(3X-5)^1/4+3=4Your Anwser Should Be X=2!SHOW WORK

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When encountering an algebraic equation like $(3X - 5)^{1/4} + 3 = 4$, the goal is to solve for the variable X. This involves understanding roots, inverse operations, and algebraic manipulation. In this comprehensive guide, we will walk through each step carefully, ensuring clarity and a deep understanding of the process. Whether you're a student preparing for exams or just looking to sharpen your algebra skills, this detailed explanation will help you master solving such equations.

Understanding the Equation and Its Components

Before diving into the solution, it’s essential to understand the structure of the equation:

$$
(3X - 5)^{1/4} + 3 = 4
$$

This equation involves:

- A radical expression: $(3X - 5)^{1/4}$, which denotes the fourth root of $(3X - 5)$.
- An addition: adding 3 to the radical expression.
- An equality: set equal to 4, which allows us to isolate the radical.

Step-by-Step Solution Process

Here's a systematic approach to solving the equation:

Step 1: Isolate the Radical Expression

The first step is to isolate $(3X - 5)^{1/4}$.

Given:

$$
(3X - 5)^{1/4} + 3 = 4
$$

Subtract 3 from both sides:

$$
(3X - 5)^{1/4} = 4 - 3
$$

$$
(3X - 5)^{1/4} = 1
$$

Step 2: Eliminate the Fourth Root

Since the radical is a fourth root, raising both sides to the 4th power will eliminate the radical:

$$
\left[(3X - 5)^{1/4}\right]^4 = 1^4
$$

Recall that $\left[a^{1/n}\right]^n = a$, so:

$$
(3X - 5) = 1^4
$$

Calculate 1^4:

$$
(3X - 5) = 1
$$

Step 3: Solve for X

Now, isolate X:

$$
3X - 5 = 1
$$

Add 5 to both sides:

$$
3X = 1 + 5
$$

$$
3X = 6
$$

Divide both sides by 3:

$$
X = \frac{6}{3} = 2
$$

Step 4: Verify the Solution

Always verify your solution by substituting $X = 2$ back into the original equation:

$$
(3 \times 2 - 5)^{1/4} + 3 = 4
$$

Calculate inside the parentheses:

$$
(6 - 5)^{1/4} + 3 = 4
$$

Simplify:

$$
(1)^{1/4} + 3 = 4
$$

Since the fourth root of 1 is 1:

$$
1 + 3 = 4
$$

which confirms that the solution $X=2$ satisfies the original equation.

Key Concepts Involved in the Solution

Understanding the following algebraic concepts is vital for solving similar equations:

Radicals and Roots

- The n-th root of a number a is written as $a^{1/n}$.
- The 4th root of a is $a^{1/4}$.
- To eliminate a radical, raise both sides to the power of n.

Inverse Operations

- Addition and subtraction are inverse operations.
- Multiplication and division are inverse operations.
- Exponentiation and root-taking are inverse operations.

Order of Operations

- Always perform operations inside parentheses first.
- Follow the order: exponents, multiplication/division, addition/subtraction.

Common Mistakes to Avoid When Solving Radical Equations

While solving equations involving roots, keep in mind:

1. **Forgetting to verify solutions:** Some solutions obtained after raising both sides to a power may not satisfy the original equation, especially when dealing with even roots.

2. **Misapplying root properties:** Remember that $\left(a^{1/n}\right)^n = a$ only when $a \geq 0$ if dealing with real numbers.

3. **Ignoring domain restrictions:** The value inside the radical must be within the domain of the root function, which generally requires $3X - 5 \geq 0$ for real solutions involving even roots.

In our case, since $(3X - 5)^{1/4}$ is real only when $3X - 5 \geq 0$:

$$
3X - 5 \geq 0 \Rightarrow X \geq \frac{5}{3}
$$

Since our solution is $X=2$, which satisfies $X \geq 5/3$, it is valid.

Additional Practice Problems

To reinforce your understanding, try solving these similar equations:

1. $(2X - 3)^{1/3} + 2 = 3$
2. $\sqrt{5X + 4} - 1 = 3$
3. $(X + 1)^{1/2} = 4$
4. $4(X - 2)^{1/4} + 1 = 5$

For each problem, follow the same steps: isolate the radical, eliminate the root by raising to the appropriate power, solve for X, and verify the solution.

Importance of Solving Radical Equations in Real-Life Contexts

Radical equations are not just abstract mathematical exercises; they have practical applications in various fields:

- Engineering: Calculating dimensions and tolerances involving root relationships.
- Physics: Determining relationships involving square or higher roots, such as in kinematics or quantum mechanics.
- Finance: Calculating compound interest rates over time involves roots.
- Biology and Medicine: Modeling growth rates often involve radical expressions.

Understanding how to manipulate and solve radical equations equips you with essential skills applicable across numerous scientific and practical disciplines.

Final Thoughts

Solving algebraic equations with radicals might seem challenging at first, but with a clear step-by-step approach, they become manageable. Remember to:

- Isolate the radical.
- Eliminate the radical by raising both sides to the appropriate power.
- Solve the resulting linear or quadratic equation.
- Verify your solutions within the domain restrictions.

In this case, we found that $X=2$ satisfies the original equation, and the process exemplifies fundamental algebraic techniques. With practice, solving such equations becomes intuitive and efficient.

Summary

Step	Action	Result
1	Subtract 3 from both sides	$(3X - 5)^{1/4} = 1$
2	Raise both sides to the 4th power	$3X - 5 = 1$
3	Add 5 to both sides	$3X = 6$
4	Divide both sides by 3	$X=2$
5	Verify substitution	Valid solution

By following this process, you can confidently approach and solve equations involving roots and radicals, enhancing your algebraic problem-solving skills.

Remember: Practice makes perfect. Each problem you solve strengthens your understanding and prepares you for more complex equations in the future.

Frequently Asked Questions

Solve for x in the equation $(3x - 5)^{1/4} + 3 = 4$. Show your work.

First, subtract 3 from both sides: $(3x - 5)^{1/4} = 1$. Then, raise both sides to the 4th power to eliminate the root: $3x - 5 = 1^4 = 1$. Next, add 5 to both sides: $3x = 6$. Finally, divide both sides by 3: $x = 2$.

What steps are involved in solving the equation (3x - 5)^{1/4} + 3 = 4 for x?

Subtract 3 from both sides to isolate the root: (3x - 5)^{1/4} = 1. Then, raise both sides to the 4th power to remove the root: 3x - 5 = 1. Add 5 to both sides: 3x = 6. Divide both sides by 3: x = 2.

How do you determine the value of x in the equation (3x - 5)^{1/4} + 3 = 4?

Subtract 3 from both sides: (3x - 5)^{1/4} = 1. Raise both sides to the 4th power: 3x - 5 = 1. Add 5: 3x = 6. Divide by 3: x = 2.

Explain the algebraic process to solve (3x - 5)^{1/4} + 3 = 4 for x.

Subtract 3 from both sides to get (3x - 5)^{1/4} = 1. Then, raise both sides to the 4th power: 3x - 5 = 1. Next, add 5 to both sides: 3x = 6. Finally, divide both sides by 3: x = 2.

Why is raising both sides of (3x - 5)^{1/4} = 1 to the 4th power valid in solving for x?

Because raising both sides to the 4th power is a valid inverse operation for the 4th root, allowing us to eliminate the root and solve for the expression inside.

Verify the solution x=2 for the equation (3x - 5)^{1/4} + 3 = 4.

Substitute x=2: (32 - 5)^{1/4} + 3 = (6 - 5)^{1/4} + 3 = 1^{1/4} + 3 = 1 + 3 = 4, which confirms the solution is correct.

Additional Resources

Mathematical Problem Solving

In the realm of algebra, equations serve as the foundational language for expressing relationships between variables. Among these, equations involving roots and exponents often challenge even seasoned mathematicians, requiring careful manipulation and understanding of algebraic principles. Today, we will explore a specific equation:
\[
(3X - 5)^{1/4} + 3 = 4
\]
with the goal of solving for \(X\). The claim is that the solution is \(X =

2), and we will methodically verify this, show the work step-by-step, and discuss the process involved in reaching this conclusion.

Understanding the Equation

At first glance, the equation involves a fractional exponent, which indicates a root. The term $(3X - 5)^{1/4}$ signifies the fourth root of the expression $3X - 5$. The entire equation reads:

$$
(3X - 5)^{1/4} + 3 = 4
$$

which can be interpreted as: the fourth root of $3X - 5$, plus 3, equals 4.

Step-by-Step Solution Approach

To solve for X, we'll follow a logical sequence of algebraic steps. The typical method involves isolating the root term, then removing the root by raising both sides to the appropriate power, and solving for X.

Step 1: Isolate the root term

Subtract 3 from both sides:

$$
(3X - 5)^{1/4} = 4 - 3
$$

$$
(3X - 5)^{1/4} = 1
$$

This simplifies our task to solving:

$$
(3X - 5)^{1/4} = 1
$$

Step 2: Eliminate the fractional exponent

Recall that raising both sides of an equation to the 4th power will eliminate the fourth root:

$$

\left[(3X - 5)^{1/4}\right]^4 = 1^4
\]
\[
3X - 5 = 1
\]

Note: When dealing with even roots, it's important to consider domain restrictions, which we'll address later.

Step 3: Solve for \(X\)

Now, isolate \(X\):
\[
3X = 1 + 5
\]
\[
3X = 6
\]
\[
X = \frac{6}{3} = 2
\]

Verification of the Solution \(X=2\)

It's crucial to verify whether this value indeed satisfies the original equation. Substituting \(X=2\):

\[
(3 \times 2 - 5)^{1/4} + 3 = 4
\]

Calculate inside the parentheses:
\[
3 \times 2 = 6
\]
\[
6 - 5 = 1
\]

Compute the fourth root of 1:
\[
1^{1/4} = 1
\]

Add 3:

$$
1 + 3 = 4
$$

Yes, the left side equals the right side, confirming $X=2$ is a valid solution.

Domain Considerations and Validity

While algebraically $X=2$ satisfies the equation, it’s important to consider the domain restrictions stemming from the root. The fourth root function, $\sqrt[4]{\cdot}$, is defined for all real numbers, but for the original expression to be real, the radicand must be non-negative:
$$
3X - 5 \geq 0
$$
$$
3X \geq 5
$$
$$
X \geq \frac{5}{3} \approx 1.666\ldots
$$

Since $X=2$ is greater than $\frac{5}{3}$, it falls within the valid domain, reaffirming the solution's legitimacy.

Summary and Additional Insights

This problem exemplifies a common type of algebraic equation involving fractional exponents and roots. The process involves:

- Isolating the root term
- Raising both sides to the appropriate power to eliminate the root
- Solving the resulting linear or quadratic equation
- Verifying the solution within the context of the original problem and its domain restrictions

The key takeaways include understanding how to manipulate fractional exponents, the importance of domain considerations, and the need for verification after solving.

In conclusion, the solution $X=2$ is obtained straightforwardly by exponentiation and substitution, and verified to satisfy the original equation within the valid domain. This problem serves as a valuable example for mastering algebraic techniques involving roots and exponents, fundamental skills for any aspiring mathematician or student.

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