Graph The Exponential Model Y = 3(6)^x Which Point Lies On The Graph? (-9 2)(2, 9)(- 1, - 18)(1, 18)

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Understanding how to analyze exponential functions and determine whether specific points lie on their graphs is a fundamental skill in algebra and calculus. In this article, we will explore the exponential model Y = 3(6)^x, examine how to graph this function, and assess which of the given points—(-9, 2), (2, 9), (-1, -18), and (1, 18)—actually lie on the graph of this model. By the end, you'll have a clear approach to testing points against exponential functions and a deeper understanding of their behavior.

What Is an Exponential Function?

Definition and Characteristics

An exponential function is a mathematical expression in which the variable appears in the exponent. Its general form is:

- Y = a b^x, where
- **a** is the initial value or the y-intercept (when x=0),
- **b** is the base, which determines the growth or decay rate.

Key characteristics of exponential functions include rapid growth or decay, a constant ratio between successive outputs, and a graph that is either increasing or decreasing exponentially.

Graphing Exponential Functions

When graphing an exponential function like Y = 3(6)^x, you typically:

- Identify the y-intercept by substituting x=0.
- Calculate additional points for different x-values to observe the trend.

- Plot these points and draw the curve, noting the asymptotic behavior as x approaches positive or negative infinity.

Analyzing the Model $Y = 3(6)^x$

Understanding the Function's Components

The function $Y = 3(6)^x$ has:

- **a = 3**, indicating the y-intercept when x=0.
- **b = 6**, a base greater than 1, indicating exponential growth.

This means at x=0, $Y = 3(6)^0 = 3(1) = 3$, so the graph crosses the y-axis at (0, 3).

Graph Behavior and Key Points

- When x increases, Y increases rapidly because 6^x grows quickly.
- When x decreases, 6^x approaches zero, so Y approaches 0 from above.
- The graph is always positive due to the positive base and coefficient.

Determining Which Points Lie on the Graph

Methodology for Testing Points

To verify if a point (x, y) lies on the graph of $Y = 3(6)^x$, follow these steps:

1. Substitute the x-value into the function to find the corresponding y-value.
2. Compare this calculated y-value with the given y-coordinate of the point.
3. If they match, the point lies on the graph; if not, it does not.

Let's apply this process to each point.

Evaluating Each Point

Point 1: (-9, 2)
- Substitute x = -9:

Y = 3(6)^(-9)

- Recall that 6^{-9} = 1 / 6^9.

- Calculate 6^9:

6^9 = 6^3 6^6 = (216) (6^6)

- 6^6 = 6^3 6^3 = 216 216 = 46,656

- Therefore, 6^9 = 216 46,656 ≈ 10,077,696

- So, Y ≈ 3 (1 / 10,077,696) ≈ 3 / 10,077,696 ≈ 0.000000297

- Since the calculated y ≈ 0.000000297, which is vastly different from 2, the point (-9, 2) does not lie on the graph.

Point 2: (2, 9)
- Substitute x = 2:

Y = 3(6)^2 = 3 36 = 108

- The actual y-value for x=2 is 108, but the point's y-coordinate is 9, so (2, 9) does not lie on the graph.

Point 3: (-1, -18)
- Substitute x = -1:

Y = 3(6)^{-1} = 3 (1/6) = 3/6 = 0.5

- The calculated y is 0.5, but the point has y = -18, so (-1, -18) does not lie on the graph.

Point 4: (1, 18)
- Substitute x = 1:

Y = 3(6)^1 = 3 6 = 18

- The calculated y-value is 18, which matches the point's y-coordinate. Therefore, (1, 18) lies on the graph.

Summary: Which Point Lies on the Graph?

Based on the calculations:

- **(-9, 2):** No
- **(2, 9):** No
- **(-1, -18):** No
- **(1, 18):** Yes

The only point from the list that lies on the graph of Y = 3(6)^x is (1, 18).

Conclusion and Practical Tips

Understanding whether a point lies on an exponential graph involves substituting the x-value into the function and seeing if the resulting y-value matches the point's y-coordinate. Remember:

- For negative x-values, the exponential function approaches zero but remains positive.
- For positive x-values, the function grows rapidly.
- Always perform precise calculations or estimations to verify points accurately.

This process is essential in fields like algebra, calculus, data modeling, and scientific research, where verifying data points against models is a common task.

Additional Resources for Learning Exponential Functions

- Khan Academy's lessons on exponential functions and graphing.
- Algebra textbooks covering exponential growth and decay.
- Online graphing calculators to visualize functions and points.

- Practice problems with varying functions to strengthen understanding.

By mastering these techniques, you'll be better equipped to analyze complex functions and interpret their graphs effectively, enhancing your mathematical literacy and problem-solving skills.

Frequently Asked Questions

What is the general form of the exponential model given in the problem?

The exponential model is Y = 3(6)^x, where 3 is the initial value and 6 is the base of the exponential function.

How do you determine if a point lies on the graph of Y = 3(6)^x?

To check if a point (x, y) lies on the graph, substitute the x-coordinate into the equation and see if the resulting y matches the given y-coordinate.

Does the point (-9, 2) lie on the graph Y = 3(6)^x?

No, because when x = -9, Y = 3(6)^{-9}, which is a very small number close to zero, not 2.

Is the point (2, 9) on the graph Y = 3(6)^x?

No, because when x = 2, Y = 3(6)^2 = 3 36 = 108, which does not equal 9.

Does the point (-1, -18) satisfy the equation Y = 3(6)^x?

No, because when x = -1, Y = 3(6)^{-1} = 3/6 = 0.5, which is not -18.

Is the point (1, 18) on the graph Y = 3(6)^x?

Yes, because when x = 1, Y = 3(6)^1 = 3 6 = 18, matching the given y-coordinate.

What is the correct point that lies on the graph from the options provided?

The point (1, 18) lies on the graph Y = 3(6)^x.

How can you verify other points to check if they are on the graph?

Substitute the x-value into the equation and compare the computed y-value to the given y-coordinate to verify if the point lies on the graph.

What does the base 6 in the exponential model signify about the graph's growth?

The base 6 indicates the graph exhibits exponential growth, increasing rapidly as x increases.

Why is the point (1, 18) the correct answer to the question?

Because substituting x = 1 into the model yields $Y = 3(6)^1 = 18$, which matches the point's y-coordinate, confirming it lies on the graph.

Additional Resources

Graph The Exponential Model $Y = 3(6)^x$: Which Point Lies On The Graph?

Understanding how to determine whether a specific point lies on an exponential graph is a fundamental skill in algebra and calculus. In this article, we'll explore the exponential model $Y = 3(6)^x$ in detail, analyze various points, and develop a systematic approach to identify which points are on the graph. This process not only enhances comprehension of exponential functions but also sharpens problem-solving skills applicable across mathematics and related disciplines.

Introduction to the Exponential Model $Y = 3(6)^x$

The exponential function $Y = 3(6)^x$ is a classic example of an exponential growth model. Its general form is $Y = a b^x$, where:

- a is the initial value or the y-intercept,
- b is the base, indicating the rate of growth or decay,
- x is the independent variable, typically representing time or another continuous measure.

In our specific model, a = 3 and b = 6. The base 6 signifies rapid growth because it’s greater than 1. When x increases, Y increases exponentially; when x decreases, Y approaches zero but remains positive.

Visualizing the graph of $Y = 3(6)^x$ reveals a curve that starts near zero for negative x and rises sharply for positive x. The graph passes through the point where x = 0, yielding Y = 3, since $6^0 = 1$ and Y = 3(1) = 3.

Key Features of the Graph

Before analyzing specific points, it helps to understand some fundamental properties of the exponential function:

- Y-intercept: At x = 0, Y = 3(6)^0 = 3.
- Growth Rate: Because b = 6 > 1, the function exhibits exponential growth.
- Asymptote: The x-axis (Y = 0) acts as a horizontal asymptote; the graph approaches zero but never touches it for negative x.
- Domain: All real numbers, x ∈ (-∞, ∞).
- Range: Y > 0, since 6^x is always positive.

Determining Whether a Point Lies on the Graph

Given the points (-9, 2), (2, 9), (-1, -18), and (1, 18), our goal is to verify which of these points satisfy the equation Y = 3(6)^x.

The process involves:

1. Substituting the x-coordinate into the equation.
2. Calculating the right side of the equation.
3. Comparing the result with the Y-coordinate.

If both values match, the point lies on the graph; if not, it does not.

Step-by-Step Analysis of Each Point

Point 1: (-9, 2)

- Substitute x = -9 into the equation:

Y = 3(6)^x
Y = 3(6)^{-9}

- Calculate 6^{-9}:

6^{-9} = 1 / 6^{9}
6^{9} = 6^9

- Calculate 6^9:

6^9 = 6^3 6^6
6^3 = 216
6^6 = (6^3)^2 = 216^2 = 46656

So, 6^9 = 216 46656 = 10,077,696

- Calculate Y:

Y = 3 / 10,077,696 ≈ 0.000000298

- Compare with Y-coordinate:

The point's Y-coordinate is 2, which is vastly larger than the calculated value (~0.0000003). Therefore, (-9, 2) does not lie on the graph.

Point 2: (2, 9)

- Substitute x = 2:

Y = 3(6)^2

- Calculate 6^2:

6^2 = 36

- Calculate Y:

Y = 3 36 = 108

- Compare with given Y-coordinate:

The point's Y-coordinate is 9, which is not equal to 108. Therefore, (2, 9) does not lie on the graph.

Point 3: (-1, -18)

- Substitute x = -1:

Y = 3(6)^{-1}

- Calculate 6^{-1}:

6^{-1} = 1/6 ≈ 0.1667

- Calculate Y:

Y = 3 1/6 = 3/6 = 0.5

- Compare with Y-coordinate:

The point's Y-coordinate is -18, which is vastly different from 0.5. Since Y is negative here but the function yields positive Y-values for all real x (because 6^x > 0), (-1, -18) does not lie on the graph.

Point 4: (1, 18)

- Substitute x = 1:

Y = 3(6)^1 = 3 6 = 18

- Compare with Y-coordinate:

The point's Y-coordinate is 18, which matches our calculation exactly.

Conclusion: The point (1, 18) lies on the graph of Y = 3(6)^x.

Summary of Analysis

Point	Calculation of Y	Actual Y	Does it lie on the graph?
(-9, 2)	3 / 6^9 ≈ 0.0000003	2	No
(2, 9)	3 36 = 108	9	No
(-1, -18)	3 (1/6) ≈ 0.5	-18	No
(1, 18)	3 6 = 18	18	Yes

Thus, the only point from the list that lies on the graph of Y = 3(6)^x is (1, 18).

Understanding Why Only (1, 18) Fits

The key insight from this exercise is that exponential functions are highly sensitive to the x-values because of their rapid growth or decay. When substituting x into Y = 3(6)^x, the resulting Y-value is strictly positive, reflecting the base's positivity and the exponential nature.

Points with Y-values inconsistent with the exponential calculation can be dismissed quickly. For example, the point (-1, -18) is invalid because Y cannot be negative for this function, reaffirming the importance of understanding the function's behavior.

Additional Tips for Analyzing Exponential Graphs

- Always start with the x-value: Substituting it into the equation gives you a predicted Y-value.
- Check the sign: Since b^x is always positive for b > 0, the Y-values are positive unless the function includes negative coefficients or modifications.
- Use calculator or software: For complex calculations, use a calculator to ensure accuracy.
- Plot the points: Visual confirmation can help identify the trend and verify points.

Conclusion

In analyzing the exponential model Y = 3(6)^x, we've demonstrated a systematic approach to determine which points lie on the graph. The key steps include substitution, calculation, and comparison. Among the points provided, only (1, 18) satisfies the equation, confirming its position on the exponential curve.

Mastering this process enhances your understanding of exponential functions and prepares you for more complex applications in mathematics, science, and engineering. Remember, the core principle remains: always verify by substitution and understand the behavior of the function to interpret the graph accurately.

Ready to practice? Try applying these steps to other exponential functions or points to strengthen your skills in graph analysis and function verification!

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