

How To Evaluate $2(\sqrt{80/5-5})$

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Evaluating complex mathematical expressions can sometimes seem daunting, but with a systematic approach, it becomes much more manageable. One such expression that often appears in algebra and arithmetic problems is $2(\sqrt{80/5-5})$. If you're wondering how to evaluate this expression step-by-step, you're in the right place. In this article, we'll break down the process into clear, logical steps, ensuring you understand each part of the calculation. Whether you're a student brushing up on your math skills or someone looking to improve problem-solving techniques, this guide will help you master evaluating expressions like $2(\sqrt{80/5-5})$.

Understanding the Expression

Before diving into calculations, it's essential to understand the components of the expression:

- 2: A constant multiplier.
- $\sqrt{\quad}$: The square root function ($\sqrt{\quad}$), which finds the non-negative root of a number.
- $80/5-5$: The expression inside the square root, involving division and subtraction.

The expression can be written as:

$$2 \times \sqrt{\frac{80}{5} - 5}$$

Our goal is to evaluate this expression step-by-step, following the order of operations (PEMDAS/BODMAS).

Step-by-Step Guide to Evaluate the Expression

Step 1: Simplify Inside the Square Root

The first step is to evaluate the expression inside the square root:

$$\sqrt{\frac{80}{5} - 5}$$

1. Division inside the numerator: $(80 \div 5)$
2. Subtraction: Subtract 5 from the result of division.

Step 2: Calculate the Division $\sqrt{(80/5)}$

Perform the division:

$$\sqrt{80 \div 5 = 16}$$

Now, the expression inside the square root simplifies to:

$$\sqrt{16 - 5}$$

Step 3: Complete the Subtraction $\sqrt{(16 - 5)}$

Perform the subtraction:

$$\sqrt{16 - 5 = 11}$$

Now, our expression inside the square root is:

$$\sqrt{\sqrt{11}}$$

Step 4: Calculate the Square Root $\sqrt{\sqrt{11}}$

The square root of 11 is an irrational number, approximately:

$$\sqrt{\sqrt{11}} \approx 3.3166$$

(rounded to four decimal places)

Step 5: Multiply by 2

Recall the original expression:

$$\sqrt[2]{\frac{80}{5} - 5}$$

which simplifies to:

$$\sqrt{11}$$

Using the approximation:

$$\sqrt{11} \approx 3.3166$$

So, the evaluated value of the expression is approximately 6.6332.

Additional Tips for Evaluating Similar Expressions

1. Follow the Order of Operations

Always remember to perform calculations in the correct order:

- Parentheses/Brackets
- Exponents (Square roots are exponents of 1/2)
- Multiplication and Division (from left to right)
- Addition and Subtraction

This sequence ensures accurate results.

2. Simplify Step-by-Step

Break complex expressions into smaller parts. Handle operations inside parentheses first, then move outward.

3. Use a Calculator Wisely

For square roots and decimal approximations, a calculator helps achieve accuracy. Make sure to use parentheses correctly to avoid order of operation errors.

4. Understand Square Roots and Irrational Numbers

Recognize that $\sqrt{11}$ is irrational. If precision is necessary, use a calculator to approximate. For exact answers, leave the square root in radical form.

5. Practice with Variations

Challenge yourself with similar expressions to build confidence. For example:

- $\sqrt{25} + 3$
- $4 \times \sqrt{49}$
- $\left(\frac{\sqrt{81}}{3}\right)$

Common Mistakes to Avoid

- **Ignoring the order of operations:** Always perform division and subtraction inside parentheses first before applying the square root.
- **Misplacing parentheses:** Parentheses change the calculation order. Be careful when rewriting expressions.
- **Rounding errors:** When approximating square roots, note the number of decimal places required.
- **Forgetting the square root of negative numbers:** In real numbers, you cannot take the square root of a negative value without involving complex numbers.

Conclusion

Evaluating the expression $2(\sqrt{80/5-5})$ involves understanding the order of operations, simplifying inside parentheses, calculating the square root, and then multiplying by 2. The key steps include:

1. Simplify the division $(80/5)$ to get 16.
2. Subtract 5 from 16 to get 11.

3. Find the square root of 11 ($\sqrt{11} \approx 3.3166$).
4. Multiply the result by 2 to arrive at approximately 6.6332.

By following this structured approach, you can confidently evaluate similar mathematical expressions. Remember to take your time, double-check each step, and use a calculator as needed for precision. Mastering these techniques will improve your problem-solving skills and make complex expressions much easier to handle in the future.

Keywords: how to evaluate, mathematical expressions, square root, order of operations, algebra, simplifying expressions, step-by-step calculation

Frequently Asked Questions

How do I simplify the expression $2 (\sqrt{80} / 5 - 5)$?

First, simplify $\sqrt{80}$ to $4\sqrt{5}$, then divide by 5, subtract 5, multiply the result by 2.

What is the value of $\sqrt{80}$ divided by 5?

$\sqrt{80}$ simplifies to $4\sqrt{5}$, so $(4\sqrt{5}) / 5$ is the value of $\sqrt{80}$ divided by 5.

How do I evaluate the entire expression $2 (\sqrt{80} / 5 - 5)$?

Calculate $\sqrt{80}$, divide by 5, subtract 5, then multiply the result by 2 to get the final answer.

Is there a simplified form of the expression $2 (\sqrt{80} / 5 - 5)$?

Yes, simplifying $\sqrt{80}$ to $4\sqrt{5}$, the expression becomes $2 ((4\sqrt{5})/5 - 5)$.

What is the approximate numerical value of $2 (\sqrt{80} / 5 - 5)$?

Approximate $\sqrt{80}$ as 8.944, then compute: $2 ((8.944/5) - 5) \approx 2 (1.789 - 5) \approx 2 (-3.211) \approx -6.422$.

Are there common mistakes to watch out for when

evaluating this expression?

Yes, common mistakes include incorrect simplification of $\sqrt{80}$, misplacing parentheses, or forgetting to distribute the multiplication after subtraction.

Additional Resources

How To Evaluate $2(\sqrt{80/5-5})$: A Step-by-Step Analytical Guide

Mathematics often presents us with expressions that require careful dissection and precise calculation. Among these, expressions involving nested radicals and multiple operations can appear intimidating at first glance. One such example is $2(\sqrt{80/5-5})$. Despite its seeming complexity, this expression can be unraveled systematically through a series of logical steps. This article aims to provide a comprehensive, detailed, and analytical approach to evaluating this expression accurately, breaking down each component and explaining the reasoning behind each step.

Understanding the Expression

Before diving into calculations, it's critical to interpret the expression correctly and understand its structure.

1. Breaking Down the Expression

The given expression is:

$$2 \times \sqrt{\frac{80}{5} - 5}$$

- The outermost operation involves multiplying 2 by the square root of a certain quantity.
- Inside the square root, the expression is $(\frac{80}{5} - 5)$.

2. Recognizing the Components

- Division within the radical: $(\frac{80}{5})$
- Subtraction inside the radical: subtracting 5 from the division result
- Square root operation: applied to the entire quantity inside the radical
- Multiplication: multiplying the square root result by 2

Understanding this structure guides us toward a logical sequence: perform division, then subtraction, then square root, and finally multiplication.

Step-by-Step Evaluation Process

To evaluate the expression accurately, it's essential to follow a systematic process, respecting the order of operations (PEMDAS/BODMAS).

1. Simplify the division $\left(\frac{80}{5}\right)$

The first step is to evaluate the division:

$$\left[\frac{80}{5} = 16\right]$$

This is straightforward as 80 divided by 5 equals 16.

2. Subtract 5 from the division result

Next, subtract 5 from 16:

$$\left[16 - 5 = 11\right]$$

Now, the expression under the radical simplifies to 11.

3. Evaluate the square root of 11

The next step involves calculating $\sqrt{11}$. Since 11 is not a perfect square, the square root will be an irrational number.

- Approximate value: $\sqrt{11} \approx 3.3166$

This approximation provides a practical value for subsequent calculations, but for exactness, we will keep the radical form.

4. Multiply by 2

Finally, multiply the radical by 2:

$$\left[2 \times \sqrt{11} \approx 2 \times 3.3166 = 6.6332\right]$$

This is an approximate numerical value of the entire expression.

Mathematical Rigor: Exact vs. Approximate Values

While the approximate value (~6.6332) is useful for practical purposes, understanding the exact form is vital for mathematical precision.

1. Exact Form

The exact value of the expression is:

```
\[
2 \times \sqrt{11}
\]
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This form preserves the irrational radical and is more precise than the decimal approximation.

2. Rationalization and Simplification

The radical $(\sqrt{11})$ is already in its simplest form since 11 is a prime number and cannot be simplified further. Therefore, the exact expression remains as above.

Common Pitfalls and How to Avoid Them

Evaluating complex expressions requires vigilance to avoid errors. Here are some common pitfalls and strategies to prevent them:

1. Misinterpreting the Expression

- Pitfall: Ignoring parentheses or misreading the order of operations.
- Solution: Carefully identify the grouping symbols. In this case, the entire radical is $(\sqrt{\frac{80}{5} - 5})$. Always perform division and subtraction inside the radical before applying the square root.

2. Ignoring the Order of Operations

- Pitfall: Performing addition/subtraction before division or vice versa.
- Solution: Follow PEMDAS/BODMAS diligently: Parentheses, Exponents, Multiplication/Division, Addition/Subtraction.

3. Approximating Too Early

- Pitfall: Rounding intermediate results too early, leading to cumulative errors.

- Solution: Keep the calculations in exact radical form until the final step, then approximate as needed.

4. Mistakes in Radical Calculation

- Pitfall: Assuming $\sqrt{11}$ is rational or simplifying incorrectly.
- Solution: Recognize that $\sqrt{11}$ is irrational and cannot be simplified further.

Alternative Approaches and Verifications

In mathematical problem-solving, verifying results through alternative methods enhances confidence.

1. Numerical Verification

Using a calculator:

- Compute $\sqrt{80/5} = \sqrt{16}$
- Subtract 5: $\sqrt{16} - 5 = \sqrt{11}$
- Calculate $\sqrt{11} \approx 3.3166$
- Multiply by 2: $2 \times 3.3166 \approx 6.6332$

This confirms the approximate value discussed earlier.

2. Symbolic Verification

Express the value symbolically as:

$$2 \sqrt{11}$$

which remains exact and is preferred in algebraic contexts.

Real-World Applications and Significance

Understanding how to evaluate such expressions is more than an academic exercise; it has practical applications across various fields.

1. Engineering and Physics

- Calculations involving waveforms, oscillations, or physical measurements often involve radicals and multiple operations.
- Accurate evaluation ensures precise modeling and analysis.

2. Computer Science and Algorithms

- Algorithms dealing with geometric computations or probabilistic models may require evaluation of radical expressions.

3. Education and Testing

- Mastering the evaluation of complex expressions enhances problem-solving skills, critical thinking, and mathematical literacy.

Conclusion: Mastery Through Practice and Precision

Evaluating the expression $2(\sqrt{80/5 - 5})$ exemplifies the importance of careful analysis, understanding order of operations, and respecting the properties of radicals. By dissecting each component—from division and subtraction to radical calculation and multiplication—students and practitioners can confidently handle similar expressions, ensuring accuracy and efficiency.

In essence, the process underscores the critical thinking and methodical approach fundamental to mathematics. Whether for academic pursuits, professional applications, or personal curiosity, mastering such evaluations empowers one to approach complex expressions with clarity and confidence.

Summary of steps:

1. Compute $\sqrt{80/5} = \sqrt{16}$.
2. Subtract 5: $\sqrt{16 - 5} = \sqrt{11}$.
3. Evaluate $\sqrt{11} \approx 3.3166$.
4. Multiply by 2: $2 \times \sqrt{11} \approx 6.6332$.

Exact form: $2\sqrt{11}$

By following this structured approach, anyone can confidently evaluate the expression and understand the underlying principles involved.

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