Name: _____

Date: _____ Class: Algebra 1, per: _____

Chapter 9 - The Art of Factoring

Objective: I can factor out greatest common factors and factor polynomial expressions by grouping.

For Questions 1-8, factor completely and verify by distribution.

1. Factor completely: $12x^3 + 18x^2$.	**2.** Factor completely: $20a^4b^2 - 30a^3b^3 + 10a^2b$.
3. Factor completely: $-8m^5 + 12m^3 - 4m^2$. Use a negative GCF.	**4.** Factor completely: $14x^2y - 21xy^2$.
5. Factor by recognizing the common binomial: $x(x+5) + 3(x+5)$.	**6.** Factor by grouping: $x^3 + 4x^2 + 3x + 12$.
7. Factor by grouping: $2x^3 - 6x^2 + 5x - 15$.	**8.** Factor completely: $9p^2q - 15pq^2 + 6pq$.

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Objective: I can factor monic quadratic trinomials, including perfect-square cases.

For Questions 9-16, identify the integer pair by its product and sum.

9. Factor $x^2 + 7x + 12$.	**10.** Factor $x^2 - x - 20$.
11. Factor $x^2 - 11x + 24$.	**12.** Factor $x^2 + 2x - 35$.
13. Factor $y^2 - 9y + 20$.	**14.** Factor $a^2 + 13a + 40$.
15. Factor $x^2 + 5x - 24$.	**16.** Factor $x^2 - 12x + 36$.

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Objective: I can factor nonmonic quadratic trinomials by decomposition and grouping.

Show the product ac, the selected pair, and the rewritten middle term.

17. Factor $2x^2 + 7x + 3$.	**18.** Factor $3x^2 - 11x - 4$.
19. Factor $6x^2 + x - 2$.	**20.** Factor $4x^2 - 4x - 15$.
21. Factor $5y^2 + 13y + 6$.	**22.** Factor $8a^2 - 14a + 3$.
23. Factor $10m^2 + m - 3$.	**24.** Factor $12x^2 - 7x - 10$.

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Objective: I can recognize and apply differences of squares, perfect squares, and cube identities.

Name or display the identity used in each factorization.

25. Factor $x^2 - 81$.	**26.** Factor $16x^2 - 25y^2$.
27. Factor $9a^2 + 30a + 25$.	**28.** Factor $4m^2 - 20m + 25$.
29. Factor $x^3 - 27$.	**30.** Factor $8y^3 + 125$.
31. Factor $64a^3 - b^3$.	**32.** Factor $27x^3 + 8$.

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Objective: I can combine several factoring methods and factor expressions completely.

Always check for a GCF before applying another pattern.

33. Factor completely: $3x^3 - 27x$.	**34.** Factor completely: $2x^3 + 8x^2 + 8x$.
35. Factor completely over the integers: $5x^4 - 80$.	**36.** Factor completely: $6x^3 - 24x^2 + 24x$.
37. Factor completely over the real numbers: $a^4 - 16$.	**38.** Factor completely: $x^4 - 5x^2 + 4$.

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Objective: I can solve polynomial equations using complete factorization and the Zero Product Property.

Move all terms to one side, factor completely, and state every real solution.

39. Solve $x^2 + 7x + 12 = 0$.	**40.** Solve $2x^2 - 5x - 3 = 0$.
41. Solve $3x^2 = 27$.	**42.** Solve $x^3 - 4x = 0$.
43. Solve $4x^2 - 12x + 9 = 0$. Identify any repeated solution.	**44.** Solve $x^3 + 2x^2 - 9x - 18 = 0$ by grouping.

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Objective: I can apply factoring to models and analyze common reasoning errors.

Explain how each factor or correction is connected to the original expression.

45. A rectangle has area $x^2+11x+24$. Find possible positive linear expressions for its dimensions.	**46.** A rectangle has area $6x^2 - 7x - 3$ and one dimension $3x + 1$. Find the other dimension.
47. A student writes $x^2 - 5x + 6 = (x - 1)(x - 6)$. Identify the error and give the correct factorization.	**48.** A student writes $x^2 + 25 = (x - 5)(x + 5)$. Explain the error and classify $x^2 + 25$ over the real numbers.

Chapter 9 - The Art of Factoring

Objective: I can determine parameters and factor challenging expressions by creating useful identities.

Write a complete derivation and verify each result by multiplication.

49. Find k if $x^2 + kx + 20$ factors using two consecutive positive integer constants. Give the factorization.	**50.** Factor $x^4 + 4x^2 + 16$ completely over the integers by creating a difference of squares.

Other topics for review:

- Remove the greatest common factor before using another factoring method.
- Trinomial factor pairs must match both the required product and required sum.
- Difference-of-squares and cube identities have fixed sign patterns.
- The Zero Product Property applies only after one side of the equation equals zero.
- Multiply the factors to verify the original polynomial exactly.