1. What Is The Equation Of A Line Parallel To Y = 4/5x + 2 That Passes Through (1, 2)?2. What Is The

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Understanding how to find the equation of a line parallel to a given line and passing through a specific point is a fundamental concept in algebra and coordinate geometry. This tutorial explores the step-by-step process of determining such a line, focusing on the line parallel to Y = 4/5x + 2 that passes through the point (1, 2). Whether you're a student preparing for exams or someone interested in grasping the principles of linear equations, this comprehensive guide will clarify the process and provide useful tips to master similar problems.

Understanding the Basics: What Is a Parallel Line?

Before diving into calculations, it's essential to understand what parallel lines are and their properties.

Definition of Parallel Lines

- Parallel lines are two or more lines in a plane that never intersect.
- They maintain a constant distance from each other.
- Parallel lines share the same slope, but have different y-intercepts.

Why Is Slope Important?

- The slope indicates the steepness or incline of a line.
- Lines with identical slopes are parallel.

Analyzing the Given Line: Y = 4/5x + 2

The given line is in slope-intercept form, which is:

$$ y = mx + b $$

Where:
- m is the slope
- b is the y-intercept

For the line $y = \frac{4}{5}x + 2$:

- Slope (m): $\frac{4}{5}$

- Y-intercept (b): 2

Since parallel lines share the same slope, any line parallel to this line must also have a slope of $\frac{4}{5}$.

Finding the Equation of a Parallel Line Passing Through (1, 2)

The key steps involve:

1. Recognizing the slope of the new line.
2. Using the point-slope form with the given point.
3. Converting the equation to slope-intercept form if needed.

Step 1: Identify the Slope

- The slope m of the new line is the same as the original:

$$ m = \frac{4}{5} $$

Step 2: Apply the Point-Slope Formula

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

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

Where:
- (x_1, y_1) is the point the line passes through
- m is the slope

Plugging in the point $(1, 2)$:

$$ y - 2 = \frac{4}{5}(x - 1) $$

Step 3: Simplify to Slope-Intercept Form

Distribute the slope:

$$ y - 2 = \frac{4}{5}x - \frac{4}{5} $$

Add 2 to both sides:

$$ y = \frac{4}{5}x - \frac{4}{5} + 2 $$

Express 2 as a fraction with denominator 5:

$$ 2 = \frac{10}{5} $$

So:

$$ y = \frac{4}{5}x - \frac{4}{5} + \frac{10}{5} $$

Combine the constants:

$$ y = \frac{4}{5}x + \frac{6}{5} $$

Final Equation:

$$ y = \frac{4}{5}x + \frac{6}{5} $$

This is the equation of the line parallel to $ y = \frac{4}{5}x + 2 $ that passes through the point $ (1, 2) $.

Key Points to Remember

When solving similar problems, keep these points in mind:

- Parallel lines share the same slope.
- The point-slope formula is a powerful tool for deriving line equations passing through a specific point.
- Always convert fractions to simplest form for clarity.
- You can rearrange the equation into slope-intercept form for easier interpretation.

Additional Examples and Variations

To deepen your understanding, here are some variations of the problem:

Example 1: Find the equation of a line parallel to $y = -\frac{2}{3}x + 4$ passing through $(-2, 5)$.

Solution:

- Slope $m = -\frac{2}{3}$

- Point $(-2, 5)$

Applying point-slope form:

$$y - 5 = -\frac{2}{3}(x + 2)$$

Distribute:

$$y - 5 = -\frac{2}{3}x - \frac{4}{3}$$

Add 5 (or $\frac{15}{3}$) to both sides:

$$y = -\frac{2}{3}x - \frac{4}{3} + \frac{15}{3}$$

Simplify:

$$y = -\frac{2}{3}x + \frac{11}{3}$$

Example 2: Find the equation of a line parallel to $y = 3x - 7$ passing through $(0, 5)$.

Solution:

- Slope $m = 3$

- Point $(0, 5)$

Equation:

$$y - 5 = 3(x - 0)$$

$$y - 5 = 3x$$

$$y = 3x + 5$$

Applications of Parallel Line Equations

Understanding how to find the equation of parallel lines has practical applications in various fields:

- Architecture: Designing structures with parallel walls or beams.
- Engineering: Ensuring components maintain consistent spacing.
- Navigation: Plotting routes that are parallel to existing paths.
- Data Analysis: Fitting parallel lines to model trends.

SEO Optimization Tips for Linear Equation Articles

To ensure your content reaches the right audience, consider the following SEO strategies:

- Use relevant keywords like "equation of a line," "parallel lines," "point-slope form," and "linear equations."
- Incorporate headings and subheadings with descriptive titles.
- Include step-by-step examples and explanations.
- Use bullet points and numbered lists for clarity.
- Optimize meta descriptions and image alt text if including visuals.
- Link to related topics such as "slope-intercept form," "point-slope form," or "linear equations."

Conclusion

Finding the equation of a line parallel to a given line and passing through a specific point is a foundational skill in algebra. By understanding the properties of parallel lines, leveraging the slope, and applying the point-slope form, you can quickly derive the required equations. For instance, for the line parallel to \(y = \frac{4}{5}x + 2 \) passing through \((1, 2) \), the resulting equation is \(y = \frac{4}{5}x + \frac{6}{5} \). Mastery of these techniques enhances your problem-solving toolkit and prepares you for more complex geometric and algebraic challenges.

Remember: Practice with different slopes and points to solidify your understanding, and always double-check your calculations for accuracy.

Frequently Asked Questions

What is the equation of a line parallel to y = (4/5)x + 2 that passes through the point (1, 2)?

Since parallel lines have the same slope, the slope is 4/5. Using point-slope form: $y - 2 = (4/5)(x - 1)$. Simplifying, the equation is $y = (4/5)x + (6/5)$.

How do you find the equation of a line parallel to a given line passing through a specific point?

Identify the slope of the given line, which will be the same for the parallel line. Then, use the point-slope form ($y - y_1 = m(x - x_1)$) with the given point to find the equation.

What is the slope of the line y = (4/5)x + 2?

The slope of the line $y = (4/5)x + 2$ is 4/5.

Can the equation y = (4/5)x + 2 be written in standard form?

Yes. Multiply both sides by 5 to clear the fraction: $5y = 4x + 10$, then rearranged as $4x - 5y = -10$.

How do you verify that two lines are parallel?

Two lines are parallel if they have the same slope but different y-intercepts. For example, lines $y = (4/5)x + c1$ and $y = (4/5)x + c2$ are parallel if $c1 \neq c2$.

What is the significance of the point (1, 2) in the problem?

The point (1, 2) is the specific point through which the new line, parallel to the given line, passes. It helps determine the particular equation of that line.

What are common methods to find the equation of a line given a point and a slope?

The most common method is using the point-slope form ($y - y_1 = m(x - x_1)$). Alternatively, you can find the slope-intercept form $y = mx + b$ by substituting the point into the equation to solve for b.

Additional Resources

Understanding Equations of Parallel Lines and Their Properties

When exploring the world of straight lines in coordinate geometry, one of the fundamental concepts to grasp is how lines relate to each other through their slopes and equations. Particularly, understanding parallel lines is crucial for both theoretical mathematics and real-world applications such as engineering, architecture, and computer graphics. This detailed guide aims to explore the question: "What is the equation of a line parallel to y = (4/5)x + 2 that passes through (1, 2)?" We will break down the problem, explain the underlying principles, and walk through the step-by-step process of deriving the equation. Additionally, we will delve into related concepts to provide a comprehensive understanding.

Fundamentals of Line Equations in the Coordinate Plane

Before tackling the specific problem, it’s essential to revisit the basics of line equations and their properties.

The Slope-Intercept Form of a Line

The most common form for the equation of a straight line in a two-dimensional plane is the slope-intercept form:

$$ y = mx + b $$

- m: the slope of the line, indicating its steepness and direction.
- b: the y-intercept, the point where the line crosses the y-axis (i.e., when $x = 0$).

In the given line:

$$ y = \frac{4}{5}x + 2 $$

- The slope $m = \frac{4}{5}$.
- The y-intercept $b = 2$.

Understanding the Slope

The slope m determines the inclination of a line:

- Positive slope: the line rises as it moves from left to right.
- Negative slope: the line falls as it moves from left to right.
- Zero slope: a horizontal line.
- Infinite slope: a vertical line (which has an undefined slope).

In the case of the given line, $m = \frac{4}{5}$, which indicates a gentle upward inclination.

What Does It Mean for Lines to Be Parallel?

Parallel lines are lines that are always equidistant from each other and never intersect, regardless of how far they extend. This geometric property translates into a simple rule:

- Parallel lines have identical slopes.

Thus, if a line is parallel to $y = \frac{4}{5}x + 2$, it must have the same slope:

$$m_{\text{parallel}} = \frac{4}{5}$$

Finding the Equation of a Parallel Line Passing Through a Specific Point

Given:

- The original line: $y = \frac{4}{5}x + 2$
- The point through which the new line passes: $(1, 2)$

Our goal:

- Find the equation of the line that is parallel to the original line and passes through $(1, 2)$.

Step 1: Recognize the Slope of the Parallel Line

Since the lines are parallel:

$$ m_{\text{new}} = m_{\text{original}} = \frac{4}{5} $$

Step 2: Use the Point-Slope Form of a Line Equation

The point-slope form is particularly useful when we know a point $ (x_0, y_0) $ and the slope $ m $:

$$ y - y_0 = m(x - x_0) $$

Plugging in:

- $ (x_0, y_0) = (1, 2) $
- $ m = \frac{4}{5} $

We get:

$$ y - 2 = \frac{4}{5}(x - 1) $$

Step 3: Simplify to Slope-Intercept Form

Distribute the slope:

$$ y - 2 = \frac{4}{5}x - \frac{4}{5} $$

Add 2 to both sides to solve for $ y $:

$$ y = \frac{4}{5}x - \frac{4}{5} + 2 $$

Express 2 as a fraction with denominator 5:

$$ 2 = \frac{10}{5} $$

Thus,

$$ y = \frac{4}{5}x - \frac{4}{5} + \frac{10}{5} $$

Combine the constants:

$$ y = \frac{4}{5}x + \frac{6}{5} $$

The Final Equation of the Parallel Line

Therefore, the equation of the line parallel to $y = \frac{4}{5}x + 2$ passing through $(1, 2)$ is:

$$ y = \frac{4}{5}x + \frac{6}{5} $$

This is a precise, standard form of the line, indicating the same slope as the original but a different y-intercept.

Verifying the Solution

Verification ensures that our solution is consistent.

Check that the point $(1, 2)$ lies on the derived line:

- Substitute $x = 1$:

$$ y = \frac{4}{5} \times 1 + \frac{6}{5} = \frac{4}{5} + \frac{6}{5} = \frac{10}{5} = 2 $$

- Since $y = 2$, the point $(1, 2)$ indeed lies on the line.

Check that the slope matches the original:

- Both lines have $m = \frac{4}{5}$. Hence, they are parallel.

Additional Considerations and Related Concepts

While the primary question has been addressed, understanding related ideas enhances mathematical fluency.

Vertical and Horizontal Lines

- Vertical lines: have an undefined slope and are represented as $x = a$, where a is the x-coordinate of the line.
- Horizontal lines: have zero slope, represented as $y = b$.

Since the slope $\frac{4}{5}$ is finite, our lines are neither vertical nor horizontal.

Lines with Different Slopes

- If the slope of the second line had been different from $\frac{4}{5}$, the lines would not be parallel.
- For example, if the line was $y = 2x + 3$, it would intersect the original line at some point.

Parallel Lines in Real-World Contexts

- Roads and Railways: Parallel lines are often used to design roads, railway tracks, and fences.
- Architectural Design: Parallel lines help in creating symmetry and aesthetic balance.
- Navigation and Mapping: Understanding parallelism assists in plotting routes and geographical features.

Summary of Key Takeaways

- Parallel lines share the same slope.
- To find the equation of a line parallel to a given line passing through a specific point:
1. Identify the slope of the original line.
2. Use the point-slope form with the given point.
3. Simplify to slope-intercept form if desired.
- The specific line passing through $(1, 2)$ and parallel to $y = \frac{4}{5}x + 2$ is:

$$y = \frac{4}{5}x + \frac{6}{5}$$

Conclusion

Understanding how to derive the equation of a parallel line through a given point involves grasping the fundamental principle that parallel lines have equal slopes. By carefully applying the point-slope form and simplifying, we can find the exact equation that meets the specified criteria. This process not only reinforces core algebraic concepts but also enhances spatial reasoning and problem-solving skills, which are invaluable across various disciplines.

Whether you are a student preparing for exams, an educator designing lessons, or a professional applying geometry principles, mastering these techniques prepares you to approach a wide range of linear relationships with confidence and clarity.

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