Equivalent Expressions

Name: _____	Date: _____	Score: _____ / 24

Quick Review

Two expressions are **equivalent** if they give the same value for every number you substitute. The **distributive property** says $a(b+c) = ab + ac$, which lets you remove parentheses. You can also **combine like terms** — terms with the same variable — by adding or subtracting their coefficients, so $4x + 3x = 7x$. To check that two expressions are equivalent, simplify both or substitute a test number into each. These tools let you rewrite an expression in a simpler, equal form.

◇ **Example:** Simplify $3(x+4) + 2x$.

⇒ Let's start by using the distributive property on $3(x+4)$. We multiply the 3 by each term inside: $3 \times x = 3x$ and $3 \times 4 = 12$, giving $3x + 12$. Now the whole expression is $3x + 12 + 2x$. The like terms are $3x$ and $2x$ — both have an x — so we add their coefficients: $3 + 2 = 5$, giving $5x$. The 12 has no like term, so it stays. The simplified result is $5x + 12$.

Answer: $5x + 12$

PRACTICE

Simplify each expression by combining like terms or distributing.

1. $2x + 5x$ _____

2. $9y - 4y$ _____

3. $3a + a$ _____

4. $6m + 2m + m$ _____

5. $8n - 3n + n$ _____

6. $2(x+3)$ _____

7. $4(y+1)$ _____

8. $5(a-2)$ _____

9. $3(2k+4)$ _____

10. $7x + 4 + 2x$ _____

11. $5y + 3 + y + 2$ _____

12. $10a - 4a + 6$ _____

13. $2(x+5) + 3$ _____

14. $4(n+2) + n$ _____

15. $3x + 2(x+1)$ _____

16. $6(a-1) + 4a$ _____

17. $8m + 5 - 3m$ _____

18. $2(3x+4) + 5x$ _____

19. $5(y+2) + 3(y+1)$ _____

20. $4(2a+1) + 2(a+3)$ _____

Word Problems

21. A box holds x red pens and x blue pens. Write a simplified expression for the total number of pens in 3 boxes. _____

22. Ana has $5n + 2$ stickers and her friend has $3n + 4$ stickers. Write a simplified expression for how many they have together. _____

23. A rectangle has length $x + 3$ and width 2. Using the distributive property, write a simplified expression for its area. _____

24. A team buys 4 jerseys at j dollars each and 4 pairs of socks at j dollars each. Write a simplified expression for the total cost, then explain why it equals $8j$. _____

Answer Keys

1. $7x$
2. $5y$
3. $4a$
4. $9m$
5. $6n$
6. $2x + 6$
7. $4y + 4$
8. $5a - 10$
9. $6k + 12$
10. $9x + 4$
11. $6y + 5$
12. $6a + 6$
13. $2x + 13$
14. $5n + 8$
15. $5x + 2$
16. $10a - 6$
17. $5m + 5$
18. $11x + 8$
19. $8y + 13$
20. $10a + 10$
21. $6x$
22. $8n + 6$
23. $2x + 6$
24. $8j$

Step-by-Step Explanations

1. Both terms have x, so add the coefficients: $2 + 5 = 7$, giving $7x$.
2. Subtract the coefficients of like terms: $9 - 4 = 5$, so $5y$.
3. A lone a has coefficient 1, so $3 + 1 = 4$, giving $4a$.
4. Add all the coefficients: $6 + 2 + 1 = 9$, so $9m$.
5. Work left to right: $8 - 3 = 5$, then $5 + 1 = 6$, giving $6n$.
6. Distribute the 2: $2 \times x = 2x$ and $2 \times 3 = 6$.
7. Distribute: $4 \times y = 4y$ and $4 \times 1 = 4$.
8. Distribute the 5: $5 \times a = 5a$ and $5 \times 2 = 10$.
9. Distribute: $3 \times 2k = 6k$ and $3 \times 4 = 12$.
10. Combine the x terms: $7x + 2x = 9x$, and 4 stays, giving $9x + 4$.
11. Like terms: $5y + y = 6y$. Constants: $3 + 2 = 5$. Result $6y + 5$.
12. Combine a terms: $10a - 4a = 6a$. The 6 stays: $6a + 6$.
13. Distribute: $2x + 10$. Then add 3: $10 + 3 = 13$, giving $2x + 13$.
14. Distribute: $4n + 8$. Combine n terms: $4n + n = 5n$, so $5n + 8$.
15. Distribute: $2(x + 1) = 2x + 2$. Then $3x + 2x = 5x$, giving $5x + 2$.
16. Distribute: $6a - 6$. Combine: $6a + 4a = 10a$, so $10a - 6$.
17. Combine m terms: $8m - 3m = 5m$. The 5 stays: $5m + 5$.
18. Distribute: $6x + 8$. Combine: $6x + 5x = 11x$, giving $11x + 8$.
19. Distribute both: $5y + 10$ and $3y + 3$. Combine: $5y + 3y = 8y$ and $10 + 3 = 13$.
20. Distribute: $8a + 4$ and $2a + 6$. Combine: $8a + 2a = 10a$ and $4 + 6 = 10$.
21. Each box has $x + x = 2x$ pens. Three boxes give $3 \times 2x = 6x$ pens.
22. Add the like terms: $5n + 3n = 8n$, and $2 + 4 = 6$. Together they have $8n + 6$ stickers.
23. Area is length times width: $2(x + 3)$. Distributing gives $2x + 6$.
24. The cost is $4j + 4j$. Both terms have j, so adding coefficients gives $8j$ — the same as 8 items at j dollars.

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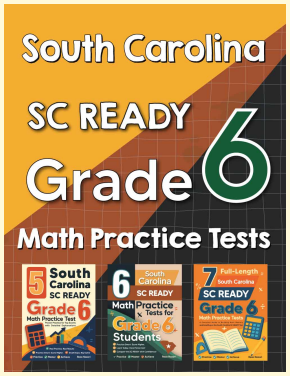

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