

Equivalent Expressions

Name: _____ Date: _____ Score: _____ / 24

Q 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. $2x + 5x$ | _____ | 11. $5y + 3 + y + 2$ | _____ |
| 2. $9y - 4y$ | _____ | 12. $10a - 4a + 6$ | _____ |
| 3. $3a + a$ | _____ | 13. $2(x + 5) + 3$ | _____ |
| 4. $6m + 2m + m$ | _____ | 14. $4(n + 2) + n$ | _____ |
| 5. $8n - 3n + n$ | _____ | 15. $3x + 2(x + 1)$ | _____ |
| 6. $2(x + 3)$ | _____ | 16. $6(a - 1) + 4a$ | _____ |
| 7. $4(y + 1)$ | _____ | 17. $8m + 5 - 3m$ | _____ |
| 8. $5(a - 2)$ | _____ | 18. $2(3x + 4) + 5x$ | _____ |
| 9. $3(2k + 4)$ | _____ | 19. $5(y + 2) + 3(y + 1)$ | _____ |
| 10. $7x + 4 + 2x$ | _____ | 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

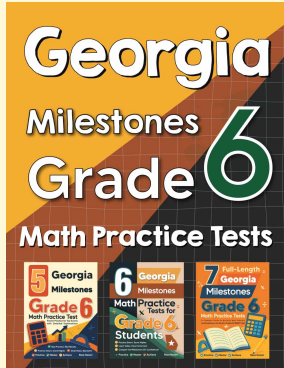
- | | |
|--------------|----------------|
| 1. $7x$ | 13. $2x + 13$ |
| 2. $5y$ | 14. $5n + 8$ |
| 3. $4a$ | 15. $5x + 2$ |
| 4. $9m$ | 16. $10a - 6$ |
| 5. $6n$ | 17. $5m + 5$ |
| 6. $2x + 6$ | 18. $11x + 8$ |
| 7. $4y + 4$ | 19. $8y + 13$ |
| 8. $5a - 10$ | 20. $10a + 10$ |
| 9. $6k + 12$ | 21. $6x$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

Step-by-Step Explanations

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