

Use The Distributive Property To Write An Equivalent Expression. $9(w+3x)$

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Understanding how to manipulate algebraic expressions is fundamental in mathematics, especially when simplifying expressions and solving equations. One of the most versatile tools in an algebraist's toolkit is the distributive property. In this article, we'll explore how to use the distributive property to write an equivalent expression for $9(w + 3x)$. We'll break down the process step-by-step, provide clear examples, and discuss the importance of this property in algebraic simplification.

What Is The Distributive Property?

The distributive property is a basic rule in algebra that allows us to multiply a single term across terms inside parentheses. It is expressed as:

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

This means that multiplying a number outside parentheses by each term inside the parentheses yields an equivalent expression. The property is essential because it simplifies complex expressions and prepares them for solving equations.

Why Is the Distributive Property Important?

- Simplifies algebraic expressions
- Facilitates solving equations
- Helps in expanding expressions
- Essential for factoring and factoring out common terms

Applying The Distributive Property To $9(w + 3x)$

Let's focus on the expression $9(w + 3x)$. The goal is to distribute the 9 across both terms inside the parentheses, transforming the expression into an equivalent form that is often easier to work with.

Step-by-Step Process

1. Identify the terms inside the parentheses: w and $3x$
2. Distribute the 9 to each term:
 - Multiply 9 by w
 - Multiply 9 by $3x$

3. Write the resulting expression:

$$9w + 9 \cdot 3x$$

4. Simplify each term:

- $9w$
- $9 \cdot 3x = 27x$

Final Equivalent Expression:

$$9w + 27x$$

Understanding The Result

The expanded form, $9w + 27x$, is equivalent to the original expression $9(w + 3x)$ because of the distributive property. Both expressions simplify calculations and make it easier to combine like terms or substitute values.

Why Expand The Expression?

- To prepare for combining like terms
- To facilitate further algebraic operations
- To clarify the structure of the expression

Examples Of Using The Distributive Property

Let's look at some additional examples to deepen understanding.

Example 1: Basic Expansion

Express $4(2a + 5b)$ using the distributive property.

Solution:

- Multiply 4 by $2a$: $4 \cdot 2a = 8a$
- Multiply 4 by $5b$: $4 \cdot 5b = 20b$

Equivalent expression: $8a + 20b$

Example 2: Distributing Negative Numbers

Express $-3(4x - 7)$.

Solution:

- Multiply -3 by $4x$: $-3 \cdot 4x = -12x$
- Multiply -3 by -7 : $-3 \cdot -7 = 21$

Equivalent expression: $-12x + 21$

Example 3: Distributing Variables

Express $k(3m + 2n)$.

Solution:

- Multiply k by $3m$: $k \cdot 3m = 3km$
- Multiply k by $2n$: $k \cdot 2n = 2kn$

Equivalent expression: $3km + 2kn$

Common Mistakes To Avoid

While applying the distributive property, students often make some common errors. Being aware of these can help prevent mistakes:

1. Forgetting to distribute to all terms

Ensure every term inside the parentheses is multiplied by the outside term.

2. Sign errors

Be cautious with negative signs when distributing negative numbers.

3. Incorrect multiplication

Double-check multiplication, especially with coefficients and variables.

Practice Problems

Test your understanding with these practice problems:

1. Expand: $7(a + 4b)$
2. Expand: $-5(2x - 3y)$
3. Expand: $2(3m + n)$
4. Expand: $-8(5p - 2q)$

Answers:

1. $7a + 28b$
2. $-10x + 15y$
3. $6m + 2n$
4. $-40p + 16q$

Why Mastering The Distributive Property Matters

Proficiency in applying the distributive property is essential for progressing in algebra. It serves as a foundation for:

- Simplifying complex expressions
- Solving linear equations
- Factoring expressions
- Understanding polynomial multiplication

By mastering this property, students can approach algebraic problems with confidence and efficiency.

Conclusion

Using the distributive property to write an equivalent expression for $9(w + 3x)$ demonstrates the power of algebraic manipulation in simplifying and understanding expressions. Distributing the 9 results in $9w + 27x$, an expanded form that provides clarity and flexibility for further calculations. Whether you're expanding expressions, solving equations, or preparing for more advanced topics, the distributive property is an indispensable tool in your mathematical toolkit.

Remember to practice regularly, pay attention to signs and coefficients, and verify your work to develop a strong understanding of algebraic principles.

With consistent effort, you'll find that applying the distributive property becomes second nature, opening the door to more complex mathematical concepts.

Frequently Asked Questions

How do you use the distributive property to simplify $9(w + 3x)$?

Apply the distributive property by multiplying 9 with each term inside the parentheses: $9w + 9 \cdot 3x$, which simplifies to $9w + 27x$.

What is an equivalent expression for $9(w + 3x)$ using the distributive property?

The equivalent expression is $9w + 27x$.

Why is it useful to write $9(w + 3x)$ as $9w + 27x$?

Writing it as $9w + 27x$ simplifies the expression, making it easier to evaluate or combine with other expressions, especially in algebraic problems.

Can the distributive property be used to expand other expressions similar to $9(w + 3x)$?

Yes, the distributive property can be used to expand any expression where a term multiplies a sum, such as $a(b + c)$ or $5(2x + y)$.

What is the key step in applying the distributive property to $9(w + 3x)$?

The key step is to multiply 9 by each term inside the parentheses separately: $9w$ and $9 \cdot 3x$, then combine the results to get the simplified expression.

Additional Resources

Use The Distributive Property To Write An Equivalent Expression is a fundamental skill in algebra that helps students simplify expressions and solve equations more efficiently. Mastering this property not only streamlines calculations but also deepens understanding of how algebraic expressions work. In this guide, we will explore the distributive property in depth, walk through step-by-step examples, and provide practical tips to confidently apply this property to write equivalent expressions, with a particular focus on the expression $9(w + 3x)$.

Understanding The Distributive Property

The distributive property is one of the key properties of real numbers and algebraic expressions. It states that when a number or a term is multiplied by a sum or difference inside parentheses, the multiplication can be "distributed" to each term within the parentheses.

The Formal Definition

For any real numbers a , b , and c :

- $a(b + c) = a b + a c$
- $a(b - c) = a b - a c$

This property allows us to eliminate parentheses and write an equivalent expression that's often easier to work with.

Applying The Distributive Property to $9(w + 3x)$

Let's focus on the specific expression $9(w + 3x)$. Our goal is to use the distributive property to write an equivalent expression, which involves distributing the 9 across the terms inside the parentheses.

Step-by-Step Breakdown

Step 1: Identify the parts of the expression

- The coefficient outside the parentheses: 9
- The terms inside the parentheses: w and $3x$

Step 2: Apply the distributive property

- Multiply 9 by w : $9 w = 9w$
- Multiply 9 by $3x$: $9 3x = 27x$

Step 3: Write the new expression

By distributing the 9, the original expression becomes:

$$9w + 27x$$

This is an equivalent expression to $9(w + 3x)$, but written without parentheses. It's often easier to evaluate or manipulate in further algebraic operations.

Why Use The Distributive Property?

Applying the distributive property has several advantages:

- Simplification: It often makes expressions easier to evaluate or further manipulate.
- Solving equations: Distributing helps isolate variables more straightforwardly.
- Factoring: Recognizing common factors in an expression can lead to factoring, which is crucial in solving quadratic equations and polynomial expressions.
- Understanding structure: It enhances comprehension of how expressions are constructed and related.

Practice: More Examples with the Distributive Property

Let's explore additional examples to reinforce understanding.

Example 1: Distribute $3(2a - 5b)$

- Step 1: Multiply 3 by $2a$: $3 \cdot 2a = 6a$
- Step 2: Multiply 3 by $-5b$: $3 \cdot -5b = -15b$

Equivalent expression: $6a - 15b$

Example 2: Distribute $-4(7x + 2y - z)$

- Step 1: Multiply -4 by $7x$: $-4 \cdot 7x = -28x$
- Step 2: Multiply -4 by $2y$: $-4 \cdot 2y = -8y$
- Step 3: Multiply -4 by $-z$: $-4 \cdot -z = +4z$

Equivalent expression: $-28x - 8y + 4z$

Tips for Mastering The Distributive Property

- Always distribute to each term inside parentheses: Do not forget any terms.
- Watch for negative signs: Distributing a negative number can change the signs of the terms.
- Combine like terms after distribution: Simplify the expression further by combining similar terms.
- Practice with different expressions: The more variety you see, the more intuitive the process becomes.

Common Mistakes to Avoid

- Forgetting to distribute to all terms: Missing a term leads to incorrect expressions.
- Misapplying signs: Distributing a negative coefficient requires careful attention to signs.
- Neglecting to simplify after distribution: Always check if like terms can be combined.

Extending the Concept: Factoring and Reverse Distributive Property

Understanding the distributive property also helps in factoring expressions. Factoring involves reversing the process: recognizing common factors to write expressions in a factored form.

Example: Factoring $9w + 27x$

- Find the greatest common factor (GCF) of $9w$ and $27x$, which is 9.
- Write 9 outside the parentheses: $9(w + 3x)$

This demonstrates the symmetry between expansion and factoring, both rooted in the distributive property.

Practical Applications in Algebra and Beyond

The ability to use the distributive property effectively is essential in various areas:

- Solving linear equations: Simplify expressions before isolating variables.
- Polynomial multiplication: Expand binomials and polynomials.
- Algebraic factoring: Reversing distribution to factor expressions.
- Word problems: Break down complex expressions into manageable parts.

Summary

Using the distributive property to write an equivalent expression, such as transforming $9(w + 3x)$ into $9w + 27x$, is a fundamental algebraic skill. It enables easier manipulation of expressions, aids in solving equations, and builds a strong foundation for more advanced topics like factoring and polynomial operations. By understanding the steps involved, practicing with various examples, and being vigilant about signs and terms, students can confidently apply the distributive property in their mathematical work.

Final Tips for Success

- Practice regularly to recognize patterns.
- Always double-check your distribution for accuracy.
- Use visual aids like algebra tiles or diagrams if you're a visual learner.
- Connect distribution with factoring to see the full picture of algebraic manipulation.

Mastering Use The Distributive Property To Write An Equivalent Expression not only improves your algebra skills but also prepares you for more complex mathematical concepts. Keep practicing, and you'll find that this property becomes an intuitive and powerful tool in your mathematical toolkit.

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