

Line Z Has A Slope Of 2.5 And Goes Through Points (4,13) . Which Equation Best Represents Line Z? A $Y=2.5x-23$ B

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Understanding the equation of a line is fundamental in algebra and coordinate geometry. When given specific information such as the slope of the line and a point through which it passes, you can accurately determine its equation. In this article, we will explore how to find the equation of Line Z, which has a slope of 2.5 and passes through the point (4, 13). We will analyze the given options, particularly focusing on the suggested equation $Y = 2.5x - 23$, and explain the steps to verify whether it correctly represents Line Z. Additionally, we will provide a comprehensive guide on the concepts involved, including slope-intercept form, point-slope form, and the methods to derive the equation from known information.

Understanding the Basics: Slope and Points

Before delving into the specific problem, it is essential to understand the fundamental concepts:

What is the Slope of a Line?

- The slope of a line indicates its steepness or incline.
- It is calculated as the ratio of the change in y to the change in x between two points on the line:
$$m = \frac{\Delta y}{\Delta x}$$
- A positive slope, such as 2.5, indicates the line rises as x increases.

What Does It Mean for a Line to Pass Through a Point?

- A point (x_1, y_1) lies on the line if substituting these coordinates into the line's equation satisfies it.
- Knowing a point and the slope allows you to precisely determine the line's equation.

Formulating the Equation of Line Z

Given:

- Slope $(m = 2.5)$
- Point $(4, 13)$

We can use the point-slope form of a line's equation:

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

Substituting the known values:

$$y - 13 = 2.5(x - 4)$$

This is the point-slope form. To express the line in the slope-intercept form $(y = mx + b)$, expand and simplify:

$$\begin{aligned} y - 13 &= 2.5x - 10 \\ y &= 2.5x - 10 + 13 \\ y &= 2.5x + 3 \end{aligned}$$

Thus, the equation of line Z is:

$$\boxed{y = 2.5x + 3}$$

Verifying the Given Equation: Is $(y = 2.5x - 23)$ the Correct Representation?

The problem mentions an option:

$$A) (y = 2.5x - 23)$$

Let's verify whether this equation passes through the point $(4, 13)$:

Substitute $(x = 4)$ into the equation:

$$y = 2.5(4) - 23 = 10 - 23 = -13$$

But the given point's y-coordinate is 13, not -13. Since the point $(4, 13)$ does not satisfy the equation

$(y = 2.5x - 23)$, this equation does not represent the line passing through (4, 13).

Conclusion:

Option A, $(y = 2.5x - 23)$, is not the correct equation of Line Z.

Deriving the Correct Equation of Line Z

As established earlier, the correct line passing through (4, 13) with a slope of 2.5 is:

$$\boxed{y = 2.5x + 3}$$

This can be confirmed by substituting $(x=4)$:

$$y = 2.5(4) + 3 = 10 + 3 = 13$$

which matches the known point.

Additional Forms of the Line's Equation

While the slope-intercept form $(y = 2.5x + 3)$ is the most straightforward, other equivalent forms exist:

Point-Slope Form

$$y - 13 = 2.5(x - 4)$$

Standard Form

Rearranged from slope-intercept:

$$y - 2.5x = 3$$

or

$$y - 2.5x - 3 = 0$$

$$2.5x - y = -3$$

\]

Multiplying through by 2 to clear decimals:

\]

$$5x - 2y = -6$$

\]

How to Use These Equations in Practice

Understanding the various forms of the line's equation allows for flexibility in solving problems:

- Slope-Intercept Form ($y = mx + b$): Useful when graphing or identifying the y-intercept directly.
- Point-Slope Form: Handy when you know a point and the slope but prefer to write the equation directly.
- Standard Form: Often used in algebraic manipulations and when solving systems of equations.

Applications and Importance of Correct Line Equations

Knowing how to derive and verify the equation of a line based on given data has numerous practical applications:

- Graphing: Accurate plotting of lines for visual analysis.
- Data Analysis: Fitting lines to data points in regression analysis.
- Physics and Engineering: Describing relationships between variables.
- Economics: Modeling linear relationships such as supply and demand.

Summary and Key Takeaways

- The slope-intercept form of the line passing through (4, 13) with a slope of 2.5 is $y = 2.5x + 3$.
- The proposed equation $y = 2.5x - 23$ does not satisfy the point (4, 13) and is therefore incorrect.
- To verify the correctness of a line's equation, substitute known points and check for consistency.
- Multiple forms of a line's equation exist; choose the one most suited for your purpose.

SEO Keywords and Phrases

- Equation of a line given slope and point
- How to find the equation of a line
- Slope-intercept form of a line
- Point-slope form of a line
- Standard form of a line equation
- Verifying line equations with points
- Line passing through a point with known slope
- Algebraic equations of lines
- Linear equation calculator
- Best representation of line with given data

Final Thoughts

Understanding how to derive the equation of a line from given slope and points is a vital skill in algebra. By applying the point-slope formula and simplifying to slope-intercept form, one can accurately determine the equation that models the line. Remember to verify your equations by substituting known points to ensure correctness. In the case of Line Z with a slope of 2.5 passing through (4, 13), the correct equation is $y = 2.5x + 3$, not the proposed $y = 2.5x - 23$. Mastering these concepts enhances problem-solving skills and prepares you for more advanced topics in mathematics and related fields.

Frequently Asked Questions

What is the slope of line Z?

The slope of line Z is 2.5.

Which point does line Z pass through?

Line Z passes through the point (4, 13).

How do you find the equation of a line given a point and a slope?

Use the point-slope form: $y - y_1 = m(x - x_1)$, then simplify to slope-intercept form if needed.

What is the point-slope form of the equation for line Z?

Using point (4,13) and slope 2.5, the point-slope form is $y - 13 = 2.5(x - 4)$.

How do you convert the point-slope form to slope-intercept form?

Distribute the slope, then add or subtract to solve for y : $y = 2.5x - 10 + 13$, which simplifies to $y = 2.5x + 3$.

What is the correct equation of line Z based on the given information?

The correct equation is $y = 2.5x + 3$.

Is the provided option $y = 2.5x - 23$ correct for line Z?

No, $y = 2.5x - 23$ is not correct because it does not pass through (4,13).

How can you verify if an equation matches line Z?

Substitute the point (4,13) into the equation and check if both sides are equal.

Why is the equation $y = 2.5x + 3$ the best representation for line Z?

Because it has the correct slope and passes through the point (4,13), satisfying the given conditions.

What is the importance of checking a point when determining a line's equation?

Checking ensures that the derived equation accurately represents the line passing through the given point.

Additional Resources

Understanding the Equation of Line Z: A Comprehensive Analysis

When studying the properties and equations of lines in coordinate geometry, the foundational concepts of slope and points through which a line passes are crucial. In this detailed review, we will explore the problem: Line Z has a slope of 2.5 and passes through the point (4, 13). Which equation best represents Line Z? Specifically, we will analyze the equation $Y = 2.5x - 23$ and evaluate its suitability as the equation of Line Z.

Fundamentals of Line Equations in Coordinate Geometry

Before delving into the specifics of the problem, it is essential to revisit the core principles that underpin the equations of lines.

The Slope-Intercept Form

- The slope-intercept form is expressed as $Y = mX + b$, where:
 - m is the slope of the line.
 - b is the y-intercept, the point where the line crosses the y-axis (i.e., when $x=0$).
- This form is particularly useful for quickly graphing lines and understanding how the slope and intercept influence the line's placement.

Determining the Equation of a Line Given a Point and Slope

- When a line's slope (m) and a specific point $((x_1, y_1))$ are known, the point-slope form is often used:

$$\begin{aligned} & \backslash \\ y - y_1 &= m(x - x_1) \\ & \backslash \end{aligned}$$

- To convert this to slope-intercept form, algebraic manipulation is performed.

Applying the Concepts to Line Z

Given:

- Slope (m) = 2.5
- Point $((x_1, y_1)) = (4, 13)$

Our goal is to determine which equation best represents Line Z, specifically examining whether $Y = 2.5x - 23$ is correct.

Step 1: Write the Point-Slope Equation

Using the point-slope form:

$\backslash$

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

\]

Plugging in the known values:

\[

$$y - 13 = 2.5 (x - 4)$$

\]

Step 2: Convert to Slope-Intercept Form

Distribute the slope:

\[

$$y - 13 = 2.5x - 10$$

\]

Add 13 to both sides:

\[

$$y = 2.5x - 10 + 13$$

\]

Simplify:

\[

$$y = 2.5x + 3$$

\]

This is the slope-intercept form based on the given point and slope:

\[

$$\boxed{Y = 2.5x + 3}$$

\]

Comparison with the Proposed Equation: $Y = 2.5x - 23$

The equation $Y = 2.5x - 23$ has the same slope (2.5) but a different y-intercept, specifically -23.

- The y-intercept of the derived line is +3.
- The y-intercept of the proposed equation is -23.

Implication: The line described by $Y = 2.5x - 23$ crosses the y-axis at -23, which is not consistent with passing through the point (4, 13) as shown below.

Verifying the Proposed Equation $Y = 2.5x - 23$

To determine whether $Y = 2.5x - 23$ passes through (4, 13):

- Substitute $x=4$:

$$\begin{aligned} & \backslash \\ Y &= 2.5(4) - 23 = 10 - 23 = -13 \\ & \backslash \end{aligned}$$

- The result is -13, which does not match the y-coordinate of the point, 13.

Conclusion: The point (4,13) does not lie on the line $Y = 2.5x - 23$. Therefore, this equation does not accurately represent Line Z.

Correct Equation of Line Z

From the earlier calculations:

$$\begin{aligned} & \backslash \\ y &= 2.5x + 3 \\ & \backslash \end{aligned}$$

- When $x=4$:

$$\begin{aligned} & \backslash \\ Y &= 2.5(4) + 3 = 10 + 3 = 13 \\ & \backslash \end{aligned}$$

which matches the point (4,13), confirming the correctness.

Thus, the accurate equation for Line Z is:

$$\begin{aligned} & \backslash \\ \boxed{Y} &= 2.5x + 3 \\ & \backslash \end{aligned}$$

Understanding the Significance of the Y-Intercept

The y-intercept provides insight into where the line crosses the y-axis.

- In the correct equation, $Y = 2.5x + 3$, the line crosses y-axis at (0,3).
- In the proposed equation, $Y = 2.5x - 23$, the line crosses y-axis at (0,-23).

Given the point (4,13), the intercept at 3 makes sense in the context of the line passing through that point, while -23 clearly does not.

Graphical Interpretation and Visualization

Visualizing the lines helps reinforce the algebraic findings.

- The line $Y = 2.5x + 3$ passes through (4,13) and crosses the y-axis at (0,3).
- The line $Y = 2.5x - 23$ crosses the y-axis at (0,-23), which is far from the point (4,13).

Plotting both lines would show that only the line with the y-intercept at 3 aligns with the given point, confirming the algebraic conclusion.

Implications for Learning and Problem Solving

This analysis underscores several key lessons:

- Always verify the proposed equation with the given point to confirm correctness.
- Understanding the relationship between slope, intercept, and points is essential for constructing accurate line equations.
- Algebraic manipulation from point-slope to slope-intercept form is straightforward but must be performed carefully.
- Graphical visualization can aid in confirming the correctness of the algebraic solution.

Summary and Final Recommendations

- The given slope of 2.5 and point (4,13) lead to the equation:

$$\boxed{Y = 2.5x + 3}$$

- The proposed equation $Y = 2.5x - 23$ does not correctly represent Line Z because it does not pass through the given point.

- When solving similar problems, always:
- Use the point-slope form for initial derivations.
- Convert to slope-intercept form for clarity.
- Verify the line equation with the given point.
- Consider the y-intercept to ensure it aligns with the point provided.

In conclusion, understanding the interplay between slope, points, and the line equation is foundational in coordinate geometry. Correctly applying these principles enables precise problem-solving and accurate representation of lines in the Cartesian plane.

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