What Are The Solutions To 3(x-10)2=243?x=1 And X=19x=-1 And X=-19x=343/3 And X=-343/3x=1 And X=19x=50.5

What Are The Solutions To 3(x-10)2=243?x=1 And X=19x=-1 And X=-19x=343/3 And X=-343/3x=1 And X=19x=50.5

Understanding the solutions to algebraic equations is fundamental in mathematics, as it helps us evaluate expressions, solve real-world problems, and develop critical thinking skills. The given expressions present a series of equations and proposed solutions that require a detailed analysis to understand their correctness and the methods used to arrive at these solutions. In this article, we will explore each equation systematically, verify the solutions, and discuss the principles behind solving such algebraic equations.

Analyzing the Equation: 3(x - 10)^2 = 243

Step 1: Understanding the Equation

The equation 3(x - 10)^2 = 243 involves a quadratic expression within the parentheses, scaled by 3. To analyze this, we need to isolate the squared term and then solve for x.

Step 2: Simplifying the Equation

Divide both sides of the equation by 3:

$$
(x - 10)^2 = \frac{243}{3} = 81
$$

Step 3: Taking the Square Root

To solve for x, take the square root of both sides:

$$
x - 10 = \pm \sqrt{81} = \pm 9
$$

This yields two solutions:

$$
x - 10 = 9 \quad \text{or} \quad x - 10 = -9
$$

Step 4: Solving for x

Add 10 to both sides:

$$
x = 9 + 10 = 19
$$
$$
x = -9 + 10 = 1
$$

Final Solutions

$$
x = 19 \quad \text{or} \quad x = 1
$$

Verification of the Solutions

The solutions obtained are x=19 and x=1. Let's verify these solutions by substituting them back into the original equation:

- For x=19:

$$
3(19 - 10)^2 = 3(9)^2 = 3 \times 81 = 243
$$

\]

- For x=1:

\[
3(1 - 10)^2 = 3(-9)^2 = 3 \times 81 = 243
\]

Both satisfy the original equation, confirming their validity.

Addressing the Listed Solutions and Their Validity

The initial statement mentions various solutions: x=1, x=19, x=-1, x=-19, x=343/3, x=-343/3, x=50.5. Let's analyze each and determine their correctness.

Solutions x=1 and x=19

As verified above, these are correct solutions to the equation 3(x - 10)^2 = 243.

Solutions x=-1 and x=-19

These are not solutions to the original equation. To verify:

- For x=-1:

\[
3(-1 -10)^2 = 3(-11)^2 = 3 \times 121 = 363 \neq 243
\]

- For x=-19:

\[
3(-19 -10)^2 = 3(-29)^2 = 3 \times 841 = 2523 \neq 243
\]

Hence, x=-1 and x=-19 are not solutions to the equation.

Solutions x=343/3 and x=-343/3

Let's test these:

- For x=343/3:

$$
3\left(\frac{343}{3} - 10\right)^2
$$

Calculate the term inside the parentheses:

$$
\frac{343}{3} - 10 = \frac{343}{3} - \frac{30}{3} = \frac{343 - 30}{3} = \frac{313}{3}
$$

Now compute:

$$
3 \times \left(\frac{313}{3}\right)^2 = 3 \times \frac{313^2}{9} = \frac{3 \times 313^2}{9} = \frac{313^2}{3}
$$

Calculate 313^2:

$$
313^2 = 97969
$$

Thus:

$$
\frac{97969}{3} \neq 243
$$

Since the result does not equal 243, x=343/3 is not a solution.

Similarly, for x=-343/3:

$$
3\left(-\frac{343}{3} - 10\right)^2
$$

Calculate:

$$
-\frac{343}{3} - \frac{30}{3} = -\frac{373}{3}
$$

Square:

$$
\left(-\frac{373}{3}\right)^2 = \frac{373^2}{9} = \frac{139129}{9}
$$

Multiply by 3:

$$
3 \times \frac{139129}{9} = \frac{3 \times 139129}{9} = \frac{417387}{9} \neq 243
$$

Since the value does not equal 243, these are not solutions.

Solution x=50.5

Test:

$$
3(50.5 - 10)^2 = 3(40.5)^2 = 3 \times (40.5)^2
$$

Calculate:

$$
(40.5)^2 = 1640.25
$$

Multiply:

$$
3 \times 1640.25 = 4921.75 \neq 243
$$

Therefore, x=50.5 is not a solution.

Summary of Valid Solutions

Based on the calculations, the only solutions satisfying the original equation are:

- $x=1$
- $x=19$

All other proposed solutions do not satisfy the equation when substituted back.

Understanding the Methodology for Solving Quadratic Equations

Step 1: Isolate the quadratic term

- Divide or manipulate the equation to express the quadratic term alone.

Step 2: Take square roots carefully

- Remember to consider both positive and negative roots when taking square roots.

Step 3: Solve for the variable

- Isolate x by adding or subtracting as needed.

Step 4: Verify solutions

- Always substitute solutions back into the original equation to verify their validity.

Common Mistakes and How to Avoid Them

- **Ignoring the ± sign:** When taking square roots, both positive and negative roots are valid solutions.
- **Incorrect algebraic manipulations:** Always perform operations carefully to avoid sign errors or miscalculations.
- **Assuming extraneous solutions:** Verify solutions by substitution to confirm they satisfy the original equation.
- **Misinterpreting solutions:** Solutions like fractions or decimal approximations need to be checked carefully.

Conclusion

The process of solving algebraic equations like 3(x - 10)^2 = 243 involves understanding the properties of quadratic functions, careful algebraic manipulation, and verification of solutions. In this case, the solutions x=1 and x=19 are valid and satisfy the original equation, confirmed through substitution. Other proposed solutions such as x=-1, x=-19, x=343/3, x=-343/3, and x=50.5 do not satisfy the equation and are therefore invalid solutions. Mastering these solving techniques enables students and mathematicians alike to approach a wide variety of algebraic problems with confidence and accuracy.

Frequently Asked Questions

What is the first step to solve the equation 3(x - 10)^2 = 243?

Divide both sides by 3 to isolate the squared term: (x - 10)^2 = 81.

How do you find the values of x after simplifying the equation to (x - 10)^2 = 81?

Take the square root of both sides, giving x - 10 = ±9.

What are the solutions for x after solving x - 10 = ±9?

x = 10 + 9 = 19 and x = 10 - 9 = 1.

Are x = 19 and x = 1 the only solutions to 3(x - 10)^2 = 243?

Yes, these are the only solutions obtained after solving the quadratic equation.

How does the solution x = -19 relate to the original equation?

It does not; the solutions are x = 1 and x = 19. x = -19 is not a solution to the original equation.

What is the significance of the solution x = 343/3 in the context of this problem?

It is not a solution to the equation 3(x - 10)^2 = 243; solutions are x = 1 and x = 19.

Can the solutions x = -343/3 or x = 50.5 be solutions to the equation?

No, only x = 1 and x = 19 satisfy the original equation.

What is the correct set of solutions for the equation 3(x - 10)^2 = 243?

The solutions are x = 1 and x = 19.

Why are x = -1 and x = -19 not solutions to the equation?

Because substituting these back into the original equation does not satisfy it; only x = 1 and x = 19 do.

How can one verify the solutions to the quadratic equation derived from 3(x - 10)^2 = 243?

By substituting x = 1 and x = 19 back into the original equation to confirm both satisfy it.

Additional Resources

Solutions to 3(x-10)^2 = 243 are fundamental in understanding quadratic equations and their applications. This particular equation involves a quadratic expression inside a squared term, and solving it requires a systematic approach to isolate the variable \(x\). The solutions to this equation not only deepen our grasp of algebraic manipulation but also demonstrate the importance of square roots and the principles of balancing equations. In this article, we will explore the various solutions provided, analyze their correctness, and

discuss the methods used to derive these solutions, along with their advantages and limitations.

Understanding the Equation: 3(x-10)^2 = 243

Before delving into individual solutions, it's essential to understand the structure of the equation itself:

- Equation form: The equation involves a quadratic expression $(x-10)^2$, multiplied by 3, and set equal to 243.
- Goal: Find all real values of x that satisfy this equation.

This type of equation is a classic quadratic form that can be solved using algebraic techniques such as isolating the squared term, taking square roots, and solving for x. The key steps are:

1. Divide both sides by 3 to simplify.
2. Take the square root of both sides, considering both positive and negative roots.
3. Solve for x by isolating the variable.

Step-by-Step Solution Process

Let's outline the solution process in detail:

1. Divide both sides by 3:

$$
3(x-10)^2 = 243 \implies (x-10)^2 = \frac{243}{3} = 81
$$

2. Take the square root of both sides:

$$
x - 10 = \pm \sqrt{81} = \pm 9
$$

3. Solve for x:

$$
x = 10 \pm 9
$$

which yields two solutions:

$$
x = 10 + 9 = 19
$$

and

$$
x = 10 - 9 = 1
$$

Thus, the solutions to the original equation are $x = 1$ and $x = 19$.

Analysis of the Provided Solutions

The solutions provided in the user's prompt include a series of different values:

- x = 1 and x = 19
- x = -1 and x = -19
- x = 343/3 and x = -343/3
- x = 1 and x = 50.5

Let's analyze each set to determine their correctness or relevance to the original equation $3(x-10)^2 = 243$.

Solutions: x = 1 and x = 19

Assessment:

These are the correct solutions to the equation as derived through the step-by-step process. They satisfy the original equation because:

- For $x=1$:

$$
3(1-10)^2 = 3(-9)^2 = 3 \times 81 = 243
$$

- For $x=19$:

$$
3(19-10)^2 = 3 \times 9^2 = 3 \times 81 = 243
$$

Pros:

- Correct solutions that directly satisfy the original equation.
- Simple to verify through substitution.

Cons:

- Limited to real solutions; complex solutions are not considered here.

Solutions: x = -1 and x = -19

Assessment:

Substituting these into the original equation:

- For $x = -1$:

$$
3(-1 - 10)^2 = 3(-11)^2 = 3 \times 121 = 363 \neq 243
$$

- For $x = -19$:

$$
3(-19 - 10)^2 = 3(-29)^2 = 3 \times 841 = 2523 \neq 243
$$

Conclusion:

These are not solutions to the original equation. They do not satisfy the equation, indicating a misunderstanding or miscalculation. Their inclusion might be based on an earlier misinterpretation or a different problem.

Solutions: x = 343/3 and x = -343/3

Assessment:

Calculating these:

- For $x = \frac{343}{3}$:

$$
3\left(\frac{343}{3} - 10\right)^2
$$

Calculate the inside:

$$
\frac{343}{3} - 10 = \frac{343}{3} - \frac{30}{3} = \frac{343 - 30}{3} = \frac{313}{3}
$$

Now, square it:

$$
\left(\frac{313}{3}\right)^2 = \frac{313^2}{9} = \frac{97969}{9}
$$

Multiply by 3:

$$
3 \times \frac{97969}{9} = \frac{3 \times 97969}{9} = \frac{293907}{9} \approx 32656.33
$$

which does not equal 243, so these are not solutions.

Similarly, for $x = -\frac{343}{3}$:

$$
x - 10 = -\frac{343}{3} - 10 = -\frac{343}{3} - \frac{30}{3} = -\frac{373}{3}
$$

\]

Square:

\[
\left(-\frac{373}{3}\right)^2 = \frac{373^2}{9} = \frac{139129}{9}
\]

Multiply by 3:

\[
3 \times \frac{139129}{9} = \frac{417387}{9} \approx 46488.56
\]

Again, not equal to 243, so these are invalid solutions for the original equation.

Solutions: x = 1 and x = 50.5

Assessment:

Check \(x=1\):

\[
3(1-10)^2 = 3 \times 81 = 243
\]

which is correct.

Check \(x=50.5\):

\[
3(50.5 - 10)^2 = 3 \times (40.5)^2
\]

Calculate:

\[
(40.5)^2 = 1640.25
\]

Multiply:

$$
3 \times 1640.25 = 4921.75 \neq 243
$$

Therefore, $x=50.5$ is not a solution.

Summary of Valid Solutions and Their Significance

The only solutions that satisfy the original equation are:

- x = 1
- x = 19

These solutions result directly from the algebraic process and are confirmed via substitution.

Additional Considerations and Alternative Methods

While the algebraic approach detailed above is straightforward, alternative methods can enhance understanding and efficiency:

Graphical Method

- Plotting the function $f(x) = 3(x-10)^2$ and identifying where it intersects $y=243$.
- Pros:
- Visual understanding of solutions.
- Easy to identify multiple solutions if they exist.
- Cons:
- Less precise; only approximations unless high-resolution graphs are used.

Using the Quadratic Formula

- Rewriting the original problem or transforming it into a quadratic form.
- Not necessary here, but useful in more complex equations.

Practical Applications of These Solutions

Understanding solutions to quadratic equations like this has broad applications:

- Physics: Calculating projectile trajectories.
- Engineering: Stress analysis involving quadratic relationships.
- Economics: Cost and revenue models with quadratic components.
- Data Science: Fitting quadratic models to data.

Conclusion

The solutions to the equation $3(x-10)^2 = 243$ are precisely $x=1$ and $x=19$. These are derived through fundamental algebraic manipulation involving isolating the squared term, taking square roots, and solving for x. The other solutions provided, such as -1, -19, $343/3$, $-343/3$, and 50.5, do not satisfy the original equation and are, therefore, invalid in this context.

Mastering the process of solving quadratic equations is a vital skill in mathematics, offering insights into more complex algebraic structures and their real-world applications. Understanding when a solution is valid involves careful substitution and verification, ensuring that solutions are consistent with the original problem statement. Whether approached analytically or graphically, solving such equations forms a cornerstone of algebra and its numerous applications across disciplines.

What Are The Solutions To 3 X 10 2 243 X 1 And X 19x 1 And X 19x 343 3 And X 343 3x 1 And X 19x 50 5

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