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Understanding the Problem Statement

The given problem involves two functions: F(x) and G(x). The goal is to find the function (f - G)(x), which represents the difference between the two functions evaluated at a particular value of x. This type of problem is fundamental in algebra and forms the basis for understanding how functions operate when combined through addition, subtraction, multiplication, or division.

In mathematical terms, the problem asks us to compute:

\[
(f - G)(x) = F(x) - G(x)
\]

given:

\[
F(x) = 3x - 1
\]
and
\[
G(x) = x + 2
\]

This involves substituting the given functions into the expression and simplifying to find the resultant function.

Step-by-Step Approach to Find (f - G)(x)

1. Write Down the Given Functions

Before performing any operations, clearly state the functions:

- $F(x) = 3x - 1$
- $G(x) = x + 2$

2. Set Up the Expression for (f - G)(x)

By definition:

\[
(f - G)(x) = F(x) - G(x)
\]

Substitute the known functions:

\[
(f - G)(x) = (3x - 1) - (x + 2)
\]

3. Simplify the Expression

Now, proceed with algebraic simplification:

$$
(f - G)(x) = 3x - 1 - x - 2
$$

Combine like terms:

- Combine the $3x$ and $-x$:

$$
3x - x = 2x
$$

- Combine the constants -1 and -2:

$$
-1 - 2 = -3
$$

Thus, the simplified form of the function is:

$$
(f - G)(x) = 2x - 3
$$

Interpreting the Result

The resulting function:

$$
(f - G)(x) = 2x - 3
$$

tells us how the difference between $F(x)$ and $G(x)$ varies with x. For any input x, you can now compute the difference directly using this simplified expression.

Understanding Function Operations and Their Significance

What Does the Difference of Functions Represent?

The difference of two functions, $(f - G)(x)$, measures how much $F(x)$ exceeds or falls short of $G(x)$ for each value of x. It is a new function that encapsulates the pointwise difference and can be useful in various contexts such as error analysis, optimization, and comparative studies.

Applications of Function Subtraction

- Error Measurement: In numerical analysis, the difference between an approximate solution and the exact solution can be represented as a function.
- Comparative Analysis: Understanding how two different models or datasets differ across a range of

inputs.

- Calculus and Limits: The difference function is foundational in analyzing rates of change and limits.

Graphical Interpretation of the Difference Function

Graphing F(x) and G(x)

- $F(x) = 3x - 1$ is a straight line with slope 3 and y-intercept -1.
- $G(x) = x + 2$ is a straight line with slope 1 and y-intercept 2.

Graphing (f - G)(x) = 2x - 3

- The difference function is also a line with slope 2 and y-intercept -3.
- The graph of (f - G)(x) can be visualized as the vertical difference between the graphs of F(x) and G(x) at each x.

Insights from the Graphs

- The difference line has a steeper slope (2) compared to G(x) (slope 1), indicating that the difference between F(x) and G(x) grows faster as x increases.
- The y-intercept of the difference function (-3) reflects the initial difference at $x = 0$.

Further Exploration: Combining Functions

Other Types of Operations

- Addition: $(f + G)(x) = F(x) + G(x)$
- Multiplication: $(f\ G)(x) = F(x)\ G(x)$
- Division: $(f / G)(x) = F(x) / G(x)$, provided $G(x) \neq 0$

Example: Find (f + G)(x)

Using the same functions:

$$
(f + G)(x) = (3x - 1) + (x + 2) = 4x + 1
$$

Significance of These Operations

Understanding how functions combine allows mathematicians and scientists to model complex systems, analyze relationships, and solve real-world problems where multiple factors interact.

Real-World Applications of Function Differences

Physics

- Calculating the net displacement when two objects move along the same path with different velocities.
- The difference function can represent the relative position or velocity.

Economics

- Comparing revenue and cost functions to determine profit.
- The difference function indicates profit at different levels of production.

Biology

- Modeling the difference in populations of two species over time.
- Helps in understanding competitive dynamics.

Conclusion

The task of finding (f - G)(x) for the given functions F(x) = 3x - 1 and G(x) = x + 2 illustrates core concepts in algebra related to function operations. Through systematic substitution and simplification, we derived that:

$$
(f - G)(x) = 2x - 3
$$

This new function provides insights into how the two original functions relate across all values of x. The process emphasizes the importance of understanding algebraic manipulation, the graphical interpretation of functions, and the broader applications of these concepts in various scientific and mathematical disciplines. Mastery of such operations is fundamental for advanced studies in mathematics, physics, economics, and engineering, where modeling and analysis of real-world phenomena often involve combining multiple functions.

Frequently Asked Questions

What is the general formula for finding (f - g)(x) given functions f(x) and g(x)?

$(f - g)(x) = f(x) - g(x)$

Given F(x) = 3x - 1 and G(x) = x + 2, how do you compute (F - G)(x)?

Subtract G(x) from F(x): $(F - G)(x) = (3x - 1) - (x + 2)$

What is the simplified form of (F - G)(x) when F(x) = 3x - 1 and G(x) = x + 2?

$(F - G)(x) = 3x - 1 - x - 2 = 2x - 3$

How does the subtraction of functions affect the coefficients of x in (f – g)(x)?

The coefficients of x are subtracted: 3 - 1 = 2 in this case, resulting in 2x.

If F(x) = 3x – 1 and G(x) = x + 2, what is the value of (F – G)(x) when x = 5?

Substitute x = 5: (F - G)(5) = 2(5) - 3 = 10 - 3 = 7

Can (f – g)(x) be written as a single linear function? Why?

Yes, because both functions are linear, and their difference is also linear, resulting in a single linear function.

What is the importance of understanding function subtraction in algebra?

It helps in analyzing differences between functions, solving equations, and understanding function behaviors.

Is the operation (f – g)(x) commutative? Why or why not?

No, subtraction of functions is not commutative because (f - g)(x) ≠ (g - f)(x) in general.

How would the process differ if the functions were quadratic instead of linear?

The subtraction would involve combining quadratic terms, leading to a quadratic function, but the process of subtracting coefficients remains similar.

What is the significance of calculating (f - g)(x) in real-world applications?

It helps compare different functions, analyze differences in data trends, and model scenarios where the difference between two quantities is important.

Additional Resources

If F(x) = 3x - 1 And G(x) = X + 2, Find (f - G)(x).

In the realm of algebra, functions serve as fundamental tools that help us understand relationships between variables. Whether in pure mathematics, engineering, or data science, the ability to manipulate and combine functions is essential. Today, we will explore a specific problem involving two functions: F(x) and G(x). The question posed is straightforward yet insightful—how do we find the function (f - G)(x)? This problem not only reinforces core algebraic concepts but also demonstrates the importance of understanding function operations in more complex applications.

Understanding the Problem: Functions Defined

Before diving into the solution, it’s crucial to grasp the definitions of the functions involved.

The Functions F(x) and G(x)

Given:

- F(x) = 3x - 1
- G(x) = x + 2

Note that the functions are expressed in a standard algebraic form, where each function maps an input x to an output based on a specific rule.

Clarifying the Notation

The notation (f - G)(x) indicates the difference of the two functions evaluated at x, which mathematically translates to:

\[
(f - G)(x) = F(x) - G(x)
\]

This operation involves subtracting the output of G(x) from that of F(x) for any given x.

Step 1: Understanding Function Operations

Before proceeding with the calculation, let's examine what it means to perform operations on functions.

Function Addition, Subtraction, and Composition

- Addition: $(F + G)(x) = F(x) + G(x)$
- Subtraction: $(F - G)(x) = F(x) - G(x)$
- Multiplication: $(F \cdot G)(x) = F(x) \cdot G(x)$
- Division: $(F / G)(x) = F(x) / G(x)$, assuming $G(x) \neq 0$
- Composition: $(F \circ G)(x) = F(G(x))$

In this problem, we're focusing on subtraction, which involves straightforward algebra once the functions are known.

Step 2: Applying the Definitions

Given the explicit forms:

$$
F(x) = 3x - 1
$$

$$
G(x) = x + 2
$$

we want:

$$
(f - G)(x) = F(x) - G(x)
$$

which simplifies to:

$$
(3x - 1) - (x + 2)
$$

Step 3: Simplifying the Expression

Performing the subtraction involves distributing the minus sign across the second parentheses:

$$
3x - 1 - x - 2

\]

Now, combine like terms:

- Combine the x terms: \(3x - x = 2x\)
- Combine the constants: \(-1 - 2 = -3\)

Thus, the expression simplifies to:

\[
2x - 3
\]

This is the resulting function after subtracting G(x) from F(x).

Step 4: Interpreting the Result

The function:

\[
(f - G)(x) = 2x - 3
\]

represents the new relationship derived from the original two functions. It shows how the output varies depending on the input x after the subtraction operation.

Practical Implications of the Result

Understanding how to manipulate functions like this is critical in many real-world scenarios:

- Engineering: Combining signals or system responses modeled by functions.
- Economics: Calculating the net effect of two different factors or policies.
- Data Analysis: Adjusting data transformations by combining functions.

In educational contexts, such exercises strengthen foundational skills in algebra, which are essential for more advanced mathematical topics such as calculus, differential equations, and linear algebra.

Additional Considerations

While this particular problem is straightforward, it highlights some important strategies when working with functions:

1. Always clearly define your functions

Knowing the explicit formulas helps avoid mistakes during manipulation.

2. Be cautious with signs

Distributing negative signs correctly is crucial when subtracting functions.

3. Simplify step-by-step

Breaking down the algebra into manageable steps reduces errors and improves clarity.

Extending the Problem

Once comfortable with subtracting functions, students and practitioners can explore more complex operations:

- Composite functions: (F ∘ G)(x) = F(G(x))
- Adding or multiplying functions: (F + G)(x), (F · G)(x)
- Inverse functions: Find functions that reverse the effect of F or G

These operations form the backbone of advanced mathematical modeling and problem-solving.

Conclusion

The problem of finding (f - G)(x) when given specific linear functions F(x) = 3x - 1 and G(x) = x + 2 exemplifies fundamental algebraic skills. By carefully applying the principles of function operations—particularly subtraction—we arrive at a simple yet powerful new function: 2x - 3. Mastering such operations enhances mathematical fluency, which is vital across scientific disciplines, technological fields, and everyday problem-solving.

Understanding and manipulating functions not only sharpen analytical thinking but also lay the groundwork for exploring more complex mathematical structures. Whether you're designing an engineering system, analyzing economic models, or studying advanced calculus, these foundational skills serve as essential tools in your mathematical toolkit.

If F X 3x 1 And G X X 2 Find F G X

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