Graphing Linear Inequalities in Two Variables

Two-Variable Inequalities: Repair and Reconstruct Regions

Name _____ **Date** _____ **Score** _____ / 6

QUICK REVIEW

A correct region needs both the right boundary style and the right side. A test point checks shading but cannot by itself decide whether equality is included. When dividing an inequality by a negative coefficient of y, reverse the comparison: $-2y > 2x - 4$ gives $y < -x + 2$. Reconstruct a region from boundary points, inclusion information, and a specified side or test point.

Worked example

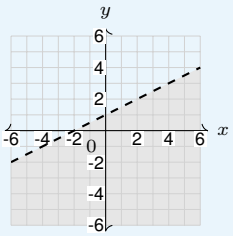
Correct a solid boundary for $y < \frac{1}{2}x + 1$. Use $(0, 0)$ to choose the shading.

1. Boundary $y = \frac{1}{2}x + 1$: $y(0) = 1$ and $y(2) = 2$. Mark $(0, 1), (2, 2)$.

2. Use a dashed line: the strict inequality excludes equality on the boundary.

3. At $(0, 0)$, $0 < 1$ is true. Shade below the boundary.

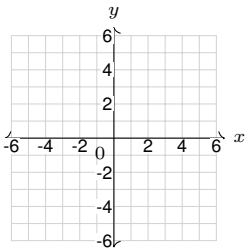
Answer: Dashed boundary through $(0, 1), (2, 2)$; shade below; $(0, 0)$ included.



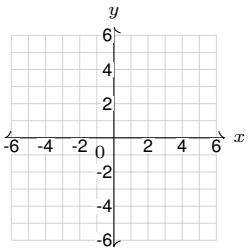
Practice Problems

Show your thinking.

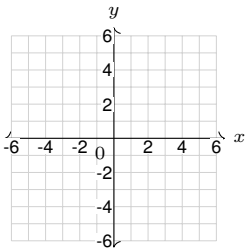
1. A student shades below $y = -x + 3$ for $y \geq -x + 3$. Correct and graph. Draw the boundary and solution region. Test $(0, 0)$.



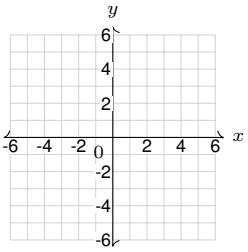
2. A solid boundary passes through $(0, -2), (2, 0)$, with the region above it. Write its inequality and draw it. Draw the boundary and solution region. Test $(0, 0)$.



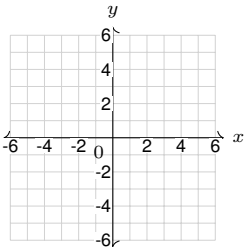
3. Design and draw a strict inequality with boundary slope $-\frac{1}{2}$, intercept 1, and the region below the boundary. Draw the boundary and solution region. Test $(0, 0)$.



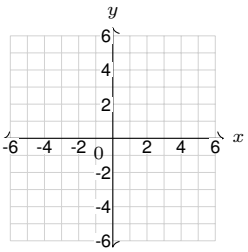
4. A student shades right of $x = -2$ for $x \leq -2$. Correct the side and draw the region. Draw the boundary and shade the solution region. Test $(0, 0)$.



5. Rewrite $-2y > 2x - 4$ before graphing its solution region. Draw the boundary and solution region. Test $(0, 0)$.



6. Graph $y \geq \frac{1}{2}x - 1$. Decide whether the boundary point $(2, 0)$ and the origin are included. Draw the boundary and solution region. Test $(0, 0)$.



Answer Key

1. Solid boundary through $(0, 3), (2, 1)$; shade above; $(0, 0)$ excluded.
2. Solid boundary through $(0, -2), (2, 0)$; shade above; $(0, 0)$ included.
3. Dashed boundary through $(0, 1), (2, 0)$; shade below; $(0, 0)$ included.
4. Solid vertical boundary $x = -2$; shade left; $(0, 0)$ excluded.
5. Dashed boundary through $(0, 2), (2, 0)$; shade below; $(0, 0)$ included.
6. Solid boundary through $(0, -1), (2, 0)$; shade above; $(0, 0)$ included.

Step-by-Step Solutions

Follow each calculation, then check your own work.

Problem 1

1. The symbol $\geq$ requires outputs above or on the boundary, not below. Boundary points are $(0, 3)$ and $(2, 1)$ since $-2 + 3 = 1$.

2. Draw a solid line through $(0, 3)$ and $(2, 1)$. Equality is allowed, so boundary points belong to the solution set.

3. Test $(0, 0)$: $0 \geq 3$ is false. Shade above the boundary, excluding this test point.

Problem 2

1. The boundary slope is $(0 - (-2))/(2 - 0) = 1$ and its intercept is -2. Solid plus above gives the inequality $y \geq x - 2$.

2. Draw a solid line through $(0, -2)$ and $(2, 0)$. Equality is allowed, so boundary points belong to the solution set.

3. Test $(0, 0)$: $0 \geq -2$ is true. Shade above the boundary, including this test point.

Problem 3

1. The required boundary is $y = -\frac{1}{2}x + 1$. Below and strict mean $y < -\frac{1}{2}x + 1$; sample boundary points are $(0, 1)$ and $(2, 0)$.

2. Draw a dashed line through $(0, 1)$ and $(2, 0)$. Equality is excluded, so boundary points do not belong to the solution set.

3. Test $(0, 0)$: $0 < 1$ is true. Shade below the boundary, including this test point.

Problem 4

1. The symbol $\leq$ requires input values no greater than -2. Points $(-3, 0)$ satisfy it, while $(0, 0)$ fails because $0 \nleq -2$.

2. Draw the solid vertical line through $(-2, -4)$ and $(-2, 4)$. Equality is allowed, so include the boundary.

3. Test $(0, 0)$ by comparing its input: $0 \leq -2$ is false. Shade to the left, where horizontal coordinates satisfy the original comparison.

Problem 5

1. Divide every term by -2 and reverse $>$: $y < -x + 2$. The boundary has points $(0, 2)$ and $(2, 0)$ because $-2 + 2 = 0$.

2. Draw a dashed line through $(0, 2)$ and $(2, 0)$. Equality is excluded, so boundary points do not belong to the solution set.

3. Test $(0, 0)$: $0 < 2$ is true. Shade below the boundary, including this test point.

Problem 6

1. At $(2, 0)$, $0 = \frac{1}{2}(2) - 1 = 0$, so the inclusive inequality accepts that boundary point. Boundary samples $(0, -1), (2, 0)$ determine the line.

2. Draw a solid line through $(0, -1)$ and $(2, 0)$. Equality is allowed, so boundary points belong to the solution set.

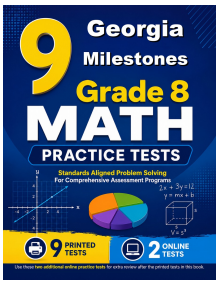
3. Test $(0, 0)$: $0 \geq -1$ is true. Shade above the boundary, including this test point.

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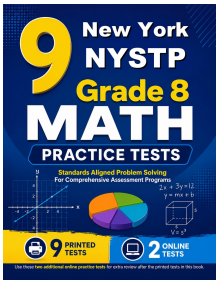
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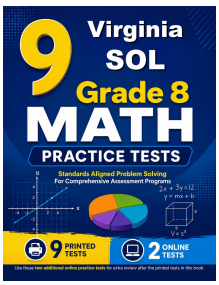
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