Find The Solution Of The Square Root Of The Quantity Of X Plus 3 Plus 6 Equals 9, And Determine If It

Find The Solution Of The Square Root Of The Quantity Of X Plus 3 Plus 6 Equals 9, And Determine If It is a common type of algebraic problem that involves solving a radical equation and verifying the solution's validity. Such problems are fundamental in understanding how to manipulate equations involving square roots and how to check for extraneous solutions. In this article, we will guide you through the step-by-step process of solving this specific problem, discuss the mathematical principles involved, and illustrate how to determine whether the solution satisfies the original equation.

Understanding the Problem

Before diving into the solution, it’s essential to clearly understand what the problem asks. The problem statement can be interpreted as:

"Find the value of x such that the square root of (x plus 3) plus 6 equals 9, and then determine if this solution is valid."

Mathematically, this can be written as:

$\sqrt{(x + 3)} + 6 = 9$

Our goal is to solve for x and verify whether the found value satisfies the original equation.

Step-by-Step Solution Process

The process involves isolating the square root, squaring both sides to eliminate the radical, solving for x, and verifying the solutions.

Step 1: Isolate the Square Root

Starting with the equation:

$\sqrt{(x + 3)} + 6 = 9$

Subtract 6 from both sides:

$\sqrt{(x + 3)} = 9 - 6$

$\sqrt{x + 3} = 3$

Step 2: Square Both Sides

To eliminate the square root, square both sides of the equation:

$(\sqrt{x + 3})^2 = 3^2$

$x + 3 = 9$

Step 3: Solve for x

Subtract 3 from both sides:

$x = 9 - 3$

$x = 6$

Step 4: Verify the Solution

Plug $x = 6$ back into the original equation:

$\sqrt{6 + 3} + 6 = 9$

Calculate inside the radical:

$\sqrt{9} + 6 = 9$

Simplify:

$3 + 6 = 9$

Verify:

$9 = 9$

Since both sides are equal, $x = 6$ is a valid solution.

Additional Considerations in Solving Radical Equations

While the solution $x = 6$ appears straightforward, it's crucial to understand some key points about solving radical equations:

1. Extraneous Solutions

Squaring both sides can introduce extraneous solutions—values that satisfy the squared equation but not the original equation. Therefore, always verify your solutions in the original equation.

2. Domain Restrictions

Square root functions are defined for non-negative radicands:

$x + 3 \geq 0$

$x \geq -3$

Our solution $x = 6$ satisfies this domain restriction, so it is acceptable.

3. Multiple Solutions

Some radical equations may yield more than one solution after squaring. Always check all solutions for validity.

Common Mistakes to Avoid

When solving radical equations, be cautious of the following pitfalls:

1. **Neglecting to verify solutions:** Always substitute solutions back into the original equation.
2. **Ignoring domain restrictions:** Ensure solutions are within the domain of the radical expression.
3. **Squaring without caution:** Recognize that squaring can introduce extraneous solutions, so verification is essential.

Extended Example: Solving a Similar Equation

To reinforce understanding, consider the following similar problem:

Solve $\sqrt{x - 2} + 4 = 6$ and verify whether the solution is valid.

Solution:

1. Isolate the radical:

$\sqrt{(x - 2)} = 6 - 4 = 2$

2. Square both sides:

$x - 2 = 4$

3. Solve for x:

$x = 4 + 2 = 6$

4. Verify:

$\sqrt{(6 - 2)} + 4 = 6$

Calculate inside the radical:

$\sqrt{4} + 4 = 6$

Simplify:

$2 + 4 = 6$

Verify:

$6 = 6$

Solution $x = 6$ is valid, and the domain restriction requires $x \geq 2$, which is satisfied.

Summary and Final Thoughts

Solving equations involving square roots requires careful isolation of the radical, squaring both sides, solving the resulting algebraic equation, and verifying potential solutions. Always consider the domain restrictions and check for extraneous solutions introduced during the squaring process. In the specific problem of finding the solution to $\sqrt{(x + 3)} + 6 = 9$, the solution $x = 6$ satisfies the original equation and falls within the appropriate domain.

Key Takeaways:

- Isolate the radical before squaring.
- Square both sides cautiously, being aware of potential extraneous solutions.
- Verify solutions by substituting back into the original equation.
- Consider the domain restrictions of the radical expression.
- Practice with similar problems to build confidence and understanding.

Understanding how to solve such radical equations enhances your algebraic skills and prepares you for more complex mathematical problems involving roots and exponents. Whether you're a student preparing for exams or a math enthusiast, mastering these techniques is essential for a solid foundation in algebra.

Frequently Asked Questions

What is the first step to solve the equation $\sqrt{(x + 3)} + 6 = 9$?

The first step is to isolate the square root term by subtracting 6 from both sides: $\sqrt{(x + 3)} = 3$.

How do you eliminate the square root in the equation $\sqrt{(x + 3)} = 3$?

Square both sides of the equation to remove the square root: $(\sqrt{(x + 3)})^2 = 3^2$, which simplifies to $x + 3 = 9$.

What is the value of x after solving the equation x + 3 = 9?

Subtract 3 from both sides: $x = 9 - 3$, so $x = 6$.

How can you verify if x = 6 is a valid solution for the original equation?

Substitute $x = 6$ back into the original equation: $\sqrt{(6 + 3)} + 6 = \sqrt{9} + 6 = 3 + 6 = 9$, which matches the right side, confirming it is a solution.

Are there any other solutions to the equation $\sqrt{(x + 3)} + 6 = 9$?

No, after squaring both sides, only $x = 6$ satisfies the original equation without extraneous solutions.

What does it mean to determine if a solution is valid in this context?

It means substituting the solution back into the original equation to ensure it satisfies the equation, verifying it is not extraneous introduced during algebraic manipulation.

Is the solution x = 6 valid for the given problem, and why?

Yes, $x = 6$ is valid because substituting it back into the original equation confirms both sides are equal, satisfying the equation.

Additional Resources

Find The Solution Of The Square Root Of The Quantity Of X Plus 3 Plus 6 Equals 9, And Determine If It

Mathematics often presents us with intriguing puzzles that challenge our problem-solving skills and deepen our understanding of algebraic principles. One such problem, seemingly straightforward yet rich with conceptual nuances, asks us to find the value of a variable within a square root expression and then interpret the result. Specifically, the problem is framed as: Find the solution of the square root of the quantity of x plus 3 plus 6 equals 9, and determine if it — a prompt that invites us to analyze, solve, and interpret the mathematical statement thoroughly.

In this article, we will decode this problem step-by-step, explore the underlying principles of algebra and square roots involved, and provide a comprehensive explanation suitable for learners and enthusiasts alike. Our goal is to clarify the problem, demonstrate the solution process clearly, and discuss the implications of the result, including whether the solution is valid within the constraints of real numbers.

Understanding the Problem Statement

Before diving into calculations, it's critical to interpret the problem correctly. The phrasing is somewhat ambiguous, so understanding the intended mathematical expression is essential.

The problem states:
"Find the solution of the square root of the quantity of x plus 3 plus 6 equals 9."

This can be read as a single algebraic equation. The key is to determine how the terms are grouped and what the expression precisely entails. The most natural interpretation, considering standard algebraic notation, is:

$$
\sqrt{x + 3} + 6 = 9
$$

Here's why:

- The phrase "square root of the quantity of x plus 3" suggests the square root is applied to the expression $x + 3$.
- The phrase "plus 6" indicates that after taking the square root, 6 is added.
- The entire expression equals 9.

Thus, the equation can be expressed algebraically as:

$$
\sqrt{x + 3} + 6 = 9
$$

Alternatively, if the problem intended the square root to encompass the entire sum $x + 3 + 6$, it would be written as:

$$
\sqrt{x + 3 + 6} = 9
$$

which simplifies to:

$$
\sqrt{x + 9} = 9
$$

Given the wording, the first interpretation — that the square root is applied only to $x + 3$, and then 6 is added — is more consistent with common phrasing.

Step-by-Step Solution Process

Step 1: Write the Equation Clearly

Based on the above interpretation, the equation is:

$$
\sqrt{x + 3} + 6 = 9
$$

Step 2: Isolate the Square Root Term

To solve for x, first isolate $\sqrt{x + 3}$:

$$
\sqrt{x + 3} = 9 - 6
$$

$$
\sqrt{x + 3} = 3
$$

Step 3: Square Both Sides to Eliminate the Square Root

Squaring both sides gives:

$$
(\sqrt{x + 3})^2 = 3^2
$$

$$
x + 3 = 9
$$

Step 4: Solve for x

Subtract 3 from both sides:

$$
x = 9 - 3

\]

$$
x = 6
$$

Step 5: Verify the Solution

It's important to verify whether this solution satisfies the original equation:

$$
\sqrt{6 + 3} + 6 = ?
$$

Calculate:

$$
\sqrt{9} + 6 = 3 + 6 = 9
$$

which matches the right side of the original equation.

Conclusion: The solution $x = 6$ is valid and satisfies the equation.

Determining If The Solution Is Valid

Mathematically, the process above confirms the solution is consistent with the algebraic steps. However, in the context of square roots, we must consider the domain restrictions:

- The square root function $\sqrt{x + 3}$ requires that its argument be non-negative:

$$
x + 3 \geq 0
$$

- For $x = 6$:

$$
6 + 3 = 9 \geq 0
$$

which is true. Therefore, the solution is within the valid domain.

Additional Note: When solving equations involving square roots, squaring both sides can sometimes introduce extraneous solutions. Here, verification confirms that $x=6$ is valid.

Exploring the Alternative Interpretation

To ensure thoroughness, consider the alternative interpretation where the entire sum $x + 3 + 6$ is under the square root:

$$
\sqrt{x + 3 + 6} = 9
$$

which simplifies to:

$$
\sqrt{x + 9} = 9
$$

Squaring both sides:

$$
x + 9 = 81
$$

$$
x = 81 - 9
$$

$$
x = 72
$$

Verify:

$$
\sqrt{72 + 3 + 6} = \sqrt{81} = 9,
$$

which matches the right side.

Domain check:

$$
x + 3 + 6 \geq 0 \Rightarrow 72 + 3 + 6 = 81 \geq 0,
$$

which is valid.

Conclusion: If the interpretation is that the square root encompasses the entire sum, then the solution is $x=72$.

Final Thoughts and Implications

This exploration highlights the importance of precise problem interpretation in algebra. As demonstrated, small differences in phrasing can lead to different equations and solutions. When tackling such problems:

- Always clarify the structure of the expression.
- Write equations explicitly.
- Isolate variables step-by-step.
- Verify solutions within the domain restrictions.

In the context of this problem, the solution hinges on whether the square root applies solely to $x + 3$ or to the entire $x + 3 + 6$. Both interpretations yield valid solutions within their respective domains:

- For $\sqrt{x + 3} + 6 = 9$, the solution is $x = 6$.
- For $\sqrt{x + 3 + 6} = 9$, the solution is $x = 72$.

Broader Relevance

Understanding how to interpret and solve equations involving square roots is fundamental in algebra. Such problems recur in various contexts — from geometry to physics — and mastering their solutions builds a strong foundation for more advanced mathematical concepts.

Final Note

Always verify potential solutions to avoid extraneous roots, especially when squaring both sides of an equation. Recognizing the importance of domain restrictions ensures solutions are valid within the real number system.

Summary

- The original problem likely asks for solving $\sqrt{x + 3} + 6 = 9$.
- The solution process involves isolating the square root, squaring both sides, and solving for x.
- The solution is $x=6$, which satisfies the equation and its domain.
- An alternative interpretation yields $x=72$.
- Proper understanding and verification are key to accurate problem-solving.

Mathematics challenges us to be precise and methodical. By carefully dissecting the problem, exploring interpretations, and verifying solutions, we reinforce our analytical skills and deepen our comprehension of algebraic principles.

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