

Simplify $15a^6bc^4/35a^2c^4 + 20a^3b + (3a^4b/7) + 20a^4b + 3a^3b/7$

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When encountering complex algebraic expressions, such as the one involving multiple fractions and variables—specifically, $15a^6bc^4/35a^2c^4 + 20a^3b + (3a^4b/7) + 20a^4b + 3a^3b/7$ —it's essential to approach the simplification process systematically. Properly simplifying such expressions not only makes calculations easier but also helps in understanding the underlying relationships between the variables involved. In this comprehensive guide, we'll walk through each step to simplify this expression effectively, covering the necessary algebraic rules, common pitfalls, and tips for accuracy.

Understanding the Components of the Expression

Before diving into the simplification process, it's crucial to analyze the structure and components of the expression.

Breaking Down the Expression

The expression can be viewed as a combination of variables, fractions, and coefficients:

- Numerator: $15a^6bc^4$
- Denominator: $35a^2c^4$
- Additional terms: $20a^3b$, $(3a^4b/7)$, $20a^4b$, $3a^3b/7$

At first glance, the expression appears to be a product and sum of multiple terms involving variables a , b , c , and constants.

Key Observations

- The expression involves multiple variables with exponents, e.g., a^6 , bc^4 , a^2 , c^4 , a^3 , a^4 , a^3b .
- Fractions are present, such as $(3a^4b/7)$ and $3a^3b/7$.
- The overall structure suggests combining like terms, simplifying fractions, and reducing coefficients.

Step-by-Step Simplification Process

To simplify this expression, we need to follow an organized approach:

1. Rewrite the expression clearly
2. Simplify individual fractions
3. Factor common terms
4. Combine like terms
5. Reduce coefficients where possible
6. Express the final simplified form

Let's explore each step in detail.

1. Rewrite the Expression Clearly

Assuming the expression is written as:

$$\left[\frac{15a^6bc^4}{35a^2c^4} \times 20a^3b \times \frac{3a^4b}{7} \times 20a^4b \times \frac{3a^3b}{7} \right]$$

Note: The expression seems to be a product of these terms. If the original expression differs, please clarify, but based on the provided info, this is a logical reconstruction.

2. Simplify the Fraction

$$\left(\frac{15a^6bc^4}{35a^2c^4} \right)$$

- Coefficients: $15/35$ reduces to $3/7$
- Variables:
 - $(a^6 / a^2 = a^{6-2} = a^4)$
 - $(b / 1 = b)$ (since only numerator has b)
 - $(c^4 / c^4 = 1)$

So,

$$\left[\frac{15a^6bc^4}{35a^2c^4} = \frac{3}{7} \times a^4 \times b \right]$$

3. Simplify the Remaining Terms

Now, write all terms explicitly:

$$\left(\frac{3}{7} a^4 b\right) \times 20a^3b \times \frac{3a^4b}{7} \times 20a^4b \times \frac{3a^3b}{7}$$

Break down each term:

- $\left(\frac{3}{7} a^4 b\right)$
- $(20 a^3 b)$
- $\left(\frac{3 a^4 b}{7}\right)$
- $(20 a^4 b)$
- $\left(\frac{3 a^3 b}{7}\right)$

4. Combine Like Terms and Coefficients

Step A: Combine all coefficients:

$$\frac{3}{7} \times 20 \times \frac{3}{7} \times 20 \times \frac{3}{7}$$

Calculate step-by-step:

- $\left(\frac{3}{7} \times 20 = \frac{3 \times 20}{7} = \frac{60}{7}\right)$
- Multiply by $\left(\frac{3}{7}\right)$:

$$\frac{60}{7} \times \frac{3}{7} = \frac{60 \times 3}{7 \times 7} = \frac{180}{49}$$

- Multiply by 20:

$$\frac{180}{49} \times 20 = \frac{180 \times 20}{49} = \frac{3600}{49}$$

- Finally, multiply by $\left(\frac{3}{7}\right)$:

$$\frac{3600}{49} \times \frac{3}{7} = \frac{3600 \times 3}{49 \times 7} = \frac{10800}{343}$$

Resulting coefficient: $\frac{10800}{343}$

Step B: Combine variables:

- For (a) :

$$a^4 \times a^3 \times a^4 \times a^4 \times a^3$$

Sum exponents:

$$4 + 3 + 4 + 4 + 3 = 18$$

So,

$$a^{18}$$

- For (b) :

Since each term has a (b) :

$$b \times b \times b \times b \times b = b^5$$

- For (c) :

In the initial fraction, (c^4 / c^4) canceled out, so (c) does not appear in the product.

5. Write the Final Expression

Putting it all together:

$$\frac{10800}{343} \times a^{18} \times b^5$$

This is the simplified form of the original expression, assuming it was a product of all these terms.

Additional Tips for Simplification

- Always reduce coefficients first: Simplify numerical fractions to their lowest terms.
- Use exponents rules: When multiplying powers with the same base, add exponents.
- Factor common terms: Identify and cancel common factors between numerator and denominator.
- Maintain clarity: Write each step explicitly to avoid mistakes.
- Verify your work: Cross-check by substituting specific values for variables to ensure the simplified form matches the original expression.

Conclusion

Simplifying complex algebraic expressions like $\frac{15a^6bc^4}{35a^2c^4} \cdot \frac{20a^3b}{(3a^4b/7)} \cdot \frac{20a^4b}{(3a^3b/7)}$ involves careful analysis, systematic application of algebraic rules, and patience. By breaking down the problem into manageable parts—simplifying fractions, combining like terms, and reducing coefficients—you can transform a complicated expression into a clean, comprehensible form. Such skills are invaluable for solving higher-level algebra problems and are foundational for advanced mathematics, physics, and engineering applications.

Remember, practice makes perfect. Regularly working through similar problems will improve your ability to simplify even the most intricate algebraic expressions with confidence.

Frequently Asked Questions

How do I simplify the expression $\frac{15a^6bc^4}{35a^2c^4} \cdot \frac{20a^3b}{(3a^4b/7)} \cdot \frac{20a^4b}{(3a^3b/7)}$?

First, factor and cancel common terms across the numerators and denominators, then multiply the remaining factors. Simplify the coefficients and combine like terms to obtain the simplest form.

What are the steps to simplify the complex algebraic expression involving multiple fractions and variables?

Identify common factors in numerators and denominators, cancel out common terms, multiply across numerators and denominators separately, and then simplify the resulting algebraic expression.

Can I cancel variables across different fractions in the expression?

Yes, you can cancel variables if they appear in numerator and denominator in the same factors, following the rules of algebraic simplification, provided they are non-zero.

How do I handle the coefficients when simplifying the expression?

Multiply all the numerical coefficients together and simplify the resulting number. Then, combine like variables with their exponents accordingly.

Is it necessary to rewrite the entire expression before simplifying?

Rearranging and factoring the expression can make it easier to identify common factors and simplify more efficiently.

What is the importance of checking for common factors before multiplying or dividing in the expression?

Checking for common factors before multiplying or dividing helps to simplify the expression early on, reducing the risk of errors and making the final simplification easier.

After simplifying the expression, how can I verify that my answer is correct?

You can verify by substituting specific numerical values for the variables into both the original and simplified expressions to see if they yield the same result.

Additional Resources

Simplify $15a^6bc^4/35a^2c^4 \cdot 20a^3b \cdot (3a^4b/7) \cdot 20a^4b \cdot 3a^3b/7$

In the realm of algebraic expressions, simplification is a fundamental skill that transforms complex formulas into more manageable forms, aiding in problem-solving and conceptual understanding. Today, we explore the process of simplifying a particularly intricate expression: $15a^6bc^4/35a^2c^4 \cdot 20a^3b \cdot (3a^4b/7) \cdot 20a^4b \cdot 3a^3b/7$. This expression combines multiple fractions, products, and powers, challenging even seasoned mathematicians to untangle its components systematically. Our goal is to break down each step clearly and logically, providing a comprehensive guide that demystifies the process and enhances your algebraic toolkit.

Understanding the Expression: An Overview

Before diving into the simplification process, it's essential to understand the structure of the given expression:

$$15a^6bc^4 / 35a^2c^4 \cdot 20a^3b \cdot (3a^4b/7) \cdot 20a^4b \cdot 3a^3b/7$$

At first glance, the expression appears to be a concatenation of several terms involving variables (a, b, c) , their powers, and fractional components. To facilitate clarity, let's separate the expression into its constituent parts:

- A numerator: $15a^6bc^4$
- A denominator: $35a^2c^4$
- Additional multiplicative factors: $20a^3b$, $(3a^4b/7)$, $20a^4b$, $3a^3b/7$

It seems that the expression is a product or quotient involving these components, but the initial format is somewhat ambiguous. A logical assumption is that the entire expression is:

$$\frac{15a^6bc^4}{35a^2c^4} \times 20a^3b \times \left(\frac{3a^4b}{7}\right) \times 20a^4b \times \frac{3a^3b}{7}$$

This interpretation aligns with algebraic notation, where division and multiplication are combined. For the sake of clarity, let's proceed with this structured form.

Step 1: Clarify and Rewrite the Expression

Expressed explicitly, the expression becomes:

$$\left(\frac{15a^6bc^4}{35a^2c^4}\right) \times 20a^3b \times \left(\frac{3a^4b}{7}\right) \times 20a^4b \times \left(\frac{3a^3b}{7}\right)$$

Now, the task reduces to simplifying this product step-by-step.

Step 2: Simplify the Fractional Part $\left(\frac{15a^6bc^4}{35a^2c^4}\right)$

Focus on simplifying the fraction:

$$\frac{15a^6bc^4}{35a^2c^4}$$

- Coefficients: $\left(\frac{15}{35}\right)$ simplifies to $\left(\frac{3}{7}\right)$ (divide numerator and denominator by 5).
- Variables (a) : $(a^6 / a^2 = a^{6-2} = a^4)$.

- Variables (b) : Since (b) appears only in numerator, it remains (b) .

- Variables (c) : $(c^4 / c^4 = 1)$, so they cancel out.

Putting it together:

$$\frac{3}{7} \times a^4 \times b$$

Step 3: Rewrite the Entire Expression

Now, the entire expression becomes:

$$\left(\frac{3}{7} a^4 b \right) \times 20a^3b \times \left(\frac{3a^4b}{7} \right) \times 20a^4b \times \left(\frac{3a^3b}{7} \right)$$

Our goal is to multiply all these components together, combining like terms.

Step 4: Multiply the Coefficients

Identify and multiply all numerical coefficients:

- From the first term: $\left(\frac{3}{7}\right)$
- Second term: (20)
- Third term: $\left(\frac{3}{7}\right)$
- Fourth term: (20)
- Fifth term: $\left(\frac{3}{7}\right)$

Calculate:

$$\left(\frac{3}{7} \right) \times 20 \times \left(\frac{3}{7} \right) \times 20 \times \left(\frac{3}{7} \right)$$

Step-by-step:

- Multiply the fractions:

$$\frac{3}{7} \times \frac{3}{7} \times \frac{3}{7} = \frac{3 \times 3 \times 3}{7 \times 7 \times 7} = \frac{27}{343}$$

- Multiply the integers:

$$\frac{20}{1} \times 20 = 400$$

- Combine:

$$\frac{27}{343} \times 400$$

Expressed as:

$$\frac{27 \times 400}{343} = \frac{10,800}{343}$$

Step 5: Simplify the Variable Part

Now, combine the variables:

- (a) :

$$a^4 \times a^3 \times a^4 \times a^3$$

- (b) :

$$b \times b \times b \times b$$

Calculate:

- For (a) :

$$a^{4 + 3 + 4 + 3} = a^{14}$$

- For (b) :

$$b^{1 + 1 + 1 + 1} = b^4$$

Step 6: Combine All Components

Putting everything together:

$$\frac{10,800}{343} a^{14} b^4$$

This is the simplified form of the original complex expression.

Final Simplified Expression

$$\boxed{\frac{10,800}{343} a^{14} b^4}$$

This expression encapsulates the entire simplification process, consolidating all coefficients, powers, and variables into a neat, manageable form.

Additional Insights and Practical Implications

Understanding the significance of this simplification is crucial in various mathematical contexts, especially when dealing with algebraic manipulations in calculus, physics, or engineering. Simplification reduces computational complexity, minimizes errors, and clarifies the relationships among variables.

Key takeaways from this process include:

- The importance of breaking down complex expressions into manageable parts.
- Recognizing common factors in numerator and denominator to simplify fractions.
- Applying exponent rules systematically, such as $(a^m \times a^n = a^{m+n})$ and $(a^m / a^n = a^{m-n})$.
- Combining coefficients carefully, especially when fractions are involved.

Final Thoughts

While the initial expression posed a challenge due to its complexity and notation, a systematic approach—identifying parts, simplifying step-by-step, and consolidating like terms—makes the task manageable. Mastering these techniques enhances algebraic fluency and prepares you for more advanced mathematical problem-solving.

Remember, the key to successfully simplifying intricate expressions lies in patience, organization, and a solid understanding of algebraic principles. As you encounter similar

challenges, this example serves as a blueprint for methodically unraveling and simplifying complex formulas into elegant, workable solutions.

Simplify $15a^6bc^4 - 35a^2c^4 - 20a^3b - 3a^4b - 7 - 20a^4b - 3a^3b - 7$

Simplify $15a^6bc^4 - 35a^2c^4 - 20a^3b - 3a^4b - 7 - 20a^4b - 3a^3b - 7$

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