

Evaluate The Expression. $-10 - (7 + -5) \times 10$

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Understanding how to evaluate mathematical expressions is fundamental in mathematics and its applications in everyday life, education, and various scientific fields. The expression $-10 - (7 + -5) \times 10$ appears straightforward but involves multiple operations, including addition, subtraction, and multiplication, along with the handling of negative numbers. Proper evaluation requires adherence to the order of operations, often remembered by the acronym PEMDAS (Parentheses, Exponents, Multiplication and Division, Addition and Subtraction). In this comprehensive guide, we will explore step-by-step how to evaluate this expression correctly, discuss relevant mathematical concepts, common pitfalls, and offer tips for mastering similar problems.

Understanding the Components of the Expression

Before diving into the evaluation process, it's essential to understand each component of the expression:

- Negative Numbers: Represented with a minus sign before a number, such as -10 or -5 .
- Parentheses: Indicate that the operations within should be performed first.
- Addition (+): Combining two numbers.
- Multiplication (X): Repeated addition or scaling, performed after parentheses according to PEMDAS.
- Subtraction (-): Deducting one number from another.

Breaking down the expression:

- The main expression is: $-10 - (7 + -5) \times 10$
 - Inside the parentheses: $7 + -5$
 - The multiplication: $(7 + -5) \times 10$
 - The subtraction from -10 : $-10 - [\text{result of the parentheses and multiplication}]$
-

The Correct Order of Operations (PEMDAS)

To evaluate the expression properly, follow the PEMDAS rule:

1. Parentheses: Solve expressions inside parentheses first.
2. Exponents: Handle any exponents (none in this case).
3. Multiplication and Division: Perform these operations next, from left to right.
4. Addition and Subtraction: Finally, perform addition and subtraction from left to right.

Applying this to our expression:

- First, evaluate the parentheses: $7 + -5$
- Then, multiply the result by 10.
- Finally, subtract this product from -10.

Step-by-Step Evaluation of the Expression

Let's analyze the expression systematically:

Step 1: Evaluate the expression inside parentheses

$(7 + -5)$:

$$- 7 + (-5) = 7 - 5 = 2$$

Note: Adding a negative number is equivalent to subtraction.

Step 2: Perform the multiplication

$$(\text{Result from parentheses}) \times 10 = 2 \times 10 = 20$$

- Multiplying 2 by 10 yields 20.

Step 3: Subtract the result from -10

$-10 - 20$:

- Since subtraction is involved, think of it as: $-10 + (-20) = -10 - 20 = -30$

Note: Subtracting a positive number is equivalent to adding a negative number.

Final Answer:

-30

Thus, the value of the expression $-10 - (7 + -5) \times 10$ is -30.

Additional Insights into the Evaluation Process

Understanding each step deeply can help avoid common errors:

- Handling Negative Numbers: Remember that adding a negative is the same as subtraction.
- Order of Operations: Always perform calculations inside parentheses first, then multiplication/division, followed by addition/subtraction.
- Parentheses Impact: They can significantly change the outcome by prioritizing certain operations.

Common Mistakes and How to Avoid Them

When evaluating such expressions, learners often make these errors:

- Ignoring Parentheses: Performing multiplication before parentheses are evaluated.
- Misinterpreting Negative Signs: Confusing subtraction with negative numbers, leading to incorrect calculations.
- Order of Operations Confusion: Performing addition before multiplication or vice versa.

Tips to avoid these pitfalls:

- Write down each step explicitly.
- Use brackets to organize calculations.
- Remember that negative signs are part of the number, not separate operators.
- Practice similar expressions to strengthen understanding.

Related Mathematical Concepts and Applications

Understanding this evaluation process connects to various broader mathematical topics:

Algebraic Expressions

- Simplifying algebraic expressions requires similar steps, especially dealing with negative numbers and parentheses.

Real-World Applications

- Financial calculations involving debts and credits.
- Physics problems with negative velocities or forces.
- Engineering computations with negative parameters.

Problem-Solving Strategies

- Break complex expressions into smaller parts.
- Verify each step carefully.
- Use mental math or scratch paper for clarity.

Practice Problems for Mastery

To solidify understanding, try solving these similar expressions:

1. Evaluate $-15 - (3 + -8) \times 4$
2. Simplify $(5 + -2) \times (6 - 4)$
3. Calculate $-20 + (10 \times -3)$
4. Solve $(8 - 3) \times -2 + 5$

Solutions:

1. $-15 - (3 + -8) \times 4$

- Inside parentheses: $3 + (-8) = -5$
- Multiply: $-5 \times 4 = -20$
- Subtract: $-15 - (-20) = -15 + 20 = 5$

2. $(5 + -2) \times (6 - 4)$

- First parentheses: $5 + (-2) = 3$
- Second parentheses: $6 - 4 = 2$
- Multiply: $3 \times 2 = 6$

3. $-20 + (10 \times -3)$

- Inside parentheses: $10 \times -3 = -30$
- Add: $-20 + (-30) = -50$

4. $(8 - 3) \times -2 + 5$

- Inside parentheses: $8 - 3 = 5$
- Multiply: $5 \times -2 = -10$
- Add: $-10 + 5 = -5$

Conclusion: Mastering Expression Evaluation

Evaluating expressions like $-10 - (7 + -5) \times 10$ hinges on understanding and correctly applying the order of operations, handling negative numbers, and simplifying step-by-step. While the initial expression may seem complex, breaking it down into manageable parts ensures accuracy and confidence. Regular practice with similar problems enhances mathematical fluency, vital for success in more advanced topics and real-world problem solving.

By mastering these fundamental skills, students and professionals alike can confidently navigate complex expressions, ensuring precise calculations in academic, scientific, and everyday contexts. Remember, patience and systematic approaches are key to mastering the art of expression evaluation.

Frequently Asked Questions

What is the first step to evaluate the expression $-10 - (7 + -5) \times 10$?

The first step is to evaluate the expression inside the parentheses: $7 + -5$.

How do you simplify the expression inside the parentheses in $-10 - (7 + -5) \times 10$?

Calculate $7 + -5$, which equals 2.

After simplifying inside the parentheses, what is the next step in evaluating $-10 - (7 + -5) \times 10$?

Replace the parentheses with the simplified value: $-10 - 2 \times 10$.

In the expression $-10 - 2 \times 10$, what operation should be performed first according to the order of operations?

Multiplication should be performed first: 2×10 equals 20.

What is the final result of evaluating $-10 - (7 + -5) \times 10$?

Calculate $-10 - 20$, which equals -30, so the final answer is -30.

Additional Resources

Evaluate The Expression: $-10 - (7 + -5) \times 10$

Mathematics, often regarded as the universal language, hinges on the precise evaluation of expressions to unlock the underlying patterns, relationships, and principles governing numbers. One such expression, seemingly straightforward yet rich in nuances, is $-10 - (7 + -5) \times 10$. Despite its apparent simplicity, it offers an engaging opportunity to explore fundamental concepts like order of operations, the significance of negative numbers, and the systematic approach required for accurate calculation. This article provides a comprehensive analysis of this expression, breaking down each step, delving into the underlying principles, and illuminating the broader mathematical context.

Understanding the Components of the Expression

Before delving into calculations, it is crucial to dissect the expression and understand each component:

- Negative Numbers: The expression contains multiple negative signs, namely -10, -5, and the negative sign within the parentheses. Recognizing how negative numbers function within arithmetic operations is vital.
- Parentheses: The parentheses $(7 + -5)$ indicate that this sum must be evaluated prior to multiplication, aligning with the order of operations.
- Operators: The expression includes addition (+), subtraction (-), and multiplication ($\times$), each with specific precedence rules.

The expression in its entirety:

$$-10 - (7 + -5) \times 10$$

can be viewed as a combination of these elements, requiring adherence to standard mathematical conventions to evaluate correctly.

Order of Operations: The Foundation for Evaluation

Mathematics relies on a set of rules known as the order of operations to determine the sequence in which parts of an expression are evaluated. In many countries, the mnemonic PEMDAS (Parentheses, Exponents, Multiplication and Division, Addition and Subtraction) guides this process:

1. Parentheses: Simplify expressions inside parentheses first.
2. Exponents: Evaluate any powers or roots.
3. Multiplication and Division: Proceed from left to right.
4. Addition and Subtraction: Proceed from left to right.

Applying this hierarchy ensures consistency across calculations. For our expression, the key is to evaluate the parentheses first, then handle multiplication, and finally address addition/subtraction.

Step-by-Step Evaluation

Step 1: Evaluate the Parentheses $(7 + -5)$

Within the parentheses, we have an addition involving a positive and a negative number:

$$7 + -5$$

This operation combines a positive 7 with a negative 5.

- Understanding addition with negatives:

Adding a negative number is equivalent to subtracting its absolute value.

Thus,

$$7 + -5 = 7 - 5 = 2$$

Result after Step 1: The entire expression simplifies to:

$$-10 - 2 \times 10$$

Step 2: Handle Multiplication (2×10)

Next, perform the multiplication, as per the order of operations.

$$2 \times 10 = 20$$

The expression now becomes:

$$-10 - 20$$

Step 3: Final Subtraction ($-10 - 20$)

Finally, perform the subtraction:

$$-10 - 20$$

- Since subtracting 20 from -10 is akin to moving further into the negative territory, the calculation is:

$$-10 - 20 = -10 + (-20) = -30$$

Result: The value of the entire expression is -30.

Mathematical Principles Underlying the Evaluation

The above steps are grounded in core algebraic principles:

- Negative Number Operations:

Understanding that subtracting a positive number is equivalent to adding its negative, and vice versa, helps simplify complex expressions.

- Order of Operations:

Adhering to PEMDAS prevents ambiguity, especially in expressions with multiple operators and parentheses.

- Associative and Commutative Properties:

In addition, the associative property allows regrouping terms, while the commutative property allows swapping operands to facilitate calculations.

- Sign Management:

Properly handling the signs, especially when negative numbers are involved, is critical to avoiding errors.

Common Pitfalls and How to Avoid Them

Evaluating expressions like $-10 - (7 + -5) \times 10$ can trip up learners due to potential misinterpretation of negative signs and operator precedence. Here are some typical mistakes and strategies to prevent them:

1. Misreading Negative Signs

- Mistake: Treating -5 as a subtraction operation rather than a negative number.

- Solution: Recognize that -5 is a negative number, and in addition, $7 + -5$ involves adding a negative.

2. Ignoring Parentheses

- Mistake: Performing multiplication before evaluating the parentheses.

- Solution: Always evaluate expressions within parentheses first, regardless of the other operators.

3. Sign Errors During Subtraction

- Mistake: Incorrectly subtracting or adding negative numbers.

- Solution: Remember that subtracting a negative is equivalent to addition of positive, and vice versa.

4. Confusing Multiplication and Addition of Negatives

- Mistake: Overlooking that multiplying a negative by a positive yields a negative.

- Solution: Use the rules:

- Negative $\times$ Positive = Negative

- Negative $\times$ Negative = Positive

Broader Mathematical Context and Applications

While the evaluated expression appears simple, it exemplifies fundamental principles that are applicable across various mathematical domains:

- Algebra:

Understanding how to manipulate expressions with negatives and parentheses is crucial for solving equations and inequalities.

- Calculus:

Handling signs correctly is vital when integrating or differentiating functions involving negative coefficients or shifts.

- Computer Science:

Programming languages follow similar precedence rules; misapplication can lead to bugs, especially in complex algorithms.

- Financial Mathematics:

Negative numbers often represent debts or losses, and precise calculations impact decision-making processes.

- Physics:

Negative values can denote direction or opposition in vector quantities; accurate computation ensures correct modeling.

Real-World Applications and Significance

Expressions involving negatives and order of operations are not merely academic exercises—they have tangible real-world implications:

- Accounting:

Calculating net income or loss involves subtracting expenses from revenue, often encountering negative values.

- Engineering:

Signal processing or control systems may involve negative feedback or phase shifts, requiring precise calculations.

- Data Analysis:

Interpreting negative deviations from a mean or baseline involves similar arithmetic principles.

In each context, mastery of evaluating expressions with negatives ensures accuracy and reliability of results.

Conclusion: The Significance of Careful Evaluation

In summary, the expression $-10 - (7 + -5) \times 10$ exemplifies the importance of understanding fundamental arithmetic rules, especially regarding negative numbers and the order of operations. Through systematic evaluation—starting with parentheses, then multiplication, followed by addition/subtraction—the correct result, -30, emerges. This process highlights the necessity of meticulous attention to detail, sign management, and adherence to established mathematical conventions. Such skills underpin more advanced mathematical reasoning and are essential tools in diverse scientific, technological, and financial fields. Mastery of these basic principles forms the foundation for tackling increasingly complex problems, emphasizing that even seemingly simple expressions carry profound educational and practical significance.

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