Simplifying Algebraic Expressions

Name: _____ Date: _____ Score: _____ / 27

Quick Review

To **simplify** an expression, do two things: distribute anything in front of parentheses, then combine like terms. **Like terms** share the same variable raised to the same power: $5x$ and $-2x$ are like; $3x$ and $3x^2$ are not. **Distributing** hands the outside factor to *every* term inside, including its sign. The most common error in this whole topic is forgetting that a leading minus sign distributes too: $-(x-5) = -x+5$, not $-x-5$. When fractions appear out front, distribute them too — $\frac{1}{2}(8x-6) = 4x-3$. After distributing, group the x's together, the x^2's together, and the constants together. That gives you the simplest form.

PRACTICE

Simplify each expression completely. Show distribution and combining.

1. The table sorts the terms of $5x+3y-2x+7y$ by their variable. Use it to write the simplified expression. _____

variable	terms	combined
x	$5x,\ -2x$	?
y	$3y,\ 7y$	?

2. The table sets up distributing -3 across $(2a-5b+4)$. Fill in the products to write the result $-3(2a-5b+4)$. _____

inside term	$\times(-3)$
$2a$	$-6a$
$-5b$	?
4	?

3. $4(x-3)-2(x+5)+7$ _____

4. $2x(3x^2-4x+5)$ _____

5. $\dfrac{6x^2+12x}{3x}$ _____

6. $\frac{1}{2}(8x-6)-\frac{2}{3}(9-6x)+5x$ _____

7. $5(2x^2-3x+1)-3(x^2-4x-2)+x$ _____

8. $-3(2x-4)+5x$ _____

9. $4(2m-3n)-(5m+2n)+3(m-n)$ _____

10. $3(2x-4)-2(x-5)$ _____

11. $-(3x-7)$ _____

12. $2(x+y)+3(x+y)$ _____

13. The table groups the terms of $7x^2-3x+5-2x^2+4x-1$ by degree. Combine each row to write the simplified expression. _____

type	terms
x^2	$7x^2,\ -2x^2$
x	$-3x,\ 4x$
constant	$5,\ -1$

14. $(3x+2)(x-4)$ _____

15. $5a-(2a-3)+4$ _____

16. $\frac{3}{4}(8x-12)+\frac{1}{3}(9x+6)$ _____

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17. $\dfrac{10x^3 - 15x^2 + 5x}{5x}$ _____

18. $-2(x^2 - 3x + 4) + x^2$ _____

19. $(2x - 1) + (3 - x) - (x - 4)$ _____

20. $a(a + b) - b(a - b)$ _____

Word Problems

21. A rectangle has length $3x + 2$ units and width $x - 5$ units, where $x > 5$. What expression represents its perimeter? ____

22. A school store sells p pencils at $\$0.50$ each and n notebooks at $\$2.00$ each. Write a simplified expression for the total cost, then find the cost of 6 pencils and 4 notebooks. ____

23. A triangle has sides of length $2x + 1$, $3x - 2$, and $x + 5$. Write a simplified expression for its perimeter. ____

24. Jasmine claims that $3(x + 5)$ and $3x + 5$ are equivalent. Simplify $3(x + 5)$ and decide whether she's right. ____

Additional Practice

25. $6(x - 2) + 4x$ _____

26. $5(2a + 1) - 3a$ _____

27. $-2(3y - 4) + y$ _____

Answer Keys

1. $3x + 10y$
2. $-6a + 15b - 12$
3. $2x - 15$
4. $6x^3 - 8x^2 + 10x$
5. $2x + 4$
6. $13x - 9$
7. $7x^2 - 2x + 11$
8. $-x + 12$
9. $6m - 17n$
10. $4x - 2$
11. $-3x + 7$
12. $5x + 5y$
13. $5x^2 + x + 4$
14. $3x^2 - 10x - 8$
15. $3a + 7$
16. $9x - 7$
17. $2x^2 - 3x + 1$
18. $-x^2 + 6x - 8$
19. 6
20. $a^2 + b^2$
21. $8x - 6$
22. $0.50p + 2n;\ \$11.00$
23. $6x + 4$
24. $3x + 15;$ not equivalent

Additional Practice Answers

25. $10x - 12$
26. $7a + 5$
27. $-5y + 8$

Additional Practice: Answers for all numbered items, including the added practice, are shown in the grid above.

Step-by-Step Explanations

1. Like terms share the same variable, so they live in the same row. Combine each row: $5x - 2x = 3x$ and $3y + 7y = 10y$. You can't merge the rows — x and y are different terms. Final: $3x + 10y$.

2. The -3 lands on every term, sign and all. $-3 \cdot 2a = -6a$, $-3 \cdot (-5b) = +15b$ (two negatives make a positive), and $-3 \cdot 4 = -12$. Putting them together: $-6a + 15b - 12$. The middle sign is the usual trap.

3. One steady path is: $4(x - 3) = 4x - 12$. $-2(x + 5) = -2x - 10$. All together: $4x - 12 - 2x - 10 + 7$. x's combine to $2x$. Constants: $-12 - 10 + 7 = -15$. Final: $2x - 15$. That gives a quick check on the answer.

4. Distribute $2x$ to each piece. $2x \cdot 3x^2 = 6x^3$. $2x \cdot (-4x) = -8x^2$. $2x \cdot 5 = 10x$. Don't forget the x on the last term — 5 alone is wrong.

5. Split the fraction: $\frac{6x^2}{3x} + \frac{12x}{3x}$. Each piece simplifies: $\frac{6x^2}{3x} = 2x$ and $\frac{12x}{3x} = 4$. Sum: $2x + 4$. (Assumes $x \neq 0$.)

6. Keep the rule visible: $\frac{1}{2}(8x - 6) = 4x - 3$. $-\frac{2}{3}(9 - 6x) = -6 + 4x$ (the $-6x$ flips with the $-\frac{2}{3}$ to give $+4x$). Now add everything: $4x - 3 - 6 + 4x + 5x = (4 + 4 + 5)x + (-3 - 6) = 13x - 9$. That gives a quick check on the answer.

7. One steady path is: $5(2x^2 - 3x + 1) = 10x^2 - 15x + 5$. $-3(x^2 - 4x - 2) = -3x^2 + 12x + 6$. All together with the trailing $+x$: $10x^2 - 3x^2 + (-15 + 12 + 1)x + (5 + 6) = 7x^2 - 2x + 11$. That gives a quick check on the answer.

8. Start with the key idea: $-3(2x - 4) = -6x + 12$. Add the $5x$: $-6x + 12 + 5x = -x + 12$. This is the part to check before moving on, because it keeps the answer tied to the original question.

9. Three distributions: $4(2m - 3n) = 8m - 12n$, $-(5m + 2n) = -5m - 2n$, $3(m - n) = 3m - 3n$. The m's: $8 - 5 + 3 = 6$, so $6m$. The n's: $-12 - 2 - 3 = -17$, so $-17n$. Final: $6m - 17n$.

10. Keep the rule visible: $3(2x - 4) = 6x - 12$. $-2(x - 5) = -2x + 10$ (the second negative flips -5 to $+5$). Combine: $6x - 12 - 2x + 10 = 4x - 2$. That gives a quick check on the answer.

11. A bare minus sign in front works like multiplying by -1. $-1 \cdot 3x = -3x$ and $-1 \cdot (-7) = +7$. Final: $-3x + 7$.

12. Treat $(x + y)$ as a chunk. You have 2 chunks plus 3 chunks — that's 5 chunks. Then distribute the 5: $5(x + y) = 5x + 5y$.

13. Combine within each row: $7x^2 - 2x^2 = 5x^2$, $-3x + 4x = x$, and $5 - 1 = 4$. Stacked together: $5x^2 + x + 4$.

14. FOIL: $3x \cdot x = 3x^2$, $3x \cdot (-4) = -12x$, $2 \cdot x = 2x$, $2 \cdot (-4) = -8$. Combine: $3x^2 - 12x + 2x - 8 = 3x^2 - 10x - 8$.

15. One steady path is: The leading minus distributes: $-(2a - 3) = -2a + 3$. So $5a - 2a + 3 + 4 = 3a + 7$. That gives a quick check on the answer.

16. Start with the key idea: $\frac{3}{4}(8x - 12) = 6x - 9$ (since $\frac{3}{4} \cdot 8 = 6$ and $\frac{3}{4} \cdot 12 = 9$). $\frac{1}{3}(9x + 6) = 3x + 2$. Sum: $6x - 9 + 3x + 2 = 9x - 7$. That gives a quick check on the answer.

17. Split into three fractions: $\frac{10x^3}{5x} = 2x^2$, $\frac{-15x^2}{5x} = -3x$, $\frac{5x}{5x} = 1$. Together: $2x^2 - 3x + 1$.

18. Keep the rule visible: $-2(x^2 - 3x + 4) = -2x^2 + 6x - 8$. Add x^2: $-2x^2 + x^2 = -x^2$. Final: $-x^2 + 6x - 8$. That gives a quick check on the answer.

19. Drop the parens carefully. Last group gets a leading minus: $-(x - 4) = -x + 4$. So $2x - 1 + 3 - x - x + 4$. The x's: $2 - 1 - 1 = 0$, so no x. Constants: $-1 + 3 + 4 = 6$. Just 6. (When the variables cancel out, the expression is actually a constant.)

20. Start with the key idea: $a(a + b) = a^2 + ab$. $-b(a - b) = -ab + b^2$. Add: $a^2 + ab - ab + b^2 = a^2 + b^2$. The mixed terms cancel. That gives a quick check on the answer.

21. Perimeter is 2(length + width). Add inside first: $(3x + 2) + (x - 5) = 4x - 3$. Now double: $2(4x - 3) = 8x - 6$. (Multiplying length times width gives the area $3x^2 - 13x - 10$ — a different quantity.)

22. Cost per item times quantity, summed: $0.50p + 2n$. Plug in $p = 6$ and $n = 4$: $0.50(6) + 2(4) = 3 + 8 = 11$. So \$11.00.

23. Perimeter is the sum of the three sides. $(2x + 1) + (3x - 2) + (x + 5)$. Combine the x's: $2 + 3 + 1 = 6$, so $6x$. Combine the constants: $1 - 2 + 5 = 4$. Final: $6x + 4$.

24. Distribute the 3 to *both* pieces inside: $3 \cdot x + 3 \cdot 5 = 3x + 15$. Jasmine only multiplied the 3 by the x and forgot the 5 — the classic distributive-property slip. Since $3x + 15 \neq 3x + 5$, the two are not the same.

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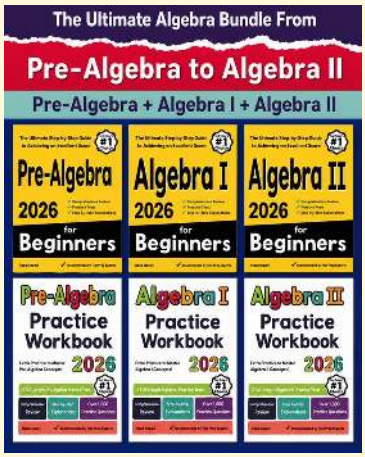

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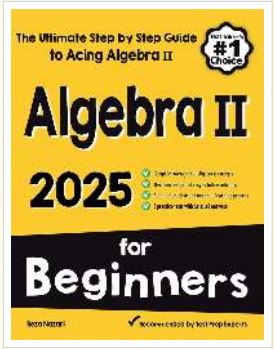

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