Multiplying Linear Expressions and Factoring

Name: _____	Date: _____	Score: _____ / 24

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. $4(x + 2)$ _____
2. $3(x - 5)$ _____
3. $5(2x + 1)$ _____
4. $6(x - 3)$ _____
5. $2(4x + 7)$ _____
6. $-3(x + 4)$ _____
7. $-2(3x - 5)$ _____
8. $7(2x - 3)$ _____
9. $\frac{1}{2}(6x + 8)$ _____
10. $10(x + 0.5)$ _____
11. Factor $2x + 6$ _____
12. Factor $5x + 15$ _____
13. Factor $8x - 12$ _____
14. Factor $9x + 6$ _____
15. Factor $10x - 25$ _____
16. Factor $14x + 21$ _____
17. Factor $6x - 18$ _____
18. Factor $12x + 16$ _____
19. $3(x + 2) + 2(x + 1)$ _____
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. $4x + 8$
2. $3x - 15$
3. $10x + 5$
4. $6x - 18$
5. $8x + 14$
6. $-3x - 12$
7. $-6x + 10$
8. $14x - 21$
9. $3x + 4$
10. $10x + 5$
11. $2(x + 3)$
12. $5(x + 3)$
13. $4(2x - 3)$
14. $3(3x + 2)$
15. $5(2x - 5)$
16. $7(2x + 3)$
17. $6(x - 3)$
18. $4(3x + 4)$
19. $5x + 8$
20. $12x$
21. $5x + 35$ square feet
22. $8(x + x) = 16x$
23. $15(x + x) = 30x$
24. $4x + 12$

Step-by-Step Explanations

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

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