The Graph Of F(x) = |x| 2 Has An X-intercept At ???A- (0,0)B- (0,-2)C- (-2,0)D- (2,2)

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Understanding the graph of functions is a fundamental aspect of algebra and calculus, especially when analyzing how functions behave across different domains. A common function students encounter is the absolute value function, denoted as f(x) = |x|. When this function is scaled or transformed, its graph can change significantly, affecting key features like intercepts, vertex, and symmetry.

In this article, we will explore the specific function f(x) = |x| 2, analyze its graph, determine its x-intercept, and clarify how to interpret multiple-choice options related to its intercepts. By the end, you'll have a detailed understanding of how to identify the x-intercept of this scaled absolute value function and comprehend the underlying concepts involved.

Understanding the Basic Absolute Value Function: f(x) = |x|

Before delving into the scaled function, let's review the fundamental features of the basic absolute value function:

- Graph shape: The graph of y = |x| is a "V" shape centered at the origin (0,0).
- Vertex: The point (0, 0) is the vertex, where the two linear pieces meet.
- Symmetry: The graph is symmetric with respect to the y-axis.
- X-intercept: The graph crosses the x-axis at (0,0), since |0| = 0.

This basic understanding provides a foundation for analyzing transformations.

Transformations of the Absolute Value Function

Transformations involve shifting, stretching, compressing, or reflecting the graph of a basic function. For the function f(x) = a|x|:

- Vertical stretch/compression: The coefficient a affects the steepness.
- Horizontal shifts: Addition or subtraction inside the absolute value shifts the graph horizontally.
- Vertical shifts: Addition or subtraction outside the absolute value shifts the graph vertically.
- Reflections: Negative values of a reflect the graph across the x-axis.

In our specific case, the function is f(x) = |x| 2, which involves a vertical stretch by a factor of 2.

Analyzing the Function f(x) = |x| 2

Let's analyze the function step by step:

- Expression: $f(x) = 2|x|$
- Effect of the coefficient: The multiplication by 2 stretches the graph vertically, making it steeper.
- Key features:
- Vertex: Still at (0, 0), since absolute value functions always have their vertex at the origin unless shifted.
- Y-intercept: When $x = 0$, $f(0) = 2\ |0| = 0$.
- X-intercept: The point(s) where $f(x) = 0$.

Since the absolute value is zero at $x = 0$, the graph crosses the x-axis at (0, 0).

The X-Intercept of f(x) = 2|x|

The x-intercept is the point where the graph crosses the x-axis, i.e., where $f(x) = 0$.

- Set $f(x) = 0$:

$2|x| = 0$

- Divide both sides by 2:

$|x| = 0$

- The absolute value is zero only when:

$x = 0$

Therefore, the only x-intercept of the function $f(x) = 2|x|$ is at (0, 0).

Interpreting Multiple Choice Options for the X-Intercept

Given the options:

- A: (0, 0)
- B: (0, -2)
- C: (-2, 0)
- D: (2, 2)

Let's analyze each in the context of the x-intercept:

1. Option A: (0, 0)

- This is the point where $x = 0$ and $y = 0$.
- The graph of $f(x) = 2|x|$ crosses the x-axis at (0, 0).
- Correct answer.

2. Option B: (0, -2)

- This point is at $x = 0$, $y = -2$.
- Since $f(0) = 0$, the y-value here is not on the graph.
- This point is below the x-axis and not an intercept.

3. Option C: (-2, 0)

- At $x = -2$, $f(-2) = 2 |-2| = 2 2 = 4$.
- This point is (–2, 4), which is above the x-axis.
- Not an intercept.

4. Option D: (2, 2)

- At $x = 2$, $f(2) = 2 |2| = 4$.
- So, the point is (2, 4), not on the x-axis.
- Not an intercept.

Conclusion: The only correct x-intercept for $f(x) = 2|x|$ is at (0, 0), corresponding to option A.

Graphing the Function f(x) = 2|x|

Visualizing the graph helps reinforce the understanding:

- The graph forms a "V" shape with the vertex at (0, 0).
- The arms of the "V" are straight lines with slopes:

- For $x \geq 0$, $f(x) = 2x$, slope = 2.
- For $x \leq 0$, $f(x) = -2x$, slope = -2.

- The graph is symmetric about the y-axis.

Key Takeaways for Students

- The absolute value function creates a V-shaped graph with a vertex at the origin.
- Scaling the absolute value by a factor (like 2) stretches the graph vertically, increasing the steepness.
- The x-intercept occurs where the function's output is zero, which for scaled absolute value functions is always at $x = 0$.
- Multiple-choice questions about intercepts should be carefully analyzed by plugging in values and understanding the function's behavior.

Additional Tips for Analyzing Similar Functions

When faced with similar problems, use these strategies:

- Identify the basic form of the function (e.g., absolute value, quadratic, linear).
- Determine how transformations (scaling, shifting, reflecting) affect key features like intercepts and vertex.
- Set the function equal to zero to find x-intercepts.
- Graph the function mentally or on paper to visualize key points.
- Compare the options systematically, plugging in values if necessary.

Conclusion

In summary, for the function $f(x) = 2|x|$, the x-intercept is at the point (0, 0). The multiple-choice options provided in the question reveal common misconceptions, such as confusing the location of intercepts or misinterpreting the effect of scaling. Recognizing that the absolute value function's x-intercept always occurs at $x = 0$, regardless of vertical scaling, is crucial for correct analysis.

Understanding these concepts not only helps in solving specific problems but also builds a solid foundation for more advanced topics involving transformations, graph analysis, and function behavior. Whether you're preparing for exams or enhancing your algebra skills, mastering the interpretation of absolute value functions and their intercepts is a vital step toward mathematical proficiency.

Frequently Asked Questions

What is the x-intercept of the graph of $f(x) = |x|$?

The x-intercept of $f(x) = |x|$ is at (0, 0).

Which point corresponds to the x-intercept of $f(x) = |x|$?

The x-intercept is at (0, 0), which is option A.

Does the graph of $f(x) = |x|$ cross the x-axis at (0, 0)?

Yes, the graph crosses the x-axis at (0, 0).

Is (0, -2) an x-intercept for f(x) = |x|?

No, (0, -2) is not an x-intercept; the x-intercept is at (0, 0).

What is the significance of the point (0, 0) in the graph of f(x) = |x|?

It is the vertex of the V-shaped graph and the x-intercept.

Which of the following options correctly identifies the x-intercept of f(x) = |x|?

Option A: (0, 0).

Does the point (-2, 0) lie on the graph of f(x) = |x|?

Yes, because |−2| = 2, so the point is (−2, 2), not (−2, 0).

Is the point (2, 2) the x-intercept of f(x) = |x|?

No, (2, 2) is not an x-intercept; the x-intercept is at (0, 0).

What is the value of y at the x-intercept of f(x) = |x|?

At the x-intercept, y = 0.

Based on the options, which point best represents the x-intercept of f(x) = |x|?

Option A: (0, 0).

Additional Resources

Understanding the Graph of F(x) = |x|^2 is fundamental for grasping how absolute value functions and quadratic functions interact visually. When analyzing this function's graph, it’s important to identify key features such as intercepts, shape, and symmetry. In this article, we will explore the nature of the graph of F(x) = |x|^2, determine its x-intercept, and clarify common misconceptions related to its points of intersection with the axes.

Introduction to the Function F(x) = |x|^2

The function F(x) = |x|^2 combines two mathematical concepts: the absolute value function and the quadratic function. To understand its graph thoroughly, we need to analyze both components.

- Absolute value function, $|x|$: It outputs the non-negative value of x, creating a V-shaped graph with a vertex at the origin.
- Squaring $|x|$: It transforms the absolute value into a parabola opening upwards, but with some distinctive properties compared to the standard quadratic $y = x^2$.

Before diving into the graph, let’s consider some key points and their implications:

- For any real number x, $|x| \geq 0$.
- $F(x) = |x|^2 = (|x|)^2$: Since $|x|$ is always non-negative, squaring it yields a non-negative result.
- The domain of the function is all real numbers, $(-\infty, \infty)$.
- The range of the function is $[0, \infty)$, since squares are never negative.

Visualizing the Graph of $F(x) = |x|^2$

To sketch or analyze the graph, it helps to evaluate the function at key points:

x	|x|	F(x) = |x|^2
-2	2	4
-1	1	1
0	0	0
1	1	1
2	2	4

From these points, we observe:

- The graph is symmetric with respect to the y-axis because the function depends on $|x|$, which is an even function.
- At $x=0$, $F(0)=0$, indicating the vertex of the graph is at the origin.
- For positive and negative x, the function values mirror each other.

The graph of $F(x) = |x|^2$ looks like a "U" shape, similar to the standard parabola $y = x^2$, but with the key difference that the input is an absolute value.

Understanding the X-Intercepts of $F(x) = |x|^2$

An x-intercept is a point where the graph crosses the x-axis, i.e., where $y=0$. To find the x-intercepts, set $F(x) = 0$ and solve for x:

$$F(x) = |x|^2 = 0$$

Since the square of any real number is zero only when the number itself is zero, the solution simplifies to:

$|x| = 0 \rightarrow x = 0$

This indicates that the only point where the graph touches or crosses the x-axis is at:

(0, 0)

Now, let's analyze the options provided:

- A - (0, 0): This is consistent with our calculation.
- B - (0, -2): Not correct, since the function is never negative; it does not cross or touch the x-axis at any point other than (0,0).
- C - (-2, 0): Incorrect, because at x=-2, F(-2) = |-2|^2= 4, not zero.
- D - (2, 2): Incorrect, since at x=2, F(2)=4, not zero.

Conclusion: The only x-intercept for F(x) = |x|^2 is at (0,0).

Deep Dive: Why Is (0, 0) the Only X-Intercept?

The key to understanding why (0,0) is the sole x-intercept lies in the properties of absolute value and squaring.

Absolute Value and Zero

- |x| = 0 if and only if x = 0.
- For any other x ≠ 0, |x| > 0.

Squaring the Absolute Value

- Since |x| ≥ 0, squaring it yields |x|^2 ≥ 0.
- The only way |x|^2 = 0 is when |x| = 0, which implies x=0.

Therefore, the graph touches the x-axis only at the origin, confirming that (0,0) is the unique x-intercept.

Additional Features of the Graph

Beyond the x-intercept, it’s instructive to explore other characteristics:

Symmetry

- The function is even: $F(-x) = F(x)$.
- The graph is symmetric about the y-axis.

Vertex

- The lowest point on the graph is at (0, 0), which acts as the vertex.

Shape and Behavior

- The graph resembles a parabola opening upward.
- For large $|x|$, $F(x)$ becomes large, tending towards infinity.
- The rate of increase is quadratic, with the same shape on both sides due to symmetry.

Summary and Key Takeaways

- The Graph of $F(x) = |x|^2$ is a symmetric parabola with its vertex at the origin.
- The only x-intercept is at (0,0) because the function equals zero only when $x=0$.
- The points provided in the options relate to common misconceptions or distractors, but the correct answer aligns with the mathematical properties of the absolute value and quadratic functions.

Quick facts:

- X-intercept: (0, 0)
- Range: $[0, \infty)$
- Symmetry: Even function, symmetric about the y-axis
- Vertex: at (0, 0)
- Shape: Upward-opening parabola-like curve

Final Notes: Clarifying Common Confusions

It's easy to conflate the graph of $|x|^2$ with other functions like $y = x^2$ or $y = |x|$. While they share some features, they are distinct:

- $y = x^2$: Standard parabola with vertex at (0,0), symmetric, with y-values reflecting the square of x.
- $y = |x|$: V-shaped graph with a vertex at (0,0); not quadratic.
- $y = |x|^2$: Parabola similar to $y = x^2$ but with the input being an absolute value, ensuring symmetry and non-negativity.

Understanding these nuances helps in accurately analyzing and graphing such functions.

In conclusion, the graph of F(x) = |x|^2 intersects the x-axis only at (0,0), making it a unique and fundamental feature of this function. Recognizing this point is essential for interpreting the graph correctly and understanding the behavior of absolute value-based quadratic functions.

The Graph Of F X X 2 Has An X Intercept At A 0 0 B 0 2 C 2 0 D 2 2

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