Solve (x 3)2 = 49. Select The Values Of X.

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When faced with algebraic equations, understanding how to isolate variables and solve for unknowns is fundamental. In this comprehensive guide, we will explore the equation (x 3)2 = 49, analyze its structure, and determine the values of x that satisfy it. Whether you're a student brushing up on algebra or someone seeking to deepen your understanding of solving equations, this article provides step-by-step methods, explanations, and tips to master this problem.

Understanding the Equation (x 3)2 = 49

Before diving into solving the equation, it’s essential to interpret its structure accurately. The notation "(x 3)2" can be ambiguous at first glance, but in algebra, it typically represents the expression:

$(x + 3)^2$

assuming the original expression is missing a plus sign, which is a common typo or formatting issue. Alternatively, if it is written as (x 3)2, it might mean:

- $(x - 3)^2$, or
- $(x 3)^2$, i.e., $(3x)^2$

To clarify, we will consider the most common interpretation:

Assumption: The expression is $(x + 3)^2 = 49$

If your original problem is different, such as involving subtraction or multiplication, the steps will vary slightly, but the core principles remain similar.

Step-by-Step Solution Process

To solve the equation, follow these systematic steps:

1. Recognize the structure of the equation

The given equation:

$(x + 3)^2 = 49$

is a quadratic equation involving a perfect square on the left and a constant on the right.

2. Take the square root of both sides

Since the equation involves a squared expression, apply the property:

If $y^2 = k$, then $y = \pm\sqrt{k}$

Applying this to our equation:

$x + 3 = \pm\sqrt{49}$

Since $\sqrt{49} = 7$,

$x + 3 = \pm 7$

3. Isolate x

Subtract 3 from both sides:

$x = -3 \pm 7$

This yields two solutions:

- $x = -3 + 7 = 4$
- $x = -3 - 7 = -10$

4. Verify the solutions

Always verify solutions by substituting back into the original equation:

- For $x = 4$:

$(x + 3)^2 = (4 + 3)^2 = 7^2 = 49$ □

- For $x = -10$:

$(-10 + 3)^2 = (-7)^2 = 49$ □

Both solutions satisfy the original equation.

Alternative Interpretations of the Expression

Suppose the original problem was:

$(x\ 3)^2 = 49$

which simplifies to:

$(3x)^2 = 49$

Let's solve this case as well.

1. Rewrite the equation

$(3x)^2 = 49$

2. Take the square root of both sides

$3x = \pm\sqrt{49} = \pm 7$

3. Solve for x

$x = \pm 7 / 3$

Thus, the solutions are:

- $x = 7/3$
- $x = -7/3$

Verify:

- For $x = 7/3$:

$(3\ 7/3)^2 = (7)^2 = 49$ □

- For $x = -7/3$:

$(3\ -7/3) = -7$, and $(-7)^2 = 49$ □

Special Cases and Additional Considerations

While the above examples cover common interpretations, here are some additional scenarios that might arise:

1. Equation with different expressions

If the original equation involves more complex expressions, such as:

(x + 3)^2 = 49

or

(a different constant), the process remains similar: isolate the squared term, take the square root, and solve for x.

2. Quadratic equations

If the equation expands into a quadratic form, for example:

$x^2 + 6x + 9 = 49$

then solving involves factoring, completing the square, or using the quadratic formula.

3. No real solutions

If after taking the square root, the right side is negative (e.g., $(x + 3)^2 = -49$), then:

- No real solutions exist
- Only complex solutions are possible, involving imaginary numbers

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Tips for Solving Similar Equations

- Always check the form of the equation before applying methods.
- When dealing with squared variables, consider taking square roots

carefully, remembering to include both positive and negative roots.
- Verify solutions by substituting them back into the original equation.
- Be cautious with equations involving absolute values, as they require considering both positive and negative cases.

Summary of Key Steps to Solve (x 3)2 = 49

Step	Description	Example
1	Recognize the structure	$(x + 3)^2 = 49$
2	Take square root of both sides	$x + 3 = \pm 7$
3	Isolate x	$x = -3 \pm 7$
4	Calculate solutions	$x = 4$ or $x = -10$
5	Verify solutions	Substitute back into original

Conclusion

Solving equations like (x 3)2 = 49 involves understanding the properties of exponents and roots. By correctly interpreting the expression, applying square root operations, and solving for the variable, you can efficiently find all solutions. Remember to verify your solutions and consider alternative interpretations based on the expression's structure.

Mastering these techniques enhances your algebraic problem-solving skills and prepares you for more complex equations in mathematics. Keep practicing with various forms to become confident in solving quadratic and radical equations.

Frequently Asked Questions (FAQs)

1. **What if the equation involves a different constant?**
   Simply replace 49 with the new constant and follow the same steps: take the square root of both sides, considering both positive and negative roots.

2. **Can I solve $(x + 3)^2 = -49$?**
   No, because the square of a real number is always non-negative. There are no real solutions; solutions involve imaginary numbers.

3. **What if the expression is $(x + 3)^3 = 49$?**
   In that case, you would take the cube root of both sides: $x + 3 = \sqrt[3]{49}$, then solve for x.

By understanding these principles and methods, you can confidently approach and solve similar algebraic equations, enhancing your mathematical proficiency.

Frequently Asked Questions

How do I solve the equation (x + 3)^2 = 49 for x?

To solve (x + 3)^2 = 49, take the square root of both sides to get x + 3 = ±7, then subtract 3 from both sides to find x = 7 - 3 = 4 or x = -7 - 3 = -10.

What are the solutions for (x + 3)^2 = 49?

The solutions are x = 4 and x = -10.

Can I solve (x + 3)^2 = 49 by taking square roots?

Yes, taking the square root of both sides yields x + 3 = ±7, which leads to the solutions x = 4 and x = -10.

What is the step-by-step process to solve (x + 3)^2 = 49?

First, take the square root of both sides: x + 3 = ±7. Then, solve for x by subtracting 3: x = 7 - 3 = 4 and x = -7 - 3 = -10.

Is (x + 3)^2 = 49 a quadratic equation?

Yes, when expanded, it becomes x^2 + 6x + 9 = 49, which is a quadratic equation. However, solving directly via square roots is straightforward.

What does the '±' symbol mean in the solution of (x + 3)^2 = 49?

The '±' indicates that there are two solutions: one with a positive 7 and one with a negative 7, leading to x = 4 and x = -10.

Are there any restrictions on the values of x for this equation?

No, since the equation involves real numbers and square roots, the solutions x = 4 and x = -10 are valid.

Can I verify the solutions x = 4 and x = -10 in the original equation?

Yes, plugging in x = 4: (4 + 3)^2 = 7^2 = 49, which is true. For x = -10: (-10 + 3)^2 = (-7)^2 = 49, also true.

What is the importance of considering both positive and negative roots in this equation?

Because squaring either a positive or negative number results in a positive, both roots must be considered to find all solutions to the squared equation.

Additional Resources

Solve (x 3)² = 49: Select the Values of x – A Comprehensive Review

Mathematics often presents us with equations that challenge our understanding of algebraic principles, logical reasoning, and problem-solving skills. One such equation is (x 3)² = 49, which, at first glance, may seem straightforward but warrants a deeper exploration to fully grasp its nuances and solution process. In this detailed review, we will dissect this equation step-by-step, examining the key concepts involved, methods to find the solutions, common pitfalls, and practical applications of solving such equations.

Understanding the Equation: Breaking Down (x 3)² = 49

Before jumping into solving, it’s essential to understand what the equation represents.

Equation Components

- (x 3)²: This indicates that the expression inside the parentheses, x 3, is being squared.

- = 49: The squared expression equals 49, a perfect square.

Key point: The expression inside the parentheses involves the variable x and a constant 3. The goal is to determine the values of x that satisfy the equation.

Possible Interpretations

Depending on how the expression (x 3) is written, there are two common interpretations:

1. (x 3) as (x − 3): This is a standard notation where the number 3 is subtracted from x.
2. (x 3) as a product: i.e., x 3, or 3x.

Given the context and typical algebraic conventions, the most common interpretation is:

> $(x - 3)^2 = 49$

However, the original phrasing—$(x\ 3)^2 = 49$—could be ambiguous. To clarify, we will address both interpretations:

- Interpretation 1: $(x - 3)^2 = 49$
- Interpretation 2: $(x\ 3)^2 = 49$

Interpreting and Solving $(x - 3)^2 = 49$

This is a classic quadratic form, and solving it involves understanding square roots and the properties of equations involving squares.

Step-by-Step Solution

1. Isolate the squared term: The equation is already isolated with the square on the left.
2. Apply the square root property: When $a^2 = b$, the solutions are $a = \pm\sqrt{b}$, provided $b \geq 0$.
3. Calculate the square root of 49: $\sqrt{49} = 7$.
4. Set up two equations:

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

5. Solve each for x:

- For $x - 3 = 7$:
$x = 7 + 3 = 10$

- For $x - 3 = -7$:
$x = -7 + 3 = -4$

Final solutions:
$x = 10$ and $x = -4$

Interpreting and Solving $(x\ 3)^2 = 49$

This interpretation treats the expression as a product of x and 3, then squared.

Step-by-Step Solution

1. Rewrite the equation:

$(3x)^2 = 49$

2. Simplify the squared term:

$(3x)^2 = 9x^2$

So, the equation becomes:
$9x^2 = 49$

3. Divide both sides by 9 to isolate x^2:

$x^2 = 49 / 9$

$x^2 = 49/9$

4. Take the square root of both sides:

$x = \pm\sqrt{(49/9)} = \pm(\sqrt{49} / \sqrt{9}) = \pm(7 / 3)$

Final solutions:
$x = 7/3$ and $x = -7/3$

Key Concepts and Principles Involved

Understanding the solution process for equations like $(x\ 3)^2 = 49$ hinges on several foundational algebraic concepts.

Square Roots and the Square Root Property

- The fundamental principle: If $a^2 = b$, then $a = \pm\sqrt{b}$.
- This emphasizes the importance of considering both the positive and negative roots.
- The property holds true only when $b \geq 0$; otherwise, solutions involve complex numbers.

Handling Absolute Values

- Equations of the form $a^2 = b$ can also be written as $|a| = \sqrt{b}$.
- The solutions are then $a = \pm\sqrt{b}$.

Variables and Constants in Expressions

- Recognizing whether the expression involves subtraction, addition, or multiplication with the variable influences the solving approach.
- Correctly interpreting $(x\ 3)$ is crucial—does it mean $x - 3$, $x + 3$, or $3x$?

Quadratic Equations and Factoring

- Equations involving x^2 are quadratic and can often be solved by factoring, completing the square, or quadratic formula.
- In the case of $x^2 = c$, solutions are straightforward with square roots.

Common Mistakes and How to Avoid Them

When solving equations like these, several typical errors can occur:

- Misinterpreting the expression: Confusing $(x\ 3)$ as $x + 3$ or $3x$. Always clarify notation.
- Ignoring the ± sign: Forgetting that taking square roots yields both positive and negative solutions.
- Forgetting to check solutions: Substituting solutions back into the original equation to verify correctness.

- Dividing by zero: Ensuring denominators are not zero when dividing during solving.

Practical Applications and Real-World Contexts

Equations similar to $(x\ 3)^2 = 49$ are not just academic exercises—they have real-world relevance.

Physics

- Calculating distances and velocities where quadratic relationships exist, such as in free fall or projectile motion.

Engineering

- Designing systems with constraints involving quadratic equations, like stress and strain calculations.

Economics and Finance

- Modeling profit functions or cost equations that involve quadratic relationships.

Statistics and Data Analysis

- Variance calculations and standard deviation computations often involve quadratic equations.

Summary of Solution Strategies

Interpretation	Solution Method	Final Values of x
$(x - 3)^2 = 49$	Square root property	$x = 10, x = -4$
$(3x)^2 = 49$	Simplify and square root	$x = 7/3, x = -7/3$

Note: Always verify the interpretation of the original expression before solving.

Conclusion: The Importance of Precise Notation and Methodical Approach

Solving the equation $(x\ 3)^2 = 49$ hinges critically on understanding the notation and applying the correct algebraic principles. Whether interpreting $(x\ 3)$ as $(x - 3)$ or $3x$, the solution process involves isolating the variable, applying the square root property, and considering both positive and negative roots. Recognizing the context and notation is fundamental to arriving at accurate solutions.

This detailed exploration underscores the importance of clarity in mathematical expressions and emphasizes a systematic approach to solving quadratic equations. Mastery of these methods not only enhances problem-solving skills but also builds a strong foundation for tackling more complex algebraic challenges in academic and practical settings.

In essence, mastering the solution process for equations like $(x\ 3)^2 = 49$ equips students and professionals with vital analytical skills applicable across numerous fields, reinforcing the timeless relevance of algebra in understanding and navigating the world.

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