Factoring Expressions

Name: _____	Date: _____	Score: _____ / 17

Factoring is the *reverse* of distributing—instead of spreading a number into a sum, you are pulling a common factor *out* of a sum! The first step is always to find the **Greatest Common Factor** of every term in the expression. Once you factor it out, the expression looks simpler and its structure becomes much clearer. This skill may seem small now, but it becomes one of the biggest tools in all of algebra!

Key Concepts & Quick Review

Steps: (1) Find GCF of all terms. (2) Divide each term by the GCF. (3) Write: GCF $\times$ (remaining terms in parentheses).

Example: $12x + 8$. GCF $= 4$. $12x \div 4 = 3x$; $8 \div 4 = 2$. Factored: $4(3x + 2)$. **Check** by distributing: $4(3x + 2) = 12x + 8$ ✓.

Examples

① Factor completely: (a) $15x - 10$ (b) $6a^2 + 9a$

Think It Through: Factoring starts by finding the greatest common factor. In part (a), the GCF of $15x$ and 10 is 5, so pull out 5 to get $5(3x - 2)$. In part (b), both terms share a factor of $3a$, so the expression becomes $3a(2a + 3)$. A good check is to distribute the factor back in and make sure you return to the original expression.

Answer: *(a)* $5(3x - 2)$; *(b)* $3a(2a + 3)$

② A rectangular school garden has area $= 18x + 24$ square feet. Factor the expression to find possible dimensions (length and width). If $x = 5$, what is the area and what are the dimensions?

Think It Through: Find the GCF of the terms $18x$ and 24, which is 6. Factoring gives $18x + 24 = 6(3x + 4)$. That tells us one possible set of dimensions is 6 feet by $(3x + 4)$ feet. When $x = 5$, the second factor becomes $3(5) + 4 = 19$, so the area is $6 \times 19 = 114$ square feet and the dimensions are $6\,ft$ by $19\,ft$.

Answer: $6(3x + 4)$; *at* x=5: $6 \times 19 = 114\,sq\,ft$

Practice Problems

Factor each expression completely by finding and pulling out the GCF.

1. $4x + 8$ _____

2. $6y - 9$ _____

3. $10n + 15$ _____

4. $12a - 18$ _____

5. $5m + 20$ _____

6. $8k - 24$ _____

7. $3x^2 + 6x$ _____

8. $4a^2 - 2a$ _____

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9. $9n^2 + 3n$ _____

10. $14y^2 - 7y$ _____

11. $6x + 9y$ _____

12. $20a - 16b$ _____

13. $15m^2 + 10m$ _____

14. $12x - 8y + 4$ _____

15. $7p^2 - 14p$ _____

Study Tips

- Always factor out the **greatest** common factor — not just any common factor. GCF of 12 and 8 is 4, not 2.
- If a term has a variable, include the **lowest power** of that variable in the GCF when it appears in every term.
- **Always verify** by distributing your answer — the result must match the original expression exactly.

Word Problems

16. A city park planner wants to tile a rectangular patio. The total number of tiles needed is $24n + 36$, where n is the number of tile columns. Factor this expression to find possible dimensions of the patio layout. If $n = 5$, how many tiles are needed, and what are the two possible sets of dimensions? _____

17. A school store sells pencils and pens in bundles. The revenue expression for one morning is $\$5p + \$15$, where p is the number of pencil bundles sold. Factor the expression. What does the factored form reveal about the pricing structure? If $p = 8$, calculate the revenue two ways — using the original and factored forms — and confirm they match. _____

Answer Keys

1) $4(x+2)$
2) $3(2y-3)$
3) $5(2n+3)$
4) $6(2a-3)$
5) $5(m+4)$
6) $8(k-3)$
7) $3x(x+2)$
8) $2a(2a-1)$
9) $3n(3n+1)$
10) $7y(2y-1)$
11) $3(2x+3y)$
12) $4(5a-4b)$
13) $5m(3m+2)$
14) $4(3x-2y+1)$
15) $7p(p-2)$
16) $12(2n+3)$; 156 tiles; dimensions 12×13
17) $5(p+3)$; unit price \$5; at $p=8$: \$55

Step-by-Step Explanations

Strategy: For Compound Interest, build the growth factor and raise it to the number of compounding periods before subtracting any interest earned. The exponent is the place to slow down, because one missed compounding period changes the whole result.

Practice 1: Find the compound amount for principal \$200, annual rate 5%, and time 2 years. **Answer:** \$220.50

For the first worked item, multiply by the growth factor once for each compounding period.

Practice 15: Find the compound amount for principal \$900, annual rate 2.5%, and time 3 years. **Answer:** \$969.20

Near the end of this topic, compare the final amount with the starting principal to isolate the interest earned.

Word-problem notes:

16. **Answer:** \$926.10

$A = 800(1.05)^3 = 800 \times 1.157625 = \$926.10.$

17. **Answer:** Total: \$1,749.60; Interest: \$249.60

$A = 1{,}500(1.08)^2 = 1{,}500 \times 1.1664 = \$1{,}749.60.$ Interest $= 1{,}749.60 - 1{,}500 = \$249.60.$

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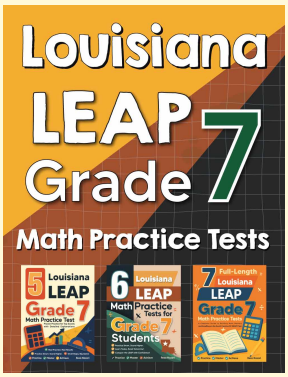

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