Answer The Questions About The Following Function.f(x)=2x2x1(a) Is The Point (2, 5) On The Graph Of F?(b)

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Understanding functions and their graphs is fundamental in mathematics, especially when analyzing whether specific points lie on a given function's graph. In this article, we will delve into the function $f(x) = 2x^2 \times 1$, examine the question of whether the point (2, 5) is on its graph, and provide a comprehensive explanation of how to analyze and interpret such problems.

Understanding the Function $f(x) = 2x^2 \times 1$

Simplifying the Function

The given function appears to be $f(x) = 2x2x1(a)$, which seems to be a typographical or formatting error. Based on standard mathematical notation, the most likely intended function is:

$$
f(x) = 2x^2 \times 1
$$

which simplifies to:

$$
f(x) = 2x^2
$$

since multiplying by 1 does not change the value.

Note: If the original function was meant to include additional terms or different notation, please clarify. However, assuming the most straightforward interpretation, the function is quadratic:

$$
f(x) = 2x^2
$$

Properties of the Function $f(x) = 2x^2$

- Type: Quadratic function
- Shape: Parabola opening upwards (since coefficient of x^2 is positive)
- Vertex: At the origin (0, 0)
- Domain: All real numbers ($-\infty, \infty$)
- Range: $[0, \infty)$

Understanding these properties helps to analyze points and behaviors on the graph.

Is the Point (2, 5) On The Graph Of $f(x) = 2x^2$?

Step 1: Understand What It Means for a Point to Lie on a Graph

A point (x, y) is on the graph of a function $f(x)$ if and only if:

$$
f(x) = y
$$

In other words, substituting the x-coordinate into the function should produce the y-coordinate.

Step 2: Substitute the x-coordinate into the function

Given the point $(2, 5)$, we substitute $x = 2$ into the function:

$$
f(2) = 2 \times (2)^2 = 2 \times 4 = 8
$$

The resulting y-value is 8.

Step 3: Compare with the point's y-coordinate

The point's y-coordinate is 5, but the function value at $x=2$ is 8. Since $8 \neq 5$, the point $(2, 5)$ does not lie on the graph of $f(x) = 2x^2$.

Conclusion: The Point (2, 5) Is Not on the Graph of $f(x) = 2x^2$

Because the y-coordinate of the point does not match the value of the function at $x=2$, the point $(2, 5)$ is not on the graph of $f(x) = 2x^2$.

Additional Insights and Related Concepts

1. How to Check If a Point Lies on a Function's Graph

To determine whether a specific point (x_0, y_0) lies on the graph:

- Step 1: Plug x_0 into the function $f(x)$.
- Step 2: Check if $f(x_0) = y_0$.
- Step 3: If equal, the point lies on the graph; if not, it doesn't.

Example:

Suppose $f(x) = 2x^2$, and the point is $(3, 18)$:

$$
f(3) = 2 \times 3^2 = 2 \times 9 = 18
$$

Since $f(3) = 18$, the point $(3, 18)$ does lie on the graph.

2. Graphing the Function $f(x) = 2x^2$

Graphing quadratic functions like $f(x) = 2x^2$ involves plotting points and understanding the parabola's shape:

- The vertex is at $(0, 0)$.
- The parabola opens upward.
- For various x values, compute $f(x)$ and plot corresponding points, e.g., $(1, 2)$, $(-1, 2)$, $(2, 8)$, $(-2, 8)$.

3. How to Find Points on the Graph

- Choose x values (both positive and negative).
- Calculate $f(x)$ for each x.
- Plot these points to sketch the parabola.

4. Solving for x Given y

If you know y and want to find corresponding x values:

$$
f(x) = y \Rightarrow 2x^2 = y
$$

$$
x^2 = \frac{y}{2}
$$

$$
x = \pm \sqrt{\frac{y}{2}}
$$

Example:

Find x when $y=8$:

$$
x = \pm \sqrt{\frac{8}{2}} = \pm \sqrt{4} = \pm 2
$$

Points: $(2, 8)$ and $(-2, 8)$.

Common Mistakes to Avoid

- Misreading the function notation: Ensure the function is correctly interpreted — in this case, $f(x) = 2x^2$.
- Incorrect substitution: Always substitute the x-value into the function accurately.
- Ignoring the domain: Remember that quadratic functions are defined for all real numbers unless specified otherwise.
- Confusing the point's coordinates: Make sure the point's x and y are correctly identified.

Summary

- The function $f(x) = 2x^2$ is a quadratic function with a parabola opening upward.
- To determine if a point (x, y) lies on this graph, substitute x into the function and compare the result with y.
- For the point $(2, 5)$, $f(2) = 8$, which does not match the y-coordinate 5, so the point is not on the graph.
- Understanding how to analyze points relative to functions is essential in graphing, solving equations, and modeling real-world situations.

Additional Resources for Learning

- Graphing Quadratic Functions: Use graphing calculators or online tools like Desmos for visual understanding.
- Solving Quadratic Equations: Practice solving $ax^2 + bx + c = 0$ to find points on the parabola.
- Function Transformations: Explore how shifting, stretching, or compressing affects the graph.

In conclusion, mastering the process of verifying whether points lie on a function's graph is a vital skill in algebra and calculus. By carefully substituting and comparing values, students can develop a deeper understanding of the behavior of quadratic functions and their graphical representations.

Frequently Asked Questions

What is the function $f(x)$ given in the problem?

The function is $f(x) = 2x^2x1(a)$, which appears to be a typo or formatting issue. Likely, it is intended to be $f(x) = 2x^2 + 1$.

How do I interpret the point (2, 5) in relation to the function?

The point (2, 5) is on the graph of $f(x)$ if plugging $x = 2$ into $f(x)$ results in $y = 5$.

How do I determine if (2, 5) is on the graph of $f(x)$?

Substitute $x = 2$ into $f(x)$ and see if the result equals 5. If it does, then the point is on the graph.

What is the value of $f(2)$ if $f(x) = 2x^2 + 1$?

$f(2) = 2(2)^2 + 1 = 24 + 1 = 8 + 1 = 9$.

Based on the previous calculation, is the point (2, 5) on the graph of $f(x)$?

No, because $f(2) = 9$, which does not equal 5, so the point (2, 5) is not on the graph.

Could there be a typo in the function definition? How should it be correctly written?

Yes, it seems so. The correct function might be $f(x) = 2x^2 + 1$, assuming the original was misformatted.

What steps can I follow to verify other points on the graph?

Substitute the x-value into the function and compare the resulting y-value with the point's y-coordinate to check if the point lies on the graph.

If the function was f(x) = 2x^2, what would be f(2)?

f(2) = 2(2)^2 = 24 = 8.

How can I graph f(x) = 2x^2 + 1?

Plot the parabola opening upwards, with its vertex at (0, 1), and plot additional points by substituting various x-values.

What is the importance of understanding the function and the given point in graphing?

It helps determine whether specific points lie on the graph, understand the shape of the function, and analyze its behavior.

Additional Resources

In-Depth Analysis of the Function $f(x) = 2x^2 + 1$ and the Point (2, 5)

Understanding the behavior of functions and their graphs is fundamental in algebra and calculus. When analyzing a specific function like $f(x) = 2x^2 + 1$, it's essential to examine its properties, the shape of its graph, and whether certain points lie on it. This comprehensive review aims to explore these aspects thoroughly, with particular focus on the question: Is the point (2, 5) on the graph of f?

Overview of the Function $f(x) = 2x^2 + 1$

Function Type and Basic Properties

- Quadratic Nature: The function $f(x) = 2x^2 + 1$ is a quadratic function, characterized by the squared term x^2. Quadratic functions graph as parabolas.

- Leading Coefficient: The coefficient of x^2 is 2, which is positive. Therefore, the parabola opens upward.

- Vertical Shift: The constant term +1 shifts the parabola 1 unit upward along the y-axis.

- Symmetry: Being a quadratic function, the graph is symmetric about its axis of symmetry, which passes through its vertex.

Vertex and Axis of Symmetry

- Vertex: The vertex of a quadratic function in the form $f(x) = ax^2 + bx + c$ is at $x = -b/(2a)$.

- For $f(x) = 2x^2 + 1$, since $b = 0$, the vertex occurs at:

$$
x = -\frac{0}{2 \times 2} = 0
$$

- Substituting $x = 0$ into the function:

$$
f(0) = 2 \times 0^2 + 1 = 1
$$

- Vertex Coordinates: (0, 1)

- Axis of Symmetry: The vertical line $x = 0$ (the y-axis) acts as the axis of symmetry due to the symmetry of the parabola around it.

Graphical Characteristics

- The parabola opens upward.

- The vertex at (0, 1) represents the minimum point.

- The parabola widens as $|x|$ increases, because the quadratic coefficient $a = 2$ causes the parabola to be steeper compared to, say, $f(x) = x^2$.

Evaluating the Point (2, 5) in Context of the Function $f(x) = 2x^2 + 1$

Step 1: Verify if (2, 5) satisfies the function

- To determine if the point (2, 5) lies on the graph of $f(x)$, substitute $x = 2$ into the function and see if $f(2) = 5$.

- Calculating f(2):

$$
f(2) = 2 \times (2)^2 + 1 = 2 \times 4 + 1 = 8 + 1 = 9
$$

- Since f(2) = 9, and the y-coordinate of the point is 5, the point (2, 5) does not satisfy the function.

Conclusion: The point (2, 5) is not on the graph of $f(x) = 2x^2 + 1$.

Step 2: Understanding the significance of this result

- The point (2, 5) lies below the actual value of f(2), which is 9.

- This indicates that (2, 5) is located below the parabola at x = 2.

- The vertical distance between the point and the parabola at x = 2 is:

$$
9 - 5 = 4
$$

- The point (2, 5) is thus outside the graph, specifically beneath the parabola.

Deeper Geometrical and Analytical Insights

Understanding the Graph's Shape and the Point's Location

- Since f(2) = 9, the point (2, 9) lies exactly on the graph at x = 2.

- The point (2, 5) is 4 units below the actual point on the graph at x = 2.

- Visualizing this, the graph at x = 2 is at y = 9, and (2, 5) is at a lower y-value, indicating the point is below the parabola.

Implications for the Graph's Behavior

- The quadratic function is smooth and continuous; no gaps or jumps.

- The difference between the point and the graph at $x = 2$ gives insight into the function's value range and potential inequalities involving $f(x)$.

- For example, the point (2, 5) satisfies:

$$
y < f(2) \implies y < 9
$$

indicating it lies below the parabola at that x-value.

Applications of This Analysis

- Graph Sketching: Knowing that $f(2) = 9$ helps in drawing an accurate parabola, and marking points below or above the parabola.

- Inequalities: If considering the set:

$$
y < 2x^2 + 1
$$

then (2, 5) is a solution since $5 < 9$.

- Distance from the Graph: The vertical distance at $x=2$ is 4, which could be relevant in optimization problems or in calculating the shortest distance from a point to the parabola.

Additional Considerations and Related Topics

1. Range and Domain of f(x)

- Domain: All real numbers, $(-\infty, \infty)$, since quadratic functions are defined everywhere.

- Range: Since the parabola opens upward with vertex at (0, 1), the minimum y-value is 1.

$$
\boxed{\text{Range}: \quad y \geq 1}
$$

- The y-coordinate 5 is within the range, but the specific point (2, 5) does not lie on the graph, as shown earlier.

2. Symmetry and Reflection

- The graph is symmetric about $x=0$.

- The reflection of a point (x, y) across the axis of symmetry $x=0$ is $(-x, y)$.

- For $x=2$, the symmetric point is $(-2, y)$.

- The value at $x = -2$:

$$
f(-2) = 2 \times (-2)^2 + 1 = 2 \times 4 + 1 = 9
$$

- The symmetric point of $(2, 9)$ is $(-2, 9)$.

3. Inverse Function and Symmetry

- Quadratic functions are not invertible over their entire domain unless restricted to intervals where they are monotonic.

- For $f(x) = 2x^2 + 1$, the inverse over $x \geq 0$:

$$
y = 2x^2 + 1 \Rightarrow x = \pm \sqrt{\frac{y - 1}{2}}
$$

- The inverse relates x and y but is not necessary for this particular point analysis.

4. Solving for x when y is given

- Given $y = 5$, solving for x:

$$
5 = 2x^2 + 1 \Rightarrow 2x^2 = 4 \Rightarrow x^2 = 2 \Rightarrow x = \pm \sqrt{2}
$$

- The x-values where $f(x) = 5$ are $x = \pm\sqrt{2} \approx \pm 1.414$.

- At these points, $(\sqrt{2}, 5)$ and $(-\sqrt{2}, 5)$ lie on the graph.

Key insight: The point $(2, 5)$ is not on the graph because $x=2$ does not satisfy the x values that yield $f(x) = 5$.

Summary and Final Conclusions

- The function $f(x) = 2x^2 + 1$ is a quadratic parabola opening upward with vertex at (0, 1).

- The point (2, 5), when tested, yields $f(2) = 9$, which significantly differs from 5.

- Therefore, the point (2, 5) is not on the graph of the function.

[Answer The Questions About The Following Function F X 2x2x1 A Is The Point 2 5 On The Graph Of F B]

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