

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?

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 $-6 - 6f + 7 - 3f - 9$. $- 3f -$ $+ 7 -$

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

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

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

$$= \left(\frac{1}{3}x - \frac{1}{3}x\right) + (-7.5)$$

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

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

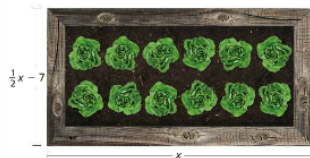
11. Which expression is equivalent to $-5v + (-2) + 1 + (-2v)$?

- (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 $\frac{3}{2}x - \frac{1}{2}x + 5 - \frac{3}{2}x - 8$.

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 (D) of 1 Game: $1.5n - 3$
DECISION DECISIONS Cost (D) of 1 Game: $12.9n - n + 3$
RATIO RAGE! Cost (D) of 1 Game: ?

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?
 We either have to turn A into a fraction or B into a decimal. Keep repeating decimal as fraction.

Assessment Practice

20. Which expressions are equivalent to $-6z + (-5.5) + 3.5z + 5y - 2.5z$? 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
 $\frac{1 \cdot 11}{2 \cdot 11}x + \frac{8 \cdot 2}{11 \cdot 2}x$
 $\frac{11}{22}x + \frac{16}{22}x$
 $\frac{27}{22}x$
 $1\frac{5}{22}x$

