9n^2-10=890 Solve By Taking Square Roots

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Solving quadratic equations is a fundamental skill in algebra that helps students understand various mathematical concepts and prepares them for advanced studies. One effective method to solve certain quadratic equations is by taking square roots, especially when the equation can be manipulated into a perfect square form. In this article, we will explore how to solve the equation *9n^2 - 10 = 890* by taking square roots, providing step-by-step instructions, tips, and explanations to ensure clarity and comprehensive understanding.

Understanding the Equation: 9n^2 - 10 = 890

Before diving into the solution process, it is essential to analyze the given equation:

- The equation is quadratic in form, involving n squared.
- The coefficient of n^2 is 9.
- The constant term is -10 on the left, equal to 890 on the right.

Our goal is to find the value(s) of n that satisfy this equation.

Step-by-Step Solution Approach

To solve the equation by taking square roots, we need to manipulate the equation into a form that allows us to isolate n^2 and then take the square root of both sides.

Step 1: Isolate the quadratic term

Starting with the original equation:

9n^2 - 10 = 890

Add 10 to both sides to isolate the quadratic term:

9n^2 = 890 + 10

Simplify:

9n^2 = 900

Step 2: Divide both sides by the coefficient of n^2

To isolate n^2, divide both sides of the equation by 9:

$n^2 = 900 / 9$

Simplify:

$n^2 = 100$

Step 3: Take the square root of both sides

Now, to solve for n, take the square root of both sides:

$n = \pm\sqrt{100}$

Recall that taking the square root yields both positive and negative roots.

Evaluate the square root:

$n = \pm 10$

Final Solution

The solutions to the equation are:

$n = 10$ and $n = -10$

Additional Explanation: Why and How to Take Square Roots

Taking square roots is a common method for solving quadratic equations, particularly when the quadratic expression is isolated and in perfect square form. Here are some important points to understand:

- **When to take square roots:** If the equation can be written as n^2 = some constant, then taking the square root of both sides is the straightforward step.
- **Remember the ± sign:** Since both positive and negative values square to give a positive number, both solutions are valid unless restricted by the problem context.

- **Ensure the expression is non-negative:** You can only take the square root of a non-negative number in real numbers. If the right side is negative, the solutions involve imaginary numbers.

In our case, since 100 is positive, the solutions are real and straightforward.

Alternative Methods to Solve the Equation

While taking square roots is effective here, other methods can also be used to solve quadratic equations:

1. Factoring

Express the quadratic as a product of binomials. However, since $9n^2 - 10 = 890$ simplifies directly, factoring might be less straightforward in this case.

2. Quadratic Formula

The quadratic formula:

$$n = [-b \pm \sqrt{(b^2 - 4ac)}] / 2a$$

can be applied if the quadratic is written in standard form. For our equation, rewriting:

$$9n^2 - 900 = 0$$

Using the quadratic formula:

$a = 9$, $b = 0$, $c = -900$

$$n = [0 \pm \sqrt{(0^2 - 49(-900))}] / (29)$$

$$n = [0 \pm \sqrt{(0 + 49900)}] / 18$$

$$n = [0 \pm \sqrt{(0 + 32{,}400)}] / 18$$

$$n = [0 \pm \sqrt{32{,}400}] / 18$$

$$n = [0 \pm 180] / 18$$

Thus:

n = 180 / 18 = 10 or n = -180 / 18 = -10

Matching our previous solution.

Understanding When to Use Which Method

- Use taking square roots when the quadratic is isolated and in a perfect square form.
- Use factoring when the quadratic factors easily.
- Use quadratic formula for general quadratic equations, especially when factoring is difficult.

Practical Applications of Solving Quadratic Equations

Quadratic equations like *9n^2 - 10 = 890* appear in various real-world scenarios:

- **Physics:** Calculating projectile motion parameters.
- **Engineering:** Designing structures with specific stress and strain properties.
- **Economics:** Modeling profit or cost functions.
- **Mathematics Education:** Understanding the properties of quadratic functions and their roots.

Mastering techniques like solving by taking square roots enhances problem-solving efficiency in these fields.

Common Mistakes to Avoid

When solving equations by taking square roots, watch out for these errors:

- **Forgetting the ± sign:** Always include both positive and negative roots unless the context restricts solutions.
- **Incorrectly isolating the quadratic term:** Ensure the equation is properly simplified before taking roots.
- **Ignoring the domain:** Take note if the problem involves only real or complex solutions.

- **Miscalculating square roots:** Double-check arithmetic to avoid errors, especially with larger numbers.

Summary

In solving the equation $9n^2 - 10 = 890$ by taking square roots, the key steps involve:

1. Isolating the quadratic term by adding or subtracting constants.
2. Dividing to normalize the coefficient of n^2.
3. Taking the square root of both sides, considering both positive and negative roots.
4. Simplifying to find the solutions for n.

The solutions obtained are $n = 10$ and $n = -10$, illustrating the effectiveness of the square root method when the quadratic is in a perfect square form.

Final Tips for Students and Learners

- Always verify if the quadratic can be expressed as a perfect square before choosing the square root method.
- Remember to consider both positive and negative roots.
- Practice with varied quadratic equations to become comfortable with different solving techniques.
- Understand the underlying principles to choose the most efficient method for each problem.

By mastering the approach of solving quadratic equations through taking square roots, students can enhance their algebraic skills and build a strong foundation for more advanced mathematical concepts.

If you want to improve your understanding of quadratic equations or need more practice problems, consider exploring additional resources or working with practice worksheets. Remember, the key to mastering algebra is consistent practice and understanding the concepts behind each method.

Frequently Asked Questions

What is the first step to solve the equation $9n^2 - 10 = 890$

by taking square roots?

The first step is to isolate the squared term by adding 10 to both sides, resulting in $9n^2 = 900$.

How do you simplify $9n^2 = 900$ before taking square roots?

Divide both sides by 9 to get $n^2 = 100$.

What is the next step after obtaining $n^2 = 100$?

Take the square root of both sides to solve for n, remembering to consider both positive and negative roots.

What are the solutions for n after taking the square root of $n^2 = 100$?

$n = \pm 10$, since both 10^2 and $(-10)^2$ equal 100.

How do you verify the solutions obtained from taking square roots?

Substitute $n = 10$ and $n = -10$ back into the original equation to ensure both satisfy it.

Are there any restrictions on taking square roots in solving equations like this?

Yes, when taking square roots, always consider both positive and negative roots, and ensure the solutions satisfy the original equation.

What is the complete solution set for the equation $9n^2 - 10 = 890$?

The solutions are $n = 10$ and $n = -10$.

Can this method be applied to any quadratic equation?

This method works for quadratics that can be written in the form of a perfect square or can be simplified to one, but more complex quadratics may require factoring or the quadratic formula.

Why is it important to check solutions after solving by taking square roots?

Because squaring both sides can introduce extraneous solutions, so verifying ensures the solutions are valid for the original equation.

Additional Resources

$9n^2 - 10 = 890$ Solve By Taking Square Roots

Mathematics often presents us with equations that challenge our problem-solving skills and require a strategic approach to find solutions efficiently. One such equation is $9n^2 - 10 = 890$, which involves a quadratic expression. Solving this kind of equation can seem daunting at first, but by understanding the principles of algebra and utilizing the method of taking square roots, we can arrive at the solution systematically. In this article, we delve into the step-by-step process of solving $9n^2 - 10 = 890$ by taking square roots, making the process clear and accessible for learners and enthusiasts alike.

Understanding the Equation: What Are We Dealing With?

Before jumping into the solution, it’s essential to interpret the equation:

> $9n^2 - 10 = 890$

This is a quadratic equation in terms of the variable n. It features a squared term n^2, multiplied by 9, and a constant term. The goal is to find the value(s) of n that satisfy this equation.

Quadratic equations are fundamental in algebra, often represented in the form:

$$ax^2 + bx + c = 0$$

Our current equation isn't immediately in this form because the constant term is on the left side. The first step is to manipulate the equation into a more workable form.

Step 1: Isolate the Quadratic Term

To facilitate solving the equation, we need to isolate the quadratic term $9n^2$:

$$9n^2 - 10 = 890$$

Add 10 to both sides to move the constant to the right:

$$9n^2 = 890 + 10$$

$$9n^2 = 900$$

This step simplifies the equation considerably, bringing us closer to the core quadratic expression.

Step 2: Simplify the Equation

Now, divide both sides of the equation by 9 to isolate \(n^2 \):

\[
n^2 = \frac{900}{9}
\]

\[
n^2 = 100
\]

At this stage, the equation is simplified to a form where taking square roots becomes straightforward.

Step 3: Take the Square Root of Both Sides

The key to solving this equation is recognizing that if:

\[
n^2 = 100
\]

then

\[
n = \pm \sqrt{100}
\]

Because both positive and negative roots satisfy the original quadratic, we consider both options:

\[
n = \pm 10
\]

Step 4: Final Solutions

Thus, the solutions to the equation \(9n^2 - 10 = 890 \) are:

\[
\boxed{
n = 10 \quad \text{and} \quad n = -10
}
\]

These two values are the points where the original equation holds true.

The Method of Taking Square Roots: Why and When?

The process employed above—taking square roots—is a fundamental technique in algebra used when an equation is expressed as $n^2 = k$, where k is a known constant. It simplifies the problem by directly revealing the variable n in terms of known quantities.

Key points about this method:

- Applicable when you have a perfect square on one side of the equation.
- Requires considering both positive and negative roots.
- Must ensure the expression inside the square root is non-negative to yield real solutions.

When Is It Appropriate to Use Square Roots?

The method of taking square roots applies primarily when:

- The equation is already or can be manipulated into the form $n^2 = k$.
- The equation involves a perfect square, making the square root straightforward.
- The goal is to solve for a variable squared, especially in quadratic equations or isolated squared terms.

Limitations and Cautions

While taking square roots is powerful, it comes with certain considerations:

- Extraneous solutions: Always verify solutions in the original equation to avoid solutions that result from squaring both sides in cases where the original domain restricts possible solutions.
- Domain restrictions: If the expression under the square root is negative, solutions are complex (not real). In real-number contexts, only non-negative radicands are valid.

Extending the Technique to Other Equations

The approach demonstrated here is versatile and can be applied to various equations. For example:

- Equations like $x^2 = 25$ directly lead to $x = \pm 5$.
- More complex quadratic equations can sometimes be simplified to a form involving a perfect square, making this method applicable.

Example: Solving a Similar Equation

Suppose you encounter:

$$
4m^2 = 36
$$

Applying the square root:

$$
m = \pm \sqrt{36} = \pm 6
$$

Similarly, you verify solutions by substituting back into the original equation to confirm their validity.

Practical Applications and Significance

Understanding how to solve equations like $9n^2 - 10 = 890$ using square roots isn't just an academic exercise; it has practical implications:

- Engineering: Calculations involving quadratic relationships in physics and engineering.
- Finance: Modeling scenarios where variables are squared, such as in variance calculations.
- Data Science: Optimization problems often involve quadratic equations.

The ability to manipulate and solve such equations is fundamental in STEM fields, underpinning more advanced concepts like quadratic functions, parabolas, and quadratic optimization.

Conclusion: Mastering the Technique

The journey of solving $9n^2 - 10 = 890$ exemplifies the power and elegance of algebraic methods. By systematically isolating the quadratic term, simplifying, and then taking square roots, we arrive at clear, precise solutions. Remember, the key steps involve:

1. Isolating the quadratic expression.
2. Simplifying to a perfect square form.
3. Taking square roots, considering both positive and negative roots.
4. Verifying solutions if needed.

Mastering this technique enhances your problem-solving toolkit, enabling you to tackle a wide range of equations with confidence. As you practice, you'll find that many seemingly complex algebraic problems unravel beautifully through the method of taking square roots, revealing the underlying simplicity of quadratic relationships.

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