# Solve For X Square Root Of (2x^2+1)=0

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When encountering equations like Solve For X Square Root Of (2x^2+1)=0, students and math enthusiasts often find themselves at a crossroads, trying to decipher the best approach to isolate the variable and understand the underlying mathematical principles. This particular equation involves both a radical (square root) and a quadratic expression, making it a compelling example for practicing algebraic techniques, such as isolating radicals, squaring both sides, and solving quadratic equations. In this comprehensive guide, we'll explore the step-by-step process to solve this problem, analyze possible solutions, and delve into the mathematical concepts involved to deepen your understanding.

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## Understanding the Equation: Break Down the Components

Before jumping into solving, it's essential to understand the structure of the equation:

Equation: $\sqrt{(2x^2 + 1)} = 0$

This equation involves:

- A square root function: √(expression)
- A quadratic expression inside the radical: $2x^2 + 1$
- An equality set to zero

Key observations:

- The square root function outputs non-negative real numbers; that is, √(expression) ≥ 0 for all real input where the radicand is ≥ 0.
- The right side of the equation is zero, which implies the radicand must evaluate to a value that makes the entire square root zero.

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## Step-by-Step Solution Process

### Step 1: Recognize the Domain Constraints

Since the square root function outputs only non-negative numbers, and it's set equal to zero, the radicand must be such that:

$\sqrt{2x^2 + 1} = 0$

=> $2x^2 + 1 \geq 0$ (for the radicand to be defined in real numbers)

and

$\sqrt{2x^2 + 1} = 0$

implies

$2x^2 + 1 = 0$

because the square root of a non-negative number equals zero only when that number is zero.

Therefore, the key step is:

$2x^2 + 1 = 0$

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## Step 2: Solve the Radicand Equation

Set the radicand equal to zero:

$2x^2 + 1 = 0$

Subtract 1 from both sides:

$2x^2 = -1$

Divide both sides by 2:

$x^2 = -1/2$

Now, analyze the solution:

- Since $x^2 = -1/2$, and the square of a real number is always $\geq 0$, this equation has no real solutions because the right side is negative.

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## Step 3: Interpret the Results

- The key insight: $x^2 = -1/2$ has no real solutions.

- Therefore, there are no real solutions to the original equation because the radicand cannot be zero for any real x.

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# Implications and Additional Considerations

## Why are there no real solutions?

- Because the expression inside the square root, $2x^2 + 1$, is always $\geq 1$ (since $x^2 \geq 0$ and adding 1), it can never be zero or negative.

- Specifically, for all real x:

$2x^2 + 1 \geq 1 > 0$

- The square root of a positive number cannot be zero unless the radicand is zero, which is impossible here.

## Conclusion:

- The original equation $\sqrt{2x^2 + 1} = 0$ has no real solutions.

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# Complex Solutions and Further Analysis

While there are no real solutions, it’s worth exploring what happens in the complex domain.

## Complex Solutions:

- To find complex solutions, we consider the equation:

$\sqrt{2x^2 + 1} = 0$

- In the complex plane, the square root function can have multiple values, but by definition, the principal square root of zero is zero.

- The key is that $2x^2 + 1 = 0$, which leads to:

$x^2 = -1/2$

- Taking square roots:

$x = \pm\sqrt{-1/2} = \pm i\sqrt{1/2} = \pm i / \sqrt{2}$

- Simplify:

$x = \pm i / \sqrt{2}$

- Rationalize the denominator:

$x = \pm(i\sqrt{2}) / 2$

Thus, the complex solutions are:

$x = \pm (i\sqrt{2}) / 2$

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# Summary of Solutions

| Domain | Solution Type | Solutions |
|---|---|---|
| Real Numbers | No solutions | Because $2x^2 + 1 \geq 1 > 0$, so the radicand $\neq 0$ |
| Complex Numbers | Yes | $x = \pm (i\sqrt{2}) / 2$ |

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# Key Takeaways for Students and Mathematicians

- Radical equations often require analyzing the domain to determine whether solutions exist.
- When the radical is set equal to zero, focus on the radicand; solving for zero provides potential solutions.
- Recognize that squares of real numbers are non-negative, which constrains the solutions.
- In the complex domain, solutions may exist even if none are present in the real numbers.
- Always check the original equation after solving to verify the solutions, especially when dealing with radicals and complex numbers.

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# Practical Applications and Related Topics

Understanding how to solve equations like $\sqrt{2x^2 + 1} = 0$ is foundational for various advanced mathematical topics:

- Radical equations and inequalities: Applying domain restrictions.
- Complex analysis: Exploring solutions in the complex plane.

- Quadratic equations: Recognizing that the radicand is quadratic in x.
- Mathematical modeling: When equations involve radicals or quadratic forms, similar reasoning applies.

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# Conclusion

In conclusion, the equation Solve For X Square Root Of (2x^2+1)=0 has no real solutions due to the nature of the radical and quadratic expression involved. The key steps involve recognizing that the radicand cannot be negative or zero in the real domain, and that the only potential solutions in the complex domain are $x = \pm (i\sqrt{2}) / 2$. Understanding these techniques enhances your algebraic problem-solving skills and prepares you for tackling more complex equations involving radicals, quadratics, and complex numbers.

Always remember to analyze the domain carefully, verify solutions, and consider the context—real or complex—when solving radical equations.

# Frequently Asked Questions

## How do you solve the equation $\sqrt{(2x^2 + 1)} = 0$?

Since the square root of any real number is non-negative, $\sqrt{(2x^2 + 1)} = 0$ implies $2x^2 + 1 = 0$. Solving $2x^2 + 1 = 0$ gives $x^2 = -1/2$, which has no real solutions. Therefore, the equation has no real solutions.

## What are the solutions to $\sqrt{(2x^2 + 1)} = 0$ in complex numbers?

In complex numbers, $x^2 = -1/2$, so $x = \pm i/\sqrt{2}$. Thus, the solutions are $x = \pm i/\sqrt{2}$ in the complex domain.

## Is there any real value of x that satisfies $\sqrt{(2x^2 + 1)} = 0$?

No, because the expression inside the square root, $2x^2 + 1$, is always positive for real x, so its square root cannot be zero. The equation has no real solutions.

## Why does the equation $\sqrt{(2x^2 + 1)} = 0$ have no real solutions?

Because the square root function outputs only non-negative values, and $2x^2 + 1$ is always positive for real x, making the square root never zero. Hence, no real solutions exist.

## Can the equation $\sqrt{(2x^2 + 1)} = 0$ be solved graphically?

Graphically, the function $y = \sqrt{(2x^2 + 1)}$ is always above zero for all real x, so it never touches the x-axis (y=0). Therefore, it has no points of intersection, indicating no real solutions.

## What is the domain of the function $\sqrt{2x^2 + 1}$?

The domain is all real numbers, since $2x^2 + 1$ is always positive, and the square root is defined for all real inputs. However, the equation $\sqrt{2x^2 + 1} = 0$ has no solution within this domain.

# Additional Resources

Solve For X Square Root Of (2x^2+1)=0: A Comprehensive Guide to Solving Radical Equations

When tackling algebraic equations, especially those involving square roots, it’s crucial to understand the principles behind the operations and the potential pitfalls such as extraneous solutions. The equation Solve For X Square Root Of (2x^2+1)=0 presents an interesting challenge because it involves a radical expression set equal to zero. In this comprehensive guide, we will break down the steps to solve this type of equation, analyze the underlying concepts, and provide tips to avoid common mistakes.

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Understanding the Equation

Let's begin by clearly understanding what the equation entails:

Equation: $\sqrt{2x^2 + 1} = 0$

This equation involves a square root function applied to a quadratic expression, set equal to zero. The goal is to find all values of x that satisfy this equation.

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Step-by-Step Approach to Solving the Equation

Step 1: Recognize the properties of square roots

The square root function, denoted as √(expression), has two fundamental properties relevant here:

1. Domain restriction: The expression inside the square root (the radicand) must be greater than or equal to zero for real solutions (since the square root of a negative number is not real).

2. Range of the square root: $\sqrt{a} \geq 0$ for all $a \geq 0$.

Given these, the equation $\sqrt{2x^2 + 1} = 0$ implies that the radicand must be such that its square root equals zero.

Step 2: Set the radicand equal to zero

Since $\sqrt{A} = 0$ if and only if $A = 0$, the key step is:

$2x^2 + 1 = 0$

This is because the square root of an expression equals zero only when that expression itself is zero.

Step 3: Solve the resulting quadratic equation

Now, solve:

$2x^2 + 1 = 0$

Subtract 1 from both sides:

$2x^2 = -1$

Divide both sides by 2:

$x^2 = -1/2$

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Analyzing the Solution Set

At this point, note that:

$x^2 = -1/2$

Since $x^2$ is always $\geq 0$ for real numbers, and the right side is negative (-1/2), there are no real solutions to this equation.

Important Note: This indicates that, under real numbers, the original equation has no solutions because the radicand cannot produce a zero under the square root.

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Confirming the Domain and Validity

Let's verify the domain considerations:

- The radicand, $2x^2 + 1$, is always $\geq 1$ because:

$x^2 \geq 0 \rightarrow 2x^2 \geq 0 \rightarrow 2x^2 + 1 \geq 1$

- Therefore, $\sqrt{2x^2 + 1} \geq 1$ for all real x.

- Since the square root of any non-negative number greater than zero cannot be zero, the original equation $\sqrt{2x^2 + 1} = 0$ has no real solutions.

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Summary of Key Insights

- The radicand $(2x^2 + 1)$ is always $\geq 1$, never zero.
- The square root function yields zero only when the radicand is zero.
- Because the radicand is never zero, the equation has no real solutions.

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When Do Equations of This Form Have Solutions?

While in this specific case, the equation has no real solutions, similar equations can:

- Have solutions if the radicand equals zero, i.e., when the inside expression can be zero.
- Have solutions if the radical is set equal to a non-zero value, leading to quadratic equations that can be solved accordingly.

Example: For $\sqrt{(ax^2 + b)} = c$, where $c \geq 0$, solutions exist if and only if the radicand $\geq 0$ and the radical equals c.

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Additional Considerations

1. Complex Solutions

If you extend the domain to complex numbers, then:

$x^2 = -1/2$

has solutions:

$x = \pm\sqrt{(-1/2)} = \pm i\sqrt{(1/2)} = \pm(i/\sqrt{2})$

In the complex domain, solutions exist, but typically, algebra problems of this type are considered over the real numbers unless specified otherwise.

2. Extraneous Solutions

Always verify solutions by substituting back into the original equation. For radical equations, this step is critical to avoid extraneous solutions introduced during algebraic manipulation.

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Final Remarks and Tips

- Always analyze the radicand's domain before solving radical equations.
- Recognize that $\sqrt{(a)} = 0$ only if $a = 0$.
- Understand that square roots are non-negative; solutions leading to negative radicands are invalid in reals.
- Confirm solutions by substitution back into the original equation.
- Be cautious with extraneous solutions introduced during algebraic operations.

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Summary: Do You Have a Solution?

In the case of Solve For X Square Root Of (2x^2+1)=0, the thorough analysis reveals that:

- The radicand ($2x^2 + 1$) is always ≥ 1.
- The square root of any number ≥ 1 cannot be zero.
- Therefore, there are no real solutions to this equation.

This example underscores the importance of understanding the properties of radical functions and the behavior of quadratic expressions within equations. By systematically analyzing the domain and applying fundamental properties, you can confidently determine whether solutions exist and avoid common pitfalls.

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In conclusion, solving radical equations requires careful consideration of domain restrictions, properties of radicals, and algebraic manipulations. While some equations may seem straightforward, they often hide nuances that are essential to understanding the solution set. Always approach such problems with a clear, step-by-step methodology, and verify your solutions thoroughly.

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