Please Show The Steps You Use :)What Are The Coordinates Of The Vertex For F(x) = 3x^2 + 6x + 3? (1 Point)Group

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Are you struggling to find the vertex of a quadratic function? Understanding how to determine the vertex is a fundamental skill in algebra, especially when working with quadratic functions of the form f(x) = ax^2 + bx + c. In this article, we will walk through the detailed steps to find the coordinates of the vertex for the function f(x) = 3x^2 + 6x + 3, ensuring you grasp each part of the process clearly. Whether you're preparing for a quiz, homework, or just want to improve your algebra skills, following these steps will help you confidently find the vertex of any quadratic function.

Understanding the Importance of the Vertex in Quadratic Functions

What Is a Vertex?

The vertex of a quadratic function is the point where the parabola opens either upward or downward and reaches its maximum or minimum value. For functions in the form f(x) = ax^2 + bx + c, the vertex provides critical information about the graph's highest or lowest point.

Why Is Finding the Vertex Important?

- Graphing accuracy: The vertex helps sketch the parabola accurately.
- Maximum or minimum value: Determines the highest or lowest point of the function.
- Real-world applications: In physics, economics, and engineering, the vertex can represent optimal points such as maximum profit or minimum cost.

Steps to Find the Vertex of f(x) = 3x^2 + 6x + 3

Step 1: Identify the coefficients a, b, and c

The quadratic function is given as f(x) = 3x^2 + 6x + 3.

- a = 3
- b = 6
- c = 3

These coefficients are essential for applying the vertex formula.

Step 2: Use the vertex formula

The x-coordinate of the vertex for a quadratic function in standard form is given by:

$$
x_v = -\frac{b}{2a}
$$

This formula finds the axis of symmetry of the parabola and helps locate the vertex's x-coordinate.

Step 3: Calculate the x-coordinate of the vertex

Insert the values of b and a into the formula:

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

So, the x-coordinate of the vertex is -1.

Step 4: Find the y-coordinate of the vertex

To find the y-coordinate, substitute x = -1 back into the original function:

$$
f(-1) = 3(-1)^2 + 6(-1) + 3
$$

Calculate step-by-step:

1. $(-1)^2 = 1$
2. $3 \times 1 = 3$
3. $6 \times -1 = -6$
4. Sum all parts: $3 + (-6) + 3 = 0$

Therefore, the y-coordinate of the vertex is 0.

Final Answer: Coordinates of the Vertex

The vertex of the quadratic function $f(x) = 3x^2 + 6x + 3$ is at:

- **x-coordinate:** -1
- **y-coordinate:** 0

or as a coordinate point: (-1, 0).

Additional Tips for Finding the Vertex

Completing the Square Method

Another way to find the vertex is by completing the square, which rewrites the quadratic in vertex form:

$$
f(x) = a(x - h)^2 + k
$$

where (h, k) is the vertex.

Steps:

1. Factor out a from the quadratic part if necessary.
2. Complete the square inside the parentheses.
3. Rewrite the quadratic in the form of a perfect square trinomial plus a constant.
4. Identify (h, k) from the vertex form.

Using the Graphing Method

Plotting the quadratic function on graph paper or using graphing tools can visually reveal the vertex. The point where the parabola reaches its minimum (upward opening) or maximum (downward opening) is the vertex.

Summary of the Process

To find the vertex of the quadratic function $f(x) = 3x^2 + 6x + 3$:

1. Identify coefficients: a = 3, b = 6.
2. Calculate x-coordinate: $x_v = -b/(2a) = -6/(2 \times 3) = -1$.
3. Find y-coordinate by substituting x = -1 into the original function:

\(f(-1) = 0\).
4. Conclude that the vertex is at (-1, 0).

Understanding and practicing these steps will allow you to quickly find the vertex of any quadratic function, enhancing your algebra and graphing skills.

Conclusion

Finding the coordinates of the vertex for quadratic functions is a vital skill in algebra that aids in graphing and understanding the behavior of parabolas. By following the simple steps—identifying coefficients, applying the vertex formula, and substituting back into the function—you can accurately determine the vertex point. Remember, practice makes perfect, so try calculating the vertex for different quadratic equations to strengthen your understanding. With these methods, you'll be well-equipped to handle quadratic functions confidently and efficiently.

Frequently Asked Questions

How do I find the vertex of the quadratic function $f(x) = 3x^2 + 6x + 3$?

To find the vertex, use the formula $x = -b / (2a)$. Here, $a = 3$ and $b = 6$, so $x = -6 / (2 3) = -6 / 6 = -1$.

What are the steps to calculate the vertex coordinates for $f(x) = 3x^2 + 6x + 3$?

First, identify a, b, and c. Then, find $x = -b / (2a)$. Next, plug this x-value into the function to find f(x), which gives the y-coordinate. The vertex is at (x, f(x)).

What is the x-coordinate of the vertex for the quadratic function $f(x) = 3x^2 + 6x + 3$?

The x-coordinate is -1, calculated using $x = -b / (2a) = -6 / (2 3) = -1$.

How do I find the y-coordinate of the vertex for $f(x) = 3x^2 + 6x + 3$?

Substitute $x = -1$ into the function: $f(-1) = 3(-1)^2 + 6(-1) + 3 = 3(1) - 6 + 3 = 0$. So, the y-coordinate is 0.

What are the coordinates of the vertex for the quadratic function f(x) = 3x^2 + 6x + 3?

The vertex is at (-1, 0).

Additional Resources

Vertex Coordinates of the Quadratic Function $F(x) = 3x^2 + 6x + 3$: A Step-by-Step Expert Breakdown

When analyzing quadratic functions, one of the most fundamental and insightful features is the vertex. The vertex not only represents the maximum or minimum point on the parabola but also provides critical information about the function's shape and position. In this comprehensive guide, we'll walk through the precise steps to find the coordinates of the vertex for the quadratic function:

$$F(x) = 3x^2 + 6x + 3$$

whether you're a student, a teacher, or an enthusiast eager to deepen your understanding of quadratic functions, this detailed exploration aims to clarify the process and ensure you can confidently determine the vertex for any similar quadratic.

Understanding the Quadratic Function and Its Graph

Before diving into the calculation steps, it's essential to grasp what a quadratic function is and why its vertex matters.

What is a Quadratic Function?

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

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

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

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

Why Focus on the Vertex?

The vertex represents either the highest point (maximum) or the lowest point (minimum) of the parabola:
- If $a > 0$, the parabola opens upward, and the vertex marks the minimum point.
- If $a < 0$, the parabola opens downward, and the vertex is the maximum point.

Knowing the vertex's coordinates helps in graphing, optimizing, and understanding the function's behavior.

Step-by-Step Method to Find the Vertex Coordinates

Now, let's delve into the systematic process to find the vertex of $F(x) = 3x^2 + 6x + 3$. We will explore three main approaches:

1. Using the Vertex Formula
2. Completing the Square
3. Graphically (conceptual understanding)

For the purpose of this article, we'll primarily focus on the Vertex Formula and Completing the Square, providing a thorough explanation of each.

Method 1: Using the Vertex Formula

The vertex formula is a straightforward method, especially when the quadratic is in standard form.

Standard form:

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

Vertex coordinates:

$$(x_{v}, y_{v}) = \left(-\frac{b}{2a}, f\left(-\frac{b}{2a}\right) \right)$$

This formula finds the x-coordinate of the vertex by calculating $-\frac{b}{2a}$, then substituting this value into the original function to find the y-coordinate.

Applying the Vertex Formula to $F(x) = 3x^2 + 6x + 3$

Let's identify the coefficients:

- $a = 3$
- $b = 6$
- $c = 3$

Step 1: Calculate the x-coordinate of the vertex:

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

Step 2: Calculate the y-coordinate by substituting $x = -1$ into the original function:

$$
F(-1) = 3(-1)^2 + 6(-1) + 3
$$
$$
= 3(1) - 6 + 3
$$
$$
= 3 - 6 + 3
$$
$$
= 0
$$

Result:

$$
\boxed{
\text{Vertex} = (-1, 0)
}
$$

This means the parabola reaches its minimum point at $(-1, 0)$.

Method 2: Completing the Square

While the vertex formula is quick, completing the square offers a more insightful view into the function's structure and is especially useful for understanding transformations and derivations.

Objective: Rewrite $F(x)$ in vertex form:

$$
F(x) = a(x - h)^2 + k
$$

where (h, k) is the vertex.

Steps to Complete the Square for $F(x) = 3x^2 + 6x + 3$

Step 1: Factor out $a = 3$ from the quadratic terms:

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

Step 2: Complete the square inside the parentheses:

- Take half of the coefficient of x, which is 2:

$$
\frac{2}{2} = 1
$$

- Square it:

$$
1^2 = 1
$$

- Add and subtract this square inside the parentheses to keep the expression equivalent:

$$
F(x) = 3\left(x^2 + 2x + 1 - 1 \right) + 3
$$

$$
= 3\left((x + 1)^2 - 1 \right) + 3

\]

Step 3: Distribute the 3:

\[
= 3(x + 1)^2 - 3 + 3
\]

\[
= 3(x + 1)^2
\]

Step 4: Identify the vertex:

\[
F(x) = 3(x + 1)^2
\]

which is in vertex form:

\[
F(x) = a(x - h)^2 + k
\]

Here, \(h = -1 \), \(k = 0 \).

Conclusion:

Vertex coordinates:

\[
(-1, 0)
\]

matching the result from the vertex formula method.

Additional Insights and Graphical Interpretation

Understanding the vertex both algebraically and visually deepens comprehension.

Graphical Perspective

- The parabola opens upward because \(a = 3 > 0 \).
- The vertex at \((-1, 0)\) is the lowest point, indicating the minimum value

of the function.
- The parabola's axis of symmetry is the vertical line $x = -1$.

Practical Implications

Knowing the vertex coordinates helps in:

- Graphing the parabola accurately.
- Determining the maximum or minimum values of related real-world problems.
- Analyzing the function's behavior under transformations.

Summary of the Process to Find the Vertex

Here's a concise recap:

1. Identify coefficients: a, b, c.
2. Calculate x-coordinate: $x_{v} = -\frac{b}{2a}$.
3. Find y-coordinate: $y_{v} = f(x_{v})$.
4. Optional - Complete the square to rewrite the function in vertex form for deeper insight.
5. Interpret the result in the context of the parabola's shape and position.

Final Thoughts: Why Mastering the Vertex Matters

The ability to find the vertex of a quadratic function like $F(x) = 3x^2 + 6x + 3$ is foundational for algebra, calculus, and many applied fields such as physics, economics, and engineering. It sharpens problem-solving skills, enhances graphing accuracy, and fosters a deeper understanding of quadratic functions' intrinsic properties.

Whether approached via the vertex formula or completing the square, these methods equip you with reliable tools to analyze any quadratic function efficiently. As you practice these techniques, you'll gain confidence and develop a more intuitive grasp of the elegant symmetry and structure underlying quadratic equations.

In essence: The coordinates of the vertex for $F(x) = 3x^2 + 6x + 3$ are (-1, 0), derived through methodical application of algebraic formulas and completing the square — a testament to the power and beauty of algebraic techniques in uncovering the fundamental features of quadratic functions.

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