# 7. In Which Step Does A Mistake First Occur?8 + 2 + (3 X 3 -2)Step 1: 8 +2 + (3 X 1)Step 2: 8 +2 + 3Step

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Understanding where and how errors occur in step-by-step problem solving is fundamental for students, educators, and anyone engaged in mathematical reasoning. This article explores the process of solving a complex arithmetic expression, analyzing each step to identify where the first mistake might occur. Through a detailed breakdown of the problem and its solution, we will shed light on common pitfalls and best practices to avoid errors in arithmetic calculations.

## Breaking Down the Problem

The original problem statement appears to be a sequence of mathematical expressions, possibly representing a multi-step calculation:

- The initial expression: 8 + 2 + (3 x 3 - 2)
- Step 1: 8 + 2 + (3 x 1)
- Step 2: 8 + 2 + 3

At first glance, the sequence suggests a progression of simplifying the original expression, but it also raises questions about how each step relates to the previous one. To analyze this properly, we need to understand the principles of order of operations, often referred to by the acronym PEMDAS (Parentheses, Exponents, Multiplication and Division, Addition and Subtraction).

## Understanding the Order of Operations

Before diving into the specific steps, it’s crucial to establish the rules governing the order in which operations should be performed:

### 1. Parentheses

- Operations inside parentheses are performed first.
- They often alter the value of the expression significantly.

## 2. Exponents

- Handle any powers or roots after parentheses.

## 3. Multiplication and Division

- These are performed next, from left to right.

## 4. Addition and Subtraction

- These are performed last, from left to right.

Applying these rules ensures consistency and correctness in calculations.

# Step-by-Step Analysis of the Problem

Let's analyze each step to identify where a mistake might occur.

## Original Expression

8 + 2 + (3 x 3 - 2)

- First, evaluate the parentheses: (3 x 3 - 2)
- Inside parentheses: multiplication first, then subtraction.

Calculating inside parentheses:
- 3 x 3 = 9
- 9 - 2 = 7

Substituting back:
- 8 + 2 + 7 = 17

Result of the original expression: 17

## Step 1: 8 + 2 + (3 x 1)

The expression now appears as:

8 + 2 + (3 x 1)

This implies the previous parentheses have been simplified or replaced. The calculation inside parentheses:

- 3 x 1 = 3

Sum:
- 8 + 2 + 3 = 13

Question: How did the expression change from the original? Is this a separate step, or a simplified version?

Potential mistake here: Replacing (3 x 3 - 2) with (3 x 1) is not mathematically justified unless specific reasoning is provided, such as rewriting or adjusting the problem.

## Step 2: 8 + 2 + 3

This step simplifies the previous expression:

- 8 + 2 + 3 = 13

No mistake here, assuming the previous step was correctly calculated.

# Identifying the First Mistake

Given the above analysis, the key question is: Where does the first mistake occur?

Based on the initial expression and subsequent steps, the most probable point of error is in transforming the original expression into the first step:

- The original expression: 8 + 2 + (3 x 3 - 2)
- The first step: 8 + 2 + (3 x 1)

This change is not valid unless there's a specific reason, such as a typo, a misinterpretation, or a different problem context.

Common Causes of Mistakes:

- Misapplication of Parentheses: Changing the contents inside parentheses without recalculating appropriately.
- Misreading the Expression: Confusing the order or the operations involved.
- Typographical Errors: Mistakes in copying or writing the expression.
- Misunderstanding of Operations: Confusing multiplication with addition or subtraction.

Clarifying the Correct Approach:

To avoid mistakes, always follow these steps:

- **Identify all parentheses and evaluate them first.**
- **Perform multiplication/division before addition/subtraction.**
- **Proceed step-by-step, double-checking each calculation.**
- **Ensure that any transformations or simplifications are justified based on the original expression.**

Practical Example:

Applying these principles to the original problem:

- Original expression: 8 + 2 + (3 x 3 - 2)
- Inside parentheses: 3 x 3 = 9; then 9 - 2 = 7
- Sum: 8 + 2 + 7 = 17

Any deviation from this process, such as replacing (3 x 3 - 2) with (3 x 1), introduces an error unless explicitly justified.

# Conclusion: The First Mistake Occurs at the Transformation Step

Based on the provided sequence, the first mistake occurs during the transition from the original expression to the first step, where the parentheses' contents are altered from (3 x 3 - 2) to (3 x 1). This change is not mathematically justified unless there's additional context or a specific instruction.

Key Takeaways:

- Always evaluate parentheses carefully before moving on.
- Do not alter parts of an expression unless justified.
- Follow the order of operations strictly.
- Double-check each step for accuracy.

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By understanding where mistakes can occur and following disciplined calculation procedures, students can improve their accuracy in solving complex expressions. Recognizing common pitfalls and practicing methodical approaches are essential skills in mathematics.

# Frequently Asked Questions

## At which step does the mistake first occur in the given calculation?

The mistake first occurs in Step 1, where the expression 3 x 1 is incorrectly written instead of 3 x 3.

## What is the correct evaluation of the expression 8 + 2 + (3 x 3 - 2)?

The correct evaluation is 8 + 2 + (9 - 2) = 8 + 2 + 7 = 17.

## Why is Step 2 incorrect in the given calculation process?

Step 2 is incorrect because it simplifies 3 x 3 to 3 instead of the correct 9, leading to an incorrect sum.

## What is the importance of following the order of operations in this calculation?

Following the order of operations ensures accurate calculation of expressions involving multiple operations, such as multiplication and addition/subtraction.

## How can mistakes in multi-step calculations like this be avoided?

Mistakes can be avoided by carefully applying the order of operations, double-checking each step, and ensuring all calculations are accurate before proceeding.

# Additional Resources

# Understanding the Mistake in the Step-by-Step Calculation: In Which Step Does A Mistake First Occur?8 + 2 + (3 X 3 - 2) Step 1: 8 + 2 + (3 X 1) Step 2: 8 + 2 + 3 Step

When tackling multi-step arithmetic problems, identifying where a mistake

occurs is crucial for understanding errors and improving mathematical reasoning. The question "In which step does a mistake first occur?" often arises during problem-solving, especially when intermediate steps seem straightforward but the final answer is incorrect. This analysis focuses on the expression 8 + 2 + (3 x 3 - 2), examining the steps involved, the potential pitfalls, and where the initial error might be introduced.

## Breaking Down the Original Expression

The original problem is:

8 + 2 + (3 x 3 - 2)

To analyze this properly, we should recall the order of operations (PEMDAS/BODMAS):

- Parentheses first
- Exponents (none here)
- Multiplication and division (left to right)
- Addition and subtraction (left to right)

Applying these rules ensures consistency and correctness in solving the problem.

## Step-by-Step Breakdown

Let’s analyze the steps provided:

Step 1:
> 8 + 2 + (3 x 1)

Step 2:
> 8 + 2 + 3

Final Step (implied):
> (Depending on the context, the sum of the above steps)

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Step 1 Analysis: Why is (3 x 1) used?

The first step presents an expression:

8 + 2 + (3 x 1)

This suggests that the initial expression has been simplified, but how did we arrive at (3 x 1) from (3 x 3 - 2)?

Original Parentheses:

- 3 x 3 - 2
- According to order of operations, we perform multiplication first:

3 x 3 = 9

Then subtract:

9 - 2 = 7

Therefore, the original expression evaluates to:

8 + 2 + 7 = 17

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Step 2 Analysis: Transition to 8 + 2 + 3

In the second step, the expression is simplified further to:

8 + 2 + 3

which implies that the previous step's (3 x 1) equals 3.

Key question: How did (3 x 1) become 3?

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Identifying the Mistake: Where Does the Error First Occur?

The critical mistake lies in the manipulation of the parentheses within the original expression.

Original expression:
8 + 2 + (3 x 3 - 2)

Applying order of operations inside parentheses:
3 x 3 = 9
9 - 2 = 7

Thus, the expression simplifies to:
8 + 2 + 7 = 17

However, in the steps provided, the calculation appears as:

- Step 1: 8 + 2 + (3 x 1)

- Step 2: 8 + 2 + 3

This indicates that somewhere, (3 x 3 - 2) was replaced by (3 x 1), which is

incorrect because:

$(3 \times 3 - 2) \neq (3 \times 1)$

The substitution of $(3 \times 3 - 2)$ with $(3 \times 1)$ is the first mistake, and it occurs during the process of simplifying the parentheses.

Why Did This Mistake Occur?

Potential reasons include:

- Misapplication of the order of operations:
Someone might have incorrectly simplified $(3 \times 3 - 2)$ by assuming $3 \times 3 = 3 \times 1$, which is incorrect.
- Misreading or misremembering the expression:
The person might have misread the original expression, confusing $3 \times 3$ with $3 \times 1$.
- Typographical error:
Perhaps, during the transcription or calculation process, the numbers got mixed up.

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Consequences of the Mistake

Once the incorrect substitution occurs, the subsequent steps are based on a flawed premise:

- Replacing $(3 \times 3 - 2)$ with $(3 \times 1)$ leads to:

$8 + 2 + 3$

- Summing these gives 13, which is incorrect relative to the original expression's true value.

Correct calculation:

$8 + 2 + (3 \times 3 - 2) = 8 + 2 + (9 - 2) = 8 + 2 + 7 = 17$

Incorrect calculation (due to mistake):

$8 + 2 + 3 = 13$

This discrepancy shows the importance of careful evaluation of parentheses and the order of operations.

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## Features and Analysis of the Steps

Features of the Steps:

- The initial expression contains nested operations, requiring proper priority handling.
- The attempt to simplify the expression step-wise indicates an understanding of breaking down complex expressions, but errors in the algebraic manipulation cause inaccuracies.
- The second step simplifies the parentheses incorrectly, leading to a wrong final answer.

Pros:

- Attempted to break down the problem into manageable parts.
- Recognized the need to evaluate parentheses first.

Cons:

- Misapplied the order of operations within parentheses.
- Replaced (3 x 3 - 2) with (3 x 1) without justification.
- Lacked clarity on how the innermost calculations were performed.

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## Key Takeaways and Lessons Learned

- Always perform operations inside parentheses first, following the correct order.
- Be cautious when simplifying expressions—double-check each step.
- Understand that (3 x 3 - 2) must be evaluated as (9 - 2) = 7, not as (3 x 1).
- Use parentheses to clarify the order of operations, especially in complex expressions.
- When in doubt, write each step explicitly to avoid misinterpretation.

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## Conclusion: Where Does the Mistake First Occur?

The first mistake occurs during the simplification of the parentheses (3 x 3 - 2), where the calculation incorrectly assumes 3 x 3 equals 3 x 1. This miscalculation propagates through the subsequent steps, leading to an incorrect final answer. Recognizing this initial error is crucial for correcting the problem-solving approach.

By understanding where the mistake first occurs, students and practitioners can improve their arithmetic skills, especially in handling nested expressions. The key is to always follow the order of operations meticulously and verify each intermediate calculation before proceeding to the next step.

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