

Make An Appropriate Substitution And Solve The Equation. $(3x + 7) + 2(3x + 7) - 15 = 0$ Select One: A.

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Solving algebraic equations can often seem daunting at first glance, but with the right approach—particularly through substitution—these problems become much more manageable. In this article, we will delve into a step-by-step method for solving the equation:

$$(3x + 7) + 2(3x + 7) - 15 = 0$$

by making an appropriate substitution. This technique simplifies the algebraic manipulation, making it easier to find the value of the variable (x) . Whether you're a student reviewing algebra fundamentals or someone looking to strengthen problem-solving skills, understanding substitution methods is essential.

Understanding the Equation

Before jumping into substitution, it's important to understand the structure of the given equation.

The equation:

$$(3x + 7) + 2(3x + 7) - 15 = 0$$

contains repeated expressions, specifically $(3x + 7)$. Recognizing this repetition is key to simplifying the problem through substitution.

Why Use Substitution?

Substitution is a technique used to replace a complicated expression with a single variable, making equations easier to manipulate. In this case, the repeated expression $(3x + 7)$ suggests that assigning it a new variable, say (u) , will streamline the equation.

Advantages of substitution include:

- Reducing complexity by turning multiple similar terms into a single variable.
- Making the algebraic process more straightforward.

- Facilitating easier solving and back-substitution to find the original variable.

Step-by-Step Solution Using Substitution

Let's now walk through solving the equation systematically.

Step 1: Make the Substitution

Identify the repeated expression:

$$(3x + 7)$$

Define:

$$(u = 3x + 7)$$

This helps rewrite the original equation more simply.

Step 2: Rewrite the Equation in Terms of (u)

Substitute (u) into the original equation:

$$(u + 2u - 15 = 0)$$

Simplify:

$$(3u - 15 = 0)$$

Step 3: Solve for (u)

Add 15 to both sides:

$$(3u = 15)$$

Divide both sides by 3:

$$(u = 5)$$

Step 4: Back-Substitute to Find x

Recall that:

$$u = 3x + 7$$

Set this equal to 5:

$$3x + 7 = 5$$

Subtract 7 from both sides:

$$3x = 5 - 7$$

$$3x = -2$$

Divide both sides by 3:

$$x = -\frac{2}{3}$$

Final Answer

The solution to the equation is:

$$\boxed{x = -\frac{2}{3}}$$

Additional Tips for Using Substitution in Algebra

- Always identify the common or repeated expressions that can be replaced.
- Clearly define your substitution to avoid confusion.
- After solving the simplified equation, substitute back to find the original variable.
- Check your solution by plugging the value of x back into the original equation to verify correctness.

Practice Problems

To strengthen your substitution skills, try solving the following equations:

1. $\backslash (2x + 4) + 3(2x + 4) - 10 = 0 \backslash$
2. $\backslash 5(3x - 2) + 2(3x - 2) + 7 = 0 \backslash$
3. $\backslash (x - 1) + 4(x - 1) - 8 = 0 \backslash$

Apply the substitution method, and you'll notice how much easier it becomes to solve these equations.

Conclusion

Using substitution is a powerful strategy in algebra, especially when dealing with equations containing repeated expressions. By identifying a common part of the equation, assigning it a variable, and solving step-by-step, you simplify the process considerably. The example discussed here demonstrates that, with a clear plan and methodical steps, even seemingly complex equations are manageable. Practice regularly to become confident in applying substitution techniques, and you'll enhance your problem-solving skills for a wide range of algebraic challenges.

Frequently Asked Questions

What is the first step to simplify the equation $(3x + 7) + 2(3x + 7) - 15 = 0$?

The first step is to recognize the common binomial expression $(3x + 7)$ and combine like terms by distributing and adding them together.

How can you make an appropriate substitution to simplify the equation $(3x + 7) + 2(3x + 7) - 15 = 0$?

Let $u = 3x + 7$, then the equation becomes $u + 2u - 15 = 0$, simplifying the process of solving for x .

After substituting $u = 3x + 7$, what is the simplified equation?

The simplified equation is $3u - 15 = 0$.

How do you solve for u after substitution?

Add 15 to both sides and then divide by 3: $u = 15 / 3 = 5$.

Once u is found, how do you find the value of x?

Substitute $u = 5$ back into $u = 3x + 7$, then solve for x : $5 = 3x + 7$, so $3x = 5 - 7 = -2$, and $x = -2/3$.

What is the final solution for x in the equation $(3x + 7) + 2(3x + 7) - 15 = 0$?

The solution is $x = -2/3$.

Why is making a substitution helpful in solving this type of equation?

Making a substitution simplifies the equation by reducing it to a single variable, making it easier to solve step-by-step.

Additional Resources

Make An Appropriate Substitution And Solve The Equation. $(3x + 7) + 2(3x + 7) - 15 = 0$ Select One: A.

Mathematics often presents us with equations that seem complex at first glance but become manageable once we recognize the underlying patterns. One effective strategy for tackling such problems is substitution — a method that simplifies the equation by introducing a new variable to replace a recurring expression. This article will guide you through the process of making an appropriate substitution and solving the given algebraic equation: $(3x + 7) + 2(3x + 7) - 15 = 0$. Whether you're a student brushing up on algebra skills or someone interested in the logical structure of equations, understanding this process enhances problem-solving confidence and mathematical reasoning.

Understanding the Equation and Its Components

Before diving into substitution, it's essential to thoroughly analyze the given equation:

$$(3x + 7) + 2(3x + 7) - 15 = 0$$

This equation involves:

- A linear expression, $3x + 7$, which appears twice.
- Its multiple, $2(3x + 7)$, which multiplies the same expression.
- A constant term, -15 .
- An equality set to zero.

The goal is to solve for the variable x , but the repeated expression suggests an opportunity to simplify the equation by substitution.

Why Use Substitution in This Context?

Substitution is an algebraic technique where a complex expression is replaced with a single variable, simplifying the original equation. In this case, since $(3x + 7)$ appears multiple times, defining a new variable to represent this expression reduces the equation's complexity.

Advantages of substitution include:

- Reducing the number of terms to manipulate.
- Clarifying the structure of the equation.
- Making it easier to isolate the variable of interest.
- Providing a systematic approach to similar problems with repeated expressions.

In our specific problem, substitution will streamline the process, allowing us to focus on solving a simpler algebraic equation rather than dealing with multiple identical expressions.

Step-by-Step Substitution and Solution Process

Let's proceed through the steps to make an appropriate substitution and solve the equation.

Step 1: Define the Substitution

Identify the repeated expression:

- Repeated expression: $3x + 7$

Let's introduce a new variable:

- Let $y = 3x + 7$

This substitution transforms the original equation into an expression involving y .

Step 2: Rewrite the Equation in Terms of y

Substitute y into the original equation:

$$(3x + 7) + 2(3x + 7) - 15 = 0$$

becomes

$$y + 2y - 15 = 0$$

which simplifies to:

$$(1 + 2) y - 15 = 0$$

or

$$3y - 15 = 0$$

Step 3: Solve the Simplified Equation for y

Now, solve for y:

$$3y - 15 = 0$$

Add 15 to both sides:

$$3y = 15$$

Divide both sides by 3:

$$y = 15 / 3$$

$$y = 5$$

Step 4: Back-Substitute to Find x

Recall that $y = 3x + 7$. Substitute $y = 5$:

$$3x + 7 = 5$$

Subtract 7 from both sides:

$$3x = 5 - 7$$

$$3x = -2$$

Divide both sides by 3:

$$x = -2 / 3$$

Result: The solution to the original equation is $x = -2/3$.

Verifying the Solution

It's always prudent to verify the solution by substituting it back into the original equation:

Original equation:

$$(3x + 7) + 2(3x + 7) - 15 = 0$$

Plug in $x = -2/3$:

Calculate $3x + 7$:

$$3(-2/3) + 7 = -2 + 7 = 5$$

Now, rewrite the original with this value:

$$5 + 2 \cdot 5 - 15 = ?$$

Calculate:

$$5 + 10 - 15 = 0$$

which simplifies to:

$$15 - 15 = 0$$

The left side equals the right side, confirming that $x = -2/3$ is indeed the solution.

Broader Applications of Substitution in Algebra

The approach illustrated here is not confined to this specific problem. Substitution is a powerful tool in algebra used in various contexts:

- Solving systems of equations where variables are interdependent.
- Simplifying rational expressions or polynomial equations.
- Handling equations involving radicals or absolute values.
- Tackling word problems that translate into complex algebraic equations.

By mastering substitution, students and professionals can approach a broad range of mathematical challenges with increased confidence and efficiency.

Common Pitfalls and Tips for Successful Substitution

While substitution streamlines problem-solving, certain pitfalls can hinder progress. Here are some tips:

- Choose the right expression to substitute: Focus on recurring expressions or those that simplify the equation upon substitution.
- Keep track of substitutions: Clearly define your variables and remember to back-substitute to find the original variable.
- Check your solution: Always verify by plugging the solution back into the original equation.
- Be cautious with more complex substitutions: When equations involve multiple terms, consider whether substitution simplifies the structure or complicates it.

Conclusion: The Power of Substitution in Algebra

The process of making an appropriate substitution transforms a seemingly complex algebraic equation into a more manageable form. In our example, defining $y = 3x + 7$ allowed us to reduce the original problem to a simple linear equation in y , leading directly to the solution $x = -2/3$. This method exemplifies how recognizing patterns and strategic substitutions can demystify algebraic challenges, making them accessible and solvable.

As you continue to explore algebra, remember that substitution is more than just a technique—it's a way of thinking about equations that emphasizes pattern recognition and strategic problem-solving. Whether you're dealing with simple linear equations or more intricate systems, mastering substitution enhances your mathematical toolkit, empowering you to navigate equations with confidence and clarity.

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