Solve The Following Equation Algebraically. Verify Your Results Using A Graphing Utility. 3(2x4)+6(x5)=3(35x)+5x19

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Introduction

Solving algebraic equations is a fundamental skill in mathematics that allows us to find the unknown value of variables. When dealing with complex expressions, it's essential to approach the problem systematically, simplifying and isolating the variable step by step. Once you have an algebraic solution, verifying it with a graphing utility ensures accuracy and provides visual confirmation of the solution. In this article, we will explore how to solve the equation:

3(2x4) + 6(x5) = 3(35x) + 5x19

Algebraically, and then verify the results using a graphing utility.

Understanding the Equation

Before diving into the solution process, it's crucial to understand the structure and components of the given equation.

Equation:

$$ 3(2x4) + 6(x5) = 3(35x) + 5x19 $$

At first glance, the notation "x4", "x5", and "x19" may seem ambiguous. Typically, in algebra, variables are represented by "x", "y", etc. However, here, it appears "x4" could mean "x times 4", or perhaps "x multiplied by 4". Similarly for "x5" and "x19".

Assumption:

- "x4" means x multiplied by 4 → x × 4
- "x5" means x multiplied by 5 → x × 5
- "x19" means x multiplied by 19 → x × 19

If this interpretation is correct, the equation becomes:

$$ 3(2 \times 4) + 6(5 \times x) = 3(35 \times x) + 5 \times 19 \times x $$

Alternatively, perhaps the notation intends for the "x" to be multiplied by the number following it. For clarity, let's rewrite the equation assuming "x4" means "x times 4", etc.

Step 1: Rewrite the Equation Clearly

Given the assumption, rewrite the equation:

$$ 3 \times (2 \times 4) + 6 \times (5 \times x) = 3 \times (35 \times x) + 5 \times 19 \times x $$

Simplify each term:

- $ 3 \times 2 \times 4 = 3 \times 8 = 24 $
- $ 6 \times 5 \times x = 30x $
- $ 3 \times 35 \times x = 105x $
- $ 5 \times 19 \times x = 95x $

Thus, the equation simplifies to:

$$ 24 + 30x = 105x + 95x $$

Combine like terms on the right:

$$ 24 + 30x = 200x $$

Step 2: Solve Algebraically

Our simplified equation is:

$$ 24 + 30x = 200x $$

Subtract $ 30x $ from both sides:

$$ 24 = 200x - 30x $$
$$ 24 = 170x $$

Divide both sides by 170:

$$ x = \frac{24}{170} $$

Reduce the fraction:

$$ x = \frac{12}{85} $$

Final algebraic solution:

$$ \boxed{ x = \frac{12}{85} } $$

Step 3: Verify the Solution

To verify the solution, substitute $ x = \frac{12}{85} $ back into the original equation and see if both sides are equal.

Original equation:

$$ 3(2 \times 4) + 6(5 \times x) = 3(35 \times x) + 5 \times 19 \times x $$

Substitute $ x = \frac{12}{85} $:

- Left side:

$$ 3 \times 8 + 6 \times 5 \times \frac{12}{85} = 24 + 6 \times 5 \times \frac{12}{85} $$

Calculate:

$$ 6 \times 5 = 30 $$
$$ 30 \times \frac{12}{85} = \frac{360}{85} $$

So,

$$ \text{Left side} = 24 + \frac{360}{85} $$

Express 24 as a fraction with denominator 85:

$$ 24 = \frac{24 \times 85}{85} = \frac{2040}{85} $$

Add:

$$ \frac{2040}{85} + \frac{360}{85} = \frac{2400}{85} $$

- Right side:

$$ 3 \times 35 \times \frac{12}{85} + 5 \times 19 \times \frac{12}{85} $$

Calculate:

$$ 3 \times 35 = 105 $$
$$ 105 \times \frac{12}{85} = \frac{1260}{85} $$

Similarly,

$$ 5 \times 19 = 95 $$
$$ 95 \times \frac{12}{85} = \frac{1140}{85} $$

Add:

$$ \frac{1260}{85} + \frac{1140}{85} = \frac{2400}{85} $$

Both sides are equal:

$$ \frac{2400}{85} = \frac{2400}{85} $$

Thus, the algebraic solution is verified.

Visual Verification Using a Graphing Utility

While algebraic methods provide an exact solution, visual verification using a graphing utility enhances understanding and confirms the correctness.

Step 1: Express Both Sides as Functions

Define:

- $y_1 = 3(2 \times 4) + 6(5 \times x)$
- $y_2 = 3(35 \times x) + 5 \times 19 \times x$

Simplify:

- $y_1 = 24 + 30x$
- $y_2 = 105x + 95x = 200x$

So, the equation reduces to:

$$y_1 = y_2$$

Or graphically:

$$y = 24 + 30x$$
$$y = 200x$$

Step 2: Plot the Functions

Using a graphing calculator or software (like Desmos, GeoGebra, or a graphing calculator):

- Plot $y = 24 + 30x$
- Plot $y = 200x$

The intersection point corresponds to the solution $x = \frac{12}{85}$.

Calculate the approximate value:

$$x = \frac{12}{85} \approx 0.1412$$

At this x-value:

- $y = 24 + 30 \times 0.1412 \approx 24 + 4.236 \approx 28.236$
- $y = 200 \times 0.1412 \approx 28.236$

The intersection occurs at roughly $(0.1412, 28.236)$, confirming the algebraic solution.

Additional Tips for Solving Similar Equations

- Always simplify expressions before attempting to solve.
- Identify the variables and their coefficients carefully.
- Combine like terms systematically.
- When in doubt, substitute the solution back into the original equation.
- Use graphing tools for visual confirmation, especially with complex or multiple-variable equations.
- Check for extraneous solutions if the equation involves square roots, denominators, or other restrictions.

Conclusion

Solving algebraic equations requires a clear understanding of the notation, systematic simplification, and careful calculation. In this example, assuming "x4" means "x times 4", and so forth, led us to the solution:

$$\boxed{ x = \frac{12}{85} }$$

Verifying algebraically by substitution confirmed the correctness of the solution. Using graphing utilities further reinforces this conclusion visually, providing confidence that the solution is accurate.

Mastering both algebraic techniques and graphing verification enhances problem-solving skills and deepens understanding of the relationships within equations. Whether you're tackling homework, preparing for exams, or solving real-world problems, these methods are essential tools in your mathematical toolkit.

Frequently Asked Questions (FAQs)

Q1: What if the equation contains variables in exponents or roots?
A: Such equations often require different methods like logarithms, factoring, or numerical solutions. It's important to recognize the type of equation before choosing the solving technique.

Q2: Can I rely solely on graphing utilities?
A2: While graphing tools are valuable for verification, algebraic solutions are more precise and necessary for exact results, especially in formal settings.

Q3: How do I handle equations with multiple variables?
A: Use substitution, elimination, or matrices to solve systems of equations involving multiple variables.

Q4: Are there online tools available for solving algebraic equations?
A4: Yes, websites like WolframAlpha, Desmos, GeoGebra, and

Frequently Asked Questions

What is the first step to solving the equation 3(2x4) + 6(x5) = 3(35x) + 5x19 algebraically?

First, simplify each term by performing the multiplications inside the parentheses: 3×2×4, 6×5, 3×35x, and 5×19, to make the equation easier to solve.

How do you simplify the expression 3(2x4)?

Multiply 3 by 2 and then by 4: 3×2×4 = 3×8 = 24, so 3(2x4) simplifies to 24.

What is the simplified form of the equation after calculating 3(2x4) and 6(x5)?

After simplification, the equation becomes 24 + 6×5 = 3(35x) + 5×19, which simplifies to 24 + 30 = 3(35x) + 95.

How do you simplify the right side of the equation

3(35x) + 5×19?

Calculate 3×35x = 105x and 5×19 = 95, so the right side simplifies to 105x + 95.

What is the simplified equation after calculating all constants?

The equation becomes 54 = 105x + 95.

How do you solve for x in the equation 54 = 105x + 95?

Subtract 95 from both sides to get 54 - 95 = 105x, which simplifies to -41 = 105x, then divide both sides by 105 to find x = -41/105.

What is the approximate value of x after solving algebraically?

x ≈ -0.3905 when rounded to four decimal places.

How can you verify the solution graphically using a graphing utility?

Plot the two expressions y = 3(2x4) + 6(x5) and y = 3(35x) + 5x19 on the graph. The intersection point's x-coordinate should match the algebraic solution, confirming its accuracy.

Why is it important to verify algebraic solutions with a graphing utility?

Verifying with a graphing utility helps confirm the correctness of the solution visually and ensures there are no calculation errors or misunderstandings of the algebraic steps.

Additional Resources

Algebraic Solution and Graphical Verification of the Equation: 3(2x4) + 6(x5) = 3(35x) + 5x19

Introduction

Mathematics, especially algebra, is the backbone of logical reasoning and problem-solving across various scientific and engineering fields. Today, we delve into a specific algebraic challenge: solving a complex linear equation and verifying the solution graphically. This process not only reinforces algebraic proficiency but also highlights the importance of visual tools like graphing utilities in confirming algebraic results.

In this detailed analysis, we will:

- Break down and simplify the given equation step-by-step.
- Solve for the variable algebraically.
- Use a graphing utility to verify the solution visually.
- Discuss the significance of combining algebraic and graphical methods.

Let’s approach this systematically, as if exploring a new, advanced product designed to sharpen analytical skills.

Understanding the Equation

The original equation is:

3(2x4) + 6(x5) = 3(35x) + 5x19

At first glance, the notation might seem unconventional, but it appears to follow a pattern where numbers are placed directly adjacent to variables, possibly indicating multiplication. To avoid ambiguity, we interpret the expressions as follows:

- 2x4 = 2 4
- x5 = x 5
- 35x = 35 x
- 5x19 = 5 x 19

This interpretation aligns with common algebraic notation, where juxtaposition indicates multiplication.

Rewritten with explicit multiplication:

3 (2 4) + 6 (x 5) = 3 (35 x) + 5 x 19

Step 1: Simplify Each Term

Let’s simplify each term separately:

1. Left Side:

- 3 (2 4) = 3 8 = 24
- 6 (x 5) = 6 5x = 30x

2. Right Side:

- 3 (35 x) = 3 35x = 105x
- 5 x 19 = 5 19 x = 95x

Simplified Equation:

24 + 30x = 105x + 95x

Step 2: Combine Like Terms

Combine the x-terms on the right:

105x + 95x = 200x

So, the equation becomes:

24 + 30x = 200x

Step 3: Isolate the Variable

To solve for x, we want to bring all x-terms to one side and constants to the other:

Subtract 30x from both sides:

24 + 30x - 30x = 200x - 30x

Simplifies to:

24 = 170x

Now, solve for x:

x = 24 / 170

Simplify the fraction:

x = 12 / 85

Result of Algebraic Solution:

\[
\boxed{
x = \frac{12}{85}
\]

This is the exact solution to the equation. To confirm its correctness, we will now verify this algebraic result graphically.

Using a Graphing Utility to Verify the Solution

Graphing calculators and software like Desmos, GeoGebra, or TI-84 are invaluable in visualizing equations and solutions. They enable us to see where two functions intersect, which corresponds to the solution of the original equation.

Step 1: Rewrite the Equation as Functions

Given the original equation:

24 + 30x = 200x

We can interpret this as:

- Left Function: \(y_1 = 24 + 30x \)

- Right Function: $y_2 = 200x$

The solution $x = \frac{12}{85}$ is where $y_1 = y_2$.

Step 2: Plot the Functions

Input these into a graphing utility:

- $y_1 = 24 + 30x$
- $y_2 = 200x$

Observe the graph to identify the point of intersection.

Step 3: Analyze the Graph

- The intersection point occurs where $y_1 = y_2$.
- By examining the graph, locate the x-coordinate at the intersection.
- The software should confirm $x \approx 0.1412$, which matches the algebraic solution $\frac{12}{85} \approx 0.1412$.

Verifying the Solution Numerically

Calculate the approximate decimal:

$$
x = \frac{12}{85} \approx 0.141176
$$

Plug into the original simplified equations:

- $y_1 = 24 + 30 \times 0.141176 \approx 24 + 4.235 \approx 28.235$
- $y_2 = 200 \times 0.141176 \approx 28.235$

The two sides are approximately equal, confirming the solution’s accuracy.

Significance of Combining Algebraic and Graphical Methods

Advantages include:

1. Enhanced Understanding: Visualizing the solution helps grasp the behavior of functions and their intersections.
2. Error Detection: Graphing can reveal inconsistencies or errors in algebraic solutions.
3. Learning Reinforcement: It bridges the gap between symbolic manipulation and conceptual understanding.

Practical Applications and Recommendations

- When solving equations involving variables, always consider verifying solutions graphically.
- Use graphing tools for complex or non-linear equations where algebraic solutions are challenging.
- Develop a habit of cross-verification to minimize errors.

Conclusion

By systematically simplifying and solving the given equation algebraically, we confirmed that:

\[
\boxed{
x = \frac{12}{85}
\]

The graphical verification using a graphing utility reinforced this result, illustrating the intersection point of the functions \(y_1 = 24 + 30x \) and \(y_2 = 200x \).

This dual approach exemplifies best practices in mathematical problem-solving: leveraging both symbolic algebra and visual analysis. As an essential skill for students and professionals alike, mastering these techniques ensures accuracy and deepens understanding—hallmarks of a true mathematical product expert.

Final Thoughts

Whether you’re tackling academic problems or applying mathematics in real-world scenarios, integrating algebraic methods with graphical visualization remains invaluable. It transforms abstract numbers into tangible insights, fostering a comprehensive grasp of the problem at hand.

The journey from initial equation to verified solution underscores the importance of clarity, precision, and the effective use of technological tools—cornerstones of modern mathematical practice.

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