

# Multiplying Linear Expressions and Factoring

Name: \_\_\_\_\_ Date: \_\_\_\_\_ Score: \_\_\_\_\_ / 24

## Q Quick Review

To **multiply** a number by an expression in parentheses, use the **distributive property**: multiply the outside factor by every term inside, like  $3(x + 4) = 3x + 12$ . **Factoring** is the reverse — you pull a common factor back out, like  $6x + 9 = 3(2x + 3)$ . To factor, find the **greatest common factor (GCF)** of all the terms, write it outside the parentheses, and put what's left inside. You can always *check* by distributing again to see if you get back where you started.

◊ **Example:** Factor  $12x + 18$ .  
 ⇒ Factoring means finding what the two terms have in common and pulling it out front. Look at the numbers 12 and 18: the biggest number that divides both is 6 — that's our GCF. Now ask, what's left after we take a 6 out of each term? From  $12x$  we get  $2x$ , and from 18 we get 3. So we write 6 outside the parentheses and  $2x + 3$  inside:  $6(2x + 3)$ . Check by distributing:  $6 \cdot 2x = 12x$  and  $6 \cdot 3 = 18$ . Perfect.

**Answer:**  $6(2x + 3)$

## PRACTICE

Multiply or factor each expression completely.

- |                          |       |                           |       |
|--------------------------|-------|---------------------------|-------|
| 1. $4(x + 2)$            | _____ | 11. Factor $2x + 6$       | _____ |
| 2. $3(x - 5)$            | _____ | 12. Factor $5x + 15$      | _____ |
| 3. $5(2x + 1)$           | _____ | 13. Factor $8x - 12$      | _____ |
| 4. $6(x - 3)$            | _____ | 14. Factor $9x + 6$       | _____ |
| 5. $2(4x + 7)$           | _____ | 15. Factor $10x - 25$     | _____ |
| 6. $-3(x + 4)$           | _____ | 16. Factor $14x + 21$     | _____ |
| 7. $-2(3x - 5)$          | _____ | 17. Factor $6x - 18$      | _____ |
| 8. $7(2x - 3)$           | _____ | 18. Factor $12x + 16$     | _____ |
| 9. $\frac{1}{2}(6x + 8)$ | _____ | 19. $3(x + 2) + 2(x + 1)$ | _____ |
| 10. $10(x + 0.5)$        | _____ | 20. Factor $4x + 8x$      | _____ |

### ◆ Word Problems

21. A rectangular garden is 5 feet wide and  $(x + 7)$  feet long. Write an expression for its area, fully expanded. \_\_\_\_\_
22. A store sells  $x$  T-shirts at \$8 each and  $x$  caps at \$8 each. Write the total revenue as a factored expression. \_\_\_\_\_
23. A contractor charges \$15 per hour for  $x$  hours of work plus  $x$  hours of cleanup at \$15 per hour. Write the total cost, factored. \_\_\_\_\_
24. The perimeter of a square is  $4(x + 3)$ . Expand this expression to find the perimeter in simplest form. \_\_\_\_\_



## Answer Keys

- |                |                           |
|----------------|---------------------------|
| 1. $4x + 8$    | 13. $4(2x - 3)$           |
| 2. $3x - 15$   | 14. $3(3x + 2)$           |
| 3. $10x + 5$   | 15. $5(2x - 5)$           |
| 4. $6x - 18$   | 16. $7(2x + 3)$           |
| 5. $8x + 14$   | 17. $6(x - 3)$            |
| 6. $-3x - 12$  | 18. $4(3x + 4)$           |
| 7. $-6x + 10$  | 19. $5x + 8$              |
| 8. $14x - 21$  | 20. $12x$                 |
| 9. $3x + 4$    | 21. $5x + 35$ square feet |
| 10. $10x + 5$  | 22. $8(x + x) = 16x$      |
| 11. $2(x + 3)$ | 23. $15(x + x) = 30x$     |
| 12. $5(x + 3)$ | 24. $4x + 12$             |

### Step-by-Step Explanations

- |  |  |
|--|--|
| <p>1. Distribute the 4: <math>4 \cdot x + 4 \cdot 2 = 4x + 8</math>.</p> <p>2. Distribute the 3: <math>3x - 15</math>.</p> <p>3. Distribute: <math>5 \cdot 2x + 5 \cdot 1 = 10x + 5</math>.</p> <p>4. Distribute the 6: <math>6x - 18</math>.</p> <p>5. Distribute: <math>2 \cdot 4x + 2 \cdot 7 = 8x + 14</math>.</p> <p>6. Distribute the <math>-3</math>: <math>-3x - 12</math> (the sign hits both terms).</p> <p>7. Distribute <math>-2</math>: <math>-6x + 10</math> (minus times minus is plus).</p> <p>8. Distribute: <math>14x - 21</math>.</p> <p>9. Half of <math>6x</math> is <math>3x</math>, half of 8 is 4: <math>3x + 4</math>.</p> <p>10. Distribute: <math>10x + 10(0.5) = 10x + 5</math>.</p> <p>11. The GCF of <math>2x</math> and 6 is 2: <math>2(x + 3)</math>.</p> <p>12. The GCF is 5: <math>5(x + 3)</math>.</p> <p>13. The GCF of 8 and 12 is 4: <math>4(2x - 3)</math>.</p> | <p>14. The GCF is 3: <math>3(3x + 2)</math>.</p> <p>15. The GCF of 10 and 25 is 5: <math>5(2x - 5)</math>.</p> <p>16. The GCF of 14 and 21 is 7: <math>7(2x + 3)</math>.</p> <p>17. The GCF is 6: <math>6(x - 3)</math>.</p> <p>18. The GCF of 12 and 16 is 4: <math>4(3x + 4)</math>.</p> <p>19. Distribute both: <math>3x + 6 + 2x + 2</math>, then combine: <math>5x + 8</math>.</p> <p>20. These are like terms: <math>4x + 8x = 12x</math>.</p> <p>21. Area is width times length: <math>5(x + 7)</math>. Distribute the 5 to get <math>5x + 35</math> square feet.</p> <p>22. Revenue is <math>8x + 8x</math>. Factor out the 8: <math>8(x + x)</math>, and since <math>x + x = 2x</math>, that is 16x dollars.</p> <p>23. The total is <math>15x + 15x</math>. Factoring out 15 gives <math>15(x + x) = 30x</math> dollars.</p> <p>24. Distribute the 4 to both terms inside: <math>4 \cdot x + 4 \cdot 3 = 4x + 12</math>.</p> |
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