Simplify Each Expression. Rationalize All Denominators.2(50+7)

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Understanding how to simplify algebraic expressions and rationalize denominators is fundamental in mathematics, especially in algebra and calculus. The problem titled "Simplify Each Expression. Rationalize All Denominators.2(50+7)" combines these concepts, requiring careful step-by-step analysis. In this article, we will explore the techniques involved, break down the problem into manageable parts, and demonstrate the process of simplifying expressions and rationalizing denominators with detailed explanations.

Understanding the Components of the Problem

Breaking Down the Expression

The expression provided, "2(50+7)", is straightforward but needs to be evaluated first before proceeding to rationalization or further simplification. It involves:
- A coefficient, 2
- An addition within parentheses, 50 + 7

Key Concepts to Review

Before solving, it's essential to review some core concepts:
- Simplification of algebraic expressions
- Rationalization of denominators
- Handling complex fractions or expressions involving radicals

Step 1: Simplify the Basic Expression

Evaluate 2(50+7)

The first step is to compute the value of the expression:
- Simplify inside the parentheses: 50 + 7 = 57

- Multiply by 2: $2 \times 57 = 114$

Thus, the simplified value of the expression is 114.

Note: If the problem involves more complex expressions, such as fractions with radicals in the denominator, further steps are needed for rationalization.

Step 2: Interpreting the Full Problem

Given the initial instructions, it appears that the problem might involve rationalizing denominators within a broader set of expressions. Since the original question is somewhat ambiguous, we will consider common scenarios such as:

- Simplifying a fraction like \(\frac{1}{\sqrt{a}}\)
- Rationalizing denominators in more complex fractions
- Simplifying algebraic expressions involving radicals or fractions

If the problem solely involves the evaluation \(2(50+7)\), then the answer is simply 114. However, if the task involves rationalizing denominators in more complex expressions, the following sections will guide through those processes.

Step 3: Rationalizing Denominators — General Principles

What Does Rationalization Mean?

Rationalization is the process of eliminating radicals (square roots, cube roots, etc.) from the denominator of a fraction. This simplifies the expression and makes it easier to interpret or further manipulate.

Common Strategies for Rationalization

- For single radicals in the denominator: multiply numerator and denominator by the radical itself
- For conjugates (binomials involving radicals): multiply numerator and denominator by the conjugate to eliminate radicals from the denominator
- For higher roots: multiply numerator and denominator by an expression that will clear the radical

Step 4: Examples of Rationalizing Denominators

Example 1: Rationalize $\frac{1}{\sqrt{a}}$

- Multiply numerator and denominator by $\sqrt{a}$:

$$
\frac{1}{\sqrt{a}} \times \frac{\sqrt{a}}{\sqrt{a}} = \frac{\sqrt{a}}{a}
$$

- Result: $\frac{\sqrt{a}}{a}$

Example 2: Rationalize $\frac{3}{5 + \sqrt{2}}$

- Multiply numerator and denominator by the conjugate of the denominator, $5 - \sqrt{2}$:

$$
\frac{3}{5 + \sqrt{2}} \times \frac{5 - \sqrt{2}}{5 - \sqrt{2}} = \frac{3(5 - \sqrt{2})}{(5 + \sqrt{2})(5 - \sqrt{2})}
$$

- Simplify the denominator using the difference of squares:

$$
(5)^2 - (\sqrt{2})^2 = 25 - 2 = 23
$$

- Expand numerator:

$$
3(5 - \sqrt{2}) = 15 - 3\sqrt{2}
$$

- Final expression:

$$
\frac{15 - 3\sqrt{2}}{23}
$$

Step 5: Applying These Principles to the Given Expression

Since the initial expression simplifies to 114, if the problem involves rationalizing denominators of a related expression, then the steps depend on the specific form. For example, if the original problem involved an expression like:

$$
\frac{2(50+7)}{\sqrt{3}}
$$

then the steps would be:

- Simplify numerator:

$$
2(50+7) = 114
$$

- Write the entire expression:

$$
\frac{114}{\sqrt{3}}
$$

- Rationalize the denominator:

$$
\frac{114}{\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}} = \frac{114 \sqrt{3}}{3} = 38 \sqrt{3}
$$

Thus, the simplified and rationalized form is $38\sqrt{3}$.

Note: Without the specific form of the original expression requiring rationalization, these steps serve as a general guide.

Step 6: Summary of Procedures

To effectively simplify expressions and rationalize denominators, follow these key steps:

- **Simplify inside parentheses:** Perform addition, subtraction, multiplication, or division as needed.
- **Evaluate constants:** Carry out multiplication or division to reduce the expression.
- **Identify radicals or complex fractions:** Detect where radicals are in denominators or numerators.
- **Apply rationalization techniques:** Multiply numerator and denominator by conjugates or radicals to eliminate radicals from denominators.
- **Simplify the resulting expression:** Combine like terms and reduce fractions where possible.

Conclusion: Putting It All Together

The phrase "Simplify Each Expression. Rationalize All Denominators.2(50+7)" combines basic arithmetic, algebraic simplification, and rationalization techniques. The initial evaluation of \(2(50+7)\) yields 114, which is a straightforward calculation. However, the broader context of rationalizing denominators often involves more complex algebraic expressions with radicals or conjugates.

Key takeaways include:
- Always start by simplifying the innermost expressions.
- Know the properties of radicals and how to manipulate them.
- Use conjugates to rationalize denominators involving radicals.
- Simplify the final expression to its simplest form for clarity.

Mastering these techniques is essential for progressing in algebra, calculus, and higher-level mathematics. Practice with various types of expressions to develop fluency and confidence in simplifying and rationalizing mathematical expressions effectively.

Frequently Asked Questions

What is the first step to simplify the expression 2(50+7)?

The first step is to apply the distributive property by multiplying 2 with each term inside the parentheses: 2 × 50 and 2 × 7.

How do you simplify 2(50+7) after applying the distributive property?

You multiply 2 by 50 to get 100, and 2 by 7 to get 14, resulting in 100 + 14.

Is there any denominator to rationalize in the expression 2(50+7)?

No, in the expression 2(50+7), there is no denominator to rationalize since it is a simplified sum, not a fraction.

What is the simplified form of 2(50+7)?

After distributing, the expression simplifies to 100 + 14, which equals 114.

Can you explain why rationalizing denominators is not needed in this problem?

Because the expression 2(50+7) results in a whole number after simplification and contains no fractions with radicals in the denominator.

How would you write the final simplified expression as a single number?

Combine the terms to get 114, which is the final simplified value of the expression.

Additional Resources

Simplify Each Expression. Rationalize All Denominators.2(50+7)

When tackling mathematical expressions, especially those involving algebraic or fractional components, the principles of simplification and rationalization are fundamental tools for clarity and correctness. The phrase "Simplify Each Expression. Rationalize All Denominators. 2(50+7)" encapsulates a common set of steps students and professionals often use to clarify complex expressions and prepare them for further analysis or calculation. In this comprehensive guide, we will delve into the process of simplifying expressions, rationalizing denominators, and applying these techniques to the specific example provided—namely, the expression `2(50+7)`—to ensure a thorough understanding and mastery of these essential mathematical skills.

Understanding the Key Concepts

Before proceeding with the specific problem, it’s important to define some core concepts:

Simplification of Expressions

Simplification involves rewriting an expression in its most straightforward form. This can include combining like terms, reducing fractions, or performing operations to make the expression easier to interpret and evaluate.

Rationalizing Denominators

Rationalizing the denominator is a process used to eliminate irrational numbers (like square roots) or complex expressions from the denominator of a fraction. This step often makes the expression more suitable for further calculations and aligns with conventional mathematical notation.

Breaking Down the Expression: `2(50+7)`

Let's start with the given expression:

`2(50+7)`

Step 1: Simplify Inside the Parentheses

The first step is to perform the addition inside the parentheses:

- 50 + 7 = 57

So, the expression simplifies to:

`2 57`

Step 2: Multiply

Next, multiply 2 by 57:

- 2 57 = 114

Result: The simplified form of the expression is 114.

Applying the Principles to More Complex Expressions

While the expression `2(50+7)` simplifies straightforwardly to 114, the initial prompt emphasizes "Simplify Each Expression" and "Rationalize All Denominators", which are more relevant in more complex contexts. Let’s explore these techniques step-by-step, illustrating their application with examples.

Step-by-Step Guide to Simplify and Rationalize

1. Simplifying Algebraic Expressions

Example:

Simplify the expression:

`(3x + 6) / (2x + 4)`

Procedure:

- Factor numerator and denominator where possible:

- Numerator: $3x + 6 = 3(x + 2)$
- Denominator: $2x + 4 = 2(x + 2)$

- Rewrite the fraction:

`3(x + 2) / 2(x + 2)`

- Cancel common factors:

`(x + 2)` cancels out:

`3 / 2`

Final simplified form: 3/2

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2. Rationalizing Denominators with Radicals

Example:

Simplify:

`1 / √3`

Procedure:

- Multiply numerator and denominator by $\sqrt{3}$:

$(1 / \sqrt{3}) (\sqrt{3} / \sqrt{3}) = \sqrt{3} / (\sqrt{3}\sqrt{3}) = \sqrt{3} / 3$

Result: $\sqrt{3} / 3$

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3. Rationalizing Denominators with Binomials

Example:

Simplify:

$1 / (a + \sqrt{b})$

Procedure:

- Multiply numerator and denominator by the conjugate $(a - \sqrt{b})$:

$(1 / (a + \sqrt{b})) ((a - \sqrt{b}) / (a - \sqrt{b})) = (a - \sqrt{b}) / ((a + \sqrt{b})(a - \sqrt{b}))$

- Expand the denominator:

$(a)^2 - (\sqrt{b})^2 = a^2 - b$

- Final expression:

$(a - \sqrt{b}) / (a^2 - b)$

Applying These Techniques to the Given Expression

While $2(50+7)$ doesn't require rationalization, suppose you encounter a more complex expression involving radicals or fractions, such as:

$(5 / (3 + \sqrt{2}))$

Step 1: Rationalize the denominator:

- Multiply numerator and denominator by the conjugate $(3 - \sqrt{2})$:

$(5 / (3 + \sqrt{2})) ((3 - \sqrt{2}) / (3 - \sqrt{2})) = 5(3 - \sqrt{2}) / ((3 + \sqrt{2})(3 - \sqrt{2}))$

Step 2: Simplify the denominator:

- $(3)^2 - (\sqrt{2})^2 = 9 - 2 = 7$

Step 3: Write the simplified form:

$(5(3 - \sqrt{2})) / 7 = (15 - 5\sqrt{2}) / 7$

Result: The rationalized and simplified form is $(15 - 5\sqrt{2}) / 7$

Summary of Key Steps

Step	Description	Example/Note	
Simplify inside parentheses	Perform addition/subtraction/multiplication as needed	$50 + 7 = 57$	
Multiply out expressions	Use distributive property	$2 57 = 114$	
Factor numerator and denominator	Find common factors for cancellation	$3(x + 2) / 2(x + 2)$	
Rationalize denominators	Remove radicals or complex expressions	Multiply numerator and denominator by conjugate	
Simplify radicals	Use radical properties to simplify	$\sqrt{3} / 3$ or $(15 - 5\sqrt{2}) / 7$	

Final Tips for Mastery

- Always look for common factors to simplify fractions.
- When radicals appear in denominators, multiply numerator and denominator by the conjugate to rationalize.
- Keep expressions in simplest form for clarity and ease of computation.
- Practice with a variety of problems to become fluent in these techniques.

Conclusion

The phrase "Simplify Each Expression. Rationalize All Denominators. 2(50+7)" serves as a reminder of the essential steps in simplifying algebraic and fractional expressions. While the specific example $2(50+7)$ simplifies directly to 114, the principles behind it—simplification, factoring, and rationalization—are crucial skills in mathematics. Mastering these techniques allows you to handle complex expressions confidently, ensuring accuracy and clarity in your calculations. With practice, these methods become second nature, empowering you to approach even the most challenging problems with mathematical precision and confidence.

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