

Working with Linear Expressions

7.EE.1 Apply properties of operations as strategies to add, subtract, factor, and expand linear expressions with rational coefficients.



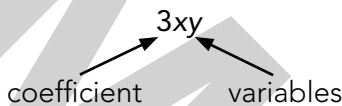
Understand the Standards

Sometimes you need to write and evaluate an expression to solve a problem. An expression can describe a real-world situation in mathematical terms.

An **expression** is a mathematical phrase that may include constants, variables, and operation symbols. A **variable** is a letter or symbol that represents an unknown quantity. A **coefficient** is the number by which a variable is multiplied. A **constant** is a symbol or number whose value does not change. In the expression $3x + 8$, 3 is the coefficient, x is the variable, and 8 is the constant.

Words to Know

- expression
- variable
- coefficient
- constant
- linear expression
- expand
- factor



A **linear expression** is a combination of terms where the highest power of a variable is 1. They also do not have variables under a square root sign or variables in denominators. Examples of linear expressions include:

$x + 3$ $2x + 8$ $x + 4y$

To **expand** an expression is to remove any parentheses by completing the multiplication.

$4(2x + 3)$ expands to $4 \times 2x + 4 \times 3$

To **factor** an expression is to find a common factor of two or more terms in an expression. You can think of factoring as the opposite of expanding an expression.

$3y - 6$ can be factored to $3(y - 2)$

Depending on the problem you are solving, you may want to use the expanded form or the factored form of the expression.

Veronica needs to simplify this expression to solve a problem. Show the steps she can follow to simplify the expression.

$8x + 15 - 3(2x + 3)$



Guided Instruction

To simplify the expression, follow these steps.

- Step 1** Expand the expression by distributing the -3 across the terms inside the parentheses. Multiply -3 by each term.

$$8x + 15 - 3(2x + 3)$$

$$8x + 15 + (-3 \times 2x) + (-3 \times 3)$$

$$8x + 15 + (-6x) + (-9)$$

$$8x + 15 - 6x - 9$$

- Step 2** Rewrite the expression using the Associative Property to group like terms together.

$$8x + 15 - 6x - 9$$

$$8x - 6x + 15 - 9$$

- Step 3** Combine the like terms.

$$8x - 6x + 15 - 9$$

$$2x + 6$$



On Your Own

Use what you know about expressions to expand each expression.

1. $5y + 4(x - 6)$ _____

2. $6(8g - 4h) - 3f$ _____

3. $3\left(\frac{1}{3}a - \frac{1}{2}b + \frac{5}{6}c\right)$ _____

4. $-2(3w + 5) - 9z$ _____

Use what you know about expressions to factor each expression, if possible.

5. $8p - 4s + 6$ _____

6. $12a - 7b + 8c$ _____

7. $5 + 3m - 2k$ _____

8. $13t + 6w - 52$ _____

Use the strategy above to simplify each of the following expressions.

9. $2(b + 3) - b$ _____

10. $6y + 9 - y + 1$ _____

11. $8 \cdot a \cdot 4$ _____

12. $3x + 2y + x - y$ _____

13. $2(a + b) + 4a + 2b$ _____

14. $5p + (2p + 1)$ _____

Review each property shown. Then identify the property used to simplify each expression below.

Associative Property $(a + b) + c = a + (b + c)$ $(ab)c = a(bc)$	Commutative Property $a + b = b + a$ $a \times b = b \times a$
Distributive Property $a(b + c) = ab + ac$	Identity Property $0 + a = a$ $1 \times a = a$

15. $3a + (5b + 2) = (3a + 5b) + 2$ _____

16. $x \times 8 + 6 = 8x + 6$ _____

17. $\frac{1}{2}(a + 2b) = \frac{a}{2} + b$ _____

18. $18a + 0 - b = 18a - b$ _____

Answer the questions below.

19. Simplify the expression.

$$ab + 2ab - b + 9$$

- A. $3a + 9$
- B. $3ab - b + 9$
- C. $2ab + 9$
- D. $3ab - (b + 9)$

20. Which expression is not equivalent to $3a + 4a$?

- A. $7a$
- B. $(3 + 4)a$
- C. $a(3 + 4)$
- D. $3 + 4a$

21. Write the steps you would use to simplify the expression $3a + 4(6a - 2) - a + 2a(8 - 5) \neq 12$ in order.

Elevate 22. Elin simplified the expression $6x + 5(2x - 1)$ to $16x - 1$. Is her answer correct? Explain why or why not.

Elevate 23. Explain the difference between $4x + (3 \times 8y)$ and $(4x + 3) \times 8y$.
