

155. No,  $\frac{2}{3} + \frac{3}{2} \neq \frac{2+3}{3+2}$ .

To add two fractions, determine a common denominator and rewrite each denominator with that denominator. Then add the numerators and write the sum over the common denominator.

$$\frac{2}{3} + \frac{3}{2} = \frac{4}{6} + \frac{9}{6} = \frac{13}{6}$$

159.  $3 = \frac{3}{1} = \frac{3(4)}{1(4)} = \frac{12}{4}$

Using the diagram, you can count that the number of one-fourths in 3 is 12.

You can also divide 3 by  $1/4$  to find this same result.

$$\begin{aligned} \frac{3}{1/4} &= \frac{3}{1} \div \frac{1}{4} \\ &= \frac{3}{1} \cdot \frac{4}{1} \\ &= 12 \end{aligned}$$

163. True

165. True

167.  $\frac{4}{5} + \frac{3}{6} = \frac{13}{10}$

Note:

$$\frac{4}{5} + \frac{3}{6} = \frac{4}{5} + \frac{1}{2} = \frac{8}{10} + \frac{5}{10} = \frac{13}{10}$$

## Section 1.4 Exponents, Order of Operations, and Properties of Real Numbers

1.  $2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 = 2^5$

3.  $(-\frac{1}{4})(-\frac{1}{4})(-\frac{1}{4}) = (-\frac{1}{4})^3$

5.  $(-3)^6 = (-3)(-3)(-3)(-3)(-3)(-3)$

7.  $(9.8)^3 = (9.8)(9.8)(9.8)$

9.  $(-\frac{1}{2})^5 = (-\frac{1}{2})(-\frac{1}{2})(-\frac{1}{2})(-\frac{1}{2})(-\frac{1}{2})$

11.  $-2^2 = -2 \cdot 2 = -4$

The value is negative.

13.  $-5^3 = -5 \cdot 5 \cdot 5 = -125$

15.  $3^2 = 3 \cdot 3 = 9$

17.  $2^6 = (2)(2)(2)(2)(2)(2) = 64$

The value is negative.

19.  $(-5)^3 = (-5)(-5)(-5) = -125$

21.  $(\frac{1}{4})^3 = (\frac{1}{4})(\frac{1}{4})(\frac{1}{4}) = \frac{1}{64}$

23.  $(-1.2)^3 = (-1.2)(-1.2)(-1.2) = -1.728$

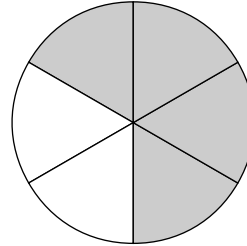
157. (a)  $1 - \frac{2}{3} = \frac{1}{3}$

One-third of the pizza was left.

(b)  $\frac{1}{2} \cdot \frac{1}{3} = \frac{1}{6}$

You ate one-sixth of the pizza for a midnight snack.

(c)



25.  $4 - 6 + 10 = -2 + 10 = 8$

27.  $-|2 - (6 + 5)| = -|2 - 11|$   
 $= -|-9| = -9$

29.  $15 + 3 \cdot 4 = 15 + 12 = 27$

31.  $(16 - 5) \div (3 - 5) = 11 \div (-2)$   
 $= -\frac{11}{2}$

33.  $(45 \div 10) \cdot 2 = (4.5)(2) = 9$

35.  $5 + (2^2 \cdot 3) = 5 + (4 \cdot 3)$   
 $= 5 + 12$   
 $= 17$

37.  $(-6)^2 - (5^2 \cdot 4) = 36 - (25 \cdot 4)$   
 $= 36 - 100$   
 $= -64$

39.  $\left(3 \cdot \frac{5}{9}\right) + 1 - \frac{1}{3} = \left(\frac{3 \cdot 5}{1 \cdot 9}\right) + \frac{1}{1} - \frac{1}{3}$   
 $= \frac{\cancel{3}(5)}{\cancel{3}(3)} + \frac{1}{1} - \frac{1}{3}$   
 $= \frac{5}{3} + \frac{3}{3} - \frac{1}{3}$   
 $= \frac{7}{3}$

41.  $4\left(-\frac{2}{3} + \frac{4}{3}\right) = 4\left(\frac{-2+4}{3}\right)$   
 $= 4\left(\frac{2}{3}\right)$   
 $= \frac{4}{1} \cdot \frac{2}{3} = \frac{4 \cdot 2}{1 \cdot 3}$   
 $= \frac{8}{3}$

43.  $\frac{3}{2}\left(\frac{2}{3} + \frac{1}{6}\right) = \frac{3}{2}\left(\frac{4}{6} + \frac{1}{6}\right)$   
 $= \frac{3}{2}\left(\frac{5}{6}\right)$   
 $= \frac{15}{12}$   
 $= \frac{\cancel{3}(5)}{4(\cancel{3})}$   
 $= \frac{5}{4}$

45.  $\frac{3 \cdot 6 - 4 \cdot 6}{5 + 1} = \frac{18 - 24}{6}$   
 $= \frac{-6}{6}$   
 $= -1$

47.  $\frac{7}{3}\left(\frac{2}{3}\right) \div \frac{28}{15} = \frac{14}{9} \div \frac{28}{15}$   
 $= \frac{14}{9} \cdot \frac{15}{28}$   
 $= \frac{14(\cancel{3})(5)}{3(\cancel{3})(2)(14)}$   
 $= \frac{5}{6}$

49.  $\frac{1 - 3^2}{-2} = \frac{1 - 9}{-2} = \frac{-8}{-2} = 4$

51.  $\frac{3^2 - 4^2}{0}$  is undefined.

Division by zero is undefined.

53.  $\frac{5^2 + 12^2}{13} = \frac{25 + 144}{13}$   
 $= \frac{169}{13}$   
 $= 13$

55.  $2.1 \times 10^2 = 2.1 \times 100 = 210$

57.  $5.84 \times 10^3 = 5.84(10)(10)(10)$   
 $= 5840$

59.  $\frac{8.4}{10^3} = \frac{8.4}{1000} = 0.0084$

61.  $\frac{732}{10^2} = \frac{732}{100} = 7.32$

63.  $\frac{0}{5^2 + 1} = \frac{0}{5 \cdot 5 + 1} = \frac{0}{25 + 1}$   
 $= \frac{0}{26} = 0$

$$\begin{aligned}
 65. (3.4)^2 - 6(1.2)^3 &= 11.56 - 6(1.728) \\
 &= 11.56 - 10.368 \\
 &= 1.192 \\
 &\approx 1.19 \text{ (Rounded to two decimal places)}
 \end{aligned}$$

$$\begin{aligned}
 67. 1000 \div \left(1 + \frac{0.09}{4}\right)^8 &= 1000 \div (1 + 0.0225)^8 \\
 &= 1000 \div 1.0225^8 \\
 &\approx 1000 \div 1.194831142 \\
 &\approx 836.94 \\
 &\text{(Rounded to 2 decimal places)}
 \end{aligned}$$

$$\begin{aligned}
 69. 4 \cdot 6^2 &= 4 \cdot 6 \cdot 6 = 144 \\
 24^2 &= 24 \cdot 24 = 576 \\
 \text{Therefore, } 4 \cdot 6^2 &\neq 24^2. \\
 \text{Note: } 24^2 &= (4 \cdot 6)^2 = 4^2 \cdot 6^2, \text{ not } 4 \cdot 6^2.
 \end{aligned}$$

$$\begin{aligned}
 71. -3^2 &= -(3 \cdot 3), \text{ or } -9 \\
 (-3)(-3) &= 9 \\
 \text{Thus, it is true that } -3^2 &\neq (-3)(-3).
 \end{aligned}$$

73. Commutative Property of Multiplication

75. Commutative Property of Addition

77. Additive Identity Property

79. Additive Inverse Property

81. Associative Property of Addition

83. Associative Property of Multiplication

85. Multiplicative Inverse Property

87. Distributive Property

89. Distributive Property

91. Associative Property of Addition

$$93. 5(u + v) = 5(v + u) \quad \text{(using the Commutative Property of Addition)}$$

or

$$5(u + v) = (u + v)5 \quad \text{(using the Commutative Property of Multiplication)}$$

$$95. 3 + x = x + 3$$

$$97. 6(x + 2) = 6x + 6 \cdot 2 = 6x + 12$$

$$\begin{aligned}
 99. (4 + y)25 &= 4 \cdot 25 + 25y \\
 &= 100 + 25y
 \end{aligned}$$

$$101. 3x + (2y + 5) = (3x + 2y) + 5$$

$$103. (6x)y = 6(xy)$$

$$\begin{aligned}
 105. \text{(a) Additive inverse: } &-50 \\
 \text{(b) Multiplicative inverse: } &\frac{1}{50}
 \end{aligned}$$

$$107. \text{(a) Additive inverse: } 1$$

$$\text{(b) Multiplicative inverse: } -1$$

$$109. \text{(a) Additive Inverse: } -2x$$

$$\text{(b) Multiplicative Inverse: } \frac{1}{2x}$$

$$111. \text{(a) Additive Inverse: } -ab$$

$$\text{(b) Multiplicative Inverse: } \frac{1}{ab}$$

$$\begin{aligned}
 113. 3(6 + 10) &= 3(6) + 3(10) \quad \text{or} \quad 3(6 + 10) = 3(16) \\
 &= 18 + 30 \quad \quad \quad = 48 \\
 &= 48
 \end{aligned}$$

$$\begin{aligned}
 115. \frac{2}{3}(9 + 24) &= \frac{2}{3} \cdot 9 + \frac{2}{3} \cdot 24 \quad \text{or} \quad \frac{2}{3}(9 + 24) = \frac{2}{3}(33) \\
 &= 6 + 16 \quad \quad \quad = 22 \\
 &= 22
 \end{aligned}$$

$$117. 5(x + 3) = 5x + 5 \cdot 3 = 5x + 15$$

Therefore,  $5(x + 3) \neq 5x + 3$ . The 5 should be multiplied by *both* terms in the parenthesis.

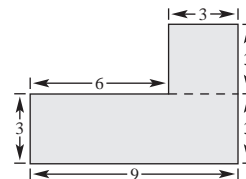
$$\begin{aligned}
 119. \frac{8}{0} &\text{ is undefined because division by 0 is undefined.} \\
 \text{Therefore, } &\frac{8}{0} \neq 0.
 \end{aligned}$$

$$\begin{aligned}
 121. 4(2 + x) &= 4(x + 2) \quad \text{Commutative Property of Addition} \\
 &= 4x + 8 \quad \text{Distributive Property}
 \end{aligned}$$

123.  $7x + 9 + 2x = 7x + 2x + 9$  Commutative Property of Addition  
 $= (7x + 2x) + 9$  Associative Property of Addition  
 $= (7 + 2)x + 9$  Distributive Property  
 $= 9x + 9$  Addition of Real Numbers  
 $= 9(x + 1)$  Distributive Property

125. The total area of the figure is the *sum* of the area of the upper rectangle and the area of the lower rectangle. The upper rectangle has length 3 and width 3. Its area is  $3 \cdot 3 = 9$ . The lower rectangle has length 9 and width 3. Its area is  $9 \cdot 3 = 27$ . Therefore, the total area is  $9 + 27 = 36$  square units.

$$\begin{aligned} \text{Area} &= 3 \cdot 3 + 9 \cdot 3 \\ &= 9 + 27 = 36 \text{ square units} \end{aligned}$$



127. The portion of the expenses for all other categories (except utilities) is the sum

$$0.06 + 0.09 + 0.35 + 0.15 + 0.13 + 0.08 + 0.07 = 0.93.$$

Therefore, the portion of expenses that is spent on utilities is the difference

$$1 - 0.93 = 0.07$$

If the total expenses are \$450,000, the amount spent on utilities is the product

$$0.07(450,000) = \$31,500.$$

The amount spent on utilities is \$31,500.

129.  $750 + 48(215) = 750 + 10,320 = 11,070$

Thus, the total amount paid for the car is \$11,070.

131. (a)  $x + 0.06x = (1 + 0.06)x$ , or  $1.06x$

(b)  $1.06(25.95) = 27.507$

You must pay \$27.51 for the item.

133.  $(a - 2) + (b + 11) + (2c + 3) = a + b + 2c - 2 + 11 + 3$

$$= a + b + 2c + 12$$

135. No, because the *order* in which these two actions are performed *does* affect the results.

137. (a) The 3 is called the base.

- (b) The 5 is called the exponent.

139. No

$$2 \cdot 5^2 = 2 \cdot 25 = 50$$

$$10^2 = 100$$

$$\text{Thus, } 2 \cdot 5^2 \neq 10^2.$$

141.  $12 + 48 \div 6 - 5 = 12 + (48 \div 6) - 5$

143. (a) Commutative Property of Addition:  $a + b = b + a$

Two real numbers can be added in either order.

Example:  $9 + 1 = 1 + 9$

- (b) Commutative Property of Multiplication:  $ab = ba$

Two real numbers can be multiplied in either order.

Example:  $5(4) = 4(5)$

145. (a) Additive Identity Property:  $a + 0 = a$

The sum of zero and a number equals the number itself.

Example:  $7 + 0 = 7$

- (b) Additive Inverse Property:  $a + (-a) = 0$

The sum of a real number and its opposite is zero.

Example:  $4 + (-4) = 0$