Which Equation Is Represented By The Graph Shown? 0.5 Al X/4 R/2 3x/4 O A. Y = 2sin(x/2) B. Y = 0.5sin(x/2)

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Understanding the relationship between a graph and its corresponding equation is fundamental in mathematics, especially in the study of trigonometry and periodic functions. When presented with a graph, one of the key skills is to analyze its features—such as amplitude, period, phase shift, and vertical shift—and then determine which equation accurately describes the graph. In this article, we will explore how to identify whether a graph represents the equation Y = 2sin(x/2) or Y = 0.5sin(x/2), based on their distinctive characteristics.

Understanding Basic Trigonometric Functions

Before diving into the specific equations, it's essential to review the basics of sine functions.

The Sine Function

The sine function, denoted as sin(x), is a periodic function with a range of -1 to 1 and a period of 2π. It produces a smooth, wave-like graph that repeats every 2π units along the x-axis.

The general form of a sine function can be written as:
\[y = A \sin(B(x - C)) + D \]

where:
- A is the amplitude (height from the centerline to the peak),
- B affects the period (how stretched or compressed the wave is),
- C is the phase shift (horizontal shift),
- D is the vertical shift.

In our specific equations, phase shift and vertical shift are not present; only amplitude and period are modified.

Key Features of Sine Graphs

- Amplitude (A): The maximum and minimum values of the wave. For example, if $A = 2$, the graph oscillates between -2 and 2.
- Period (T): The length of one complete cycle. Calculated as $T = \frac{2\pi}{B}$.
- Frequency: How many cycles occur in a unit interval, related inversely to the period.
- Phase Shift: Horizontal displacement, which shifts the graph left or right.
- Vertical Shift: Moves the entire graph up or down.

Analyzing the Given Equations

Let's examine the two equations in question:

- Option A: $Y = 2 \sin\left(\frac{x}{2}\right)$
- Option B: $Y = 0.5 \sin\left(\frac{x}{2}\right)$

Both equations have the same inner function $\sin\left(\frac{x}{2}\right)$, but differ in their amplitude: 2 versus 0.5. This difference will significantly influence the appearance of the graph.

Amplitude Comparison

- Equation A: Amplitude = 2, so the graph oscillates between -2 and 2.
- Equation B: Amplitude = 0.5, so the graph oscillates between -0.5 and 0.5.

The amplitude determines the height of the wave's peaks and the depth of its troughs. By observing the graph, one can estimate the maximum and minimum values of the wave to identify which equation it matches.

Period Calculation

Both equations have the same argument $x/2$, which influences the period.

The period T of a sine function $y = \sin(Bx)$ is:
$$T = \frac{2\pi}{B}$$

In our case, the coefficient of x inside the sine function is $\frac{1}{2}$, so:
$$T = \frac{2\pi}{1/2} = 2\pi \times 2 = 4\pi$$

Thus, regardless of the amplitude, both functions have a period of 4π. This means the wave completes one full cycle every 4π units along the x-axis.

How to Identify the Correct Equation from the Graph

Given the features above, identifying the correct equation involves analyzing the graph's amplitude and period.

Step 1: Observe the Range of the Graph

- If the maximum value reaches approximately 2, and the minimum reaches -2, the graph likely represents \(y = 2 \sin(x/2) \).
- If the maximum is around 0.5 and the minimum around -0.5, then \(y = 0.5 \sin(x/2) \) is the correct choice.

Step 2: Measure the Period

Since the period is calculated as \(4\pi \), check the distance between two consecutive peaks or troughs.

- If the distance between two peaks is approximately 4π units, the period matches.
- Confirming the period ensures the phase of the wave aligns with the expected calculation.

Step 3: Assess the Wave's Shape and Symmetry

Both sine functions produce symmetric, smooth waves. The primary differentiator remains the amplitude.

Practical Approach to Determine the Equation

To practically identify which equation the graph represents, follow these steps:

1. **Estimate the maximum and minimum y-values:** Use grid lines or a ruler to approximate the wave's peaks and troughs.

2. **Calculate the amplitude:** Find the difference between the maximum (or minimum) and the midline, then divide by 2.

3. **Measure the period:** Determine the distance between two successive peaks (or troughs).

4. **Compare with theoretical values:** Match the estimated amplitude and period with those predicted by the equations.

Conclusion: Which Equation Does the Graph Represent?

Based on the analysis, if the observed graph's peaks reach approximately 2 and troughs go down to -2, with a period of about 4π, it is consistent with Option A: $y = 2 \sin(x/2)$. Conversely, if the graph's peaks and troughs are near 0.5 and -0.5, respectively, then Option B: $y = 0.5 \sin(x/2)$ is the correct match.

Additional Tips for Identifying Trigonometric Graphs

- Always verify the amplitude first—it's the easiest to estimate visually.
- Confirm the period by measuring the distance between repeating features.
- Remember that the phase shift and vertical shift are not present in these equations, simplifying the analysis.
- Use graphing tools or software for more precise measurements when possible.

Summary

Determining which equation corresponds to a given graph is an essential skill in mathematics, especially for students studying trigonometry. By analyzing key features such as amplitude and period, one can accurately identify whether the graph represents $y = 2 \sin(x/2)$ or $y = 0.5 \sin(x/2)$. Remember, the amplitude influences the height of the wave, while the period affects the wave's horizontal length. Careful observation and measurement are fundamental to making the correct identification.

Keywords: sine function, trigonometry, graph analysis, amplitude, period, sinusoidal wave, equation identification, math tutorial, periodic functions, graph features

Frequently Asked Questions

What type of function is represented by the graph in the question?

The graph represents a sine function, as indicated by the options involving 'sin'.

Which equation best matches the amplitude and period shown in the graph?

Based on the options, $Y = 0.5\sin(x/2)$ (option B) likely matches a smaller amplitude and stretched period compared to $Y = 2\sin(x/2)$.

How does the coefficient inside the sine function affect the graph?

The coefficient inside the sine function, like $x/2$, affects the period of the graph; a larger denominator results in a longer period.

What is the amplitude of the function $Y = 0.5\sin(x/2)$?

The amplitude is 0.5, which indicates the maximum height from the midline of the sine wave.

How does the coefficient outside the sine function influence the graph's shape?

In these options, the coefficient outside (like 0.5 or 2) affects the amplitude of the wave, with larger values producing taller waves.

Between the two options, which one has a larger amplitude?

$Y = 2\sin(x/2)$ has a larger amplitude of 2, while $Y = 0.5\sin(x/2)$ has an amplitude of 0.5.

If the graph shows a sine wave with a smaller amplitude, which equation is more likely correct?

$Y = 0.5\sin(x/2)$ is more likely correct if the amplitude appears smaller on the graph.

How can you determine which equation matches the graph without seeing it?

You can compare the amplitude and period of the graph to the properties of the given equations to identify the correct one.

Additional Resources

Which Equation Is Represented By The Graph Shown? 0.5 Al X/4 R/2 3x/4 O A. Y = 2sin(x/2) B. Y = 0.5sin(x/2)

Understanding the relationship between a graph and its corresponding equation is a fundamental skill in mathematics, especially in the study of trigonometry and functions. When analyzing a graph, the key challenge often lies in identifying which mathematical equation accurately describes the visual data. In this article, we will explore which equation is represented by the graph shown, focusing on the two options provided:

- Y = 2sin(x/2)
- Y = 0.5sin(x/2)

Through a detailed breakdown, we will dissect the characteristics of these functions, interpret their graphs, and determine which equation aligns with the visual representation.

Understanding the Basic Structure of Sine Functions

Before delving into the specifics of the equations, it’s essential to review the fundamental properties of the sine function, as both options involve sine:

The Standard Sine Function: Y = sin(x)

- Amplitude: The maximum height of the wave from the centerline, which is 1 for the basic sine function.
- Period: The length of one complete cycle, calculated as 2π for the standard sine.
- Phase Shift: Horizontal shift along the x-axis.
- Vertical Shift: Upward or downward translation along the y-axis.

Modifications to the Basic Sine Function

When you introduce coefficients, such as in $Y = A \sin(Bx)$, these properties change:

- Amplitude: Becomes $|A|$. For example, if $A = 0.5$, the wave oscillates between -0.5 and 0.5.
- Period: Adjusts to $\frac{2\pi}{|B|}$. For example, if $B = \frac{1}{2}$, the period becomes 4π.

Understanding these modifications is crucial for analyzing the provided options.

Comparing the Two Equations

Let's analyze the two given equations:

1. Y = 2sin(x/2)
- Amplitude: 2
- Period: \(2\pi / (1/2) = 2\pi \times 2 = 4\pi \)

2. Y = 0.5sin(x/2)
- Amplitude: 0.5
- Period: Same as above, \(4\pi \)

Notice that both equations share the same period because they have the same coefficient inside the sine function, \(x/2 \).

Key Features to Identify the Correct Equation

To determine which equation matches the graph, focus on the following features:

1. Amplitude (Maximum and Minimum Values)

- Y = 2sin(x/2): The maximum value is 2; the minimum is -2.
- Y = 0.5sin(x/2): The maximum value is 0.5; the minimum is -0.5.

How to identify: Observe the peaks and troughs of the graph. If the graph's maximum reaches around 2 and the minimum around -2, option A is more accurate. Conversely, if the peaks are near 0.5 and troughs near -0.5, option B is correct.

2. Period of the Wave

- Both functions have a period of \(4\pi \), as calculated earlier.

How to identify: Count the length of one complete cycle along the x-axis. If the graph completes a cycle over approximately \(4\pi \), that confirms the period.

3. Phase Shift and Horizontal Scaling

- Both equations involve \(x/2 \) inside the sine, which implies a horizontal stretch by a factor of 2 compared to the standard sine wave.

How to identify: Look at the distance between successive peaks. If they are spaced approximately \(4\pi \), it confirms the period.

Practical Approach to Identifying the Correct Equation

When analyzing a graph, follow these steps:

Step 1: Observe the Amplitude
- Identify the maximum and minimum points.
- Measure their y-values.

Step 2: Determine the Period
- Measure the distance along the x-axis between two consecutive peaks or troughs.
- Compare this measurement with the expected periods.

Step 3: Examine the Horizontal Stretch
- Recognize whether the wave appears stretched or compressed compared to the basic sine graph.

Step 4: Match with Equations
- Using the observed amplitude and period, decide whether the function aligns with $2\sin(x/2)$ or $0.5\sin(x/2)$.

Example Analysis

Suppose you observe the following on the graph:

- The peaks reach approximately +2 and troughs -2.
- The length of one full cycle (from peak to peak) is about 4π.

Interpretation:

- The amplitude suggests the coefficient A is 2, matching the first equation.
- The period aligns with the calculation $2\pi / (1/2) = 4\pi$, consistent with the graph.

Conclusion:

Based on these observations, the graph most likely represents Y = 2sin(x/2).

Additional Considerations

Effect of Phase Shifts

- If the graph is shifted left or right, consider phase shifts, which are not explicitly present in the given equations but can be incorporated as $Y = A \sin(Bx + C)$.

Vertical Shifts

- If the entire wave is shifted upward or downward, this indicates a vertical translation, which is not present in the provided options.

Symmetry and Behavior

- Sine functions are symmetric about the origin, and this symmetry can also aid in analysis.

Final Verdict: Which Equation Is Represented By The Graph?

Based on the detailed analysis, the key distinguishing feature is the amplitude. If the graph's maximum and minimum are approximately +2 and -2, then the equation

$$Y = 2\sin(x/2)$$

is the most accurate representation.

Conversely, if the peaks and troughs are closer to +0.5 and -0.5, then

$$Y = 0.5\sin(x/2)$$

would be the correct choice.

Summary

- Both options involve sine functions with a horizontal stretch (period of 4π) due to the $x/2$ inside.
- The primary difference lies in amplitude: 2 versus 0.5.
- To identify which equation the graph represents, focus on the maximum and minimum y-values.
- Measure the period and compare it with the expected 4π.
- Consider the overall shape, symmetry, and shifts.

By applying these principles, you can confidently determine which equation is represented by a given graph, enhancing your understanding of sinusoidal functions and their graphical representations.

Final Tips for Analyzing Trigonometric Graphs

- Always start by noting the key features: amplitude, period, phase shift.
- Use a ruler or grid to measure distances accurately.
- Cross-reference your observations with the mathematical properties of the functions.
- Practice with multiple graphs to develop intuition and familiarity.

With this comprehensive guide, you’re well-equipped to analyze sinusoidal graphs and identify their corresponding equations with confidence.

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