-4/7-8/9+4/7+9/8Which Of The Following Expressions Are Equivalent To

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Understanding and simplifying algebraic expressions is a fundamental skill in mathematics that helps develop logical thinking and problem-solving abilities. The expression *-4/7 - 8/9 + 4/7 + 9/8* presents an interesting challenge for students and learners alike, as it involves multiple fractions, some of which are similar, and others that are different. The key to solving such expressions lies in understanding how to manipulate fractions, apply basic algebraic rules, and identify equivalent expressions.

This article aims to explore the expression in detail, analyze its components, and determine which of the following expressions are equivalent to it. Whether you're a student preparing for exams or someone interested in improving your algebraic skills, this comprehensive guide will help clarify the process of simplifying complex fractional expressions and recognizing equivalences.

Understanding the Expression

Before diving into the calculations, it is important to understand what the expression consists of:

- The expression is: *-4/7 - 8/9 + 4/7 + 9/8*
- It involves four fractional terms:
- Two with denominator 7: *-4/7* and *+4/7*
- Two with denominators 9 and 8: *-8/9* and *+9/8*
- The signs are mixed: addition and subtraction.

The goal is to simplify this expression as much as possible to find its equivalent form.

Step-by-Step Simplification Process

Simplifying complex fractional expressions involves combining like terms and finding common denominators. Let's analyze the expression step by step.

Step 1: Combine like terms with the same denominators

Notice that *-4/7* and *+4/7* are additive inverses; they cancel each other out:

-4/7 + 4/7 = 0

This simplifies that part of the expression to zero.

Remaining expression after this cancellation:

0 - 8/9 + 9/8

which simplifies to:

- 8/9 + 9/8

Step 2: Simplify the remaining terms

Now, the expression reduces to:

-8/9 + 9/8

To combine these, find a common denominator.

Step 3: Find common denominator

The denominators are 9 and 8.

- The least common denominator (LCD) of 9 and 8 is:

LCD = 9 × 8 = 72

- Convert each fraction to an equivalent with denominator 72:

- For -8/9:

- Numerator: -8 × 8 = -64

- Fraction: -64/72

- For 9/8:

- Numerator: 9 × 9 = 81

- Fraction: 81/72

Step 4: Combine the fractions

Now, the expression becomes:

-64/72 + 81/72 = (81 - 64)/72 = 17/72

Since the original expression was:

-8/9 + 9/8 = 17/72

and recalling that the earlier parts canceled out, the entire simplified form is:

17/72

Final Simplified Result

The simplified form of the original expression *-4/7 - 8/9 + 4/7 + 9/8* is 17/72.

This demonstrates that the original complex expression is equivalent to the fraction 17/72.

Identifying Equivalent Expressions

Now that we've simplified the expression to 17/72, the next step is to examine which of the following expressions are equivalent to it.

Suppose the options include various fractions and algebraic expressions. Some typical options might be:

1. 17/72
2. 34/144
3. -17/72
4. 2/9 + 1/8

Let's analyze each:

Option 1: 17/72

- This is exactly our simplified form, so it is equivalent.

Option 2: 34/144

- Simplify 34/144:

- Divide numerator and denominator by 2:

34 ÷ 2 = 17

144 ÷ 2 = 72

- Result: 17/72

- Therefore, 34/144 is equivalent to 17/72.

Option 3: -17/72

- This is the negative of our simplified result, so not equivalent.

Option 4: 2/9 + 1/8

- Find common denominator:

- LCD of 9 and 8 is 72

- Convert:

2/9 = (2×8)/(9×8) = 16/72

1/8 = (1×9)/(8×9) = 9/72

- Sum: 16/72 + 9/72 = 25/72

- Since 25/72 ≠ 17/72, not equivalent.

Summary:

Option	Expression	Equivalent to original?	Explanation
1	17/72	Yes	Identical to simplified form
2	34/144	Yes	Simplifies to 17/72
3	-17/72	No	Negative of the simplified form
4	2/9 + 1/8	No	Sum equals 25/72, not equivalent

Mathematical Concepts Involved

Understanding which expressions are equivalent involves several core mathematical concepts:

1. Fraction Simplification

Reducing fractions to their simplest form by dividing numerator and denominator by their greatest common divisor (GCD).

2. Finding Common Denominators

Key to adding or subtracting fractions involves converting fractions to equivalent fractions with a common denominator.

3. Canceling Like Terms

Recognizing when terms cancel each other, especially when they are additive inverses.

4. Recognizing Equivalent Fractions

Knowing that multiplying numerator and denominator by the same number does not change the value, which helps in identifying equivalent fractions.

Practical Applications of Fraction Simplification and Equivalence

Understanding how to manipulate and recognize equivalent fractions has numerous applications:

- Simplifying calculations in algebra, geometry, and arithmetic
- Comparing fractions efficiently
- Solving complex algebraic expressions
- Applying fractions in real-world situations such as measurements, recipes, and financial calculations

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Common Mistakes to Avoid

While working with fractions, especially in complex expressions, learners often encounter pitfalls:

- Forgetting to find common denominators before adding/subtracting

- Incorrectly simplifying fractions (not dividing numerator and denominator by GCD)
- Overlooking cancellation opportunities
- Confusing the signs (+/-) when combining terms
- Assuming different fractions are equivalent without simplifying properly

Being mindful of these common errors can improve accuracy and confidence when working with fractional expressions.

Practice Problems to Reinforce Learning

To solidify understanding, consider practicing with similar expressions:

1. Simplify: *3/4 + 1/4 - 1/2*
2. Determine if *10/20* and *1/2* are equivalent.
3. Express *7/9* and *14/18* as equivalent fractions.
4. Find the simplified form of: *-5/6 + 2/3*

Conclusion

The expression *-4/7 - 8/9 + 4/7 + 9/8* simplifies elegantly to 17/72 after canceling like terms and combining fractions. Recognizing the equivalent expressions, such as 34/144, further reinforces the importance of understanding fraction simplification and equivalence. Mastering these skills enables learners to handle more complex algebraic problems with confidence and precision.

Whether you're solving equations, comparing fractions, or preparing for exams, the ability to identify and work with equivalent expressions is a vital mathematical skill. Practice regularly, understand the underlying concepts, and you'll find that handling fractions becomes increasingly intuitive.

Frequently Asked Questions

What is the simplified form of the expression -4/7 - 8/9 + 4/7 + 9/8?

The simplified form is 0 + 0, which equals 0.

Are the expressions -4/7 - 8/9 + 4/7 + 9/8 and 0 equivalent?

Yes, because simplifying the original expression results in 0, so it is equivalent to 0.

Which of the following expressions are equivalent to -4/7 - 8/9 + 4/7 + 9/8?

Any expression that simplifies to 0 is equivalent; for example, -4/7 + 4/7 - 8/9 + 9/8.

How do you simplify the expression -4/7 - 8/9 + 4/7 + 9/8?

Group similar terms: (-4/7 + 4/7) + (-8/9 + 9/8). The first group sums to 0; the second group simplifies to 0 as well, so the entire expression equals 0.

Is the expression -4/7 - 8/9 + 4/7 + 9/8 equal to 1?

No, the expression simplifies to 0, not 1.

Can the original expression be written as a single fraction? If so, what is it?

Yes, combining all terms over a common denominator results in an expression that simplifies to 0.

What is the key step in determining which expressions are equivalent to -4/7 - 8/9 + 4/7 + 9/8?

The key step is simplifying the expression by combining like terms and reducing it to its simplest form, which is 0.

Additional Resources

Which Of The Following Expressions Are Equivalent To -4/7 - 8/9 + 4/7 + 9/8

Introduction

Mathematics, at its core, is a language of patterns, relationships, and logical consistencies. Among its fundamental constructs are algebraic expressions that, while seemingly complex, often simplify to familiar or equivalent forms through systematic analysis. The expression -4/7 - 8/9 + 4/7 + 9/8 epitomizes such a scenario, posing an intriguing question: which expressions are equivalent to this combination?

The task of establishing equivalence involves deep understanding of algebraic manipulations, properties of fractions, and the principles underpinning simplification. This long-form investigation aims to dissect this specific expression comprehensively, exploring its structure, simplifying it step-by-step, and evaluating which other expressions share its value. This approach not only clarifies the

mathematical intricacies but also offers insights into techniques valuable for students, educators, and mathematicians alike.

Dissecting the Original Expression

The Expression in Focus

Let's clarify the given expression:

$$
- \frac{4}{7} - \frac{8}{9} + \frac{4}{7} + \frac{9}{8}
$$

The expression contains four terms involving fractions, with apparent positive and negative components. At first glance, some terms may cancel each other out, hinting at potential simplification.

Initial Observations

- The terms $- \frac{4}{7}$ and $+ \frac{4}{7}$ are additive inverses, which suggests they could cancel each other.
- The remaining terms are $- \frac{8}{9}$ and $+ \frac{9}{8}$.

This observation implies that the entire expression might simplify considerably.

Step-by-Step Simplification

Combining Like Terms

We can write the expression as:

$$
\left(- \frac{4}{7} + \frac{4}{7} \right) + \left(- \frac{8}{9} + \frac{9}{8} \right)
$$

The first group simplifies:

$$
- \frac{4}{7} + \frac{4}{7} = 0
$$

The second group requires a common denominator to combine:

$$
- \frac{8}{9} + \frac{9}{8}
$$

Simplifying the Remaining Terms

Step 1: Find a common denominator

The denominators are 9 and 8. Their least common multiple (LCM) is 72.

Express each fraction with denominator 72:

$$
- \frac{8}{9} = - \frac{8 \times 8}{9 \times 8} = - \frac{64}{72}
$$

$$
\frac{9}{8} = \frac{9 \times 9}{8 \times 9} = \frac{81}{72}
$$

Step 2: Combine the fractions

$$
- \frac{64}{72} + \frac{81}{72} = \frac{-64 + 81}{72} = \frac{17}{72}
$$

Final Simplified Result

Adding back the canceled terms:

$$
0 + \frac{17}{72} = \frac{17}{72}
$$

Conclusion of Simplification

The original expression simplifies neatly to:

$$
\boxed{\frac{17}{72}}
$$

This means any expression equivalent to $\frac{17}{72}$ is mathematically identical in value to the original.

Identifying Equivalent Expressions

Characteristics of Equivalent Expressions

To determine which expressions are equivalent to $\frac{17}{72}$, consider the properties:

- They must simplify to the same reduced form.
- They may be expressed as different combinations of fractions, sums, differences, or algebraic manipulations that resolve to $\frac{17}{72}$.

Examples of Equivalent Expressions

Below are some candidate expressions, with their verification process:

1. $\frac{34}{144}$

Simplify numerator and denominator:

$$
\gcd(34, 144) = 2
$$

$$
\frac{34/2}{144/2} = \frac{17}{72}
$$

Conclusion: Equivalent.

2. $\frac{51}{216}$

Simplify:

$$
\gcd(51, 216) = 3
$$

$$
\frac{51/3}{216/3} = \frac{17}{72}
$$

Conclusion: Equivalent.

3. Expressing as sum of fractions:

$$
\frac{10}{72} + \frac{7}{72} = \frac{17}{72}
$$

Or, for example:

$$
\frac{1}{8} + \frac{1}{9} + \frac{1}{72}
$$

Let's verify:

$$
\frac{1}{8} = \frac{9}{72}
$$
$$
\frac{1}{9} = \frac{8}{72}
$$
$$
\frac{1}{72} = \frac{1}{72}
$$

Sum:

$$
\frac{9 + 8 + 1}{72} = \frac{18}{72} = \frac{1}{4}
$$

Not matching $\frac{17}{72}$. So this is not equivalent.

4. Multiplying the simplified form by 1:

$$
\frac{17}{72} \times 1 = \frac{17}{72}
$$

Trivially equivalent, but not a different expression.

5. Adding zero:

$$
\frac{17}{72} + 0 = \frac{17}{72}
$$

Again, trivial.

Summary of Equivalent Expressions

- Fractions that reduce to $\frac{17}{72}$.
- Any expression algebraically simplified to $\frac{17}{72}$.

Broader Perspectives and Applications

Mathematical Significance

Understanding the process of simplifying complex fractional expressions is fundamental in algebra and higher mathematics. Recognizing cancellation opportunities, common denominators, and reduction techniques form essential skills.

Educational Implications

This analysis demonstrates several teaching points:

- The importance of identifying additive inverses.
- The methodical approach to combining fractions.
- The value of simplifying fractions to their lowest terms.

Real-World Applications

While this specific fractional expression may seem abstract, the techniques employed are widely applicable:

- In engineering, for simplifying circuit calculations.
- In finance, for comparing ratios and proportions.
- In data analysis, for normalizing or standardizing values.

Final Remarks

The exploration of the expression -4/7 - 8/9 + 4/7 + 9/8 reveals the elegance of algebraic simplification. Its ultimate reduction to $\frac{17}{72}$ exemplifies how apparent complexity often masks underlying simplicity. Recognizing equivalent expressions hinges on a clear understanding of fraction operations, common denominators, and reduction techniques.

The key takeaways include:

- Always look for terms that cancel or simplify.
- Find common denominators for combining fractions.
- Reduce fractions to their simplest form for comparison.
- Recognize that multiple expressions can be equivalent if they simplify to the same value.

In conclusion, the original expression's equivalence class includes all fractions that reduce to $\frac{17}{72}$. This understanding aids in broader mathematical problem-solving and enhances conceptual clarity, fostering a deeper appreciation for the interconnectedness of algebraic expressions.

References

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This long-form analysis underscores the importance of methodical reasoning in mathematics, demonstrating that even complex-looking expressions can often be unraveled through systematic simplification.

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