

Find The Equation Of The Line Through (9,5) Which Is Parallel To The Line $Y=7x+6$. Give Your Answer In

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Understanding how to find the equation of a line that passes through a specific point and is parallel to a given line is a fundamental concept in coordinate geometry. This process involves applying principles related to the slope of lines and the point-slope form of a linear equation. In this comprehensive guide, we will walk through the step-by-step procedure to determine the equation of such a line, ensuring clarity and depth to help students and enthusiasts grasp the concept thoroughly.

Understanding the Basics: Lines, Slopes, and Parallelism

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

1. The Equation of a Line

- The general form of a line's equation in slope-intercept form is $Y = mX + c$, where:
- m is the slope of the line.
- c is the y-intercept (the point where the line crosses the y-axis).

2. Slope of a Line

- The slope (m) indicates the steepness and direction of the line.
- For a line passing through two points $((x_1, y_1))$ and $((x_2, y_2))$, the slope is calculated as:

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

- The slope is a measure of how much y changes for a unit change in x .

3. Parallel Lines and Their Slopes

- Two lines are parallel if they have the same slope.
- Therefore, if you know the slope of one line, the line parallel to it will have the same slope.

Analyzing the Given Line: $Y=7x+6$

The line provided is:

$$\begin{array}{l} \backslash[\\ Y = 7x + 6 \\ \backslash] \end{array}$$

- The slope (m) of this line is 7.
- Since we want a line parallel to this one, the new line must also have a slope of 7.

Given Point and the Requirements

- The point through which the new line passes: (9, 5)
- The new line must be parallel to the line $Y = 7x + 6$.
- The task is to find the equation of the line passing through this point and having the same slope.

Step-by-Step Solution

Step 1: Identify the slope of the new line

- Since the original line's slope is 7, the new line's slope (m) is also 7.

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

- The point-slope form is:

$$Y - y_1 = m (X - x_1)$$

where $((x_1, y_1))$ is the point through which the line passes.

- Plugging in the point $((9, 5))$ and slope 7:

$$Y - 5 = 7 (X - 9)$$

Step 3: Simplify to Find the Equation

- Expand the right side:

$$Y - 5 = 7X - 63$$

- Add 5 to both sides to isolate Y:

$$Y = 7X - 63 + 5$$

$$Y = 7X - 58$$

Thus, the equation of the line passing through $((9, 5))$ and parallel to $(Y=7x+6)$ is:

$$\boxed{Y = 7X - 58}$$

Final Answer in Different Forms

Depending on the requirement, the equation can be expressed in various forms:

1. Slope-Intercept Form

$$Y = 7X - 58$$

$$Y = 7X - 58$$

\]

- Here, the slope is 7, and the y-intercept is -58.

2. Standard Form

- To write in standard form $(AX + BY = C)$:

\[

$$Y = 7X - 58$$

\]

- Move all to one side:

\[

$$7X - Y = 58$$

\]

or equivalently,

\[

$$7X - Y - 58 = 0$$

\]

3. Point-Slope Form (as previously shown)

\[

$$Y - 5 = 7 (X - 9)$$

\]

Additional Considerations and Tips

To ensure comprehensive understanding, here are some additional points and tips:

- **Check your slope:** Always verify that the slope of the new line matches the original line's slope for parallelism.
- **Use the correct point:** Make sure the point $((x_1, y_1))$ is substituted accurately into the point-slope form.

- **Convert between forms:** Practice converting equations among slope-intercept, standard, and point-slope forms for versatility.
- **Graphical interpretation:** Visualizing the lines can help solidify understanding of parallelism and the effects of changing the intercept.
- **Application:** Such problems are common in coordinate geometry, calculus, and algebra courses, and are foundational for advanced topics such as linear regression and analytic geometry.

Common Mistakes to Avoid

While solving similar problems, be mindful of these common errors:

1. **Using the wrong slope:** Remember, the parallel line must have the same slope as the given line.
2. **Incorrect substitution:** Ensure the correct point coordinates are substituted into the point-slope form.
3. **Sign errors:** Pay attention to signs during algebraic manipulations, especially when expanding or simplifying equations.
4. **Forgetting to simplify:** Always simplify the final equation for clarity and standardization.

Practice Problems for Reinforcement

To reinforce learning, try solving these similar problems:

1. Find the equation of the line passing through $((4, -2))$ and parallel to $(Y = 3x + 1)$.
2. Determine the equation of the line passing through $((-1, 4))$ and parallel to $(Y = -2x + 5)$.
3. Write the equation of the line passing through $((0, 0))$ and parallel

to $(Y = \frac{1}{2}x - 3)$.

Conclusion

In summary, finding the equation of a line passing through a specific point and parallel to a given line involves identifying the slope of the original line, applying the point-slope form, and simplifying the resulting expression. For the problem at hand, the line passing through $(9, 5)$ and parallel to $(Y=7x+6)$ is $Y=7X-58$. Mastery of these steps lays a strong foundation for more complex geometric and algebraic analyses.

Remember, practicing multiple problems enhances understanding and confidence, so continue exploring various scenarios involving parallel and perpendicular lines, different forms of equations, and real-world applications of coordinate geometry.

Frequently Asked Questions

What is the slope of the line parallel to $y=7x+6$ that passes through $(9,5)$?

The slope of the parallel line is 7, same as the given line $y=7x+6$.

How do you find the equation of a line passing through $(9,5)$ and parallel to $y=7x+6$?

Use the point-slope form with the point $(9,5)$ and the slope 7: $y - 5 = 7(x - 9)$.

What is the equation of the line passing through $(9,5)$ and parallel to $y=7x+6$ in slope-intercept form?

Simplify $y - 5 = 7(x - 9)$ to $y = 7x - 63 + 5$, which gives $y = 7x - 58$.

Can you write the equation of the line in standard form?

Yes. Starting from $y = 7x - 58$, rewrite as $7x - y = 58$.

Why is the slope of the parallel line the same as the original line $y=7x+6$?

Because parallel lines have equal slopes, so the new line must also have a slope of 7.

What are some key points to remember when finding a line parallel to a given line?

Identify the slope of the original line, use the same slope for the new line, and substitute the given point into the point-slope form to find the equation.

Additional Resources

Finding the Equation of a Line Parallel to a Given Line Through a Specific Point

Understanding how to find the equation of a line that passes through a particular point and is parallel to a given line is a fundamental concept in coordinate geometry. This task involves several key steps, including understanding the slope of the given line, recognizing the properties of parallel lines, and applying the point-slope or slope-intercept form to derive the required equation. In this detailed review, we will explore each aspect thoroughly, providing clarity and depth to ensure a comprehensive understanding.

Understanding the Basics of Line Equations

Before diving into the problem, it's essential to revisit some core concepts related to lines in the coordinate plane.

The Slope-Intercept Form of a Line

- The slope-intercept form is expressed as:

\[

$$y = mx + c$$

\]

where:

- m is the slope of the line.

- c is the y-intercept, the point where the line crosses the y-axis.

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

The Point-Slope Form of a Line

- The point-slope form is given by:

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

where:

- $((x_1, y_1))$ is a known point on the line.
- (m) is the slope of the line.
- This form is advantageous when you know a point on the line and its slope, which is the case in this problem.

Understanding the Given Line: $(y = 7x + 6)$

- The given line is in slope-intercept form, with:
 - Slope $(m_1 = 7)$
 - Y-intercept at (6)
- The key property here is the slope. The slope indicates how steep the line is and the direction it inclines.

Properties of Parallel Lines

- Parallel lines in a plane always have identical slopes.
- If two lines are parallel, then:

$$m_1 = m_2$$

where:

 - (m_1) is the slope of the first line.
 - (m_2) is the slope of the second line.
- Therefore, a line parallel to $(y = 7x + 6)$ will also have a slope of 7.
-

Step-by-Step Solution to Find the Line Through

\((9, 5)\) Parallel to the Given Line

Now, with the foundational concepts understood, let's proceed step-by-step to find the required line.

Step 1: Identify the Slope of the Parallel Line

- Since the new line must be parallel to $(y = 7x + 6)$, it shares the same slope:

$$\begin{aligned} &[\\ m_{\text{new}} &= 7 \\ &] \end{aligned}$$

Step 2: Use the Point-Slope Form with the Given Point

- The given point through which the line passes is $((x_1, y_1) = (9, 5))$.
- Applying the point-slope form:

$$\begin{aligned} &[\\ y - y_1 &= m (x - x_1) \\ &] \\ &[\\ y - 5 &= 7 (x - 9) \\ &] \end{aligned}$$

Step 3: Simplify the Equation

- Expand the right side:

$$\begin{aligned} &[\\ y - 5 &= 7x - 63 \\ &] \end{aligned}$$

- Now, add 5 to both sides to solve for (y) :

$$\begin{aligned} &[\\ y &= 7x - 63 + 5 \\ &] \\ &[\\ y &= 7x - 58 \\ &] \end{aligned}$$

Resulting Equation:

$$\begin{aligned} &[\\ \boxed{y &= 7x - 58} \\ &] \end{aligned}$$

This is the equation of the line passing through $((9, 5))$ and parallel to $(y = 7x + 6)$.

Alternative Forms of the Equation

While the slope-intercept form $(y = 7x - 58)$ is straightforward and easy to interpret, sometimes the problem might require the equation in other formats.

Standard Form

- The standard form of a line is:

$$Ax + By + C = 0$$

- To convert $(y = 7x - 58)$ into standard form:

- Subtract $(7x)$ from both sides:

$$-7x + y = -58$$

- Multiply through by (-1) to make the coefficient of (x) positive:

$$7x - y = 58$$

Thus, the standard form is:

$$\boxed{7x - y = 58}$$

Verification of the Solution

To ensure the correctness of the derived equation, verify two key points:

1. The point $((9, 5))$ lies on $(y = 7x - 58)$:

$$y = 7(9) - 58 = 63 - 58 = 5$$

Correct.

2. The slope is consistent with the original line:

```
\[
\text{Slope} = 7
\]
```

matches the original line's slope.

Practical Applications and Contexts

Understanding how to find such a line has real-world significance and various applications:

- Engineering: Designing parallel components or paths that maintain consistent slopes or gradients.
- Navigation: Plotting routes that are parallel to existing pathways.
- Economics: Modeling parallel trends in data or graphs.

This skill is pivotal in fields requiring precise geometric or algebraic modeling.

Common Mistakes and Tips to Avoid

- Confusing the slope: Remember, the parallel line must have the same slope, not just a similar one.
- Incorrect point substitution: Always double-check the substitution of the point coordinates into the equation.
- Sign errors: Be cautious with signs, especially when expanding or rearranging equations.
- Neglecting to verify: Always verify that the point lies on the derived line and that the slope matches.

Summary and Final Remarks

- The key to solving this problem lies in understanding the properties of parallel lines and the forms of line equations.
- The process involves extracting the slope from the given line, applying the point-slope form with the given point, and simplifying to obtain the desired equation.
- The final answer, $(y = 7x - 58)$, accurately represents the line passing

through $((9, 5))$ and parallel to $(y = 7x + 6)$.

This comprehensive exploration not only provides the solution but also deepens the understanding of the underlying concepts, preparing you for similar problems in algebra, coordinate geometry, and beyond.

In conclusion, mastering how to find the equation of a line through a given point parallel to another line is a fundamental yet powerful skill. It combines understanding slopes, line forms, and algebraic manipulation—an essential toolkit for anyone studying or working with geometry and algebra.

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