🔢 Class 8 Algebraic Expressions & Identities

By Thinking Juggernaut

Name: _____ Date: _____ Score: ____/24

📚 Algebraic Expressions & Identities

In Class 8, we explore:

- Advanced multiplication and division of algebraic expressions
- Application of algebraic identities to simplify expressions
- Factorization using common factors and identities
- Working with expressions containing multiple variables and powers

Standard Algebraic Identities:

1. $(a + b)^2 = a^2 + 2ab + b^2$
2. $(a - b)^2 = a^2 - 2ab + b^2$
3. $(a + b)(a - b) = a^2 - b^2$
4. $(x + a)(x + b) = x^2 + (a + b)x + ab$
5. $(a + b + c)^2 = a^2 + b^2 + c^2 + 2ab + 2bc + 2ca$
6. $(a + b)^3 = a^3 + b^3 + 3ab(a + b)$
7. $(a - b)^3 = a^3 - b^3 - 3ab(a - b)$
8. $a^3 + b^3 = (a + b)(a^2 - ab + b^2)$
9. $a^3 - b^3 = (a - b)(a^2 + ab + b^2)$

Factorization Methods:

- **Common Factor Method:** $6x + 9 = 3(2x + 3)$
- **Regrouping Method:** $ax + bx + ay + by = x(a + b) + y(a + b) = (a + b)(x + y)$
- **Using Identities:** $x^2 - 9 = (x + 3)(x - 3)$
- **Middle Term Splitting:** For $x^2 + bx + c$

📝 Sample Problem

Problem: Factorize using identity: $4x^2 - 12xy + 9y^2$

Step 1: Recognize the pattern

Compare with: $a^2 - 2ab + b^2 = (a - b)^2$

Step 2: Identify a and b

$a^2 = 4x^2 \rightarrow a = 2x$

$b^2 = 9y^2 \rightarrow b = 3y$

Step 3: Verify middle term

$2ab = 2(2x)(3y) = 12xy$ ✓

Step 4: Write factored form

$$4x^2 - 12xy + 9y^2 = (2x - 3y)^2$$

💡 **Remember:** Always verify by expanding the factored form to check your answer!

Part A: Warm-up Questions

⭐ Easy Level

1. Expand using identity: $(3x + 4)^2$

Hint: Use $(a + b)^2 = a^2 + 2ab + b^2$

2. Simplify: $(x + 5)(x - 5)$

3. Factorize by taking out common factor: $12x^2 + 18x$

4. Expand: $(2a - 3b)^2$

5. Multiply: $(x + 7)(x + 3)$

6. Factorize using identity: $x^2 - 16$

7. Find the product: $(3m + 2n)(3m - 2n)$

8. If $a + b = 7$ and $ab = 12$, find $a^2 + b^2$

Part B: Practice Questions

☆☆ Medium Level

9. Factorize: $x^2 + 10x + 25$

10. Expand using identity: $(2x + 3y + 4z)^2$

11. Factorize by regrouping: $ax + ay + bx + by$

12. Evaluate using identity: 103^2

13. Factorize: $9a^2 - 24ab + 16b^2$

14. **Match the Following:**

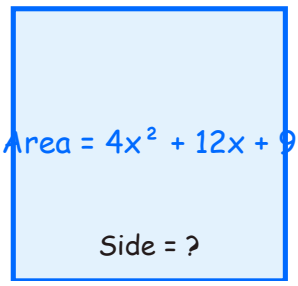
Column A (Expression)	Column B (Factored Form)
1. $x^2 - 25$	a. $(x + 9)(x - 9)$
2. $x^2 + 12x + 36$	b. $(x - 5)(x + 5)$

3. $x^2 - 81$	c. $(x + 6)^2$
4. $4x^2 - 9$	d. $(2x - 3)(2x + 3)$

15. If $x - y = 3$ and $xy = 10$, find $x^2 + y^2$

16. Simplify: $(x + 2)^2 - (x - 2)^2$

17. **Word Problem:** The area of a square is $(4x^2 + 12x + 9)$ cm^2. Find the length of its side.



18. Evaluate: 98 × 102 using identity

Part C: Challenge Questions

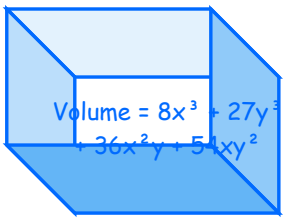
⭐⭐⭐ Hard Level

19. Factorize completely: $x^3 - 27$

20. If $a + b + c = 12$ and $ab + bc + ca = 47$, find $a^2 + b^2 + c^2$

21. Expand: $(2x - 3y)^3$

22. **Word Problem:** The volume of a cube is $(8x^3 + 27y^3 + 36x^2y + 54xy^2)$ cubic units. Find the length of its edge by factorizing the expression.



23. Factorize: $x^4 - 16$

24. Prove that: $(a + b)^2 + (a - b)^2 = 2(a^2 + b^2)$

📝 Answer Key

Part A: Warm-up (Easy)

1. $9x^2 + 24x + 16$

2. $x^2 - 25$

3. $6x(2x + 3)$

4. $4a^2 - 12ab + 9b^2$

5. $x^2 + 10x + 21$

6. $(x + 4)(x - 4)$

7. $9m^2 - 4n^2$

8. $(a+b)^2 = a^2 + 2ab + b^2$; $49 = a^2 + b^2 + 24$; $a^2 + b^2 = 25$

Part B: Practice (Medium)

9. $(x + 5)^2$

10. $4x^2 + 9y^2 + 16z^2 + 12xy + 24xz + 24yz$

11. $a(x + y) + b(x + y) = (a + b)(x + y)$

12. $(100 + 3)^2 = 10000 + 600 + 9 = 10609$

13. $(3a - 4b)^2$

14. 1-b, 2-c, 3-a, 4-d

15. $(x-y)^2 = x^2 - 2xy + y^2$; $9 = x^2 + y^2 - 20$; $x^2 + y^2 = 29$

16. $x^2 + 4x + 4 - x^2 + 4x - 4 = 8x$

17. $4x^2 + 12x + 9 = (2x + 3)^2$; Side = 2x + 3 cm

18. (100-2)(100+2) = 10000 - 4 = 9996

Part C: Challenge (Hard)

19. $(x - 3)(x^2 + 3x + 9)$

20. $(a+b+c)^2 = a^2+b^2+c^2+2(ab+bc+ca)$; $144 = a^2+b^2+c^2 + 94$; $a^2+b^2+c^2 = 50$

21. $8x^3 - 27y^3 - 36x^2y + 54xy^2$

22. Recognize $(a+b)^3$ form: $(2x + 3y)^3$; Edge = 2x + 3y units

23. $(x^2)^2 - 4^2 = (x^2 - 4)(x^2 + 4) = (x-2)(x+2)(x^2 + 4)$

24. LHS = $a^2+2ab+b^2 + a^2-2ab+b^2 = 2a^2 + 2b^2 = 2(a^2+b^2)$ = RHS

📊 Scoring Guide

Total Questions: 24 | Total Marks: 24

Score Range	Performance Level	What to Do Next
20-24	⭐⭐⭐ Excellent!	Outstanding! You've mastered algebraic identities and factorization. Move on to quadratic equations and advanced polynomial division.
15-19	⭐⭐ Very Good!	Great work! Practice more on cubic identities and complex factorization problems to strengthen your skills.

10-14	⭐ Good Effort!	Keep practicing! Focus on memorizing all identities and recognizing patterns in expressions for factorization.
0-9	Keep Trying!	Review the identities section thoroughly. Practice basic expansions and simple factorizations daily before tackling word problems.

📝 Tips for Improvement:

- **Memorize all identities:** Create flashcards for each identity and practice daily
- **Recognize patterns:** Look for perfect squares, difference of squares, sum/difference of cubes
- **Verify by expansion:** Always expand your factored form to check correctness
- **Practice mental math:** Use identities to calculate squares and products quickly
- **Work systematically:** For complex expressions, try different methods (common factor, regrouping, identities)
- **Visual representation:** Draw area models for $(a+b)^2$ to understand geometrically

🎯 Common Mistakes to Avoid:

- ❌ Confusing $(a-b)^2$ with $a^2 - b^2$ (missing the 2ab term)
- ❌ Wrong signs in expansion: $(a-b)^2 = a^2 - 2ab + b^2$ (not $-2ab - b^2$)
- ❌ Not taking out common factors first before applying identities
- ❌ Incomplete factorization: $x^4 - 16 = (x^2-4)(x^2+4)$ but (x^2-4) can be factored further!
- ❌ Forgetting to verify the middle term when using perfect square identities

✨ Great Job Completing This Worksheet! ✨

Keep practicing algebraic identities and factorization!

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