

### Solve & Discuss It!

How can the tiles below be sorted?

#### Lesson 4-3

### Simplify Expressions

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**I can...**  
use properties of operations to simplify expressions.

**Focus on math practices**

**Reasoning** Would sorting the tiles with positive coefficients together and tiles with negative coefficients together help to simplify an expression that involves all the tiles? Explain.

201

**Essential Question** How are properties of operations used to simplify expressions?

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**EXAMPLE 1** **Combine Like Terms with Integer Coefficients**

A teacher used algebra tiles to model  $-2c + 3c - 5 - 4c + 7$ . Simplify the expression.

**STEP 1** Write the expression by grouping like terms together.

Use the Commutative and Associative Properties to reorder and group like terms.

$$\begin{aligned}
 & -2c + 3c - 5 - 4c + 7 \\
 & = -2c + 3c - 4c - 5 + 7 \\
 & = -2c - 4c + 3c - 5 + 7 \\
 & = (-2c - 4c + 3c) + (-5 + 7)
 \end{aligned}$$

**STEP 2** Combine like terms.

$$(-2c - 4c + 3c) + (-5 + 7)$$

**Use Structure** Why can you not combine unlike terms?

The simplified expression is  $-3c + 2$ .

**Try It!**

Simplify the expression  $-6 - 6f + 7 - 3f - 9$ .   $- 3f -$    $+ 7 -$

$-$

**Convince Me!** How do you decide in what way to reorder the terms of an expression when simplifying it?

202 4-3 Simplify Expressions

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**EXAMPLE 2** Combine Like Terms with Rational Coefficients

Simplify the expression  $-3 - \frac{1}{3}x + (-4.5) - \frac{1}{3}x$ .

$$-3 + \frac{1}{3}x + (-4.5) - \frac{1}{3}x$$

$$= \left(\frac{1}{3}x - \frac{1}{3}x\right) + (-3 + (-4.5))$$

$$= \left(\frac{1}{15}x - \frac{1}{15}x\right) + (-3 + (-4.5))$$

$$= \frac{2}{15}x + (-7.5)$$

The simplified expression is  $\frac{2}{15}x - 7.5$ .

Use the Commutative and Associative Properties to reorder and group like terms.

**Use Structure** Include the signs of terms when reordering the terms.

**Try It!**

Simplify each expression.

a.  $59.95m - 30 + 7.95m + 45 + 9.49m$

b.  $-0.5p + \frac{1}{2}p - 2.75 + \frac{2}{3}p$

**EXAMPLE 3** Combine Like Terms with Two Variables

Simplify the expression  $4a - 5b - 6 + 2b - 3a$ .

$$4a - 5b - 6 + 2b - 3a$$

$$= (4a - 3a) + (-5b + 2b) - 6$$

$$= 1a - 3b - 6$$

The simplified expression is  $a - 3b - 6$ .

Use the Commutative and Associative Properties to reorder and group like terms.

**Try It!**

Simplify the expression  $-3.7 + 5g + 4k + 11.1 - 10g$ .

$$(-3.7 - 10g) + 4k + (11.1)$$

$$= \quad + 4k + \quad$$

The simplified expression is .

**KEY CONCEPT**

When simplifying algebraic expressions, use properties of operations to combine like terms.

To simplify the expression below, group like terms.

$$\frac{3}{10}y - 3.5x - \frac{3}{8} + 0.53x + 5.25 - 2.75y - 12$$

$$(-3.5x + 0.53x) + \left(\frac{3}{10}y - 2.75y\right) + \left(-\frac{3}{8} + 5.25 - 12\right)$$

Then combine like terms.

$$-2.97x - 2.45y - 7.125$$

**Do You Understand?**

1. **Essential Question** How are properties of operations used to simplify expressions?

2. **Make Sense and Persevere** Explain why constant terms expressed as different rational number types can be combined.

3. **Reasoning** How do you know when an expression is in its simplest form?

**Do You Know How?**

4. Simplify  $-4b + (-9k) - 6 - 3b + 12$

$$(-4b + -3b) + (-9k) + (-6 + 12)$$

$$-7b + -9k + +6$$

5. Simplify  $-2 + 6.45z - 6 + (-3.25z)$ .

6. Simplify  $-9 + \left(-\frac{1}{3}y\right) + 6 - \frac{4}{3}y$ .

Name: \_\_\_\_\_

**Practice & Problem Solving**

In 7–10, simplify each expression.

7.  $-2.8f + 0.9f - 12 - 4$

8.  $3.2 - 5.1n - 3n + 5$

9.  $2n + 5.5 - 0.9n - 8 + 4.5p$

10.  $12 + (-4) - \frac{2}{5}j - \frac{4}{5}j + 5$

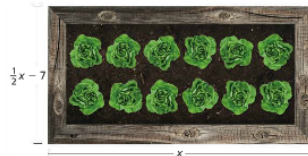
11. Which expression is equivalent to  $-5v + (-2) + 1 + (-2v)$ ?

- (A)  $-9v$
- (B)  $-4v$
- (C)  $-7v - 1$
- (D)  $-7v + 3$

12. Which expression is equivalent to  $\frac{2}{3}x + (-3) + (-2) - \frac{1}{3}x$ ?

- (A)  $x + 5$
- (B)  $-\frac{1}{3}x - 5$
- (C)  $\frac{1}{3}x - 1$
- (D)  $\frac{1}{3}x - 5$

13. The dimensions of a garden are shown. Write an expression to find the perimeter.



14. Simplify the expression  $8h + (-7.3d) - 14 + 5d - 3.2h$ .

15. Simplify  $4 - 2y + (-8y) + 6.2$ .

16. Simplify  $\frac{3}{5}z - \frac{2}{5}z + 5 - \frac{3}{5}z - 8$ .

17. **Construct Arguments** Explain whether  $11t - 4t$  is equivalent to  $4t - 11t$ . Support your answer by evaluating the expression for  $t = 2$ .

18. The signs show the costs of different games at a math festival. How much would it cost  $n$  people to play Decimal Decisions and Ratio Rage?

**PROBABILITY**  
Cost (C) of 1 Game: 1.50 - 1  
**DECISIONS**  
Cost (C) of 1 Game: 12.00 - n + 3  
**RATIO RAGE!**  
Cost (C) of 1 Game: 2

19. **Higher Order Thinking** In the expression  $ax + bx$ ,  $a$  is a decimal and  $b$  is a fraction. How do you decide whether to write  $a$  as a fraction or  $b$  as a decimal?

**Assessment Practice**

20. Which expressions are equivalent to  $-6z + (-5.5) + 3.5z + 5y - 2.5$ ? Select all that apply.

- $-8 + 5y + 2.5z$
- $-2.5z + 5y - 8$
- $-8 + 5y + (-2.5z)$
- $2.5y + (-2.5z) - 5.5$
- $5y - 8 - 2.5z$

$2x + 3x$   
 $5x$   
 $Ax + Bx$   
 $0.5x + \frac{8}{11}x$   
 ~~$0.5x + 0.727272...x$~~   
 $\frac{5 \div 5}{10 \div 5}x + \frac{8}{11}x$       LCM  
 $\frac{1 \cdot 11}{2 \cdot 11}x + \frac{8 \cdot 2}{11 \cdot 2}x$        $\frac{11 \cdot 10}{10 \cdot 11}$   
 $\frac{11}{22}x + \frac{16}{22}x$        $\frac{11 \cdot 11}{2 \cdot 11}$   
 $\frac{27}{22}x$   
 $1\frac{5}{22}x$

