WILL GIVE BRAINLIEST!!!find The Equation Of The Line That Passes Through The Point (1,4) And Is Parallel

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Understanding the Problem: Finding the Equation of a Parallel Line

When tackling problems involving straight lines in coordinate geometry, it's essential to understand the fundamental concepts about lines, their slopes, and how they relate to each other. In this particular problem, we are asked to find the equation of a line that passes through a specific point, (1, 4), and is parallel to another line.

The key points to note are:

- The line must pass through the point (1, 4).
- The line must be parallel to a given line (though the original problem might specify which line; if not, we assume a general case or a specific line for illustration).

This type of problem is common in algebra and coordinate geometry, and solving it involves understanding the properties of parallel lines, the concept of slope, and how to formulate the equation of a line.

Key Concepts for Solving the Problem

1. The Equation of a Line in Slope-Intercept Form

The most common form used for line equations is the slope-intercept form:

$$ y = mx + b $$

where:
- m is the slope of the line.
- b is the y-intercept (the point where the line crosses the y-axis).

2. Slope of a Parallel Line

Two lines are parallel if and only if they have the same slope. Therefore, to find the equation of a line parallel to a given line, we must determine the slope of the original line and then use that same slope.

3. Point-Slope Form of a Line

Another useful form is the point-slope form:

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

where:
- (x_1, y_1) is a point on the line.
- m is the slope.

This form is especially handy when a point and slope are known.

Step-by-Step Solution to Find the Equation of the Parallel Line

Assuming the problem states that the line we are to find must be parallel to a specific line, for example, the line:

$$ y = 2x + 3 $$

which has a slope $m = 2$.

If the original line's slope is given, the process is straightforward. If not, you need that information; otherwise, you cannot determine the parallel line's slope.

Using the given point $(1, 4)$ and the slope $m = 2$, here are the steps:

Step 1: Identify the slope of the original line

- For the example, the slope $m = 2$.

Step 2: Use the point-slope form to write the equation

- Plug in the point $(x_1, y_1) = (1, 4)$ and the slope $m = 2$:

$$ y - 4 = 2(x - 1) $$

Step 3: Simplify the equation to slope-intercept form

$$ y - 4 = 2x - 2 $$

$$ y = 2x - 2 + 4 $$

$$ y = 2x + 2 $$

This is the equation of the line passing through (1, 4) and parallel to the line $y = 2x + 3$.

General Approach When the Original Line is Not Given

If the problem does not specify the line to which the new line must be parallel, but only asks for a line passing through (1, 4) and parallel to some existing line, then:

- You must know the slope of the existing line.
- If the slope is unknown, you cannot uniquely determine the new line unless additional information is provided.

In real-world scenarios or exam questions, the original line is often specified. If not, you are expected to understand how to find the line given the slope and a point.

Alternative Scenarios and Examples

Example 1: Find the line passing through (1, 4) and parallel to y = -3x + 5

- Slope of the given line: $m = -3$
- Use point-slope form:

$$ y - 4 = -3(x - 1) $$

- Simplify:

$$ y - 4 = -3x + 3 $$

$$ y = -3x + 3 + 4 $$

$$ y = -3x + 7 $$

Result: $y = -3x + 7$

Example 2: Find the line passing through (1, 4) and parallel to y = 0.5x - 2

- Slope: $m = 0.5$

- Point-slope form:

$$y - 4 = 0.5(x - 1)$$

- Simplify:

$$y - 4 = 0.5x - 0.5$$

$$y = 0.5x - 0.5 + 4$$

$$y = 0.5x + 3.5$$

Result: $y = 0.5x + 3.5$

Key Takeaways and Tips for Solving Parallel Line Problems

- Always identify the slope of the original line when given.
- Remember that parallel lines have identical slopes.
- Use the point-slope form for easy calculation when a point and slope are known.
- Convert the line equation into slope-intercept form for clarity and standard presentation.
- Check your work by verifying that the line passes through the given point.

Common Mistakes to Avoid

- Forgetting that parallel lines share the same slope.
- Mixing up the slope and y-intercept.
- Incorrectly substituting values into the point-slope formula.
- Failing to simplify the equation fully after substitution.
- Assuming the slope without proper information.

Conclusion: Mastering the Equation of Parallel Lines

Finding the equation of a line passing through a specific point and parallel to another line is a fundamental skill in algebra and coordinate geometry. By understanding the relationship between parallel lines, recognizing the importance of slope, and mastering the point-slope form, students can efficiently solve such problems. Whether the original line is given explicitly or implied, the key steps involve identifying the correct slope, using the point-slope formula, and simplifying to the desired form. With practice, solving these types of problems becomes straightforward, laying a solid foundation for more advanced topics in mathematics.

Frequently Asked Questions

What is the general form of the equation of a line that passes through the point (1, 4) and is parallel to a given line?

The general form is $y - y_1 = m(x - x_1)$, where (x_1, y_1) is the point (1, 4) and m is the slope of the line parallel to the given line.

How do you find the slope of a line parallel to a given line?

The slope of a line parallel to a given line is the same as the slope of that line. So, if the original line has slope m, the parallel line will also have slope m.

If a line passes through point (1, 4) and is parallel to the line y = 2x + 3, what is its equation?

Since the given line has slope 2, the parallel line also has slope 2. Using point-slope form: $y - 4 = 2(x - 1)$. Simplifying, $y - 4 = 2x - 2$, so the equation is $y = 2x + 2$.

What is the step-by-step method to find the equation of a line passing through a point and parallel to another line?

1. Identify the slope of the given line. 2. Use that slope as the slope for the new line. 3. Plug in the point (1, 4) into the point-slope form: $y - y_1 = m(x - x_1)$. 4. Simplify to slope-intercept form if needed.

Can the equation of a line passing through (1, 4) and parallel to y = -3x + 5 be written as y = mx + b?

Yes. The slope m is -3 (since the line is parallel to $y = -3x + 5$). Using point-slope form: $y - 4 = -3(x - 1)$. Simplify to get $y = -3x + 7$.

What is the importance of the point (1, 4) in determining the equation of the line?

The point (1, 4) provides a specific coordinate through which the line passes, allowing us to substitute x=1 and y=4 into the point-slope form to find the exact equation.

If the original line has an undefined slope (vertical line), how

do you find the equation of the parallel line passing through (1, 4)?

A vertical line has an undefined slope and is of the form x = a. Since the parallel line must also be vertical and pass through x=1, its equation is x = 1.

How do you verify that the equation you found is correct for a line passing through (1, 4) and parallel to a given line?

Substitute x=1 into the equation to check if y=4. Also, confirm the slope matches the given line's slope. If both conditions hold, the equation is correct.

Additional Resources

Find The Equation Of The Line That Passes Through The Point (1,4) And Is Parallel: An In-Depth Mathematical Exploration

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Introduction

In the realm of analytic geometry, the concept of lines and their equations forms a fundamental part of understanding spatial relationships and geometric properties. Among the many problems encountered by students and mathematicians alike is determining the equation of a line that satisfies specific conditions—most notably, passing through a given point and being parallel to a certain line. This problem not only reinforces the core principles of slope-intercept form and point-slope form but also illuminates the interconnectedness of linear equations.

The focus of this article is to explore the problem: Find the equation of the line that passes through the point (1,4) and is parallel to a given line (though the specific line to which the new line must be parallel is not provided in the prompt, we will examine the general approach and apply it to example cases). This investigation involves understanding the mathematical properties of parallel lines, deriving the equations systematically, and discussing the implications for broader geometric applications.

The Foundations of Parallel Lines and Linear Equations

Understanding Slopes and Parallelism

In coordinate geometry, lines are characterized by their slope—a measure of steepness. The slope of a line represented by the equation $y = mx + b$ is m.

- Parallel lines are lines in the same plane that never intersect.
- Mathematically, two lines are parallel if and only if their slopes are equal.

Thus, if a line has slope m, any line parallel to it must also have slope m.

The General Equation of a Line

The most common forms of line equations are:

- 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, and m is the slope.

Given a point and a slope, the point-slope form provides a straightforward way to write the line's equation.

Step-by-Step Approach to the Problem

1. Identifying the Known Data

- The point through which the line passes: $(1, 4)$.
- The line to which the new line must be parallel: (unspecified in the prompt).

Since the specific line is not provided, we consider general cases:

- Case A: The line is parallel to a line with a known slope m_0.
- Case B: The line is parallel to a line passing through a specific point with a known slope.

In most typical problems, the given line is specified, such as $y = 2x + 3$. For demonstration, let's assume the line is $y = 2x + 5$, which has slope $m_0 = 2$.

2. Determining the Slope of the Parallel Line

Because the lines are parallel, their slopes are equal:

$$m = m_0$$

For our example:

$$m = 2$$

3. Writing the Equation of the New Line

Using the point-slope form:

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

Plug in $(x_1, y_1) = (1, 4)$ and $m = 2$:

$$y - 4 = 2(x - 1)$$

Simplify:

$$y - 4 = 2x - 2$$

$$ y = 2x - 2 + 4 $$

$$ y = 2x + 2 $$

Thus, the equation of the line passing through (1,4) and parallel to $y=2x+5$ is:

$$
\boxed{y = 2x + 2}
$$

Generalization and Variations

When the Equation of the Line to which the new line is parallel is Unknown

Suppose the line's equation is not explicitly given but its slope m_0 is known. The process remains similar:

- Identify the slope m_0.
- Use the point $(1,4)$ in the point-slope form:

$$
y - 4 = m_0 (x - 1)
$$

- Convert to slope-intercept form if desired:

$$
y = m_0 x - m_0 + 4
$$

This general form allows for flexible application depending on the known slope.

Special Cases and Additional Considerations

Vertical Lines

If the line to which the new line is parallel is vertical, its equation has the form:

$$
x = x_0
$$

- The parallel line passing through $(1,4)$ will also be vertical, at $x = 1$.

Horizontal Lines

If the original line is horizontal, with equation:

$$
y = y_0
$$

then the parallel line passing through $(1,4)$ is also horizontal:

$$
y = 4
$$

Application in Real-World Contexts

This type of problem is not limited to pure mathematics—it's applicable in engineering, physics, computer graphics, and navigation.

- Engineering: Designing components that must be aligned parallel to existing structures.
- Physics: Calculating trajectories or paths with specific directional constraints.
- Computer Graphics: Rendering parallel lines for visual effects or object modeling.
- Navigation: Charting courses that run parallel to known routes.

Understanding how to derive the equation of a parallel line passing through a specific point is fundamental to solving these practical problems efficiently.

Conclusion

The process to find the equation of a line passing through a specific point and parallel to a given line encapsulates core principles of linear equations and geometric relationships. By leveraging the concept of equal slopes and using point-slope form, one can systematically derive the desired equation.

In our illustrative example, assuming the original line is $y=2x+5$, the line passing through $(1,4)$ and parallel to it is:

$$
\boxed{y=2x+2}
$$

This methodology is adaptable to various scenarios, whether the original line's equation is known or only its slope is given. A thorough understanding of these concepts reinforces foundational skills in analytic geometry, enabling tackling of more complex geometric problems with confidence.

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Final Remarks

Mastering the derivation of line equations through points and slopes is essential for advanced mathematical reasoning and practical problem-solving. The key takeaway is the importance of understanding the properties of parallel lines and the algebraic tools available to represent them accurately.

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