Simplifying Algebraic Expressions

Name: _____	Date: _____	Score: _____ / 26

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

VISUAL PRACTICE

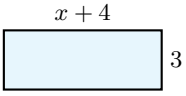
Use the graph, table, chart, or diagram to answer the question.

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 m has left. _____

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Answer Keys

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

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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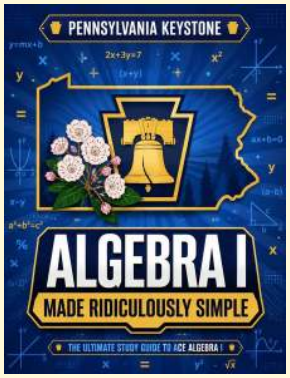

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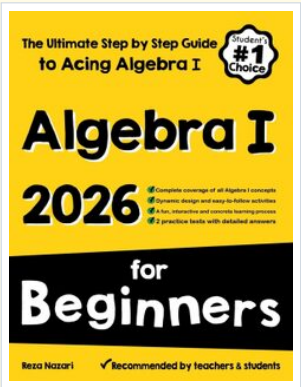

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