

Add and Subtract Algebraic Expressions



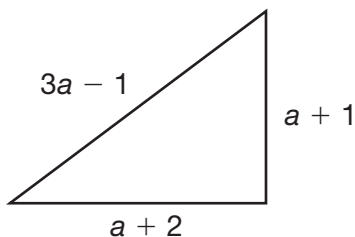
Getting the Idea

The same rules you learned for adding and subtracting rational numbers also apply to adding and subtracting algebraic expressions.

Number properties and the order of operations can also help you solve problems involving addition or subtraction of expressions.

Example 1

Write an expression to represent the perimeter of the triangle below.



Strategy Add the expressions for the 3 sides. Simplify the sum.

Step 1

Write an expression to represent the perimeter.

The perimeter of a figure is the sum of its side lengths.

$$(a + 1) + (a + 2) + (3a - 1)$$

Step 2

Use the commutative and associative properties to reorder and group like terms.

$$(a + 1) + (a + 2) + (3a - 1) =$$

$$a + 1 + a + 2 + 3a - 1 =$$

$$a + a + 3a + 1 + 2 - 1$$

Step 3

Add.

$$a + a + 3a + 1 + 2 - 1 =$$

$$(a + a + 3a) + (1 + 2 - 1) =$$

$$5a + 2$$

Solution The expression $5a + 2$ represents the perimeter of the triangle.

Remember that subtracting an integer is the same as adding its opposite. You can use the same strategy to subtract an algebraic expression.

Example 2

Subtract.

$$4x + 8 - (3 + 4y)$$

Strategy Find the opposite of the expression being subtracted. Then add the opposite to the original expression.

Step 1 Find the opposite of the quantity being subtracted.

The opposite of $3 + 4y$ is $-(3 + 4y)$.

$-(3 + 4y)$ is the same as $-1(3 + 4y)$, so distribute -1 over the two terms.

$$-(3 + 4y) = (-3) - 4y$$

Step 2 Rewrite the problem as an addition problem by adding the opposite.

$$4x + 8 - (3 + 4y) =$$

$$4x + 8 + (-3) - 4y$$

Step 3 Use the commutative and associative properties to reorder and group like terms.

$$4x + 8 + (-3) - 4y = 4x - 4y + 8 + (-3)$$

Then add.

$$4x - 4y + 8 + (-3) = 4x - 4y + 5$$

Solution The difference is $4x - 4y + 5$.

Example 3

Drew baked c corn muffins. He brought $\frac{3}{4}$ of the corn muffins to the bake sale and gave $\frac{1}{8}$ of the muffins to his grandmother.

Write an expression that represents the number of muffins Drew had left.

Strategy Translate the problem into an expression. Then simplify.

Step 1 Write an expression for the number of muffins Drew had left.

Drew baked c muffins. He brought $\frac{3}{4}$ of the muffins to the bake sale.

He also gave $\frac{1}{8}$ of the muffins to his grandmother.

This can be represented as $c - \frac{3}{4}c - \frac{1}{8}c$.

Step 2

Simplify the expression using a common denominator.

$$c - \frac{3}{4}c - \frac{1}{8}c =$$

$$1c - \frac{3}{4}c - \frac{1}{8}c =$$

$$\frac{8}{8}c - \frac{6}{8}c - \frac{1}{8}c =$$

$$\frac{(8 - 6 - 1)}{8}c = \frac{1}{8}c$$

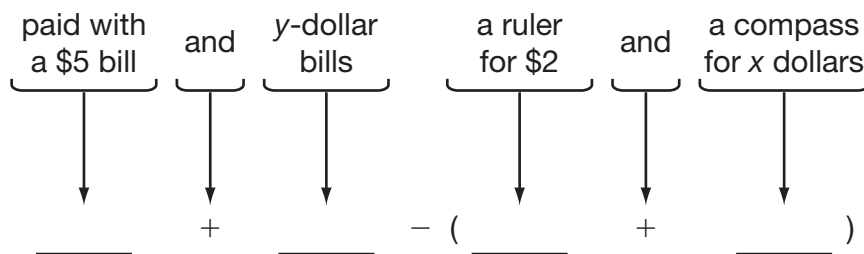
Solution The number of muffins Drew had left can be represented by the expression $\frac{1}{8}c$.

**Coached Example**

Carter bought a ruler for \$2 and a compass for x dollars. He paid for the items with a \$5 bill and y -dollar bills. Write an expression in simplest form that represents how much money, in dollars, he received in change.

Translate the problem into an expression.

What operation do the key words “received in change” indicate? _____



Simplify the expression you wrote.

Find the opposite of the expression being subtracted.

The opposite of $2 + x$ is _____.

Distribute the -1 over the two terms. _____.

Rewrite the problem as an addition problem by adding the opposite.

_____ + _____

Use number properties to reorder and group like terms. Then add.

The expression _____ represents the amount of change, in dollars, that Carter received.



Lesson Practice

Choose the correct answer.

1. Add.

$$7y + 5 + (3 - y)$$

- A. $8y + 8$
- B. $6y + 8$
- C. $-6y + 8$
- D. $-8y + 8$

2. Subtract.

$$5 + 5q - (3q - 9)$$

- A. $2q - 9$
- B. $2q - 4$
- C. $-2q + 4$
- D. $2q + 14$

3. Add.

$$5k + 4 + (6 - 2m)$$

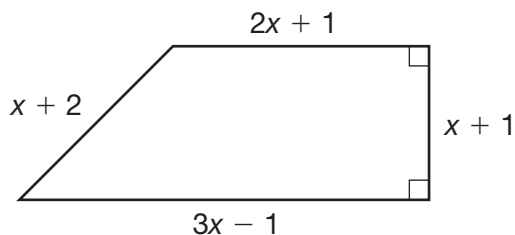
- A. $5k - 2m + 10$
- B. $3k + m + 10$
- C. $5k + 2m + 10$
- D. $10k + 3m$

4. Subtract.

$$5r + 3 - (1 + 6r)$$

- A. $-11r + 2$
- B. $-2r + 2$
- C. $-r + 2$
- D. $11r + 2$

5. Which expression represents the perimeter, in units, of this trapezoid?



- A. $7x + 3$
- B. $7x - 1$
- C. $2x + 1$
- D. $2x - 1$

6. Angelo and Jimmy went shopping. Angelo had a dollars in his wallet. He spent $\frac{1}{3}$ of that money on new jeans. Jimmy had j dollars in his wallet. He spent $\frac{1}{2}$ of that money on a new jacket. Jimmy had more money left than Angelo. Which expression shows the difference between the amounts of money, in dollars, that each boy had left?

- A. $\frac{1}{3}a - \frac{1}{2}j$
- B. $\frac{2}{3}a - \frac{1}{2}j$
- C. $\frac{1}{2}j - \frac{2}{3}a$
- D. $\frac{1}{2}j - \frac{1}{3}a$

7. Which expression is equivalent to the expression below?

$$4r + 9 + r + 2s - 3$$

- A. $14r - s$
- B. $7r + 6$
- C. $5r + 2s - 12$
- D. $5r + 2s + 6$

8. Which of the following shows a simplified version of this expression?

$$2k + (-3m) - 6k + 2m$$

- A. $-4k - 2m$
- B. $-4k - m$
- C. $4k - 5m$
- D. $4k - m$

9. Mr. and Mrs. Duane share a savings account. There were d dollars in the savings account when Mr. Duane withdrew \$45 from the account. Mrs. Duane deposited m dollars into the account. Then Mr. Duane deposited an additional \$65 into the account.

- A. Write an expression to show how much money, in dollars, is in the account after the transactions.

- B. Simplify the expression. Explain your thinking.

10. The expression below shows the perimeter of a rectangle with sides $(2 + s)$ and $(5 - m)$. Which is an equivalent expression? Circle all that apply.

$$(2 + s) + (5 - m) + (2 + s) + (5 - m)$$

- A. $(4 + 2s) + (10 - 2m)$
 B. $(2 + s) + (5 - m)$
 C. $2(2 + s) + 2(5 - m)$
 D. $14 + 2s - 2m$
 E. $14 + 2s + 2m$
 F. $14 + 4sm$
 G. $14sm$
11. Draw a line from each expression to the equivalent simplified expression.

- | | | |
|-------------------------|---|-------------|
| A. $3a + 11 - (2 + 4a)$ | • | • $7a - 9$ |
| B. $3a + 11 + (2 + 4a)$ | • | • $-a + 9$ |
| C. $3a - 11 + (2 + 4a)$ | • | • $7a + 9$ |
| D. $3a + 11 - (2 - 4a)$ | • | • $7a + 13$ |

12. Landon biked 4 miles on Monday, $2m$ miles on Wednesday, and $(10 - m)$ miles on Friday. How many miles did he bike during the week? Use values from the box to complete a simplified expression that represents the situation.

_____ + _____

| |
|------|
| -6 |
| 14 |
| $3m$ |
| m |

13. Look at each equation. Is the expression on the left simplified correctly on the right? Select Yes or No.

A. $6x - 7y + 3x = 3x - 7y$ Yes No

B. $10 - 3x - 4x = 3x$ Yes No

C. $(22x + 5) - (3x + 9) = 19x - 4$ Yes No

D. $12x - y - 5x = 7x - y$ Yes No

14. Tania bought three shirts for $(12 + d)$, $(7d + 5)$, and $(20 - 2d)$ dollars. Which expression represents the total cost? Circle all that apply.

A. $37 + 6d$

B. $12 + d + 7d + 5 - 20 - 2d$

C. $(12 + 5 - 20) + (d + 7d - 2d)$

D. $(12 + 5 + 20) + (d + 7d - 2d)$

E. $12 + d + 7d + 5 + 20 - 2d$

F. $37 + 10d$

G. $(d + 12) + (5 + 7d) + (-2d + 20)$

15. Select True or False for each equation.

A. $2p + 3d - (p + d) = p + 2d$ True False

B. $4p + 22d - (21p + 54d) = -17p + 76d$ True False

C. $-p + 100d + 79p - 6d = 78p + 94d$ True False

D. $56p - 32d - (25p + d) = 31p - 31d$ True False