

Simplify Each Expression Using The Correct Order Or Operation The Question Is: $(2 \times (9 - 8))^{24 + 3}$

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When tackling mathematical expressions, understanding how to correctly apply the order of operations is essential to arrive at the right answer. The expression $(2 \times (9 - 8))^{24 + 3}$ may seem straightforward, but without following proper steps, it's easy to make mistakes. This article will guide you through the process of simplifying this expression by applying the correct order of operations, often remembered by the acronym PEMDAS (Parentheses, Exponents, Multiplication and Division, Addition and Subtraction). We will break down each step in detail, explore common pitfalls, and provide tips for solving similar problems efficiently.

Understanding the Order of Operations (PEMDAS)

Before diving into the specific expression, it's important to review the fundamental rules governing mathematical operations.

What is PEMDAS?

PEMDAS stands for:

- Parentheses – Do calculations inside parentheses first.
- Exponents – Handle exponents or powers next.
- Multiplication and Division – From left to right.

- Addition and Subtraction – From left to right.

Following this order ensures consistency and accuracy in mathematical calculations.

Why Is Correct Operation Order Important?

Incorrectly applying these rules can lead to wrong answers. For example, doing addition before multiplication can significantly change the result. Therefore, mastering the order of operations is crucial for correctly simplifying complex expressions like $(2 \times (9 - 8))^{24} + 3$.

Step-by-Step Simplification of the Expression

$$(2 \times (9 - 8))^{24} + 3$$

Let's analyze the expression:

$$(2 \times (9 - 8))^{24} + 3$$

Step 1: Simplify Inside the Parentheses

First, focus on the innermost parentheses:

$$(9 - 8)$$

Since subtraction is straightforward:

$$9 - 8 = 1$$

Now, the expression becomes:

$$(2 \times (1))^{24} + 3$$

Step 2: Simplify Multiplication Inside the Parentheses

Next, evaluate 2×1 :

$$2 \times 1 = 2$$

This simplifies the expression further:

$$(2)^{24} + 3$$

Step 3: Handle the Exponent

Now, apply the exponent:

$$(2)^{24}$$

Compute 2 raised to the 24th power:

$$2^{24} = 16,777,216$$

So, the expression now looks like:

$$16,777,216 + 3$$

Step 4: Final Addition

Finally, perform the addition:

$$16,777,216 + 3 = 16,777,219$$

Final answer: 16,777,219

Key Points to Remember When Simplifying Expressions

To ensure accuracy in similar problems, keep these tips in mind:

1. Always Start with Parentheses

Any calculations inside parentheses should be completed first. Nested parentheses require working from the innermost outward.

2. Address Exponents Next

Once parentheses are simplified, handle any exponents or powers. Remember that exponents apply to the entire expression within their scope.

3. Perform Multiplication and Division from Left to Right

After exponents, do all multiplication and division in order encountered from left to right.

4. Complete Addition and Subtraction Last

Finally, perform all addition and subtraction, again from left to right.

Common Mistakes to Avoid

Even seasoned math students can make errors if they're not careful. Here are some common pitfalls:

- Skipping steps or rushing through calculations, leading to overlooked parentheses or exponents.

- Performing operations out of order, such as adding before multiplying.
- Misreading the expression, especially with nested parentheses or multiple exponents.
- Incorrectly calculating exponents, especially large powers like 2^{24} .

To prevent these mistakes, always write down each step and double-check your work.

Applying These Steps to Similar Problems

Once comfortable with the process, you can apply the same principles to other expressions. For example:

Example 1: Simplify $(3 + 2)^3 - (4 / 2)$

Solution:

1. Parentheses first:

$$- 3 + 2 = 5$$

$$- 4 / 2 = 2$$

2. Exponents:

$$- 5^3 = 125$$

3. Subtract:

$$- 125 - 2 = 123$$

Answer: 123

Example 2: Simplify $5 + 2 \times (8 - 3)^2$

Solution:

1. Parentheses:

$$- 8 - 3 = 5$$

2. Exponent:

$$- 5^2 = 25$$

3. Multiplication:

$$- 2 \times 25 = 50$$

4. Addition:

$$- 5 + 50 = 55$$

Answer: 55

Conclusion: Mastering the Order of Operations

Simplifying expressions like $(2 \times (9 - 8))^2 + 3$ depends heavily on applying the correct order of operations—PEMDAS. By systematically working through parentheses, exponents, multiplication/division, and finally addition/subtraction, you can confidently evaluate even complex expressions.

Remember, practice makes perfect. The more you work through various problems, the more intuitive these steps become. Keep a clear, organized approach, and don't rush — accuracy is more important than speed. With these strategies, you'll be well-equipped to handle a wide range of mathematical expressions and improve your problem-solving skills.

Key Takeaway: Always follow the order: Parentheses → Exponents → Multiplication and Division → Addition and Subtraction to simplify expressions correctly and efficiently.

Frequently Asked Questions

What is the first step to simplify the expression $(2 \times (9-8))^{24} + 3$?

The first step is to evaluate the expression inside the parentheses: $(9-8)$.

After simplifying inside the parentheses, what do we do next in $(2 \times (9-8))^{24} + 3$?

Next, multiply 2 by the result of $(9-8)$, which is 1, so the expression becomes $(2 \times 1)^{24} + 3$.

How do we handle the exponent in the expression $(2 \times 1)^{24} + 3$?

Since 2×1 equals 2, the expression simplifies to $2^{24} + 3$.

What is the value of 2^{24} in the expression $2^{24} + 3$?

2^{24} equals 16,777,216.

What is the final simplified result of $(2 \times (9-8))^{24} + 3$?

The final result is $16,777,216 + 3$, which equals 16,777,219.

Why is it important to follow the order of operations when simplifying this expression?

Following the order of operations ensures the calculation is accurate, especially when exponents and parentheses are involved.

Can you summarize the steps to simplify $(2 \times (9-8))^{24} + 3$?

Yes, first evaluate $(9-8)$, then multiply the result by 2, raise that to the 24th power, and finally add 3.

What common mistake should be avoided when simplifying expressions like $(2x(9-8))^{24+3}$?

A common mistake is performing operations out of order or neglecting parentheses, which can lead to incorrect results. Always follow PEMDAS/BODMAS.

Additional Resources

Simplify Each Expression Using The Correct Order Or Operation The Question Is: $(2x(9-8))^{24+3}$

Introduction

Mathematics, often regarded as the universal language, hinges on the correct application of operations to derive accurate results. Among fundamental skills, the ability to simplify algebraic expressions correctly is vital, whether for academic pursuits, professional calculations, or everyday problem-solving. The expression $(2x(9-8))^{24+3}$ exemplifies the importance of understanding and applying the order of operations—often remembered through the acronym PEMDAS (Parentheses, Exponents, Multiplication and Division, Addition and Subtraction). This investigative article explores the step-by-step process of simplifying such an expression accurately, delving into the underlying principles and common pitfalls.

The Significance of the Order of Operations

Before dissecting the specific expression, it is crucial to understand the overarching rules that govern mathematical simplification:

- Parentheses: Simplify expressions inside parentheses first.

- Exponents: Calculate powers and roots next.
- Multiplication and Division: Perform these operations from left to right.
- Addition and Subtraction: Finally, carry out these operations from left to right.

Misapplication can lead to erroneous results, which underscores why mastery of this hierarchy is essential.

Dissecting the Expression: $(2x(9-8))^{24} + 3$

Let us now analyze the expression step-by-step:

$$\begin{aligned} & \backslash[\\ & (2x(9-8))^{24} + 3 \\ & \backslash] \end{aligned}$$

Step 1: Simplify Inside the Parentheses

- First, evaluate $(9 - 8)$:

$$\begin{aligned} & \backslash[\\ & 9 - 8 = 1 \\ & \backslash] \end{aligned}$$

- Now, the expression becomes:

$$\begin{aligned} & \backslash[\\ & (2x \times 1)^{24} + 3 \\ & \backslash] \end{aligned}$$

Step 2: Simplify the Multiplication Inside the Parentheses

- Multiply $2x$ by 1 :

$$\begin{aligned} & \left[\right. \\ & 2x \times 1 = 2x \\ & \left. \right] \end{aligned}$$

- The expression simplifies further to:

$$\begin{aligned} & \left[\right. \\ & (2x)^{24} + 3 \\ & \left. \right] \end{aligned}$$

Step 3: Address the Exponentiation

- The core exponentiation is $(2x)^{24}$.
- Remember that $(a \times b)^n = a^n \times b^n$. Applying this property:

$$\begin{aligned} & \left[\right. \\ & (2x)^{24} = 2^{24} \times x^{24} \\ & \left. \right] \end{aligned}$$

- The entire expression now becomes:

$$\begin{aligned} & \left[\right. \\ & 2^{24} \times x^{24} + 3 \\ & \left. \right] \end{aligned}$$

Step 4: Final Expression

- The simplified form is:

$$2^{24} \times x^{24} + 3$$

Calculating the Numerical Coefficient: 2^{24}

While the algebraic form is often sufficient, understanding the magnitude of 2^{24} can be insightful.

- $2^{10} \approx 1024$
- $2^{20} = (2^{10})^2 \approx 1024^2 = 1,048,576$
- $2^{24} = 2^{20} \times 2^4 = 1,048,576 \times 16 = 16,777,216$

Thus:

$$2^{24} = 16,777,216$$

- Final simplified form with numerical coefficient:

$$16,777,216 \times x^{24} + 3$$

Deep Dive into the Simplification Process

The Hierarchy of Operations

This example underscores the importance of correctly following the order of operations:

1. Parentheses

- Always evaluate expressions within parentheses first.
- In this case, $(9 - 8)$ simplifies to 1.

2. Multiplication Inside Parentheses

- After parentheses, perform multiplication: $2x \times 1 = 2x$.

3. Exponentiation

- Recognize that the entire $(2x)$ is raised to the 24th power.
- Use the property $(ab)^n = a^n \times b^n$ to simplify.

4. Final Addition

- Complete the operation with the addition of 3.

Common Pitfalls and How to Avoid Them

- Ignoring parentheses: Failing to simplify $(9 - 8)$ first can lead to incorrect multiplication.
- Misplacing exponents: Not applying the exponent to both $2x$ as a whole, or forgetting the property $(ab)^n = a^n \times b^n$.
- Order confusion: Performing addition before exponents, which violates PEMDAS.

Practical Implications

- Educational settings: Reinforces the need for students to understand and follow operation hierarchies.
- Programming: Ensures that expressions are parsed and evaluated correctly.
- Scientific calculations: Accurate simplification prevents errors in complex models.

Broader Context and Applications

The process demonstrated here is foundational in various disciplines:

- Algebra and Pre-Calculus: Simplifying expressions for solving equations.
- Calculus: Preparing expressions for differentiation and integration.
- Engineering: Calculating stress, electric fields, or other parameters involving exponential relationships.
- Computer Science: Parsing expressions in compilers and interpreters.

Understanding how to simplify $(2 \times (9 - 8))^{24} + 3$ exemplifies core mathematical literacy that supports more advanced problem-solving.

Conclusion

The investigation into the expression $(2 \times (9 - 8))^{24} + 3$ reveals the importance of meticulous application of the order of operations. Starting with the innermost parentheses, then moving outward to exponents, multiplication, and finally addition, ensures the correctness of the simplified form.

In this case, the expression reduces to:

\[

$$16,777,216 \times x^{24} + 3$$

\]

This exploration underscores a broader lesson: mastery of fundamental operation hierarchies is essential for accurate mathematical reasoning. Whether in academia, industry, or everyday problem-solving, understanding and applying these principles reliably leads to correct and meaningful results.

References

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About the Author

[Insert brief author bio emphasizing expertise in mathematics education, mathematical problem-solving, or related fields.]

Note: This article aims to serve as a comprehensive guide to simplifying algebraic expressions correctly, emphasizing the importance of the order of operations through a detailed analysis of a specific example.

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