Evaluate Using Distributive Property: [(-2/7) (4/9)] + [(-3/5) (4/9)]

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When tackling algebraic expressions involving fractions, one of the most effective strategies is to use the distributive property. The distributive property allows you to simplify complex expressions by breaking them down into manageable parts. In this article, we will explore how to evaluate the expression:

$$\left(-\frac{2}{7} \times \frac{4}{9} \right) + \left(-\frac{3}{5} \times \frac{4}{9} \right)$$

using the distributive property, step by step. Understanding this process not only helps in solving this specific problem but also enhances your overall algebraic skills when working with fractions and similar expressions.

Understanding the Distributive Property

What Is the Distributive Property?

The distributive property is a fundamental rule in algebra that states:

$$a \times (b + c) = a \times b + a \times c$$

This property allows you to distribute a multiplication over addition or subtraction inside parentheses. While the property is commonly applied to expressions with parentheses, it can also be useful in simplifying expressions involving multiple terms with common factors.

Why Use the Distributive Property for Fractions?

When dealing with fractions, the distributive property helps by:

- Simplifying multiplications involving fractions.
- Combining similar terms efficiently.
- Reducing the complexity of algebraic expressions.

In the given problem, both terms share a common factor of $\frac{4}{9}$, which makes the distributive property a natural choice for simplification.

Step-by-Step Evaluation of the Expression

Now, let's evaluate the expression:

$$ \left(-\frac{2}{7} \times \frac{4}{9} \right) + \left(-\frac{3}{5} \times \frac{4}{9} \right) $$

using the distributive property.

Step 1: Recognize the Common Factor

Notice that both terms involve the factor $\frac{4}{9}$:

- First term: $-\frac{2}{7} \times \frac{4}{9}$
- Second term: $-\frac{3}{5} \times \frac{4}{9}$

This common factor suggests that we can factor out $\frac{4}{9}$:

$$ \frac{4}{9} \times \left(-\frac{2}{7} + -\frac{3}{5} \right) $$

Alternatively, written more clearly:

$$ \frac{4}{9} \times \left(-\frac{2}{7} - \frac{3}{5} \right) $$

Here, the distributive property simplifies the original sum of two products into a single product of a common factor and a sum of fractions.

Step 2: Simplify the Expression Inside the Parentheses

Now, focus on simplifying:

$$ -\frac{2}{7} - \frac{3}{5} $$

To perform this addition (or subtraction), we need a common denominator.

- The denominators are 7 and 5.
- The least common denominator (LCD) is $7 \times 5 = 35$.

Convert each fraction:

$$
-\frac{2}{7} = -\frac{2 \times 5}{7 \times 5} = -\frac{10}{35}
$$
$$
-\frac{3}{5} = -\frac{3 \times 7}{5 \times 7} = -\frac{21}{35}
$$

Now, sum these:

$$
-\frac{10}{35} - \frac{21}{35} = -\frac{10 + 21}{35} = -\frac{31}{35}
$$

Step 3: Multiply the Common Factor

Recall that the factored-out term is $\frac{4}{9}$. Therefore, the entire expression becomes:

$$
\frac{4}{9} \times \left(-\frac{31}{35} \right)
$$

Multiply the numerators and denominators:

$$
\frac{4 \times (-31)}{9 \times 35} = \frac{-124}{315}
$$

Final Result

The evaluated expression is:

$$ \boxed{\frac{-124}{315}} $$

which can also be written as:

$$ -\frac{124}{315} $$

Since 124 and 315 share no common factors other than 1, the fraction is already in its simplest form.

Additional Tips for Using the Distributive Property with Fractions

1. Always Look for Common Factors

Before applying the distributive property, examine the expression for common factors. Factoring out common terms simplifies calculations.

2. Convert Fractions to a Common Denominator

When adding or subtracting fractions, ensure they have the same denominator to combine them efficiently.

3. Simplify Before Multiplying

If possible, reduce fractions to their simplest form before multiplying to make calculations easier.

4. Multiply Numerators and Denominators Directly

Remember that multiplying fractions involves multiplying numerators together and denominators together:

$$
\frac{a}{b} \times \frac{c}{d} = \frac{a \times c}{b \times d}
$$

Practice Problems to Enhance Your Skills

To solidify your understanding of evaluating expressions using the distributive property with fractions, try these practice problems:

1. Simplify $\left(\frac{3}{4} \times 2 \right) + \left(\frac{3}{4} \times 5 \right)$.

2. Evaluate $\left(-\frac{1}{3} \times 6 \right) + \left(-\frac{1}{3} \times 9 \right)$.

3. Simplify $\frac{2}{5} \times (7 - 3)$.

4. Evaluate $\left(\frac{2}{3} \times 4 \right) + \left(\frac{2}{3} \times -2 \right)$.

By practicing these problems, you'll become more comfortable applying the distributive property to fractional expressions.

Conclusion

Using the distributive property to evaluate expressions involving fractions is a powerful and efficient method. In the specific example of:

$$ \left(-\frac{2}{7} \times \frac{4}{9} \right) + \left(-\frac{3}{5} \times \frac{4}{9} \right) $$

we demonstrated how factoring out the common $\frac{4}{9}$ simplifies the calculation, leading to the final answer:

$$-\frac{124}{315}$$

This approach not only simplifies complex algebraic expressions but also deepens your understanding of how fractions and algebraic properties interact. Practice with similar exercises to master the skill, and soon you'll find it easier to handle more advanced algebraic problems involving fractions and the distributive property.

Frequently Asked Questions

How do I evaluate the expression [(-2/7) (4/9)] + [(-3/5) (4/9)] using the distributive property?

First, factor out the common term (4/9) from both parts: [(–2/7) + (–3/5)] (4/9). Then, find a common denominator for (–2/7) + (–3/5), sum the numerators accordingly, and multiply the result by (4/9).

What is the first step to simplify [(-2/7) (4/9)] + [(-3/5) (4/9)] using the distributive property?

Identify the common factor (4/9) and rewrite the expression as [(–2/7) + (–3/5)] multiplied by (4/9).

How do you combine the fractions (–2/7) and (–3/5) before multiplying by (4/9)?

Find a common denominator, which is 35, then convert each fraction: (–2/7) = (–10/35), and (–3/5) = (–21/35). Add them to get (–10/35) + (–21/35) = (–31/35).

What is the final value of the expression [(-2/7) (4/9)] + [(-3/5) (4/9)] after simplification?

After combining, the expression becomes (–31/35) (4/9). Multiply numerators: (–31) 4 = –124, and denominators: 35 9 = 315, so the final answer is (–124/315).

Why is the distributive property useful in evaluating expressions like this one?

It allows you to factor out common terms, simplifying the calculation by combining like parts before multiplying, which reduces potential errors and makes multi-step computations easier.

Additional Resources

Evaluate Using Distributive Property: [(-2/7) (4/9)] + [(-3/5) (4/9)]

In the realm of mathematics, especially algebra and arithmetic, the distributive property is a fundamental concept that simplifies complex expressions and enhances our understanding of how numbers interact. When faced with an expression like [(-2/7) (4/9)] + [(-3/5) (4/9)], students and practitioners alike can benefit from applying the distributive property to streamline the calculation process. This article aims to explore, in a detailed yet accessible manner, how the distributive property can be employed to evaluate such an expression effectively, emphasizing the importance of understanding the underlying principles and the step-by-step approach to solving similar problems.

Understanding the Distributive Property

Before diving into the specific problem, it is essential to grasp the core idea behind the distributive property. In algebra, the distributive property states that:

$a(b + c) = a b + a c$

This property allows us to distribute a multiplication across terms within parentheses, thereby simplifying expressions and making calculations more manageable.

In the context of our problem, the distributive property is helpful because both terms involve the common factor (4/9). Recognizing this commonality enables us to factor out (4/9) and rewrite the expression in a form that simplifies the calculation.

Why Use the Distributive Property in This Context?

- Efficiency: It reduces the number of steps needed to evaluate the expression.
- Clarity: It makes the structure of the expression more transparent.
- Scalability: It allows for easier extension to more complex expressions.

Decomposing the Expression

The given expression is:

$$
[(-\frac{2}{7}) \times \frac{4}{9}] + [(-\frac{3}{5}) \times \frac{4}{9}]
$$

At first glance, this appears as two separate products summed together. However, both terms share the factor $\frac{4}{9}$, which suggests an opportunity to factor out this common element.

Step 1: Recognize the Common Factor

Both terms include $\frac{4}{9}$:

- First term: $-\frac{2}{7} \times \frac{4}{9}$
- Second term: $-\frac{3}{5} \times \frac{4}{9}$

Therefore, the entire expression can be viewed as:

$$
\frac{4}{9} \times \left(-\frac{2}{7} + -\frac{3}{5} \right)
$$

This is the key insight that allows us to apply the distributive property effectively.

Step 2: Rewrite the Expression

Using the distributive property, rewrite as:

$$
\frac{4}{9} \times \left(-\frac{2}{7} - \frac{3}{5} \right)
$$

Note that because both original terms are negative, and we're adding, the terms inside the parentheses are summed with their signs.

Step 3: Focus on the Sum Inside the Parentheses

Now, the problem reduces to calculating:

$$
-\frac{2}{7} - \frac{3}{5}
$$

This requires adding two fractions with different denominators, which involves finding a common denominator.

Calculating the Sum Inside the Parentheses

Adding fractions with different denominators is a common task in arithmetic, and it hinges on finding the least common denominator (LCD).

Step 1: Identify the Denominators

- First fraction: 7
- Second fraction: 5

Step 2: Find the Least Common Denominator (LCD)

The LCD of 7 and 5 is their least common multiple:

- 7: factors are 7
- 5: factors are 5
- Since 7 and 5 are prime, their LCD is $7 \times 5 = 35$

Step 3: Rewrite Each Fraction with the LCD

- $-\frac{2}{7} = -\frac{2 \times 5}{7 \times 5} = -\frac{10}{35}$
- $-\frac{3}{5} = -\frac{3 \times 7}{5 \times 7} = -\frac{21}{35}$

Step 4: Add the Fractions

$$
-\frac{10}{35} - \frac{21}{35} = -\frac{10 + 21}{35} = -\frac{31}{35}
$$

Thus, the sum inside the parentheses simplifies to $-\frac{31}{35}$.

Completing the Evaluation

Having simplified the sum inside the parentheses, the entire expression becomes:

$$
\frac{4}{9} \times \left(-\frac{31}{35} \right)
$$

Now, multiply the fractions directly.

Step 1: Multiply Numerators and Denominators

$$
\frac{4}{9} \times -\frac{31}{35} = - \frac{4 \times 31}{9 \times 35}
$$

Calculate the numerator and denominator:

- Numerator: $4 \times 31 = 124$
- Denominator: $9 \times 35 = 315$

So, the product is:

$$
-\frac{124}{315}
$$

Step 2: Simplify the Fraction (if possible)

Check for common factors between 124 and 315:

- 124 factors: 2, 2, 31 → prime factors are $2^2 \times 31$

- 315 factors: 3, 3, 5, 7 → prime factors are $3^2 \times 5 \times 7$

Since there are no common prime factors, the fraction $-\frac{124}{315}$ is already in simplest form.

Final Answer:

$$
\boxed{-\frac{124}{315}}
$$

This is the evaluated value of the original expression using the distributive property, demonstrating both the power and efficiency of this approach.

Implications and Broader Applications

The process exemplified here is not merely a mathematical exercise but a demonstration of a versatile principle applicable across various domains:

- Algebraic Simplification: Recognizing common factors to reduce complex expressions.
- Problem Solving Efficiency: Breaking down multi-step calculations into manageable parts.
- Mathematical Literacy: Developing a deeper understanding of how fractions and algebraic properties interact.

Such techniques are fundamental in higher mathematics, including calculus, linear algebra, and beyond, where the ability to manipulate expressions efficiently is critical.

Conclusion: The Power of the Distributive Property

The evaluation of the expression [(-2/7) (4/9)] + [(-3/5) (4/9)] illustrates the importance of the distributive property as a tool for simplifying and solving mathematical problems. By recognizing the common factor $\frac{4}{9}$, we transformed a potentially cumbersome calculation into a straightforward sequence of steps:

1. Factoring out the common term.
2. Calculating the sum of fractions with different denominators.
3. Multiplying the simplified sum by the common factor.

Through this approach, we arrived at the final answer: $-\frac{124}{315}$. Mastery of such techniques not only streamlines calculations but also enhances conceptual understanding, fostering more confident problem-solving skills in mathematics.

Whether you're a student, educator, or professional, leveraging the distributive property is a valuable strategy that simplifies complexity and reveals the elegant structure underlying mathematical expressions.

Evaluate Using Distributive Property 2 7 4 9 3 5 4 9

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