Given G(x)=3x+6, Find The Value Of X When G(x)=30.

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Understanding how to find the value of x in a function like G(x)=3x+6 when a specific output is given is fundamental in algebra. This article provides a comprehensive guide to solving such problems, focusing on the example where G(x)=30, and details the methods involved, step-by-step solutions, and related concepts to deepen your understanding.

Introduction to Functions and Linear Equations

Before diving into the problem, it's essential to understand the basic concepts involved: functions, linear equations, and how to manipulate algebraic expressions to find unknown variables.

What is a Function?

A function is a relationship between a set of inputs and a set of possible outputs where each input is related to exactly one output. In the context of G(x)=3x+6, G is a function that assigns an output based on the input x.

Understanding Linear Functions

Linear functions are functions where the variable x appears to the power of 1, and their graphs are straight lines. The general form of a linear function is:

\[G(x) = mx + b \]

where:
- m is the slope (rate of change),
- b is the y-intercept (value of G(x) when x=0).

In our case, G(x)=3x+6, which is a linear function with a slope of 3 and a y-intercept of 6.

Step-by-Step Solution to Find x When G(x)=30

Let’s now focus on solving the specific problem:

Given: $G(x) = 3x + 6$
Find: x when $G(x) = 30$

Step 1: Set up the Equation

Since $G(x)$ is given as $3x + 6$, and we are told $G(x) = 30$, we substitute 30 into the function:

$$ 30 = 3x + 6 $$

This gives us a simple linear equation to solve for x.

Step 2: Isolate the Variable x

To find the value of x, we need to isolate it on one side of the equation:

$$ 3x + 6 = 30 $$

Subtract 6 from both sides:

$$ 3x = 30 - 6 $$
$$ 3x = 24 $$

Step 3: Solve for x

Now, divide both sides by 3:

$$ x = \frac{24}{3} $$
$$ x = 8 $$

Therefore, the value of x when $G(x)=30$ is 8.

Verification of the Solution

Verifying your solution is an essential step to confirm accuracy.

Substitute x=8 back into the function:

$$ G(8) = 3(8) + 6 = 24 + 6 = 30 $$

Since the output matches the given $G(x)$ value, $x=8$ is correct.

Understanding the Importance of Such Problems in Algebra

Problems like this are foundational in algebra because they help reinforce the skills of:

- Manipulating algebraic expressions
- Solving linear equations
- Understanding functions and their graphs
- Applying inverse operations

These skills are crucial for more advanced mathematics and real-world applications, such as engineering, economics, and sciences.

Additional Concepts Related to Finding x in Functions

Beyond simple linear functions, there are other related concepts that extend the understanding of how to find x given a function value.

Inverse Functions

An inverse function essentially reverses the roles of inputs and outputs. For the function $G(x)=3x+6$, its inverse $G^{-1}(x)$ can be found by solving for x:

1. Replace $G(x)$ with y:
$$ y = 3x + 6 $$
2. Swap x and y:
$$ x = 3y + 6 $$
3. Solve for y:
$$ 3y = x - 6 $$
$$ y = \frac{x - 6}{3} $$

So, the inverse function is:

$$ G^{-1}(x) = \frac{x - 6}{3} $$

Using the inverse function, you can directly find x for any given $G(x)$.

Graphing the Function and Visualizing the Solution

Graphing $G(x)=3x+6$ involves plotting points and drawing a straight line. The x-intercept occurs when $G(x)=0$:

$$ 0 = 3x + 6 $$

$$3x = -6$$
$$x = -2$$

The y-intercept (G(0)) is 6. Plotting these points and drawing the line helps visualize the relationship between x and G(x). When G(x)=30, the corresponding x-value is 8, which aligns with the point on the graph at (8,30).

Practical Applications of Finding X in Functions

Understanding how to find x when a function value is given has numerous real-world applications:

- Economics: Calculating break-even points where revenue equals costs.
- Physics: Determining the position or velocity at specific times.
- Engineering: Solving for parameters in design equations.
- Data Analysis: Interpolating or extrapolating data points.

For example, if a company's revenue function is R(x)=3x+6 (where x is the number of units sold), and the revenue is targeted at $30, finding x helps determine the necessary units to sell.

Common Mistakes and Tips to Avoid Errors

When solving for x in such problems, be mindful of:

- Incorrect algebraic manipulations: Always perform inverse operations carefully.
- Sign errors: Pay attention to positive and negative signs.
- Forgetting to verify solutions: Substitute back into the original function.
- Overlooking domain restrictions: Ensure the solution makes sense within the context.

Tips:

- Write each step clearly.
- Double-check calculations.
- Use inverse functions for more complex problems.

Summary

To summarize, solving for x in the function G(x)=3x+6 when G(x)=30 involves setting up the equation, isolating x, and solving step-by-step:

1. Substitute $G(x)=30$:
$$30 = 3x + 6$$
2. Subtract 6:
$$24 = 3x$$
3. Divide by 3:
$$x=8$$

The value of x is 8, which can be verified by substitution. Mastering this process enhances algebraic skills and builds a foundation for more advanced mathematical problems.

Conclusion

Understanding how to find the value of x when given a specific function output is a fundamental skill in algebra. The problem $G(x)=3x+6$ when $G(x)=30$ exemplifies a straightforward linear equation. By following systematic steps—setting up the equation, isolating x, and verifying your solution—you can confidently solve similar problems. These skills are not only academically valuable but also applicable across numerous real-world scenarios, making them essential for anyone looking to strengthen their mathematical foundation.

Whether you're a student beginning to learn algebra or someone brushing up on your skills, practicing such problems will improve your problem-solving abilities and deepen your understanding of functions and equations.

Frequently Asked Questions

Given G(x) = 3x + 6, what is the value of x when G(x) = 30?

To find x, set 3x + 6 = 30. Subtract 6 from both sides: 3x = 24. Divide both sides by 3: x = 8.

How do you solve for x in the equation G(x) = 3x + 6 when G(x) = 30?

Replace G(x) with 30: 3x + 6 = 30. Subtract 6 from both sides: 3x = 24, then divide both sides by 3: x = 8.

What is the value of x in G(x) = 3x + 6 if G(x) equals 30?

x equals 8, because solving 3x + 6 = 30 yields x = 8.

In the function G(x) = 3x + 6, when G(x) is 30, what is the value of x?

x = 8, since plugging into the equation and solving gives 3(8) + 6 = 30.

If G(x) = 3x + 6 and G(x) = 30, how do you find the value of x?

Set 3x + 6 equal to 30, then solve for x: 3x = 24, so x = 8.

What steps are involved in finding x when G(x) = 30 for the function G(x) = 3x + 6?

Subtract 6 from 30 to get 3x = 24, then divide both sides by 3 to find x = 8.

Why is x equal to 8 when G(x) = 3x + 6 and G(x) = 30?

Because substituting G(x) = 30 into 3x + 6 and solving for x results in x = 8.

Can you find x in G(x) = 3x + 6 when G(x) is given as 30?

Yes, by solving 3x + 6 = 30, which gives x = 8.

Additional Resources

Given G(x) = 3x + 6, Find The Value Of X When G(x) = 30

Introduction

Mathematics often presents us with seemingly straightforward functions that, upon closer examination, reveal layers of complexity and insight. One such function, G(x) = 3x + 6, serves as an excellent example of linear functions, their properties, and how to manipulate them to solve for specific variables. This investigative article delves into the process of determining the value of x when G(x) equals a particular value—here, 30. Through a detailed exploration, we will uncover the underlying principles, step-by-step calculations, and broader implications of solving such equations.

Understanding the Function G(x) = 3x + 6

Before embarking on the problem-solving journey, it is essential to understand the nature of the function.

What is a linear function?

A linear function is a function that can be expressed in the form:

$$ G(x) = mx + b $$

where:
- m is the slope of the line, indicating its steepness.
- b is the y-intercept, the point where the line crosses the y-axis.

In this case, $G(x) = 3x + 6$:
- Slope $m = 3$
- y-intercept $b = 6$

Graphical interpretation

Plotting this function on a coordinate plane results in a straight line that crosses the y-axis at (0, 6). The slope of 3 indicates that for every unit increase in x, G(x) increases by 3 units. This linearity simplifies the process of solving for x when G(x) takes on specific values.

Formulating the Problem

Given the function:

$$ G(x) = 3x + 6 $$

and the condition:

$$ G(x) = 30 $$

the goal is to find the value of x that satisfies this condition.

Mathematical approach

The problem is to solve the equation:

$$ 3x + 6 = 30 $$

This involves inverse operations to isolate x and find its value.

Step-by-Step Solution

Let's systematically solve for x:

Step 1: Set the function equal to 30

$$ 3x + 6 = 30 $$

Step 2: Subtract 6 from both sides to isolate the term with x

$$ 3x = 30 - 6 $$
$$ 3x = 24 $$

Step 3: Divide both sides by 3 to solve for x

$$ x = \frac{24}{3} $$
$$ x = 8 $$

Conclusion

The value of x when G(x) equals 30 is x = 8.

Verification of the Solution

To ensure the correctness of the solution, substitute x = 8 back into the original function:

$$ G(8) = 3(8) + 6 = 24 + 6 = 30 $$

Since the result matches the given value, the solution is verified.

Broader Context and Applications

While this problem appears simple, understanding how to manipulate linear functions has numerous applications across various fields:

In Economics

- Cost functions: Determining the number of units needed to reach a target revenue.
- Supply and demand models: Finding equilibrium points where the quantity supplied equals the demand at a specific price.

In Physics

- Motion equations: Calculating the position of an object at a given time, assuming constant velocity.

In Engineering

- Signal processing: Modeling linear relationships between variables for system control.

In Data Science

- Regression analysis: Fitting linear models to data points to predict future outcomes.

Deeper Mathematical Insights

Beyond the straightforward algebraic solution, this problem emphasizes important mathematical concepts:

The importance of inverse operations

Solving for x demonstrates the necessity of reversing operations—subtraction to undo addition, division to undo multiplication.

The role of linearity

The linearity of G(x) simplifies inverse calculations. For non-linear functions, solving for x often requires more advanced methods, such as factoring, completing the square, or numerical techniques.

The visualization aspect

Graphing the function and the specific point where G(x) = 30 can provide visual confirmation and enhance understanding.

Potential Variations and Extensions

This basic problem can be extended or modified to explore more complex scenarios:

- Non-linear functions: For example, G(x) = x^2 + 6, and solving for x given G(x) = 30.
- Multiple variables: Introducing additional variables to model more real-world situations.
- Inequalities: Finding ranges of x that satisfy G(x) > 30 or G(x) < 30.

Example list of variations:

- Find x when G(x) = 15.
- Determine the value of x for G(x) = 45.
- Solve for x when G(x) = 0.

Educational Significance

Understanding how to manipulate and solve such equations is fundamental in mathematics education. It reinforces algebraic skills, promotes logical thinking, and builds a foundation for advanced topics.

Teaching tips:

- Use graphing tools to visualize the function and the target value.
- Incorporate real-world problems that utilize linear functions.
- Encourage students to verify solutions through substitution.

Conclusion

The process of finding the value of x when $G(x) = 30$, given the function $G(x) = 3x + 6$, exemplifies core algebraic principles and highlights the elegance of linear functions. By methodically applying inverse operations, we determine that $x = 8$ satisfies the condition. This investigation underscores the importance of understanding function properties, visualization, and verification in mathematical problem-solving.

Furthermore, such foundational exercises serve as gateways to more complex mathematical concepts and real-world applications, reinforcing the relevance of algebra in diverse fields. Whether in economics, physics, engineering, or data science, mastering these techniques equips individuals to analyze and interpret relationships between variables effectively.

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Author's Note

This article aims to provide a comprehensive understanding of solving for a variable in a linear function, emphasizing clarity, verification, and real-world relevance. Whether you are a student, educator, or enthusiast, mastering these techniques is essential for progressing in mathematics and its applications.

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