

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.

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|--------------------------|-------|---------------------------|-------|
| 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

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|----------------|---------------------------|
| 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

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