Find The Value Of R So That The Line Through (-4, 3) And (r, -3) Has A Slope Of 2/3

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Understanding how to find the value of a variable in the context of a line passing through two points with a specified slope is a fundamental concept in algebra and coordinate geometry. In this article, we will explore the process of determining the value of R such that the line passing through the points (-4, 3) and (r, -3) has a slope of $\frac{2}{3}$. This problem not only enhances your algebraic skills but also deepens your understanding of the relationship between points, slopes, and equations of lines.

Understanding the Slope of a Line

What Is Slope?

The slope of a line measures its steepness and direction. It is calculated as the ratio of the vertical change (rise) to the horizontal change (run) between two points on the line. The slope (m) between two points (x_1, y_1) and (x_2, y_2) is given by:

$$
m = \frac{y_2 - y_1}{x_2 - x_1}
$$

This formula is fundamental in coordinate geometry and helps determine the nature of the line—whether it is increasing, decreasing, or horizontal/vertical.

Importance of Slope in the Given Problem

In our problem, the slope is specified as $\frac{2}{3}$. Knowing this, along with two points on the line, allows us to set up an equation to solve for the unknown variable R. This approach exemplifies how algebra and geometry intersect to solve real-world problems and mathematical exercises.

Setting Up the Problem

Given Points and Slope

- Point 1: $(-4, 3)$
- Point 2: $(r, -3)$
- Slope (m): $\frac{2}{3}$

Our goal is to find the value of R such that the slope between these two points equals $\frac{2}{3}$.

Applying the Slope Formula

Using the slope formula:

$$
\frac{y_2 - y_1}{x_2 - x_1} = m
$$

we substitute:

$$
\frac{-3 - 3}{r - (-4)} = \frac{2}{3}
$$

which simplifies to:

$$
\frac{-6}{r + 4} = \frac{2}{3}
$$

This equation contains the variable R, and solving it will give us the value that makes the slope exactly $\frac{2}{3}$.

Solving for R

Step-by-Step Solution

1. Cross-multiplied Equation:

$$
-6 \times 3 = 2 \times (r + 4)
$$

which simplifies to:

$$
-18 = 2(r + 4)
$$

2. Distribute and Isolate R:

$$
-18 = 2r + 8
$$

Subtract 8 from both sides:

$$
-18 - 8 = 2r
$$

$$
-26 = 2r
$$

3. Divide to Find R:

$$
r = \frac{-26}{2} = -13
$$

Result: The value of R that satisfies the condition is $\boxed{-13}$.

Interpreting the Result

Verification of the Solution

To verify, substitute R = -13 into the original slope formula:

$$
\frac{-3 - 3}{-13 + 4} = \frac{-6}{-9} = \frac{2}{3}
$$

which confirms that the slope is indeed $\frac{2}{3}$, matching the specified value.

Significance of the Result

This exercise demonstrates how algebraic manipulation and understanding of the slope formula allow us to find unknown variables in geometric contexts. It emphasizes the importance of setting up correct equations and verifying solutions to ensure accuracy.

Additional Considerations and Applications

Generalization of the Method

The approach used here can be generalized to find unknowns in various geometric problems involving slopes:
- When given two points and a desired slope, set up the slope formula and solve for unknowns.
- When given a point and a slope, find the equation of the line, then determine other points satisfying that equation.

Applications in Real-World Scenarios

Understanding how to manipulate slopes and solve for variables has practical applications:
- Engineering: designing roads or ramps with specific inclines.
- Physics: analyzing motion along a line with a fixed rate of change.
- Data Analysis: fitting lines to data points to understand relationships.

Summary

In conclusion, finding the value of R so that the line passing through (-4, 3) and (r, -3) has a slope of $\frac{2}{3}$ involves applying the slope formula, setting up an algebraic equation, and solving for the unknown. The key steps include substituting the known points into the slope formula, simplifying, cross-multiplying, and isolating R. The solution R = -13 ensures the line's slope is exactly

\(\frac{2}{3}\), illustrating the power of algebra in solving geometric problems. This method is versatile and can be applied across various mathematical and real-world contexts, reinforcing the interconnectedness of algebra and geometry.

If you're interested in further exploring slope-related problems or other aspects of coordinate geometry, consider practicing with different points, slopes, and equations to build your confidence and deepen your understanding.

Frequently Asked Questions

What is the general formula to find the slope of a line passing through two points?

The slope (m) is given by (y2 - y1) / (x2 - x1), where (x1, y1) and (x2, y2) are the two points.

Given the points (-4, 3) and (r, -3), how do you set up the equation to find r for a slope of 2/3?

Use the slope formula: (-3 - 3) / (r - (-4)) = 2/3. Simplify to (-6) / (r + 4) = 2/3.

How do you solve for r in the equation (-6) / (r + 4) = 2/3?

Cross-multiply: (-6) 3 = 2 (r + 4). Simplify to -18 = 2r + 8, then solve for r.

What is the solution for r after solving the equation -18 = 2r + 8?

Subtract 8 from both sides: -18 - 8 = 2r, which gives -26 = 2r. Divide both sides by 2: r = -13.

What is the value of r so that the line through (-4, 3) and (r, -3) has a slope of 2/3?

The value of r is -13.

Can r be any other value to produce the same slope, or is it unique?

In this context, r is uniquely determined as -13 to produce the slope of 2/3.

How does understanding the slope formula help in coordinate geometry problems like this?

It allows you to relate changes in y and x coordinates directly, enabling you to find unknowns like r when given a specific slope.

What are some common mistakes to avoid when solving for r in slope problems?

Common mistakes include incorrect cross-multiplication, sign errors, or forgetting to solve for the variable after simplification.

Additional Resources

Find The Value Of R So That The Line Through (-4, 3) And (r, -3) Has A Slope Of 2/3

Understanding how to find the value of r in the context of a line passing through two points with a specified slope is a fundamental concept in coordinate geometry. This type of problem challenges students and enthusiasts to connect the geometric intuition with algebraic manipulation, reinforcing their grasp of slope calculations and linear equations. In this detailed review, we will explore the process step-by-step, analyze the underlying concepts, and discuss common pitfalls and strategies to master such problems.

Introduction to the Problem

The problem asks us to determine the value of the variable r such that the line passing through the points (-4, 3) and (r, -3) has a slope of 2/3. This is a classic example of applying the slope formula:

$$
m = \frac{y_2 - y_1}{x_2 - x_1}
$$

where $(x_1, y_1) = (-4, 3)$ and $(x_2, y_2) = (r, -3)$.

The goal is to substitute the given points into the slope formula, set it equal to 2/3, and solve for r. This approach exemplifies how algebra and geometry intersect, with the slope serving as a bridge between coordinate pairs.

Step-by-Step Solution Breakdown

1. Write Down the Slope Formula

Starting from the basic definition:

\[

$$
m = \frac{y_2 - y_1}{x_2 - x_1}
$$

Given the points, substitute the known coordinates:

$$
2/3 = \frac{-3 - 3}{r - (-4)}
$$

which simplifies to:

$$
2/3 = \frac{-6}{r + 4}
$$

Understanding this setup is crucial because it transforms the problem into an algebraic equation, making it solvable for r.

2. Cross-Multiplied Equation

To eliminate the fraction, cross-multiplied:

$$
2/3 \times (r + 4) = -6
$$

which yields:

$$
2(r + 4) = -6 \times 3
$$

or

$$
2(r + 4) = -18
$$

Cross-multiplication is a key skill in solving proportions, and recognizing this step is essential in algebraic problem-solving.

3. Expand and Simplify

Distribute the 2:

$$
2r + 8 = -18
$$

\]

Subtract 8 from both sides:

$$
2r = -18 - 8
$$

$$
2r = -26
$$

Divide both sides by 2:

$$
r = -13
$$

This solution indicates that when r is -13, the line passing through (-4, 3) and (-13, -3) has the slope of 2/3.

Verification of the Solution

Verifying the correctness of the solution is a vital step. Substitute r = -13 back into the slope formula:

$$
m = \frac{-3 - 3}{-13 - (-4)} = \frac{-6}{-13 + 4} = \frac{-6}{-9} = \frac{2}{3}
$$

Since the calculated slope matches the given slope exactly, r = -13 is verified as the correct solution.

Conceptual Insights and Critical Analysis

Understanding the Slope Formula

The slope formula measures the steepness and direction of a line. When given two points, it provides a ratio of vertical change to horizontal change:

$$
m = \frac{\Delta y}{\Delta x}
$$

In this problem, the vertical change is fixed (-6), but the horizontal change depends on r. Recognizing how to set up the equation correctly is fundamental.

Why is the Value of R Important?

The value of r determines the position of the second point along the x-axis, directly affecting the slope. The problem effectively asks: "At what x-coordinate does a point need to be so that the line passing through it and the fixed point (-4, 3) has the desired slope?"

This concept ties into the idea of linear relationships and how changing one coordinate influences the overall slope.

Common Mistakes and Pitfalls

- Incorrect substitution: Forgetting to include the minus signs or misplacing the points can lead to errors.
- Misinterpretation of the slope formula: Using the wrong order of points can change the sign of the slope.
- Arithmetic errors during cross-multiplication: Multiplying or simplifying incorrectly can derail the solution.
- Failure to verify solutions: Always substituting back to confirm the correctness.

Understanding these pitfalls helps students develop a more robust problem-solving approach.

Features and Educational Value

Pros:

- Reinforces understanding of the slope formula and algebraic manipulation.
- Develops problem-solving skills applicable to a wide range of geometry problems.
- Encourages verification and critical thinking.
- Demonstrates the connection between algebra and coordinate geometry.

Cons:

- Might be straightforward for advanced students but challenging for beginners.
- Could benefit from visual aids like graphing to enhance understanding.
- Assumes familiarity with algebraic operations and fraction handling.

Extensions and Related Problems

- Find the equation of the line given the points and slope.
- Determine the value of r for different slopes.
- Graph the points and the line to visualize the problem.
- Explore similar problems involving different points or slopes, such as perpendicular or parallel lines.

These extensions deepen comprehension and help students see the broader applications of the concepts.

Conclusion and Final Thoughts

The problem of finding r so that the line through (-4, 3) and (r, -3) has a slope of 2/3 exemplifies foundational principles of coordinate geometry. It highlights how algebraic techniques can be used to solve geometric problems and emphasizes the importance of attention to detail and verification. By systematically applying the slope formula, performing cross-multiplication, and simplifying, we find that r = -13 satisfies the condition. Mastery of such problems enhances mathematical reasoning and prepares learners for more complex topics involving lines, slopes, and linear equations. Whether for academic purposes or practical applications, understanding this process is an invaluable skill in the mathematician’s toolkit.

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