What Is The Factored Form Of This Expression?4t2 27t + 18A. (4t 18)(t 1)B. (4t 3)(t 6)C. (2t 9)(2t 2)D.

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Introduction

Understanding how to factor quadratic expressions is a fundamental skill in algebra that helps simplify complex expressions, solve equations, and analyze mathematical relationships. When presented with an algebraic expression such as $4t^2 + 27t + 18$, students often ask, "What is the factored form of this expression?" This question leads us into exploring the process of factoring quadratic trinomials, identifying the correct factors, and understanding the significance of factored expressions in mathematics.

In this article, we will examine the quadratic expression $4t^2 + 27t + 18$ in detail. We will evaluate multiple options provided for its factored form, analyze the process of factoring, and ultimately determine which of the given options correctly represents the factored form. By the end of this guide, you'll have a comprehensive understanding of how to factor quadratic expressions and interpret their factored forms for various algebraic problems.

The Importance of Factoring in Algebra

Factoring is a key technique in algebra used to break down complex polynomials into simpler, multiplyable binomials or monomials. This process not only simplifies expressions but also plays a critical role in solving quadratic equations, graphing quadratic functions, and analyzing polynomial behavior.

Some reasons why factoring is essential include:

- Solving Quadratic Equations: Factoring transforms quadratic equations into products of binomials set equal to zero, making it easier to find roots.

- Simplifying Expressions: Factored form can simplify the process of adding, subtracting, or dividing algebraic expressions.

- Identifying Roots and Zeros: Factoring reveals the solutions or zeros of the polynomial, which are critical in many applications.

Understanding the Quadratic Expression: $4t^2 + 27t + 18$

Let's analyze the quadratic expression $4t^2 + 27t + 18$:

- Coefficients:
- Quadratic coefficient (a): 4
- Linear coefficient (b): 27
- Constant term (c): 18

- Goal: Express this quadratic in factored form, typically as a product of two binomials.

Before jumping into factoring, it’s helpful to understand some key concepts:

- The product of the binomials' leading coefficients should equal a.
- The product of the constants should equal c.
- The sum of the outer and inner products should equal the middle coefficient b.

Step-by-Step Process of Factoring Quadratic Expressions

Step 1: Multiply the quadratic coefficient and the constant term.

Calculate a × c:

- $4 \times 18 = 72$

Step 2: Find two numbers that multiply to 72 and add to 27.

Identify pairs of numbers with a product of 72:

- 1 and 72 (sum 73)
- 2 and 36 (sum 38)
- 3 and 24 (sum 27) □ candidate
- 4 and 18 (sum 22)
- 6 and 12 (sum 18)
- 8 and 9 (sum 17)

The pair 3 and 24 multiplies to 72 and adds to 27, which matches the middle coefficient.

Step 3: Rewrite the middle term using these numbers.

Express 27t as 3t + 24t:

$$
4t^2 + 3t + 24t + 18
$$

Step 4: Factor by grouping.

Group terms:

$$
(4t^2 + 3t) + (24t + 18)
$$

Factor each group:

- t from the first group: $t(4t + 3)$
- 6 from the second group: $6(4t + 3)$

Now, factor out the common binomial:

$$
(4t + 3)(t + 6)
$$

Result: The factored form of $4t^2 + 27t + 18$ is $(4t + 3)(t + 6)$.

Evaluating the Given Options

Based on the process above, let's analyze the options provided:

A. (4t + 18)(t + 1)

- Expand: $4t \times t = 4t^2$
- $4t \times 1 = 4t$
- $18 \times t = 18t$
- $18 \times 1 = 18$

Sum: $4t^2 + (4t + 18t) + 18 = 4t^2 + 22t + 18$

This does not match the original middle term (27t). So, Option A is incorrect.

B. (4t + 3)(t + 6)

- Expand: $4t \times t = 4t^2$
- $4t \times 6 = 24t$
- $3 \times t = 3t$
- $3 \times 6 = 18$

Sum: $4t^2 + 24t + 3t + 18 = 4t^2 + 27t + 18$

This matches the original expression exactly, so Option B is correct.

C. (2t + 9)(2t + 2)

- Expand: $2t \times 2t = 4t^2$
- $2t \times 2 = 4t$
- $9 \times 2t = 18t$

- $9 \times 2 = 18$

Sum: $4t^2 + 4t + 18t + 18 = 4t^2 + 22t + 18$

Again, middle term is 22t, not 27t, so Option C is incorrect.

D. (2t + 9)(2t + 2)

Same as Option C; same expansion, so incorrect.

Conclusion: The Correct Factored Form

From the detailed analysis, the only option that correctly factors $4t^2 + 27t + 18$ is:

Option B: (4t + 3)(t + 6)

This factorization is verified by expansion and aligns perfectly with the original quadratic expression.

Significance of Correct Factoring

Knowing the correct factored form is crucial in many algebraic applications:

- Solving Equations: Setting each factor to zero to find roots:
- $4t + 3 = 0 \Rightarrow t = -\frac{3}{4}$
- $t + 6 = 0 \Rightarrow t = -6$

- Graphing Quadratic Functions: The roots determine where the parabola intersects the x-axis.

- Simplifying Expressions: Factoring simplifies further algebraic manipulation.

Additional Tips for Factoring Quadratic Expressions

- Always check the greatest common factor (GCF) first.
- Use the AC method (also known as factoring by grouping) when the quadratic is not easily factorable.
- Confirm your factors by expanding and comparing with the original expression.
- Practice with different quadratic forms to become proficient.

Final Thoughts

Factoring quadratic expressions is a fundamental skill that unlocks a deeper understanding of algebraic concepts. The expression $4t^2 + 27t + 18$ factors neatly into $(4t + 3)(t + 6)$, as demonstrated through the process of multiplication, identifying factors, and expansion verification.

By mastering these steps and understanding how to evaluate multiple options, students can develop confidence in solving more complex algebraic problems and applying their knowledge in various mathematical contexts.

Keywords for SEO Optimization

- Factoring quadratic expressions

- How to factor quadratics
- Quadratic trinomial factoring
- Algebraic expression factorization
- Solving quadratic equations by factoring
- Best method to factor quadratic
- Factored form of $4t^2 + 27t + 18$
- Algebra tips for students
- Polynomial factoring techniques
- Understanding quadratic roots and factors

Remember: Practice makes perfect when it comes to algebra. Work through different quadratic expressions regularly to strengthen your factoring skills and build mathematical confidence!

Frequently Asked Questions

What is the factored form of the quadratic expression 4t^2 + 27t + 18?

The factored form is (4t + 3)(t + 6), which matches option B: (4t 3)(t 6).

How do I factor the quadratic expression 4t^2 + 27t + 18?

First, find two numbers that multiply to 4 18 = 72 and add to 27. These are 9 and 8, but since 4t^2 is involved, the correct factorization is (4t + 3)(t + 6).

Which of the given options correctly represents the factored form of

$4t^2 + 27t + 18$?

Option B: (4t + 3)(t + 6) is correct because it expands to $4t^2$ + 24t + 3t + 18, simplifying to the original expression.

Is the factorization (4t 18)(t 1) correct for $4t^2 + 27t + 18$?

No, because expanding (4t + 18)(t + 1) gives $4t^2$ + 4t + 18t + 18, which simplifies to $4t^2$ + 22t + 18, not 27t.

Why is option C, (2t 9)(2t 2), not the correct factorization?

Because expanding (2t + 9)(2t + 2) results in $4t^2$ + 4t + 18t + 18, or $4t^2$ + 22t + 18, which does not match the original expression's middle term of 27t.

Additional Resources

Understanding the Factored Form of the Expression $4t^2 + 27t + 18A$

In algebra, rewriting quadratic expressions in their factored form is a fundamental skill that simplifies solving equations, analyzing graphs, and understanding the properties of quadratic functions. The expression $4t^2 + 27t + 18A$ presents an intriguing case for factorization, prompting students and educators alike to analyze its structure, coefficients, and potential factors. Determining the factored form involves understanding the underlying principles of factoring quadratic trinomials, examining the coefficients, and applying various algebraic techniques. In this article, we dissect this expression comprehensively, explore the options provided, and elucidate the process of arriving at the correct factored form.

Understanding Quadratic Expressions and Factoring

The Nature of Quadratic Expressions

A quadratic expression generally takes the form $ax^2 + bx + c$, where:

- a is the coefficient of the quadratic term (t^2)
- b is the coefficient of the linear term (t)
- c is the constant term

In the given expression, $4t^2 + 27t + 18A$, the quadratic coefficient is 4, the linear coefficient is 27, and the constant term involves 18A. The presence of the variable A in the constant term suggests that the expression may be part of a broader algebraic context, such as an expression involving a parameter or a variable representing a constant.

Factoring quadratic expressions aims to rewrite them as a product of two binomials, which simplifies solving for t or analyzing the graph of the quadratic function.

Methods of Factoring Quadratic Expressions

Several techniques are commonly used for factoring quadratics:

- Factor by inspection (trial and error): Suitable for simple coefficients.
- Factoring by grouping: Useful when the quadratic can be split into groups with common factors.
- Using the quadratic formula: When factoring is difficult, the roots obtained from the quadratic formula can help express the quadratic as a product of binomials.
- Completing the square: A method to rewrite the quadratic in vertex form, which can then be factored.

In this scenario, the most straightforward approach is to examine the quadratic's coefficients and see if the expression can be factored directly into binomials, especially considering the options provided.

Analyzing the Given Expression: $4t^2 + 27t + 18A$

Coefficients and Constant Term

Let's analyze the structure:

- Quadratic coefficient (a): 4
- Linear coefficient (b): 27
- Constant term (c): 18A

Since A is a variable, the factorization may involve A, or the options may specify particular factorizations involving constants.

The key is to determine whether the expression can be factored into binomials of the form (m t + n)(p t + q), where m, p, n, and q are constants, possibly involving A.

Examining the Multiple Choice Options

The question provides four options:

A. $(4t + 18)(t + 1)$

B. $(4t + 3)(t + 6)$

C. $(2t + 9)(2t + 2)$

D. [The option appears incomplete, but based on context, likely similar to the above]

Let's analyze options A, B, and C to determine which correctly factors the original expression.

Option A: $(4t + 18)(t + 1)$

- Expand:

$(4t + 18)(t + 1) = 4t\ t + 4t\ 1 + 18\ t + 18\ 1$

$= 4t^2 + 4t + 18t + 18$

$= 4t^2 + (4t + 18t) + 18$

$= 4t^2 + 22t + 18$

- Compare with original: $4t^2 + 27t + 18A$

- Result: The expanded form of option A is $4t^2 + 22t + 18$, which does not match the original expression, especially since the linear coefficient (22 vs. 27) and the constant term (18 vs. 18A) differ.

- Conclusion: Option A does not match the original expression unless A is related to a constant to make the constant term match, but given the form, it's unlikely.

Option B: $(4t + 3)(t + 6)$

- Expand:

$(4t + 3)(t + 6) = 4t\ t + 4t\ 6 + 3\ t + 3\ 6$

$= 4t^2 + 24t + 3t + 18$

$= 4t^2 + (24t + 3t) + 18$

$= 4t^2 + 27t + 18$

- Comparison:

- Quadratic term: $4t^2$ matches
- Linear term: $27t$ matches
- Constant term: 18 matches

- Observation: The factored form matches exactly with the quadratic part of the original expression, except for the A in the constant term.

- Implication: If the original expression's constant term is 18A, then for the factorization to be exact, A must be 1.

- Conclusion: When A = 1, the expression $4t^2 + 27t + 18$ factors as $(4t + 3)(t + 6)$. Given this, option B perfectly matches the quadratic part.

Option C: (2t + 9)(2t + 2)

- Expand:

(2t + 9)(2t + 2) = 2t 2t + 2t 2 + 9 2t + 9 2

= $4t^2$ + 4t + 18t + 18

= $4t^2$ + (4t + 18t) + 18

= $4t^2$ + 22t + 18

- Comparison: The expanded form is $4t^2$ + 22t + 18, which does not match the original quadratic coefficients.

- Implication: This factorization corresponds to a quadratic with a linear coefficient of 22, not 27, and a constant 18, which does not match the original unless A adjusts accordingly.

Determining the Correct Factored Form

Based on the detailed expansion and comparison, the key factors are:

1. The quadratic portion $4t^2$ + 27t matches only with options B and C, but their expansions differ in the linear coefficient.

2. Option B, when expanded, yields $4t^2 + 27t + 18$, which perfectly matches the quadratic part of the expression $4t^2 + 27t + 18A$, provided $A = 1$.

3. The constant term in the original expression involves $18A$, indicating that A is a variable or parameter that influences the constant term.

4. If A is a parameter that can vary, then the factorization $(4t + 3)(t + 6)$ is valid only when $A = 1$. Otherwise, the general factored form would include A explicitly.

Conclusion and Final Analysis

The analysis indicates that among the options provided, Option B: $(4t + 3)(t + 6)$ is the correct factorization of the quadratic component $4t^2 + 27t + 18$ when $A = 1$. This is supported by direct expansion and comparison.

However, the original expression $4t^2 + 27t + 18A$ introduces the parameter A, which suggests that the factored form may vary depending on the value of A. If A is a constant equal to 1, then the factored form aligns perfectly with option B.

In a broader algebraic context, when factoring expressions involving parameters like A, it's essential to consider whether A is a variable or a constant. If A is an unknown parameter, the factored form must explicitly include A or be expressed with variables that account for its influence.

Given the options and the expansion results, the most appropriate answer is:

Option B: $(4t + 3)(t + 6)$

This factorization succinctly captures the quadratic portion of the expression and matches the structure when A = 1.

Implications in Algebra Education and Practice

Understanding the process of factoring quadratic expressions is essential for students and practitioners of algebra. Recognizing which factorization matches a given quadratic involves:

- Expanding potential binomials
- Comparing coefficients
- Understanding the role of parameters like A

This exercise exemplifies the importance of both algebraic manipulation and critical analysis in solving problems involving quadratic expressions.

Furthermore, it underscores the significance of context — whether

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