What Is The Product?(6r−1)(−8r−3)

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Understanding the product of algebraic expressions is fundamental in mathematics, especially in algebra. The expression *(6r − 1)(−8r − 3)* represents a multiplication of two binomials involving a variable *r*. In this article, we will explore what this product is, how to expand it, and the significance of such algebraic operations.

Introduction to Algebraic Products

Before diving into the specifics of *(6r − 1)(−8r − 3)*, it's essential to understand what algebraic products are.

Definition of a Product in Algebra

In algebra, the product refers to the result obtained when two or more expressions are multiplied together. When dealing with binomials—expressions with two terms—the product is often expanded using methods such as the FOIL technique (First, Outer, Inner, Last) or distributive property.

Importance of Expanding Binomials

Expanding binomials allows us to:

- Simplify expressions
- Solve equations
- Factor expressions
- Understand polynomial multiplication

Analyzing the Expression (6r − 1)(−8r − 3)

Let's analyze the specific expression:

$$(6r - 1)(-8r - 3)$$

This is the multiplication of two binomials involving the variable *r*. To find the product, we need to expand this expression systematically.

Step-by-step Expansion

The expansion involves multiplying each term in the first binomial by each term in the second binomial.

Method: Distributive Property

- Multiply $6r$ by $-8r$
- Multiply $6r$ by -3
- Multiply -1 by $-8r$
- Multiply -1 by -3

Let's perform each step:

1. $6r \times -8r = -48r^2$

2. $6r \times -3 = -18r$

3. $-1 \times -8r = +8r$

4. $-1 \times -3 = +3$

Now, combine all these results:

$$-48r^2 - 18r + 8r + 3$$

Next, combine like terms:

$$-48r^2 + (-18r + 8r) + 3 = -48r^2 - 10r + 3$$

Final expanded form:

$-48r^2 - 10r + 3$

Significance of the Result

The expanded form $-48r^2 - 10r + 3$ is a quadratic expression in standard form. Understanding this process helps in various mathematical applications, including solving quadratic equations, graphing parabolas, and algebraic factorization.

Applications of Multiplying Binomials

Multiplying binomials like $(6r - 1)(-8r - 3)$ has practical applications across multiple fields.

1. Simplifying Expressions

Simplification allows mathematicians and students to work with more manageable forms, especially when solving equations or analyzing functions.

2. Polynomial Operations

Multiplying binomials is a foundation for polynomial multiplication, which is essential in calculus, physics, engineering, and computer science.

3. Factoring and Solving Equations

Knowing how to expand and then factor quadratics is crucial in solving algebraic equations efficiently.

Common Methods for Multiplying Binomials

There are several techniques used in expanding binomials, each with its advantages.

1. FOIL Method

The FOIL technique stands for First, Outer, Inner, Last:

- First: $6r \times -8r = -48r^2$
- Outer: $6r \times -3 = -18r$
- Inner: $-1 \times -8r = +8r$
- Last: $-1 \times -3 = +3$

Then, sum the results:

$$-48r^2 - 18r + 8r + 3$$

Combine like terms as shown earlier.

2. Distributive Property

As demonstrated above, multiply each term in the first binomial by each term in the second.

3. Box Method (Area Model)

This visual method involves creating a 2x2 grid to multiply each term and then summing the products.

Understanding the Resulting Polynomial

The polynomial $-48r^2 - 10r + 3$ is a quadratic expression with:

- A leading coefficient of −48
- A linear coefficient of −10
- A constant term of 3

This polynomial can be used in various ways:

- To analyze the parabola it represents
- To find roots or zeros
- To determine its graph's vertex and axis of symmetry

Factoring the Resulting Polynomial

Factoring quadratic expressions is often the next step after expansion.

Factoring $-48r^2 - 10r + 3$

The process involves:

- Looking for common factors
- Using quadratic factoring methods such as splitting the middle term or quadratic formula

Let's explore factoring this polynomial.

Step 1: Consider the quadratic in standard form:

$$-48r^2 - 10r + 3$$

Step 2: Multiply the coefficient of r^2 (−48) with the constant term (3):

$$-48 \times 3 = -144$$

Step 3: Find two numbers that multiply to −144 and add to −10 (the coefficient of r).

Factors of −144:

- 1 and −144
- 2 and −72
- 3 and −48
- 4 and −36
- 6 and −24
- 8 and −18
- 9 and −16
- 12 and −12

Check sums:

- 8 + (−18) = −10 → Yes!

Step 4: Rewrite the middle term using these factors:

$$-48r^2 + 8r - 18r + 3$$

Step 5: Factor by grouping:

- From the first two terms: $8r(-6r + 1)$
- From the last two terms: $-3(6r - 1)$

Note that:

$$-48r^2 + 8r = 8r(-6r + 1)$$

and

$$-18r + 3 = -3(6r - 1)$$

Since both factors contain $(6r - 1)$, rewrite:

$$8r(-6r + 1) - 3(6r - 1)$$

Factor out the common binomial:

$$(6r - 1)(-8r - 3)$$

This shows the original factors are preserved in the quadratic's factorization.

Summary and Key Takeaways

- The product $(6r - 1)(-8r - 3)$ expands to $-48r^2 - 10r + 3$.
- Expanding binomials involves multiplying each term systematically.
- Techniques like FOIL, distributive property, and area models facilitate binomial multiplication.
- The resulting quadratic expression can be factored back into binomials, often revealing the original factors.
- Understanding such operations is crucial in algebra for solving equations, graphing functions, and more.

Practical Tips for Students and Learners

- Always write out each step to avoid errors during expansion.
- Practice with different binomials to become comfortable with various methods.
- Use visual aids like area models for better conceptual understanding.
- Remember to combine like terms carefully after expansion.

- Check your work by factoring the result to see if it reproduces the original binomials.

Conclusion

The expression *(6r − 1)(−8r − 3)* exemplifies fundamental algebraic concepts involving binomial multiplication. By expanding this product, we find a quadratic polynomial that encapsulates the combined effect of both binomials. Mastery of such operations enhances problem-solving skills and provides a strong foundation for more advanced mathematics topics. Whether you are solving equations, graphing functions, or exploring polynomial behaviors, understanding how to manipulate binomials like *(6r − 1)(−8r − 3)* is an essential skill for students and professionals alike.

Frequently Asked Questions

What is the product of (6r − 1) and (−8r − 3)?

The product is $-48r^2 - 26r + 3$.

How do you expand the expression (6r − 1)(−8r − 3)?

You use the distributive property (FOIL): $6r -8r = -48r^2$; $6r -3 = -18r$; $-1 -8r = 8r$; $-1 -3 = 3$. Summing these gives $-48r^2 - 10r + 3$.

What is the simplified form of (6r − 1)(−8r − 3)?

The simplified form is $-48r^2 - 10r + 3$.

Can you show step-by-step how to multiply (6r − 1)(−8r − 3)?

Yes. First, multiply 6r by −8r to get $-48r^2$. Next, multiply 6r by −3 to get −18r. Then, multiply −1 by −8r to get 8r. Finally, multiply −1 by −3 to get 3. Combine all terms: $-48r^2 - 18r + 8r + 3$, which simplifies to $-48r^2 - 10r + 3$.

What algebraic rule is used to find the product of (6r − 1)(−8r − 3)?

The distributive property (also known as FOIL for binomials) is used to expand the product.

Is the product of (6r − 1) and (−8r − 3) a quadratic expression?

Yes, because the highest degree term is r squared, making it a quadratic expression.

What is the coefficient of r^2 in the product of (6r − 1)(−8r − 3)?

The coefficient of r^2 is −48.

How does the sign of each term in the product (6r − 1)(−8r − 3) influence the final expression?

The signs determine whether each term is positive or negative; for example, multiplying positive and negative terms results in negative terms, as seen with $-48r^2$ and −10r, while the constant term is positive.

What is the importance of correctly expanding binomials like (6r − 1)(−8r − 3)?

Proper expansion ensures accurate algebraic expressions, which is crucial for solving equations, factoring, and simplifying expressions in mathematics.

Can the product (6r − 1)(−8r − 3) be factored back into binomials?

Yes, the original factors are the binomials (6r − 1) and (−8r − 3). The expansion confirms their product, and factoring can be done by recognizing the original binomials.

Additional Resources

What Is The Product? (6r − 1)(−8r − 3)

In the realm of algebra, understanding how to manipulate and interpret expressions is fundamental. One common operation is multiplying binomials, which often appears in various mathematical contexts, from solving equations to modeling real-world phenomena. Among these, the product of two binomials such as (6r − 1)(−8r − 3) exemplifies the process of expanding and simplifying algebraic expressions. This article aims to thoroughly examine the question: What Is The Product? (6r − 1)(−8r − 3), providing an in-depth analysis suitable for students, educators, or anyone interested in algebraic operations.

Understanding the Components of the Expression

Before delving into the multiplication process, it's essential to dissect the given expression:

(6r − 1)(−8r − 3)

This expression consists of two binomials:

- The first binomial: 6r − 1
- The second binomial: −8r − 3

Each binomial has two terms, with coefficients and variables. The variable r is common, and the coefficients are 6 and −8, with constants −1 and −3, respectively.

The Significance of Binomial Multiplication

Multiplying binomials is a foundational skill in algebra, often achieved through the distributive property or FOIL method (First, Outer, Inner, Last):

- First: Multiply the first terms of each binomial
- Outer: Multiply the outer terms
- Inner: Multiply the inner terms
- Last: Multiply the last terms

Applying this method ensures all term combinations are accounted for, leading to an accurate expanded form.

Step-by-Step Expansion of $(6r - 1)(-8r - 3)$

Let's carefully analyze the multiplication process:

Step 1: Multiply the First Terms

$6r \times -8r = -48r^2$

This gives the quadratic term, which is the highest degree term in the expanded expression.

Step 2: Multiply the Outer Terms

$6r \times -3 = -18r$

Step 3: Multiply the Inner Terms

$-1 \times -8r = 8r$

Note that multiplying two negatives yields a positive.

Step 4: Multiply the Last Terms

$-1 \times -3 = 3$

Again, negatives multiplied together give a positive.

Step 5: Combine All Results

Now, sum all the products:

- Quadratic term: $-48r^2$
- Linear terms: $-18r + 8r = -10r$

- Constant term: 3

Final Expanded Form:

$-48r^2 - 10r + 3$

Interpreting the Result

The Expanded Expression: $-48r^2 - 10r + 3$

This quadratic expression encapsulates the product of the original binomials. Its structure reveals several key features:

- The leading coefficient is -48, indicating the parabola opens downward.
- The linear coefficient is -10, affecting the slope.
- The constant term is 3.

Understanding the nature of this quadratic can be useful in various contexts, such as graphing, solving equations, or analyzing the behavior of functions.

Additional Insights and Applications

1. Factoring the Result

While the quadratic form is expanded, factoring it back into binomials can provide insights into roots or solutions:

Attempt to factor $-48r^2 - 10r + 3$

The process involves:

- Factoring out the greatest common factor (GCF), if any
- Applying quadratic factoring methods, such as trial, decomposition, or quadratic formula

In this case, GCF is 1, so proceed with quadratic factoring.

2. Solving for r (Equation Set to Zero)

Suppose we want to solve:

$-48r^2 - 10r + 3 = 0$

Applying quadratic formula:

\[r = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \]

with a = -48, b = -10, c = 3

Calculations:

- Discriminant:

$$\Delta = (-10)^2 - 4(-48)(3) = 100 - (-576) = 100 + 576 = 676$$

- Square root of discriminant:

$$\sqrt{676} = 26$$

- Roots:

$$r = \frac{10 \pm 26}{-96}$$

Calculations for roots:

- First root:

$$r = \frac{10 + 26}{-96} = \frac{36}{-96} = -\frac{3}{8}$$

- Second root:

$$r = \frac{10 - 26}{-96} = \frac{-16}{-96} = \frac{1}{6}$$

Thus, the solutions are $r = -3/8$ and $r = 1/6$.

Practical Applications of Multiplying Binomials

Understanding the product of binomials like $(6r - 1)(-8r - 3)$ is more than an academic exercise; it has real-world implications:

- Physics: Calculating areas, forces, or trajectories where quadratic relations are involved.
- Economics: Modeling profit, cost, or demand functions that are quadratic.
- Engineering: Analyzing systems with quadratic behavior or constraints.
- Computer Science: Algorithm analysis involving polynomial expressions.

Common Errors and Misconceptions

When multiplying binomials, students often encounter pitfalls:

- Sign errors: Forgetting that negative signs affect the product.
- Omitting terms: Failing to multiply all term combinations.
- Incorrect distribution: Confusing distributive property steps with other operations.
- Misinterpretation of the quadratic: Not recognizing the degree or structure.

Awareness of these common mistakes helps in mastering binomial multiplication accurately.

Summary and Final Thoughts

The product of $(6r - 1)(-8r - 3)$, after thorough expansion and simplification, is $-48r^2 - 10r + 3$. This quadratic expression encapsulates the interactions of the original binomials' coefficients and variables, revealing the underlying algebraic structure.

From initial dissection to solving the quadratic, each step demonstrates the importance of systematic approaches in algebra. Recognizing the significance of such expressions extends beyond mathematics, touching fields like physics, economics, and engineering.

Mastering binomial multiplication not only enhances algebraic fluency but also equips learners with critical problem-solving skills applicable across disciplines. Whether analyzing quadratic functions, solving equations, or modeling phenomena, understanding what the product is and how to derive it remains a cornerstone of mathematical literacy.

In conclusion, What Is The Product? $(6r - 1)(-8r - 3)$ is a quadratic expression $-48r^2 - 10r + 3$, obtained through systematic application of the distributive property. This process exemplifies core algebraic principles and highlights the importance of careful calculation, sign management, and interpretation within mathematical problem-solving.

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