CHAPTER 2
Fundamentals of Algebra

Section 2.1 Writing and Evaluating Algebraic Expressions

Solutions to Odd-Numbered Exercises

1. $60t$

The variable quantity is the number of hours traveled, and this quantity is represented by the letter t. If the average speed is 60 miles per hour, the distance traveled is $60t$.

3. $2.19m$

The variable quantity is the number of pounds of meat, and this quantity is represented by the letter m. If the cost per pound is \$2.19, the cost for the meat is $2.19m$.

5. Variable: x

Constant: 3

7. Variable: x, z

Constant: None

9. $4x, 3$

11. $3x^2, 5$

13. $\frac{5}{3}, -3y^3$

15. $2x, -3y, 1$

17. $3(x + 5), 10$

19. $\frac{x}{4}, \frac{5}{x}$

21. $\frac{3}{x + 2}, -3x, 4$

23. -6

25. $-\frac{1}{3}$

27. $-\frac{3}{2}$

29. 2π

31. 4.7

33. $y^5 = y \cdot y \cdot y \cdot y \cdot y$

35. $2^2x^4 = 2 \cdot 2 \cdot x \cdot x \cdot x \cdot x$

37. $4y^2z^3 = 4 \cdot y \cdot y \cdot z \cdot z \cdot z$

39. $(a^2)^3 = a^2 \cdot a^2 \cdot a^2$
$= a \cdot a \cdot a \cdot a \cdot a \cdot a$

41. $4x^3 \cdot x^4 = 4 \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x$

43. $(ab)^3 = (ab)(ab)(ab) = a \cdot a \cdot a \cdot b \cdot b \cdot b$

45. $(x + y)^2 = (x + y)(x + y)$

47. $\left(\frac{a}{3s}\right)^4 = \left(\frac{a}{3s}\right)\left(\frac{a}{3s}\right)\left(\frac{a}{3s}\right)\left(\frac{a}{3s}\right)$

49. $[3(r + s)^2][3(r + s)]^2 = 3(r + s)(r + s)[3(r + s)][3(r + s)]$
$= 3 \cdot 3 \cdot 3(r + s)(r + s)(r + s)(r + s)$

51. $2 \cdot u \cdot u \cdot u \cdot u = 2u^4$

(2 is *not* a factor of the base.)

53. $(2u) \cdot (2u) \cdot (2u) \cdot (2u) = (2u)^4$

(2 *is* a factor of the base.)

55. $a \cdot a \cdot a \cdot b \cdot b = a^3b^2$

57. $3 \cdot (x - y) \cdot (x - y) \cdot 3 \cdot 3 = 3 \cdot 3 \cdot 3 \cdot (x - y)(x - y)$
$= 3^3(x - y)^2$

59. $\left(\frac{x^2}{2}\right)\left(\frac{x^2}{2}\right)\left(\frac{x^2}{2}\right) = \left(\frac{x^2}{2}\right)^3$

61. (a) When $x = \frac{1}{2}$, the value of $2x - 1$ is $2\left(\frac{1}{2}\right) - 1 = 1 - 1 = 0$.

(b) When $x = 4$, the value of $2x - 1$ is $2(4) - 1 = 8 - 1 = 7$.

63. (a) When $x = -2$, the value of $2x^2 - 5$ is $2(-2)^2 - 5 = 2(4) - 5 = 8 - 5 = 3$.

(b) When $x = 3$, the value of $2x^2 - 5$ is $2(3)^2 - 5 = 2(9) - 5 = 18 - 5 = 13$.

65. (a) When $x = 4$ and $y = 3$, the value of $3x - 2y$ is $3(4) - 2(3) = 12 - 6 = 6$.

(b) When $x = \frac{2}{3}$ and $y = 1$, the value of $3x - 2y$ is $3\left(\frac{2}{3}\right) - 2(1) = 2 - 2 = 0$.

67. (a) When $x = 3$ and $y = 3$, the value of $x - 3(x - y)$ is $3 - 3(3 - 3) = 3 - 3(0) = 3 - 0 = 3$.

(b) When $x = 4$ and $y = -4$, the value of $x - 3(x - y)$ is

$$4 - 3(4 - (-4)) = 4 - 3(4 + 4) = 4 - 3(8)$$
$$= 4 - 24 = -20.$$

69. (a) When $a = 2$, $b = -3$, and $c = -1$, the value of $b^2 - 4ac$ is $(-3)^2 - 4(2)(-1) = 9 + 8 = 17$.

(b) When $a = -4$, $b = 6$, and $c = -2$, the value of $b^2 - 4ac$ is $6^2 - 4(-4)(-2) = 36 - 32 = 4$.

71. (a) When $x = 4$ and $y = 2$, the value of $(x - 2y)/(x + 2y)$ is

$$\frac{4 - 2 \cdot 2}{4 + 2 \cdot 2} = \frac{4 - 4}{4 + 4}$$
$$= \frac{0}{8}$$
$$= 0.$$

(b) When $x = 4$ and $y = -2$, the value of $(x - 2y)/(x + 2y)$ is undefined because

$$\frac{4 - 2(-2)}{4 + 2(-2)} = \frac{4 + 4}{4 - 4} = \frac{8}{0}$$

and division by 0 is undefined.

73. (a) When $x = 2$ and $y = 4$, the value of $\frac{5x}{y - 3}$ is $\frac{5(2)}{4 - 3} = \frac{10}{1} = 10$.

(b) When $x = 2$ and $y = 3$, the value of $\frac{5x}{y - 3}$ is undefined because $\frac{5(2)}{3 - 3} = \frac{10}{0}$, and division by zero is undefined.

75. (a) When $b = 3$ and $h = 5$, the value of $\frac{1}{2}bh$ is $\frac{1}{2} \cdot 3 \cdot 5 = \frac{15}{2}$.

(b) When $b = 2$ and $h = 10$, the value of $\frac{1}{2}bh$ is $\frac{1}{2} \cdot 2 \cdot 10 = 10$.

77. (a) When $r = 50$ and $t = 3.5$, the value of rt is $(50)(3.5) = 175$.

(b) When $r = 35$ and $t = 4$, the value of rt is 140.

79. (a)

x	-1	0	1	2	3	4
$3x - 2$	-5	-2	1	4	7	10

When $x = -1$, $3x - 2 = 3(-1) - 2 = -3 - 2 = -5$.

When $x = 0$, $3x - 2 = 3 \cdot 0 - 2 = 0 - 2 = -2$.

When $x = 1$, $3x - 2 = 3 \cdot 1 - 2 = 3 - 2 = 1$.

When $x = 2$, $3x - 2 = 3 \cdot 2 - 2 = 6 - 2 = 4$.

When $x = 3$, $3x - 2 = 3 \cdot 3 - 2 = 9 - 2 = 7$.

When $x = 4$, $3x - 2 = 3 \cdot 4 - 2 = 12 - 2 = 10$.

(b) For each one-unit increase in x, the value of the expression $3x - 2$ increases by 3.

(c) You might notice that 3 is the coefficient of x in the expression $3x - 2$. In the expression $\frac{2}{3}x + 4$, the coefficient of x is $\frac{2}{3}$. You might predict that the value of this expression would increase by $\frac{2}{3}$ for each one-unit increase in the value of x.

x	-1	0	1	2	3	4
$\frac{2}{3}x + 4$	$\frac{10}{3}$	4	$\frac{14}{3}$	$\frac{16}{3}$	6	$\frac{20}{3}$

81. Area $= n^2$

If $n = 8$, the value of $n^2 = 8^2 = 64$.

Thus, the area is 64 square units.

83. Area $= a(a + b)$

If $a = 5$ and $b = 4$, the value of $a(a + b) = 5(5 + 4) = 5(9) = 45$.

Thus, the area is 45 square units.

85. (a) A square has 4 sides.

If $n = 4$, the value of $\frac{n(n-3)}{2}$ is $\frac{4(4-3)}{2} = \frac{4(1)}{2} = \frac{4}{2} = 2$.

Thus, a square has 2 diagonals.

(b) A pentagon has 5 sides.

If $n = 5$, the value of $\frac{n(n-3)}{2}$ is $\frac{5(5-3)}{2} = \frac{5(2)}{2} = \frac{10}{2} = 5$.

Thus, a pentagon has 5 diagonals.

(c) A hexagon has 6 sides.

If $n = 6$, the value of $\frac{n(n-3)}{2}$ is $\frac{6(6-3)}{2} = \frac{6(3)}{2} = \frac{18}{2} = 9$.

Thus, a hexagon has 9 diagonals.

87. (a) 4, 5, 5.5, 5.75, 5.875, 5.9375, 5.96875

The value appears to be approaching 6.

(b) 9, 7.5, 6.75, 6.375, 6.1875, 6.09375, 6.046875

The value appears to be approaching 6.

89. (a) $(15 \cdot 12)c$ or $180c$

Plastic chairs: If $c = \$1.95$, the value of $180c$ is $180(1.95) = \$351$.

Wood chairs: If $c = \$2.95$, the value of $180c$ is $180(2.95) = \$531$.

(b) Canopy 1: $t = (20)(20) = 400$
If $t = 400$, the value of $115 + 0.25t$ is $115 + 0.25(400) = \$215$.

Canopy 2: $t = (20)(30) = 600$
If $t = 600$, the value of $115 + 0.25t$ is $115 + 0.25(600) = \$265$.

Canopy 3: $t = (30)(40) = 1200$
If $t = 1200$, the value of $115 + 0.25t$ is $115 + 0.25(1200) = \$415$.

Canopy 4: $t = (30)(60) = 1800$
If $t = 1800$, the value of $115 + 0.25t$ is $115 + 0.25(1800) = \$565$.

Canopy 5: $t = (40)(60) = 2400$
If $t = 2400$, the value of $115 + 0.25t$ is $115 + 0.25(2400) = \$715$.

91. No, $3x$ is not a term of $4 - 3x$. The terms of this expression are 4 and $-3x$.

93. No, it is not possible to evaluate the expression $\frac{x+2}{y-3}$ when $x = 5$ and $y = 3$. If $y = 3$, the value of the denominator of $y - 3$ would be 0, and division by 0 is undefined.