline 0 \end{array}$$

$12,600

58. $1\frac{1}{2} + 2\frac{2}{3} = \frac{3}{2} + \frac{8}{3}$ LCM = 6

$\frac{3}{2} + \frac{8}{3} = \frac{3}{2} \cdot \frac{3}{3} + \frac{8}{3} \cdot \frac{2}{2} = \frac{9}{6} + \frac{16}{6} = \frac{25}{6} = 4\frac{1}{6}$ cups

59. 77, 71, 83, 80, 73, 74, 73, 81
The total of these values is 612 inches.

$\text{Mean} = \frac{612}{8} = 76.5$ inches

60. 113, 127, 133, 128, 108, 126, 117, 129, 128, 121
Write the values in ascending order.

108 113 117 121 (126 127) 128 128 129 133

$\text{Median} = \frac{126 + 127}{2} = \frac{253}{2} = 126.5$

61. 22, 19, 30, 25, 18, 33, 45, 21
The largest value is 45; the smallest value is 18.
Range = 45 − 18 = 27

62. 96, 88, 95, 79, 88, 99
The value 88 is repeated. The mode is 88.
The largest value is 99; the smallest value is 79.
Range = 99 − 79 = 20

63. $4^3 = 4 \cdot 4 \cdot 4 = 64$

64. $\left(\frac{2}{5}\right)^3 = \left(\frac{2}{5}\right)\left(\frac{2}{5}\right)\left(\frac{2}{5}\right) = \frac{8}{125}$

65. $-2^6 = -2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 = -64$

66. $3^5 \cdot 5^2 = (3\cdot 3\cdot 3\cdot 3\cdot 3)(5\cdot 5) = 243\cdot 25 = 6075$

67. $5 + 8\cdot 4 = 5 + 32 = 37$

68. $25 - 15 \div 5 = 25 - 3 = 22$

69. $3 + 13\cdot 5 - 20 = 3 + 65 - 20 = 68 - 20 = 48$

70. $(3+13)\cdot 5 - 20 = (16)\cdot 5 - 20 = 80 - 20 = 60$

71. $54 - 27 \div 3^2 = 54 - 27 \div 9 = 54 - 3 = 51$

72. $\frac{3}{4} + \frac{1}{4}\cdot\frac{12}{25} = \frac{3}{4} + \frac{1}{\cancel{4}_1}\cdot\frac{\cancel{12}^3}{25} = \frac{3}{4} + \frac{3}{25}$

LCM = 100

$\frac{3}{4} + \frac{3}{25} = \frac{3}{4}\cdot\frac{25}{25} + \frac{3}{25}\cdot\frac{4}{4} = \frac{75}{100} + \frac{12}{100} = \frac{87}{100}$

73. $x + 14$

74. $x - 20$

75. $2x - 8$

76. $6x + 9$

77. $3.55c$

78. $20 + 0.15m$

79. $3x + 17$ for $x = 9$

$3(9) + 17 = 27 + 17 = 44$

80. $9 - 8x$ for $x = -2$

$9 - 8(-2) = 9 + 16 = 25$

81. $10a - 4b$ for $a = 2$ and $b = -9$

$10(2) - 4(-9) = 20 + 36 = 56$

82. $(8x-9)(2x-11)$ for $x = 4$

$[8(4)-9][2(4)-11] = (32-9)(8-11)$

$= (23)(-3)$

$= -69$

83. $x^2 - 7x - 30$ for $x = -3$

$(-3)^2 - 7(-3) - 30 = 9 - 7(-3) - 30$

$= 9 + 21 - 30$

$= 30 - 30$

$= 0$

84. $b^2 - 4ac$ for $a = -1, b = -8,$ and $c = 5$

$(-8)^2 - 4(-1)(5) = 64 - 4(-1)(5)$

$= 64 + 4(5)$

$= 64 + 20$

$= 84$

85. $5(x+7) = 5x + 35$

86. $6x + 21x = 27x$

87. $8x - 25 - 3x + 17 = 8x - 3x - 25 + 17 = 5x - 8$

88. $8y - 6(4y - 21) = 8y - 24y + 126 = -16y + 126$

89. $15 - 23k + 7(4k - 9) = 15 - 23k + 28k - 63$

$= -23k + 28k + 15 - 63$

$= 5k - 48$

90. $-8(2x+25) - (103 - 19x)$

$= -16x - 200 - 103 + 19x$

$= -16x + 19x - 200 - 103$

$= 3x - 303$

91. $x^3 - 4x^2 - 10x + 41$

a) 4

b) $x^3, -4x^2, -10x, 41$

c) $1, -4, -10, 41$

92. $-x^2 + 5x - 30$

a) 3

b) $-x^2, 5x, -30$

c) $-1, 5, -30$

CHAPTER 1 TEST

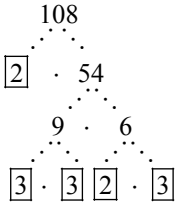
1. $-15 > -18$

2. $|-17| = 17$

3. $7 + (-13) = 7 - 13 = -6$

4. $-7(-9) = 63$

5. $1 \cdot 45 = 45$
$3 \cdot 15 = 45$
$5 \cdot 9 = 45$
$\{1, 3, 5, 9, 15, 45\}$

6.


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

7. $\frac{60}{84} = \frac{\cancel{2}^{1} \cdot \cancel{2}^{1} \cdot \cancel{3}^{1} \cdot 5}{\cancel{2}_{1} \cdot \cancel{2}_{1} \cdot \cancel{3}_{1} \cdot 7} = \frac{5}{7}$

8. $\frac{67}{18} = 3\frac{13}{18}$

9. $\frac{\cancel{11}^{1}}{\cancel{63}_{21}} \cdot \frac{\cancel{15}^{5}}{\cancel{44}_{4}} = \frac{5}{84}$

10. $\frac{2}{9} \div \frac{8}{21} = \frac{2}{9} \cdot \frac{21}{8} = \frac{\cancel{2}^{1}}{\cancel{9}_{3}} \cdot \frac{\cancel{21}^{7}}{\cancel{8}_{4}} = \frac{7}{12}$

11. $\frac{3}{5} + \frac{11}{12}$ LCM = 60
$\frac{3}{5} + \frac{11}{12} = \frac{3}{5} \cdot \frac{12}{12} + \frac{11}{12} \cdot \frac{5}{5} = \frac{36}{60} + \frac{55}{60} = \frac{91}{60}$

12. $\frac{5}{24} - \frac{4}{9}$ LCM = 72
$\frac{5}{24} - \frac{4}{9} = \frac{5}{24} \cdot \frac{3}{3} - \frac{4}{9} \cdot \frac{8}{8} = \frac{15}{72} - \frac{32}{72} = -\frac{17}{72}$

13.
$$\begin{array}{r} 8.05 \\ \times 2.27 \\ \hline 5635 \\ 16100 \\ \underline{161000} \\ 18.2735 \end{array}$$

14. $0.36 = \frac{36}{100} = \frac{9}{25}$

15.
$$\begin{array}{r} 499 \\ \times\ 13 \\ \hline 1497 \\ +\ 4990 \\ \hline \$\,6487 \end{array}$$

16.
$$\begin{array}{r} 1203.34 \\ -407.83 \\ \hline \$795.51 \end{array}$$

17. $72\% = \frac{72}{100} = \frac{18}{25}$

18. $6\% = 6 \div 100 = 0.06$

19. 43, 46, 71, 95, 85, 27, 37, 8, 44, 26, 34, 85, 91, 79, 89, 20
The total of these values is 880.
$\text{Mean} = \frac{880}{16} = 55$
Write the values in ascending order.
8 20 26 27 34 37 43 (44 46) 71 79 85 85 89 91 95
$\text{Median} = \frac{44 + 46}{2} = \frac{90}{2} = 45$

20. $16 - 8 \cdot 5 = 16 - 40 = -24$

21. $-9 + 4 \cdot 13 - 6 \cdot 3 = -9 + 52 - 18 = 52 - 27 = 25$

22. $\frac{4^2 + 3^2}{3 + 4 \cdot 13} = \frac{16 + 9}{3 + 4 \cdot 13} = \frac{16 + 9}{3 + 52} = \frac{25}{55} = \frac{5}{11}$

23. $4n - 7$

24. $50 + 20h$

25. $16 - 5x$ for $x = -9$
$16 - 5(-9) = 16 + 45 = 61$

26. $x^2 + 6x - 17$ for $x = -8$
$(-8)^2 + 6(-8) - 17 = 64 + 6(-8) - 17$
$= 64 - 48 - 17$
$= -1$

27. $5(2x - 13) = 10x - 65$

28. $7y - 8(2y - 30) = 7y - 16y + 240 = -9y + 240$