

2-8 Graphing Linear Inequalities

A **linear inequality**, like $y \geq 2x - 1$, resembles a linear equation, but with an inequality sign instead of an equals 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.

Steps to Graph a Linear Inequality:

Step 1: Graph the boundary; that is, the related linear equation. If the inequality symbol is \leq or \geq , 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 $x + 2y = 4$.

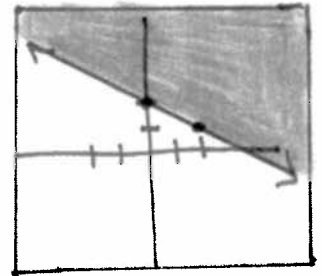
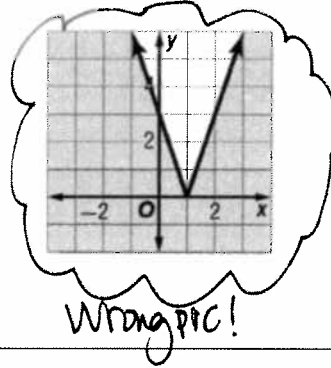
Use the slope-intercept form, $y = -\frac{1}{2}x + 2$, to graph the boundary line.

The boundary line should be solid.

Test the point $(0, 0)$.

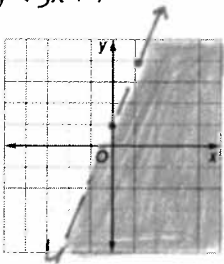
$$\begin{aligned} 0 + 2(0) &\stackrel{?}{\geq} 4 & (x, y) &= (0, 0) \\ 0 &\geq 4 & & \text{false} \end{aligned}$$

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

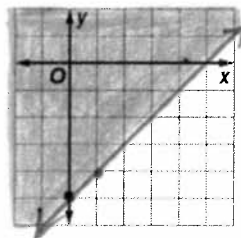


PRACTICE: Graph each inequality.

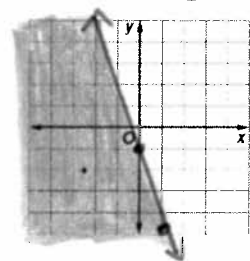
1. $y < 3x + 1$



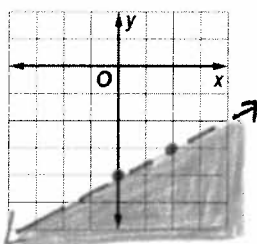
2. $y \geq x - 5$



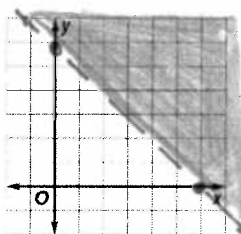
3. $4x + y \leq -1$ $y \leq -4x - 1$



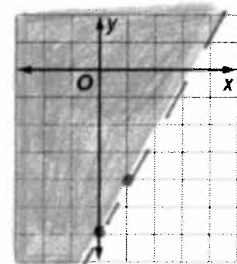
4. $y < \frac{x}{2} - 4$ $y < \frac{1}{2}x - 4$



5. $x + y > 6$



6. $0.5x - 0.25y < 1.5$



$$\begin{aligned} -0.25y &< -0.5x + 1.5 \\ y &> 2x - 6 \end{aligned}$$

2-8 Graphing Absolute Value Inequalities

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 \leq or \geq , and dashed if the inequality is $<$ or $>$. Choose a test point not on the boundary to determine which region to shade.

Steps to graph the inequality $y \leq 3|x - 1|$:

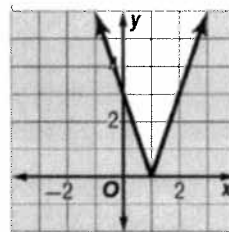
1. First graph the equation $y = 3|x - 1|$.
2. Since the inequality is \leq , the graph of the boundary is solid.
3. Test $(0, 0)$.

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

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

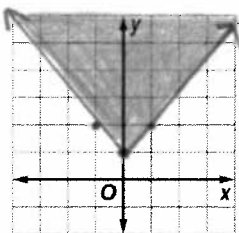
$$0 \leq 3 \quad \text{true}$$

4. Shade the region that contains $(0, 0)$.

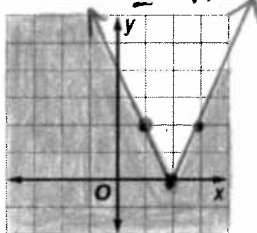


PRACTICE: Graph each inequality.

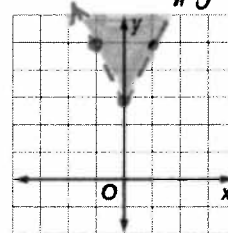
1. $y \geq |x| + 1$



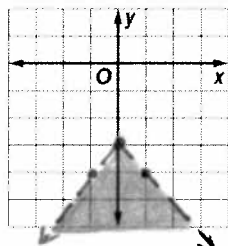
2. $y \leq |2x - 1| \leq 2|x - 2|$ *change to 2*



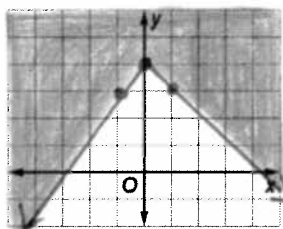
3. $y - 2|x| > 3$ *y > 2|x| + 3*



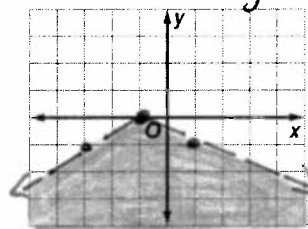
4. $y < -|x| - 3$



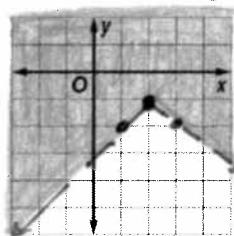
5. $|x| + y \geq 4$ *y >= -|x| + 4*



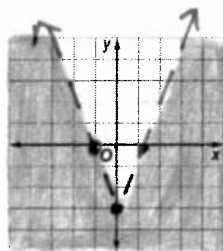
6. $|x + 1| + 2y < 0$ *2y < -|x + 1|, y < -1/2|x + 1|*



7. $(2 - x) + y > -1$ *change to x - 2* $y > -|x - 2| - 1$



8. $y < 3|x| - 3$



9. $y \leq |1 - x| + 4$ *change to x - 1*

