

2-2

Simplifying Algebraic Expressions

 **Check Skills You'll Need**

1. **Vocabulary Review**
Is the expression $5 + 3a - 15$ simplified? Explain.

Simplify each expression.

2. 3×2.8
3. 5.9×0.3
4. 1.4×3.6


 **CONTENT STANDARD**

8.EE.7b

Vocabulary Tip

Expressions with only integers are always like terms.

What You'll Learn

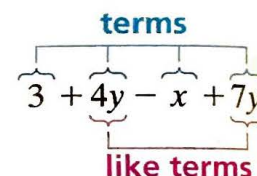
To combine like terms and to simplify algebraic expressions

New Vocabulary term, like terms

Why Learn This?

Some calculations, such as finding the cost of several items, involve more than one variable. Simplifying expressions first can make calculations easier.

An expression may have one or more terms. A **term** is a number, a variable, or the product of a number and one or more variables. **Like terms** are terms that have exactly the same variable factors.

**Like Terms**

-5 and 8
 $2x$ and $-3x$
 $2x^2$ and $-3x^2$
 $2xy$ and $-3xy$

Not Like Terms

$-5x$ and 8
 $2x$ and $-3y$
 $2x^2$ and $-3x$
 $2x$ and $-3xy$

Often a variable does not have a number in front of it. In this case, there is an *understood* "1" in front of the variable. For example, b is the same as $1b$ and $-a$ is the same as $-1a$.

When you add or subtract like terms, you are combining like terms.

EXAMPLE Combining Like Terms

- 1 Combine like terms in the expression $5m + 9m + m$.

$$\begin{aligned} 5m + 9m + m &= 5m + 9m + 1m && \leftarrow \text{Rewrite } m \text{ as } 1m. \\ &= (5 + 9 + 1)m && \leftarrow \text{Distributive Property} \\ &= 15m && \leftarrow \text{Combine like terms by adding.} \end{aligned}$$

 **Quick Check**

1. Combine like terms in the expression $2t + t - 17t$.

When defining variables, it is often helpful to choose letters that remind you of what the variables represent.

EXAMPLE Application: Picnics

- 2 Garrick buys 5 loaves of bread and 8 cans of tuna for a picnic. Tanya buys a loaf of bread and 2 cans of tuna. Define and use variables to represent the total cost.

Words Garrick: cost of 5 loaves plus cost of 8 cans



Let b = the cost of a loaf of bread.
Let t = the cost a can of tuna.

Expression $5b$ + $8t$

Words Tanya: cost of 1 loaf plus cost of 2 cans



Expression b + $2t$

Combined Expression $(5b + 8t) + (b + 2t)$

$$(5b + 8t) + (b + 2t) = 5b + b + 8t + 2t \quad \leftarrow \text{Commutative Property of Addition}$$

$$= (5 + 1)b + (8 + 2)t \quad \leftarrow \text{Distributive Property}$$

$$= 6b + 10t \quad \leftarrow \text{Simplify.}$$

Quick Check

2. In one trip to a hardware store, you buy 16 boards, 2 boxes of nails, and a hammer. On a second trip, you buy 10 more boards and a box of nails. Define and use variables to represent the total cost.

When you use the Distributive Property with subtraction, remember to distribute the negative sign.

EXAMPLE Distributing and Simplifying

- 3 Simplify $8.5c - 3(c + 5)$.

$$8.5c - 3(c + 5) = 8.5c + (-3)(c + 5) \quad \leftarrow \text{Add the opposite of } 3(c + 5).$$

$$= 8.5c + [-3c + (-15)] \quad \leftarrow \text{Distributive Property}$$

$$= 8.5c + (-3c) - 15 \quad \leftarrow \text{Simplify.}$$

$$= [8.5 + (-3)]c - 15 \quad \leftarrow \text{Distributive Property}$$

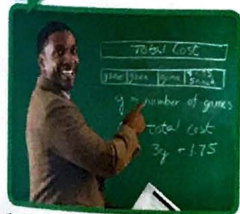
$$= 5.5c - 15 \quad \leftarrow \text{Simplify.}$$

Quick Check

3. Simplify the expression $11 - 2(3.4b + 1)$.



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Check Your Understanding

1. **Vocabulary** Are $3x^2y^5z^{11}$ and $5x^2z^5y^{11}$ like terms? Explain.

Simplify each expression. The exercises have been started for you.

2. $-3r + 2r + r - 2$
 $= (-3 + 2 + 1)r - 2$

3. $4x - 2 + \frac{5}{6}y + y - 4$
 $= 4x + \frac{5}{6}y + y - 4 - 2$

4. $9m + 2(2 + n)$
 $= 9m + 4 + 2n$

5. $2.3a + 5(3 + a)$
 $= 2.3a + 15 + 5a$

6. **Mental Math** Combine like terms in the expression $1.3a + 2.4a$.

Homework Exercises

For more exercises, see **Extra Skills and Word Problems**.

GO for Help

For Exercises	See Examples
7-15	1
16-22	2
23-28	3

Combine like terms. Write your answer in simplest form.

7. $8b + 3b$

8. $9r + 22r$

9. $3.4x - 3x$

10. $19z - 24z + 6z$

11. $-25t + 21t - 7t$

12. $-13b - 17b + 32b$

13. $\frac{3}{8}a + a + \frac{7}{8}a$

14. $19t - t + 6t$

15. $j - 0.4j - 1.5j$

Simplify each expression. Write your answer in simplest form.

16. $3a + 2 + a$

17. $\frac{2}{5}x + 1 + \frac{3}{5}x$

18. $n + 4n - 3$

19. $5n - 6r + 4n + 3r$

20. $2z - 3.5y - 1.8z + y$

21. $9 - 7t + 1 + 4t$

22. **Clothing** For the summer, Tia buys 3 T-shirts and 2 pairs of shorts. Her brother buys 4 T-shirts and 1 pair of shorts. Define and use variables to represent the total cost.

Simplify each expression. Write your answer in simplest form.

23. $3 - 5(a - 4)$

24. $7(t + 8.5) - 5t + 4$

25. $-8(m + 2) - 1.9m$

26. $4.3(5.6 + c) + 9c$

27. $-5b - 2(b - 1)$

28. $16b - \frac{2}{3}(c + 3) - 4b$

29. **Guided Problem Solving** On Saturday, Simone drove to the mall and back home. Then she drove 10 miles to a flea market and back. On Sunday, she made 2 trips from home to the mall and back. Define and use a variable to write a simplified expression for the total distance Simone traveled.

- Draw a diagram showing the trips between the mall, the flea market, and home.
- What quantity do you need to represent with a variable?



GPS

30. **Party Planning** You buy 6 lb of sliced turkey, 3 lb of cole slaw, and 4 lb of cheese for a party. Then you invite more people to the party, so you buy another 4 lb of turkey, 2 lb of cole slaw, and 3 lb of cheese. Define and use variables to represent the total cost.
31. On a shopping trip, Kelly buys 3 barrettes and a headband. Her sister buys 2 barrettes and 2 headbands. Define and use variables to represent the total cost.

Simplify each expression.

32. $7b + 5 - 9b + c$ 33. $x + 2(x - y)$
34. $-5u + 6 + u + 4u$ 35. $\left(\frac{5}{9}x + y\right) - \left(\frac{4}{9}x - 9\right)$
36. $3(t - 14) - 5(t + 12)$ 37. $33.7y + 8.4 - 2.04y$
38. $9(a + 1.4b) + 8(b - 16a)$ 39. $4.2x + 8.1x + 1.8x - 2.1x$
40. **Writing in Math** One way to organize a CD collection is by categories of music. Explain how combining like terms is similar to organizing a CD collection by categories.
41. **Open-Ended** Write two different expressions that can be simplified to $3m + 8$. One expression should have three terms, and the other should have four terms.
42. **Reasoning** Does $5a + 5b = 10ab$? Explain.
43. **Challenge** Simplify the expression $2.5(2t - 8v) - 3(3v + 1.5t)$.



Test Prep and Mixed Review

Practice

Multiple Choice

44. On one day, Sean buys 3 notebooks, 4 markers, and a ruler at the school bookstore. The next day, he buys another notebook and 3 more markers. Let n = the cost of a notebook, m = the cost of a marker, and r = the cost of a ruler. Which expression represents the total cost?
- (A) $3n + 7m + r$ (C) $4n + 7m + 1$
- (B) $3n + 7m + r + n$ (D) $4n + 7m + r$
45. You ride your bicycle 12 miles north of your home. Then you ride 10 miles east. To the nearest mile, how far are you from your home?
- (F) 22 mi (H) 6 mi
- (G) 16 mi (J) 5 mi

Find the side length of a cube with each given volume.

46. 343 m^3 47. $\frac{1}{64} \text{ in.}^3$

GO for Help

For Exercises	See Lesson
46–47	1-3