Simplify: (-4ab^2)(-3b^2c) (5a)

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When tackling algebraic expressions like *(-4ab^2)(-3b^2c) (5a)*, the goal is to simplify the expression by combining like terms, applying the properties of multiplication, and managing coefficients and variables effectively. Simplification makes complex expressions more manageable and easier to evaluate or substitute values into. In this comprehensive guide, we will explore step-by-step how to simplify this expression, covering essential algebraic principles, detailed procedures, and tips to ensure clarity and precision.

Understanding the Components of the Expression

Before diving into the simplification process, it is crucial to understand the individual parts of the expression:

Expression: **(-4ab^2)(-3b^2c) (5a)**

This expression consists of:

- Coefficients: Numbers multiplying variables, such as -4, -3, and 5.
- Variables: Letters representing unknown quantities, such as a, b, and c.
- Exponents: Indicate repeated multiplication of the same variable, such as b^2.

Let's break down the expression into manageable parts:

- First part: *-4ab^2*
- Second part: *-3b^2c*
- Third part: *5a*

Our goal: to multiply all these parts together and simplify the resulting expression.

Step-by-Step Process for Simplification

The best way to simplify complex algebraic expressions is to follow a systematic approach:

Step 1: Rewrite the Expression Clearly

Express the entire multiplication explicitly:

```
(-4ab^2) × (-3b^2c) × (5a)
```

Step 2: Multiply the Coefficients

Identify and multiply the numerical coefficients:

- Coefficient from first term: -4
- Coefficient from second term: -3
- Coefficient from third term: 5

Calculating the product of coefficients:

1. Multiply -4 and -3:
    - $-4 \times -3 = 12$ (since a negative times a negative is positive)
2. Now multiply the result by 5:
    - $12 \times 5 = 60$

Result: The combined coefficient is 60.

Step 3: Multiply the Variables

Next, focus on the variables, applying the properties of exponents:

- Variables involved: a, b, c
- Expressed in each term:

- First term: a^1, b^2
- Second term: b^2, c^1
- Third term: a^1

Combine like variables:

- For a:

- First term: a^1
- Third term: a^1

Multiply: $a^1 \times a^1 = a^{(1+1)} = a^2$

- For b:

- First term: b^2

- Second term: b^2

Multiply: $b^2 \times b^2 = b^{(2+2)} = b^4$

- For c:

- Only in second term: c^1

- Multiply by nothing else, so c remains c^1

Variables after multiplication:

$a^2b^4c^1$

Step 4: Combine the Results

Putting together the coefficients and variables:

$$60 \times a^2b^4c$$

This is the simplified form of the algebraic expression prior to any further reduction.

Final Simplified Expression

Result:

$60a^2b^4c$

This expression is fully simplified, combining coefficients and variables, with exponents indicating repeated multiplication of variables.

Additional Tips for Simplifying Algebraic Expressions

To enhance your algebra skills, consider these helpful tips:

1. **Always handle coefficients separately**: Multiply numerical parts first, then variables.
2. **Use properties of exponents**: When multiplying variables with the same base, add their exponents.

3. **Be mindful of negative signs:** Remember that multiplying two negatives yields a positive, while multiplying a positive and a negative yields a negative.

4. **Check for common factors:** Simplify any factors that appear in numerator and denominator if dealing with fractions.

5. **Practice with similar problems:** The more you practice, the more intuitive the process becomes.

Why Simplification Matters

Simplifying algebraic expressions is vital for various reasons:

1. **Ease of computation:** Simplified expressions are easier to evaluate or substitute values into.

2. **Clarity in problem-solving:** Simplification helps reveal the structure of the problem.

3. **Preparation for solving equations:** Simplified forms make solving for variables more straightforward.

4. **Enhancing algebraic skills:** Regular practice improves understanding of fundamental principles like exponents, coefficients, and variable manipulation.

Real-World Applications of Algebraic Simplification

Algebra isn't just an academic exercise; it has significant applications in various fields:

Science and Engineering

- Simplifying equations related to physics, such as force, velocity, or electrical circuits.
- Calculating engineering parameters more efficiently.

Finance and Economics

- Simplifying formulas for compound interest, depreciation, or profit calculations.

Data Analysis and Computer Science

- Optimizing algorithms by simplifying complex expressions.
- Analyzing data trends using algebraic models.

Practice Problems to Reinforce Learning

To strengthen your understanding, try simplifying these expressions:

1. (3x^2y)(-2xy^3)
2. (-5m^3n)(4mn^2)
3. (-6p^2q)(-3pq^4)(2p)

Check your solutions by applying the same principles outlined above: multiply coefficients, add exponents for like bases, and simplify accordingly.

Conclusion

Simplifying the expression *(-4ab^2)(-3b^2c) (5a)* involves carefully multiplying coefficients and combining like variables using the properties of exponents. The process is straightforward when broken down systematically:

- Multiply the coefficients: $-4 \times -3 \times 5 = 60$
- Combine variables: $a^1 \times a^1 = a^2$, $b^2 \times b^2 = b^4$, c^1 remains as c
- Assemble the simplified form: $60a^2b^4c$

Mastering such simplification techniques enhances your overall algebra skills, making complex problems more approachable and solving them more efficient. With consistent practice, you'll develop greater confidence and proficiency in handling algebraic expressions in academic and real-world contexts.

Frequently Asked Questions

What is the simplified form of the expression (-4ab^2)(-3b^2c)(5a)?

The simplified form is 60a^2b^4c.

How do you multiply algebraic expressions like

$(-4ab^2)(-3b^2c)(5a)$?

Multiply the coefficients and then combine like variables by adding exponents: (-4) (-3) 5 = 60; a a = a^2; b^2 b^2 = b^4; c remains as c. So, the result is $60a^2b^4c$.

What are the steps to simplify the expression $(-4ab^2)(-3b^2c)(5a)$?

First, multiply the coefficients: -4 -3 5 = 60. Next, combine like variables: a a = a^2; b^2 b^2 = b^4; c remains unchanged. The simplified expression is $60a^2b^4c$.

Can you explain how to handle the negative signs in the expression $(-4ab^2)(-3b^2c)(5a)$?

Yes, multiply the negative coefficients: -4 -3 = 12; then multiply by 5: 12 5 = 60. Since multiplying two negatives yields a positive, the overall coefficient is positive 60.

What is the coefficient in the simplified expression of $(-4ab^2)(-3b^2c)(5a)$?

The coefficient is 60.

Which variables are combined during the simplification of $(-4ab^2)(-3b^2c)(5a)$?

Variables a and b are combined: a with a to become a^2, and b with b^2 to become b^4. The variable c remains as c.

What is the importance of combining like terms in algebraic expressions like this one?

Combining like terms simplifies the expression, making it easier to evaluate or further manipulate.

Is the order of multiplication important in simplifying $(-4ab^2)(-3b^2c)(5a)$?

No, multiplication is commutative, so the order does not affect the final simplified result.

What is the final simplified answer to the expression $(-4ab^2)(-3b^2c)(5a)$?

The simplified expression is $60a^2b^4c$.

Can the expression $(-4ab^2)(-3b^2c)(5a)$ be simplified

further?

No, it is already simplified to $60a^2b^4c$.

Additional Resources

Simplify: $(-4ab^2)(-3b^2c)(5a)$

When navigating the fascinating realm of algebraic expressions, the ability to simplify complex products is an essential skill that enhances understanding and problem-solving efficiency. Today, we take a deep dive into the expression $(-4ab^2)(-3b^2c)(5a)$—a seemingly intricate combination of constants and variables—and explore the step-by-step process of simplifying it into its most compact, understandable form. This exploration not only demonstrates core algebraic principles but also underscores the importance of systematic approaches to handling algebraic expressions.

Understanding the Components: Dissecting the Expression

Before diving into the simplification process, it’s crucial to understand what each part of the expression contributes. The expression is a product of three separate factors:

1. $(-4ab^2)$
2. $(-3b^2c)$
3. $(5a)$

Let’s analyze each component:

The First Factor: $(-4ab^2)$

- Constants: -4
- Variables:
- a (raised to the first power implicitly)
- b (raised to the second power, b^2)

This factor combines a negative coefficient with variables a and b^2.

The Second Factor: $(-3b^2c)$

- Constants: -3
- Variables:
- b (raised to the second power, b^2)
- c (raised to the first power implicitly)

Again, a negative constant multiplied by variables, including b^2 and c.

The Third Factor: $(5a)$

- Constants: 5

- Variable: a

This is a straightforward term with a positive coefficient and a variable a.

Step-by-Step Simplification Process

Simplifying the entire expression involves systematically applying algebraic principles, particularly the distributive property and the laws of exponents. The goal: combine constants and group like variables to produce a simplified, single-term expression.

Step 1: Rewrite the Expression

Express the original product explicitly:

$$
(-4ab^2) \times (-3b^2c) \times (5a)
$$

This makes it easier to analyze and manipulate.

Step 2: Simplify the Constants

Multiply all numerical coefficients:

$$
(-4) \times (-3) \times 5
$$

- Multiplying negatives: Negative times negative results in a positive.
- Calculating:
- $-4 \times -3 = 12$
- $12 \times 5 = 60$

Result: The combined constant is 60.

Step 3: Combine Like Variables Using Exponent Laws

Recall the key rules for exponents:

- Product of same bases: $x^m \times x^n = x^{m + n}$
- Variables appearing in multiple factors: sum their exponents when multiplied.

Now, analyze each variable:

For a:

- Appears as a in the first factor (a^1)
- Appears as a in the third factor (a^1)
- No a in the second factor

Total exponent for a:
\[

$$
a^{1} \times a^{1} = a^{1+1} = a^{2}
$$

For b:

- Appears as b^2 in the first factor
- Appears as b^2 in the second factor
- No b in the third factor

Total exponent for b:

$$
b^{2} \times b^{2} = b^{2+2} = b^{4}
$$

For c:

- Only appears in the second factor as c^{1}

Thus, c^{1} remains as is.

Final Expression: The Simplified Result

Combining all the simplified components:

$$
\boxed{
60 \times a^{2} \times b^{4} \times c
}
$$

Or, written more compactly:

$$
\boxed{
60a^{2}b^{4}c
}
$$

This expression represents the most simplified form of the original product, with all constants combined and like variables consolidated.

Key Takeaways and Best Practices

This example underscores several critical algebraic principles:

1. Systematic Approach

- Break down each component individually.
- Simplify constants separately from variables.

- Use exponent laws to combine like terms efficiently.

2. Attention to Sign and Coefficients

- Remember that multiplying two negatives yields a positive.
- Carefully track the coefficients to avoid errors.

3. Handling Variables & Exponents

- Identify which variables are common across factors.
- Apply the rule $x^m \times x^n = x^{m + n}$ diligently.
- Recognize that variables not appearing in all factors remain as is.

4. Double-Check Your Work

- Verify each step to ensure no miscalculations.
- Confirm that exponents are correctly added, and signs are accurate.

Practical Applications and Additional Insights

Understanding how to simplify algebraic expressions like $(-4ab^2)(-3b^2c)(5a)$ is foundational for higher-level mathematics, including calculus, algebraic factorization, and solving equations. Mastery of this skill:

- Facilitates faster problem-solving.
- Enables clearer understanding of more complex expressions.
- Provides a stepping stone toward mastering polynomial operations and algebraic manipulations.

Furthermore, this process exemplifies the importance of organizing calculations systematically—a vital practice for success in mathematics and related fields.

Conclusion

The journey from the initial complex product to the elegant, simplified expression $60a^2b^4c$ demonstrates the power of fundamental algebraic principles. By carefully dissecting each component, applying the laws of exponents, and meticulously handling constants and signs, we transform a daunting expression into a concise, manageable form. Whether you're a student sharpening your algebra skills or a professional seeking to reinforce foundational concepts, mastering such simplifications is an invaluable asset—transforming complexity into clarity with precision and confidence.

[Simplify 4ab 2 3b 2c 5a]

Simplify 4ab 2 3b 2c 5a

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