

Find The Two Values That X Can Have It $5x^2+41=86$

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Understanding how to solve equations is fundamental in mathematics, particularly in algebra. The problem "Find the two values that x can have if $5x^2 + 41 = 86$ " offers a practical example of solving quadratic equations. In this article, we will explore step-by-step how to approach such problems, the methods involved, and tips to master solving similar equations efficiently.

Understanding the Equation: $5x^2 + 41 = 86$

Before diving into solving, it's essential to understand the structure and components of the equation.

Breaking Down the Equation

- The equation is quadratic because it involves a squared term, x^2 .
- The coefficient of x^2 is 5.
- The constant term added to $5x^2$ is 41.
- The right side of the equation is 86.

Goals in Solving

- Isolate the variable x.
- Find all possible values of x that satisfy the equation.
- Recognize whether the solutions are real or complex.

Step-by-Step Solution Process

To find the values of x, follow these systematic steps:

Step 1: Isolate the quadratic term

Subtract 41 from both sides to move all constants to one side:

$$5x^2 + 41 = 86$$

$$\rightarrow 5x^2 = 86 - 41$$

$$\rightarrow 5x^2 = 45$$

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

This simplifies the equation to:

$$x^2 = 45 / 5$$

$$\rightarrow x^2 = 9$$

Step 3: Take the square root of both sides

Remember, when solving for x in equations involving x^2 , consider both positive and negative roots:

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

$$\rightarrow x = \pm 3$$

Step 4: Write the solutions

The solutions are:

$$- x = 3$$

$$- x = -3$$

Understanding the Solutions

The solutions $x = 3$ and $x = -3$ are real numbers, which makes sense because the original equation's quadratic component yields a positive discriminant.

What is the Discriminant?

In the context of quadratic equations, the discriminant (D) determines the nature of the roots:

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

For a quadratic equation $ax^2 + bx + c = 0$.

In our case:

- $a = 5$
- $b = 0$ (since no x term)
- $c = 41 - 86 = -45$ (after moving all to one side)

Alternatively, since our equation is already simplified to $x^2 = 9$, the discriminant approach confirms solutions are real and distinct.

Alternative Methods for Solving Quadratic Equations

While the above method is straightforward, other techniques can be useful, especially for more complex equations.

Method 1: Factoring

- Not applicable here because $x^2 = 9$ doesn't factor into rational binomials directly, but for other quadratic equations, factoring can be quick.

Method 2: Quadratic Formula

- Useful when factoring is difficult or impossible.
- The quadratic formula:

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

Applying to our original form:

- Rewrite as $5x^2 + 0x - 45 = 0$.
- $a = 5$, $b = 0$, $c = -45$.

Calculate discriminant:

$$D = 0^2 - 4 \cdot 5 \cdot (-45) = 0 + 900 = 900$$

Apply quadratic formula:

$$x = [-0 \pm \sqrt{900}] / (2 \cdot 5) = \pm 30 / 10 = \pm 3$$

Same solutions: $x = 3$ and $x = -3$.

Understanding When Solutions Are Complex

In some cases, quadratic equations yield complex solutions, especially when the discriminant is negative.

Example of complex solutions

Suppose the equation was:

$$5x^2 + 41 = 86$$

If, after similar steps, you find:

$$x^2 = -1$$

Solutions would be:

$$x = \pm i$$

Where i is the imaginary unit.

Summary of Key Concepts

- Quadratic equations can be solved using factoring, completing the square, or the quadratic formula.
- The discriminant determines whether solutions are real or complex.
- When solving for x , always consider both positive and negative roots.
- Simplify the equation step by step for clarity and accuracy.

Practical Applications of Solving Equations

Understanding how to solve quadratic equations like $5x^2 + 41 = 86$ has numerous applications across various fields:

- Physics: Calculating projectile motion parameters.
- Engineering: Analyzing stress and strain in materials.
- Economics: Modeling profit maximization.
- Computer Science: Algorithms involving quadratic solutions.

Tips for Mastering Quadratic Equations

- Practice different methods: factoring, quadratic formula, completing the square.
- Always check your solutions by substituting back into the original equation.
- Understand the discriminant to predict the nature of solutions.
- Use graphing tools to visualize equations and solutions.

Conclusion

To find the two values that x can have in the equation $5x^2 + 41 = 86$, follow a systematic approach by isolating x^2 , simplifying, and applying square root principles. The solutions are $x = 3$ and $x = -3$, both real numbers. Mastery of solving quadratic equations is essential for tackling a wide range of mathematical problems and real-world applications. With practice, recognizing the most efficient methods and understanding the underlying concepts will become second nature, enabling you to confidently solve similar equations in various contexts.

Frequently Asked Questions

What are the two possible values of x in the equation $5x^2 + 41 = 86$?

First, subtract 41 from both sides: $5x^2 = 45$. Then divide both sides by 5: $x^2 = 9$. Taking square roots gives $x = \pm 3$. So, the two possible values are $x = 3$ and $x = -3$.

How do you solve the quadratic equation $5x^2 + 41 = 86$?

Subtract 41 from both sides to get $5x^2 = 45$. Divide both sides by 5: $x^2 = 9$. Take the square root of both sides, resulting in $x = \pm 3$.

What is the significance of the $\pm$ sign when solving for x in $5x^2 + 41 = 86$?

The $\pm$ sign indicates that there are two solutions: one positive and one negative, specifically $x = 3$ and $x = -3$.

Can 0 be a solution to the equation $5x^2 + 41 = 86$?

No, plugging in 0 yields $5(0)^2 + 41 = 41$, which does not equal 86. Therefore, 0 is not a solution.

Is the equation $5x^2 + 41 = 86$ a quadratic equation, and why?

Yes, because it involves x squared (x^2) and can be written in the standard quadratic form, $5x^2 + 0x + 41 = 86$.

What steps are involved in solving for x in the equation $5x^2 + 41 = 86$?

Subtract 41 from both sides, divide by 5 to isolate x^2 , then take the square root of both sides to find $x = \pm 3$.

Are the solutions to $5x^2 + 41 = 86$ real numbers?

Yes, because after solving, we find $x = \pm 3$, which are real numbers.

Additional Resources

Find The Two Values That X Can Have It $5x^2 + 41 = 86$

Mathematics often presents us with intriguing puzzles that challenge our problem-solving skills and deepen our understanding of algebraic concepts. One such problem is to determine the possible values of the variable x that satisfy the quadratic equation $5x^2 + 41 = 86$. At first glance, the problem appears straightforward, but uncovering the solutions involves a careful process rooted in algebraic manipulation and the fundamental principles of solving quadratic equations. This article will guide you through the steps necessary to find these two potential values, exploring the underlying concepts and providing clarity for readers at various levels of

mathematical proficiency.

Understanding the Problem: What Are We Solving For?

Before diving into calculations, it's essential to understand what the problem is asking. The phrase "Find the two values that x can have in $5x^2 + 41 = 86$ " indicates that the goal is to identify all possible values of x that make the equation true. Since the equation involves x^2 , it's a quadratic equation, which typically has two solutions—hence the phrase "two values."

Key points to consider:

- The equation involves a quadratic term $5x^2$.
- Constants are present: 41 and 86.
- Our task is to isolate x and find all real solutions that satisfy the equation.

By understanding the nature of quadratic equations, we realize that solving this problem involves algebraic manipulation, specifically isolating x^2 , simplifying the equation, and then applying methods such as square roots or the quadratic formula.

Step-by-Step Solution Process

To find the values of x , we follow a systematic approach:

Step 1: Isolate the quadratic term

Starting with the original equation:

$$5x^2 + 41 = 86$$

Subtract 41 from both sides to isolate the term containing x^2 :

$$5x^2 = 86 - 41$$

$$5x^2 = 45$$

Step 2: Divide to simplify

Divide both sides by 5 to solve for x^2 :

$$x^2 = \frac{45}{5}$$

$$[x^2 = 9]$$

This simplification reveals that the square of (x) equals 9.

Step 3: Take square roots to find possible (x) values

Since $(x^2 = 9)$, solving for (x) involves taking the square root of both sides:

$$[x = \pm \sqrt{9}]$$

$$[x = \pm 3]$$

This yields two potential solutions: $(x = 3)$ and $(x = -3)$.

Step 4: Verify solutions (optional but recommended)

Always a good practice, verify whether these solutions satisfy the original equation:

- For $(x = 3)$:

$$[5(3)^2 + 41 = 5 \times 9 + 41 = 45 + 41 = 86] \text{ (which matches the right side).}$$

- For $(x = -3)$:

$$[5(-3)^2 + 41 = 5 \times 9 + 41 = 45 + 41 = 86] \text{ (also matches).}$$

Both solutions are valid.

Understanding the Underlying Concepts

While the above steps seem straightforward, they encapsulate key algebraic principles that are fundamental to solving quadratic equations.

The Quadratic Equation and Its Solutions

A quadratic equation typically takes the form:

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

In our case, the equation is already simplified to a form where $(b = 0)$:

$$[5x^2 + 41 - 86 = 0]$$

which simplifies to:

$$[5x^2 - 45 = 0]$$

Rearranged as:

$$5x^2 = 45$$

The solutions involve taking square roots, which introduce the positive and negative possibilities—this is why quadratic equations often have two solutions.

Methods for Solving Quadratic Equations

While direct algebraic manipulation works here, other methods exist:

- Factoring: Express the quadratic as a product of binomials.
- Completing the square: Rewrite the quadratic in perfect square form.
- Quadratic formula: Use the formula:

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

In our case, since the quadratic simplifies nicely, the square root method is the most straightforward.

The Discriminant and Real Solutions

The discriminant $(D = b^2 - 4ac)$ determines whether solutions are real or complex.

- If $(D > 0)$, two real solutions.
- If $(D = 0)$, one real solution.
- If $(D < 0)$, solutions are complex conjugates.

For our original equation, the discriminant calculation confirms two real solutions:

$$a = 5, \quad b = 0, \quad c = -45$$

$$D = 0^2 - 4 \times 5 \times (-45) = 0 + 900 = 900$$

Since $(D > 0)$, solutions are real, matching our earlier findings.

Implications and Applications of the Solutions

Understanding the solutions to quadratic equations like $(5x^2 + 41 = 86)$ isn't merely an academic exercise. Such problems underpin numerous real-world applications:

- Physics: Calculating projectile trajectories involves quadratic equations.
- Engineering: Structural analysis often requires solving quadratics for stress and load calculations.
- Economics: Optimization problems may involve quadratic functions to

maximize profits or minimize costs.

- Computer Science: Algorithms for graphics rendering or data analysis sometimes depend on solving quadratic equations efficiently.

In our specific case, finding that x can be either 3 or -3 demonstrates how symmetry around the origin in quadratic functions influences their solutions, which is fundamental in understanding the shape and properties of parabolas.

Conclusion: The Power of Algebra in Solving Equations

The process of finding the two values that x can have in $5x^2 + 41 = 86$ exemplifies the elegance and utility of algebraic methods. By systematically isolating the quadratic term, simplifying, and applying the square root principle, we uncovered both solutions: $x = 3$ and $x = -3$. These solutions not only satisfy the initial equation but also serve as a reminder of the symmetry inherent in quadratic functions.

Mastering such techniques empowers students and professionals alike to approach complex problems with confidence. Whether in academic pursuits, engineering challenges, or scientific research, understanding how to solve quadratic equations is a foundational skill that unlocks a deeper comprehension of the mathematical world. As demonstrated, even a seemingly simple equation can reveal a wealth of insight when approached with clarity and rigor.

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