Use The Point -slope Formula To Write An Equation Of The Line That Passes Through (2.9,0.4) And Has A

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Understanding how to find the equation of a line is a fundamental skill in algebra and coordinate geometry. When given a specific point and the slope of a line, students can determine the line's equation using the point-slope formula. This tutorial will guide you through the process of using the point-slope formula to write the equation of a line passing through a given point, specifically (2.9, 0.4), and with a specified slope, which we'll denote as A. Whether you're preparing for exams or just strengthening your algebraic skills, mastering this method is essential.

What Is the Point-Slope Formula?

The point-slope formula is a way to write the equation of a line when you know:

- A point through which the line passes, denoted as (x_1, y_1)

- The slope of the line, denoted as m

The formula is expressed as:

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

This formula is versatile and straightforward, allowing you to derive the line's equation directly from the known point and slope.

Applying the Point-Slope Formula: Step-by-Step Guide

Let's assume you are given the point $(2.9, 0.4)$ and a slope A. Your goal is to write the equation of the line passing through this point with the specified slope.

Step 1: Identify Your Known Values

- Point: $(x_1, y_1) = (2.9, 0.4)$

- Slope: $m = A$

Ensure you know the value of A. It can be any real number, such as 2, -3.5, or $\frac{1}{2}$.

Step 2: Write the Point-Slope Equation

Substitute the known values into the formula:

$$ y - 0.4 = A(x - 2.9) $$

Step 3: Simplify the Equation

Depending on your needs, you can leave the equation in point-slope form or convert it to slope-intercept or standard form.

Converting to Slope-Intercept Form ($y = mx + b$)

1. Distribute the slope A:

$$ y - 0.4 = A x - 2.9A $$

2. Add 0.4 to both sides:

$$ y = A x - 2.9A + 0.4 $$

This is the slope-intercept form, which explicitly shows the slope A and the y-intercept $-2.9A + 0.4$.

Converting to Standard Form ($Ax + By = C$)

1. Start from the point-slope form:

$$ y - 0.4 = A(x - 2.9) $$

2. Rearrange:

$$ y = A x - 2.9A + 0.4 $$

3. Bring all terms to one side:

$$ y - A x = - 2.9A + 0.4 $$

4. Multiply through by -1 if desired to standardize:

$$ A x - y = 2.9A - 0.4 $$

This form is useful for certain applications, such as finding intersections.

Understanding the Role of the Slope A

The slope A determines the steepness and direction of the line:

- If $A > 0$, the line rises as x increases.

- If $A < 0$, the line falls as x increases.

- If $A = 0$, the line is horizontal.

- If A is undefined or not given, the line is vertical, and the equation is $x = 2.9$.

Knowing the value of A is crucial for accurately writing the line's equation.

Practice Examples

Let's examine some example problems to reinforce understanding.

Example 1: Find the line passing through (2.9, 0.4) with a slope of 3

Solution:

Using the point-slope formula:

$$ y - 0.4 = 3(x - 2.9) $$

Distributing:

$$ y - 0.4 = 3x - 8.7 $$

Adding 0.4 to both sides:

$$ y = 3x - 8.7 + 0.4 $$

$$ y = 3x - 8.3 $$

This is the slope-intercept form.

Example 2: Find the line passing through (2.9, 0.4) with a slope of $-\frac{1}{2}$

Solution:

Using the point-slope formula:

$$ y - 0.4 = -\frac{1}{2}(x - 2.9) $$

Distribute:

$$ y - 0.4 = -\frac{1}{2}x + \frac{1}{2} \times 2.9 $$

Calculate:

$$ y - 0.4 = -\frac{1}{2}x + 1.45 $$

Add 0.4 to both sides:

$$ y = -\frac{1}{2}x + 1.45 + 0.4 $$

$$ y = -\frac{1}{2}x + 1.85 $$

Special Cases and Additional Tips

Vertical Lines

- When the slope A is undefined (which occurs when the line is vertical), the equation is simply:

$$ x = 2.9 $$

- No point-slope form is necessary; this is the standard form of a vertical line.

Horizontal Lines

- When $A = 0$, the line is horizontal, passing through $(2.9, 0.4)$, and its equation is:

$$ y = 0.4 $$

Choosing the Correct Form

- Use the point-slope form when the slope and a point are known.

- Convert to slope-intercept form for easy graphing.

- Convert to standard form for algebraic operations like finding intersections.

Visualizing the Line

Graphing the line helps in understanding its behavior. To do so:

1. Plot the given point $(2.9, 0.4)$.

2. Use the slope A to identify another point:

- For example, move right 1 unit ($x + 1$) and up or down based on the slope A:

- If $A = 2$, from $(2.9, 0.4)$, go to $(2.9 + 1, 0.4 + 2) = (3.9, 2.4)$.

3. Draw a straight line through these points.

This visual approach reinforces the algebraic derivation.

Conclusion

Mastering how to use the point-slope formula to write the equation of a line passing through a specific point with a given slope is an essential algebra skill. Remember that:

- The formula is $y - y_1 = m(x - x_1)$.

- Substitute the point coordinates and slope A.

- Simplify to your desired form for easier interpretation or graphing.

- Recognize special cases for horizontal and vertical lines.

With consistent practice, you'll be able to quickly and accurately write equations of lines in various contexts. This foundational skill opens doors to more advanced topics in algebra, calculus, and coordinate geometry, empowering you to analyze and interpret linear functions effectively.

Frequently Asked Questions

How do you use the point-slope formula to write the equation of a line passing through (2.9, 0.4) with a given slope?

You substitute the point (2.9, 0.4) and the slope into the point-slope formula $y - y_1 = m(x - x_1)$.

What is the point-slope formula and how is it used in line equations?

The point-slope formula is $y - y_1 = m(x - x_1)$, used to find the equation of a line given a point and slope.

If a line passes through (2.9, 0.4) and has a slope of 3, what is its equation?

Using the point-slope formula: $y - 0.4 = 3(x - 2.9)$, which simplifies to $y = 3x - 8.3 + 0.4$, giving $y = 3x - 7.9$.

How can I find the equation of a line passing through (2.9, 0.4) with an unknown slope?

You write the equation as $y - 0.4 = m(x - 2.9)$, where m is the slope, which can be determined if additional information is provided.

What steps should I follow to write the equation of a line using the point-slope formula?

Identify the point and slope, substitute into $y - y_1 = m(x - x_1)$, then simplify to slope-intercept form if needed.

Can I convert the point-slope form to slope-intercept form after writing the equation?

Yes, after substituting the point and slope, expand and simplify to convert the equation into $y = mx + b$ format.

Why is the point (2.9, 0.4) important when using the point-slope formula?

Because it provides a specific point through which the line passes, allowing you to write its equation given the slope.

Is the point-slope formula applicable for vertical lines passing through (2.9, 0.4)?

No, vertical lines have undefined slope and are written as x = constant; the point-slope formula is for non-vertical lines.

How do I determine the slope if the line passes through (2.9, 0.4) and another point?

Calculate the slope $m = (y_2 - y_1) / (x_2 - x_1)$ using the two points, then use the point-slope formula to find the line's equation.

Additional Resources

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Introduction

In the realm of analytic geometry, the ability to derive the equation of a line from given points and slopes is fundamental. Among the various methods available, the point-slope formula stands out for its straightforwardness and efficiency, especially when a specific point and the slope are known. This article undertakes an in-depth exploration of how to utilize the point-slope formula to write the equation of a line passing through the point (2.9, 0.4) with a given slope, which will be elucidated further.

Understanding the Point-Slope Formula

Definition and Significance

The point-slope form of a line's equation is expressed as:

\[y - y_1 = m(x - x_1) \]

where:

- \((x_1, y_1) \) is a known point through which the line passes.
- \(m \) is the slope of the line.

This formula is particularly advantageous when the slope and a point are known, as it allows for immediate formulation of the line's equation without first needing to find the y-intercept.

Why Use the Point-Slope Formula?

- Efficiency: It simplifies the process, especially when the slope and a point are given.
- Clarity: It provides a clear, direct route to the line's equation.
- Flexibility: It can be easily rearranged into other forms like slope-intercept or standard form.

Step-by-Step Process to Write the Line Equation

To demonstrate the application of the point-slope formula, consider the process involving the point $(2.9, 0.4)$ and an unspecified slope m. The steps are as follows:

1. Identify the Known Point and Slope

- Known point: $(x_1, y_1) = (2.9, 0.4)$
- Known or given slope: m

(Note: Since the problem statement indicates "has a," it suggests the slope has not been specified here. For illustration, we will use a hypothetical slope; subsequent sections will discuss how to handle different slope values.)

2. Write the Point-Slope Equation

$$y - 0.4 = m(x - 2.9)$$

This is the general form, with m remaining as an unknown for now.

3. Substituting the Slope

Depending on the given slope:

- For example, if $m = 1$:

$$y - 0.4 = 1(x - 2.9)$$

which simplifies to:

$$y - 0.4 = x - 2.9$$

$$y = x - 2.9 + 0.4$$

$$y = x - 2.5$$

- For a different slope, say $m = -2$:

$$y - 0.4 = -2(x - 2.9)$$

$$ y - 0.4 = -2x + 5.8 $$

$$ y = -2x + 5.8 + 0.4 $$

$$ y = -2x + 6.2 $$

Handling Different Slope Scenarios

Since the slope m is not specified in the initial prompt, this section discusses the implications of various slope values and how to proceed.

1. Known Slope Value

If the slope is given, simply substitute into the point-slope formula and simplify, as illustrated in the previous examples.

2. Slope Is Unknown

If the slope is unknown, but other information is provided (e.g., the line is parallel or perpendicular to another line), you can determine m accordingly:

- Parallel lines: share the same slope.
- Perpendicular lines: have slopes that are negative reciprocals.

3. Slope as a Variable

In some cases, the slope may be expressed as a variable m. The equation remains:

$$ y - 0.4 = m(x - 2.9) $$

and can be left in this form or rearranged as needed.

Converting to Other Forms

Once the point-slope form is established, it can be transposed into other common line equations for different applications.

Slope-Intercept Form

Rearranged from point-slope:

$$ y = m(x - 2.9) + 0.4 $$

which expands to:

$$ y = mx - 2.9m + 0.4 $$

This form is especially useful when you want to identify the y-intercept explicitly.

Standard Form

Rearranged to standard form:

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

or expanded and rearranged:

$$ y - y_1 - m x + m x_1 = 0 $$

which simplifies to:

$$ m x - y + (y_1 - m x_1) = 0 $$

Practical Applications and Examples

Example 1: Write the line equation for slope $m = 3$

Given:

$$ (x_1, y_1) = (2.9, 0.4) $$
$$ m = 3 $$

Applying point-slope:

$$ y - 0.4 = 3(x - 2.9) $$

Simplify:

$$ y - 0.4 = 3x - 8.7 $$

$$ y = 3x - 8.7 + 0.4 $$

$$ y = 3x - 8.3 $$

Example 2: Write the line equation for a perpendicular slope if the original slope is 3

The negative reciprocal:

$$ m_{perp} = -\frac{1}{3} $$

Applying point-slope:

$$ y - 0.4 = -\frac{1}{3}(x - 2.9) $$

Simplify:

$$ y - 0.4 = -\frac{1}{3}x + \frac{2.9}{3} $$

$$ y = -\frac{1}{3}x + \frac{2.9}{3} + 0.4 $$

Expressing as a decimal:

$$ \frac{2.9}{3} \approx 0.9667 $$
$$ y \approx -\frac{1}{3}x + 0.9667 + 0.4 $$
$$ y \approx -\frac{1}{3}x + 1.3667 $$

Analytical Considerations and Limitations

- Precision of Input Data: The accuracy of the resulting equation hinges on the precision of the known point and slope.
- Slope Ambiguity: Without a specified slope, the line cannot be uniquely determined; the point-slope formula provides a family of lines parameterized by m.
- Equation Forms: Depending on the context, different forms of the line's equation may be preferable; the point-slope form is often most straightforward for derivation purposes.

Broader Implications and Educational Significance

Mastering the use of the point-slope formula is crucial in fields ranging from engineering to economics, where modeling relationships between variables is essential. It also serves as a foundation for understanding more complex concepts like linear transformations and regressions.

Educationally, the process exemplifies algebraic manipulation, understanding of geometric concepts, and the importance of clarity in mathematical communication.

Conclusion

The point-slope formula provides a powerful and elegant method for deriving the equation of a line when a point and slope are known. Its versatility allows for quick formulation and conversion into various useful forms, facilitating deeper understanding and practical application across disciplines. Whether working with explicit slope values or exploring the family of lines passing through a specific point, mastering this technique is an essential component of mathematical literacy.

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Acknowledgments

This article was prepared to provide comprehensive insight into the application of the point-slope formula, aiming to support educators, students, and practitioners in mastering fundamental analytical geometry techniques.

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