

What Is An Equation Of The Line That Passes Through The Points (-4, -3) And (8, 6)?

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Understanding the equation of a line passing through specific points is a fundamental concept in algebra and coordinate geometry. When given two points, such as (-4, -3) and (8, 6), the goal is to determine the linear equation that describes the straight line connecting these points. This process involves calculating the slope of the line and then using point-slope or slope-intercept forms to find the equation. This article provides a comprehensive guide to deriving the equation of a line through two points, with detailed explanations, step-by-step procedures, and practical examples to enhance understanding.

Understanding the Basics: Coordinates and Linear Equations

Before diving into the specific problem, it is essential to grasp the fundamental concepts involved.

Coordinates in the Cartesian Plane

- Coordinate System: A two-dimensional plane defined by a horizontal axis (x-axis) and a vertical axis (y-axis).
- Points: Any location in the plane can be represented as an ordered pair (x, y), where x is the horizontal coordinate and y is the vertical coordinate.
- Given Points: In our case, the points are (-4, -3) and (8, 6).

Linear Equations and Their Forms

- Standard Form: $Ax + By + C = 0$
- Slope-Intercept Form: $y = mx + b$, where m is the slope and b is the y-intercept.
- Point-Slope Form: $y - y_1 = m(x - x_1)$, where (x_1, y_1) is a point on the line.

The key to deriving the line's equation passing through two points is first to find the slope (m), then use an appropriate form of the equation.

Calculating the Slope of the Line

The slope (m) measures the steepness of the line and is calculated as the ratio of the change in y to the change in x between two points.

Formula for Slope

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

Where:

- (x_1, y_1) = first point
- (x_2, y_2) = second point

Applying the Formula to Our Points

Given:

- Point 1: $(-4, -3)$
- Point 2: $(8, 6)$

Calculations:

$$m = \frac{6 - (-3)}{8 - (-4)} = \frac{6 + 3}{8 + 4} = \frac{9}{12} = \frac{3}{4}$$

Result: The slope of the line passing through $(-4, -3)$ and $(8, 6)$ is $m = 3/4$.

Formulating the Equation of the Line

Once the slope is known, the next step is to determine the equation of the line.

Using Point-Slope Form

The point-slope form is particularly convenient since we already have the slope and one point:

$$y - y_1 = m(x - x_1)$$

Choose either point; here, we'll use $(-4, -3)$:

$$y - (-3) = \frac{3}{4} (x - (-4))$$

Simplify:

$$y + 3 = \frac{3}{4} (x + 4)$$

Deriving the Slope-Intercept Form

Expanding the equation:

$$y + 3 = \frac{3}{4} x + \frac{3}{4} \times 4$$

$$y + 3 = \frac{3}{4} x + 3$$

Subtract 3 from both sides:

$$y = \frac{3}{4} x + 3 - 3$$

$$y = \frac{3}{4} x$$

Final Equation in Slope-Intercept Form:

$$\boxed{y = \frac{3}{4} x}$$

This is the equation of the line passing through the points (-4, -3) and (8, 6).

Verifying the Equation

To ensure the derived equation is correct, verify that both points satisfy it.

- For (-4, -3):

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$$y = \frac{3}{4}x \rightarrow -3 = \frac{3}{4} \times (-4) = -3$$

- For (8, 6):

$$6 = \frac{3}{4} \times 8 = 6$$

Both points satisfy the equation, confirming its correctness.

Additional Methods to Find the Equation of a Line

While the point-slope and slope-intercept forms are most straightforward, other approaches exist.

Using Two-Point Form

The two-point form is derived directly from the two points:

$$\frac{y - y_1}{x - x_1} = \frac{y_2 - y_1}{x_2 - x_1}$$

Substitute the points:

$$\frac{y + 3}{x + 4} = \frac{6 + 3}{8 + 4} = \frac{9}{12} = \frac{3}{4}$$

Cross-multiplied:

$$4(y + 3) = 3(x + 4)$$

Simplify:

$$4y + 12 = 3x + 12$$

Subtract 12 from both sides:

$$4y = 3x$$

Divide both sides by 4:

$$y = \frac{3}{4} x$$

Again, matching the previous result.

Practical Applications of Line Equations

Understanding how to derive the equation of a line through two points has numerous real-world applications:

- Engineering and Construction: Designing roads, bridges, and structures aligned along specific paths.
- Physics: Modeling motion along a straight path.
- Economics: Representing relationships between variables, such as supply and demand.
- Computer Graphics: Drawing lines and shapes based on coordinate points.
- Navigation: Calculating routes and paths between locations.

Summary and Key Takeaways

- To find the equation of a line passing through two points, first compute the slope using the slope formula.
- Use either point-slope or slope-intercept form to write the line's equation.
- Confirm the accuracy by substituting the original points into the derived equation.
- The line passing through (-4, -3) and (8, 6) has the equation:

$$\boxed{y = \frac{3}{4} x}$$

- Mastering this process enhances problem-solving skills in algebra, geometry, and related fields.

Additional Tips for Students and Learners

- Always check the calculations, especially when dealing with fractions.
- Practice deriving line equations with various pairs of points to build confidence.
- Understand the geometric meaning of the slope: positive slopes indicate an upward trend, negative slopes indicate a downward trend, zero slope represents a horizontal line, and an undefined slope indicates a vertical line.
- Remember that the line's equation can be expressed in many forms; choose the one most suitable for your purpose.

Conclusion

Determining the equation of a line through two points is a fundamental skill that bridges algebra and geometry. By calculating the slope and applying the appropriate formula, you can accurately describe any straight line in the coordinate plane. The specific example of points $(-4, -3)$ and $(8, 6)$ illustrates this process clearly, resulting in the equation $y = (3/4)x$. Developing proficiency with these concepts will empower you to solve more complex problems and understand the geometric relationships in various mathematical and real-world contexts.

Frequently Asked Questions

How do I find the equation of a line passing through the points $(-4, -3)$ and $(8, 6)$?

First, calculate the slope using $(y_2 - y_1) / (x_2 - x_1)$, then use point-slope form to find the equation.

What is the slope of the line passing through $(-4, -3)$ and $(8, 6)$?

The slope is $(6 - (-3)) / (8 - (-4)) = 9 / 12 = 3/4$.

How do I write the equation of a line given two points?

Find the slope, then use the point-slope form $y - y_1 = m(x - x_1)$ with one of the points, and simplify to get the slope-intercept form.

What is the equation of the line passing through $(-4, -3)$ and $(8, 6)$?

Using the slope $3/4$ and point $(-4, -3)$, the equation is $y + 3 = (3/4)(x + 4)$, which simplifies to $y = (3/4)x + 0$.

Is the line passing through $(-4, -3)$ and $(8, 6)$ in slope-intercept form?

Yes, the equation can be written as $y = (3/4)x$, which is in slope-intercept form.

How can I verify that the equation of the line passes through both points?

Substitute each point into the equation $y = (3/4)x$; if both satisfy the equation, then the line passes through both points.

Additional Resources

What Is An Equation Of The Line That Passes Through The Points (-4, -3) And (8, 6)?

Understanding the equation of a line that passes through two specific points is a fundamental concept in algebra and analytic geometry. When given two coordinate points, such as (-4, -3) and (8, 6), mathematicians and students alike aim to find a single linear equation that accurately describes the line connecting these points. This process involves several steps, including calculating the slope, determining the line's intercepts, and formulating the equation in a standard or slope-intercept form. In this article, we will explore this process in detail, providing a comprehensive overview that not only explains how to derive the equation but also contextualizes its significance in mathematical reasoning and real-world applications.

Understanding the Basics: Coordinates and Lines

What Are Coordinates?

Coordinates are numerical values that specify the position of a point in a two-dimensional plane. They are expressed in ordered pairs (x, y) , where:

- x indicates the point's horizontal position relative to the origin $(0, 0)$.
- y indicates the vertical position relative to the origin.

For example, the point $(-4, -3)$ is located 4 units to the left of the vertical (y) axis and 3 units below the horizontal (x) axis. Similarly, the point $(8, 6)$ is 8 units to the right and 6 units above the origin.

The Concept of a Line Passing Through Two Points

A straight line in a plane can be uniquely determined if two distinct points on the line are known. This is a fundamental principle in Euclidean geometry: two points define a line. The goal in our case is to find an algebraic expression—called the equation—that describes this line, meaning that any point (x, y) that lies on this line will satisfy the equation.

Step 1: Calculating the Slope of the Line

What Is Slope?

The slope of a line measures its steepness or incline. It quantifies how much the y-value changes for a given change in x-value. Mathematically, the slope (denoted as 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 ratio indicates the rate of change of y concerning x .

Calculating the Slope for Our Points

Let's compute the slope for the points $(-4, -3)$ and $(8, 6)$.

Using the formula:

$$m = \frac{6 - (-3)}{8 - (-4)} = \frac{6 + 3}{8 + 4} = \frac{9}{12} = \frac{3}{4}$$

Result: The slope of the line passing through these points is $(\frac{3}{4})$.

This positive slope indicates that as x increases, y also increases, and the line rises from left to right with a gentle incline.

Step 2: Choosing the Equation Form

Once the slope is known, the next step is to formulate the equation of the line. The most common forms are:

- Slope-Intercept Form: $(y = mx + b)$
- Point-Slope Form: $(y - y_1 = m(x - x_1))$
- Standard Form: $(Ax + By = C)$

Each form has its advantages depending on the information available and the context.

For our purposes, starting with the point-slope form is convenient because we already know a point on the line and its slope.

Step 3: Deriving the Equation Using Point-Slope Form

Applying the Point-Slope Formula

The point-slope form is:

$$y - y_1 = m(x - x_1)$$

Choosing the point $((-4, -3))$ for $((x_1, y_1))$:

$$y - (-3) = \frac{3}{4}(x - (-4))$$

Simplify:

$$y + 3 = \frac{3}{4}(x + 4)$$

Expanding and Simplifying

Distribute the slope:

$$y + 3 = \frac{3}{4}x + \frac{3}{4} \times 4$$

$$y + 3 = \frac{3}{4}x + 3$$

Subtract 3 from both sides to isolate y:

$$y = \frac{3}{4}x + 3 - 3$$

$$y = \frac{3}{4}x$$

Result: The equation of the line in slope-intercept form is:

$$y = \frac{3}{4}x$$

$$\boxed{y = \frac{3}{4}x}$$

This linear equation succinctly describes all points on the line passing through (-4, -3) and (8, 6).

Step 4: Verification of the Equation

To confirm the correctness of our derived equation, we should verify that both given points satisfy it.

- For (-4, -3):

$$y = \frac{3}{4}x \rightarrow -3 = \frac{3}{4} \times (-4) = -3$$

Yes, the point satisfies the equation.

- For (8, 6):

$$6 = \frac{3}{4} \times 8 = \frac{3}{4} \times 8 = 6$$

Again, the point satisfies the equation.

Thus, the line $(y = \frac{3}{4}x)$ passes through both points as expected.

Additional Perspectives and Variations

Expressing the Equation in Standard Form

Sometimes, it's beneficial to write the equation in the standard form $(Ax + By = C)$.

Starting from $(y = \frac{3}{4}x)$, multiply both sides by 4 to clear the denominator:

$$4y = 3x$$

Rearranged:

$$-$$

$$3x - 4y = 0$$

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This form is often used in algebraic contexts that require coefficients to be integers.

Implications of the Equation

Knowing the equation of a line helps in various applications:

- Graphing: Plotting the line on a coordinate plane.
- Finding intersections: Determining where this line intersects with others.
- Estimations: Making predictions based on the line's trend.
- Real-world modeling: Using linear equations to model relationships, such as speed over time, cost versus quantity, etc.

Applications and Significance in Broader Contexts

In Mathematics and Education

Deriving the line's equation from two points is a core skill in algebra, fostering understanding of linear relationships and the behavior of functions. It illustrates the connection between geometric intuition (the line passing through points) and algebraic expression (the equation).

In Science and Engineering

Linear equations are fundamental in modeling phenomena where relationships are proportional or additive. For example, in physics, the equation of a constant velocity motion, or in engineering, the relationship between input and output in linear systems.

In Data Analysis and Economics

Regression analysis often involves fitting a line to data points, predicting future trends, and understanding relationships between variables. The fundamental process of finding a line through points underpins these more complex statistical methods.

Conclusion: The Power of Simple Geometry and

Algebra

Finding the equation of a line passing through two points, such as $(-4, -3)$ and $(8, 6)$, exemplifies the synergy between geometric visualization and algebraic manipulation. The process—calculating the slope, choosing an appropriate form, and verifying the result—embodies a core mathematical skill that transcends classroom boundaries, impacting science, technology, and everyday problem-solving. The line $(y = \frac{3}{4}x)$ not only connects the given points but also illustrates the elegance and utility of linear equations in capturing relationships succinctly and precisely.

Summary:

- The slope (m) between $(-4, -3)$ and $(8, 6)$ is $(\frac{3}{4})$.
- Using point-slope form with point $(-4, -3)$, the line's equation simplifies to $(y = \frac{3}{4}x)$.
- The equation accurately passes through both points, confirming its correctness.
- Additional forms, such as standard form, provide alternative representations suited to different contexts.
- Understanding how to derive and interpret this equation deepens comprehension of linear relationships essential across various disciplines.

In essence, this exploration underscores how a simple pair of points encapsulates a rich mathematical process—transforming raw data into a precise, functional description of a line.

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