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Understanding the Function H(x) = -3x^2 + 5

When working with functions in mathematics, particularly quadratic functions like $H(x) = -3x^2 + 5$, it is essential to understand their structure and behavior. This specific function is a quadratic function with a leading coefficient of -3 and a constant term of 5.

What is a Quadratic Function?

A quadratic function is any function that can be expressed in the form:

- $f(x) = ax^2 + bx + c$

where:
- a, b, and c are constants,
- $a \neq 0$.

In our case, the function is:

- $H(x) = -3x^2 + 5$

which means:
- $a = -3$,
- $b = 0$,
- $c = 5$.

Key Features of $H(x) = -3x^2 + 5$

- Vertex: Since the parabola opens downward ($a < 0$), it has a maximum point at the vertex.
- Axis of Symmetry: The vertical line passing through the vertex.
- Y-intercept: The value of H(x) when $x = 0$.
- Domain: All real numbers, $\mathbb{R}$.
- Range: Since the parabola opens downward, the range is all real numbers less than or equal to the maximum value at the vertex.

Calculating H(0.1): Step-by-Step Approach

The primary goal here is to find the value of the function H at x = 0.1, i.e., H(0.1).

Step 1: Write the function

H(x) = -3x^2 + 5

Step 2: Substitute x = 0.1 into the function

H(0.1) = -3(0.1)^2 + 5

Step 3: Simplify the exponent

0.1 squared is:

- (0.1)^2 = 0.01

Step 4: Multiply by -3

-3 0.01 = -0.03

Step 5: Add the constant term

H(0.1) = -0.03 + 5

Step 6: Final calculation

H(0.1) = 4.97

Interpreting the Result: What Does H(0.1) = 4.97 Mean?

The value H(0.1) = 4.97 indicates that when x is 0.1, the output of the function H is approximately 4.97. This suggests that at x = 0.1, the parabola is close to its maximum point but slightly less than the maximum value of 5, which occurs at the vertex (x=0).

Significance in Real-Life Contexts

Such calculations are essential in various fields, including physics, engineering, and economics, where understanding the behavior of quadratic relationships helps in modeling and decision-making.

Exploring the Properties of H(x) = -3x^2 + 5

Understanding the properties of this quadratic function provides insights into its behavior, including its maximum point, symmetry, and intercepts.

Vertex of the Parabola

Since the quadratic is in the form H(x) = ax^2 + c, with b=0, the vertex can be found at:

- x = -b / (2a)

Given b=0:

- x = 0 / (2 -3) = 0

Plugging x=0 into H(x):

- H(0) = -3(0)^2 + 5 = 5

Thus, the vertex is at (0, 5), which is the maximum point of the parabola.

Axis of Symmetry

The axis of symmetry passes through the vertex:

- x = 0

Y-Intercept

At x=0:

- H(0) = 5

The y-intercept is at (0, 5).

X-Intercepts (Roots of H(x))

To find the x-intercepts, set H(x) = 0:

- 0 = -3x^2 + 5

- 3x^2 = 5

- $x^2 = 5/3$

- $x = \pm\sqrt{5/3}$

Calculating:

- $\sqrt{5/3} \approx \sqrt{1.6667} \approx 1.291$

Therefore, the x-intercepts are approximately at:

- $x \approx \pm 1.291$

Applications of Quadratic Functions like $H(x) = -3x^2 + 5$

Quadratic functions have numerous applications across different domains. Here are some common uses:

1. Physics: Projectile Motion

- Modeling the trajectory of objects under gravity.
- The parabola describes the path of a projectile.

2. Economics: Revenue and Cost Analysis

- Maximizing profit or minimizing costs.
- The parabola can represent revenue functions or cost functions.

3. Engineering: Structural Design

- Analyzing stresses and material strengths.
- Parabolas are used in designing arches and bridges.

4. Biology: Population Models

- Modeling growth rates with quadratic relationships in some cases.

Understanding the Broader Context: Why Is Calculating H(0.1) Important?

Calculating specific values such as H(0.1) helps in understanding the behavior of the function around certain points. For example:

- Sensitivity Analysis: How does a small change in x affect H(x)?
- Approximation: Estimating the function's value near critical points.
- Optimization: Finding maximum or minimum values relevant to real-world problems.

In the case of H(0.1):

- It tells us how close the function's value is to its maximum at x=0.
- It helps visualize the shape and steepness of the parabola near the vertex.

Additional Exercises for Practice

To deepen understanding, consider solving the following:

1. Find H(-0.5).
2. Determine the x-values where H(x) = 2.
3. Sketch the graph of $H(x) = -3x^2 + 5$.
4. Find the maximum value of H(x) and at which x it occurs.
5. Explore how changing the coefficients affects the shape and position of the parabola.

Conclusion: Mastering Quadratic Function Calculations

Calculating values like H(0.1) for quadratic functions such as $H(x) = -3x^2 + 5$ is fundamental for understanding their behavior. Recognizing key features like the vertex, intercepts, and symmetry enhances your ability to analyze and interpret these functions effectively. Whether in academic settings or real-world applications, mastering these calculations enables you to model, predict, and optimize scenarios involving quadratic relationships. Remember, practice with various points and functions will strengthen your skills and deepen your comprehension of quadratic functions' properties and applications.

Frequently Asked Questions

What is the value of H(0.1) for the function $H(x) = -3x^2 + 5$?

$H(0.1) = -3(0.1)^2 + 5 = -3(0.01) + 5 = -0.03 + 5 = 4.97$

How do you evaluate H(0.1) for the quadratic function H(x) =

$-3x^2 + 5$?

Substitute $x = 0.1$ into the function: $H(0.1) = -3(0.1)^2 + 5$, then compute the value to get 4.97.

What is the process to find H(0.1) when given $H(x) = -3x^2 + 5$?

Plug in 0.1 for x in the function, calculate the square of 0.1, multiply by -3, then add 5 to find the value.

Is H(0.1) closer to 5 or a lower value, and what does that indicate about the function at x=0.1?

H(0.1) is approximately 4.97, very close to 5, indicating the function's value near x=0 is just slightly less than 5.

Why is it important to evaluate H(0.1) in understanding the behavior of the function $H(x) = -3x^2 + 5$?

Evaluating H(0.1) helps us understand how the function behaves near x=0, showing how the value decreases slightly due to the negative quadratic term.

Additional Resources

Given $H(x) = -3x^2 + 5$, Find the Indicated Values: H(0.1)

When working with functions in algebra and calculus, one of the fundamental skills is evaluating the function at specific points. In this article, we will explore Given $H(x) = -3x^2 + 5$, find the indicated value: H(0.1). This problem is a classic example of function evaluation, which helps us understand how a function behaves at particular inputs. Whether you're a student brushing up on algebra or someone seeking to deepen your understanding of functions, this guide will walk you through the process step-by-step, ensuring clarity and confidence in solving similar problems.

Understanding the Function H(x)

Before diving into calculations, it's essential to understand the structure of the given function:

$H(x) = -3x^2 + 5$

This is a quadratic function where:

- The coefficient of x^2 is -3, indicating the parabola opens downward.
- The constant term is 5, which affects the vertical shift.

Key Components:

- Quadratic term ($-3x^2$): The part of the function responsible for the curvature.
- Constant term (+5): The y-intercept, or the value of H(x) when x = 0.

Understanding these helps visualize the graph and anticipate the function's behavior.

Step-by-Step Guide to Finding H(0.1)

Calculating H(0.1) involves substituting x = 0.1 into the function and simplifying. Let's break down the process:

Step 1: Write the expression

$H(0.1) = -3(0.1)^2 + 5$

Step 2: Calculate the square of 0.1

0.1 squared (0.1^2) equals 0.01.

Step 3: Multiply by -3

$-3 \times 0.01 = -0.03$

Step 4: Add 5

$-0.03 + 5 = 4.97$

Final Result:

$H(0.1) = 4.97$

This is the value of the function at the input x = 0.1.

Additional Insights and Variations

While evaluating H(0.1) is straightforward, understanding how to handle different types of inputs or related problems can be beneficial.

1. Evaluating for Negative Inputs

Suppose you need to find H(-0.2):

- Square the input: $(-0.2)^2 = 0.04$
- Multiply by -3: $-3 \times 0.04 = -0.12$
- Add 5: $-0.12 + 5 = 4.88$

2. Evaluating for Larger Inputs

For $x = 2$:

- $2^2 = 4$
- $-3 \times 4 = -12$
- $-12 + 5 = -7$

Note that as x increases in magnitude, the quadratic term dominates, affecting the overall value significantly.

Visualizing the Function

Understanding the behavior of $H(x)$ can be enhanced by visualizing its graph:

- The parabola opens downward because of the negative coefficient.
- The vertex can be found using the vertex formula for quadratics:

$x_{vertex} = -b / 2a$

For $H(x) = -3x^2 + 5$, $a = -3$, $b = 0$:

$x_{vertex} = -0 / (2 \times -3) = 0$

- The y-coordinate of the vertex:

$H(0) = -3(0)^2 + 5 = 5$

- So, the vertex is at (0, 5), which is also the maximum point.

This visualization helps predict the function's value at nearby points, including $x = 0.1$.

Common Mistakes to Avoid

When evaluating functions, especially quadratic ones, be mindful of:
- Order of operations: Always exponentiate before multiplying.
- Sign errors: Remember that the coefficient is negative; negative times positive yields negative.
- Precision: Use correct decimal placement and avoid rounding until the final step for accuracy.

Practice Problems

To reinforce understanding, try solving these:

1. Find H(0.5).

2. Calculate H(-0.1).

3. Determine the value of H(1).

4. Find the value of H(2.5).

Summary

In this guide, we've dissected the process of evaluating the function $H(x) = -3x^2 + 5$ at a specific point, $x = 0.1$. By substituting the value into the function, simplifying step-by-step, and understanding the components of the quadratic, you can confidently find function values at various points. Mastery of such evaluations is foundational for exploring more advanced topics in mathematics, including derivatives, integrals, and graph analysis.

Remember, practice makes perfect. By working through similar problems and visualizing the functions, you'll develop a more intuitive understanding of how functions behave and how to evaluate them accurately.

Happy math solving!

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