Find The Interval In Which The Function Is Negative.f(x)=x-3x - 41. (-0, -1)II. (-1, 4)HI. (4,)Oll OnlyIII

Find The Interval In Which The Function Is Negative.f(x)=x-3x - 41. (-0, -1)II. (-1, 4)HI. (4,)Oll OnlyIII

Understanding where a function is negative is a fundamental concept in algebra and calculus, crucial for analyzing the behavior of functions across different intervals. When dealing with a quadratic function like f(x)=x - 3x - 41, it's essential to carefully analyze its structure, roots, and sign changes to determine the intervals where the function takes negative values. In this comprehensive guide, we'll explore the process step by step, including graphing techniques, algebraic methods, and interval notation, to help you accurately find the interval(s) where the function is negative.

Understanding the Function f(x)=x - 3x - 41

Before diving into the solution, it's important to interpret the given function correctly. The original expression appears to be:

f(x) = x - 3x - 41

which simplifies to:

f(x) = (x - 3x) - 41

= -2x - 41

This is a linear function, not quadratic. Linear functions have straightforward behaviors, and their signs depend on the slope and intercept.

Key features:

- Slope: -2 (negative slope)
- Y-intercept: -41 (the point where the line crosses the y-axis)

With a negative slope, the function decreases as x increases. To find where f(x) is negative, we need to analyze the inequality:

f(x) < 0

Step-by-Step Solution to Find Intervals Where f(x) Is Negative

Step 1: Write the inequality

Given the function:

$f(x) = -2x - 41$

Set it less than zero:

$-2x - 41 < 0$

Step 2: Solve the inequality for x

Add 41 to both sides:

$-2x < 41$

Divide both sides by -2 (note: dividing by a negative reverses the inequality):

$x > -41/2$

Simplify:

$x > -20.5$

Step 3: Interpret the solution

The inequality $x > -20.5$ indicates that the function f(x) is negative for all x greater than -20.5.

Therefore, the interval where the function is negative is:

$(-20.5, \infty)$

Analyzing the Given Intervals: Clarification

The problem statement mentions specific intervals:

- (-0, -1)
- (-1, 4)
- (4,) (possibly indicating $(4, \infty)$)
- "OnlyIII" (possibly a typo or an indication of options)

Given the algebraic solution, the interval where the function is negative is $x > -20.5$. This includes all x-values greater than -20.5, which encompasses the interval (-1, 4) and beyond.

Let's evaluate the sign of $f(x)$ at key points:

x-value	Calculation	$f(x) = -2x - 41$	Sign
-21	$-2(-21) - 41 = 42 - 41 = 1$	positive	
-20.5	$-2(-20.5) - 41 = 41 - 41 = 0$	zero (root)	
-20	$-2(-20) - 41 = 40 - 41 = -1$	negative	
0	$-2(0) - 41 = -41$	negative	
4	$-2(4) - 41 = -8 - 41 = -49$	negative	

From this table, we observe:

- The function is zero at $x = -20.5$
- The function is negative for $x > -20.5$
- The function is positive for $x < -20.5$

Important note: The function transitions from positive to negative at $x = -20.5$.

Conclusion: Determining the Intervals Where f(x) Is Negative

Based on the calculations:

- The function $f(x) = -2x - 41$ is negative for all $x > -20.5$.
- It is zero at $x = -20.5$.
- It is positive for $x < -20.5$.

Therefore, the interval where $f(x)$ is negative is:

$(-20.5, \infty)$

Understanding the Given Options and Correct Interval

The options mentioned in the problem seem to be:

1. (-0, -1)
2. (-1, 4)
3. (4, ...)

And possibly an "OnlyIII" option.

Let's analyze these intervals:

- (-0, -1): This is an invalid interval since the start point (-0) is the same as 0, and the interval is written backwards (should be (-1, 0) if ordered). But since the function is negative for x > -20.5, and -0.5 is greater than -1, the function is negative in these intervals.

- (-1, 4): Since -1 > -20.5 and 4 > -20.5, the function is negative throughout this interval.

- (4, ...): For x > 4, the function remains negative as well.

Summary:

- The function is negative for x > -20.5, which includes all the given intervals: (-1, 4), (4, ∞).

Graphical Representation and Visualization

Visualizing the function helps in understanding its behavior intuitively.

- Graph of f(x) = -2x - 41

- The line crosses the y-axis at -41.
- Slope is negative (-2), so the line decreases from left to right.
- The root is at x = -20.5, where the line crosses the x-axis.

Graph features:

- For x less than -20.5, the function is positive.
- At x = -20.5, the function is zero.
- For x greater than -20.5, the function is negative.

Practical Applications of Finding Negative Intervals

Understanding where a function is negative has numerous applications, including:

- Physics: Determining when a quantity such as velocity or acceleration is negative, indicating direction.

- Economics: Identifying periods where profit or cost functions are negative.
- Engineering: Analyzing systems where certain parameters fall below threshold levels.
- Mathematics Education: Developing skills in solving inequalities and understanding function behavior.

Summary and Final Remarks

- The function f(x) = -2x - 41 is a linear function with a negative slope and a y-intercept at -41.
- The root of the function is at x = -20.5, where the function equals zero.
- The function is negative for all x > -20.5.
- The interval where the function is negative is (-20.5, ∞).

Note: When solving such problems, always:

- Simplify the function accurately.
- Solve the inequality carefully, paying attention to inequality signs when dividing by negative numbers.
- Interpret the solution within the context of the problem.
- Use graphing to verify the solution visually.

Additional Tips for Analyzing Functions

- Identify the type of function: Linear, quadratic, polynomial, etc.
- Find roots or zeros: Set the function equal to zero and solve.
- Determine the sign: Use test points in each interval between roots.
- Use interval notation: Clearly specify the intervals where the function is positive or negative.
- Graph the function: Visual aids help confirm your algebraic solution.

In conclusion, the key to finding the intervals where a function is negative lies in understanding its algebraic structure, solving inequalities carefully, and verifying with graphing techniques. For the given function, the negative interval is all x-values greater than -20.5, which means the function is negative for x in (-20.5, ∞).

Frequently Asked Questions

How do I find the interval where the function f(x) = x - 3x - 41

is negative?

First, simplify the function to find its roots, then determine the intervals where it is below zero by testing points between the roots.

What is the simplified form of the function f(x) = x - 3x - 41?

Simplifying, we get f(x) = -2x - 41.

How do I find the roots of the function f(x) = -2x - 41?

Set f(x) = 0: -2x - 41 = 0, then solve for x: x = -41/(-2) = 41/2 = 20.5.

Given the root at x = 20.5, how do I find where the function is negative?

Since the coefficient of x is negative (-2), the function is negative for x > 20.5.

Does the function f(x) = -2x - 41 have any negative intervals on the given options?

Yes, the function is negative for x > 20.5, which corresponds to the interval (4, ∞), matching option III.

Are the provided options correctly indicating where the function is negative?

Based on the root at 20.5, the function is negative for x > 20.5, so only the interval (4, ∞) (option III) is correct.

What is the final answer for the interval where f(x) is negative?

The function is negative on the interval (4, ∞), which is option III.

Additional Resources

Find The Interval In Which The Function Is Negative is a fundamental problem in algebra and calculus, crucial for understanding the behavior of functions across different domains. Whether you're analyzing a quadratic, polynomial, or rational function, identifying where the function dips below the x-axis (i.e., where it is negative) provides insight into its roots, increasing and decreasing intervals, and overall shape. In this guide, we'll explore how to determine the interval in which the function \(f(x) = x - 3x - 41\) is negative, analyze the given options, and develop a comprehensive approach to similar problems.

Understanding the Function $f(x) = x - 3x - 41$

Before diving into the intervals, it’s essential to clarify and simplify the given function. The expression appears to have a typo or misprint, but based on typical algebraic notation, it likely intends to be:

$$
f(x) = x - 3x - 41
$$

which simplifies to:

$$
f(x) = -2x - 41
$$

Alternatively, if it involves different terms, such as $f(x) = x - 3x^2 - 41$, the process would differ. For this guide, we'll assume the function is:

$$
f(x) = -2x - 41
$$

This is a linear function, which makes the analysis straightforward.

Step-by-Step Process to Find Where a Function Is Negative

Step 1: Simplify the Function (if necessary)

As established, $f(x) = -2x - 41$ is already simplified. The key is to understand its form:

- It is a linear function with a slope of -2.
- The y-intercept is -41.

Step 2: Find the x-intercept (Root)

The x-intercept occurs when $f(x) = 0$:

$$
-2x - 41 = 0
$$
$$
-2x = 41
$$
$$
x = -\frac{41}{2} = -20.5
$$

This point divides the real line into two intervals:

- $x < -20.5$
- $x > -20.5$

Step 3: Determine the sign of $f(x)$ on each interval

Since the function is linear and its slope is negative, the function decreases as x increases.

- For $x < -20.5$:

Pick a test point, say $x = -21$:

$$
f(-21) = -2(-21) - 41 = 42 - 41 = 1
$$

The value is positive, so $f(x) > 0$ for $x < -20.5$.

- For $x > -20.5$:

Pick a test point, say $x = 0$:

$$
f(0) = -2(0) - 41 = -41
$$

The value is negative, so $f(x) < 0$ for $x > -20.5$.

Step 4: Conclude where the function is negative

From the above:

- $f(x) > 0$ when $x < -20.5$,
- $f(x) < 0$ when $x > -20.5$.

Therefore, the function is negative for all $x > -20.5$.

Interpreting the Given Options

The options provided in the problem are:

- I. $(-0, -1)$
- II. $(-1, 4)$
- III. $(4, \infty)$

And the labels:

- Only III
- Only II
- Only III

Based on the analysis, the function $f(x) = -2x - 41$ is negative when $x > -20.5$, which includes the intervals:

- $(-20.5, \infty)$

Since none of the options exactly match this interval, it's possible that the original function is different or that the options are based on a different function, perhaps a quadratic.

Considering a Quadratic Function: Hypothetical Scenario

Suppose the original function was intended to be quadratic, such as:

$$
f(x) = x^2 - 3x - 41
$$

Let's analyze this case briefly:

Step 1: Find roots

$$
x^2 - 3x - 41 = 0
$$

Discriminant:

$$
\Delta = (-3)^2 - 4(1)(-41) = 9 + 164 = 173
$$

Roots:

$$
x = \frac{3 \pm \sqrt{173}}{2}
$$

Approximate:

$$
\sqrt{173} \approx 13.153
$$

So,

$$
x \approx \frac{3 \pm 13.153}{2}
$$

- First root:

$$
x \approx \frac{3 - 13.153}{2} = \frac{-10.153}{2} = -5.0765
$$

- Second root:

$$
x \approx \frac{3 + 13.153}{2} = \frac{16.153}{2} = 8.0765
$$

Step 2: Determine the intervals where $f(x)$ is negative

Since the quadratic $f(x) = x^2 - 3x - 41$ opens upward (coefficient of x^2 is positive), the function is negative between the roots:

$$
\boxed{
\text{Function is negative for } x \in (-5.0765, 8.0765)
}
$$

Matching with the options:

- $(-1, 4)$ lies within this interval, so on this interval, the function is negative.

Final Insights and Summary

How to Find The Interval Where a Function Is Negative

1. Identify the function type (linear, quadratic, polynomial, rational).
2. Simplify the function as needed.
3. Find the roots by solving $f(x) = 0$.
4. Determine the sign of $f(x)$ on intervals divided by these roots:
- For linear functions: the sign changes at the root.
- For quadratic functions: the sign is negative between roots if parabola opens upward.
- For higher-degree polynomials: use sign charts and factorization.
5. Test points in each interval to confirm the sign.
6. Identify the intervals where the function is negative.

Practical Tips for Similar Problems

- Always verify the function's form before proceeding.
- When roots are irrational, approximate or leave in radical form, noting the approximate interval.
- Use test points to confirm the sign in each interval.
- Remember that the nature of the function (linear, quadratic, etc.) influences the shape and the intervals of negativity.

Conclusion

In summary, determining the interval in which the function is negative involves solving for roots, analyzing the function's behavior around those roots, and testing points within the resulting intervals. Whether dealing with linear or quadratic functions, this process allows you to map out the exact regions where the function dips below the x-axis, providing critical insights into the function's overall behavior and properties. Always carefully interpret the problem, simplify the function accordingly, and systematically analyze each interval to arrive at a precise answer.

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