What Is The Product Of (2p + 7)(3p2 + 4p 3)?

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Understanding how to multiply algebraic expressions like (2p + 7)(3p2 + 4p 3) is fundamental in algebra. This process involves applying the distributive property, often called the FOIL method for binomials, to simplify expressions into a single polynomial. Whether you're a student brushing up on algebra skills or someone seeking to deepen your understanding of polynomial multiplication, this article provides a comprehensive guide to calculating the product of these two binomials, along with explanations, tips, and detailed steps.

Breaking Down the Expression: (2p + 7)(3p2 + 4p 3)

Before diving into the multiplication process, it’s essential to analyze the components:

- The first binomial is (2p + 7).
- The second binomial is (3p2 + 4p 3).

Note: The notation 3p2 typically indicates 3p^2 (3 times p squared), and 4p 3 likely means 4p + 3 (4 times p plus 3). Clarifying this is crucial because the interpretation affects the multiplication process.

Assumption:
- 3p2 = $3p^2$
- 4p 3 = 4p + 3

This interpretation aligns with standard algebraic notation, where:

- Exponent notation is used with a caret or superscript (e.g., p^2).
- When written without an exponent symbol, "p2" is often read as p squared.

Rewritten Expression for Clarity:
$(2p + 7)(3p^2 + 4p + 3)$

Understanding Polynomial Multiplication

Multiplying two binomials or polynomials involves applying the distributive property systematically. The key steps include:

1. Distribute each term in the first binomial over each term in the second.
2. Multiply coefficients and variables separately.
3. Combine like terms to simplify the expression.

Why is this important?
Mastering these steps ensures accuracy in solving algebraic expressions, which is vital for higher-level math topics like quadratic equations, calculus, and beyond.

Step-by-Step Guide to Multiply $(2p + 7)(3p^2 + 4p + 3)$

Step 1: Distribute 2p over the second polynomial

Multiply 2p by each term in $(3p^2 + 4p + 3)$:

- $2p\ 3p^2 = 2\ 3\ p\ p^2 = 6p^3$
- $2p\ 4p = 2\ 4\ p\ p = 8p^2$
- $2p\ 3 = 2\ 3\ p = 6p$

Step 2: Distribute 7 over the second polynomial

Multiply 7 by each term in $(3p^2 + 4p + 3)$:

- $7\ 3p^2 = 21p^2$
- $7\ 4p = 28p$
- $7\ 3 = 21$

Step 3: Write the expanded terms

Combine all results:

- $6p^3$
- $8p^2$
- $6p$
- $21p^2$
- $28p$
- 21

Combining Like Terms

Now, group similar terms to simplify the expression:

- p^3 term: $6p^3$ (only one)
- p^2 terms: $8p^2 + 21p^2 = (8 + 21)\ p^2 = 29p^2$
- p terms: $6p + 28p = (6 + 28)\ p = 34p$
- Constant term: 21

Final simplified expression:

$6p^3 + 29p^2 + 34p + 21$

Complete Polynomial Product

Answer:
The product of $(2p + 7)$ and $(3p^2 + 4p + 3)$ is:

$6p^3 + 29p^2 + 34p + 21$

This cubic polynomial represents the expanded form of the multiplication.

Additional Tips for Polynomial Multiplication

Use of Distributive Property

- Always distribute each term in the first binomial across all terms in the second.
- Keep track of signs (+ or -) to avoid errors.

Combining Like Terms

- Group similar powers of p to simplify your expression.
- Double-check coefficients for accuracy.

Organizing Your Work

- Write each step clearly.
- Use a table or grid if needed to keep track of multiplications.

Practice Problems for Mastery

1. Multiply $(p + 4)(2p^2 + p + 5)$
2. Find the product of $(3p - 2)(p^2 + 4p + 1)$
3. Expand $(5p + 3)(p^2 - 2p + 7)$

Tip: Always follow the same step-by-step method: distribute each term, multiply coefficients and variables, then combine like terms.

Common Mistakes to Avoid

- Misinterpreting the notation: Confirm whether variables are squared or multiplied.
- Forgetting to distribute all terms: Ensure every term in the first binomial multiplies every term in the second.
- Incorrectly combining like terms: Only combine terms with the same variable and exponent.
- Sign errors: Pay attention to positive and negative signs during distribution.

Real-World Applications of Polynomial Multiplication

Polynomial multiplication is crucial in various fields:

- Engineering: Calculating areas, volumes, and stress analysis.
- Physics: Expressing equations of motion or wave functions.
- Computer Science: Algorithms involving polynomial operations.
- Economics: Modeling cost and revenue functions.

Understanding how to multiply polynomials efficiently allows professionals and students to model and solve complex real-world problems accurately.

Summary

In conclusion, multiplying $(2p + 7)(3p^2 + 4p + 3)$ involves applying the distributive property to each term, multiplying coefficients and variables carefully, and then combining like terms to arrive at the simplified polynomial expression. The final result is $6p^3 + 29p^2 + 34p + 21$. Mastery of this process is essential in algebra and forms the foundation for more advanced mathematical concepts.

By practicing with similar problems and following systematic steps, you'll become proficient in polynomial multiplication, enabling you to tackle a wide range of algebraic challenges with confidence.

Remember: Always analyze the expression carefully, interpret notation properly, and work systematically to ensure accuracy in your algebraic calculations.

Frequently Asked Questions

What is the product of (2p + 7) and (3p^2 + 4p^3)?

The product is obtained by distributing each term: (2p)(3p^2 + 4p^3) + 7(3p^2 + 4p^3), which simplifies to 6p^3 + 8p^4 + 21p^2 + 28p^3.

How do you expand the expression (2p + 7)(3p^2 + 4p^3)?

Expand by distributing each term: multiply 2p by each term in the second polynomial and then 7 by each term, then combine like terms.

What is the simplified form of (2p + 7)(3p^2 + 4p^3)?

The simplified form is 8p^4 + 28p^3 + 21p^2.

Can you factor the expression (2p + 7)(3p^2 + 4p^3)?

Yes, factoring is not necessary here since it's a product of two polynomials, but after expansion, the polynomial can sometimes be factored further depending on context.

What degree polynomial is obtained after multiplying (2p + 7) and (3p^2 + 4p^3)?

The resulting polynomial is of degree 4, with the highest power term being 8p^4.

What are the coefficients in the expanded form of (2p + 7)(3p^2 + 4p^3)?

The coefficients are 8 for p^4, 28 for p^3, and 21 for p^2.

Is the multiplication of (2p + 7)(3p^2 + 4p^3) commutative?

No, the multiplication of polynomials is not commutative in the sense of changing the order of factors, but the product is the same regardless of the order of multiplication.

What is the importance of understanding polynomial multiplication like (2p + 7)(3p^2 + 4p^3)?

Understanding polynomial multiplication is fundamental in algebra, allowing for the expansion, simplification, and factoring of complex expressions, which are essential skills in higher mathematics and problem-solving.

Additional Resources

What Is The Product Of (2p + 7)(3p^2 + 4p + 3)?

Understanding the product of algebraic expressions is fundamental in algebra, and the expression (2p + 7)(3p^2 + 4p + 3) is a classic example that exemplifies the application of distributive properties, particularly the FOIL method for binomials and the distributive property for polynomials. Calculating this product not only reinforces understanding of algebraic multiplication but also demonstrates how to simplify expressions by combining like terms. This article aims to explore this expression thoroughly, breaking down each step involved, analyzing the properties, and discussing its significance in algebra.

Breaking Down the Expression

Before delving into the actual multiplication, it’s important to understand the components:

- The first binomial: (2p + 7)
- The second polynomial: (3p^2 + 4p + 3)

The goal is to multiply these two expressions to obtain a simplified polynomial. This process involves distributing each term in the binomial across all terms in the second polynomial and then combining like terms.

Step-by-Step Multiplication Process

Distributive Property and FOIL Method

The distributive property states:

$$ (a + b)(c + d) = ac + ad + bc + bd $$

While this is straightforward for binomials, the process extends to multiplying a binomial by a trinomial by distributing each term appropriately.

In our case:

$$
(2p + 7)(3p^2 + 4p + 3)
$$

We can think of this as:

$$
2p \times (3p^2 + 4p + 3) + 7 \times (3p^2 + 4p + 3)
$$

This approach simplifies the process, making it manageable.

Multiplying Each Term

Let's perform each multiplication:

1. Multiply 2p by each term in the second polynomial:

- $2p \times 3p^2 = 2 \times 3 \times p \times p^2 = 6p^{3}$
- $2p \times 4p = 2 \times 4 \times p \times p = 8p^{2}$
- $2p \times 3 = 2 \times 3 \times p = 6p$

2. Multiply 7 by each term in the second polynomial:

- $7 \times 3p^2 = 7 \times 3 \times p^2 = 21p^{2}$
- $7 \times 4p = 7 \times 4 \times p = 28p$
- $7 \times 3 = 21$

Combine Like Terms

Now, gather all the terms:

$$
6p^{3} + 8p^{2} + 6p + 21p^{2} + 28p + 21
$$

Group similar powers:

- Cubic term: $6p^{3}$
- Quadratic terms: $8p^{2} + 21p^{2} = 29p^{2}$
- Linear terms: $6p + 28p = 34p$
- Constant term: 21

The simplified polynomial expression is:

$$
\boxed{6p^{3} + 29p^{2} + 34p + 21}
$$

This is the product of the original binomial and trinomial.

Understanding the Result

The process highlights several key algebraic principles:

- Distribution of each term in the binomial across all terms in the polynomial.
- Combining like terms to simplify the expression.
- The importance of careful calculation to avoid errors, especially with signs and coefficients.

This expanded form is useful for further algebraic operations, such as factoring or solving equations involving the expression.

Features and Significance of the Product

Features:

- Degree of the polynomial: The degree is 3, indicating a cubic polynomial resulting from multiplying a linear binomial with a quadratic polynomial.
- Coefficients: The coefficients (6, 29, 34, 21) result from the combination of the original coefficients during distribution.
- Terms: The polynomial has four terms, typical for a cubic expression resulting from such a multiplication.

Significance:

- Demonstrates the application of distributive properties in polynomial multiplication.
- Serves as a foundation for understanding polynomial multiplication in higher algebra.
- Provides a basis for factoring techniques since knowing the expanded form aids in reverse operations.
- Useful in real-world contexts, such as calculating areas (product of polynomials as area functions), physics (product of linear and quadratic relationships), and more.

Pros and Cons of Polynomial Multiplication Approach

Pros:

- Systematic process: The distributive method is straightforward and universally applicable.

- Clarity: Step-by-step multiplication reduces errors and enhances understanding.
- Foundation for advanced algebra: Essential for grasping more complex polynomial operations.

Cons:

- Can be tedious: As polynomials grow larger, the number of terms increases exponentially.
- Potential for mistakes: Errors in signs or coefficients can occur without careful calculation.
- Requires memorization: Knowing multiplication rules and combining like terms is essential.

Alternative Techniques and Tips

While the distributive method is the primary approach, alternative methods include:

- Vertical multiplication (similar to long multiplication): Writing the expressions in columns and multiplying systematically.
- Using algebraic identities: Recognizing patterns such as difference of squares, sum of cubes, etc., when applicable.
- Graphical interpretation: Visualizing the multiplication as area models, especially helpful in understanding the geometric significance.

Tips for effective polynomial multiplication:

- Write each term clearly.
- Line up like terms to facilitate easy combination.
- Double-check coefficients and signs.
- Practice with smaller polynomials before tackling complex expressions.

Applications and Real-World Relevance

Polynomial multiplication is fundamental in various fields:

- Engineering: Calculating areas and volumes, modeling physical phenomena.
- Computer Science: Algorithms involving polynomial operations, coding theory.
- Economics: Modeling relationships with polynomial functions.
- Physics: Describing motion, force, and energy relationships.

Understanding the product of such expressions enables professionals and students to model, analyze, and interpret complex systems accurately.

Conclusion

The product of $(2p + 7)(3p^2 + 4p + 3)$ exemplifies the core principles of algebraic multiplication, illustrating how distribution and combination of like terms lead to a simplified polynomial. The detailed process reveals the importance of systematic calculation and the significance of understanding polynomial structures. Mastering such operations is crucial for progressing in algebra and related STEM fields. Whether used for solving equations, graphing functions, or modeling real-world systems, the ability to multiply polynomials confidently forms a cornerstone of mathematical literacy.

Through practice and application, students can develop a deeper understanding of polynomial behavior, paving the way for more advanced topics such as factoring, polynomial division, and algebraic functions. The key takeaway is that algebraic multiplication, while sometimes complex, follows logical rules that, once mastered, unlock a wide array of mathematical and real-world problem-solving capabilities.

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