Which Of The Following Functions Best Describes This Graph?A. Y = X2-8x +15B. Y = X2 -5x+6C. Y = (x+3)(x+5)D.

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Understanding the relationship between algebraic functions and their graphs is a fundamental skill in mathematics. Many students encounter problems where they are presented with a graph and asked to determine which among several function options best describes its shape and key features. This process involves analyzing the graph's key characteristics—such as intercepts, vertex, symmetry, and shape—and matching these features to the algebraic forms provided. In this article, we will explore how to identify the correct function that corresponds to a given graph by examining the options:

- A. $y = x^2 - 8x + 15$
- B. $y = x^2 - 5x + 6$
- C. $y = (x + 3)(x + 5)$
- D. (unspecified in the prompt, but likely similar quadratic forms)

While the original prompt presents an incomplete description of the options, we'll assume all options are quadratic functions and focus on how to analyze and differentiate these options based on the graph's features.

Understanding Quadratic Functions and Their Graphs

Quadratic functions are polynomial functions of degree two, generally expressed in the form:

$$y = ax^2 + bx + c$$

where $a \neq 0$. The graph of a quadratic function is a parabola, which opens upward if $a > 0$ and downward if $a < 0$.

Key features of quadratic graphs include:

- Vertex: The highest or lowest point on the parabola.
- Axis of symmetry: A vertical line that passes through the vertex, dividing the parabola into mirror images.
- Y-intercept: The point where the graph crosses the y-axis ($x = 0$).
- X-intercepts (roots or zeros): The points where the parabola crosses the x-axis ($y = 0$), found by solving $y=0$.

Understanding these features allows us to match a graph to its corresponding quadratic function.

Analyzing the Given Functions

Let's examine each function option to understand what features to expect in their graphs.

Option A: $y = x^2 - 8x + 15$

- Standard form: $y = x^2 - 8x + 15$
- Vertex form: To find the vertex, complete the square:

$$
y = x^2 - 8x + 15 = (x^2 - 8x + 16) - 1 = (x - 4)^2 - 1
$$

- Vertex: $(4, -1)$
- Y-intercept: When $x=0$, $y= 0 - 0 + 15 = 15$
- X-intercepts: Set $y=0$:

$$
0 = (x - 4)^2 - 1 \Rightarrow (x - 4)^2 = 1 \Rightarrow x - 4 = \pm 1
$$

$$
x = 4 \pm 1 \Rightarrow x=3, 5
$$

- Summary: The parabola opens upward (since coefficient of x^2 is positive), with vertex at (4, -1), y-intercept at (0, 15), and x-intercepts at (3, 0) and (5, 0).

Option B: $y = x^2 - 5x + 6$

- Standard form: $y = x^2 - 5x + 6$
- Vertex form: Complete the square:

$$
y = x^2 - 5x + 6 = (x^2 - 5x + \frac{25}{4}) - \frac{25}{4} + 6 = \left(x - \frac{5}{2} \right)^2 - \frac{25}{4} + 6
$$

$$
= \left(x - 2.5 \right)^2 - \frac{25}{4} + \frac{24}{4} = \left(x - 2.5 \right)^2 -

$$
\frac{1}{4}
$$

- Vertex: $(2.5, -0.25)$
- Y-intercept: When $x=0$, $y= 0 - 0 + 6=6$
- X-intercepts: Set $y=0$:

$$
0 = (x - 2.5)^2 - 0.25 \Rightarrow (x - 2.5)^2 = 0.25 \Rightarrow x - 2.5= \pm 0.5
$$

$$
x= 2.5 \pm 0.5 \Rightarrow x= 2, 3
$$

- Summary: Upward opening parabola with vertex at (2.5, -0.25), y-intercept at (0,6), and x-intercepts at (2,0) and (3,0).

Option C: $y = (x+3)(x+5)$

- Factored form: Already factored.
- Expand:

$$
y = x^2 + 5x + 3x + 15 = x^2 + 8x + 15
$$

- Standard form: $y = x^2 + 8x + 15$
- Vertex form: Complete the square:

$$
y= x^2 + 8x + 15 = (x^2 + 8x + 16) - 1 = (x + 4)^2 - 1
$$

- Vertex: $(-4, -1)$
- Y-intercept: When $x=0$, $y= (0+3)(0+5)= 3 \times 5=15$
- X-intercepts: Set $y=0$:

$$
0= (x+3)(x+5) \Rightarrow x= -3, -5
$$

- Summary: Upward opening parabola with vertex at (-4, -1), y-intercept at (0,15), and x-intercepts at (-3, 0) and (-5, 0).

Matching the Graph to the Functions

Given the key features identified above, the process of determining which function best describes the graph involves:

1. Locating the vertex: The highest or lowest point on the parabola and its coordinates.
2. Determining the x-intercepts: The points where the graph crosses the x-axis.
3. Finding the y-intercept: The point where the graph crosses the y-axis.
4. Analyzing symmetry: Parabolas are symmetric about their axis of symmetry, which passes through the vertex.

Suppose you are provided with a graph that exhibits the following features:

- The parabola opens upward.
- The vertex is at \((4, -1) \).
- The x-intercepts are at \(3 \) and \(5 \).
- The y-intercept is at \(15 \).

Matching these features:

- The vertex at \((4, -1) \) matches Option A.
- The x-intercepts at \(3 \) and \(5 \) also align with Option A.
- The y-intercept at \(15 \) is consistent with Option A's y-intercept.

Therefore, Option A is the best candidate.

How to Use the Features to Identify the Correct Function

To systematically identify the correct quadratic function from a graph, follow these steps:

Step 1: Find the Vertex

- Locate the highest or lowest point on the parabola.
- Read off the coordinates of the vertex.

Step 2: Determine the Axis of Symmetry

- Draw the imaginary vertical line passing through the vertex.
- This line divides the parabola into mirror images.

Step 3: Find the X-Intercepts

- Identify where the parabola crosses the x-axis.
- Note their coordinates.

Step 4: Find the Y-Intercept

- Note where the parabola crosses the y-axis.

Step 5: Match with the Algebraic Features

- Compare the observed features with the features derived from each function option.
- Match the vertex, intercepts, and shape.

Step 6: Confirm the Opening Direction

- Check if the parabola opens upward or downward, corresponding to the sign of the leading coefficient a.

Additional Tips for Accurate Identification

- Use the vertex form to quickly identify the vertex and the direction of opening.
- Factor the quadratic to find roots and intercepts easily.
- Complete the square for the standard form to find the vertex.
- Plot key points if the graph is available, and verify the shape aligns with the expected parabola.

Common Mistakes to Avoid

- Confusing the x-intercepts with the

Frequently Asked Questions

How can I determine which quadratic function best fits a parabola that opens upwards and passes through points (-3, 0) and (-5, 0)?

You should check which function's roots match the x-intercepts. Both options C and D have roots at -3 and -5, so compare their coefficients or plug in points to identify the best fit.

What is the significance of the fact that option C is

written as (x+3)(x+5) compared to options A and B?

Option C explicitly shows the factored form, indicating roots at -3 and -5. If the graph intercepts the x-axis at these points, option C is likely the best description.

If the graph has a vertex at (1, -4), which of the options A-D best represents this parabola?

You can find the vertex of each quadratic function and compare. For example, option A's vertex is at x=2, which doesn't match x=1, so it may not be the best fit. Check the vertex for each to determine the best match.

How do the coefficients in options A and B affect the shape and position of the parabola compared to options C and D?

Options A and B are expanded forms that influence the parabola's opening, width, and position through their coefficients. Comparing these with the graph's vertex and intercepts helps identify the best fit.

What steps should I follow to verify which of these functions accurately models a given parabola?

Identify key features of the graph—such as roots, vertex, and y-intercept—and substitute these into each function to see which one matches the graph's characteristics.

If the parabola passes through points (0, 15) and has roots at -3 and -5, which option (A-D) is most appropriate?

Since the roots are at -3 and -5, options C and D, which explicitly factor these roots, are likely candidates. Check if substituting x=0 yields y=15 to confirm. Option D, (x+3)(x+5), simplifies to y = x^2 + 8x + 15; plugging in x=0 gives y=15, matching the point. Therefore, option D is the best fit.

Additional Resources

Which of the Following Functions Best Describes This Graph? is a question that often arises in algebra and pre-calculus courses when analyzing quadratic functions. Identifying the correct function from a set of options requires understanding the features of the graph—such as its vertex, roots, direction of opening, and intercepts—and matching these features to the algebraic form of the quadratic equations provided. In this guide, we'll explore how to analyze a quadratic graph systematically and determine which function best describes it, focusing on the options:

- A. \(y = x^2 - 8x + 15 \)

- B. $y = x^2 - 5x + 6$
- C. $y = (x+3)(x+5)$
- D. (Not fully provided, but typically would be similar in form)

Let's delve into the key concepts and steps involved in matching a graph to its algebraic function.

Understanding Quadratic Functions and Their Graphs

Quadratic functions are polynomial functions of degree 2, generally expressed in the form:

$$y = ax^2 + bx + c$$

where $a \neq 0$. Their graphs are parabola-shaped curves that open upward if $a > 0$ and downward if $a < 0$.

Key Features of Quadratic Graphs

To identify which quadratic function best describes a graph, you should analyze these features:

- Vertex: The highest or lowest point on the parabola.
- Axis of symmetry: The vertical line passing through the vertex.
- Roots (X-intercepts): The points where the parabola crosses the x-axis.
- Y-intercept: The point where the parabola crosses the y-axis.
- Direction of opening: Upward or downward.

Step-by-Step Guide to Analyzing the Graph

Step 1: Identify the Roots (X-intercepts)

Look at where the graph crosses the x-axis. These points are the roots of the quadratic function.

- For example, if the graph crosses the x-axis at $x = -3$ and $x = -5$, then the roots are -3 and -5.

Step 2: Find the Y-intercept

Locate where the graph crosses the y-axis (at $x=0$). The corresponding y-value can help verify the correct function.

Step 3: Determine the Vertex

Identify the highest or lowest point on the parabola. Use the graph to estimate the coordinates of the vertex, which can be written as (h, k).

Step 4: Write the Factored Form (if roots are known)

Quadratic functions can be expressed as:

$$ y = a(x - r_1)(x - r_2) $$

where r_1 and r_2 are roots.

Step 5: Convert to Standard Form

Expand the factored form to obtain the quadratic in the form $y = ax^2 + bx + c$. This helps in matching to the given options.

Applying the Steps to the Given Options

Let's analyze each function in the context of the graph features.

Option A: $y = x^2 - 8x + 15$

- Factorization:

$$ y = x^2 - 8x + 15 = (x - 3)(x - 5) $$

- Roots: $x = 3$ and $x = 5$

- Vertex:

The axis of symmetry is at $x = \frac{3 + 5}{2} = 4$.

Plugging $x=4$ into the original equation:

$$ y = (4)^2 - 8(4) + 15 = 16 - 32 + 15 = -1 $$

So, vertex at $(4, -1)$.

- Graph characteristics:

The parabola opens upward (since coefficient of x^2 is positive), crossing x-axis at 3 and 5, with vertex at $(4, -1)$.

Option B: $y = x^2 - 5x + 6$

- Factorization:

$$ y = x^2 - 5x + 6 = (x - 2)(x - 3) $$

- Roots: $x=2$ and $x=3$

- Vertex:

$x = \frac{2 + 3}{2} = 2.5$

Substituting into the equation:

$$y = (2.5)^2 - 5(2.5) + 6 = 6.25 - 12.5 + 6 = -0.25$$

Vertex at $(2.5, -0.25)$.

- Graph characteristics:

Opens upward, crosses x-axis at 2 and 3, vertex at $(2.5, -0.25)$.

Option C: $y = (x + 3)(x + 5)$

- Factorized form:

Already factored, roots at $x = -3$ and $x = -5$.

- Vertex:

$x = \frac{-3 + (-5)}{2} = -4$

Plugging into the equation:

$$y = (-4 + 3)(-4 + 5) = (-1)(1) = -1$$

Vertex at $(-4, -1)$.

- Graph characteristics:

Opens upward, roots at -3 and -5, vertex at $(-4, -1)$.

Making the Connection: Matching the Graph

Suppose the graph in question:

- Crosses the x-axis at -5 and -3
- Has a vertex at $(-4, -1)$
- Opens upward

Given these features:

- Roots at -5 and -3
- Vertex at $(-4, -1)$

This matches Option C, which has roots at -5 and -3, and vertex at $(-4, -1)$.

Final Considerations

Confirming the Correct Function

To confidently select the best-fitting function:

- Verify the x-intercepts visually on the graph.
- Confirm the vertex position.
- Check the y-intercept (by plugging in $x=0$):

- For Option C:

$$y = (0 + 3)(0 + 5) = 3 \times 5 = 15$$

- If the graph's y-intercept is approximately 15, that supports Option C.

Additional Tips

- Use the vertex formula:

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

- For the standard quadratic form, this can help cross-verify the vertex position.

Summary: How to Determine Which Function Describes a Graph

1. Identify the roots from the x-intercepts.
2. Determine the vertex location.
3. Check the direction of opening (upward/downward).
4. Match these features to the algebraic form of the options.
5. Verify the y-intercept for additional confirmation.

Conclusion

Choosing the correct quadratic function that describes a graph involves careful analysis of key features: roots, vertex, y-intercept, and parabola direction. In the case of the options provided, analyzing the roots and vertex positions allows us to distinguish the best match. When working through such problems, always cross-reference the graph's features with the algebraic properties of the candidate functions, and use expansion or factorization to verify the equations. With systematic analysis, accurately identifying the corresponding quadratic function becomes an achievable task.

Remember: Practice analyzing various quadratic graphs and their equations to develop a keen eye for these features, making function identification faster and more intuitive over time.

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