Two Points A (-2, 9) And B (4, 8) Lie On A Line L. (i) Find The Slope Of The Line L. (2)marks (ii) Find

Understanding the Problem Statement

Two Points A (-2, 9) And B (4, 8) Lie On A Line L. (i) Find The Slope Of The Line L. (2)marks (ii) Find

This problem involves analyzing a line in a two-dimensional coordinate plane that passes through two given points. The goal is to determine the slope of the line and to find additional properties or measurements related to this line, based on the given information.

Introduction to Points and Lines in the Coordinate Plane

Before diving into calculations, it's essential to understand some fundamental concepts related to points and lines in the Cartesian coordinate system.

Points in the Coordinate Plane

- A point in the plane is represented by an ordered pair (x, y).
- The x-coordinate indicates the position along the horizontal axis.
- The y-coordinate indicates the position along the vertical axis.

Lines in the Coordinate Plane

- A line is a collection of points extending infinitely in both directions.
- A straight line can be uniquely identified using various methods:
- Through two distinct points.
- By its slope and y-intercept.
- Using equations like slope-intercept form or point-slope form.

Finding the Slope of Line L

The first step in analyzing the line passing through points A and B is to calculate its slope.

Definition of Slope

The slope (m) of a line passing through two points (x_1, y_1) and (x_2, y_2) is given by the formula:

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

This value represents the rate of change of y with respect to x and indicates how steep the line is.

Applying the Formula to Points A and B

Given points:

- $A(-2, 9)$ with $x_1 = -2$ and $y_1 = 9$.
- $B(4, 8)$ with $x_2 = 4$ and $y_2 = 8$.

Substituting into the slope formula:

$$
m = \frac{8 - 9}{4 - (-2)} = \frac{-1}{4 + 2} = \frac{-1}{6}
$$

Therefore, the slope of line L is:

$$
\boxed{m = -\frac{1}{6}}
$$

Interpretation:
The negative slope indicates that the line decreases as x increases; for every 6 units increase in x, y decreases by 1 unit.

Further Analysis: Equation of the Line L

Once the slope is known, the next logical step is to find the line's equation. This provides a complete description of the line in algebraic form.

Using Point-Slope Form

The point-slope form of a line passing through a point (x_1, y_1) with slope m is:

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

Choosing point A $(-2, 9)$ and $m = -\frac{1}{6}$:

$$
y - 9 = -\frac{1}{6}(x + 2)
$$

Simplify to find the slope-intercept form:

$$
y - 9 = -\frac{1}{6}x - \frac{1}{6} \times 2
$$

$$
y - 9 = -\frac{1}{6}x - \frac{2}{6}
$$

$$
y - 9 = -\frac{1}{6}x - \frac{1}{3}
$$

$$

Adding 9 to both sides:

$$
y = -\frac{1}{6} x - \frac{1}{3} + 9
$$

Express 9 as $\frac{27}{3}$:

$$
y = -\frac{1}{6} x + \left(- \frac{1}{3} + \frac{27}{3}\right) = -\frac{1}{6} x + \frac{26}{3}
$$

Final Equation of Line L:

$$
\boxed{y = -\frac{1}{6} x + \frac{26}{3}}
$$

Additional Properties and Measurements of Line L

The second part of the problem likely involves finding other characteristics related to line L, such as:

- The y-intercept.
- The x-intercept.
- The length of the segment between points A and B.
- The distance from a point to the line.
- The equation in different forms (e.g., standard form).

Let's explore some of these.

Y-Intercept of the Line

The y-intercept occurs where $x=0$:

$$
y = -\frac{1}{6} \times 0 + \frac{26}{3} = \frac{26}{3}
$$

So, the y-intercept point is:

$$
(0, \frac{26}{3})
$$

X-Intercept of the Line

The x-intercept occurs where $y=0$. Set $y=0$ in the equation:

$$
0 = -\frac{1}{6} x + \frac{26}{3}
$$

Multiply through by 6 to clear denominators:

$$
0 = -x + 6 \times \frac{26}{3} = -x + 2 \times 26 = -x + 52
$$

Solve for x:

$$
x = 52
$$

Thus, the x-intercept is at:

$$
(52, 0)
$$

Distance Between Points A and B

The length of the segment AB can be found using the distance formula:

$$
d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}
$$

Substituting the points:

$$
d = \sqrt{(4 - (-2))^2 + (8 - 9)^2} = \sqrt{(6)^2 + (-1)^2} = \sqrt{36 + 1} = \sqrt{37}
$$

Hence, the length of segment AB is:

$$
\boxed{\sqrt{37}} \approx 6.08
$$

Summary of Key Results

- The slope of line L passing through points A and B is $-\frac{1}{6}$.
- The equation of line L in slope-intercept form is $y = -\frac{1}{6} x + \frac{26}{3}$.
- The y-intercept occurs at $\left(0, \frac{26}{3}\right)$.
- The x-intercept occurs at $(52, 0)$.
- The distance between points A and B is $\sqrt{37}$ units.

Conclusion

Understanding how to extract meaningful information from two points in the coordinate plane is fundamental in coordinate geometry. Calculating the slope provides insights into the line's inclination, while deriving the equation in various forms enables graphing and further analysis. The methods employed here—using the slope formula, point-slope form, and distance formula—are foundational techniques applicable to a wide array of problems in mathematics, physics, engineering, and related fields. Mastery of these concepts enhances problem-solving skills and deepens comprehension of geometric relationships in the plane.

Frequently Asked Questions

What is the formula to find the slope of the line passing through points A (-2, 9) and B (4, 8)?

The slope (m) is calculated as (change in y) divided by (change in x), so m = (8 - 9) / (4 - (-2)) = (-1) / (6) = -1/6.

What is the value of the slope of line L passing through points A (-2, 9) and B (4, 8)?

The slope of line L is -1/6.

How do you find the equation of line L passing through points A (-2, 9) and B (4, 8)?

First, find the slope m = -1/6. Then, use point-slope form with one point (e.g., A): y - 9 = (-1/6)(x + 2). Simplify to get the line's equation.

What is the point-slope form of the line passing through point A (-2, 9) with slope -1/6?

The point-slope form is y - 9 = (-1/6)(x + 2).

How can you verify that point B (4, 8) lies on the line with equation y - 9 = (-1/6)(x + 2)?

Substitute x = 4 into the equation: y - 9 = (-1/6)(4 + 2) = (-1/6)(6) = -1. So, y - 9 = -1, hence y = 8, which matches point B's y-coordinate, confirming it lies on the line.

What is the slope-intercept form of the line passing through points A (-2, 9) and B (4, 8)?

Using the slope m = -1/6 and point A, the equation in slope-intercept form is y = (-1/6)x + (since y - 9 = (-1/6)(x + 2), then y = (-1/6)x + (9 - (-1/6) 2)). Calculating the intercept: y = (-1/6)x + 10/3.

Additional Resources

Understanding the Line L Passing Through Points A (-2, 9) and B (4, 8): A Comprehensive Review

When working with coordinate geometry, one of the fundamental concepts is understanding how points relate to lines in the Cartesian plane. In this context, we're considering two specific points, A (-2, 9) and B (4, 8), which lie on the same line, referred to as Line L. Our goal is to explore the methods to analyze this line, starting with calculating its slope, and then delving deeper into related aspects such as the equation of the line, its properties, and applications.

Part 1: Finding the Slope of Line L

Understanding the Slope Concept

The slope of a line is a measure that indicates its steepness and direction. It is a fundamental attribute in the equation of a line and provides insight into how the y-value changes concerning the 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 formula computes the ratio of the change in y-coordinates (rise) to the change in x-coordinates (run).

Calculating the Slope for Points A and B

Given points:
- $A (-2, 9)$ with $x_1 = -2$, $y_1 = 9$
- $B (4, 8)$ with $x_2 = 4$, $y_2 = 8$

Applying the slope formula:

$$
m = \frac{8 - 9}{4 - (-2)} = \frac{-1}{4 + 2} = \frac{-1}{6}
$$

Result:

$$
\boxed{m = -\frac{1}{6}}
$$

This negative slope indicates that Line L declines as we move from left to right. The line is decreasing at a rate of one unit vertically for every six units horizontally.

Significance of the Slope

- Positive slope (> 0): Line rises from left to right.

- Negative slope (< 0): Line falls from left to right.
- Zero slope (0): Horizontal line.
- Undefined slope: Vertical line where $x_1 = x_2$.

In this case, the slope of $-\frac{1}{6}$ tells us that the line is slightly decreasing, with a gentle slope.

Part 2: Further Analysis of the Line L

Having established the slope, the next natural step involves understanding the line's equation, its properties, and how it can be represented in various forms.

Part 2.1: Equation of Line L

Point-Slope Form

The point-slope form is an effective way to write the equation of a line when you know a point on the line and its slope:

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

Choosing point A (-2, 9):

$$
y - 9 = -\frac{1}{6} (x + 2)
$$

Simplify:

$$
y - 9 = -\frac{1}{6} x - \frac{1}{3}
$$

Add 9 to both sides:

$$
y = -\frac{1}{6} x - \frac{1}{3} + 9
$$

Express 9 as a fraction with denominator 3:

$$
y = -\frac{1}{6} x - \frac{1}{3} + \frac{27}{3}
$$

Combine:

$$
y = -\frac{1}{6} x + \frac{26}{3}
$$

Thus, the equation of line L in slope-intercept form:

$$
\boxed{y = -\frac{1}{6} x + \frac{26}{3}}
$$

Standard Form of the Line

Multiply through by 6 to clear fractions:

$$
6y = -x + 52
$$

Rearranged:

$$
x + 6y = 52
$$

This is the standard form of the line, which is often used for algebraic manipulations and geometric interpretations.

Part 2.2: Graphical Representation

Visualizing the line provides intuitive understanding:

- The y-intercept (c) is $\frac{26}{3} \approx 8.67$. This is where the line crosses the y-axis.
- The slope indicates that for every increase of 6 units in x, y decreases by 1 unit.
- Plotting points:
- At $x = 0$, $y \approx 8.67$
- At $x = -6$, $y = -\frac{1}{6} \times -6 + \frac{26}{3} = 1 + \frac{26}{3} \approx 9.67$

Plotting these points and drawing a straight line passing through them confirms the accuracy of the equation.

Part 2.3: Properties of Line L

Midpoint Between Points A and B

The midpoint M between points A and B is calculated as:

$$
M_x = \frac{x_1 + x_2}{2} = \frac{-2 + 4}{2} = 1
$$
$$
M_y = \frac{y_1 + y_2}{2} = \frac{9 + 8}{2} = 8.5
$$

So, the midpoint is:

$$
\boxed{M (1, 8.5)}
$$

This point lies on the line and can serve as a reference for various geometric constructions.

Distance Between Points A and B

The length of segment AB:

$$
d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2} = \sqrt{(4 - (-2))^2 + (8 - 9)^2} = \sqrt{6^2 + (-1)^2} = \sqrt{36 + 1} = \sqrt{37}
$$

Approximately:

$$
d \approx 6.08
$$

The segment length provides insight into the scale of the figure and can be useful for applications involving measurements.

Part 2.4: Parallel and Perpendicular Lines

Understanding lines related to line L enhances problem-solving skills:

- Parallel lines: Lines with the same slope, $-\frac{1}{6}$, but different y-intercepts.
- Perpendicular lines: Lines with slopes that are negative reciprocals. The slope of any line perpendicular to L would be:

$$
m_{\perp} = -\frac{1}{m} = -\frac{1}{-\frac{1}{6}} = 6
$$

The perpendicular line passing through A would have the form:

$$
y - 9 = 6(x + 2)
$$

which simplifies to:

$$
y = 6x + 12 + 9 = 6x + 21
$$

Part 2.5: Applications and Real-World Contexts

Line equations like the one we've derived serve numerous practical applications:

- Navigation: Determining straight-line paths between points.
- Engineering: Structural analyses involving slopes and intercepts.
- Physics: Describing motion, where slope could represent velocity.
- Economics: Modeling linear relationships between variables.

Understanding the slope and equation of lines helps in optimizing, predicting, and analyzing real-world data.

Conclusion

The exercise of analyzing the line passing through points A (-2, 9) and B (4, 8) encapsulates core principles of coordinate geometry:

- The slope is computed as $-\frac{1}{6}$, indicating a gentle decline.
- The equation of the line can be expressed in both slope-intercept form $y = -\frac{1}{6} x + \frac{26}{3}$ and standard form $x + 6y = 52$.
- The line's properties, including the midpoint, length between points, and relationships with parallel and perpendicular lines, are essential for deeper geometric understanding.
- Visualizing the line aids in grasping the concepts and applying them in practical contexts.

In essence, such detailed analysis not only reinforces fundamental concepts in algebra and geometry but also enhances problem-solving skills applicable across various scientific and engineering disciplines. The process underscores the importance of precision, visualization, and contextual understanding in mathematical investigations.

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