

What Is The Sum Of $3x + 2y - Z$ And $-5x + 7y + Z$

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When dealing with algebraic expressions, understanding how to add or combine similar terms is fundamental. Specifically, questions like "What is the sum of $3x + 2y - Z$ and $-5x + 7y + Z$?" require a clear grasp of algebraic operations, particularly the addition of expressions involving multiple variables. This article aims to provide a comprehensive explanation of how to evaluate such sums, explore the underlying principles, and demonstrate methods for simplifying and understanding algebraic expressions.

Understanding Algebraic Expressions

Before diving into the specific problem, it's essential to understand what algebraic expressions are and how they function.

What Are Algebraic Expressions?

An algebraic expression is a combination of variables, constants, and mathematical operations such as addition, subtraction, multiplication, and division. Examples include:

- $3x + 2y - Z$
- $-5x + 7y + Z$
- $4a - 3b + c$

These expressions do not have an equal sign; they are not equations but parts of equations or standalone expressions that can be simplified or evaluated.

Variables and Constants

- Variables: Symbols like x , y , and Z that represent unknown or changeable quantities.
- Constants: Fixed numerical values, like 2, -5, or 7.

Adding Algebraic Expressions: The Basics

Adding algebraic expressions involves combining like terms, which are terms with the same variables raised to the same powers.

Like Terms

- Terms with the same variable(s) raised to the same power.
- Example: $3x$ and $-5x$ are like terms.
- Example: $2y$ and $7y$ are like terms.
- Example: $-Z$ and Z are like terms.

Combining Like Terms

To add expressions:

1. Identify all like terms.
2. Sum their coefficients.
3. Keep the variables unchanged.

For example, in the expressions:

- $3x + 2y - Z$
- $-5x + 7y + Z$

The like terms are:

- x terms: $3x$ and $-5x$
- y terms: $2y$ and $7y$
- Z terms: $-Z$ and Z

By combining these, we can find the sum of the two expressions.

Step-by-Step Solution for the Sum

Let's analyze the problem thoroughly:

Expression 1: $3x + 2y - Z$

Expression 2: $-5x + 7y + Z$

We want to find:

$$\text{Sum} = (3x + 2y - Z) + (-5x + 7y + Z)$$

Step 1: Arrange the expressions

It's helpful to write the sum explicitly:

$$(3x + 2y - Z) + (-5x + 7y + Z)$$

Step 2: Group like terms

Group similar variables:

- x terms: $3x$ and $-5x$
- y terms: $2y$ and $7y$
- Z terms: $-Z$ and $+Z$

Step 3: Add coefficients of like terms

- For x: $3 + (-5) = -2$
- For y: $2 + 7 = 9$
- For Z: $-1 + 1 = 0$

Step 4: Write the simplified expression

Putting it all together:

$$-2x + 9y + 0$$

Since adding zero doesn't change the expression, the sum simplifies to:

$$-2x + 9y$$

Final Result and Interpretation

The sum of the algebraic expressions $3x + 2y - Z$ and $-5x + 7y + Z$ simplifies to $-2x + 9y$. This result indicates that, after combining like terms, the only remaining variables are x and y, with the Z terms canceling each other out.

Additional Insights on Combining Algebraic Expressions

Understanding how to handle similar problems is crucial in algebra. Here are some key points and tips:

1. Always identify like terms

Failing to recognize like terms can lead to incorrect simplification. Remember, like terms

share the same variables with identical exponents.

2. Be cautious with signs

Pay attention to plus and minus signs when grouping and combining terms. Mistakes often occur with negative coefficients.

3. Simplify step-by-step

Approach complex expressions by breaking them down into smaller parts, combining one set of like terms at a time.

4. Practice with various expressions

Regular practice enhances understanding and speed in algebraic manipulations.

Applications of Combining Algebraic Expressions

The ability to add and simplify algebraic expressions is fundamental in numerous areas:

- Solving equations: Simplify expressions to solve for variables.
- Modeling real-world problems: Express relationships mathematically.
- Calculus and advanced math: Simplify functions before differentiation or integration.
- Physics and engineering: Combine formulas involving multiple variables to analyze systems.

Common Mistakes to Avoid

- Adding unlike terms: For example, combining $3x$ and $2y$ directly without recognizing they are unlike.
- Incorrect sign handling: Misinterpreting the negative sign before z or other coefficients.
- Neglecting to simplify completely: Leaving like terms uncombined.

Practice Problems for Mastery

To ensure mastery, try solving these problems:

1. Find the sum of $4a + 3b - c$ and $-a + 2b + 5c$.

2. Simplify the sum of $7x - 4y + 2z$ and $-3x + y - 2z$.
3. Combine the expressions: $-2m + 5n - p$ and $3m - n + p$.

Answers:

1. $3a + 5b + 4c$
2. $4x - 3y$
3. $m + 4n$

Conclusion

Understanding how to find the sum of algebraic expressions like $3x + 2y - Z$ and $-5x + 7y + Z$ is a foundational skill in algebra. By recognizing like terms, carefully handling signs, and simplifying step-by-step, you can confidently combine expressions and interpret their meaning. Mastery of these techniques empowers you to solve more complex problems in mathematics, science, and engineering, laying the groundwork for advanced analytical skills.

Whether you're a student learning algebra or someone applying mathematical concepts professionally, these principles are essential for effective problem-solving and mathematical communication. Practice regularly, double-check your work, and approach each problem methodically to enhance your proficiency in algebraic manipulation.

Frequently Asked Questions

What is the sum of the expressions $3x + 2y - Z$ and $-5x + 7y + Z$?

The sum is $(3x + 2y - Z) + (-5x + 7y + Z) = (3x - 5x) + (2y + 7y) + (-Z + Z) = -2x + 9y + 0 = -2x + 9y$.

How do I simplify the sum of $3x + 2y - Z$ and $-5x + 7y + Z$?

Combine like terms: $3x$ and $-5x$ give $-2x$; $2y$ and $7y$ give $9y$; $-Z$ and Z cancel out to zero. So, the simplified sum is $-2x + 9y$.

Are the variables Z canceling out when adding the two expressions?

Yes, because $Z + (-Z)$ equals zero, so they cancel each other out in the sum.

What is the coefficient of x in the sum of the two expressions?

The coefficient of x is -2 , obtained by adding 3 and -5 .

What is the coefficient of y in the sum of $3x + 2y - Z$ and $-5x + 7y + Z$?

The coefficient of y is 9 , obtained by adding 2 and 7 .

Does the sum of these expressions depend on the specific values of x , y , or Z ?

No, the sum simplifies to an algebraic expression $-2x + 9y$, independent of specific variable values.

Can the sum of $3x + 2y - Z$ and $-5x + 7y + Z$ be written as a single simplified expression?

Yes, the sum simplifies to $-2x + 9y$.

If $x=1$, $y=2$, and $Z=3$, what is the numerical value of the sum?

Substituting the values, the sum is $-2(1) + 9(2) = -2 + 18 = 16$.

Is the sum of these two expressions linear in terms of x and y ?

Yes, the sum simplifies to a linear expression in x and y : $-2x + 9y$.

What is the importance of combining like terms in algebraic expressions like these?

Combining like terms simplifies the expression, making it easier to understand and evaluate for specific variable values.

Additional Resources

What Is The Sum Of $3x + 2y - Z$ And $-5x + 7y + Z$

Understanding the sum of algebraic expressions is fundamental in algebra, a branch of mathematics that deals with symbols and the rules for manipulating these symbols. When we encounter expressions like $3x + 2y - Z$ and $-5x + 7y + Z$, the question naturally arises: what is their combined value? This inquiry not only involves simple addition but also

requires a clear understanding of how algebraic expressions are combined by combining like terms. In this article, we will explore this question in depth—dissecting the process step-by-step, examining the underlying principles, and illustrating the broader significance of such computations within mathematics.

Understanding Algebraic Expressions and Their Components

What Are Algebraic Expressions?

An algebraic expression is a combination of variables, constants, and mathematical operations such as addition, subtraction, multiplication, and division. Unlike equations, expressions do not contain an equality sign; they are simply quantities that can be manipulated or simplified.

For example:

- $3x + 2y - Z$
- $-5x + 7y + Z$

In these expressions:

- Variables (x , y , Z) represent unknown quantities or values.
- Coefficients (like 3, 2, -5, 7) are numbers multiplying the variables.
- Constants are fixed numerical values, which are sometimes implied within the coefficients or explicitly written.

Breaking Down the Expressions

Let's analyze the two expressions:

1. Expression A: $3x + 2y - Z$
2. Expression B: $-5x + 7y + Z$

Notice that both expressions involve the same variables, which allows us to combine them in a meaningful way.

Combining the Expressions: The Methodology

Adding Algebraic Expressions

To find the sum of the two expressions, we perform algebraic addition. This involves combining like terms—terms that have the same variable raised to the same power.

Step-by-step process:

1. Write the expressions one after the other, aligning similar terms:

$$\begin{array}{r} (3x + 2y - Z) \\ + (-5x + 7y + Z) \end{array}$$

2. Combine like terms:

$$\begin{array}{l} \text{- x-terms: } 3x + (-5x) = (3 - 5) x = -2x \\ \text{- y-terms: } 2y + 7y = (2 + 7) y = 9y \\ \text{- Z-terms: } -Z + Z = (-1 + 1) Z = 0 \end{array}$$

3. Write the simplified sum:

$$-2x + 9y$$

This process demonstrates how algebraic addition relies on the principle of combining like terms.

The Result of the Sum: Simplified Expression

Final Expression

After combining the like terms, the sum of the two expressions $3x + 2y - Z$ and $-5x + 7y + Z$ simplifies to:

$$-2x + 9y$$

Notably, the Z-terms cancel each other out, illustrating a fundamental property of algebra: when adding inverse terms, they nullify each other.

Interpretation of the Result

This simplified expression encapsulates the combined effect of the original expressions, but it does not specify particular numerical values for x or y. To determine a specific numerical sum, values for x and y would need to be known.

Broader Significance of Combining Algebraic Expressions

Applications in Mathematics and Real-World Contexts

The ability to combine and simplify algebraic expressions is crucial across various fields:

- Engineering: Simplifying complex formulas for stress, strain, or electrical currents.
- Economics: Modeling and analyzing financial scenarios with multiple variables.
- Physics: Calculating net forces or energy by combining different vector components.
- Computer Science: Optimizing algorithms that involve mathematical computations.

The Role of Like Terms

The process emphasizes the importance of recognizing like terms—terms with the same variables raised to the same powers. This recognition is vital for simplification and solving equations efficiently.

Key points:

- Only like terms can be combined.
- Coefficients are added or subtracted accordingly.
- Variables not matching are left as they are.

Understanding the Impact of Variable Coefficients and Constants

Coefficients and Their Significance

Coefficients determine the weight or influence of each variable in the expression. When combining expressions, these coefficients are algebraically added, impacting the overall value.

For instance:

- The x-coefficients: 3 and -5 combine to -2.
- The y-coefficients: 2 and 7 combine to 9.

Constants and Their Cancellation

Constants are numerical values without variables. In our example, the Z terms cancel because they are inverse of each other (-Z and +Z). This cancellation is a common

occurrence in algebra and reflects the symmetry or balance within the expressions.

Extending the Concept: Variable Values and Numerical Results

Substituting Values for Variables

To find the numerical result of the combined expression, specific values for x and y are needed. For example, suppose:

$$-x = 4$$

$$-y = 2$$

Then, the simplified expression $-2x + 9y$ becomes:

$$-2(4) + 9(2) = -8 + 18 = 10$$

This demonstrates how algebraic simplifications can lead to straightforward numerical calculations once variable values are known.

Implications for Solving Equations

Understanding how to combine expressions is foundational for solving equations—an essential skill in mathematics. For example, if you set the combined expression equal to a constant, you can solve for the variables:

$$-2x + 9y = C$$

Depending on additional constraints or information, you can find specific solutions for x and y .

Conclusion: The Power of Simplification in Algebra

The question of what is the sum of $3x + 2y - Z$ and $-5x + 7y + Z$ encapsulates fundamental algebraic principles. The process involves recognizing like terms, applying addition or subtraction accordingly, and interpreting the results within a broader mathematical context. The simplified sum, $-2x + 9y$, highlights the elegance of algebra—where complex expressions can be distilled into simpler forms that are easier to analyze, interpret, and

apply.

Mastering these techniques is crucial not only for solving academic problems but also for tackling real-world challenges across diverse disciplines. Whether calculating net forces, optimizing financial portfolios, or designing engineering systems, the foundational skills demonstrated here underpin much of scientific and technological progress. Understanding how to combine algebraic expressions enhances problem-solving capabilities, analytical thinking, and mathematical literacy—skills that are invaluable in an increasingly data-driven world.

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