Graphing Linear and Absolute Value Inequalities

Name Key
Date _____ Block _____

A linear inequality, like $y \geq 2x - 1$, resembles a linear equation, but with an inequality sign instead of an equal sign. The graph of the related linear equation separates the coordinate plane into two half-planes. The line is the boundary of each half-plane.

Graphing a Linear Inequality

Step 1: Graph the boundary; that is, the related linear equation. If the inequality symbol is ≤ or ≥, the boundary is solid. If the inequality symbol is < or >, the boundary is dashed.

Step 2: Choose a point not on the boundary and test it in the inequality. (0, 0) is a good point to choose if the boundary does not pass through the origin.

Step 3: If a true inequality results, shade the half–plane containing your test point. If a false inequality results, shade the other half-plane.

Example: Graph $x + 2y \geq 4$.

The boundary is the graph of $x + 2y = 4$.

Use the slope-intercept form, $y = -\frac{1}{2}x + 2$, to graph the boundary line.

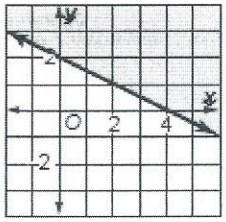
The boundary line should be solid.

Test the point (0, 0).

$0 + 2(0) \stackrel{?}{\geq} 4$ $\qquad$ $(x, y) = (0, 0)$

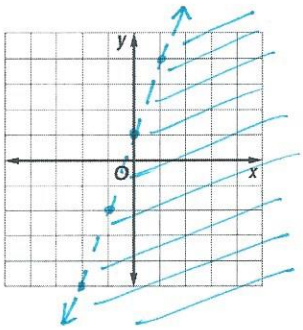
$0 \geq 4$ $\qquad$ false

Shade the region that does *not* contain (0, 0).

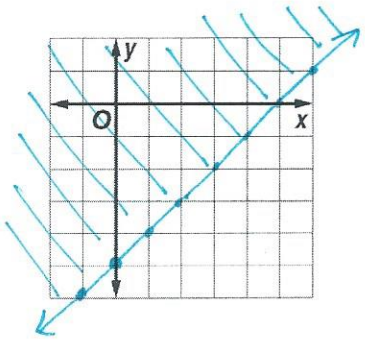


PRACTICE: Graph each inequality.

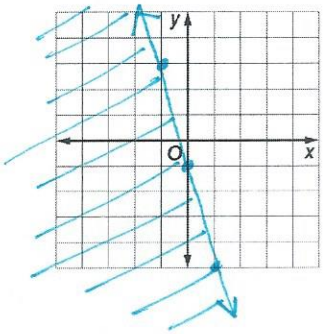
1. $y < 3x + 1$



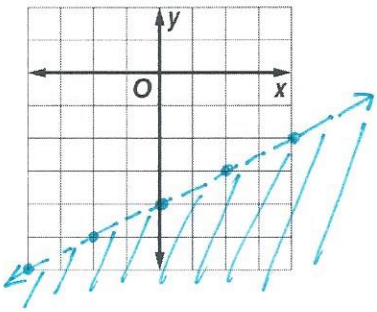
2. $y \geq x - 5$



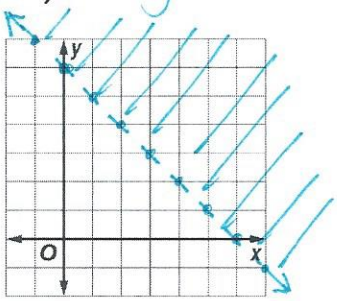
3. $4x + y \leq -1$ $\quad y \leq -4x - 1$



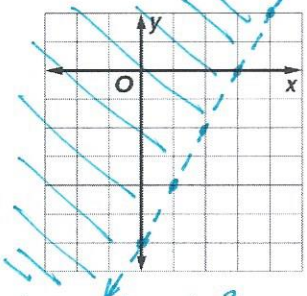
4. $y < \frac{x}{2} - 4$



5. $x + y > 6$ $\quad y > -x + 6$



6. $0.5x - 0.25y < 1.5$



$\frac{1}{2}x - \frac{1}{4}y < \frac{3}{2}$

$-4 \cdot -\frac{1}{4}y < -4 \cdot \frac{1}{2}x + -4 \cdot \frac{3}{2}$

$y > 2x - 6$

Key

Graphing an Absolute Value Inequality

Graphing absolute value inequalities is similar to graphing linear inequalities. The graph of the related absolute value equation is the boundary. This boundary is graphed as a solid line if the inequality is ≤ or ≥, and dashed if the inequality is < or >. Choose a test point not on the boundary to determine which region to shade.

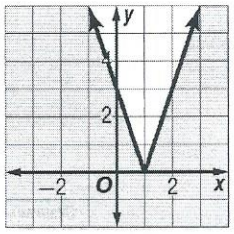
Step 1: First graph the equation $y = 3|x - 1|$.
Step 2: Since the inequality is ≤, the graph of the boundary is solid.
Step 3: Test (0, 0).

$0 \overset{?}{\leq} 3\,|0 - 1|$ $\quad (x, y) = (0, 0)$

$0 \overset{?}{\leq} 3\,|-1|$ $\quad |-1| = 1$

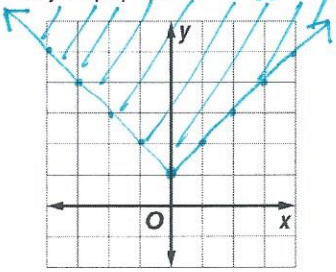
$0 \leq 3$ $\quad$ true

Step 4: Shade the region that contains (0, 0).

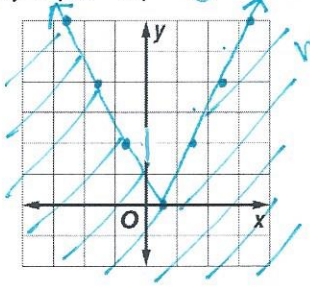


PRACTICE: Graph each inequality.

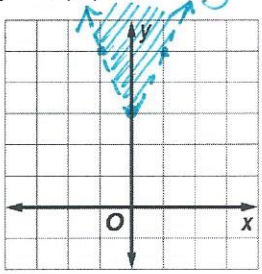
1. $y \geq |x| + 1$ vertex: (0, 1), $a = 1$



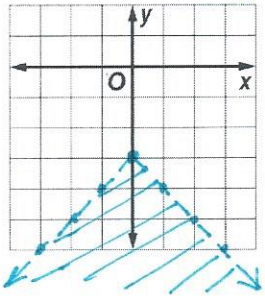
2. $y \leq |2x - 1| \Rightarrow y \leq |2(x - \frac{1}{2})|$ vertex: $(\frac{1}{2}, 0)$, $a = 1$



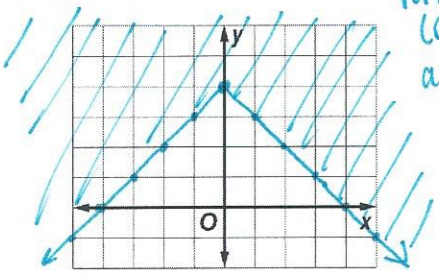
3. $y - 2|x| > 3 \rightarrow y > 2|x| + 3$ vertex: (0, 3), $a = 2$



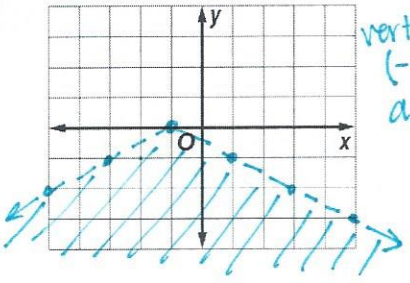
4. $y < -|x| - 3$ vertex: (0, −3), $a = -1$



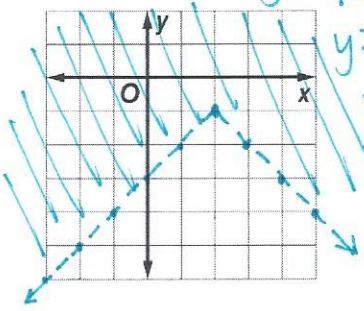
5. $|x| + y \geq 4$ $\quad y \geq -|x| + 4$ vertex: (0, 4), $a = -1$



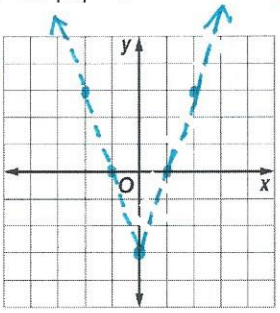
6. $|x + 1| + 2y < 0$ $\quad 2y < -|x+1|$, $y < -\frac{1}{2}|x+1|$ vertex: (−1, 0), $a = -\frac{1}{2}$



7. $|2 - x| + y > -1$ $\quad y > -|2-x| - 1$, $y > -|x+2| - 1$, $y > |-1(x-2)| - 1$ vertex: (2, −1), $a = -1$



8. $y < 3|x| - 3$ vertex: (0, −3), $a = 3$



9. $y \leq |1 - x| + 4$ $\quad y \leq |-x+1| + 4$, $y \leq |-(x-1)| + 4$ vertex: (1, 4), $a = 1$