2.1 Exercises

Concept Check

Fill-in-the-Blank. Complete each sentence using information found in this section.

1. If no number is written next to a variable, the coefficient is understood to be the number _____.
2. Any constant, variable, or product or quotient of a constant and/or variable is a/an _____ .
3. A single number is a/an _____ .
4. In a term, the number being multiplied by the variable is the numerical _____ of that term.
5. To combine like terms, add or subtract the _____ and keep the common variable expression.
6. When substituting, _____ must be used around negative numbers.

True/False. Determine whether each statement is true or false. If a statement is false, explain how it can be changed so the statement will be true. (**Note:** There may be more than one acceptable change.)

7. A variable that does not appear to have an exponent has an exponent of 1.
8. In the term $-9x$, nine is being subtracted from x.
9. In the term "$12a$," 12 is the constant.
10. Like terms have the same coefficients.

Practice

Identify the like terms in each list of terms. See Example 1.

1. $-5, 3, 7x, 8, 9x, 3y$
2. $-2x^2, x^3, 5x^2, 14x^2, 10x^3$
3. $5xy, -x^2, -6xy, 3x^2y, 5x^2y, 2x^2$
4. $3ab^2, -ab^2, 8ab, 9a^2b, -10a^2b, ab, 12a^2$
5. $24, 8.3, 1.5xyz, -1.4xyz, -6, xyz, 5xy^2z, 2xyz^2$
6. $-35y, 1.62, -y^2, -y, 3y^2, \frac{1}{2}, 75y, 2.5y^2$

Simplify each expression by combining like terms. See Example 2.

7. $8x + 7x$
8. $3y + 8y$
9. $5x + (-2x)$
10. $7x + (-3x)$
11. $6y^2 - y^2$
12. $16z^2 - 5z^2$
13. $3x - 5x + 12x$
14. $2a + 14a - 25a$
15. $6c - 13c + 5c$
16. $40x - 30x - 10x$

17. $4x + 2 + 3x$

18. $3x - 1 + x$

19. $5x^2 - 3x^2 + 2x$

20. $-2x^2 - x^2 - x$

21. $7x^2 - 4x^2 + 20$

22. $14y^3 - 25 + 8y^3$

23. $2x^2 - 2y + 5x^2 + 6x^2$

24. $4a + 2a - 3b - a$

25. $4x + 7 - 8 + 3x$

26. $-5x - 1 + 8 + 9x$

27. $2n^2 - 6n + 1 - 4n^2 + 8n - 4$

28. $3n^2 + 2n - 5 - n^2 + n - 4$

29. $3 - 5x^2 + 4x^2 + 20x + 42 - 17x$

30. $13x + 12x^2 + 15x - 35 - 41 - 2x^2$

31. $3(n+1) + n$

32. $2(n-4) + n + 1$

33. $5(a-b) + 2a - 3b$

34. $4a - 3b + 2(a+2b)$

35. $3(2x+y) + 2(x-y)$

36. $4(x+5y) + 3(2x-7y)$

37. $y - \dfrac{4y+5y}{3}$

38. $z - \dfrac{3z+5z}{4}$

39. $\dfrac{2x+3x}{3} + x$

40. $\dfrac{2y+4y}{5} - 2y$

Evaluate the expression for $x = 2$ and $y = -3$. See Example 3.

41. $-x^2$

42. $-y^2$

43. $(-x)^2$

44. $(-y)^2$

45. $-x$

46. $-y$

Simplify each expression and then evaluate the expression for $x = 4$, $y = 3$, $a = -2$, and $b = -1$. See Examples 4 through 7.

47. $5y + 4 - 2y$

48. $7b - 17 - b$

49. $3(y-1) + 2(y+2)$

50. $4(y+3) + 5(y-2)$

51. $3.1a^2 - 0.9a^2 + 4a - 5.3a^2$

52. $8.3x^2 - 5.7x^2 + x^2 + 2$

53. $2.4(x+1) + 1.3(x-1)$

54. $1.3(y+2) - 2.6(8-y)$

55. $\dfrac{3a+5a}{-2} + 12a$

56. $8a + \dfrac{5a+4a}{9}$

57. $\dfrac{-4b-2b}{-3} + \dfrac{2b+5b}{7}$

58. $\dfrac{5b+3b}{4} + \dfrac{-4b-b}{-5}$

Simplify each expression and then evaluate the expression for $x = -2$ and $y = -1$. See Examples 4 and 7.

59. $2x^2 - 3x^2 + 5x - 8 + 1$

60. $5x^2 - 4x + 2 - x^2 + 3$

61. $y^2 + 2y^2 + 2y - 3y$

62. $y^2 + y^2 - 8y + 2y - 5$

63. $y^3 + 3y^3 + 5y - 4y^2 + 1$

64. $7y^3 + 4y^2 + 6 + y^2 - 12$

65. $2\left(x^2 - 3x - 5\right) + 3\left(x^2 + 5x - 4\right)$

66. $5\left(y^2 - 4y + 3\right) - 2\left(y^2 - 2y + 10\right)$

Simplify each expression and then evaluate the expression for $a = -1$, $b = -2$, and $c = 3$. See Example 5.

67. $a^2 - a + a^2 - a$

68. $a^3 - 2a^3 - 3a + a - 7$

69. $5ab - 7a + 4ab + 2b$

70. $2ab + 4b - 3a + ab - b$

71. $14\left(a + 7\right) - 15\left(b + 6\right) + 2\left(c - 3\right)$

72. $12\left(a - 3\right) + 8\left(b - 2\right) - 3\left(c + 4\right)$

73. $20\left(a + b + c\right) - 10\left(a + b + c\right)$

74. $16\left(a - b + c\right) + 16\left(-a + b - c\right)$

Applications

Solve.

75. An apartment management company owns a property with 100 units. The company has determined that the profit made per month from the property can be calculated using the equation $P = -10x^2 + 1500x - 6000$, where x is the number of units rented per month. How much profit does the company make when 80 units are rented?

76. A ball is thrown upward from an initial height of 96 feet with an initial velocity of 16 feet per second. After t seconds, the height of the ball can be described by the expression $-16t^2 + 16t + 96$. What is the height of the ball after 3 seconds?

77. You have a 5-pound dumbbell that you use for wrist curls and a 10-pound dumbbell that you use for bicep curls. Your little brother likes to brag that if he lifts your 5-pound dumbbell two times, he's actually lifting 10 pounds. Using that logic, you could claim that the amount of weight you lift in a day can be modeled by the expression $5x + 10y$, where x is the number of wrist curls you do and y is the number of bicep curls you do. How much could you claim to have lifted on a day you did 15 wrist curls and 30 bicep curls?

78. Dan has 340 yards of fencing available to enclose a rectangular field. The area of the enclosure using this fencing can be modeled by $A = 170x - x^2$, where x is the width of the field. If the field ends up being 70 yards wide, how much will the area be?

79. A moving company starts the week with 72 bundles of small boxes and 50 bundles of medium boxes. During the week, they use 25 bundles of small boxes and 32 bundles of medium boxes. At the end of the week, they buy 125 bundles of medium boxes. The total number of boxes at the end of the week can be modeled by the expression $72s + 50m - 25s - 32m + 125m$, where s represents the number of boxes in a bundle of small boxes and m represents the number of boxes in a bundle of medium boxes.

a. Simplify the expression by combining like terms.

b. How many boxes are in stock at the end of the week if there are 40 boxes in a small bundle of boxes and 30 boxes in a medium bundle of boxes?

80. During a sale, all newly released video games are priced the same and all Blu-ray discs are priced the same. During the first day of the sale, Mitchell buys 4 video games and 6 Blu-ray discs. The next day he buys 2 more video games and returns 2 of the Blu-ray discs. The amount of money Mitchell spends can be modeled by $4v + 6d + 2v - 2d$, where v represents the cost of each video game and d represents the cost of each Blu-ray disc.

a. Simplify the expression by combining like terms.

b. How much did Mitchell spend if each video game costs \$35 and each Blu-ray disc costs \$19?

Writing & Thinking

81. Define constant and variable. Explain why those particular words are used.

82. Discuss like and unlike terms and give an example of each.

83. The text recommends simplifying an expression (combining like terms) before evaluating. Do you think this is necessary?
Evaluate the expression $4x^2 - 5(x+2) + 3x + 10 + 2x$ for $x = 3$:

a. by substituting and then evaluating.

b. by first simplifying and then evaluating.

Which method would you recommend? Why?

84. Explain the difference between -13^2 and $(-13)^2$.