Solve The Equation. 6+2x=4(x+2)3(x3) Select The Correct Choice Below And, If Necessary, Fill In The Answer

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Introduction to Solving Algebraic Equations

Mathematics is a universal language that allows us to describe relationships, analyze data, and solve real-world problems. Among the foundational skills in mathematics is solving algebraic equations, which involves finding the value of the variable that makes the equation true. In this guide, we will explore a specific algebraic equation: 6 + 2x = 4(x + 2) 3(x 3), and walk through the process of solving it step-by-step.

Understanding how to approach such equations is essential for students, educators, and anyone interested in developing their problem-solving skills. This comprehensive tutorial will break down the problem, interpret the notation, and guide you through multiple methods to find the correct solution.

Breaking Down the Equation

Before diving into solving, it’s crucial to interpret the given equation correctly. The equation is:

6 + 2x = 4(x + 2) 3(x 3)

At first glance, the notation appears complex, but with careful analysis, we can clarify its meaning.

Analyzing the Components

- The left side of the equation is straightforward: 6 + 2x.
- The right side contains multiple expressions: 4(x + 2) and 3(x 3).

Given the standard notation in algebra, the lack of explicit multiplication signs might suggest multiplication between the expressions. The most probable interpretation is:

6 + 2x = 4(x + 2) 3(x 3)

Here, the asterisks () indicate multiplication. The second parenthesis, 3(x 3), might be a typo or shorthand, but most logically, it could represent 3(x - 3) or a similar expression.

Note: Since the original problem states "3(x3)", it’s likely a typo or formatting issue. Assuming it should be 3(x - 3), the entire right side becomes:

4(x + 2) 3(x - 3)

Therefore, the rewritten equation becomes:

6 + 2x = 4(x + 2) 3(x - 3)

Standardized Form of the Equation

Assuming the above interpretation, the equation is:

$6 + 2x = 4(x + 2) 3(x - 3)$

which simplifies to:

$6 + 2x = [4(x + 2)] [3(x - 3)]$

Now, let's expand the right side step-by-step.

Step-by-Step Solution Process

Step 1: Expand Both Factors on the Right Side

- Expand $4(x + 2)$:

$4(x + 2) = 4x + 8$

- Expand $3(x - 3)$:

$3(x - 3) = 3x - 9$

Step 2: Multiply the Two Binomials

Now, multiply (4x + 8) and (3x - 9):

\[

(4x + 8) \times (3x - 9)

\]

Using the distributive property (FOIL method):

- First: 4x \times 3x = 12x^2
- Outer: 4x \times -9 = -36x
- Inner: 8 \times 3x = 24x
- Last: 8 \times -9 = -72

Adding these results:

\[

12x^2 - 36x + 24x - 72

\]

Combine like terms:

\[

12x^2 - 12x - 72

\]

Thus, the right side simplifies to:

\[

12x^2 - 12x - 72

\]

Step 3: Write the Full Equation

Now, the original equation becomes:

\[

6 + 2x = 12x^2 - 12x - 72

\]

Step 4: Move All Terms to One Side to Form a Quadratic Equation

Subtract 6 + 2x from both sides:

\[

0 = 12x^2 - 12x - 72 - 6 - 2x

\]

Simplify:

\[

0 = 12x^2 - 12x - 2x - 72 - 6

\]

\[

0 = 12x^2 - 14x - 78

\]

Divide through by 2 to simplify coefficients:

\[
0 = 6x^2 - 7x - 39
\]

Solving the Quadratic Equation

The quadratic equation now is:

6x^2 - 7x - 39 = 0

To find the solutions for x, we can use the quadratic formula:

\[
x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}
\]

where:

- \(a = 6\)
- \(b = -7\)
- \(c = -39\)

Calculating the Discriminant

The discriminant \(D\):

\[

$$
D = b^2 - 4ac
$$

$$
D = (-7)^2 - 4 \times 6 \times (-39)
$$

$$
D = 49 - (-936)
$$

$$
D = 49 + 936 = 985
$$

Since the discriminant is positive and not a perfect square, the solutions will be irrational but real.

Applying the Quadratic Formula

$$
x = \frac{-(-7) \pm \sqrt{985}}{2 \times 6}
$$

$$
x = \frac{7 \pm \sqrt{985}}{12}
$$

Thus, the solutions are:

\[

x = \frac{7 + \sqrt{985}}{12}

\quad \text{and} \quad

x = \frac{7 - \sqrt{985}}{12}

\]

Numerical Approximation of the Solutions

To provide more practical solutions, approximate \(\sqrt{985}\):

\[

\sqrt{985} \approx 31.4

\]

Calculate each solution:

- First solution:

\[

x \approx \frac{7 + 31.4}{12} = \frac{38.4}{12} \approx 3.2

\]

- Second solution:

\[

x \approx \frac{7 - 31.4}{12} = \frac{-24.4}{12} \approx -2.03

\]

Therefore, the approximate solutions are:

$$
x \approx 3.2 \quad \text{or} \quad x \approx -2.03
$$

Verification of Solutions

It’s important to verify whether the solutions satisfy the original equation, especially given the initial assumptions about notation.

Plugging back into the original equation:

$$
6 + 2x = 4(x + 2) \times 3(x - 3)
$$

- For $x \approx 3.2$:

- Left side:

$$
6 + 2(3.2) = 6 + 6.4 = 12.4
$$

- Right side:

$$
4(3.2 + 2) \times 3(3.2 - 3) = 4(5.2) \times 3(0.2)
$$

$$
= 4 \times 5.2 \times 3 \times 0.2
$$

$$
= (4 \times 5.2) \times (3 \times 0.2) = 20.8 \times 0.6 = 12.48
$$

- Close enough considering rounding errors; the solution is valid.

- For $x \approx -2.03$:

- Left side:

$$
6 + 2(-2.03) = 6 - 4.06 = 1.94
$$

- Right side:

$$
4(-2.03 + 2) \times 3(-2.03 - 3) = 4(-0.03) \times 3(-5.03)
$$

$$
= -0.12 \times -15.09 \approx 1.81
$$

- Again, close within rounding error, confirming the approximate solution.

Final Answer and Choosing the Correct Solution

Based on the above calculations, the solutions to the original equation are approximately:

- x ≈ 3.2
- x ≈ -2.03

Depending on the context or specific instructions, the problem might ask to select the correct choice from multiple options or to fill in the exact algebraic form

Frequently Asked Questions

What is the first step to solve the equation 6 + 2x = 4(x + 2) - 3(x - 3)?

Distribute the 4 and the -3 on the right side: 6 + 2x = 4x + 8 - 3x + 9.

How do you simplify the equation 6 + 2x = 4x + 8 - 3x + 9?

Combine like terms on the right: 4x - 3x = x, and 8 + 9 = 17, so it becomes 6 + 2x = x + 17.

What is the next step after simplifying to 6 + 2x = x + 17?

Subtract x from both sides: 6 + 2x - x = 17, which simplifies to 6 + x = 17.

How do you solve for x in 6 + x = 17?

Subtract 6 from both sides: x = 17 - 6, so x = 11.

What is the solution to the equation 6 + 2x = 4(x + 2) - 3(x - 3)?

The value of x is 11.

Which option correctly solves the equation 6 + 2x = 4(x + 2) - 3(x - 3)?

x = 11.

Is the solution x = 11 correct for the given equation?

Yes, substituting x = 11 back into the original equation satisfies the equation.

What is a common mistake to avoid when solving this equation?

A common mistake is forgetting to distribute the -3 or incorrectly combining like terms.

Can you verify the solution x = 11 by substituting back into the original equation?

Yes, substituting x = 11 into 6 + 2x gives 6 + 2(11) = 6 + 22 = 28, and on the right side 4(11 + 2) - 3(11 - 3) = 4(13) - 3(8) = 52 - 24 = 28. Both sides are equal, confirming x = 11.

What is the overall process for solving equations like 6 + 2x = 4(x + 2) - 3(x - 3)?

Distribute, combine like terms, isolate the variable by adding or subtracting terms, then solve for x.

Additional Resources

Solve The Equation. 6+2x=4(x+2)3(x3) Select The Correct Choice Below And, If Necessary, Fill In The Answer

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Introduction

Mathematics, often regarded as the language of logic and precision, offers a myriad of challenges that test our problem-solving abilities. Among these, algebraic equations stand as foundational elements, requiring careful manipulation and understanding to arrive at solutions. The problem "Solve The Equation. 6+2x=4(x+2)3(x3) Select The Correct Choice Below And, If Necessary, Fill In The Answer" exemplifies such an algebraic challenge, demanding a methodical approach to decode, simplify, and solve.

This comprehensive analysis aims to dissect this equation thoroughly, explore its intricacies, and provide clarity for learners and enthusiasts alike. We will examine the components of the equation, interpret potential ambiguities, perform step-by-step solutions, and discuss the implications of the correct answers. Our goal is to not only solve the problem but also to illuminate the underlying principles governing algebraic solutions.

Understanding the Equation: Parsing the Components

The equation presented is:

$6 + 2x = 4(x + 2)3(x3)$

At first glance, the expression appears complex, possibly containing typographical or formatting ambiguities. To ensure clarity, we must interpret the notation correctly.

Potential Interpretations

1. Literal reading with implied multiplication:

- "4(x + 2)3(x3)" might mean $4 \times (x + 2) \times 3 \times (x3)$, implying a series of multiplications.

2. Typographical errors or formatting issues:

- The expression "3(x3)" could be intended as $3 \times x^3$ or $3(x^3)$.

- The lack of explicit multiplication signs could cause confusion.

3. Possible intended expression:

- The entire right side may be:

$4(x + 2) \times 3 \times x^3$

- Alternatively, perhaps $4(x + 2) + 3(x^3)$ if the operator is missing.

Assumption for Clarity

Given the structure, the most plausible interpretation is:

$$6 + 2x = 4 \times (x + 2) \times 3 \times x^3$$

Expressed mathematically as:

$$6 + 2x = 4(x + 2) \times 3 \times x^3$$

This interpretation aligns with standard algebraic notation, where multiplication signs are often omitted but implied.

Step-by-Step Solution Strategy

To solve the equation:

$$6 + 2x = 4(x + 2) \times 3 \times x^3$$

Step 1: Simplify the Right Side

Calculate the right side:

- First, expand the constants:

$4 \times 3 = 12$

- Now, the right side becomes:

$12 \times (x + 2) \times x^3$

Step 2: Rewrite the Equation

The simplified form is:

$6 + 2x = 12 \times (x + 2) \times x^3$

Step 3: Expand or Rearrange as Needed

Since the right side involves a product of terms, it might be beneficial to expand or leave as is depending on the approach.

Let's expand (x + 2):

$6 + 2x = 12 \times (x + 2) \times x^3$

which becomes:

$6 + 2x = 12 \times (x \times x^3 + 2 \times x^3) = 12 \times (x\square + 2x^3)$

Now, the right side is:

$12x^4 + 24x^3$

Step 4: Write the Equation in Standard Form

Bring all terms to one side:

$6 + 2x - 12x^4 - 24x^3 = 0$

Rearranged:

$-12x^4 - 24x^3 + 2x + 6 = 0$

To simplify, divide the entire equation by -2:

$6x^4 + 12x^3 - x - 3 = 0$

Analyzing the Resulting Polynomial Equation

The simplified polynomial is:

$6x^4 + 12x^3 - x - 3 = 0$

This is a quartic (degree 4) polynomial, which can be challenging to solve algebraically. However, attempting rational root testing could yield solutions.

Rational Root Theorem and Testing Possible Roots

The Rational Root Theorem states that any rational root, in lowest terms p/q, where p divides the constant term (-3) and q divides the leading coefficient (6).

Possible values of p:

- ±1, ±3

Possible values of q:

- 1, 2, 3, 6

Candidate roots:

- ±1, ±1/2, ±1/3, ±1/6, ±3, ±3/2, ±1/3, ±1/6

Now, test these candidates by substituting into the polynomial:

$f(x) = 6x\square + 12x^3 - x - 3$

Testing Candidate Roots

1. x = 1

$f(1) = 6(1) + 12(1) - 1 - 3 = 6 + 12 - 1 - 3 = 14 \square 0$

2. x = -1

f(-1) = 6(1) + 12(-1) - (-1) - 3 = 6 - 12 + 1 - 3 = -8 $\neq$ 0

3. x = 3

f(3) = 6(81) + 12(27) - 3 - 3 = 486 + 324 - 3 - 3 = 804 $\neq$ 0

4. x = -3

f(-3) = 6(81) + 12(-27) + 3 - 3 = 486 - 324 + 3 - 3 = 162 $\neq$ 0

5. x = 1/2

f(0.5) = 6(0.5)^4 + 12(0.5)^3 - 0.5 - 3

Calculate:

- (0.5)^4 = 0.0625

- (0.5)^3 = 0.125

Thus:

6 0.0625 = 0.375

12 0.125 = 1.5

Total: 0.375 + 1.5 - 0.5 - 3 = 1.875 - 3. = -1.125 $\neq$ 0

6. x = -1/2

f(-0.5):

$6(0.5)^4 + 12(-0.5)^3 - (-0.5) - 3$

Calculations:

- $(0.5)^4 = 0.0625$

- $(-0.5)^3 = -0.125$

So:

$60.0625 = 0.375$

$12(-0.125) = -1.5$

Sum: $0.375 - 1.5 + 0.5 - 3 = -0.625 - 3 = -3.625$ □ 0

Similarly, testing other candidates yields no rational roots.

Alternative Approaches

Given the difficulty with rational roots, numerical methods or graphing could be employed to approximate solutions. Alternatively, factoring by grouping or substitution might not be straightforward here, indicating the solutions are irrational or complex.

Final Insights and Implications

The Nature of the Solutions

The polynomial derived from the original equation is of degree four with no rational roots. This suggests:

- The solutions are irrational or complex numbers.

- Analytic solutions involve quartic formula, which is complex and often impractical.

- Numerical methods (e.g., Newton-Raphson, graphing calculators) are more suitable for approximation.

Significance in Educational Context

Understanding this problem highlights several key learning points:

- The importance of clear notation and interpretation in algebra.

- The application of polynomial factorization and rational root testing.

- The necessity of numerical methods when algebraic solutions are complex.

- The critical role of assumptions in interpreting ambiguous expressions.

Practical Recommendations for Students and Educators

- Always clarify notation: When encountering ambiguous expressions, confirm the intended operations.

- Break down complex equations: Simplify step-by-step to manageable components.

- Use computational tools: Graphing calculators or algebra software can assist in solving high-degree polynomials.

- Practice rational root testing: Familiarity with the Rational Root Theorem enhances problem-solving efficiency.

- Understand limitations: Not all equations have rational solutions; be prepared to employ numerical methods.

Conclusion

The equation 6 + 2x = 4(x + 2)3(x3) encapsulates the complexity and elegance of algebraic problem-solving. Through careful interpretation, systematic simplification, and application of algebraic principles, we've transformed a seemingly daunting expression into a manageable polynomial. Although rational roots are elusive, the exercise underscores vital mathematical techniques and the importance of critical thinking.

By approaching such problems with patience, clarity, and the right tools, learners can deepen their understanding of algebra, preparing them for more advanced challenges. The key takeaway is

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