

# Simplifying Algebraic Expressions

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

Date: \_\_\_\_\_

Score: \_\_\_\_\_ / 26

## Q Quick Review

**Like terms** are terms with the *same variable* raised to the *same power*. So  $5x$  and  $-3x$  are like terms;  $5x$  and  $5x^2$  are not (different powers); and  $5x$  and  $5y$  are not either (different variables). To combine like terms, you just add or subtract their coefficients:  $5x + (-3x) = 2x$ . The **Distributive Property** ( $a(b + c) = ab + ac$ ) lets you clear parentheses by handing the outside number to each piece inside. The full simplification rhythm is three steps: **(1)** distribute to clear all parentheses, **(2)** group like terms, **(3)** combine the coefficients. The most common mistake is forgetting that a minus sign in front of parentheses flips *every* sign inside — think of it as multiplying by  $-1$ .

## PRACTICE

Simplify each expression by combining like terms.

- |                           |       |                               |       |
|---------------------------|-------|-------------------------------|-------|
| 1. $5x + 3x$              | _____ | 11. $\frac{1}{2}(4x + 8)$     | _____ |
| 2. $7a - 2a + 4$          | _____ | 12. $-4(x - 3) + 4x$          | _____ |
| 3. $2(x + 6)$             | _____ | 13. $6x + 2y - 3x + y$        | _____ |
| 4. $-3(2y - 5)$           | _____ | 14. $-(x + 5) + 2x$           | _____ |
| 5. $4m + 3 - 2m + 1$      | _____ | 15. $3(x^2 + 2) - x^2$        | _____ |
| 6. $6(n + 2) - 4n$        | _____ | 16. $5(2x - 3) - 2(x + 4)$    | _____ |
| 7. $3(x - 4) + 2(x + 1)$  | _____ | 17. $\frac{1}{3}(9x - 6) + x$ | _____ |
| 8. $-5(2p + 3) + 8p$      | _____ | 18. $4 - 2(3 - x)$            | _____ |
| 9. $7 - 3(k - 2)$         | _____ | 19. $8x + 3 - (2x - 5)$       | _____ |
| 10. $2(a + b) + 3(a - b)$ | _____ | 20. $2(x + y) - 2(x - y)$     | _____ |

## ◆ VISUAL PRACTICE

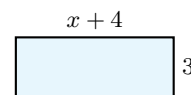
Use the graph, table, chart, or diagram to answer the question.

21. Use the area model to write the simplified expression.

$x^2$	$4x$
$3x$	$12$

Answer: \_\_\_\_\_

22. The figure is a rectangle. Write and simplify an expression for the area.



Answer: \_\_\_\_\_

## ◆ Word Problems

23. A rectangular garden has length  $(3x + 2)$  ft and width  $(x + 4)$  ft. Write and simplify an expression for the perimeter. \_\_\_\_\_
24. Mia buys 3 notebooks at  $(n + 1)$  dollars each and 2 pens at  $(n - 2)$  dollars each. Write and simplify an expression for her total cost. \_\_\_\_\_
25. A square has side length  $(2x + 5)$  inches. Write and simplify an expression for its perimeter. \_\_\_\_\_
26. Devon has  $\$(4x + 20)$  in his wallet and spends  $\$(x + 6)$  on lunch. Write and simplify an expression for how much money he has left. \_\_\_\_\_



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## Answer Keys

- |   |   |
|---|---|
| <p>1. <math>8x</math></p> <p>2. <math>5a + 4</math></p> <p>3. <math>2x + 12</math></p> <p>4. <math>-6y + 15</math></p> <p>5. <math>2m + 4</math></p> <p>6. <math>2n + 12</math></p> <p>7. <math>5x - 10</math></p> <p>8. <math>-2p - 15</math></p> <p>9. <math>-3k + 13</math></p> <p>10. <math>5a - b</math></p> <p>11. <math>2x + 4</math></p> <p>12. <math>12</math></p> <p>13. <math>3x + 3y</math></p> | <p>14. <math>x - 5</math></p> <p>15. <math>2x^2 + 6</math></p> <p>16. <math>8x - 23</math></p> <p>17. <math>4x - 2</math></p> <p>18. <math>2x - 2</math></p> <p>19. <math>6x + 8</math></p> <p>20. <math>4y</math></p> <p>21. <math>x^2 + 7x + 12</math></p> <p>22. <math>3x + 12</math></p> <p>23. <math>(8x + 12)</math> ft</p> <p>24. <math>\\$(5n - 1)</math></p> <p>25. <math>(8x + 20)</math> in</p> <p>26. <math>\\$(3x + 14)</math></p> |
|---|---|

### Step-by-Step Tutor Notes

1. Both are  $x$ -terms with the same variable to the same power, so they combine. Just add the coefficients:  $5 + 3 = 8$ . Result:  $8x$ .
2. The  $a$ -terms combine:  $7a - 2a = 5a$ . The  $+4$  is a constant on its own — nothing else like it — so it tags along unchanged.
3. No like terms to combine, just a distribution. Hand the 2 to both pieces:  $2 \cdot x = 2x$  and  $2 \cdot 6 = 12$ . Final:  $2x + 12$ .
4. Distribute the  $-3$  carefully.  $-3 \cdot 2y = -6y$ . Then  $-3 \cdot (-5) = +15$  (negative times negative is positive). Result:  $-6y + 15$ .
5. Focus on the main idea of the problem, then simplify carefully. Sort by type.  $m$ -terms:  $4m - 2m = 2m$ . Constants:  $3 + 1 = 4$ . Combine:  $2m + 4$ . So the answer is  $2m + 4$ .
6. Distribute first:  $6n + 12 - 4n$ . Now combine  $n$ -terms:  $6n - 4n = 2n$ . The  $+12$  stays. Result:  $2n + 12$ .
7. Distribute both:  $3x - 12 + 2x + 2$ . Group by type:  $x$ -terms are  $3x + 2x = 5x$ ; constants are  $-12 + 2 = -10$ . Together:  $5x - 10$ .
8. Distribute:  $-10p - 15 + 8p$ . Combine  $p$ -terms:  $-10p + 8p = -2p$ . Constant  $-15$  stays. Result:  $-2p - 15$ .
9. Distribute the  $-3$ :  $7 - 3k + 6$ . (The minus times  $-2$  is  $+6$  — easy to miss.) Now combine constants:  $7 + 6 = 13$ . Final:  $-3k + 13$ .
10. Distribute each:  $2a + 2b + 3a - 3b$ . Group by letter —  $a$ -terms:  $2a + 3a = 5a$ ;  $b$ -terms:  $2b - 3b = -b$ . Combine:  $5a - b$ .
11. Half of  $4x$  is  $2x$ , and half of 8 is 4. So  $2x + 4$ . Fractions distribute the same way whole numbers do.
12. Distribute:  $-4x + 12 + 4x$ . The  $-4x$  and  $+4x$  cancel each other out, leaving just 12. (Whenever variables cancel like this, the problem is checking that you noticed.)
13. Two kinds of terms here, so sort them.  $x$ -terms:  $6x - 3x = 3x$ .  $y$ -terms:  $2y + y = 3y$  (remember the silent 1 in front of  $y$ ). Result:  $3x + 3y$ .
14. The bare minus in front of  $(x + 5)$  acts like a  $-1$ . So distribute:  $-x - 5 + 2x$ . Combine  $x$ -terms:  $-x + 2x = x$ . Final:  $x - 5$ .
15. Distribute:  $3x^2 + 6 - x^2$ . The  $x^2$ -terms combine (same variable, same power):  $3x^2 - x^2 = 2x^2$ . Result:  $2x^2 + 6$ .
16. Distribute both, watching the second negative:  $10x - 15$  from the first, and  $-2x - 8$  from the second. Combine:  $10x - 2x = 8x$ ,  $-15 - 8 = -23$ . Final:  $8x - 23$ .
17. Distribute the  $\frac{1}{3}$ : one-third of  $9x$  is  $3x$ , one-third of  $-6$  is  $-2$ . So  $3x - 2 + x$ . Combine  $x$ -terms:  $3x + x = 4x$ . Result:  $4x - 2$ .
18. Distribute the  $-2$  carefully.  $-2 \cdot 3 = -6$  and  $-2 \cdot (-x) = +2x$ . So  $4 - 6 + 2x$ . Combine constants:  $4 - 6 = -2$ . Final:  $2x - 2$ .
19. That bare minus flips both signs inside the parens:  $8x + 3 - 2x + 5$ . (The  $-5$  becomes  $+5$  — this is where students lose points.) Combine:  $8x - 2x = 6x$ ,  $3 + 5 = 8$ . Result:  $6x + 8$ .
20. Distribute each:  $2x + 2y - 2x + 2y$ . The  $x$ -terms cancel completely ( $2x - 2x = 0$ ), and the  $y$ -terms add up:  $2y + 2y = 4y$ . Clean answer:  $4y$ .
21. Move carefully through the arithmetic; one clean operation usually unlocks the next one. Add the four regions:  $x^2 + 4x + 3x + 12 = x^2 + 7x + 12$ . After simplifying, the answer is  $x^2 + 7x + 12$ .
22. Start with the definition the problem is testing, then apply it directly. Area is length times width:  $3(x + 4) = 3x + 12$ . So the answer is  $3x + 12$ .
23. Perimeter of a rectangle is  $2(\text{length}) + 2(\text{width})$ . Replace the length and width:  $2(3x + 2) + 2(x + 4)$ . Distribute both:  $6x + 4 + 2x + 8$ . Combine:  $6x + 2x = 8x$ ,  $4 + 8 = 12$ . Final:  $(8x + 12)$  feet.
24. Three notebooks cost  $3(n + 1)$  dollars, and two pens cost  $2(n - 2)$ . Add:  $3(n + 1) + 2(n - 2)$ . Distribute:  $3n + 3 + 2n - 4$ . Combine:  $3n + 2n = 5n$ ,  $3 - 4 = -1$ . Total:  $\$(5n - 1)$ .
25. A square has four equal sides, so perimeter =  $4(2x + 5)$ . Distribute:  $4 \cdot 2x = 8x$  and  $4 \cdot 5 = 20$ . Final:  $(8x + 20)$  inches.
26. Money left = what he had — what he spent:  $(4x + 20) - (x + 6)$ . The minus flips both signs in the second parens:  $4x + 20 - x - 6$ . (That  $-6$  is the easy-to-miss one.) Combine:  $4x - x = 3x$ ,  $20 - 6 = 14$ . Final:  $\$(3x + 14)$ .



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