

Solve The Equation. $2t+15 / t=92$

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When faced with algebraic equations, understanding how to manipulate and solve for the variable is essential. The equation $2t + 15 / t = 92$ presents a common challenge that involves both algebraic operations and the handling of rational expressions. In this comprehensive guide, we will explore methods to solve this equation step-by-step, discuss the underlying concepts, and provide tips to enhance your problem-solving skills. Whether you're a student preparing for exams or someone interested in sharpening your algebraic reasoning, this article will serve as an in-depth resource.

Understanding the Equation

Before diving into the solution, it's important to analyze the structure of the equation:

$$2t + 15 / t = 92$$

The equation contains two terms involving the variable t :

1. A linear term: $2t$
2. A rational term: $15 / t$

The goal is to find the value(s) of t that satisfy this equation.

Key Concepts and Strategies

Handling Rational Equations

Rational equations involve fractions with variables in the numerator or denominator. To solve them:

- Eliminate the denominator by multiplying both sides of the equation by the least common denominator (LCD).
- Simplify the resulting polynomial or algebraic equation.
- Solve for the variable, considering any restrictions (e.g., values that make the denominator zero).

Dealing with Variables in Denominator

Since t appears in the denominator, it's crucial to identify any restrictions:

- $t \neq 0$, because division by zero is undefined.
- When multiplying through by t , ensure $t \neq 0$, or else you risk eliminating valid solutions or creating extraneous solutions.

Step-by-Step Solution

Let's now work through the equation systematically.

Step 1: Write down the original equation

$$2t + 15 / t = 92$$

Step 2: Eliminate the fraction

To clear the denominator, multiply every term by t :

$$t(2t) + t(15 / t) = 92t$$

This simplifies to:

$$2t^2 + 15 = 92t$$

Step 3: Rearrange into standard quadratic form

Bring all terms to one side:

$$2t^2 - 92t + 15 = 0$$

This is a quadratic equation in standard form.

Step 4: Simplify the equation

Note that all coefficients are divisible by 1; no further simplification is necessary.

Step 5: Use the quadratic formula

Quadratic formula:

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

Where:

- $a = 2$
- $b = -92$
- $c = 15$

Calculate the discriminant:

$$D = b^2 - 4ac = (-92)^2 - 4 \cdot 2 \cdot 15$$

Compute step-by-step:

$$(-92)^2 = 8464$$

$$4 \cdot 2 \cdot 15 = 120$$

$$D = 8464 - 120 = 8344$$

Since $D > 0$, there are two real solutions.

Calculate the square root:

$$\sqrt{8344} \approx 91.36$$

Now, find the two solutions:

$$t = [92 \pm 91.36] / (2 \cdot 2) = [92 \pm 91.36] / 4$$

Calculating the Solutions

First solution:

$$t = (92 + 91.36) / 4 = 183.36 / 4 \approx 45.84$$

Second solution:

$$t = (92 - 91.36) / 4 = 0.64 / 4 = 0.16$$

Verifying the Solutions

It's important to verify solutions in the original equation, especially because multiplying through by t could introduce extraneous solutions.

Check $t \approx 45.84$

Calculate:

$$2t + 15 / t \approx 2 \cdot 45.84 + 15 / 45.84 \approx 91.68 + 0.327 \approx 92.007$$

Close to 92, considering rounding errors. So, $t \approx 45.84$ is a valid solution.

Check $t = 0.16$

Calculate:

$$2 \cdot 0.16 + 15 / 0.16 \approx 0.32 + 93.75 \approx 94.07$$

This does not equal 92, indicating that $t = 0.16$ is an extraneous solution introduced during algebraic manipulation.

Final Answer

The only valid solution to the equation $2t + 15 / t = 92$ is approximately:

$$t \approx 45.84$$

Additional Tips for Solving Rational Equations

- Always check for restrictions: values that make denominators zero.
- Confirm solutions by substituting back into the original equation.
- When solving quadratic equations, consider the discriminant to determine the nature of solutions.
- Be mindful of extraneous solutions introduced during algebraic manipulations.

Summary

Solving the equation $2t + 15 / t = 92$ involves clearing the rational expression through multiplication, transforming the problem into a quadratic equation, applying the quadratic formula, and verifying solutions. The key steps include:

1. Multiplying through by t to eliminate the fraction.
2. Rearranging into a standard quadratic form.
3. Calculating the discriminant and solutions.
4. Validating solutions against the original equation.

By understanding these fundamental techniques, you can confidently approach a wide range of rational equations.

Practice Problems

To reinforce your understanding, try solving these similar problems:

1. Solve for t : $3t + 7 / t = 50$

2. Solve: $(t + 2) / 3 = (2t - 5) / 4$

3. Find t: $5 / t + 2t = 20$

Remember, always analyze the structure of the equation, eliminate denominators carefully, and verify your solutions.

Conclusion

Mastering the process of solving rational equations like $2t + 15 / t = 92$ is a vital skill in algebra. By systematically eliminating fractions, transforming equations into solvable forms, and verifying solutions, you develop a strong foundation in algebraic problem-solving. Practice regularly with similar equations to build confidence and proficiency. With patience and attention to detail, you'll be able to tackle even more complex algebraic challenges with ease.

If you have further questions or need additional explanations, don't hesitate to seek out tutorials, practice problems, or ask a math instructor. Happy solving!

Frequently Asked Questions

How do you solve the equation $(2t + 15)/t = 92$ for t?

Multiply both sides by t to eliminate the denominator: $2t + 15 = 92t$. Then, bring all terms to one side: $2t + 15 - 92t = 0$, simplifying to $-90t + 15 = 0$. Subtract 15: $-90t = -15$. Divide both sides by -90: $t = (-15)/(-90) = 1/6$.

What is the value of t in the equation $(2t + 15)/t = 92$?

$t = 1/6$.

Can I check my solution $t = 1/6$ in the original equation? How?

Yes. Substitute $t = 1/6$ into the original: $(2(1/6) + 15)/(1/6) = ?$ Calculate

numerator: $(2/6 + 15) = (1/3 + 15) = (1/3 + 45/3) = 46/3$. Denominator: $1/6$. So, $(46/3) / (1/6) = (46/3) (6/1) = (46 \cdot 6) / 3 = 276 / 3 = 92$. Since the result is 92, the solution is correct.

What steps are involved in solving the equation $(2t + 15)/t = 92$?

First, multiply both sides by t to clear the denominator, resulting in $2t + 15 = 92t$. Next, bring all terms to one side: $2t + 15 - 92t = 0$. Simplify to $-90t + 15 = 0$. Then, isolate t : $-90t = -15$, and solve for t : $t = 1/6$.

Are there any restrictions on t in the equation $(2t + 15)/t = 92$?

Yes, t cannot be zero because it's in the denominator. So, $t \neq 0$.

How do I verify that $t = 1/6$ is the correct solution for the equation?

Substitute $t = 1/6$ into the original equation and simplify: $(2(1/6) + 15)/(1/6) = (1/3 + 15)/(1/6)$. Convert 15 to thirds: $(1/3 + 45/3) = 46/3$. Then divide by $1/6$: $(46/3) (6/1) = (46 \cdot 6)/3 = 276/3 = 92$. Since the left side equals 92, $t = 1/6$ is correct.

Additional Resources

Solve The Equation. $2t+15 /t=92$: A Comprehensive Guide to Mastering Rational Equations

Understanding how to solve the equation $2t + 15 / t = 92$ is an essential skill in algebra that lays the foundation for tackling more complex mathematical problems. This equation, which involves a rational expression, challenges students and learners to manipulate variables across different terms, apply algebraic principles, and arrive at a solution efficiently. In this detailed guide, we will walk through the step-by-step process of solving this equation, discuss common pitfalls, and share tips to improve your algebraic problem-solving skills.

Breaking Down the Equation

Before diving into the solution, it's important to understand the structure of the equation:

$$2t + 15 / t = 92$$

This is a rational equation because it contains a variable in the denominator (t). Such equations require careful handling because dividing by zero is undefined. As we analyze this equation, we'll consider the domain restrictions and algebraic manipulations necessary to find the value(s) of t that satisfy the equation.

Step 1: Understanding the Equation Components

The equation is composed of two terms:

- The linear term: $2t$
- The rational term: $15 / t$

The sum of these two equals 92.

Key observations:

- The variable t appears both in the numerator (implicitly in the first term) and as the denominator in the second term.
- The domain excludes $t = 0$ because division by zero is undefined.

Step 2: Eliminating the Denominator

To simplify the equation, a common approach is to clear the denominator. Multiplying both sides of the equation by t (assuming $t \neq 0$) will eliminate the fraction:

$$t (2t + 15 / t) = t 92$$

This gives:

$$t 2t + t (15 / t) = 92t$$

Simplify each term:

- $t 2t = 2t^2$
- $t (15 / t) = 15$ (since t cancels out)

So, the equation becomes:

$$2t^2 + 15 = 92t$$

Step 3: Rearranging into a Standard Quadratic Form

Bring all terms to one side to set the equation equal to zero:

$$2t^2 - 92t + 15 = 0$$

This is a quadratic equation in standard form.

Step 4: Solving the Quadratic Equation

The quadratic is:

$$2t^2 - 92t + 15 = 0$$

Method 1: Quadratic Formula

Recall the quadratic formula:

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

where $a = 2$, $b = -92$, $c = 15$.

Calculate the discriminant:

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

$$D = (-92)^2 - 4 \cdot 2 \cdot 15$$

$$D = 8464 - 120$$

$$D = 8344$$

Since the discriminant is positive, there are two real solutions.

Calculate the square root:

$$\sqrt{D} = \sqrt{8344} \approx 91.36$$

Now, find the two solutions:

$$t = [92 \pm 91.36] / (2 \cdot 2) = [92 \pm 91.36] / 4$$

Compute each:

$$1. t_1 = (92 + 91.36) / 4 = 183.36 / 4 \approx 45.84$$

$$2. t_2 = (92 - 91.36) / 4 = 0.64 / 4 = 0.16$$

Step 5: Verify Solutions Within Domain

Recall the original domain restriction:

$$t \neq 0$$

Both solutions $t \approx 45.84$ and $t = 0.16$ are valid since neither equals zero.

To ensure the solutions are correct, substitute back into the original equation:

Check $t \approx 45.84$:

Calculate:

$$2(45.84) + 15 / 45.84$$

$$\begin{aligned} - 2(45.84) &\approx 91.68 \\ - 15 / 45.84 &\approx 0.327 \end{aligned}$$

$$\text{Sum: } 91.68 + 0.327 \approx 92.007$$

Close enough considering rounding, so $t \approx 45.84$ is a valid solution.

Check $t = 0.16$:

Calculate:

$$2(0.16) + 15 / 0.16$$

$$\begin{aligned} - 2(0.16) &= 0.32 \\ - 15 / 0.16 &\approx 93.75 \end{aligned}$$

$$\text{Sum: } 0.32 + 93.75 \approx 94.07$$

This is not equal to 92, suggesting rounding errors or that this is an approximate solution. Let's verify with more precise calculations or use exact fractions.

Step 6: Final Exact Solutions

Use the quadratic formula with exact values:

$$\text{Discriminant } D = 8344$$

Express square root exactly:

Since $8344 = 4 \cdot 2086$, and 2086 is not a perfect square, the exact solutions are:

$$t = [92 \pm \sqrt{8344}] / 4$$

Thus, the solutions are:

$$t = (92 + \sqrt{8344}) / 4$$

and

$$t = (92 - \sqrt{8344}) / 4$$

These are exact, but for practical purposes, decimal approximations are sufficient.

Summary of the Solution Process

1. Recognize the structure of the equation involving rational expressions.
2. Multiply through by the denominator to clear fractions.
3. Rearrange into a quadratic form.
4. Apply the quadratic formula to find solutions.
5. Verify solutions in the original equation.
6. Consider domain restrictions (exclude $t = 0$).

Additional Tips for Solving Rational Equations

- Always check for restrictions on the variable, especially division by zero.
- When eliminating denominators, remember to multiply both sides of the equation.
- Use the quadratic formula when the quadratic is not easily factorable.
- Check solutions in the original equation to confirm they are valid, especially when approximations are involved.
- Be cautious with solutions that make denominators zero; discard any that violate the domain.

Practice Problems

To strengthen your understanding, try solving these similar equations:

1. $(3t + 7) / t = 10$
2. $(4t - 5) / (t + 2) = 3$
3. $(t^2 + 6) / t = 8$

By practicing these, you'll improve your ability to handle rational equations confidently.

Conclusion

Mastering how to solve the equation $2t + 15 / t = 92$ involves understanding

the structure of rational expressions, applying algebraic manipulations, and solving quadratic equations. Whether through the quadratic formula or factoring, the key is to work systematically, verify solutions, and be mindful of the domain restrictions. With consistent practice and attention to detail, you'll develop strong problem-solving skills that extend beyond this particular equation to more advanced algebraic challenges.

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