

Simplify $3x(4x + 5) + 3$ And Find Its Value For $x = 3$

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Understanding how to simplify algebraic expressions and evaluate them for specific values of variables is fundamental in mathematics. Whether you're a student brushing up on your algebra skills or a professional applying these concepts in real-world scenarios, mastering the process of simplification and substitution is essential. This article will guide you through the steps to simplify the expression $3x(4x + 5) + 3$ and find its value when $x = 3$. We will explore the concepts involved, provide detailed steps, and discuss common pitfalls to avoid.

Introduction to Algebraic Expressions and Simplification

Algebraic expressions are combinations of variables, numbers, and operations. Simplifying these expressions means rewriting them in a more manageable or concise form without changing their value. Simplification often involves combining like terms, applying the order of operations, and factoring when necessary.

Understanding how to manipulate these expressions is crucial because it allows for easier computation and provides insights into the relationships between variables and constants.

Understanding the Expression: $3x(4x + 5) + 3$

Before diving into the simplification process, let's analyze the given expression:

$$3x(4x + 5) + 3$$

At first glance, the expression appears to be missing an operator between $4x$ and 5 . Typically, in algebra, when two variables or numbers are written next to each other, it implies multiplication unless specified otherwise.

Assumption: The expression is intended to be $3x(4x + 5) + 3$, where $(4x + 5)$ is a binomial multiplied by $3x$.

This assumption is reasonable because:

- The parentheses suggest an addition inside, which is common in algebraic expressions.

- The lack of an operator between $4x$ and 5 hints at multiplication, which is standard in algebra.

Therefore, the expression simplifies to:

$$3x(4x + 5) + 3$$

Step-by-Step Simplification of the Expression

Simplifying algebraic expressions involves applying algebraic rules systematically. Here's a step-by-step guide to simplify $3x(4x + 5) + 3$.

Step 1: Apply the Distributive Property

The distributive property states that:

$$a(b + c) = ab + ac$$

Applying this to $3x(4x + 5)$:

- Multiply $3x$ by $4x$
- Multiply $3x$ by 5

Calculation:

- $3x \cdot 4x = (3 \cdot 4)(x \cdot x) = 12x^2$
- $3x \cdot 5 = 15x$

Result after distribution:

$$12x^2 + 15x$$

Step 2: Rewrite the Expression

Now, replace the original expression with the simplified parts:

$$12x^2 + 15x + 3$$

This is the simplified form of the original expression.

Step 3: Verify if Further Simplification is Possible

Look for common factors among the terms:

- $12x^2$
- $15x$
- 3

Notice that all coefficients are divisible by 3:

- $12x^2 \div 3 = 4x^2$
- $15x \div 3 = 5x$
- $3 \div 3 = 1$

Factor out 3:

$$3 (4x^2 + 5x + 1)$$

This is called factoring out the greatest common factor (GCF).

Final Simplified Expression:

$$3 (4x^2 + 5x + 1)$$

This form is often preferable because it reveals the structure of the polynomial and makes evaluation easier.

Evaluating the Expression for $X = 3$

Now that the expression is simplified, the next step is to find its value when $x = 3$.

Using the factored form:

$$3 (4x^2 + 5x + 1)$$

Substitute $x = 3$ into the expression:

$$3 [4(3)^2 + 5(3) + 1]$$

Step 1: Calculate inside the brackets

$$- 3^2 = 9$$

$$- 4 \cdot 9 = 36$$

$$- 5 \cdot 3 = 15$$

Step 2: Add the terms inside the brackets

$$36 + 15 + 1 = 52$$

Step 3: Multiply by 3

$$3 \cdot 52 = 156$$

Therefore, the value of the expression when $x = 3$ is 156.

Summary of the Process

To recap, here are the steps to simplify and evaluate the expression:

1. Identify the correct form of the expression: Recognize missing operators and interpret the expression correctly.
2. Apply the distributive property: Multiply outside terms with each term inside parentheses.
3. Simplify the resulting expression: Combine like terms.
4. Factor if possible: To reveal common factors and simplify further.
5. Substitute the given value of x : Replace the variable with the specified value.
6. Perform calculations step-by-step: To ensure accuracy and clarity.

Common Mistakes to Avoid

While working through algebraic expressions, it's easy to make mistakes. Here are some pitfalls to watch out for:

- Misinterpreting the expression: Missing parentheses or operators can lead to incorrect calculations.
- Ignoring the order of operations: Always remember PEMDAS (Parentheses, Exponents, Multiplication and Division, Addition and Subtraction).
- Forgetting to square or multiply correctly: Be attentive when dealing with exponents.
- Forgetting to substitute the variable: Make sure to replace all instances of the variable with its value before calculating.
- Errors in arithmetic: Double-check calculations, especially when dealing with multiple steps.

Conclusion

Simplifying algebraic expressions and evaluating them for specific values of variables are core skills in mathematics. The process involves understanding the structure of the expression, applying algebraic properties like the distributive property, factoring, and careful substitution.

In this case, we simplified $3x(4x + 5) + 3$ to $3(4x^2 + 5x + 1)$ and found that when $x = 3$, the value of the expression is 156.

Mastering these steps enhances problem-solving skills and prepares you for more advanced topics in algebra, calculus, and other mathematical disciplines. Practice regularly, double-check your work, and remember that understanding each step is essential for success.

Additional Resources for Learning Algebra

- Khan Academy Algebra Course: Offers comprehensive lessons and practice problems.
- Mathway or Wolfram Alpha: Tools for checking algebraic solutions.
- Algebra textbooks: For in-depth explanations and exercises.
- Online tutorials and videos: Visual demonstrations can enhance understanding.

By consistently practicing these techniques, you'll build confidence in your algebra skills and be well-prepared to tackle increasingly complex problems.

Frequently Asked Questions

What is the first step to simplify the expression $3x(4x + 5) + 3$?

First, distribute $3x$ across the terms inside the parentheses: $3x \cdot 4x + 3x \cdot 5$.

How do you simplify $3x \cdot 4x$ in the expression?

Multiply the coefficients and variables: $3 \cdot 4 = 12$ and $x \cdot x = x^2$, giving $12x^2$.

What is the simplified form of the expression $3x(4x + 5) + 3$?

The simplified form is $12x^2 + 15x + 3$.

How do you evaluate the expression at $x = 3$?

Substitute $x = 3$ into the simplified expression: $12(3)^2 + 15(3) + 3$.

What is the value of $12(3)^2 + 15(3) + 3$ when $x = 3$?

Calculate step-by-step: $12 \cdot 9 + 45 + 3 = 108 + 45 + 3 = 156$.

What is the final answer for the expression when $x = 3$?

The value of the expression at $x = 3$ is 156.

Additional Resources

Simplify $3x(4x + 5) + 3$ And Find Its Value For $x = 3$ is a mathematical problem that encompasses the fundamental skills of algebraic manipulation and substitution. This type of problem is commonly encountered by students learning to simplify expressions and evaluate them for specific values of variables. Understanding how to break down complex expressions into manageable parts is essential for mastering algebra, which serves as a building block for more advanced mathematics. In this article, we will explore the process of simplifying the given expression step by step, interpret its components, and then substitute the specific value of $(x = 3)$ to find the numerical result. Additionally, we'll discuss common pitfalls, strategies for effective problem-solving, and the importance of clear notation.

Understanding the Expression

Before diving into simplification, it's crucial to understand what the expression $3x(4x + 5) + 3$ entails. At first glance, the expression appears to involve multiplication and addition, with variables and constants mixed together. The key challenge is ensuring correct interpretation of the expression, especially the part $(4x + 5)$, which might seem ambiguous.

Potential interpretations include:

- Interpretation 1: The expression might be missing an operator between $4x$ and 5 ; in many algebraic contexts, this is understood as multiplication, i.e., $4x \cdot 5$.
- Interpretation 2: It might be a typographical omission, and the intended expression is $3x(4x + 5)$, which is a common form involving a distributive factor.

Given the typical structure of algebra problems and the context, the most logical interpretation is:

Simplify $3x(4x + 5) + 3$

This interpretation makes sense because:

- It involves standard algebraic operations.
- It allows for applying the distributive property.
- It leads to a straightforward calculation process.

Note: If the original expression was intended differently, clarifying the operators is always

recommended. For the purposes of this review, we proceed with the above assumption.

Step-by-Step Simplification

Step 1: Recognize the structure

The expression:

$$3x \times (4x + 5) + 3$$

contains a product of $(3x)$ and $(4x + 5)$, plus an additional constant 3.

Step 2: Apply the distributive property

To simplify, expand the product:

$$3x \times (4x + 5) = 3x \times 4x + 3x \times 5$$

Calculating each term:

- $3x \times 4x = 12x^2$ (since $3 \times 4 = 12$ and $x \times x = x^2$)
- $3x \times 5 = 15x$

Step 3: Write the expanded expression

Now, the entire expression becomes:

$$12x^2 + 15x + 3$$

This is a quadratic expression in terms of (x) .

Step 4: Final simplified form

$$\boxed{12x^2 + 15x + 3}$$

The expression is now fully simplified, ready for evaluation at a specific value of (x) .

Evaluating the Expression for $X = 3$

With the simplified form $(12x^2 + 15x + 3)$, we can substitute $(x = 3)$:

$$12(3)^2 + 15(3) + 3$$

Step 1: Calculate the square

$$(3)^2 = 9$$

Step 2: Multiply

$$12 \times 9 = 108$$

$$15 \times 3 = 45$$

Step 3: Sum all parts

$$108 + 45 + 3 = 156$$

Therefore, the value of the expression when $(x = 3)$ is:

$$\boxed{156}$$

Discussion: Significance and Applications

This problem underscores the importance of systematically approaching algebraic expressions. Simplification not only makes calculations easier but also provides clearer insights into the behavior of the function or expression.

Features of the process include:

- Recognizing the structure of the expression.
- Applying the distributive property correctly.

- Simplifying terms step-by-step.
- Substituting specific values to evaluate the expression.
- Ensuring accuracy at each step to avoid errors.

Common Pitfalls and How to Avoid Them

While the process is straightforward, several common mistakes can occur:

- Misinterpreting the expression: Always clarify operators, especially when parentheses are involved.
- Ignoring the order of operations: Follow PEMDAS (Parentheses, Exponents, Multiplication and Division, Addition and Subtraction).
- Incorrect distribution: Ensure each term inside the parentheses is multiplied by each term outside.
- Arithmetic errors: Double-check calculations, especially when dealing with exponents and multiple terms.
- Substitution mistakes: Be careful to substitute the value of (x) after complete simplification.

Tips to avoid these pitfalls:

- Write out each step clearly.
- Use parentheses liberally to avoid ambiguity.
- Double-check calculations.
- Practice similar problems regularly to build confidence.

Features and Benefits of Mastering Such Problems

Mastering the simplification and evaluation of algebraic expressions offers several benefits:

- Strengthens foundational algebra skills, essential for advanced mathematics.
- Enhances problem-solving abilities, applicable in real-world contexts like engineering, economics, and science.
- Prepares for standardized tests, where similar problems are frequently encountered.
- Develops logical thinking by understanding how to manipulate expressions systematically.

Key features include:

- Clear step-by-step methodology.
- Emphasis on understanding rather than rote memorization.
- Flexibility to handle more complex expressions by building confidence with basic operations.

Conclusion

The problem Simplify $3x(4x - 5) + 3$ And Find Its Value For $X = 3$ demonstrates fundamental algebraic concepts such as distribution, combining like terms, and substitution. By carefully interpreting the expression, applying the distributive property, and simplifying, we find the fully expanded form $(12x^2 + 15x + 3)$. Substituting $(x = 3)$ yields a numerical value of 156.

This exercise highlights the importance of clarity in expression interpretation, systematic problem-solving, and attention to detail. Whether for students, educators, or professionals, developing these skills fosters a deeper understanding of algebra and enhances mathematical literacy. As such problems become more complex, the foundational techniques outlined here serve as a reliable approach to tackling a wide range of algebraic challenges with confidence.

In summary:

- Always clarify the expression before starting.
- Use the distributive property to expand products.
- Combine like terms carefully.
- Substitute specific values after full simplification to avoid errors.
- Practice regularly to improve speed and accuracy.

Mastering these steps ensures that you can confidently handle similar algebraic problems, laying a solid groundwork for future mathematical endeavors.

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