Simplify 1.Cube Root Of 125 Subtract Square Root Of A Quarter 2. 1/2+1/4(1/3-1/4)3.(-5)-(-8)-(-7)-(+2)

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Understanding the Expression

The given expression is a complex mathematical problem involving various operations such as roots, fractions, and arithmetic with negative and positive numbers. To approach this systematically, we need to break down the expression into manageable parts.

The expression reads:

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At first glance, it appears to be a sequence of operations, possibly with some formatting ambiguities. For clarity, let's interpret it as the following expression:

$(\sqrt[3]{125}) - \sqrt{(1/4)} + 1/2 + 1/4(1/3 - 1/4)\ 3 + (-5) - (-8) - (-7) + (+2)$

Step-by-Step Breakdown of the Expression

1. Cube Root of 125

The cube root of 125 is a common mathematical value:

- $125 = 5^3$
- Therefore, $\sqrt[3]{125} = 5$

2. Square Root of A Quarter

- A quarter is ¼
- The square root of ¼ is $\sqrt{(1/4)} = 1/2$

3. Simplify the Remaining Terms

The rest of the expression involves:

- ½ (which is ½)
- ¼(1/3 - 1/4) 3
- -5
- -(-8)
- -(-7)
- +2

Let's analyze each component.

Calculating Each Part

3.1. Evaluate ¼(1/3 - 1/4)

- First, compute (1/3 - 1/4):

Find common denominator: 12

- 1/3 = 4/12
- 1/4 = 3/12

Subtract:

4/12 - 3/12 = 1/12

Now, multiply by ¼:

¼ 1/12 = (1/4) (1/12) = 1/48

3.2. Multiply by 3

- 1/48 3 = 3/48 = 1/16

3.3. Summarize the parts so far

Now, let's write out all components:

- Cube root of 125: 5
- Square root of ¼: ½
- The term ¼(1/3 - 1/4)3: 1/16

Remaining terms:

- ½ (from earlier)
- 1/16 (from above)
- -5
- -(-8)
- -(-7)
- +2

Combining the Components

4. Combine the numerical values

Let's list all the values:

- 5 (cube root of 125)
- - ½ (square root of ¼)
- + ½ (standalone)
- + 1/16 (from earlier)
- - 5
- - (-8) → +8
- - (-7) → +7
- + 2

Now, sum all these.

Performing the Final Calculation

5. Sum all terms

Start with:

- 5
- Subtract ½
- Add ½

- Add 1/16
- Subtract 5
- Add 8
- Add 7
- Add 2

Let's handle step-by-step:

1. 5 - ½ + ½ = 5 + (- ½ + ½) = 5 + 0 = 5

2. Add 1/16:

- 5 + 1/16 = (80/16) + (1/16) = 81/16

3. Subtract 5:

- 81/16 - 5

- 5 = 80/16

- So, 81/16 - 80/16 = 1/16

4. Add 8:

- 1/16 + 8 = 8 + 1/16 = (128/16) + (1/16) = 129/16

5. Add 7:

- 129/16 + 7

- 7 = 112/16

- Total: 129/16 + 112/16 = 241/16

6. Add 2:

- 2 = 32/16

- Total: 241/16 + 32/16 = (241 + 32)/16 = 273/16

Final Result

The simplified value of the entire expression is:

273/16

Expressed as a mixed number:

- $273 \div 16 = 17$ with a remainder of 1

- So, 17 1/16

Summary of the Simplification Process

1. Identified key components: cube root, square root, fractions, and arithmetic operations.
2. Calculated roots: $\sqrt[3]{125} = 5$ and $\sqrt{1/4} = 1/2$.
3. Simplified fractional parts: $(1/3 - 1/4) = 1/12$, then multiplied by $1/4$ and 3 to get $1/16$.
4. Combined like terms carefully, respecting the order of operations.
5. Converted all terms into a common denominator (16) for easy addition and subtraction.
6. Performed the arithmetic step-by-step, arriving at the final value of 273/16 or 17 1/16.

Importance of Systematic Approach in Mathematical Simplification

When faced with complex expressions, a structured approach is essential. Breaking down the problem into smaller parts, calculating each term individually, and then combining results reduces errors and enhances understanding. This methodology is widely applicable in various fields such as engineering, physics, and computer science, where complex calculations are common.

Practical Applications of Such Calculations

Understanding how to simplify expressions like this one is fundamental in many real-world scenarios:

- Engineering Design: Calculations involving roots and fractions are common when dealing with material properties or signal processing.
- Financial Mathematics: Roots and fractions are used in interest rate calculations and risk assessments.
- Computer Programming: Algorithms often require the simplification of mathematical expressions for efficiency and accuracy.
- Educational Purposes: Developing problem-solving skills and understanding mathematical operations.

Conclusion

The comprehensive simplification of the expression "Cube Root of 125 minus Square Root of A Quarter plus various fractions and integers" demonstrates the importance of methodical problem-solving. By systematically evaluating each component—starting from roots, moving through fractional calculations, and culminating in combining all terms—the final answer of 273/16 (or 17 1/16) was obtained. Mastery of such techniques not only enhances mathematical proficiency but also prepares learners for tackling complex problems across diverse disciplines.

Remember: When simplifying complex expressions, always follow the order of operations (PEMDAS/BODMAS), break the problem into parts, convert all fractions to common denominators for easy calculation, and carefully handle positive and negative signs to arrive at accurate results.

Frequently Asked Questions

How do you simplify the cube root of 125?

Since 125 is a perfect cube, its cube root is 5 because 5 × 5 × 5 = 125.

What is the value of the square root of a quarter?

The square root of a quarter (¼) is ½ because $(½)^2$ = ¼.

How do you simplify the expression 1/2 + 1/4 (1/3 - 1/4)?

First, compute inside the parentheses: 1/3 - 1/4 = 4/12 - 3/12 = 1/12. Then, multiply 1/4 by 1/12: 1/4 × 1/12 = 1/48. Finally, add 1/2 + 1/48: convert 1/2 to 24/48, so total is 24/48 + 1/48 = 25/48.

What is the result of simplifying -5 - (-8) - (-7) + 2?

Simplify step-by-step: -5 + 8 + 7 + 2 = (3) + 7 + 2 = 10.

What is the overall value when simplifying all parts of the expression: cube root of 125 minus square root of a quarter, plus 1/2 + 1/4(1/3 - 1/4), minus 5 - (-8) - (-7) + 2?

Calculate each part: cube root of 125 = 5; square root of ¼ = ½; sum = 5 - ½ = 4.75. The second part, as above, is 25/48. The third part simplifies to 10. Combining all: 4.75 + 25/48 + 10, which is approximately 14.77 when expressed as a decimal.

Additional Resources

Comprehensive Analysis and Breakdown of the Expression: Simplify 1.Cube Root of 125 Subtract Square Root of a Quarter 2. 1/2 + 1/4(1/3 - 1/4)3.(-5) - (-8) - (-7) - (+2)

Introduction

Mathematics often involves simplifying complex expressions to reveal their fundamental values. The given expression presents a combination of roots, fractions, and arithmetic operations, requiring careful step-by-step analysis to understand its components and arrive at an accurate solution. This detailed review aims to dissect each part of the expression, clarify the operations involved, and provide a comprehensive understanding of the entire problem.

Understanding the Overall Expression

The expression can be viewed as comprising multiple parts, each involving different mathematical concepts:

1. Cube root of 125 minus square root of a quarter
2. A fractional sum involving nested parentheses and multiplication
3. A sequence of integers with multiple negative signs

The expression appears to be:

> Simplify
> (Cube Root of 125) - (Square Root of ¼)
> + ½ + ¼$(1/3 - 1/4)^3$ + (-5) - (-8) - (-7) - (+2)

Breaking Down the Expression into Components

Let's write the expression more explicitly:

$$
\sqrt[3]{125} - \sqrt{\frac{1}{4}} + \frac{1}{2} + \frac{1}{4} \left(\frac{1}{3} - \frac{1}{4} \right)^3 + (-5) - (-8) - (-7) - (+2)
$$

This form makes it easier to analyze each part separately.

Part 1: Cube Root of 125

Mathematical concept:
The cube root of a number a^3 is a.

Since 125 is a perfect cube (5^3):

$$
\sqrt[3]{125} = 5
$$

Significance:
This is a straightforward calculation, often one of the first steps in simplifying the expression.

Part 2: Square Root of a Quarter

Mathematical concept:
The square root of a fraction involves taking the root of numerator and denominator separately:

$$
\sqrt{\frac{1}{4}} = \frac{\sqrt{1}}{\sqrt{4}} = \frac{1}{2}
$$

Significance:
This simplifies to a common fraction, which will be subtracted from the cube root component in the overall expression.

Part 3: The Sum of 1/2 and the Fractional Expression

The remaining parts involve more complex calculations:

$$
\frac{1}{2} + \frac{1}{4} \left(\frac{1}{3} - \frac{1}{4} \right)^3
$$

Sub-part 3.1: Simplify the parentheses

Calculate $\frac{1}{3} - \frac{1}{4}$:

- Common denominator: 12
- $\frac{4}{12} - \frac{3}{12} = \frac{1}{12}$

Sub-part 3.2: Cube this difference

$$
\left(\frac{1}{12} \right)^3 = \frac{1}{12^3} = \frac{1}{1728}
$$

Sub-part 3.3: Multiply by 1/4

$$
\frac{1}{4} \times \frac{1}{1728} = \frac{1}{4 \times 1728} = \frac{1}{6912}
$$

\]

Sub-part 3.4: Add 1/2 to this term

\[
\frac{1}{2} + \frac{1}{6912}
\]

To add these:

- Convert \(\frac{1}{2}\) to denominator 6912:

\[
\frac{1}{2} = \frac{3456}{6912}
\]

- Now, sum:

\[
\frac{3456}{6912} + \frac{1}{6912} = \frac{3456 + 1}{6912} = \frac{3457}{6912}
\]

This is the combined value of the fractional sum component.

Part 4: The Sequence of Negative and Positive Integers

The expression involves:

\[
(-5) - (-8) - (-7) - (+2)
\]

The key here is understanding how to handle the negative signs and subtraction:

- Subtracting a negative number is equivalent to adding its positive counterpart.

Let's analyze step-by-step:

1. \(-5 - (-8)\):

\[
-5 + 8 = 3
\]

2. Now, subtract \(-7\):

\[
3 - (-7) = 3 + 7 = 10
\]

3. Finally, subtract $+2$:

$$
10 - 2 = 8
$$

Summary of this part: The entire sequence simplifies to 8.

Final Assembly of the Expression

Now, combining all parts:

$$
\text{Part 1} - \text{Part 2} + \text{Part 3} + \text{Part 4}
$$

which translates to:

$$
5 - \frac{1}{2} + \frac{3457}{6912} + 8
$$

Simplification of the Entire Expression

Let's proceed step-by-step:

1. Combine 5 and 8:

$$
5 + 8 = 13
$$

2. Express $\frac{1}{2}$ with denominator 6912:

$$
\frac{1}{2} = \frac{3456}{6912}
$$

3. Express 13 as denominator 6912:

$$
13 = \frac{13 \times 6912}{6912} = \frac{89936}{6912}
$$

4. Combine all fractions:

$$

\frac{89936}{6912} - \frac{3456}{6912} + \frac{3457}{6912}
\]

- Sum numerator:

\[
89936 - 3456 + 3457 = 89936 + (3457 - 3456) = 89936 + 1 = 89937
\]

- Final fraction:

\[
\frac{89937}{6912}
\]

Final Result:

\[
\boxed{\frac{89937}{6912}}
\]

This is an exact improper fraction representation of the simplified value of the entire expression.

Additional Insights and Context

Practical significance:

- Expressions involving roots and fractions are common in algebra, calculus, and applied mathematics.
- Understanding how to manipulate roots, negative signs, and nested parentheses is crucial for solving complex problems efficiently.
- Converting to common denominators simplifies fractional operations and ensures accuracy.

Common mistakes to avoid:

- Misinterpreting nested parentheses or the order of operations.
- Forgetting that subtracting a negative number results in addition.
- Failing to reduce roots correctly or miscalculating exponents.

Potential extensions:

- Approximating the decimal value:
\(\frac{89937}{6912} \approx 13.01\), which can be useful for practical estimations.
- Expressing as a mixed number:
Since \(89937 ÷ 6912 \approx 13\) with a remainder, it can be written as:

\[

13 + \frac{89937 - (13 \times 6912)}{6912}
\]

Calculating the remainder:

\[
13 \times 6912 = 89936
\]

Remainder:

\[
89937 - 89936 = 1
\]

So,

\[
\boxed{13 \frac{1}{6912}}
\]

which is a mixed number form.

Conclusion

This detailed review has illustrated the importance of methodical decomposition when tackling complex mathematical expressions. By systematically analyzing roots, fractions, negative signs, and nested operations, we arrive at an exact simplified form: \(\frac{89937}{6912}\), or approximately 13.01. Mastery of such techniques enhances problem-solving skills in algebra and beyond, fostering a deeper understanding of the interconnectedness of mathematical concepts.

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