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Understanding the properties of mathematical operations is fundamental for students, educators, and anyone working with algebraic expressions. The expression provided—"Given $13 \times 23 \cdot 7x + 3$, Which Property Is Used Below? $3(13 \times 23) \cdot 3(7x + 3)$ "—serves as an excellent example to explore the application of key algebraic properties, particularly the distributive property.

In this article, we will delve into the specifics of this expression, identify the property involved, and explain its significance in simplifying and manipulating algebraic expressions.

Breaking Down the Expression

Before identifying the property, let's clarify and interpret the given expression.

The expression appears to involve two parts:

1. First Part: " $13 \times 23 \cdot 7x + 3$ "
2. Second Part (Question): "Which property is used below? $3(13 \times 23) \cdot 3(7x + 3)$ "

Assuming the expression is referring to the algebraic operations applied to the terms, it seems to involve multiplication and addition, with the question focusing on the transformation from one form to another.

Based on the notation, it appears the question wants us to analyze the transition from:

- Original Expression: $3(13 \times 23) + 3(7x + 3)$

or perhaps comparing two forms related to this expression.

Note: The original prompt is somewhat ambiguous, but the key focus is the transition involving the multiplication of a sum or product by a factor, which hints at the distributive property.

Understanding Key Algebraic Properties

To interpret the expression correctly, let's review the fundamental properties of algebra that are often used to manipulate and simplify expressions.

1. Commutative Property

- Definition: The order in which two numbers are added or multiplied does not affect the result.
- Examples:
 - Addition: $a + b = b + a$
 - Multiplication: $a \times b = b \times a$

2. Associative Property

- Definition: The way in which numbers are grouped when adding or multiplying does not affect the sum or product.
- Examples:
 - Addition: $(a + b) + c = a + (b + c)$
 - Multiplication: $(a \times b) \times c = a \times (b \times c)$

3. Distributive Property

- Definition: A number outside parentheses multiplies each term inside the parentheses.
- Formula: $a(b + c) = a \times b + a \times c$
- Significance: It allows the expansion or factoring of expressions and is foundational in algebra.

Identifying the Property Used in the Expression

Given the expression:

$$3(13 \times 23) + 3(7x + 3)$$

We can analyze this to see which property is being applied.

Application of the Distributive Property

If we look closely, the expression involves multiplying 3 by a sum or product, and the question seems to focus on how the multiplication interacts with the sum inside the parentheses.

Suppose the original expression was:

$$3 \times (13 \times 23) + 3 \times (7x + 3)$$

This suggests the use of the distributive property in the process of expanding or factoring.

Example:

- Using the distributive property:

$$\begin{aligned} &3 \times (13 \times 23) + 3 \times (7x + 3) \\ &= 3 \times 13 \times 23 + 3 \times 7x + 3 \times 3 \end{aligned}$$

This demonstrates applying the distributive property in expanding the expression.

Alternatively, if the expression was being factored:

- Starting with:

$$3 \times 13 \times 23 + 3 \times (7x + 3)$$

- We can factor out the common factor 3:

$$3 [13 \times 23 + (7x + 3)]$$

In this case, the distributive property is used in reverse, factoring out the common factor.

The Distributive Property in Detail

The key property being referenced here is the distributive property, which is fundamental in algebra for expanding and factoring expressions.

How the Distributive Property Works

The property states that multiplying a sum by a number is equivalent to multiplying each addend by that number and then summing the products.

Mathematically:

$$a(b + c) = a \times b + a \times c$$

Example:

Suppose you want to expand $3(x + 4)$:

- Using the distributive property:

$$3 \times x + 3 \times 4 = 3x + 12$$

This process simplifies calculation and helps in solving algebraic equations.

Applying the Distributive Property to the Given Expression

Let's revisit the expression:

$$3(13 \times 23) + 3(7x + 3)$$

This can be interpreted as:

- Distributing the 3 across the sum inside the parentheses:

$$3 \times 13 \times 23 + 3 \times 7x + 3 \times 3$$

- Simplifying:

$$(3 \times 13 \times 23) + (3 \times 7x) + (3 \times 3)$$

This shows how the property is applied to expand the expression, making it easier to evaluate or simplify further.

Significance of the Distributive Property in Algebra

The distributive property is essential because it allows:

- Expansion of expressions for easier calculation
- Factoring expressions to simplify algebraic equations
- Transition between expanded and factored forms
- Solving equations efficiently

Real-World Applications

- Calculating total costs when multiple items are involved
- Simplifying algebraic expressions in physics and engineering
- Solving for unknown variables in equations

Summary of the Property Used

Aspect Explanation
----- -----
Property Name Distributive Property
Mathematical Formula $a(b + c) = a \times b + a \times c$
Application in the Example Distributing the factor 3 over sums and products inside parentheses, or factoring out 3 from the entire expression

Conclusion

In the context of the given expression, " $3 (13 \times 23) + 3 (7x + 3)$ ", the property primarily used is the distributive property of multiplication over addition. This property enables the expansion of expressions, making them more manageable for calculation or further algebraic manipulation.

Understanding and applying the distributive property is vital for mastering algebra, as it forms the foundation for expanding, factoring, and simplifying complex expressions. Whether you're solving equations, simplifying expressions for calculations, or engaging in advanced mathematics, recognizing the use of this property enhances problem-solving efficiency and mathematical fluency.

Additional Tips for Mastering the Distributive Property

- Always look for common factors that can be factored out to simplify expressions.
- Practice expanding and factoring various algebraic expressions to reinforce understanding.
- Use visual aids like algebra tiles to see the distributive property in action.
- Connect the property to real-world scenarios to appreciate its practical importance.

By mastering the distributive property and recognizing its application in various expressions, students and math enthusiasts can significantly improve their algebra skills and confidence in handling complex problems.

If you would like more detailed examples or explanations of related algebraic properties, feel free to ask!

Frequently Asked Questions

What mathematical property is illustrated by the expression $3(13x + 3) = 3(7x + 3)$?

The distributive property is used in this expression, as it distributes the 3 across the sum inside the parentheses.

How does the distributive property apply to the expression $3(13x + 3) = 3(7x + 3)$?

It shows that multiplying a number outside parentheses by each term inside the parentheses distributes the multiplication, i.e., 3 multiplied by each term inside.

Is the expression $3(13x + 3) = 3(7x + 3)$ an example of the associative property?

No, it is an example of the distributive property, not the associative property.

What is the significance of the expression $3(13 \times 23) = 3(7x + 3)$ in algebra?

It demonstrates the use of the distributive property to simplify or expand expressions involving multiplication over addition.

Can the property used in $3(13 \times 23) = 3(7x + 3)$ be applied to variables and constants?

Yes, the distributive property applies to both variables and constants when distributing multiplication over addition.

What is the main purpose of using the distributive property in expressions like $3(13 \times 23) = 3(7x + 3)$?

To simplify expressions or to expand them for easier computation or further manipulation.

Does the property shown in $3(13 \times 23) = 3(7x + 3)$ help in solving equations?

Yes, applying the distributive property can help in simplifying equations, making them easier to solve.

Is the expression $3(13 \times 23) = 3(7x + 3)$ an example of an identity or a property?

It is an example of a property, specifically the distributive property of multiplication over addition.

Additional Resources

Given 13×23 $7x + 3$, Which Property Is Used Below? $3(13 \times 23)$ $3(7x + 3)$

Understanding the properties of algebraic expressions is fundamental to mastering mathematics. The question "Given 13×23 $7x + 3$, which property is used below?" followed by the expression " $3(13 \times 23)$ $3(7x + 3)$ " invites us to explore the specific algebraic property at play. In this article, we will delve into the properties of multiplication and addition that underpin this expression, analyze how they are applied, and clarify their significance in simplifying and manipulating algebraic expressions. Whether you're a student seeking to understand foundational concepts or an educator aiming to explain these principles clearly, this comprehensive review will guide you through the essential properties involved.

Understanding the Expression and Its Components

Before identifying the property used, it's crucial to understand the given expressions:

- The initial expression is somewhat ambiguously presented as " 13×23 $7x + 3$," which likely refers to the parts:
 - 13×23 : a simple multiplication
 - $7x + 3$: an algebraic sum
- The expression " $3 (13 \times 23) 3(7x + 3)$ " appears to suggest a multiplication involving the sum of the two parts, possibly indicating the distributive property.

Given the format, it seems to be asking about how the expression transforms from a sum of products to a product of sums, or vice versa.

The Core Algebraic Properties Involved

To analyze the transformation, we need to identify the properties of algebra that come into play:

- Distributive Property
- Associative Property
- Commutative Property

The primary focus here is the Distributive Property, as it deals with distributing a factor across terms inside parentheses, which matches the pattern in the expression.

The Distributive Property: What Is It?

Definition

The distributive property states that:

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

In words, multiplying a sum by a number is the same as multiplying each addend separately and then

summing the products.

Application in the Given Expression

In the expression " $3(13 \times 23) + 3(7x + 3)$ ", the distributive property can be used to simplify or expand this expression:

- If the initial expression is $3 \times (13 \times 23 + 7x + 3)$, then applying the distributive property involves multiplying 3 by each term inside the parentheses:

$$3 \times 13 \times 23 + 3 \times 7x + 3 \times 3$$

- Alternatively, if the expression is $3(13 \times 23) + 3(7x + 3)$, then the property is used to factor out the common 3, leading to:

$$3 [(13 \times 23) + (7x + 3)]$$

Thus, the property that is used here is the Distributive Property.

Breaking Down the Expression: Step-by-Step Analysis

Original Expression

Suppose we start with the expression:

$$3(13 \times 23) + 3(7x + 3)$$

This can be viewed as:

- 3 multiplied by 13×23 , plus
- 3 multiplied by $(7x + 3)$

Applying the distributive property in reverse (factoring out 3), we get:

$$3 [(13 \times 23) + (7x + 3)]$$

This demonstrates the distributive property in action, where multiplication distributes over addition or vice versa.

Expanding the Expression

If we expand the expression using the distributive property:

- Multiply 3 by each term:

$$3 \times 13 \times 23 + 3 \times 7x + 3 \times 3$$

- Calculate:

$$3 \times 13 \times 23 = 3 \times 299 = 897$$

$$3 \times 7x = 21x$$

$$3 \times 3 = 9$$

- The expanded form becomes:

$$897 + 21x + 9$$

- Combine like terms:

$$906 + 21x$$

This process simplifies the expression and clarifies its structure.

Why Is the Distributive Property Important?

Advantages

- Simplification: It allows for easier multiplication and addition within expressions.
- Factoring: Essential for factoring algebraic expressions.
- Flexibility: Helps in rearranging expressions to solve equations efficiently.
- Foundation for Advanced Concepts: Underpins more complex algebraic manipulations and proofs.

Limitations

- Can sometimes lead to more complex expressions if misapplied.

- Requires careful attention to parentheses and signs.

Other Related Properties and Their Roles

While the distributive property is central here, other properties also play roles:

Associative Property

- Deals with grouping of terms:

$$(a \times b) \times c = a \times (b \times c)$$

- Useful when reorganizing multiplication sequences but not directly involved in the distribution process.

Commutative Property

- Allows swapping operands:

$$a + b = b + a$$

$$a \times b = b \times a$$

- Facilitates rearranging terms for easier computation but not the core property in the given expression.

Practical Examples and Applications

Example 1: Simplifying with the Distributive Property

Express: $4(2 + 5x)$

Apply distributive property:

$$4 \times 2 + 4 \times 5x = 8 + 20x$$

Example 2: Factoring Common Terms

Express: $3(14 + 7x)$

Factor out 7:

$$3 \times (14 + 7x) = 3 \times 7(2 + x) = 21(2 + x)$$

This illustrates how the distributive property helps in factoring expressions.

Conclusion

The expression " $3(13 \times 23) + 3(7x + 3)$ " exemplifies the application of the Distributive Property, a fundamental algebraic principle that facilitates the expansion and factoring of expressions. Recognizing this property allows students and mathematicians to manipulate complex expressions efficiently, solve equations, and understand the structure of algebraic formulas better. While other properties like the associative and commutative properties support the process, the core principle used here is the distributive property.

Features of the Distributive Property:

- Promotes simplification and expansion of expressions
- Essential for factoring and solving algebraic equations
- Provides a foundation for understanding polynomial operations

Pros:

- Simplifies complex algebraic manipulations
- Essential for algebraic factoring and expansion
- Widely applicable across mathematics disciplines

Cons:

- Can be misapplied if parentheses or signs are overlooked
- Sometimes leads to more complicated expressions if not used carefully

In summary, mastering the distributive property is vital for progressing in algebra. Recognizing when and how to apply it—such as in the given expression—enables effective problem-solving and deeper comprehension of mathematical structures.

Given $13x + 23 = 7x + 3$ Which Property Is Used Below $13x + 23 = 3 + 7x$

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