F(x)=-x^2+3 Find F(-2)

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Understanding how to evaluate functions at specific points is a fundamental skill in algebra and mathematics overall. One common type of function is quadratic functions, which have the general form $F(x) = ax^2 + bx + c$. In this article, we will explore how to evaluate the quadratic function $F(x) = -x^2 + 3$ at a particular point, specifically at $x = -2$. This step-by-step approach will help you grasp the process of substituting values into functions and understanding their behavior.

What Is a Quadratic Function?

Definition of a Quadratic Function

A quadratic function is a polynomial function of degree 2, meaning the highest power of the variable x is 2. Its general form is:

$$
F(x) = ax^2 + bx + c
$$

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

In our specific case, the function is:

$$
F(x) = -x^2 + 3
$$

which is a quadratic function with $a = -1$, $b = 0$, and $c = 3$.

Graph of a Quadratic Function

- The graph of a quadratic function is a parabola.
- If $a > 0$, the parabola opens upward.
- If $a < 0$, the parabola opens downward.
- The vertex of the parabola gives the maximum or minimum point.

In the case of $F(x) = -x^2 + 3$, since $a = -1$, the parabola opens downward, and the vertex is at the highest point of the graph.

Evaluating the Function at a Specific Point

Understanding Function Evaluation

To find $F(-2)$, you substitute $x = -2$ into the function:

$$
F(-2) = -(-2)^2 + 3
$$

The process involves:
- Replacing the variable x with the given value.
- Calculating the resulting algebraic expression.

Step-by-Step Calculation of $F(-2)$

1. Substitute $x = -2$ into the function:

$$
F(-2) = -(-2)^2 + 3
$$

2. Calculate the square:

$$
(-2)^2 = 4
$$

3. Apply the negative sign:

$$
-4
$$

4. Add 3:

$$
-4 + 3 = -1
$$

Therefore,

$$
F(-2) = -1
$$

\]

Interpreting the Result

What Does \(F(-2) = -1 \) Mean?

This value indicates that when \(x = -2 \), the output of the function \(F(x) = -x^2 + 3 \) is \(-1 \). Graphically, this corresponds to the point \((-2, -1)\) on the parabola.

Implications of the Value

- Since the parabola opens downward (because \(a = -1 \)), the maximum value of the function occurs at the vertex.
- The value at \(x = -2 \) is below the maximum point, which occurs at the vertex.
- Understanding the value at specific points helps in graphing the function accurately.

How to Find the Vertex of \(F(x) = -x^2 + 3 \)

Vertex Formula for a Quadratic Function

The vertex of a quadratic function \(y = ax^2 + bx + c \) occurs at:

\[
x = -\frac{b}{2a}
\]

In our case:
- \(a = -1 \),
- \(b = 0 \),
- \(c = 3 \).

Applying the formula:

\[
x_{vertex} = -\frac{0}{2 \times -1} = 0
\]

The \(x \)-coordinate of the vertex is 0.

Finding the y-coordinate of the Vertex

Substitute $x = 0$ into the original function:

$$
F(0) = - (0)^2 + 3 = 0 + 3 = 3
$$

The vertex is at $(0, 3)$, which is the maximum point for this parabola.

Summary of the Vertex:

- Coordinates: $(0, 3)$
- Maximum Value: 3

Graphing the Function $F(x) = -x^2 + 3$

Key Features to Plot

- Vertex: $(0, 3)$
- Y-intercept: When $x = 0$, $F(0) = 3$
- X-intercepts: Find where $F(x) = 0$

Finding the X-Intercepts

Set $F(x) = 0$:

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

Solve for x:

$$
x^2 = 3
$$

$$
x = \pm \sqrt{3}
$$

So, the parabola crosses the x-axis at $x = \pm \sqrt{3}$ (approximately ± 1.732).

Plotting the Points

- Vertex at $(0, 3)$
- X-intercepts at $(\sqrt{3}, 0)$ and $(-\sqrt{3}, 0)$
- Y-intercept at $(0, 3)$

The graph opens downward, with the maximum at the vertex, and crosses the x-axis at the points above.

Real-World Applications of Quadratic Functions

Projectile Motion

Quadratic functions model the trajectory of objects in projectile motion, where the height over time follows a parabola.

Maximum or Minimum Problems

- Business: profit maximization.
- Engineering: structural analysis.

Design and Engineering

Quadratic functions help in designing parabolic arches and reflectors.

Conclusion: How to Find $F(-2)$ in Practice

Summary of Steps

1. Identify the function: $F(x) = -x^2 + 3$.
2. Substitute the given value: $x = -2$.
3. Calculate the powers and simplify:

$$
F(-2) = -(-2)^2 + 3 = -4 + 3 = -1
$$

4. Interpret the result: The output is -1, corresponding to the point $(-2, -1)$ on the graph.

Why This Is Important

Evaluating functions at specific points is essential in understanding their graphs, analyzing their behavior, and applying them to real-world problems.

In summary, finding \(F(-2) \) for the quadratic function \(F(x) = -x^2 + 3 \) involves straightforward substitution and calculation. This process helps you visualize the function's behavior, locate key features like the vertex and intercepts, and apply quadratic functions in various mathematical and real-life contexts. Mastering these steps enhances your algebra skills and deepens your understanding of quadratic functions' significance.

Frequently Asked Questions

What is the given function in the problem?

The given function is F(x) = -x^2 + 3.

How do you find F(-2) for the function F(x) = -x^2 + 3?

To find F(-2), substitute x = -2 into the function: F(-2) = -(-2)^2 + 3.

What is the value of (-2)^2?

The value of (-2)^2 is 4.

What is the next step after calculating (-2)^2?

Next, substitute that value into the function: F(-2) = -4 + 3.

What is the result of -4 + 3?

The result is -1.

What is the final answer for F(-2)?

F(-2) = -1.

Why is it important to substitute the value correctly into the function?

Substituting correctly ensures an accurate calculation of the function's value at a specific point.

Can this method be used to find F(x) for any other value of x?

Yes, you can substitute any value of x into the function to find F(x) for that value.

Additional Resources

F(x) = $-x^2 + 3$ Find F(-2): An In-Depth Investigation

In the realm of mathematics, functions serve as fundamental tools for representing relationships between variables. Among the myriad of functions studied, quadratic functions hold a special place due to their unique properties and widespread applications. Today, we delve into a specific quadratic function, $F(x) = -x^2 + 3$, and explore the process of evaluating it at a particular point, namely F(-2). Beyond a simple calculation, this investigation unveils the underlying structure, characteristics, and significance of this function, offering insights valuable to students, educators, and enthusiasts alike.

Understanding the Function $F(x) = -x^2 + 3$

Before computing F(-2), it is essential to understand the nature of the function itself. The given function is quadratic, characterized by the general form:

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

In our case:

- a = -1
- b = 0
- c = 3

This particular quadratic function exhibits several key features:

Parabola Orientation

Because the coefficient a = -1 is negative, the parabola opens downward. This means the graph reaches a maximum point (vertex) at its highest value.

Vertex of the Parabola

The vertex of a quadratic function $ax^2 + bx + c$ is located at:

- $x = -b / (2a)$

Since b = 0:

- x = 0 / (2 -1) = 0

The vertex's x-coordinate is at 0, and the y-coordinate (the maximum value) is:

- F(0) = - (0)^2 + 3 = 3

Thus, the parabola peaks at the point (0, 3).

Axis of Symmetry

The axis of symmetry is the vertical line passing through the vertex:

- x = 0

This symmetry indicates that for any value of x, the function's value at x and -x are related.

Y-Intercept

The y-intercept occurs when x = 0:

- F(0) = 3

This confirms the vertex and the y-intercept coincide at the same point.

Calculating F(-2): Step-by-Step Analysis

Having established the function's attributes, we now focus on evaluating F(-2).

Step 1: Substitute x = -2 into the function

The function is:

- F(x) = -x^2 + 3

Plugging in x = -2:

- F(-2) = -(-2)^2 + 3

Step 2: Simplify the expression

Calculate (-2)^2:

- (-2)^2 = 4

Now, substitute:

- F(-2) = -4 + 3

Step 3: Final calculation

Perform the addition:

- $F(-2) = -4 + 3 = -1$

Therefore, the value of the function at $x = -2$ is -1.

Interpreting the Result: Significance and Implications

While the calculation appears straightforward, understanding its significance within the context of the function's graph and properties enriches our comprehension.

Symmetry of the Function

Given the function's symmetry about the y-axis (since $b = 0$), the values at x and $-x$ are related. Specifically:

- $F(-x) = -(-x)^2 + 3 = -x^2 + 3 = F(x)$

This confirms that $F(-2) = F(2)$.

Calculating $F(2)$:

- $F(2) = -(2)^2 + 3 = -4 + 3 = -1$

Matching the value at $x = 2$, which emphasizes the symmetry.

Visual Representation

Plotting the function:

- The parabola peaks at (0, 3).
- It intersects the y-axis at 3.
- At $x = 2$ and $x = -2$, the function dips to -1.
- This symmetric behavior illustrates the classic "upside-down" parabola centered at the vertex.

Real-World Contexts

Quadratic functions like $F(x) = -x^2 + 3$ often model phenomena such as projectile motion, where the maximum height is at the vertex, and the symmetry reflects equal ascent and descent times.

In this case:

- The maximum height is 3 units at x = 0.
- At a horizontal distance of 2 units from the vertex, the "height" is -1 units.

Broader Mathematical Insights and Applications

Evaluating F(-2) provides a stepping stone into understanding quadratic relationships, their graphs, and real-world applications.

1. Symmetry and Function Behavior

The symmetry about the y-axis simplifies analysis, allowing predictions about the function's behavior at negative and positive inputs without recomputing.

2. Range and Domain

- Domain: All real numbers, (-∞, ∞)
- Range: Since the parabola opens downward with maximum value 3, the range is (-∞, 3]

3. Vertex and Maximum Value

As identified, the vertex at (0, 3) signifies the maximum point. At x = -2, the value is -1, well below the maximum.

4. Applications in Physics and Engineering

Understanding the function's shape aids in modeling physical systems where maximum or minimum points are critical, such as:

- Projectile trajectories
- Optimization problems
- Signal processing

Conclusion: The Significance of F(-2) in Mathematical Analysis

The evaluation of F(-2) in the function F(x) = -x^2 + 3 exemplifies the elegance and utility of quadratic functions. Through a systematic approach—substituting values, simplifying, and interpreting results—we gain insights into the function's symmetry, maximum point, and real-world relevance.

In this case, the calculation reveals that F(-2) = -1, a value symmetrically mirrored at F(2), reinforcing the concept of symmetry inherent in even functions. This simple computation opens pathways to broader understanding, emphasizing the importance of foundational mathematical principles in analyzing and applying quadratic functions across diverse fields.

Whether used as a pedagogical example or as a building block in more complex models, grasping how to evaluate and interpret such functions remains a cornerstone of mathematical literacy and analytical prowess.

F X X 2 3 Find F 2

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