In Simplest Radical Form, What Are The Solutions To The Quadratic Equation 0 =-3x - 4x + 5?-b B-4ac2aQuadratic

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Understanding quadratic equations and their solutions is fundamental in algebra and higher mathematics. When dealing with quadratic equations, especially those in standard form, finding solutions in simplest radical form is a common goal. In this article, we explore the process of solving the quadratic equation $0 = -3x - 4x + 5$, transforming it into a standard form, calculating the discriminant, and expressing solutions in simplest radical form. We will also discuss the significance of radical simplification, methods used, and relevant formulas like the quadratic formula.

Understanding the Given Equation

Before solving the quadratic, it's essential to interpret and simplify the given equation:

$0 = -3x - 4x + 5$

Notice that the terms involving x are like terms and can be combined:

$-3x - 4x = -7x$

Thus, the equation simplifies to:

$0 = -7x + 5$

However, this is a linear equation, not quadratic. But since the original prompt references quadratic solutions and mentions the quadratic formula, it’s likely that there was an intent to analyze a quadratic form or perhaps a misstatement.

Let’s assume a more typical quadratic form based on the context:

$0 = ax^2 + bx + c$

Given the mention of "-b B-4ac2aQuadratic," which seems to refer to the quadratic formula:

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

Suppose the intended quadratic is:

$0 = -3x^2 - 4x + 5$

This form aligns with the quadratic formula framework.

Note: If the original question was about the linear equation, then the solution is straightforward. But for the purposes of this detailed article, we will proceed with solving the quadratic equation:

Equation to solve:

$0 = -3x^2 - 4x + 5$

Converting to Standard Quadratic Form

A quadratic equation in standard form is expressed as:

$ax^2 + bx + c = 0$

In our case:

$a = -3$

$b = -4$

$c = 5$

The quadratic formula is applicable here:

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

Calculating the Discriminant

The discriminant, denoted as D, determines the nature of solutions:

$D = b^2 - 4ac$

Calculating D:

$D = (-4)^2 - 4\ (-3)\ 5$

$D = 16 - 4\ (-3)\ 5$

$D = 16 - (-60)$

$D = 16 + 60$

$D = 76$

Since $D > 0$, the quadratic equation has two real solutions.

Finding the Solutions in Radical Form

Using the quadratic formula:

$x = [-b \pm \sqrt{(D)}] / (2a)$

Substituting the known values:

$x = [-(-4) \pm \sqrt{(76)}] / (2 -3)$

Simplify numerator:

$x = [4 \pm \sqrt{76}] / (-6)$

Now, observe $\sqrt{76}$:

76 can be simplified as:

$76 = 4 \ 19$

Therefore:

$\sqrt{76} = \sqrt{(4 \ 19)} = \sqrt{4} \ \sqrt{19} = 2\sqrt{19}$

Substituting back:

$x = [4 \pm 2\sqrt{19}] / (-6)$

Expressing Solutions in Simplest Radical Form

Now, write the solutions explicitly:

$x = (4 \pm 2\sqrt{19}) / (-6)$

To simplify, factor numerator:

$x = [2(2 \pm \sqrt{19})] / (-6)$

Divide numerator and denominator by 2:

$x = (2 \pm \sqrt{19}) / (-3)$

Alternatively, express as:

$x = - (2 \pm \sqrt{19}) / 3$

This is the simplest radical form of the solutions, with the radical $\sqrt{19}$ remaining unsimplified since 19 is prime and cannot be simplified further.

Summary of Solutions

The solutions to the quadratic equation $0 = -3x^2 - 4x + 5$ are:

1. $x = -(2 + \sqrt{19}) / 3$
2. $x = -(2 - \sqrt{19}) / 3$

These solutions are in simplest radical form and provide exact values for the roots of the quadratic.

Why Express Solutions in Simplest Radical Form?

Expressing solutions in simplest radical form offers several benefits:

- **Exactness**: Radical form provides precise solutions, avoiding rounding errors inherent in decimal approximations.
- **Mathematical Clarity**: It reveals the structure of roots, especially when roots involve irrational numbers.
- **Ease of Further Calculations**: Simplified radical solutions are easier to manipulate in subsequent algebraic operations.

Additional Methods for Solving Quadratic Equations

While the quadratic formula is a universal method, other approaches can also be used:

1. Factoring

Applicable when the quadratic can be factored into binomials:

$ax^2 + bx + c = (mx + n)(px + q)$

However, factoring is not always straightforward, especially with irrational roots.

2. Completing the Square

A technique to derive solutions by rewriting the quadratic in perfect square form, often leading to radical solutions in a different form.

3. Graphical Method

Plotting the quadratic function and identifying the points where it intersects the x-axis.

Application of the Discriminant in Solution Analysis

The discriminant's value indicates the nature of solutions:

- **D > 0**: Two real solutions (as in our example).
- **D = 0**: One real repeated solution.
- **D < 0**: Two complex solutions involving imaginary numbers.

In our case, $D=76$, which is positive, confirming two real solutions.

Summary and Conclusion

In solving the quadratic equation $0 = -3x^2 - 4x + 5$, we followed a systematic approach:

1. Identified coefficients: a, b, c
2. Calculated the discriminant: $D = 76$
3. Applied the quadratic formula: $x = [-b \pm \sqrt{D}] / (2a)$
4. Simplified radical: $\sqrt{76} = 2\sqrt{19}$
5. Expressed solutions in simplest radical form: $x = -(2 \pm \sqrt{19}) / 3$

Expressing solutions in simplest radical form ensures clarity, precision, and ease of further calculations. When dealing with quadratic equations, understanding how to manipulate radicals and recognize perfect squares is crucial for arriving at exact solutions.

Final Remarks

Mastering the process of solving quadratic equations in simplest radical form is an essential skill in algebra. It enhances problem-solving capabilities and deepens understanding of mathematical structures involving irrational roots. Whether you are solving equations for academic purposes or applying these concepts in real-world scenarios such as physics, engineering, or economics, the ability to express solutions precisely and clearly is invaluable.

Always remember to verify solutions by substituting back into the original equation, especially when radicals are involved, to ensure accuracy. With practice, solving quadratic equations and expressing roots in simplest radical form will become an intuitive and valuable part of your mathematical toolkit.

Frequently Asked Questions

What is the quadratic equation represented in the form $0 = -3x - 4x + 5$?

The given equation simplifies to $0 = -7x + 5$.

How do you solve the quadratic equation $0 = -7x + 5$ for x?

Rearrange the equation to find x: $-7x = -5$, then divide both sides by -7 to get $x = 5/7$.

What are the solutions to the quadratic equation $0 = -7x + 5$ in simplest radical form?

The solutions are $x = 5/7$; since it simplifies to a rational number, it is already in simplest form and does not involve radicals.

Can the quadratic formula be applied to the equation $0 = -7x + 5$?

Yes, but since the equation is linear, the quadratic formula is not necessary. The solution is straightforward: $x = 5/7$.

What is the value of the discriminant for the quadratic equation $0 = -7x + 5$?

Since the equation is linear, it does not have a discriminant. If it were quadratic, the discriminant would be $b^2 - 4ac$, but here, $a=0$, so the formula doesn't apply.

What does 'simplest radical form' mean, and does it apply to the solutions of this equation?

Simplest radical form refers to expressing roots with radicals in their simplest form. Since the solution is a rational number, it doesn't involve radicals and is already in simplest form.

Is the equation 0 = −3x − 4x + 5 a quadratic or linear equation?

It is a linear equation because the highest power of x is 1 after simplification.

How do you interpret the b^2 − 4ac part in the quadratic formula for this problem?

Inapplicable here because the equation simplifies to a linear form, so the quadratic formula and discriminant are not needed.

Additional Resources

In Simplest Radical Form, What Are The Solutions To The Quadratic Equation 0 = −3x − 4x + 5? −b B−4ac2a

Understanding quadratic equations is fundamental in algebra, serving as a cornerstone for more advanced mathematical concepts. When faced with an equation such as 0 = −3x − 4x + 5, students and mathematicians alike seek to find the solutions that satisfy the equation's truth. These solutions are often expressed in simplest radical form, especially when dealing with irrational numbers. This article delves into the process of solving quadratic equations, explores the significance of radical expressions, and offers a comprehensive analysis of the specific equation provided.

Understanding the Nature of Quadratic Equations

What Is a Quadratic Equation?

A quadratic equation is any polynomial equation of degree 2, typically written in the standard form:

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

where \(a\), \(b\), and \(c\) are constants, with \(a \neq 0\). The solutions to quadratic equations are the values of \(x\) that make the equation true—these are known as roots or zeros of the polynomial.

Quadratic equations are ubiquitous in various fields, including physics, engineering, economics, and beyond, often modeling parabolic relationships such as projectile motion, profit maximization, and more.

Methods of Solving Quadratic Equations

Several approaches exist to solving quadratic equations:

- Factoring: Expressing the quadratic as a product of binomials.
- Quadratic Formula: Using the formula $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$.
- Completing the Square: Rewriting the quadratic in perfect square form.
- Graphical Method: Plotting the parabola and identifying the points where it crosses the x-axis.

Each method has its advantages, with the quadratic formula being the most universally applicable, especially when the quadratic does not factor neatly.

Analyzing the Given Equation: 0 = -3x - 4x + 5

Simplification of the Equation

The first step involves simplifying the given expression:

$$ 0 = -3x - 4x + 5 $$

Combining like terms:

$$ 0 = (-3x - 4x) + 5 $$
$$ 0 = -7x + 5 $$

The resulting linear equation indicates a single solution for x:

$$ -7x + 5 = 0 $$
$$ -7x = -5 $$
$$ x = \frac{-5}{-7} = \frac{5}{7} $$

However, the original prompt refers to a quadratic equation, and this simplification shows a linear one. To align with the context of quadratic equations, it's likely that the initial expression was intended to be quadratic or perhaps contains a typographical error.

Interpreting the Equation as a Quadratic: The Role of the Expression -b B-4ac2a

Deciphering the Notation

The notation "-b B-4ac2a" appears to be a distorted or shorthand representation of the quadratic discriminant formula:

$$ \Delta = b^2 - 4ac $$

In the context of the quadratic formula, the discriminant (Δ) determines the nature of the roots:

- If $\Delta > 0$, there are two distinct real roots.
- If $\Delta = 0$, there is one real root (a repeated root).
- If $\Delta < 0$, roots are complex conjugates.

Given the notation, it's plausible that the problem intends to analyze the roots of a quadratic equation using the quadratic formula, particularly focusing on expressing solutions in radical form involving the discriminant.

Constructing the Appropriate Quadratic Equation

Given the initial linear form, perhaps the intended quadratic is:

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

Suppose the coefficients are:

- $a = 1$,
- $b = -7$,
- $c = 5$,

which corresponds to the simplified form:

$$ 0 = x^2 - 7x + 5 $$

This quadratic aligns with the context, as it involves non-trivial solutions and the potential for radical expressions.

Applying the Quadratic Formula

The quadratic formula is:

$$ x = \frac{-b \pm \sqrt{\Delta}}{2a} $$

with the discriminant:

$$ \Delta = b^2 - 4ac $$

Plugging in the coefficients:

$$ \Delta = (-7)^2 - 4(1)(5) = 49 - 20 = 29 $$

Since $\Delta = 29$ is positive and not a perfect square, solutions will involve radicals and cannot be simplified to rational numbers.

Expressing Solutions in Simplest Radical Form

Calculating the Roots

Using the quadratic formula:

$$ x = \frac{-(-7) \pm \sqrt{29}}{2 \times 1} = \frac{7 \pm \sqrt{29}}{2} $$

These are the exact solutions in radical form. Notice that $\sqrt{29}$ is irrational, and cannot be simplified further since 29 is prime.

Understanding Simplest Radical Form

Expressing solutions in simplest radical form involves:

- Radical Simplification: Ensuring the radical cannot be simplified further.
- Rationalizing the Denominator: When radicals appear in the denominator, they are often rationalized for clarity.
- Presentation of Results: Solutions should be expressed in the form:

$$ x = \frac{p \pm q\sqrt{r}}{s} $$

where p, q, r, s are integers, and r is square-free.

In this case:

$$ x = \frac{7 \pm \sqrt{29}}{2} $$

already in simplest radical form, as $\sqrt{29}$ cannot be simplified further.

Implications and Applications of the Solutions

Understanding Irrational Solutions

The solutions involving radical expressions highlight an important aspect of quadratic equations: the roots are not always rational. When the discriminant is not a perfect square, solutions involve irrational numbers, which are often expressed in radical form for exactness.

This precise expression has practical importance in fields requiring high accuracy, such as physics or engineering, where approximate decimal solutions might introduce errors.

Graphical Interpretation

Plotting the quadratic function $f(x) = x^2 - 7x + 5$ reveals the parabola's intersections with the x-axis at points:

$$ x = \frac{7 \pm \sqrt{29}}{2} $$

The roots' radical form indicates the parabola intersects the x-axis at irrational points approximately:

$$ x \approx \frac{7 \pm 5.385}{2} $$

which gives approximate solutions:

- $x \approx \frac{7 + 5.385}{2} \approx 6.1925$
- $x \approx \frac{7 - 5.385}{2} \approx 0.8075$

Conclusion: The Significance of Simplest Radical Solutions

In summary, when solving quadratic equations, expressing solutions in simplest radical form provides an exact representation of roots, especially when they involve irrational numbers. The process involves calculating the discriminant, recognizing whether roots are rational or irrational, and then presenting the solutions accordingly.

For the specific quadratic $x^2 - 7x + 5 = 0$, solutions are:

$$ x = \frac{7 \pm \sqrt{29}}{2} $$

These solutions exemplify the importance of radicals in algebraic expressions, ensuring precision and clarity in mathematical communication. Whether used in theoretical mathematics or applied sciences, expressing roots in radical form remains a fundamental skill, enabling a deeper understanding of the nature of quadratic solutions and their geometric interpretations.

Final Note: If the initial equation was intended differently or involved other coefficients, the same principles apply: simplify the equation, identify coefficients, compute the discriminant, and express solutions in radical form accordingly.

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