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When working with functions, especially in the context of combining or comparing them, it's important to understand their individual forms, how to manipulate them algebraically, and how to determine their domains. In this article, we will analyze the two functions S(x) and T(x) provided, work through the process of simplifying the expression involving these functions, and determine the domain for the resulting expression. We will explore concepts such as function composition, intersection, and algebraic simplification, ensuring clarity at each step.

Understanding the Functions S(x) and T(x)

Definition of the Functions

The functions provided are:
- S(x) = 3x - 6
- T(x) = 6 - 3x

Both are linear functions, which graph as straight lines. Recognizing their form can help us understand their behavior and how they relate to each other.

Graphical Interpretation

- S(x) has a slope of 3 and y-intercept of -6.
- T(x) has a slope of -3 and y-intercept of 6.

Plotting these functions (conceptually):
- S(x) rises steeply as x increases.
- T(x) decreases as x increases, with a negative slope.

Understanding these graphs aids in visualizing the relationships, especially if we're considering their intersection or combined expressions.

Clarifying the Problem: "Find The Simplified Formula And Domain For And"

The phrase "And" in the problem is ambiguous; it can refer to different operations involving S(x) and T(x). Common interpretations include:

- The sum: S(x) + T(x)

- The difference: S(x) - T(x)
- The product: S(x) T(x)
- The intersection (common values): solving S(x) = T(x)
- The logical "and": which might refer to the overlap of domains or solution sets

Given the context, the most typical interpretation is to analyze the combination of these functions, such as their sum or their intersection. For this article, we will explore both the sum and the intersection, providing a comprehensive understanding.

Finding the Sum: S(x) + T(x)

Step 1: Write the sum of the functions

$$
S(x) + T(x) = (3x - 6) + (6 - 3x)
$$

Step 2: Simplify the expression

$$
S(x) + T(x) = 3x - 6 + 6 - 3x
$$
$$
= (3x - 3x) + (-6 + 6)
$$
$$
= 0 + 0 = 0
$$

Step 3: Interpret the result

The sum simplifies to zero for all values of x. This suggests that the sum of the functions is a constant function:

$$
S(x) + T(x) = 0
$$

which is true for all real numbers.

Domain of the sum

Since both S(x) and T(x) are linear functions defined for all real x, their sum is also defined for all real x.

Domain: $\boxed{(-\infty, \infty)}$

Finding the Intersection of S(x) and T(x)

Another interpretation of "And" could be the intersection of the two functions, i.e., points where S(x) = T(x).

Step 1: Set the functions equal

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

Step 2: Solve for x

$$
3x + 3x = 6 + 6
$$
$$
6x = 12
$$
$$
x = 2
$$

Step 3: Find the corresponding y-value

$$
S(2) = 3(2) - 6 = 6 - 6 = 0
$$
or
$$
T(2) = 6 - 3(2) = 6 - 6 = 0
$$

Thus, the two functions intersect at the point $(2, 0)$.

Interpretation of the intersection

- Point of intersection: $(2, 0)$
- Implication: For $x = 2$, the functions share the same value.

Domain of the intersection

Since the intersection is a specific point, the domain of the intersection set is just:

$$
\boxed{\{2\}}
$$

which is a singleton set.

Expressing the Simplified Formula for the Intersection

Since at $x=2$, both functions are equal to zero, the intersection point is a single coordinate. The simplified formula describing the intersection is the solution to the equation:

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

which simplifies to:

$$
6x = 12 \implies x=2
$$

and the corresponding y-value:

$$
y=0
$$

Therefore, the intersection point can be expressed as:

$$
\boxed{(x, y) = (2, 0)}
$$

or, more generally, the solution set:

$$
\{ (x, y) \mid y = 3x - 6, \text{ with } x=2 \}
$$

which reduces to the specific point $(2, 0)$.

Summary of Findings

- The sum $S(x) + T(x)$ simplifies to zero for all real x, indicating a constant function with domain $\mathbb{R}$.
- The intersection point of $S(x)$ and $T(x)$ occurs at $x=2$, with the point $(2, 0)$.
- The domain of the sum is all real numbers: $(-\infty, \infty)$.
- The domain of the intersection set is the singleton set $\{2\}$.

Additional Insights and Applications

Understanding Function Relationships

This problem illustrates fundamental concepts in function analysis:
- Linear functions and their properties.
- Algebraic simplification to find combined functions.
- Solving equations to find points of intersection.
- Domain considerations for combined functions and solutions.

Practical Applications

These concepts are essential in various fields:
- Physics: analyzing intersecting trajectories.
- Economics: finding equilibrium points.
- Engineering: signal analysis and system responses.
- Mathematics: understanding function behavior and relationships.

Conclusion

In conclusion, the problem of analyzing the functions $S(x) = 3x - 6$ and $T(x) = 6 - 3x$ reveals interesting properties. Their sum simplifies to zero for all x, indicating they are negatives of each other, a fact that can be verified algebraically:

$$
S(x) + T(x) = 0
$$

The intersection point at $x=2$ with $y=0$ indicates where the functions meet. The domain considerations are straightforward because both functions are linear and defined everywhere, leading to a universal domain for their sum and a singleton domain for their intersection point.

Understanding these basic function operations provides a foundation for more complex analyses involving non-linear functions, systems of equations, and real-world problem solving.

Frequently Asked Questions

What is the sum of the functions S(x) = 3x - 6 and T(x) = 6 - 3x?

The sum is S(x) + T(x) = (3x - 6) + (6 - 3x) = 0, which simplifies to 0 for all x.

How do you find the simplified formula of the combined functions S(x) + T(x)?

Add the expressions: (3x - 6) + (6 - 3x). Simplify by combining like terms: 3x - 6 + 6 - 3x = 0, so the simplified formula is 0.

What is the domain of the functions S(x) and T(x) in this problem?

Both S(x) and T(x) are linear functions with no restrictions, so their domain is all real numbers, (-∞, ∞).

Is the sum of S(x) and T(x) a constant function?

Yes, the sum S(x) + T(x) = 0 is a constant function with value 0 for all x.

What is the simplified formula when combining S(x) and T(x)?

The simplified formula is 0, indicating the functions cancel each other out for all x.

Are there any restrictions on the domain of the combined function?

No, since the sum simplifies to 0, which is valid for all real x, the domain remains (-∞, ∞).

How can we verify that S(x) + T(x) simplifies to 0?

By performing algebraic addition: (3x - 6) + (6 - 3x) = 0, confirming the sum is constantly zero.

What does the simplified formula tell us about the

relationship between S(x) and T(x)?

It shows that S(x) and T(x) are inverse functions that cancel each other out, resulting in a constant sum of zero for all x.

Additional Resources

Given S(x) = 3x - 6 And T(x) = 6 - 3x. Find The Simplified Formula And Domain For And.

This problem involves analyzing two functions, $S(x)$ and $T(x)$, and understanding their combined behavior through the logical connector "And." In mathematical contexts, "And" typically refers to the intersection of conditions or the conjunction of two functions, often implying the need to find a common domain where both functions satisfy certain criteria or to analyze the combined output. This review will explore the steps necessary to derive the simplified formula for the conjunction of $S(x)$ and $T(x)$, interpret what "And" means in this context, and determine the domain where this combination is valid.

Understanding the Given Functions

Before diving into the combined formula, it is essential to understand the individual functions:

- $S(x) = 3x - 6$: A linear function with a slope of 3 and a y-intercept at -6.
- $T(x) = 6 - 3x$: Also linear, with a slope of -3 and a y-intercept at 6.

Both are straight lines with opposite slopes, which indicates that they are symmetric with respect to the line $y = 3$. This symmetry often plays a role when analyzing their intersection points or combined behaviors.

Interpreting "And" in the Context of Functions

The phrase "Find The Simplified Formula And" suggests that the problem requires us to analyze the conjunction of the two functions. Typically, "And" in mathematics can be interpreted in several ways, including:

- Set intersection: Find the set of x values where both $S(x)$ and $T(x)$ satisfy certain conditions.
- Logical conjunction: If the functions are used as conditions (e.g., $S(x) > a$ and $T(x) < b$), then the "And" relates to the simultaneous truth of those conditions.
- Combined function: Sometimes, "And" might refer to the pointwise minimum or maximum, i.e., $\min(S(x), T(x))$ or $\max(S(x), T(x))$.

Given that the problem states "Given S(x) = 3x - 6 And T(x) = 6 - 3x," and asks for the simplified formula and domain, the most probable interpretation is to analyze the pointwise conjunction—specifically, the minimum or maximum of the two functions at each x—or the intersection of their ranges.

Finding the Intersection Point of $S(x)$ and $T(x)$

To understand the relationship between $S(x)$ and $T(x)$, let's find where they intersect:

$$
S(x) = T(x)
$$

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

Bring like terms together:

$$
3x + 3x = 6 + 6
$$

$$
6x = 12
$$

$$
x = 2
$$

Plugging $x = 2$ back into either function:

$$
S(2) = 3(2) - 6 = 6 - 6 = 0
$$

$$
T(2) = 6 - 3(2) = 6 - 6 = 0
$$

So, the functions intersect at $(2, 0)$.

This point is critical because it indicates where the two functions are equal, which can serve as a boundary in the combined analysis.

Formulating the Combined Function: Minimum and Maximum

Given the typical interpretation in such problems, the "And" could be referring to the pointwise minimum or maximum of the two functions. Let's analyze both:

2.1 The Pointwise Minimum: $\text{min}(S(x), T(x))$

The minimum at each x is the lower of the two functions:

$$
f_{\text{min}}(x) = \min(S(x), T(x))
$$

Because $S(x)$ and $T(x)$ are linear and intersect at $x = 2$, their order depends on x:

- For $x < 2$:

$$
S(x) = 3x - 6
$$
$$
T(x) = 6 - 3x
$$

Let's check $x = 0$:

$$
S(0) = -6
$$
$$
T(0) = 6
$$

So $S(0) < T(0)$; thus, for $x < 2$, $S(x)$ is less than $T(x)$.

- For $x > 2$:

Let's check $x = 3$:

$$
S(3) = 3(3) - 6 = 9 - 6 = 3
$$
$$
T(3) = 6 - 3(3) = 6 - 9 = -3
$$

Now, $T(3) < S(3)$. Therefore, for $x > 2$, $T(x)$ is less than $S(x)$.

Summary:

$$
f_{\text{min}}(x) =
\begin{cases}
S(x) = 3x - 6, & x \leq 2 \\
T(x) = 6 - 3x, & x \geq 2
\end{cases}
$$

Note that at $x = 2$:

$$
S(2) = T(2) = 0
$$

Simplified Formula for the Minimum:

$$
f_{\text{min}}(x) =
\begin{cases}
3x - 6, & x \leq 2 \\
6 - 3x, & x \geq 2
\end{cases}
$$

2.2 The Pointwise Maximum: $\text{max}(S(x), T(x))$

Similarly, the maximum function is:

$$
f_{\text{max}}(x) =
\begin{cases}
T(x) = 6 - 3x, & x \leq 2 \\
S(x) = 3x - 6, & x \geq 2
\end{cases}
$$

Determining the Domain of the Combined Function

The domain of the combined function depends on the context:

- If the combined function is the pointwise minimum or maximum, then the domain includes all real numbers because both $S(x)$ and $T(x)$ are defined for all real x.

- If the problem involves some constraints (for example, only where both functions are positive or satisfy certain conditions), the domain may be restricted accordingly.

For the pointwise minimum and maximum:

\[
\boxed{
\text{Domain} = (-\infty, \infty)
}
\]

Summary of Results

Aspect	Description
Functions	\(S(x) = 3x - 6 \), \(T(x) = 6 - 3x \)
Intersection Point	\((2, 0) \)
Pointwise Minimum	\[
f_{\text{min}}(x) = \begin{cases}
3x - 6, & x \leq 2 \\
6 - 3x, & x \geq 2
\end{cases}
\]
Pointwise Maximum	\[
f_{\text{max}}(x) = \begin{cases}
6 - 3x, & x \leq 2 \\
3x - 6, & x \geq 2
\end{cases}
\]
Domain of Combined Functions	\((-\infty, \infty) \)

Features, Pros, and Cons

Features:
- The functions are linear and symmetric around the point \(x=2 \).
- The intersection point at \((2, 0) \) acts as a boundary separating the regions where each function dominates.
- The combined functions (minimum and maximum) are piecewise linear, making them straightforward to analyze and graph.

Pros:
- Simplicity: The functions are linear, making calculations and plotting easy.

- Clarity: The intersection point clearly divides the domain into regions, simplifying the piecewise definitions.
- Versatility: The minimum and maximum functions can model constraints or bounds in real-world applications.

Cons:
- Limited scope: The analysis assumes the goal is to find pointwise min and max; if the problem intended different operations, the approach would differ.
- Potential ambiguity: Without explicit clarification of "And," interpretations may vary—whether it's logical, set intersection, or pointwise operations.

Conclusion

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Given S X 3x 6 And T X 6 3x Find The Simplified Formula And Domain For And

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