Graphing Linear Inequalities in Two Variables

Two-Variable Inequalities: Boundaries and Half-Planes

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

QUICK REVIEW

An inequality in two variables describes a region of ordered pairs. First draw its boundary by replacing the comparison with equality. Use a solid line for $\leq$ or $\geq$ and a dashed line for $<$ or $>$. For $y > mx + b$, shade above; for $y < mx + b$, shade below. Substitute a point off the boundary to check the selected side.

Worked example

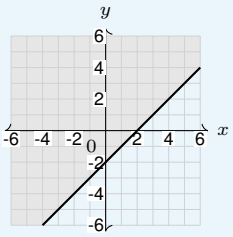
Graph $y \geq x - 2$. Draw the boundary and solution region. Test $(0, 0)$.

1. Use the boundary $y = 1x - 2$. At $x = 0$, $y = -2$; at $x = 2$, $y = (1)(2) + (-2) = 0$.

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.

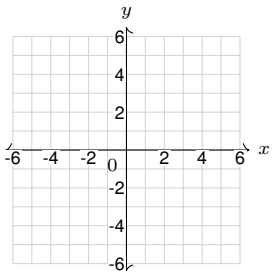
Answer: Solid boundary through $(0, -2), (2, 0)$; shade above; $(0, 0)$ included.



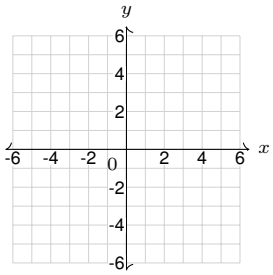
Practice Problems

Show your thinking.

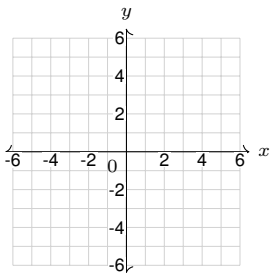
1. Graph $y > x + 1$. Draw the boundary and solution region. Test $(0, 0)$.



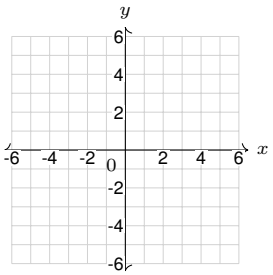
2. Graph $y \leq -\frac{1}{2}x + 2$. Draw the boundary and solution region. Test $(0, 0)$.



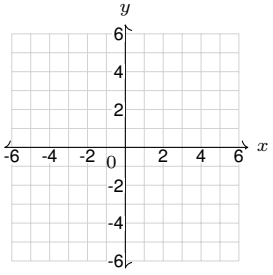
3. Graph $y \geq 2x - 3$. Draw the boundary and solution region. Test $(0, 0)$.



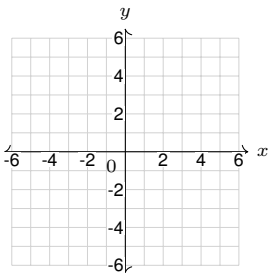
4. Graph $y < -2x + 1$. Draw the boundary and solution region. Test $(0, 0)$.



5. Graph $y \leq -2$ and describe its horizontal boundary. Draw the boundary and solution region. Test $(0, 0)$.



6. Graph $x > 1$ and describe its vertical boundary. Draw the boundary and shade the solution region. Test $(0, 0)$.



Answer Key

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

Step-by-Step Solutions

Follow each calculation, then check your own work.

Problem 1

1. Use the boundary $y = 1x + 1$. At $x = 0$, $y = 1$; at $x = 2$, $y = (1)(2) + (1) = 3$.
2. Draw a dashed line through $(0, 1)$ and $(2, 3)$. Equality is excluded, so boundary points do not belong to the solution set.
3. Test $(0, 0)$: $0 > 1$ is false. Shade above the boundary, excluding this test point.

Problem 2

1. Use the boundary $y = -\frac{1}{2}x + 2$. At $x = 0$, $y = 2$; at $x = 2$, $y = (-\frac{1}{2})(2) + (2) = 1$.
2. Draw a solid line through $(0, 2)$ and $(2, 1)$. Equality is allowed, so boundary points belong to the solution set.
3. Test $(0, 0)$: $0 \leq 2$ is true. Shade below the boundary, including this test point.

Problem 3

1. Use the boundary $y = 2x - 3$. At $x = 0$, $y = -3$; at $x = 2$, $y = (2)(2) + (-3) = 1$.
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 true. Shade above the boundary, including this test point.

Problem 4

1. Use the boundary $y = -2x + 1$. At $x = 0$, $y = 1$; at $x = 2$, $y = (-2)(2) + (1) = -3$.
2. Draw a dashed line through $(0, 1)$ and $(2, -3)$. 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 5

1. Use the boundary $y = 0x - 2$. At $x = 0$, $y = -2$; at $x = 2$, $y = (0)(2) + (-2) = -2$.
2. Draw a solid line through $(0, -2)$ and $(2, -2)$. Equality is allowed, so boundary points belong to the solution set.
3. Test $(0, 0)$: $0 \leq -2$ is false. Shade below the boundary, excluding this test point.

Problem 6

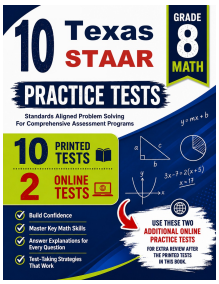
1. Replace the comparison by equality: $x = 1$. Points $(1, -4)$ and $(1, 4)$ both have the required fixed horizontal coordinate.
2. Draw the dashed vertical line through $(1, -4)$ and $(1, 4)$. The strict comparison excludes every boundary point.
3. Test $(0, 0)$ by comparing its input: $0 > 1$ is false. Shade to the right, where horizontal coordinates satisfy the original comparison.

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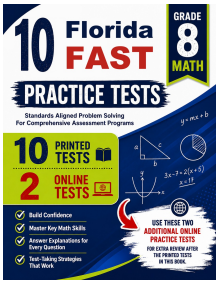
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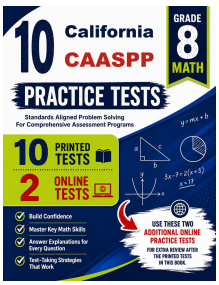
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