

# 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. $2x + 5x$      | _____ | 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

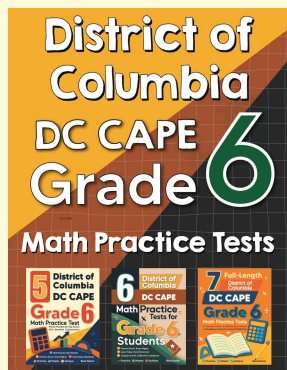
- |                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                   |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>1. <math>7x</math></p> <p>2. <math>5y</math></p> <p>3. <math>4a</math></p> <p>4. <math>9m</math></p> <p>5. <math>6n</math></p> <p>6. <math>2x + 6</math></p> <p>7. <math>4y + 4</math></p> <p>8. <math>5a - 10</math></p> <p>9. <math>6k + 12</math></p> <p>10. <math>9x + 4</math></p> <p>11. <math>6y + 5</math></p> <p>12. <math>6a + 6</math></p> | <p>13. <math>2x + 13</math></p> <p>14. <math>5n + 8</math></p> <p>15. <math>5x + 2</math></p> <p>16. <math>10a - 6</math></p> <p>17. <math>5m + 5</math></p> <p>18. <math>11x + 8</math></p> <p>19. <math>8y + 13</math></p> <p>20. <math>10a + 10</math></p> <p>21. <math>6x</math></p> <p>22. <math>8n + 6</math></p> <p>23. <math>2x + 6</math></p> <p>24. <math>8j</math></p> |
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### Step-by-Step Explanations

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