On The Same Coordinate Plane, Graph A Line With A Slope Of -3 That Passes Through The Point (-6, 7)

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Understanding how to graph lines on the coordinate plane is fundamental in algebra and geometry. It enables students and professionals to visualize relationships between variables, analyze functions, and solve real-world problems involving linear equations. Today, we will focus on a specific yet illustrative problem: graphing a line with a slope of -3 that passes through the point (-6, 7). This task involves applying key concepts such as the slope-intercept form, point-slope form, and the coordinate plane's principles.

In this comprehensive guide, we will explore the process step-by-step, provide explanations of essential concepts, and discuss practical tips for accurate graphing. Whether you're a student preparing for an exam, a teacher designing lesson plans, or someone interested in understanding the fundamentals of graphing lines, this article offers valuable insights.

Understanding the Basics: The Coordinate Plane and Linear Equations

The Coordinate Plane

The coordinate plane, also known as the Cartesian plane, is a two-dimensional surface formed by two perpendicular axes:
- The x-axis (horizontal)
- The y-axis (vertical)

These axes intersect at the origin point (0, 0). Every point on the plane can be represented as an ordered pair (x, y), indicating its position relative to the axes.

Linear Equations and Their Graphs

A linear equation is an algebraic expression that models a straight line when graphed. The general form of a linear equation in two variables is:
\[y = mx + b \]
where:
- \(m \) is the slope of the line
- \(b \) is the y-intercept, the point where the line crosses the y-axis

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Deciphering the Given Data: Slope and Point

The problem specifies:
- The slope (m) as -3
- The point (-6, 7) through which the line passes

This information uniquely determines the line, and our goal is to graph it accurately.

Formulating the Equation of the Line

To graph the line, we need its equation in a usable form. The most straightforward is the slope-intercept form $y = mx + b$. Since we are given the slope and a point, we can use the point-slope form to find the equation:

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

where:
- (x_1, y_1) is the known point (-6, 7)
- m is the slope (-3)

Step-by-Step Calculation

1. Substitute the known values into the point-slope form:
$$y - 7 = -3(x - (-6))$$
2. Simplify the expression:
$$y - 7 = -3(x + 6)$$
3. Distribute the slope:
$$y - 7 = -3x - 18$$
4. Solve for y:
$$y = -3x - 18 + 7$$
$$y = -3x - 11$$

Thus, the equation of the line in slope-intercept form is:
$$y = -3x - 11$$

Graphing the Line Step-by-Step

1. Identify the Y-Intercept

The y-intercept b is -11, meaning the line crosses the y-axis at (0, -11).

2. Plot the Y-Intercept

Plot the point (0, -11) on the coordinate plane.

3. Use the Slope to Find Another Point

The slope $m = -3$ indicates that for every 1 unit increase in x, y decreases by 3 units. Alternatively, for every 1 unit decrease in x, y increases by 3.

- Starting from (0, -11), move:
- 1 unit to the right ($x = 1$)
- $y = -11 + (-3) \times 1 = -11 - 3 = -14$

Plot the point (1, -14).

Similarly, moving:
- 1 unit to the left ($x = -1$)
- $y = -11 + 3 \times 1 = -11 + 3 = -8$

Plot the point (-1, -8).

4. Draw the Line

Using the two points (0, -11) and (1, -14), draw a straight line through them, extending across the coordinate plane. Make sure the line is straight and extends beyond the plotted points.

5. Verify the Line Passes Through the Given Point

Check that the point (-6, 7) lies on the line:
- Plug $x = -6$ into the line equation:
$$y = -3(-6) - 11 = 18 - 11 = 7$$

Since the calculated y is 7, which matches the point's y-coordinate, the point (-6, 7) indeed lies on the line, confirming our graph's accuracy.

Additional Tips for Accurate Graphing

- Always plot the y-intercept first to establish a reference point.

- Use the slope to find additional points, ensuring the line is accurate.
- When plotting points, label them clearly.
- Use graphing tools or graph paper for precision.
- Extend the line beyond the plotted points to clearly show its direction.

Applications of Graphing Lines with Negative Slopes

Understanding lines with negative slopes is essential in various real-world contexts:

- Economics: Representing decreasing demand or supply curves.
- Physics: Describing objects with decreasing velocity over time.
- Statistics: Visualizing negative correlations between variables.
- Engineering: Analyzing decline or depreciation trends.

Mastering the process of graphing such lines enhances problem-solving skills and conceptual understanding.

Practice Problems to Reinforce Learning

1. Graph the line with a slope of -2 passing through the point (3, 4).
2. Find the equation of the line passing through (-2, 5) with a slope of -4, and graph it.
3. Determine whether the point (0, -11) lies on the line \(y = -3x - 11 \). (Answer: Yes, it does.)
4. Plot the line with the equation \(y = -3x - 11 \) on graph paper and verify its accuracy.

Conclusion: Mastering Line Graphs with Slope and Point

Graphing a line on the coordinate plane using a given slope and point is a fundamental skill in algebra and geometry. By understanding how to convert between different forms of linear equations, plotting key points, and applying the slope, students can accurately represent lines and analyze their properties.

In this tutorial, we demonstrated how to derive the equation of a line with a slope of -3 passing through (-6, 7), and how to graph it step-by-step. Remember to verify your points and equations to ensure accuracy. Practice regularly with different slopes and points to strengthen your understanding of linear graphs and their applications across various fields.

Whether you're tackling homework, preparing for exams, or applying these concepts in professional scenarios, mastering line graphing techniques is a valuable skill that lays the foundation for advanced math and analytical thinking.

Keywords: graphing lines, slope -3, point (-6, 7), linear equations, coordinate plane, slope-intercept form, point-slope form, plotting points, algebra, geometry, graphing tips, linear functions, math tutorial

Frequently Asked Questions

What is the slope of the line passing through (-6, 7) with a slope of -3?

The slope is already given as -3.

How can I find the equation of a line with slope -3 passing through (-6, 7)?

Use the point-slope form: $y - y_1 = m(x - x_1)$. Plug in m = -3 and point (-6, 7): y - 7 = -3(x + 6).

What is the slope-intercept form of the line passing through (-6, 7) with slope -3?

First, find the y-intercept by solving the point-slope form: y = -3x + b. Using the point (-6, 7): 7 = -3(-6) + b → 7 = 18 + b → b = -11. So, y = -3x - 11.

How do I plot the line on the coordinate plane?

Plot the point (-6, 7). Then, use the slope -3 to find another point: from (-6, 7), move down 3 units and right 1 unit to get to (-5, 4). Draw a straight line passing through these points.

What is the equation of the line in standard form?

Starting from y = -3x - 11, rewrite as 3x + y = -11.

Can I find a second point on the line easily?

Yes. For example, when x = 0, y = -3(0) - 11 = -11. So, the point (0, -11) lies on the line.

Is the line with slope -3 passing through (-6, 7) increasing or decreasing?

The slope is negative (-3), so the line is decreasing from left to right.

What is the significance of the slope being -3 for this line?

It indicates that for every 1 unit increase in x, y decreases by 3 units, showing a steep downward trend.

How does knowing a point and slope help in graphing the line?

Knowing a point and slope allows you to use point-slope form to easily plot the line by identifying a starting point and using the slope to find additional points.

If I wanted to find the x-intercept of this line, how would I do it?

Set $y = 0$ in the equation $y = -3x - 11$ and solve for x: $0 = -3x - 11 \rightarrow 3x = -11 \rightarrow x = -11/3$.

Additional Resources

On The Same Coordinate Plane, Graph A Line With A Slope Of -3 That Passes Through The Point (-6, 7)

Understanding how to graph a straight line on the coordinate plane is a fundamental skill in mathematics, especially in algebra. It provides a visual representation of relationships between variables and helps in solving real-world problems. Today, we will explore a specific example: plotting a line with a steep negative slope that passes through a given point. This task not only enhances comprehension of graphing techniques but also deepens understanding of the concepts of slope and coordinate points.

The Foundations: What Is a Coordinate Plane and Why Is It Important?

Before delving into the specifics of graphing our particular line, it’s essential to revisit the basic components of the coordinate plane.

The Coordinate Plane

The coordinate plane, also known as the Cartesian plane, is a two-dimensional surface defined by two perpendicular axes:

- Horizontal axis (x-axis): Represents the independent variable or input.

- Vertical axis (y-axis): Represents the dependent variable or output.

The point where these axes intersect is called the origin, designated as (0, 0).

Why the Coordinate Plane Matters

Graphing on the coordinate plane allows us to visualize the relationship between two variables. For example, in economics, physics, and engineering, plotting data points and lines helps identify trends, patterns, and relationships. In algebra, graphing lines from their equations makes it easier to interpret their slope, intercepts, and solutions.

Understanding the Slope and Its Significance

The core concept in our task is the slope, which measures the steepness and direction of the line.

What Is the Slope?

- The slope (m) is the ratio of the change in y (vertical change) to the change in x (horizontal change) between any two points on a line.
- Mathematically, $m = \frac{\Delta y}{\Delta x}$.

Significance of the Slope

- Positive slope: The line rises from left to right.
- Negative slope: The line falls from left to right.
- Zero slope: The line is horizontal.
- Undefined slope: The line is vertical.

In our case, the slope is -3, indicating a line that decreases steeply as it moves from left to right.

The Given Data: Point and Slope

Our task involves plotting a line with:

- Slope $m = -3$
- Passes through point $(-6, 7)$

This information uniquely determines the line's equation, and from there, we can graph it accurately.

Deriving the Equation of the Line

To graph the line, it’s often easiest to write its equation in point-slope form:

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

where (x_1, y_1) is a point on the line (here, $(-6, 7)$), and m is the slope.

Step-by-Step Calculation

Plugging in the known values:

$$ y - 7 = -3(x - (-6)) $$
$$ y - 7 = -3(x + 6) $$

This is the point-slope form of the line’s equation.

Expanding:

$$ y - 7 = -3x - 18 $$

Adding 7 to both sides:

$$ y = -3x - 18 + 7 $$
$$ y = -3x - 11 $$

Thus, the slope-intercept form of the line is:

$$ y = -3x - 11 $$

This form is particularly useful for graphing because it directly provides the y-intercept and the slope.

Visualizing the Line: Key Points and Graphing Steps

To accurately graph the line, we need specific points through which it passes. The y-intercept is immediately visible from the slope-intercept form, and additional points can be generated by choosing x-values and solving for y.

Step 1: Identify the y-intercept

- The y-intercept b is -11, meaning the line crosses the y-axis at (0, -11).

Step 2: Confirm the passing point

- Plugging in $x = -6$ into the equation:

$$ y = -3(-6) - 11 = 18 - 11 = 7 $$

which matches our given point, confirming the accuracy.

Step 3: Find additional points

Choose an x-value and compute y:

- For $x = 0$:

$$y = -3(0) - 11 = -11$$

- For $x = 2$:

$$y = -3(2) - 11 = -6 - 11 = -17$$

- For $x = -2$:

$$y = -3(-2) - 11 = 6 - 11 = -5$$

Plotting these points:

- (0, -11)
- (2, -17)
- (-2, -5)

Step-by-Step Graphing Process

1. Plot the known points:
- The y-intercept at (0, -11).
- The point (-6, 7).

2. Use the slope to find more points:
- From (-6, 7), move right 1 unit (x increases by 1) and down 3 units (since slope = -3).
- Alternatively, from the y-intercept (0, -11), move right 1 unit to (1, -11), then down 3 units to (1, -14).

3. Draw the line:
- Connect these points with a straight edge, extending across the grid.
- Ensure the line is straight and passes through all plotted points.

4. Check the line's accuracy:
- Verify it passes through the known points.
- Confirm the slope by measuring the rise over run between plotted points.

Interpreting the Graph: Real-World Significance

While the graphing process is mathematical, it often has tangible interpretations:

- Rate of Change: The slope of -3 indicates that for each increase of 1 in x, y decreases by 3. This could represent a scenario like a boat losing 3 miles per hour for every mile traveled upstream in a river with a current.
- Initial Value: The y-intercept at -11 suggests that when x is zero, y is at -11. In real-world

terms, this could mean an initial deficit, such as debt, before any progress.

Understanding these concepts helps students and professionals interpret data visually and make predictions based on the graph.

Common Mistakes and Tips for Accurate Graphing

- Confusing slope sign: Remember that negative slopes decrease y as x increases.
- Incorrect point plotting: Always verify points by substituting x-values into the equation.
- Misreading axes: Ensure axes are scaled uniformly to maintain proportionality.
- Drawing straight lines: Use a ruler or straightedge for clarity.

Practical Applications and Further Explorations

Graphing lines like the one described can extend into various fields:

- Economics: Modeling cost functions decrease with increasing efficiency.
- Physics: Describing objects with constant negative acceleration.
- Data Science: Visualizing negative correlations between variables.

Further exploration could include:

- Finding the x-intercept: set $y = 0$:

$$0 = -3x - 11 \Rightarrow x = -\frac{11}{3} \approx -3.67$$

- Analyzing the line’s behavior as x approaches infinity or negative infinity.
- Deriving equations of parallel or perpendicular lines based on the given slope.

Conclusion

Graphing a line with a slope of -3 passing through the point (-6, 7) exemplifies the process of translating algebraic data into visual form. By deriving the equation in slope-intercept form, identifying key points, and understanding the significance of the slope and intercepts, students can accurately plot such lines and interpret their meaning. This foundational skill not only enhances mathematical proficiency but also equips individuals to analyze real-world scenarios through visual data representation. As with all mathematical tasks, practice and attention to detail are the keys to mastery, making the journey of graphing both educational and engaging.

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