

Quadratic Formula $2x^2-9x-35=0$

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Understanding quadratic equations is fundamental in algebra, and solving them efficiently is a key skill for students and professionals alike. The quadratic formula provides a straightforward method to find the roots of any quadratic equation, regardless of its coefficients. In this article, we will explore the quadratic equation $2x^2 - 9x - 35 = 0$, demonstrate how to solve it using the quadratic formula, and discuss related concepts such as the discriminant, roots, and their significance.

Introduction to Quadratic Equations

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

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

where $a \neq 0$, and a, b, c are real numbers. These equations describe a parabola when graphed and have two solutions (which could be real or complex).

Significance of Solving Quadratic Equations

Quadratic equations appear in various fields such as physics, engineering, economics, and biology. They model projectile motion, optimize profit functions, and describe natural phenomena. Therefore, mastering their solutions is crucial.

The Quadratic Equation $2x^2 - 9x - 35 = 0$

Let's focus on the specific quadratic equation:

$$2x^2 - 9x - 35 = 0$$

Our goal is to find the values of x that satisfy this equation. These values are called roots or solutions of the quadratic.

Why Use the Quadratic Formula?

While factoring is a common method to solve quadratics, it is not always straightforward, especially when coefficients are not obvious factors. The quadratic formula offers a universal solution:

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

This formula works for all quadratic equations, provided the coefficients are known.

Applying the Quadratic Formula to $2x^2 - 9x - 35 = 0$

Step 1: Identify the coefficients

In the given quadratic, the coefficients are:

- $(a = 2)$
- $(b = -9)$
- $(c = -35)$

Step 2: Compute the discriminant

The discriminant (D) determines the nature of the roots:

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

Calculating:

$$D = (-9)^2 - 4 \times 2 \times (-35)$$

$$D = 81 - (-280)$$

$$D = 81 + 280$$

$$D = 361$$

Since $(D > 0)$, the quadratic has two distinct real roots.

Step 3: Calculate the roots

Using the quadratic formula:

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

Plug in the known values:

$$x = \frac{-(-9) \pm \sqrt{361}}{2 \times 2}$$

$$x = \frac{9 \pm 19}{4}$$

Calculate each root:

- First root:

$$x = \frac{9 + 19}{4} = \frac{28}{4} = 7$$

- Second root:

$$x = \frac{9 - 19}{4} = \frac{-10}{4} = -\frac{5}{2} = -2.5$$

Final solutions:

$$x = 7 \quad \text{and} \quad x = -2.5$$

Interpreting the Roots

The solutions $(x = 7)$ and $(x = -2.5)$ are the points where the parabola $(y = 2x^2 - 9x - 35)$ intersects the x-axis.

Graphical Perspective

- The parabola opens upward because $(a = 2 > 0)$.
- The roots indicate the x-intercepts.
- The vertex of the parabola can be calculated to understand its shape better.

Vertex Calculation

The x-coordinate of the vertex:

$$x_v = -\frac{b}{2a} = -\frac{-9}{2 \times 2} = \frac{9}{4} = 2.25$$

Substitute into the original equation to find y-coordinate:

$$y = 2(2.25)^2 - 9(2.25) - 35$$

$$y = 2(5.0625) - 20.25 - 35$$

$$y = 10.125 - 20.25 - 35 = -45.125$$

Thus, the vertex is at $(2.25, -45.125)$.

Additional Methods for Solving Quadratic Equations

While the quadratic formula is versatile, other methods include:

- Factoring: Useful when coefficients are factors of the constant term.
- Completing the Square: Converts quadratic into a perfect square trinomial.
- Graphical Solution: Visual method using graphing tools.

For the quadratic $(2x^2 - 9x - 35 = 0)$, factoring is less straightforward, so the quadratic formula is the most efficient.

Discriminant and Root Nature

The discriminant $(D = 361)$ indicates:

- Two real roots (since $(D > 0)$)
- Roots are rational because $(\sqrt{D} = 19)$ is rational
- Roots are distinct

In cases where the discriminant is zero, the quadratic has one real root (a repeated root), and if negative, the roots are complex conjugates.

Importance of the Quadratic Formula in Real Life

Understanding and applying the quadratic formula is essential in:

- Physics: Calculating projectile trajectories.
- Engineering: Designing structures with parabolic shapes.
- Economics: Modeling profit and cost functions.
- Biology: Population growth models.

By mastering this formula, students and professionals can solve complex quadratic problems efficiently.

Tips for Solving Quadratic Equations

- Always identify coefficients accurately.
- Calculate the discriminant first to understand the nature of roots.
- Simplify radicals and fractions for cleaner solutions.
- Use graphing calculators or software for visual understanding.
- Practice with various equations to improve fluency.

Conclusion

The quadratic equation $(2x^2 - 9x - 35 = 0)$ exemplifies how the quadratic formula provides a reliable method for finding solutions. By following systematic steps—identifying coefficients, calculating the discriminant, and applying the formula—you can solve any quadratic efficiently. Recognizing the nature of roots through the discriminant further enriches understanding of quadratic functions. Mastery of these concepts is vital for advancing in algebra and applying mathematical principles across numerous disciplines.

Keywords: quadratic formula, quadratic equations, solving quadratics, discriminant, roots, quadratic solutions, algebra, parabola, real roots, complex roots, quadratic formula steps, quadratic formula example

Frequently Asked Questions

How do I use the quadratic formula to solve $2x^2 - 9x - 35 = 0$?

To solve $2x^2 - 9x - 35 = 0$ using the quadratic formula, identify $a=2$, $b=-9$, and $c=-35$. Plug these into the formula $x = [-b \pm \sqrt{(b^2 - 4ac)}] / 2a$. Calculate the discriminant and then find the two solutions.

What are the solutions to the quadratic equation $2x^2 - 9x - 35 = 0$?

The solutions are $x = 5$ and $x = -3$. These can be found by factoring or using the quadratic formula.

How can I factor $2x^2 - 9x - 35 = 0$ directly?

Factoring involves finding two numbers that multiply to $2 \cdot -35 = -70$ and add up to -9 . These numbers are -14 and 5 . So, rewrite the quadratic as $2x^2 - 14x + 5x - 35$ and factor by grouping to get $(2x + 5)(x - 7) = 0$.

What is the discriminant for the quadratic $2x^2 - 9x - 35 = 0$, and what does it tell us?

The discriminant is $D = b^2 - 4ac = (-9)^2 - 4(2)(-35) = 81 + 280 = 361$. Since $D > 0$, there are two real solutions.

Why is the quadratic formula useful for solving $2x^2 - 9x - 35 = 0$?

The quadratic formula is useful because it provides a straightforward way to find solutions even when the quadratic cannot be easily factored, ensuring you can solve any quadratic equation.

Can the quadratic $2x^2 - 9x - 35 = 0$ be solved graphically?

Yes, by graphing the parabola $y = 2x^2 - 9x - 35$ and finding where it intersects the x-axis. Those intersection points correspond to the solutions $x = 5$ and $x = -3$.

Additional Resources

Quadratic Formula $2x^2 - 9x - 35 = 0$: Unlocking the Secrets of Quadratic Equations

Understanding quadratic equations is foundational in algebra, and the quadratic formula remains one of the most powerful tools to solve these equations efficiently. Today, we delve into the quadratic equation $2x^2 - 9x - 35 = 0$, exploring its structure, solving methods, and real-world applications. Whether you're a student brushing up on algebra or a curious learner eager to deepen your mathematical knowledge, this comprehensive guide aims to clarify the concepts and methods involved in solving such an equation.

Understanding the Quadratic Equation

Before examining the specific equation $2x^2 - 9x - 35 = 0$, it's essential to grasp what a quadratic equation entails. In algebra, a quadratic equation is any polynomial equation of degree two, generally expressed as:

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

where:

- a, b, and c are coefficients, with $a \neq 0$
- x represents the variable

The equation $2x^2 - 9x - 35 = 0$ fits this form, with:

- $a = 2$
- $b = -9$
- $c = -35$

Quadratic equations are significant because they describe parabolas when graphed, and their solutions (roots) indicate the points where the parabola intersects the x-axis.

Methods to Solve Quadratic Equations

Several techniques exist for solving quadratic equations, each suited for different types of equations or solving preferences:

1. Factoring

- Useful when the quadratic is factorable into binomials with integer coefficients.
- Involves rewriting the quadratic as a product of two binomials and setting each to zero.

2. Completing the Square

- Transforms the quadratic into a perfect square trinomial, allowing for straightforward solving.
- Often used for derivations of the quadratic formula itself.

3. Quadratic Formula

- A universal method applicable to all quadratic equations.
- Based on the derivation from completing the square, the quadratic formula is:

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

The discriminant, $D = b^2 - 4ac$, determines the nature of the roots:

- $D > 0$: Two real and distinct solutions
- $D = 0$: One real repeated solution
- $D < 0$: Two complex solutions

Given its universality and straightforward application, the quadratic formula is often the method of choice.

Applying the Quadratic Formula to $2x^2 - 9x - 35 = 0$

Let's now focus on solving the specific quadratic: $2x^2 - 9x - 35 = 0$ using the quadratic formula.

Step 1: Identify coefficients

- $a = 2$
- $b = -9$
- $c = -35$

Step 2: Calculate the discriminant (D)

$$\begin{aligned} D &= b^2 - 4ac \\ &= (-9)^2 - 4 \cdot 2 \cdot (-35) \\ &= 81 - (-280) \\ &= 81 + 280 \\ &= 361 \end{aligned}$$

Since $D = 361 > 0$, the equation has two real and distinct solutions.

Step 3: Compute the square root of the discriminant

$$\sqrt{D} = \sqrt{361} = 19$$

Step 4: Plug into the quadratic formula

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

Substituting the values:

$$x = \frac{9 \pm 19}{2 \cdot 2}$$

$$x = \frac{9 \pm 19}{4}$$

This yields two solutions:

$$- x_1 = \frac{9 + 19}{4} = \frac{28}{4} = 7$$

$$- x_2 = \frac{9 - 19}{4} = \frac{-10}{4} = -2.5$$

Result: The solutions to the quadratic equation are $x = 7$ and $x = -2.5$.

Interpreting the Solutions and Their Graphical Significance

The roots $x = 7$ and $x = -2.5$ are the points where the parabola, defined by $y = 2x^2 - 9x - 35$, intersects the x-axis. Visualizing the parabola can provide insight into the nature of the solutions:

- The parabola opens upward because the coefficient $a = 2$ is positive.
- The vertex of the parabola lies midway between the roots, at a point calculated via the vertex formula: $x = -b / (2a)$.

Calculating the vertex x-coordinate:

$$x_v = -(-9) / (2 \cdot 2) = 9 / 4 = 2.25$$

Substituting x_v into the original quadratic to find y:

$$\begin{aligned} y_v &= 2(2.25)^2 - 9(2.25) - 35 \\ &= 2 \cdot 5.0625 - 20.25 - 35 \\ &= 10.125 - 20.25 - 35 \\ &= -45.125 \end{aligned}$$

Therefore, the vertex is at $(2.25, -45.125)$, below the x-axis, confirming the parabola crosses the x-axis at $x = -2.5$ and $x = 7$.

Real-World Applications of Quadratic Equations

Quadratic equations like $2x^2 - 9x - 35 = 0$ are not just abstract mathematical concepts; they have practical applications across various fields:

- Physics: Calculating projectile trajectories, where the height of an object over time follows a quadratic pattern.
- Engineering: Designing structures or components that involve parabolic shapes or load distributions.
- Economics: Modeling profit or revenue functions that follow quadratic relationships.
- Biology: Describing population growth under limited resources, sometimes modeled with quadratic equations.
- Computer Graphics: Rendering curves and parabolic shapes in visual simulations.

Understanding how to solve such equations equips professionals and students with tools to analyze and predict real-world phenomena effectively.

Additional Insights and Tips for Solving Quadratic Equations

- Always verify whether the quadratic is factorable; factoring can be quicker if applicable.
- Use the discriminant to determine the nature of solutions before solving.
- For complex coefficients or equations that don't factor easily, the quadratic formula is the most reliable method.
- When dealing with word problems, carefully translate the scenario into a quadratic equation before solving.
- Graphing calculators or algebra software can provide visual confirmation of solutions.

Conclusion: Mastering the Quadratic Formula

The journey of solving the quadratic equation $2x^2 - 9x - 35 = 0$ underscores the elegance and utility of the quadratic formula. With solutions $x = 7$ and $x = -2.5$, we see how algebraic methods translate into graphical insights and real-world applications. Mastery of these techniques enables students, educators, and professionals alike to navigate complex problems with confidence, unlocking the myriad possibilities that quadratic equations present in science, engineering, and beyond.

By understanding the structure, applying the formula accurately, and interpreting the solutions thoughtfully, learners can harness the power of quadratic equations to solve diverse challenges and deepen their mathematical literacy.

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