If $G(x) = 3x - 3$, Find X If $G(x) = 12$

Understanding the Problem

If $G(x) = 3x - 3$, Find X If $G(x) = 12$ is a typical algebraic problem involving functions and their values. In this context, $G(x)$ is a linear function, and the task is to determine the value of x that makes the function output 12. This type of problem is fundamental in algebra and forms the basis for understanding more complex functions and equations. To solve it efficiently, we need to understand what the function $G(x)$ represents and how to manipulate the equation to isolate the variable x.

Breaking Down the Function $G(x) = 3x - 3$

What is a Function?

A function is a relationship that assigns exactly one output to each input. In this case, $G(x)$ is the function that takes an input x and produces an output based on the rule $G(x) = 3x - 3$. This is a linear function because it involves a linear expression in x.

Understanding the Formula

- $G(x) = 3x - 3$ indicates that for any value of x, the output is three times x minus three.
- The coefficient 3 determines the slope or rate of change of the function.
- The constant term -3 shifts the graph vertically downward by 3 units on the coordinate plane.

Setting Up the Equation

Given that $G(x) = 12$

Since the problem states that $G(x)$ equals 12, we substitute 12 into the function to find the corresponding x-value:

$$12 = 3x - 3$$

This equation now relates the known output to the unknown input x. Our goal is to solve for x.

Solving for X: Step-by-Step Process

Step 1: Isolate the 3x Term

To do this, add 3 to both sides of the equation:

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12 + 3 = 3x - 3 + 3
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```
15 = 3x
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Step 2: Divide Both Sides by 3

This step simplifies the equation and isolates x:

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x = 15 / 3
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x = 5
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Conclusion of the Solution

The value of x that makes G(x) equal to 12 is **5**. Therefore, when substituting x = 5 into the function G(x), the output will be 12.

Verification of the Solution

Check by Substitution

To verify, substitute x = 5 back into the original function:

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G(5) = 3(5) - 3 = 15 - 3 = 12
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Since the output matches the given value, the solution x = 5 is correct.

Additional Insights and Related Concepts

Understanding Linear Functions

Linear functions like G(x) = 3x - 3 are fundamental in algebra because of their simplicity and widespread application. They are characterized by a constant rate of change, which makes solving for specific outputs straightforward.

Graphical Interpretation

- The graph of G(x) = 3x - 3 is a straight line with a slope of 3.
- The y-intercept is at -3, meaning the line crosses the y-axis at (0, -3).
- The point (5, 12) lies on this line, confirming the algebraic solution.

Extensions and Variations

1. If the function had a different form, such as G(x) = ax + b, the process to find x when G(x) is known remains similar.
2. In cases with quadratic or higher-degree polynomials, solving for x involves different methods such as factoring or quadratic formula.
3. Understanding how to manipulate equations is crucial in solving real-world problems involving functions.

Practical Applications of Such Problems

Problems like these are not just academic exercises; they have real-world relevance in fields such as engineering, economics, and data analysis. For example:

- Calculating the required input to achieve a desired output in manufacturing processes.
- Determining the break-even point in business models where profit functions are linear.
- Predicting future values based on current trends modeled by linear functions.

Summary

In summary, solving for x in the equation G(x) = 3x - 3 when G(x) = 12 involves straightforward algebraic manipulation. The key steps are to set the function equal to the given output, isolate the variable, and verify the solution. The process underscores the importance of understanding functions and their properties, which serve as building blocks for more advanced mathematical concepts. The solution $x = 5$ is confirmed by substitution, ensuring accuracy and reinforcing fundamental algebra skills.

Frequently Asked Questions

What is the value of x when G(x) = 12 for the function G(x) = 3x - 3?

$x = 5$ because $3x - 3 = 12 \rightarrow 3x = 15 \rightarrow x = 5$.

How do you solve for x in the equation G(x) = 12 given G(x) = 3x - 3?

Set $3x - 3 = 12$, then add 3 to both sides to get $3x = 15$, and divide both sides by 3 to find $x = 5$.

If G(x) = 3x - 3 and G(x) = 12, what is the process to find x?

Substitute $G(x)$ with 12: $12 = 3x - 3$. Add 3 to both sides: $15 = 3x$. Divide both sides by 3: $x = 5$.

What is the solution for x when G(x) = 12 and G(x) = 3x - 3?

The solution is $x = 5$.

Can you verify the value of x by plugging it back into G(x)?

Yes. Substituting $x = 5$ into $G(x)$: $3(5) - 3 = 15 - 3 = 12$, which matches the given $G(x)$ value.

What is the inverse function of G(x) = 3x - 3?

To find the inverse, solve $y = 3x - 3$ for x: $x = (y + 3) / 3$. So, the inverse function is $G^{-1}(y) = (y + 3) / 3$.

How does understanding the inverse function help in solving G(x) = 12?

Using the inverse function $G^{-1}(y)$, substitute $y = 12$: $x = (12 + 3) / 3 = 15 / 3 = 5$, confirming the solution.

What real-world scenarios could involve solving for x in G(x) = 3x - 3?

Examples include calculating break-even points in economics, determining input values for desired outputs in manufacturing, or solving for time or distance in physics problems.

Is the solution x = 5 unique for G(x) = 12?

Yes, since G(x) is a linear function with a one-to-one correspondence, the solution x = 5 is unique.

What would change if G(x) was a different linear function, say G(x) = 2x + 4, and G(x) = 12?

You would set 2x + 4 = 12, then solve: 2x = 8, so x = 4. Different functions lead to different solutions.

Additional Resources

Understanding the Problem: Finding the Value of X When G(x) = 12

In the realm of algebra, one of the foundational concepts students and professionals alike grapple with is the manipulation and understanding of functions. A function, in simple terms, describes a relationship between an input and an output. The question at hand — "If G(x) = 3x - 3, find X if G(x) = 12" — is a classic example of solving for an unknown within a functional context. This problem not only tests one's grasp of basic algebra but also provides an insightful look into how functions operate, how to manipulate algebraic expressions, and how to interpret the results in a broader mathematical setting. As we delve into this problem, it will serve as a gateway to understanding the mechanics of functions, their representations, and the methods used to find specific input values based on given outputs.

Understanding the Function G(x) = 3x - 3

Defining a Function

A function, denoted typically by a letter such as G, maps elements from one set (the domain) to elements in another set (the codomain). In this case, G(x) = 3x - 3 defines a function G where each input x is mapped to an output calculated as three times x minus three.

This particular function is linear, meaning its graph is a straight line. The general form of a linear function is y = mx + b, where m is the slope, and b is the y-intercept. Comparing G(x) = 3x - 3 to this form:
- Slope (m) = 3
- Y-intercept (b) = -3

Understanding these parameters is vital because they describe how the function behaves graphically and algebraically.

Graphical Representation

Plotting G(x) = 3x - 3 on a Cartesian plane provides visual insight:
- The y-intercept occurs at (0, -3).
- The slope of 3 indicates that for every one unit increase in x, the output G(x) increases by 3 units.
- The line extends infinitely in both directions, with the same slope throughout.

Graphing helps to verify algebraic solutions and understand the relationship between the input and output visually.

Deciphering the Problem: Setting G(x) = 12

Equation Setup

The problem states: "Find X if G(x) = 12". Since G(x) is defined as 3x - 3, we can set:
$$ 3x - 3 = 12 $$

This is a straightforward algebraic equation where the goal is to solve for x, the input that produces an output of 12.

Rearranging the Equation

To solve for x, algebraic manipulation is necessary:
1. Add 3 to both sides to isolate the term with x:
$$ 3x - 3 + 3 = 12 + 3 $$
$$ 3x = 15 $$

2. Divide both sides by 3 to solve for x:
$$ \frac{3x}{3} = \frac{15}{3} $$
$$ x = 5 $$

Thus, the input x that yields G(x) = 12 is 5.

Mathematical Verification and Interpretation

Verification of the Solution

It is good mathematical practice to verify the solution:
- Substitute x = 5 back into the original function:
$$ G(5) = 3(5) - 3 = 15 - 3 = 12 $$

- Since the computed output matches the given output, the solution x=5 is correct.

Implications of the Solution

The solution x=5 indicates that when the input to the function G is 5, the output is 12. This simple yet powerful exercise demonstrates how functions are used to model relationships and how to manipulate algebraic expressions to find specific input values based on desired outputs.

Broader Context and Applications

The Role of Linear Functions in Real-World Scenarios

Linear functions such as G(x) = 3x - 3 are pervasive in various fields:
- Economics: Calculating total revenue based on unit price and quantity.
- Physics: Describing constant velocity motion.
- Computer Science: Cost functions in algorithms and complexity analysis.

Understanding how to find input values based on outputs is critical in these contexts, enabling professionals to make predictions, optimize processes, or interpret data effectively.

Graphical Interpretation and its Significance

Graphing linear functions allows for:
- Visual comprehension of relationships.
- Identification of key features such as intercepts and slopes.
- Better understanding of how changing parameters affect the graph.

In the context of the problem, plotting G(x) and marking the point where G(x) = 12 confirms that x=5 is the correct input, reinforcing the algebraic solution.

Educational Significance and Learning Takeaways

Key Mathematical Skills Demonstrated

This problem encapsulates several essential skills:
- Setting up equations based on function definitions.
- Algebraic manipulation to isolate variables.
- Verification of solutions through substitution.
- Graphical understanding of linear functions.

Mastery of these skills forms the foundation for more advanced topics in mathematics, such as quadratic functions, systems of equations, and calculus.

Common Misconceptions and How to Avoid Them

Some typical pitfalls include:
- Forgetting to set the function equal to the given output.
- Making algebraic errors during manipulation.
- Misinterpreting the solution (e.g., overlooking negative values if they exist).

To avoid these, students should:
- Carefully read the problem statement.
- Double-check algebraic steps.
- Verify solutions by substitution.

Conclusion: The Significance of Solving for X in Functions

The process of determining the value of x when G(x) = 12, given the function G(x) = 3x - 3, exemplifies the core principles of algebra and the practical application of functions. The solution, x=5, is not just a numerical answer but a representation of the relationship modeled by the function. It demonstrates how algebraic manipulations serve as tools to unlock the underlying relationships between variables—an essential aspect of mathematical literacy.

Beyond the immediate problem, this exercise underscores the importance of understanding functions as foundational elements in mathematics, science, engineering, and beyond. Whether modeling economic systems, physical phenomena, or computational processes, the ability to find specific input values based on outputs enables professionals and students alike to interpret, analyze, and influence the systems they study. Mastery of such problems paves the way for tackling more complex mathematical challenges and enhances critical thinking skills vital in numerous disciplines.

In essence, solving for x in G(x) = 12 is more than an isolated algebraic task; it is a window into the systematic approach that underpins much of mathematical reasoning and problem-solving in the modern world.

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