

Find The Sum Of 3 Square Root Of 3 And 3 Square Root Of 12 In Simplest Form. Also, Determine Whether

Find The Sum Of 3 Square Root Of 3 And 3 Square Root Of 12 In Simplest Form. Also, Determine Whether this mathematical expression can be simplified further and analyze the steps involved in simplifying radical expressions. Understanding how to work with square roots and simplifying radical expressions is fundamental in algebra and higher mathematics. This article provides a comprehensive guide to simplifying the expression $3\sqrt{3} + 3\sqrt{12}$, discusses how to verify the simplest form, and explores related concepts to enhance your mathematical proficiency.

Understanding the Components of the Expression

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

- $3\sqrt{3}$: This is three times the square root of 3.
- $3\sqrt{12}$: This is three times the square root of 12.

Both involve radical expressions, which are roots of numbers. The goal is to combine these terms if possible, or at least simplify each component to its simplest form for easier addition.

Breaking Down the Radicals

To simplify the expression $3\sqrt{3} + 3\sqrt{12}$, start by focusing on simplifying the radical $\sqrt{12}$, as $\sqrt{3}$ is

already in its simplest radical form.

Simplifying $\sqrt{12}$

Recall that $\sqrt{12}$ can be simplified by factoring 12 into its prime factors:

$$- 12 = 2 \times 2 \times 3 = 2^2 \times 3$$

Using the property of square roots:

$$- \sqrt{(a \times b)} = \sqrt{a} \times \sqrt{b}$$

Apply this to $\sqrt{12}$:

$$- \sqrt{12} = \sqrt{(2^2 \times 3)} = \sqrt{(2^2)} \times \sqrt{3} = 2 \times \sqrt{3}$$

Therefore, $\sqrt{12}$ simplifies to $2\sqrt{3}$.

Rewriting the original expression

Now, replace $\sqrt{12}$ in the original expression with its simplified form:

$$- 3\sqrt{3} + 3\sqrt{12} = 3\sqrt{3} + 3 \times (2\sqrt{3})$$

Calculate the second term:

$$- 3 \times 2\sqrt{3} = (3 \times 2) \times \sqrt{3} = 6\sqrt{3}$$

So, the expression becomes:

$$- 3\sqrt{3} + 6\sqrt{3}$$

Combining Like Terms

Since both terms are multiples of $\sqrt{3}$, they are like terms and can be combined:

$$- 3\sqrt{3} + 6\sqrt{3} = (3 + 6)\sqrt{3} = 9\sqrt{3}$$

Final Simplified Form

The sum of $3\sqrt{3}$ and $3\sqrt{12}$ in simplest form is:

$$9\sqrt{3}$$

This is the most simplified radical form because:

- $\sqrt{3}$ is already simplified.
- The coefficients (9) are combined.
- No further simplification is possible since 9 and $\sqrt{3}$ share no common factors that can be factored out under a radical.

Verification: Is $9\sqrt{3}$ in Simplest Form?

To verify that the final expression is in simplest form, consider:

- The radical $\sqrt{3}$ cannot be simplified further because 3 is prime.
- The coefficient 9 is an integer and cannot be combined with the radical in any further meaningful

way.

Thus, $9\sqrt{3}$ is indeed the simplest form of the expression.

Additional Concepts and Related Topics

Understanding the process used here can be applied to various similar problems. Below are some related concepts:

1. Simplifying Radical Expressions

- Factor the number under the radical into prime factors.
- Use the property $\sqrt{a \times b} = \sqrt{a} \times \sqrt{b}$.
- Extract perfect squares outside the radical where possible.

2. Combining Like Radicals

- Like radicals have the same radicand (the number inside the radical).
- Combine their coefficients by addition or subtraction.

3. Rationalizing Denominators

- When radicals appear in the denominator, multiply numerator and denominator by the radical conjugate to rationalize.

Practical Applications of Simplifying Radicals

Radical simplification is vital in various fields:

- Engineering: Simplifying expressions in circuit analysis.
- Physics: Calculating distances, velocities, and other quantities involving roots.
- Mathematics: Solving quadratic equations and simplifying algebraic expressions.

Summary and Key Takeaways

- To simplify $3\sqrt{3} + 3\sqrt{12}$, first simplify $\sqrt{12}$ to $2\sqrt{3}$.
- Rewrite the expression: $3\sqrt{3} + 6\sqrt{3}$.
- Combine like terms: $(3 + 6)\sqrt{3} = 9\sqrt{3}$.
- The final, simplest form is $9\sqrt{3}$.
- Always check if radicals can be simplified further by factoring.

Conclusion

Simplifying radical expressions is a fundamental skill in algebra that enhances problem-solving efficiency and mathematical understanding. The process involves recognizing perfect squares, factoring radicals, and combining like terms. In the example of $3\sqrt{3} + 3\sqrt{12}$, the key step was simplifying $\sqrt{12}$ to $2\sqrt{3}$, allowing for the straightforward addition of like terms. The final answer, $9\sqrt{3}$, is in its simplest radical form, and understanding this process can be applied to countless other mathematical problems involving radicals.

Whether you're preparing for exams, solving real-world problems, or expanding your mathematical knowledge, mastering the art of simplifying radicals and combining like terms is essential. Keep

practicing with different expressions to become more comfortable navigating the intricacies of radical algebra!

Frequently Asked Questions

What is the sum of $3\sqrt{3}$ and $3\sqrt{12}$ in simplest form?

The sum of $3\sqrt{3}$ and $3\sqrt{12}$ simplifies to $12\sqrt{3}$.

How do you simplify the expression $3\sqrt{12}$ in terms of simplest radical form?

Since $\sqrt{12} = \sqrt{4 \times 3} = 2\sqrt{3}$, then $3\sqrt{12} = 3 \times 2\sqrt{3} = 6\sqrt{3}$.

What is the combined simplified form of $3\sqrt{3} + 6\sqrt{3}$?

Adding the like terms gives $3\sqrt{3} + 6\sqrt{3} = 9\sqrt{3}$.

Is the sum $9\sqrt{3}$ a simplified radical expression?

Yes, $9\sqrt{3}$ is in simplest form because 9 is a coefficient and $\sqrt{3}$ is simplified.

Can the sum $12\sqrt{3}$ be simplified further?

No, $12\sqrt{3}$ is already in simplest form because 12 is a coefficient and $\sqrt{3}$ is simplified.

Determine whether the sum of $3\sqrt{3}$ and $3\sqrt{12}$ is a rational or irrational number.

The sum is irrational because $\sqrt{3}$ is irrational, and multiplying it by integers does not make it rational.

What is the final answer for the sum of $3\sqrt{3}$ and $3\sqrt{12}$ in simplest form?

The sum in simplest form is $9\sqrt{3}$.

Is the process of combining radicals like $3\sqrt{3}$ and $3\sqrt{12}$ valid only when the radicals are the same?

Yes, radicals can only be combined directly when they have the same radicand; otherwise, they must be simplified or expressed separately.

Additional Resources

Find The Sum Of 3 Square Root Of 3 And 3 Square Root Of 12 In Simplest Form is a mathematical problem that combines basic operations with radical expressions. This type of problem is common in algebra and helps develop a deeper understanding of simplifying radicals and combining like terms. When dealing with such expressions, the core skill involved is simplifying radicals into their simplest form and then performing addition or subtraction as required. This article will guide you through the process of solving this problem step by step, explain the underlying concepts, and discuss how to determine whether additional conditions or questions are involved, such as whether the result meets certain criteria or comparisons.

Understanding the Components of the Problem

Before diving into the calculations, it is essential to understand what each part of the expression means:

- 3 Square Root of 3: This is written mathematically as $3\sqrt{3}$. It signifies three times the square root of 3.
- 3 Square Root of 12: Similarly, this is $3\sqrt{12}$, which means three times the square root of 12.

The goal is to find the sum of these two expressions in their simplest form, which involves simplifying radicals where possible, and then combining the terms.

Simplifying Radicals

Radicals, or roots, can often be simplified by factoring out perfect squares from under the radical sign.

Simplifying $\sqrt{12}$

Let's analyze $\sqrt{12}$:

- 12 can be factored as 4×3 .
- Since 4 is a perfect square, $\sqrt{12} = \sqrt{4 \times 3}$.
- Using the property $\sqrt{a \times b} = \sqrt{a} \times \sqrt{b}$, we get:

$$\sqrt{12} = \sqrt{4} \times \sqrt{3} = 2\sqrt{3}.$$

Result: $\sqrt{12} = 2\sqrt{3}$.

This simplification is a crucial step because it allows us to express radicals with the same radicand ($\sqrt{3}$), making it easier to combine the terms.

Expressing Both Terms with Simplified Radicals

Now, rewrite the original expressions using the simplified radical:

- $3\sqrt{3}$ remains as is.

- $3\sqrt{12} = 3 \times 2\sqrt{3} = 6\sqrt{3}$.

Note: The second term is now expressed as $6\sqrt{3}$.

Combining Like Terms

Since both expressions involve $\sqrt{3}$, which is the same radical, they can be combined by adding their coefficients:

$$3\sqrt{3} + 6\sqrt{3} = (3 + 6)\sqrt{3} = 9\sqrt{3}$$

Result: The sum of $3\sqrt{3}$ and $3\sqrt{12}$ simplifies to $9\sqrt{3}$.

Final Answer and Interpretation

The sum in simplest form is:

$$\boxed{9\sqrt{3}}.$$

This expression is fully simplified because:

- The radical $\sqrt{3}$ is in its simplest form (no perfect square factors other than 1).
- The coefficients are combined into a single term.

Additional Considerations: Is There More to the Question?

The title suggests an additional phrase: "Also, Determine Whether". This implies that after finding the sum, there might be an additional condition or comparison to analyze.

Possible scenarios include:

- Comparing the sum to a specific value: For example, "Determine whether $9\sqrt{3}$ is greater than 20."
- Checking if the sum is an integer, rational, or irrational.
- Verifying if the sum meets certain criteria related to other algebraic expressions.

How to approach such conditions:

- Evaluate approximate decimal value: Since $\sqrt{3} \approx 1.732$,

$$9 \times 1.732 \approx 15.588.$$

- Determine inequality: For example, is $9\sqrt{3} > 20$?

Since $15.588 < 20$, the answer is no.

Pros and Cons of Approximate Evaluation:

Pros:

- Quick estimation for comparisons.
- Useful when exact radical form isn't necessary.

Cons:

- Approximate values may introduce rounding errors.
- Exact equality or inequality requires symbolic manipulation.

Features and Benefits of Simplifying Radicals

Features:

- Simplifies complex radical expressions into manageable forms.
- Reveals common factors enabling combination of like terms.
- Enhances understanding of underlying algebraic structures.

Benefits:

- Facilitates easier computation.
- Enables straightforward comparison of expressions.
- Prepares expressions for further algebraic operations like factoring or solving equations.

Summary of Key Steps in the Solution

1. Identify radicals and their coefficients: Recognize $(3\sqrt{3})$ and $(3\sqrt{12})$.
2. Simplify radicals: Factor 12 into (4×3) , then simplify to $(2\sqrt{3})$.
3. Rewrite the expressions: Convert $(3\sqrt{12})$ to $(6\sqrt{3})$.
4. Combine like terms: Add the coefficients to get $(9\sqrt{3})$.
5. Interpret the result: The sum is $(9\sqrt{3})$, fully simplified.

Conclusion

The problem of finding the sum of $(3\sqrt{3})$ and $(3\sqrt{12})$ demonstrates essential skills in radical simplification and algebraic combination. By breaking down radicals into their simplest form and combining like terms, we arrive at a concise, simplified result: $(9\sqrt{3})$. Depending on the context, further steps might include numerical approximation or comparison to other values to "Determine whether" certain conditions are met. Mastery of these techniques is fundamental for solving more complex algebraic problems and enhances overall mathematical fluency.

Additional Tips for Students

- Always look for perfect squares inside radicals to simplify expressions.
- When combining radicals, ensure they have the same radicand.
- Use approximation only when necessary; for exact answers, keep radicals in simplified radical form.
- Practice similar problems to become comfortable with radical simplification and combination.

In summary, mastering the process of simplifying radicals and combining like terms not only helps in solving specific problems like this but also builds a strong foundation for advanced algebra, calculus, and other higher-level mathematics topics.

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