Which Correctly Describes How The Graph Of The Inequality 5x + 2y > 13 Is Shaded?

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Understanding how to correctly shade the graph of the inequality 5x + 2y > 13 is essential for accurately representing the solution set on the coordinate plane. When graphing inequalities, the key steps involve converting the inequality into a comparable form, determining whether to shade above or below the boundary line, and carefully following the conventions for open or closed lines depending on the inequality symbol. This article will provide a comprehensive guide to understanding, graphing, and shading the inequality 5x + 2y > 13, ensuring clarity for students, educators, and anyone interested in linear inequalities.

Understanding the Inequality 5x + 2y > 13

What Does the Inequality Represent?

The inequality 5x + 2y > 13 represents the set of all points (x, y) in the coordinate plane that satisfy the condition 5x + 2y is greater than 13. Geometrically, this inequality is associated with a boundary line, and the solution set consists of all points lying on one side of this line.

Converting to Slope-Intercept Form

To graph the boundary, it’s often easiest to express the inequality in slope-intercept form (y = mx + b). Starting with:

5x + 2y > 13

Subtract 5x from both sides:

2y > -5x + 13

Divide both sides by 2:

y > -\(\frac{5}{2}\)x + \(\frac{13}{2}\)

This form clearly shows the boundary line's equation: y = -\(\frac{5}{2}\)x + \(\frac{13}{2}\).

Graphing the Boundary Line

Step 1: Draw the Line y = -\(\frac{5}{2}\)x + \(\frac{13}{2}\)

- Plot the y-intercept: When x = 0, y = 13/2 = 6.5.
- Find another point: For example, when x = 2:
y = -\(\frac{5}{2}\)(2) + 13/2 = -5 + 6.5 = 1.5.
- Draw a straight line through these points.

Step 2: Determine the Line Style

- Since the inequality is strictly greater than (">"), the boundary line is drawn as a dashed line, indicating that points on the line are not included in the solution set.
- For "greater than or equal to" (≥), the line would be solid.

Deciding Which Side to Shade

Step 3: Test a Point

To determine which side of the boundary line to shade, select a test point that is not on the line; the origin (0,0) is a common choice unless it lies on the line.

- Substitute (0,0) into the inequality:

5(0) + 2(0) > 13

0 > 13? No, this is false.

Since the test point (0,0) does not satisfy the inequality, shade the side of the line that does not contain (0,0).

Step 4: Shade the Correct Region

- The side of the line that satisfies the inequality is the opposite side of the test point.
- Because (0,0) does not satisfy the inequality, shade the side of the line away from (0,0), which is the side where 5x + 2y > 13 holds true.

Summary of Key Steps to Graph and Shade the Inequality 5x + 2y > 13

1. Rewrite the inequality in slope-intercept form: y > -\(\frac{5}{2}\)x + \(\frac{13}{2}\).
2. Plot the boundary line y = -\(\frac{5}{2}\)x + \(\frac{13}{2}\) as a dashed line.
3. Use a test point, such as (0,0), to determine which side of the line satisfies the inequality.
4. Shade the side of the boundary line where the inequality holds true, based on the test point's result.

Visual Illustration and Practical Tips

How the Graph Looks

- The boundary line is dashed, indicating that points on the line are not included.
- The shading area is the set of points satisfying 5x + 2y > 13, which lies on one side of the dashed line.

Common Mistakes to Avoid

- Using a solid line for strict inequalities (">" or "<") — remember to use a dashed line.
- Incorrectly choosing the test point — always verify whether the test point satisfies the inequality.
- Shading the wrong side — ensure you shade the side that satisfies the inequality based on the test.

Practical Tips for Students

- Always convert inequalities to slope-intercept form for easier graphing.
- Label your axes and mark the points clearly.
- Use different colors for the line and shading to improve clarity.
- Double-check the test point and the shading region before finalizing your graph.

Additional Insights into Graphing Inequalities

Comparison with Other Inequalities

- For "less than" inequalities (e.g., $5x + 2y < 13$), the process is similar, but you shade the opposite side of the boundary line.
- For inequalities with "greater than or equal to" ($\geq$) or "less than or equal to" ($\leq$), the boundary line is solid, indicating points on the line satisfy the inequality.

Applications of Graphing Inequalities

- Budget constraints in economics.
- Feasible regions in linear programming.
- Solutions to systems of inequalities in optimization problems.
- Visualizing inequalities in real-world scenarios like resource allocation.

Conclusion

Graphing the inequality $5x + 2y > 13$ involves converting the inequality into slope-intercept form, drawing a dashed boundary line, testing a point to determine the shading side, and shading the region that satisfies the inequality. Remember, the key to correctly shading lies in understanding the inequality symbol and following the proper conventions for dashed or solid lines and the direction of shading. Mastery of this process not only improves your ability to graph linear inequalities accurately but also deepens your understanding of how inequalities represent solution sets on the coordinate plane.

By following these steps and tips, you can confidently graph and interpret the inequality $5x + 2y > 13$, gaining valuable skills for algebra, geometry, and applied mathematics.

Frequently Asked Questions

How is the region for the inequality $5x + 2y > 13$ typically shaded on a graph?

The region above the boundary line is shaded because the inequality is 'greater than', indicating points where $5x + 2y$ exceeds 13.

Does the graph of $5x + 2y > 13$ include the boundary line?

No, since the inequality is 'greater than' and not 'greater than or equal to', the boundary line is dashed and not shaded.

How do you determine which side of the boundary line to

shade for 5x + 2y > 13?

You test a point not on the line (commonly the origin) in the inequality; if it satisfies the inequality, shade that side, which in this case is above the line.

What is the boundary line for the inequality 5x + 2y > 13?

The boundary line is the equation 5x + 2y = 13, which is drawn as a dashed line to indicate it is not included in the solution set.

How can you rewrite the inequality 5x + 2y > 13 to understand its shading better?

Solve for y: 2y > 13 - 5x, then y > (13 - 5x)/2; the shading is above this line since y is greater than the expression.

What does the shading of the graph of 5x + 2y > 13 represent?

It represents all the points (x, y) in the coordinate plane that satisfy the inequality, where 5x + 2y is greater than 13.

Additional Resources

Which Correctly Describes How The Graph Of The Inequality 5x + 2y > 13 Is Shaded?

Understanding the graphical representation of inequalities is a fundamental skill in algebra and coordinate geometry. When students and educators encounter the inequality 5x + 2y > 13, a key question arises: Which region of the coordinate plane should be shaded to correctly represent the solution set? This comprehensive exploration aims to clarify the process, principles, and subtle nuances involved in accurately graphing and shading inequalities like 5x + 2y > 13.

Introduction to Graphing Linear Inequalities

Before delving into the specifics of the inequality 5x + 2y > 13, it’s essential to establish a foundational understanding of how linear inequalities are graphed.

A linear inequality in two variables, such as ax + by (possibly with a comparison symbol), divides the coordinate plane into two regions: one that satisfies the inequality and one that does not. The boundary between these regions is always a straight line, which is derived from the corresponding linear equation (the equality case).

Key Steps in Graphing Linear Inequalities:
1. Rewrite the inequality in slope-intercept form (y = mx + b) if possible.

2. Graph the boundary line (the related equality) using dashed or solid lines depending on the inequality.
3. Shade the appropriate region that satisfies the inequality.

Analyzing the Inequality 5x + 2y > 13

Let's examine the specific inequality:

$$
5x + 2y > 13
$$

This inequality compares a linear combination of x and y to a constant.

Step 1: Express the boundary line

Replace the inequality with an equality to find the boundary:

$$
5x + 2y = 13
$$

Step 2: Convert to slope-intercept form

Solve for y:

$$
2y = 13 - 5x
$$

$$
y = \frac{13 - 5x}{2} = -\frac{5}{2}x + \frac{13}{2}
$$

This is a straight line with slope $-\frac{5}{2}$ and y-intercept $\frac{13}{2}$.

Step 3: Graph the boundary line

- Since the original inequality is strict (>), the boundary line is dashed, indicating that points on the line are not included in the solution set.
- Plot the line using the intercepts:
- When $x=0$, $y=\frac{13}{2} = 6.5$.
- When $y=0$, solve for x:

$$
0 = -\frac{5}{2}x + \frac{13}{2}
$$

$$
\frac{5}{2}x = \frac{13}{2}
$$

$$
x = \frac{13/2}{5/2} = \frac{13/2} \times \frac{2}{5} = \frac{13}{5} = 2.6
$$

- Plot these points: (0, 6.5) and (2.6, 0), then draw a dashed line through them.

Determining Which Side to Shade

The critical question: Which side of the dashed boundary line should be shaded to correctly represent the inequality $5x + 2y > 13$?

This involves testing a point outside the boundary to see if it satisfies the inequality.

Common Practice:

- Use the origin (0,0), unless it lies on the boundary line.
- Substitute into the inequality:

$$
5(0) + 2(0) > 13
$$

$$
0 > 13 \quad \text{(False)}
$$

Since the statement is false, the origin is not part of the solution set. Therefore, the side of the line that contains the origin is not the solution region.

Conclusion:

- The solution region is on the opposite side of the line from the origin.

Visualizing and Shading the Correct Region

Step 1: After plotting the dashed boundary line, identify the side to shade:

- Because the origin does not satisfy the inequality, shade the side of the line that does not contain

(0,0).
- Alternatively, pick a test point on the other side, such as (3, 5), and verify:

$$
5(3) + 2(5) > 13
$$

$$
15 + 10 > 13
$$

$$
25 > 13 \quad \text{(True)}
$$

The point (3, 5) satisfies the inequality, so shade the side of the line where (3, 5) is located.

Step 2: Use clear markings:

- Dashed line: indicates the boundary is not included.
- Shaded region: represents all points satisfying $5x + 2y > 13$.

Summary of the Shading Process

To correctly shade the graph of $5x + 2y > 13$:

1. Graph the boundary line $5x + 2y = 13$ with a dashed line.
2. Choose a test point, typically the origin, to determine which side of the line to shade.
3. If the test point satisfies the inequality, shade that side; if not, shade the opposite side.
4. Confirm the shading covers all solutions, forming a half-plane above or below the boundary line as determined.

Additional Considerations and Common Mistakes

1. Solid vs. Dashed Lines:

- Use a solid line if the inequality includes equality ($\geq$ or $\leq$).
- Use a dashed line for strict inequalities ($>$ or $<$).

2. Test Point Selection:

- The origin is convenient unless it lies on the boundary line.

- Always verify with a test point to avoid mis-shading.

3. Interpreting the Inequality:

- The sign of the coefficient in front of x and y affects the slope and direction of the boundary line.
- The inequality's direction ($>$, $<$) determines shading.

4. Multiple Inequalities:

- When graphing systems, the overlapping shaded regions from multiple inequalities define the feasible solution set.

5. Real-World Relevance:

- Shaded regions often represent feasible solutions in optimization problems, resource allocation, and constraint modeling.

Conclusion: Which Correctly Describes How The Graph Is Shaded?

The proper shading of the graph representing the inequality $5x + 2y > 13$ involves the following:

- Drawing the boundary line $5x + 2y = 13$ as a dashed line, since the inequality is strict.
- Using a test point (such as the origin) to determine which side of the line satisfies the inequality.
- Shading the side of the boundary line that contains points satisfying $5x + 2y > 13$, i.e., the half-plane where the inequality holds true.
- Ensuring clarity in the graph with appropriate line styles and shading conventions.

In essence, the correct graph of the inequality is the dashed boundary line with shading on the side where the inequality is true, identified via substitution of a test point. This method guarantees an accurate visual representation of the solution set for the inequality, aligning with standard mathematical conventions and pedagogical best practices.

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