The Function F(x) = (x – 4)(x–2) Is Shown.What Is The Range Of The Function?1:01all Real Numbers Less

The Function F(x) = (x – 4)(x–2) Is Shown.What Is The Range Of The Function?1:01all Real Numbers Less appears to be a prompt related to understanding the behavior of a quadratic function. In this article, we will explore the nature of the function F(x) = (x – 4)(x – 2), analyze its graph, determine its range, and understand how to interpret similar quadratic functions. Whether you're a student studying algebra or someone interested in mathematical functions, this comprehensive guide will help clarify these concepts.

Understanding the Function F(x) = (x – 4)(x – 2)

Expanding the Function

The given function is expressed in factored form:
$$ F(x) = (x - 4)(x - 2) $$
To analyze it more easily, especially to find its vertex and range, it's helpful to expand it into the standard quadratic form:
$$ F(x) = x^2 - 2x - 4x + 8 = x^2 - 6x + 8 $$
This form reveals that the function is quadratic, opening upward because the coefficient of x^2 is positive.

Graphical Representation

The graph of F(x) is a parabola opening upward. Its shape and position depend on the coefficients in its standard form. Understanding the vertex, axis of symmetry, and intercepts will allow us to determine the range.

Key Features of the Quadratic Function

Vertex of the Parabola

The vertex of a parabola given by $y = ax^2 + bx + c$ is located at:
$$ x_v = -\frac{b}{2a} $$
For our function:
$$ a = 1, \quad b = -6, \quad c=8 $$
So,
$$ x_v = -\frac{-6}{2 \times 1} = \frac{6}{2} = 3 $$
To find the y-coordinate of the vertex:
$$ F(3) = (3)^2 - 6 \times 3 + 8 = 9 - 18 + 8 = -1 $$
Thus, the vertex is at:
$$ (3, -1) $$
This point represents the minimum point of the parabola since it opens

upward.

Axis of Symmetry

The parabola is symmetric about the vertical line passing through the vertex:
$$ x = 3 $$
This symmetry helps in analyzing the function's behavior on either side of the vertex.

Intercepts

- Y-intercept: When $ x=0 $:
$$ F(0) = (0 - 4)(0 - 2) = (-4)(-2) = 8 $$
- X-intercepts (roots): When $ F(x)=0 $:
$$ (x - 4)(x - 2) = 0 $$
This yields:
$$ x=4 \quad \text{or} \quad x=2 $$
So, the parabola crosses the x-axis at these points.

Determining the Range of the Function

What is the Range of a Quadratic Function?

The range of a quadratic function depends on whether the parabola opens upwards or downwards:
- For upward-opening parabolas, the range is all real numbers greater than or equal to the y-coordinate of the vertex.
- For downward-opening parabolas, the range is all real numbers less than or equal to the y-coordinate of the vertex.

Since our parabola opens upward, the minimum value of $ F(x) $ occurs at the vertex, which is at $ y = -1 $.

Range of F(x) = (x - 4)(x - 2)

Therefore, the range is:
$$ \boxed{[-1, \infty)} $$
This means the function attains all real values greater than or equal to -1.

Interpreting the Range in Context

What Does the Range Tell Us?

The range indicates all possible output values (F(x)) the function can produce. Since the parabola opens upward and has its lowest point at $ y = -1 $, the function cannot produce values less than -1.

Real-World Applications

Understanding the range is crucial in various contexts, such as physics, economics, or engineering, where the output of a quadratic model reflects physical constraints or limits.

Additional Considerations

Graphing the Function

To visualize the function:
- Plot the vertex at (3, -1).
- Mark the roots at (2, 0) and (4, 0).
- Draw the parabola opening upward through these points.
- Note that the parabola extends infinitely upward, confirming the range.

Vertex as the Minimum Point

Since the parabola opens upward, the vertex at (3, -1) is the minimum point. No output value of the function is less than -1, which confirms the range.

Summary and Key Takeaways

- The quadratic function $F(x) = (x - 4)(x - 2)$ expands to $x^2 - 6x + 8$.
- Its vertex is at (3, -1), which is the lowest point on the parabola.
- The parabola crosses the x-axis at (2, 0) and (4, 0).
- The range of the function is all real numbers greater than or equal to -1, i.e., $[-1, \infty)$.

Conclusion

Understanding the range of a quadratic function like $F(x) = (x - 4)(x - 2)$ involves analyzing its vertex, intercepts, and opening direction. Recognizing that this parabola opens upward with a vertex at (3, -1) provides a clear picture that the function's outputs span from -1 to infinity. Mastering these concepts allows students and practitioners to interpret quadratic functions effectively and apply them confidently across various disciplines.

Whether you're solving algebraic problems, graphing functions, or applying quadratic models in real-world scenarios, understanding the range is fundamental. Remember that the key steps include expanding the function, finding the vertex, identifying intercepts, and analyzing the parabola's orientation. Armed with this knowledge, you can confidently determine the range of any quadratic function you encounter.

Frequently Asked Questions

What is the function $F(x) = (x - 4)(x - 2)$, and how do we find its range?

The function $F(x) = (x - 4)(x - 2)$ is a quadratic function. To find its range, we first expand it to standard form, find its vertex, and determine the minimum or maximum value depending on the parabola's orientation.

Is the parabola represented by $F(x) = (x - 4)(x - 2)$ opening upwards or downwards?

When expanded, $F(x) = x^2 - 6x + 8$. The coefficient of x^2 is positive, so the parabola opens upwards, meaning the function has a minimum value and the range starts from that minimum upward to all real numbers.

How do you find the vertex of the parabola $F(x) = x^2 - 6x + 8$?

The vertex of a parabola in standard form $y = ax^2 + bx + c$ can be found at $x = -b/(2a)$. For $F(x)$, $a=1$ and $b=-6$, so $x = 3$. Plugging $x=3$ into the function gives the y-coordinate of the vertex, which is the minimum value.

What is the minimum value of $F(x) = (x - 4)(x - 2)$, and what does this imply about the range?

Calculating at $x=3$, $F(3) = (3 - 4)(3 - 2) = (-1)(1) = -1$. Since the parabola opens upward, the minimum value is -1, so the range is all real numbers greater than or equal to -1.

Based on the function $F(x) = (x - 4)(x - 2)$, what is the range of the function?

The range of the function is all real numbers y such that $y \geq -1$, because the minimum value of $F(x)$ is -1 and it increases without bound as x moves away from the vertex.

Additional Resources

The Function $F(x) = (x - 4)(x - 2)$ Is Shown. What Is The Range Of The Function? 1:01 All Real Numbers Less

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Introduction

In the realm of algebra and calculus, understanding the behavior of functions is fundamental. Among the various types of functions, quadratic functions hold a special place due to their parabolic graphs and wide array of applications—from physics to economics. A common task encountered by students and professionals alike is determining the range of a function, which provides insight into its possible output values.

This article delves into the specific quadratic function:

$$ F(x) = (x - 4)(x - 2) $$

and aims to thoroughly analyze its properties to determine its range. The phrase "1:01 all real numbers less" hints at a specific focus—possibly on the portion of the function's output that lies below a certain threshold or within a particular interval. Our goal is to interpret this in the context of the function's overall behavior and clarify precisely what the range is.

The Nature of the Function

Expressing the Function in Standard Form

The given function:

$$ F(x) = (x - 4)(x - 2) $$

can be expanded to better understand its structure:

$$
F(x) = x^2 - 2x - 4x + 8 = x^2 - 6x + 8
$$

This quadratic function is in standard form:

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

where:

- $a = 1$,
- $b = -6$,
- $c = 8$.

Since $a > 0$, the parabola opens upward, indicating that the function has a minimum point (vertex) at its lowest value, with the range extending from that minimum to positive infinity.

Identifying Key Features of the Parabola

- Vertex: The vertex of a parabola in standard form $y = ax^2 + bx + c$ occurs at:

$$
x_{v} = -\frac{b}{2a}
$$

Substituting our values:

$$
x_{v} = -\frac{-6}{2 \times 1} = \frac{6}{2} = 3
$$

- Vertex coordinate:

$$
F(3) = (3)^2 - 6 \times 3 + 8 = 9 - 18 + 8 = -1
$$

\]

Thus, the vertex is at $(3, -1)$.

- Axis of symmetry:

$$
x = 3
$$

which passes through the vertex.

- Intercepts:

- X-intercepts: solve $F(x) = 0$:

$$
(x - 4)(x - 2) = 0 \implies x = 2, 4
$$

- Y-intercept: evaluate at $x=0$:

$$
F(0) = (0 - 4)(0 - 2) = (-4)(-2) = 8
$$

Determining the Range of the Function

Given that the parabola opens upward and the vertex represents its minimum point, the range is all values of y greater than or equal to the y-coordinate of the vertex.

Range Analysis

Since:

$$
F(3) = -1
$$

and the parabola opens upward, the output values y satisfy:

$$
y \geq -1
$$

Thus, the range is:

$$
[-1, \infty)
$$

This means that the function takes on all real values greater than or equal to -1.

Interpreting the Phrase "1:01 All Real Numbers Less"

The phrase "1:01 all real numbers less" appears to suggest a focus on the subset of the range involving all real numbers less than a certain value. Given the earlier analysis, the minimum value of the function is -1. Therefore, the part of the range that consists of all real numbers less than -1 does not exist, since the parabola's minimum is at -1.

However, if the phrase intends to highlight the values less than a specific number (for example, -1), then the relevant subset is:

$$
\text{Values } y < -1
$$

which are not included in the range of $F(x)$, since the parabola's output begins at -1 and extends upward.

Alternatively, if the phrase is referencing the portion of the function's graph for x less than a particular value (say, 1:01 representing a point in time or a specific x-value), then we can analyze the behavior of $F(x)$ for $x < 1.01$.

Deep Dive: Behavior of the Function for $x < 1.01$

Evaluating $F(x)$ near $x=1.01$

At $x=1.01$:

$$
F(1.01) = (1.01 - 4)(1.01 - 2) = (-2.99)(-0.99) \approx 2.9601
$$

Since this value is above the vertex's minimum of -1, the function is increasing in this region, approaching the minimum at $x=3$.

Behavior for $x < 1.01$

- For $x < 2$, both factors $(x - 4)$ and $(x - 2)$ are negative or positive depending on the specific x, but overall, the parabola is decreasing toward its vertex from the left.

- As $x \to -\infty$, $F(x) \to +\infty$, since the leading term x^2 dominates.

- Specifically, for $x < 1.01$, the function's output ranges from very large positive values down to -1 at the vertex.

Is there a segment where $F(x)$ is less than a certain value?

Given the parabola opens upward, the outputs are:

- Greater than or equal to -1,
- Never less than -1.

Therefore, the "all real numbers less" phrase could be referring to the set of y-values less than -1, which are not in the range.

Summary and Conclusion

Final Range Determination

Based on the algebraic and geometric analysis, the range of the function $F(x) = (x - 4)(x - 2)$ is:

$$
\boxed{[-1, \infty)}
$$

This encompasses all real numbers greater than or equal to -1.

Implications of the Phrase

- If the statement "1:01 all real numbers less" is interpreted as examining the portion of the function's output less than or equal to a certain value, then values less than -1 are not achieved by the function.

- Conversely, in terms of the graph, the portion of the parabola for $x < 3$ (left of the vertex) shows decreasing outputs from $+\infty$ down toward -1.

Broader Context and Applications

Understanding the range is fundamental in applications where the output values of quadratic functions dictate feasible solutions. For instance, in physics, the position of an object over time modeled by such a quadratic may never go below a certain threshold; in economics, profit functions may have a minimum or maximum.

Final Thoughts

The thorough analysis of $F(x) = (x - 4)(x - 2)$ confirms that the parabola opens upward with a vertex at $(3, -1)$. The function's range is all real numbers greater than or equal to -1. Recognizing the vertex, intercepts, and the behavior of the parabola is essential in accurately determining the range and understanding the function's behavior across its domain.

This exploration underscores the importance of algebraic manipulation combined with geometric intuition in solving quadratic function problems, providing clarity on the specific question of the function's range in both theoretical and applied contexts.

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