

Write The Equation Of Line In Slope-intercept Form: Line Parallel To $Y + x = 3$ That Passes Through The Point

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Understanding how to write equations of lines in slope-intercept form is a fundamental skill in algebra and coordinate geometry. This knowledge not only helps in graphing lines efficiently but also in analyzing relationships between variables. In particular, problems involving lines parallel to a given line and passing through a specific point are common in both academic settings and real-world applications. This article provides a comprehensive guide to writing the equation of a line in slope-intercept form, focusing on lines parallel to the given line $y + x = 3$ that pass through a designated point.

Introduction to the Slope-Intercept Form of a Line

The slope-intercept form of a line's equation is one of the most straightforward and widely used forms in algebra. It is expressed as:

$$y = mx + b$$

where:

- y is the dependent variable,
- x is the independent variable,
- m is the slope of the line,
- b is the y-intercept (the point where the line crosses the y-axis).

This form directly indicates the slope and y-intercept, making it easier to graph and analyze lines.

Understanding the Given Line: $Y + X = 3$

Before delving into parallel lines, it's essential to analyze the given line $y + x = 3$.

Rewriting in Slope-Intercept Form

To better understand its slope and intercepts, let's convert $y + x = 3$ into slope-intercept form:

$$y = -x + 3$$

Thus, the slope of this line is $(m = -1)$, and its y-intercept is at $(0, 3)$.

Graphical Representation

- The line crosses the y-axis at $(0, 3)$.
- The slope of (-1) indicates that for every increase of 1 unit in (x) , (y) decreases by 1 unit.
- It passes through points such as $(0, 3)$ and $(1, 2)$, $(-1, 4)$, etc.

Finding a Line Parallel to $Y + X = 3$

Since the goal is to find a line parallel to the given line, let's understand what it means for two lines to be parallel.

Parallel Lines and Their Slopes

- Parallel lines have identical slopes.
- Therefore, any line parallel to $(y = -x + 3)$ must also have a slope of (-1) .

Equation of a Parallel Line

- The general form of a line parallel to the given line is:

$$\begin{aligned} &[\\ y &= -x + b \\ &] \end{aligned}$$

where (b) is a constant that determines where the line crosses the y-axis.

Writing the Equation of a Line in Slope-Intercept Form Passing Through a Specific Point

Suppose the point through which the line passes is (x_1, y_1) . To find the specific line in slope-intercept form:

1. Use the known slope $(m = -1)$.
2. Substitute the point (x_1, y_1) into the equation $(y = mx + b)$ to solve for (b) .

Step-by-step process:

- Write the general form:

$$\begin{aligned} & \backslash[\\ & y = -x + b \\ & \backslash] \end{aligned}$$

- Plug in the point $\backslash(x_1, y_1) \backslash$:

$$\begin{aligned} & \backslash[\\ & y_1 = -x_1 + b \\ & \backslash] \end{aligned}$$

- Solve for $\backslash(b) \backslash$:

$$\begin{aligned} & \backslash[\\ & b = y_1 + x_1 \\ & \backslash] \end{aligned}$$

- Therefore, the equation of the line is:

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

Summary:

- The line's slope is $\backslash(-1) \backslash$.
- The y-intercept $\backslash(b) \backslash$ is obtained by adding the y-coordinate and x-coordinate of the point through which the line passes.

Practical Examples

Let's illustrate this process with specific examples.

Example 1: Line passing through (2, 5)

- Given point: $\backslash(2, 5) \backslash$
- Slope: $\backslash(m = -1) \backslash$

Calculate $\backslash(b) \backslash$:

$$\begin{aligned} & \backslash[\\ & b = y_1 + x_1 = 5 + 2 = 7 \\ & \backslash] \end{aligned}$$

Equation of the line:

$$\begin{aligned} & \backslash[\\ & y = -x + 7 \end{aligned}$$

\]

This line is parallel to $(y = -x + 3)$ and passes through $(2, 5)$.

Example 2: Line passing through $(-3, 4)$

- Given point: $(-3, 4)$

- Slope: (-1)

Calculate (b) :

$$\begin{aligned} &[\\ b &= 4 + (-3) = 1 \\ &] \end{aligned}$$

Equation:

$$\begin{aligned} &[\\ y &= -x + 1 \\ &] \end{aligned}$$

This is another parallel line passing through the point $(-3, 4)$.

General Formula for the Equation of the Parallel Line

To summarize, if:

- The original line is $(y + x = 3)$ (or $(y = -x + 3)$),
- The slope of the parallel line is (-1) ,
- The point it passes through is (x_1, y_1) ,

then the equation in slope-intercept form is:

$$\begin{aligned} &[\\ &\boxed{ \\ y &= -x + (x_1 + y_1) \\ &} \\ &] \end{aligned}$$

This formula allows you to quickly determine the specific equation of any line parallel to the given line passing through any point.

Step-by-Step Guide to Write the Equation of the

Desired Line

1. Identify the slope of the given line:

- Convert the given line to slope-intercept form if necessary.
- For $(y + x = 3)$, the slope is (-1) .

2. Use the parallel line's slope:

- Since the lines are parallel, the slope remains (-1) .

3. Plug the point into the line's equation:

- Suppose the point is (x_1, y_1) .
- Plug into $(y = -x + b)$:

$$b = y_1 + x_1$$

4. Write the complete equation:

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

This process ensures the resulting line is parallel to the original and passes through the specified point.

Additional Tips and Common Mistakes

- Ensure correct conversion to slope-intercept form: Always verify the slope after rewriting the original equation.
- Remember the slope remains unchanged: Parallel lines share the same slope but have different intercepts.
- Double-check point substitution: When calculating (b) , carefully substitute the point's coordinates.
- Use consistent notation: Clearly denote your point (x_1, y_1) to avoid confusion.

Conclusion

Mastering how to write the equation of a line in slope-intercept form, especially for lines parallel to a given line and passing through a specific point, is an essential algebraic skill. By understanding the relationship between slope, intercepts, and points, students can efficiently derive equations that accurately represent lines in the coordinate plane. Remember, the key steps involve identifying the slope of the original line, maintaining that slope for the parallel line, and substituting the given point

to find the y-intercept. Using these principles, you can confidently solve a wide range of problems involving parallel lines and their equations.

Whether you're studying for exams, working on geometry projects, or applying these concepts in real-life scenarios, the ability to manipulate and understand line equations is invaluable. Practice with different points and lines to solidify your understanding and enhance your problem-solving skills.

Keywords: line equation, slope-intercept form, parallel lines, $y + x = 3$, passing through a point, algebra, coordinate geometry, slope, y-intercept, graphing lines, equation derivation, algebra tips

Frequently Asked Questions

How do you find the equation of a line parallel to the line $y + x = 3$?

First, rewrite the given line in slope-intercept form to identify its slope. Since $y + x = 3$, it becomes $y = -x + 3$, so its slope is -1 . A line parallel to it will also have slope -1 .

What is the slope of the line $y + x = 3$?

The slope of the line $y + x = 3$ is -1 , because rewriting it as $y = -x + 3$ shows the slope is -1 .

How do you write the equation of a line parallel to $y + x = 3$ passing through a specific point (a, b) ?

Use the point-slope form: $y - b = m(x - a)$, where m is the slope (-1) . Substitute the point coordinates into the formula to get the line's equation.

What is the equation of the line parallel to $y + x = 3$ passing through $(2, 5)$?

Using slope $m = -1$ and point $(2, 5)$: $y - 5 = -1(x - 2)$. Simplify to get $y - 5 = -x + 2$, so $y = -x + 7$.

Can you give an example of writing the equation of a parallel line passing through a point?

Yes. For example, passing through $(0, 0)$: $y - 0 = -1(x - 0)$, which simplifies to $y = -x$.

Why is the slope of a line parallel to $y + x = 3$ also -1 ?

Parallel lines have identical slopes. Since $y + x = 3$ has slope -1 , any line parallel to it must also have slope -1 .

How do you convert the equation $y + x = 3$ into slope-intercept form?

Subtract x from both sides to get $y = -x + 3$, which is in slope-intercept form $y = mx + b$.

What steps are involved in writing the equation of a line in slope-intercept form passing through a point and parallel to a given line?

Identify the slope from the given line, use the point-slope form with the point and slope, then simplify to slope-intercept form $y = mx + b$.

Additional Resources

Write The Equation Of Line In Slope-intercept Form: Line Parallel To $Y + X = 3$ That Passes Through The Point is a fundamental concept in analytic geometry that combines understanding of lines, slopes, and algebraic equations. Mastering this skill is essential for solving a wide range of problems involving lines, whether in academics, engineering, or everyday scenarios. This guide aims to walk you through the detailed steps to find the equation of a line in slope-intercept form that is parallel to a given line and passes through a specific point.

Understanding the Basics: The Slope-Intercept Form and Parallel Lines

Before diving into the specific problem, it's vital to understand the foundational concepts involved:

What Is the Slope-Intercept Form?

The slope-intercept form of a line's equation 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.

This form is particularly user-friendly because it directly reveals the slope and the y -intercept, making it easy to graph and analyze lines.

What Does It Mean for Lines to Be Parallel?

Two lines are parallel if they have the same slope but different y -intercepts. Parallel lines:

- Never intersect,
- Have identical slopes ($m_1 = m_2$),
- Differ in their intercepts ($b_1 \neq b_2$).

Understanding this property is crucial because when asked to find a line parallel to a given line, the primary step is to determine the slope of the original line.

Step 1: Rewrite the Given Equation in Slope-Intercept Form

Our starting point is the given line:

$$Y + X = 3$$

Converting to Slope-Intercept Form:

- The original equation is in standard form: $X + Y = 3$.
- To express in slope-intercept form, solve for Y:

$$Y = -X + 3$$

This reveals:

- Slope (m) = -1,
- Y-intercept (b) = 3.

Step 2: Determine the Slope of the Parallel Line

Since the line we seek is parallel to the original line, its slope must be the same:

$$m_{\text{parallel}} = -1$$

Step 3: Use the Point Through Which the Line Passes

Suppose the line passes through a point, say (x_0, y_0) . For this example, let's assume the point is:

$$(2, 5)$$

(Note: If you're given a specific point, replace these coordinates accordingly.)

Step 4: Apply the Point-Slope Form

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

$$Y - y_0 = m (X - x_0)$$

Plugging in the known point and the slope:

$$Y - 5 = -1 (X - 2)$$

Step 5: Convert to Slope-Intercept Form

Distribute and simplify:

$$- Y - 5 = -1 X + 2$$

$$- Y = -X + 2 + 5$$

$$- Y = -X + 7$$

This is the slope-intercept form of the line passing through (2, 5) and parallel to $Y + X = 3$.

Complete Summary of Steps

1. Rewrite the given line in slope-intercept form to identify the slope.
2. Identify the slope of the parallel line (same as the original).
3. Use the point-slope formula with the given point and the slope.
4. Simplify to slope-intercept form for the final equation.

Additional Examples and Practice Problems

To reinforce your understanding, here are some practice scenarios:

Example 1:

Find the equation of a line in slope-intercept form that is parallel to $Y + 2X = 4$ and passes through (3, 2).

Solution:

- Rewrite in slope-intercept form:

$$Y = -2X + 4$$

- Slope of parallel line: $m = -2$

- Use point-slope form with point (3, 2):

$$Y - 2 = -2 (X - 3)$$

- Expand:

$$Y - 2 = -2X + 6$$

- Final equation:

$$Y = -2X + 6 + 2$$

$$Y = -2X + 8$$

Example 2:

Find the line passing through (0, 0) and parallel to $Y = 5X - 1$.

Solution:

- Slope of the given line: $m = 5$

- Use point-slope form:

$$Y - 0 = 5(X - 0)$$

- Simplifies to:

$$Y = 5X$$

Tips for Success

- Always convert the given line to slope-intercept form to identify the slope.
- Remember that parallel lines share the same slope.
- Use the point-slope formula to incorporate the specific point.
- Expand and simplify carefully to reach the slope-intercept form.
- Verify your answer by ensuring the line passes through the given point and has the correct slope.

Common Mistakes to Avoid

- Not converting the original line properly: Always double-check your algebra when rewriting equations.
- Mixing slopes: Remember that parallel lines must have exactly the same slope.
- Incorrectly applying the point-slope formula: Be attentive to signs and distribute correctly.
- Forgetting to convert back to slope-intercept form for the final answer.

Final Thoughts

Write The Equation Of Line In Slope-intercept Form: Line Parallel To $Y + X = 3$ That Passes Through The Point is an example that combines fundamental algebraic skills with geometric intuition. By systematically converting equations, understanding the concept of parallel lines, and applying the point-slope formula, you can confidently derive the required line equations for any given scenario. Practice with different points and lines to strengthen your skills, and soon you'll find this process becomes second nature in your problem-solving toolkit.

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