Which Graph Shows The Solution To The System Of Linear Inequalities?x 4y < 4y < X + 1On A Coordinate

Which Graph Shows The Solution To The System Of Linear Inequalities?x 4y < 4y < X + 1On A Coordinate is a common question students encounter when studying systems of inequalities. Understanding how to interpret these inequalities and visually represent their solutions on a coordinate plane is essential for mastering algebraic concepts. In this article, we will explore the step-by-step process of solving such systems, how to sketch the solution regions, and how to identify the correct graph that depicts the solution set.

Understanding the System of Inequalities

Before diving into graphing, it’s crucial to understand the given inequalities:

Analyzing the Inequalities

The system provided is:

- x 4y < 4y
- 4y < x + 1

At first glance, the inequalities seem to have some formatting issues. Assuming the intended inequalities are:
1. x - 4y < 0
2. 4y < x + 1

This interpretation aligns with common linear inequalities involving x and y.

Rewriting the Inequalities

To better understand, rewrite each inequality in slope-intercept form (y = mx + b):

- For x - 4y < 0:
    - Subtract x from both sides: -4y < -x

  - Divide both sides by -4 (remember to flip the inequality sign): y > (1/4)x

- For 4y < x + 1:
  - Divide both sides by 4: y < (1/4)x + 1/4

Now, the system consists of:

- y > (1/4)x
- y < (1/4)x + 1/4

These two inequalities represent regions between two lines.

Graphing the System of Inequalities

Graphing inequalities involves plotting their boundary lines and shading the appropriate regions.

Step 1: Graph the Boundary Lines

The boundary lines are the equations:

- y = (1/4)x
- y = (1/4)x + 1/4

Both are straight lines with slope 1/4, but with different y-intercepts:

- Line 1: passes through (0, 0)
- Line 2: passes through (0, 1/4)

Plot these lines:
- For y = (1/4)x:
- When x = 0, y = 0

- When $x = 4$, $y = 1$
- For $y = (1/4)x + 1/4$:
- When $x = 0$, $y = 0.25$
- When $x = 4$, $y = 1.25$

Draw both lines on the coordinate plane, noting that the lines are parallel since they have the same slope.

Step 2: Determine the Shading Regions

The inequalities specify:
- $y > (1/4)x$ (above the line $y = (1/4)x$)
- $y < (1/4)x + 1/4$ (below the line $y = (1/4)x + 1/4$)

Since the lines are parallel, the solution region is the area between these two lines where both inequalities are satisfied.

Step 3: Test a Point to Confirm the Solution Region

Choose a test point not on the boundary, such as (0, 0.5):

- For $y > (1/4)x$:
- $0.5 > 0 \rightarrow$ True
- For $y < (1/4)x + 1/4$:
- $0.5 < 0 + 0.25 \rightarrow$ False

Thus, (0, 0.5) is not in the solution region. Try point (0, 0):

- $y > (1/4)x$:
- $0 > 0 \rightarrow$ False
- $y < (1/4)x + 1/4$:
- $0 < 0 + 0.25 \rightarrow$ True

Since only one inequality is true, the point (0, 0) is not in the solution region.

Now, test point (0, 0.2):

- $y > (1/4)x$:
- $0.2 > 0 \rightarrow$ True
- $y < (1/4)x + 1/4$:
- $0.2 < 0 + 0.25 \rightarrow$ True

Both are true, so the point (0, 0.2) is in the solution region.

Therefore, the solution region is the area between the two lines, above $y = (1/4)x$ and below $y = (1/4)x + 1/4$.

Identifying the Correct Graph

Based on the analysis, the graph that shows the solution to the system should display:

- Two parallel lines with slope 1/4
- The region between these lines shaded, indicating y-values greater than the lower line and less than the upper line
- Shading should be above y = (1/4)x and below y = (1/4)x + 1/4

Common mistakes to avoid:
- Confusing the direction of inequalities (remember to flip the inequality when dividing by negative numbers)
- Forgetting to shade the correct region
- Not using test points to confirm the solution area

Visualizing the Solution on a Coordinate Plane

A typical graph demonstrating this system includes:
- The two parallel boundary lines
- Shaded region between the lines
- Clear indication of the inequalities' directions (e.g., dashed lines for strict inequalities)

Graph features to look for:

1. Parallel lines with the same slope, differing y-intercepts
2. The solution region between the lines shaded appropriately
3. Proper representation of the inequalities (dashed or solid lines based on whether equality is included)

Conclusion: Choosing The Correct Graph

To identify the graph that shows the solution to the system of inequalities:

- Verify the boundary lines are parallel with slope 1/4
- Check that the shading is between y = (1/4)x and y = (1/4)x + 1/4

- Ensure the shading corresponds to y > (1/4)x and y < (1/4)x + 1/4

Understanding the relationships between inequalities and their graphical representations is key to solving such problems efficiently. When selecting among multiple graphs, look for the precise alignment of boundary lines and the correct shading area. With practice, recognizing these visual cues becomes intuitive, making it easier to confirm the solution set quickly.

Final tip: Always test a point within the shaded region to confirm it satisfies both inequalities. This verification step is crucial for ensuring your graph accurately depicts the solution to the system.

By mastering these concepts, students can confidently interpret and graph systems of linear inequalities, enhancing their overall understanding of algebra and coordinate geometry.

Frequently Asked Questions

How can I identify the solution region for the system of inequalities 4y < 4y < x + 1 on a graph?

The solution region is the area where both inequalities are satisfied simultaneously. Since 4y < 4y is always false unless interpreted as a typo, assuming the inequalities are 4y < x + 1 and possibly another, you should graph each inequality separately and find the overlapping shaded region that satisfies both.

What features should I look for in a graph to determine it shows the solution to the system 4y < x + 1?

Look for the shaded region that lies below the line y = (x + 1)/4 (if rearranged), with the line itself possibly dashed if the inequality is strict, and ensure that the shaded area correctly represents the inequalities' conditions.

Is the graph of the solution to the system of inequalities always a bounded or unbounded region?

It can be either bounded or unbounded depending on the inequalities. For 4y < x + 1, the solution region is typically unbounded, extending infinitely in certain directions, unless additional inequalities restrict it.

How do I interpret the boundary lines in the graph of inequalities like 4y < x + 1?

The boundary line is the line where 4y = x + 1. If the inequality is strict (<), the boundary line is dashed, indicating points on the line are not included in the solution region. If it were ≤, the line would be solid, including boundary points.

What is the correct way to graph the system of inequalities to show the solution clearly?

First, graph each inequality separately, using dashed lines for strict inequalities. Then, shade the region that satisfies each inequality, and identify the overlapping shaded area as the solution to the system.

Additional Resources

Which Graph Shows The Solution To The System Of Linear Inequalities? x + 4y < 4 and y < x + 1

Introduction

In the realm of algebra and coordinate geometry, the visualization of systems of inequalities plays a pivotal role in understanding feasible solutions. Among various instructional and analytical contexts, the question, "Which graph shows the solution to the system of linear inequalities x + 4y < 4 and y < x + 1?" is both fundamental and instructive. This inquiry not only tests comprehension of inequality regions but also emphasizes the importance of graphical representation in solving systems.

This article explores the intricacies of plotting such systems, delves into the principles that underpin their graphical solutions, and provides a comprehensive guide for interpreting and identifying the correct graph. By examining the properties of each inequality, the nature of their boundary lines, and the regions they encompass, readers will be equipped with a thorough understanding necessary for accurate graph identification.

Understanding the System of Inequalities

Before analyzing the graphs, it is essential to grasp the nature of the inequalities involved:

1. x + 4y < 4
2. y < x + 1

These inequalities define regions in the coordinate plane that satisfy certain conditions. The solution to the system is the intersection of these regions—points that satisfy both inequalities simultaneously.

Dissecting Each Inequality

1. The Inequality $x + 4y < 4$

This inequality can be rewritten as:

$x + 4y < 4$

or equivalently,

$4y < 4 - x$

and further as:

$y < (4 - x)/4$

Boundary Line:

- The boundary line is given by the equation $x + 4y = 4$.
- The boundary is a straight line, which can be plotted by finding intercepts:

- When $x = 0$: $0 + 4y = 4 \rightarrow y = 1$
- When $y = 0$: $x + 0 = 4 \rightarrow x = 4$

- The line passes through points (0, 1) and (4, 0).

Line Type:

- Since the inequality is "<" (less than), the boundary line is dashed to indicate that points on the line are not included in the solution region.

Region:

- The inequality $y < (4 - x)/4$ indicates the region below the boundary line.

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2. The Inequality $y < x + 1$

This inequality delineates a region below the line $y = x + 1$.

Boundary Line:

- The boundary line is $y = x + 1$.

- At $x = 0$: $y = 1$ → point (0, 1)
- At $x = -1$: $y = 0$ → point (-1, 0)

Line Type:

- Since the inequality is "<" (less than), the boundary line is dashed.

Region:

- The solution region is below the line $y = x + 1$.

Graphical Interpretation of the System

Visualizing Each Region

- For $x + 4y < 4$: Shade the area below the dashed line passing through (0, 1) and (4, 0).
- For $y < x + 1$: Shade the area below the dashed line passing through (0, 1) and (-1, 0).

Intersection of Regions

- The solution to the system is the overlap of the two shaded regions—points that satisfy both inequalities simultaneously.
- The intersection will lie below both boundary lines, specifically in the region that is underneath both the lines $y = (4 - x)/4$ and $y = x + 1$.

Key Features for Graph Identification

To accurately determine which graph depicts the solution, consider these fundamental features:

1. Boundary Lines

- Position and slope:
- $x + 4y = 4$: passes through (0, 1) and (4, 0); slope = $-1/4$.
- $y = x + 1$: passes through (0, 1) and (-1, 0); slope = 1.

- Line style:
- Both are dashed lines, indicating the boundary is not included in the solution region.

2. Shaded Regions

- For both inequalities, the shading is below the boundary lines.
- The overlapping shaded region is the solution set.

3. Points of Intersection

- The two boundary lines intersect where:

- $x + 4y = 4$
- $y = x + 1$

- Substitute y from the second into the first:

$x + 4(x + 1) = 4$

$x + 4x + 4 = 4$

$5x + 4 = 4$

$5x = 0$

$x = 0$

- Plug back into $y = x + 1$:

$y = 0 + 1 = 1$

- The lines intersect at (0, 1), which is on both boundary lines. Since the inequalities are strict, the point (0, 1) is not included in the solution region, but it marks the boundary.

Analyzing Candidate Graphs

Given the above analysis, the correct graph should have:

- Two dashed lines: one passing through (0, 1) and (4, 0), the other through (0, 1) and (-1, 0).
- The shading below both lines.
- The overlapping shaded region should be the feasible solution space.

Common Mistakes to Avoid

- Using solid lines: The inequalities are strict; the boundary lines are dashed.
- Incorrect shading: The solution region is below both lines, not above.
- Ignoring the intersection point: The key intersection at (0, 1) confirms the lines' crossing point.

Practical Step-by-Step Approach to Graphing

1. Plot the boundary lines:

- Draw $y = (4 - x)/4$ as a dashed line passing through (0, 1) and (4, 0).
- Draw $y = x + 1$ as a dashed line passing through (0, 1) and (-1, 0).

2. Determine the shading:
- For $x + 4y < 4$, shade below the first line.
- For $y < x + 1$, shade below the second line.

3. Identify the intersection region:
- The solution is the common shaded area beneath both lines.

4. Verify the solution:
- Pick a test point within the shaded region (e.g., (0, 0)):
- $x + 4(0) = 0 < 4$ → true
- $0 < 0 + 1 = 1$ → true
- The point (0, 0) satisfies both inequalities, confirming the correctness of the solution region.

Final Determination: Which Graph Is Correct?

The graph that accurately depicts:

- Dashed boundary lines representing the equations $x + 4y = 4$ and $y = x + 1$.
- Shaded regions below both lines.
- The intersection point at (0, 1) lying on both lines but not included in the solution.

This graph visually captures the feasible solution set for the system $x + 4y < 4$ and $y < x + 1$.

Broader Implications and Educational Significance

Understanding how to interpret such graphs is vital in multiple disciplines, including economics, engineering, and data science, where systems of inequalities underpin optimization problems, feasible region analyses, and decision-making processes.

The exercise of matching a graph to the system of inequalities enhances spatial reasoning and deepens comprehension of how algebraic inequalities translate into geometric regions. It also cultivates skills in discerning boundary types, shading conventions, and intersection points—key competencies for students and professionals alike.

Conclusion

Identifying the correct graph that shows the solution to the system of linear inequalities x + 4y < 4 and y < x + 1 involves a careful analysis of boundary lines, shading, and intersection points. The proper graph features dashed lines passing through the key points (0, 1), (4, 0), and (-1, 0), with the solution region located below both boundary lines. Recognizing these features ensures accurate interpretation and enhances one's ability to visualize systems of inequalities in the coordinate plane.

Through meticulous examination and understanding of the boundary lines and shaded regions, students and analysts alike can confidently determine the correct graphical representation of the solution set, fostering deeper mastery of geometric solutions in algebraic contexts.

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