



Lesson 7-2

Simplifying Algebraic Expressions




Interactive Study Guide

See pages 151–152 for:


- Getting Started
- Vocabulary Start-Up
- Notes


Essential Question

Why are algebraic rules useful?


Common Core State Standards
Content Standards
7.EE.1, 7.EE.2Mathematical Practices
1, 3, 4, 5, 7

Vocabulary

term
coefficient
like terms
constant
simplest form
simplifying the expression

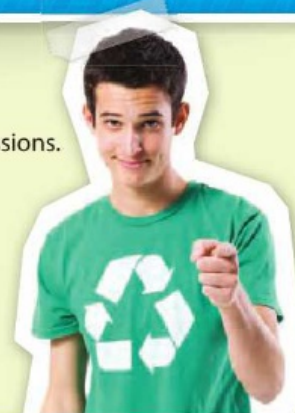

What You'll Learn

- Identify parts of an algebraic expression.
- Use the Distributive Property to simplify algebraic expressions.



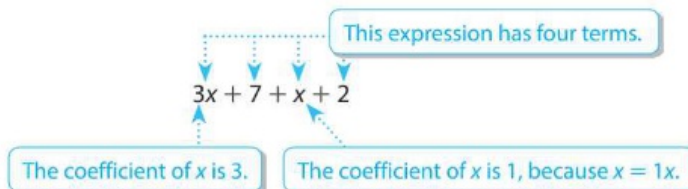
Real-World Link

Recycling Two middle school classes are having a competitive week-long recycling drive. At the end of the week, whichever class collects more recyclables wins and is treated to a pizza party! Algebraic expressions can be used to represent the results of the drive.

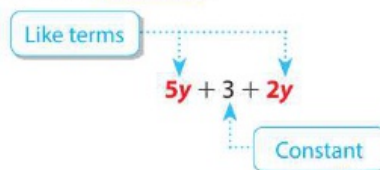


Parts of Algebraic Expressions

When addition or subtraction signs separate an algebraic expression into parts, each part is a **term**. The numerical part of a term that contains a variable is called the **coefficient** of the variable.



In this chapter, we will work only with terms with an exponent of 1. In this case, **like terms** are terms that contain the same variables, such as $2n$ and $5n$ or $6xy$ and $4xy$. A term without a variable is called a **constant**.



Example 1

Identify the like terms in the following expressions.

- a. $3x + 4y + 4x$
 $3x$ and $4x$ are like terms since the variables are the same.
- b. $5x + 3 + 7x + 4$
 $5x$ and $7x$ are like terms since the variables are the same. Constant terms 3 and 4 are also like terms.

Got It? Do this problem to find out.

1. Identify the like terms in the expression $-4x + 2y + 3y + 2x$.

LIKE TERMS
 $2x, -4x$
 $2y, 3y$



Rewriting a subtraction expression using addition will help you identify the terms of an expression.

Example 2



Identify the terms, like terms, coefficients, and constants in the expression

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

$$6x - 2y + x - 5 = 6x + (-2y) + x + (-5)$$

Definition of subtraction

$$= 6x + (-2y) + 1x + (-5)$$

Identity Property

$$3a + 1$$

The terms are $6x$, $-2y$, x , and -5 . The like terms are $6x$ and x . The coefficients are 6 , -2 , and 1 . The constant is -5 .

Got It? Do this problem to find out.

2 Identify the terms, like terms, coefficients, and constants in the expression

$$3n + 5m - 6m + 2.$$

$$1 + n + n + m + m + m + m + m + (-m) + (-m) + (-m) + (-m) + (-m) + (-m) + 2$$

$$\rightarrow 3n + 5m + (-6m) + 2$$



Simplify Algebraic Expressions

An algebraic expression is in **simplest form** if it has no like terms and no parentheses. When you use the Distributive Property to combine like terms, you are **simplifying the expression**.

Example 3



Simplify each expression.

a. $4x + 6 + 2x$

$$\begin{aligned} 4x + 6 + 2x &= 4x + 2x + 6 \\ &= (4 + 2)x + 6 \\ &= 6x + 6 \end{aligned}$$

Commutative Property
Distributive Property
Simplify.

b. $5n + 2 - n - 6$

$$\begin{aligned} 5n + 2 - n - 6 &= 5n + 2 + (-n) + (-6) \\ &= 5n + 2 + (-1n) + (-6) \\ &= 5n + (-1n) + 2 + (-6) \\ &= [5 + (-1)]n + 2 + (-6) \\ &= 4n + (-4) \text{ or } 4n - 4 \end{aligned}$$

Definition of Subtraction
Identity Property
Commutative Property
Distributive Property
Simplify.

c. $6y - 3(x - 2y)$

$$\begin{aligned} 6y - 3(x - 2y) &= 6y + (-3)[x + (-2y)] \\ &= 6y + (-3x) + (-3 \cdot -2y) \\ &= 6y + (-3x) + 6y \\ &= 6y + 6y + (-3x) \\ &= (6 + 6)y + (-3x) \\ &= 12y + (-3x) \text{ or } 12y - 3x \end{aligned}$$

Definition of Subtraction
Distributive Property
Simplify.
Commutative Property
Distributive Property
Simplify.

$$\begin{aligned} 4(q + 8p) + p \\ 4(q) + 4(8p) \\ 4q + 32p + p \\ 4q + 33p \end{aligned}$$

Watch Out!

Distributive Property In Example 3c, remember to distribute -3 , not $+3$, to the terms in the parentheses.

Got It? Do these problems to find out.

3a. $4x + 6 - 3x$

$$(4x - 3x) + 6$$

$$x + 6$$

3b. $2m + 3 - 7m - 4$

$$2m + (-7m) = -5m$$

$$3 - 4 = -1$$

$$-5m + (-1) = -5m - 1$$

3c. $4(q + 8p) + p$



Example 4



Financial Literacy You have some money in a savings account. Your sister has \$25 more than you have in her account. Write an expression in simplest form that represents the total amount of money in both accounts.



Words	amount of your money plus amount of your sister's money
Variable	Let x = amount of your money. Let $x + 25$ = amount of your sister's money.
Expression	$x + (x + 25)$



$$\begin{aligned}
 x + (x + 25) &= (x + x) + 25 && \text{Associative Property} \\
 &= (1x + 1x) + 25 && \text{Identity Property} \\
 &= (1 + 1)x + 25 && \text{Distributive Property} \\
 &= 2x + 25 && \text{Simplify.}
 \end{aligned}$$

The expression $2x + 25$ represents the total amount of money you and your sister have in your accounts.



Got It? Do these problems to find out.

$$\begin{aligned}
 M &= \text{Mato's STAMPS} \\
 M + 16 &= \text{Lola's STAMPS} \\
 M + M + 16 &= 2M + 16
 \end{aligned}$$

- 4a. Mato and Lola both collect stamps. Lola has 16 more stamps in her collection than Mato. Write an expression in simplest form that represents the total number of stamps in both collections.
- 4b. Derek has as many stamps as Mato. Write an expression to represent the total of all 3 collections.

Guided Practice



Identify the terms, like terms, coefficients, and constants in each expression.

(Examples 1 and 2)

1. $-2a + 3a + 5b$

2. $2x + 3x + 4 + 4x$

3. $mn + 4m + 6n + 2mn$

4. $3a + 5b + 4 + 6a$

5. $3x + 4x + 5y$

6. $-4p - 6q - 5$

Simplify each expression. (Example 3)

7. $6x + 2x + 3$

8. $-2a + 3a + 6$

9. $7x + 4 - 5x - 8$

10. $5a - 2 - 3a + 7$

11. $-3(m - 1) + 4m + 2$

12. $4a - 6 - 2(a - 1)$



13. Marena is using a certain number of blue beads in a bracelet design. She will use 7 more red beads than blue beads. Write an expression in simplest form that represents the total number of beads in her bracelet design. (Example 4)



14. Kyung bought 3 CDs that cost x dollars each, 2 DVDs that cost \$10 each; and a book that cost \$15. Write an expression in simplest form that represents the total amount that Kyung spent. (Example 4)

Independent Practice

Go online for Step-by-Step Solutions



Identify the terms, like terms, coefficients, and constants in each expression. (Examples 1 and 2)

15. $3a + 2 + 3a + 7$
 16. $4m + 3 + m + 1$
 17. $3c + 4d + 5c + 8$
 18. $7j + 11jk + k + 9$
 19. $4x + 4y + 4z + 4$ ← CANNOT SIMPLIFY
 20. $3m + 3n + 2p + 4r$

$$x+x+x+x+y+y+y+y+z+z+z+z+(+)+(+)+(+)$$

Simplify each expression. (Example 3)

21. $4a + 3a$
 22. $9x + 2x$
 23. $-5m + m + 5$
 24. $6x - x + 3$
 25. $7p + 3 + 4p + 5$
 26. $2a + 4 + 2a + 9$
 27. $4a - 3b - 7a - 3b$
 28. $-x - 2y - 8x - 2y$
 29. $x + 5(6 + x)$
 30. $2a + 3(2 + a)$
 31. $-3(6 - 2r) - 3r$
 32. $-2(2x - 5) - 4x$

$$\begin{aligned} & -5m + 6 + (-7) + 2m \\ & -5m + 6 - 7 + 2m \end{aligned}$$

COEFFICIENTS
-5, 2

CONSTANTS
6, -7

For each situation, write an expression in simplest form that represents the total amount. (Example 4)

33. Mateo has y pairs of shoes. His brother has 5 fewer pairs.
 34. You used p minutes one month on your cell phone. The next month you used 75 fewer minutes.
 35. Nathan scored x points in his first basketball game. He scored three times as many points in his second game. In his third game, he scored 6 more than the second game.
 36. On Monday, Rebekah spent d dollars on lunch. She spent \$0.50 more on Tuesday than she did on Monday. On Wednesday, she spent twice as much as she did on Tuesday.

Simplify each expression.

37. $2(x - y) + 3x$
 38. $-3(a - 2b) - 4b$
 39. $-4(3m + 2n) - 5m + y$
 40. $\frac{2}{3}(6a + 3b) - \frac{1}{2}(a - 2b)$
 41. $\frac{1}{4}(m + 2n) - \frac{1}{3}(3m - 3n)$
 42. $2(x - y) - (x + y)$
 43. $\frac{2}{5}(2a - b) + \frac{2}{3}(a + 2b)$
 44. $-\frac{3}{4}(3x + 2y) - \frac{3}{8}(x - 3y)$

$$\begin{aligned} & -3(a - 2b) - 4b \\ & -3(a) - (-3)(2b) - 4b \\ & -3a - (-6b) - 4b \\ & -3a + 6b + (-4b) \\ & -3a + 2b \end{aligned}$$

45. **CCSS Use Math Tools** Write an expression to represent each model. Then simplify the expression using algebra tiles.



c. Use algebra tiles to write and simplify your own expression.

$$\frac{1}{4}(m+2n) - \frac{1}{3}(3m-3n)$$

$$\frac{1}{4}(m) + \frac{1}{4}(2n) - \frac{1}{3}(3m) - \frac{1}{3}(3n)$$

$$\left(\frac{1}{4}m + \frac{1}{2}n\right) - (m + n)$$

$$\frac{1}{4} \begin{array}{|c|c|} \hline m+2n & \\ \hline \frac{1}{4}m & \frac{1}{2}n \\ \hline \end{array}$$

$$\frac{1}{4}m + \frac{1}{2}n$$

$$\begin{array}{c|c} m & n \\ \hline \frac{1}{4}m & +\frac{1}{2}n \\ -1m & -(-1n) = 1n \end{array}$$

$$-\frac{3}{4}m + \frac{1}{2}n$$

$$-\frac{3}{4}m + \frac{3}{2}n$$

$$-\frac{3}{4}(3x+2y) - \frac{3}{8}(x-3y)$$

$$-\frac{3}{4} \begin{array}{|c|c|} \hline 3x+2y & \\ \hline -\frac{9}{4}x & -\frac{6}{4}y \\ \hline \end{array} + -\frac{3}{8} \begin{array}{|c|c|} \hline x+(-3y) & \\ \hline -\frac{3}{8}x & \frac{9}{8}y \\ \hline \end{array}$$

$$-\frac{9}{4}x + (-\frac{6}{4}y) + (-\frac{3}{8}x + \frac{9}{8}y)$$

$$-\frac{18}{8}x + (-\frac{12}{8}y)$$

$$\begin{array}{c|c} x & y \\ \hline -\frac{18}{8}x & +(-\frac{12}{8}y) \\ -\frac{3}{8}x & +\frac{9}{8}y \\ \hline -\frac{21}{8}x & +(-\frac{3}{8}y) \end{array}$$

Simplify each expression.

37. $2(x - y) + 3x$

39. $-4(3m + 2n) - 5m + y$

41. $\frac{1}{4}(m + 2n) - \frac{1}{3}(3m - 3n)$

38. $-3(a - 2b) - 4b$ $\leftarrow -3a + 2b$

40. $\frac{2}{3}(6a + 3b) - \frac{1}{2}(a - 2b)$ $\leftarrow \frac{7}{2}a + 3b$

42. $2(x - y) - (x + y)$ $\leftarrow x - 3y$

42. $2(x - y) - (x + y)$

$$2 \begin{array}{|c|c|} \hline x & (-y) \\ \hline 2x & -2y \\ \hline \end{array} + -1 \begin{array}{|c|c|} \hline x & y \\ \hline -x & -y \\ \hline \end{array}$$

X	Y
2x	+(-2y)
-1x	+(-1y)

$$x + (-3y) = x - 3y$$

$$2(x - y) - (x + y)$$

$$(x - y) + (x - y) - (x + y)$$

X	Y
x	-y
x	-y
-x	-y

$$x - 3y$$