

Pre-Calculus 11
Chapter 9: Linear and Quadratic Inequalities

9.1 Linear Inequalities in Two Variables

With inequalities, solutions are represented by an entire set of solutions, or a **solution region**.

Equation:	Inequality:
$x+4=6$	$x+4 \geq 6$
<i>a single solution</i> → $x=2$	$x \geq 2$ ← <i>solution is a range of numbers</i>

For any given linear inequality, there will always be an associated linear equation.

This equation represents the **boundary line**, dividing the Cartesian plane into 2 solution region.

Inequality:	Boundary Line Equation:
$2x+3y \geq 5$	$2x+3y=5$

Example: Graph each inequality. Clearly label scale and axes.

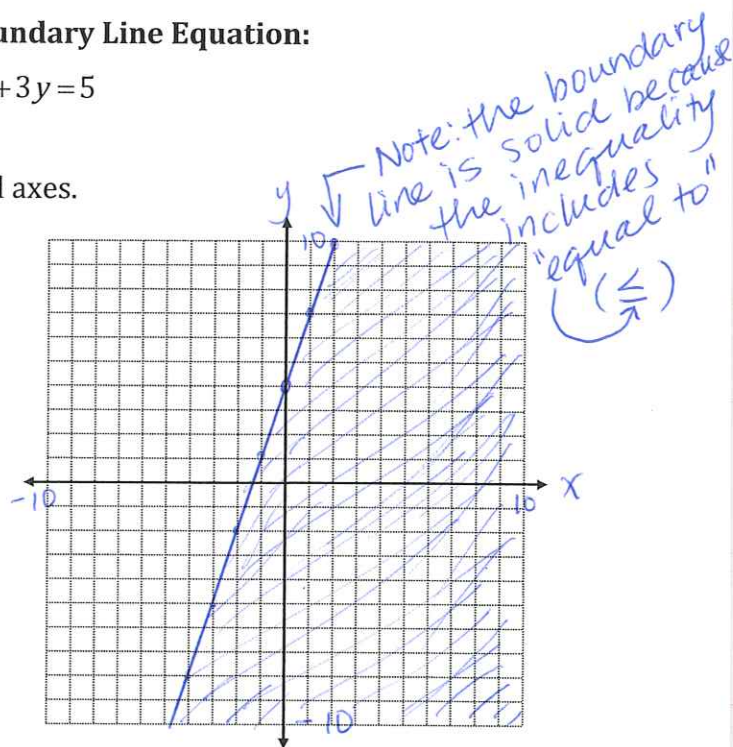
a) $y \leq 3x+4$ ① Boundary Line: $y=3x+4$
 slope = 3
 y-int = 4

② Select a test point from either region: $(0,0)$ is nice to use

$$0 \leq 3(0)+4?$$

$$0 \leq 4 \checkmark$$

∴ The solution is the region that includes $(0,0)$. We shade it in.



b) $4x+2y \geq 10$ ① Re-arrange inequality

$$2y \geq -4x+10$$

$$y \geq -2x+5$$

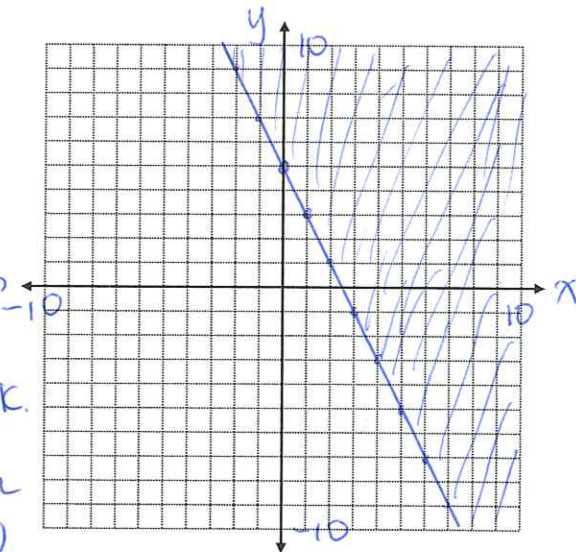
② slope = -2, y-int = 5

③ Select test point: $(0,0)$ again

$$4(0)+2(0) \geq 10$$

$$0 \geq 10 \text{ X does n't work.}$$

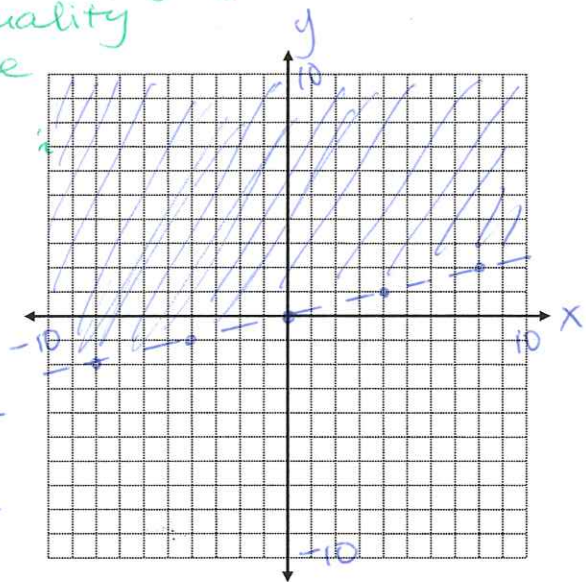
∴ The solution is the region that doesn't include $(0,0)$



Recall: when dividing/multiplying both sides of an inequality by a negative, the direction of the inequality changes.

c) $5x - 20y < 0$

$-20y < -5x$
 $y > \frac{1}{4}x$



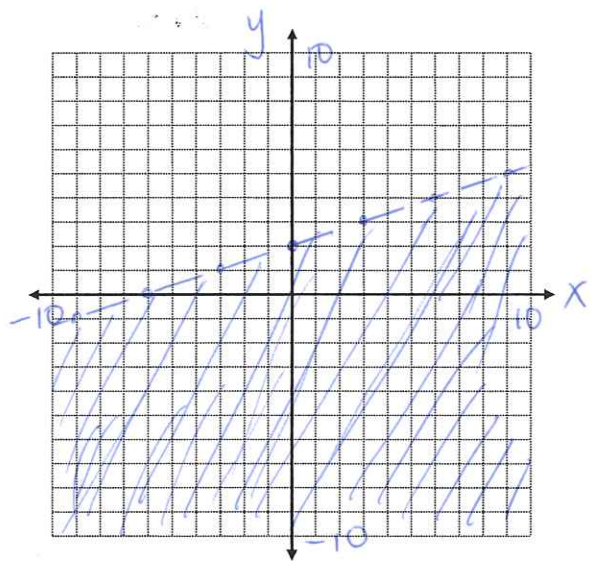
The boundary line is not part of the solution.
 (0,0) is on the boundary line, select a different test point: (0,1) $5(0) - 20(1) < 0$
 $-20 < 0 \checkmark$

d) $x - 3y > -6$

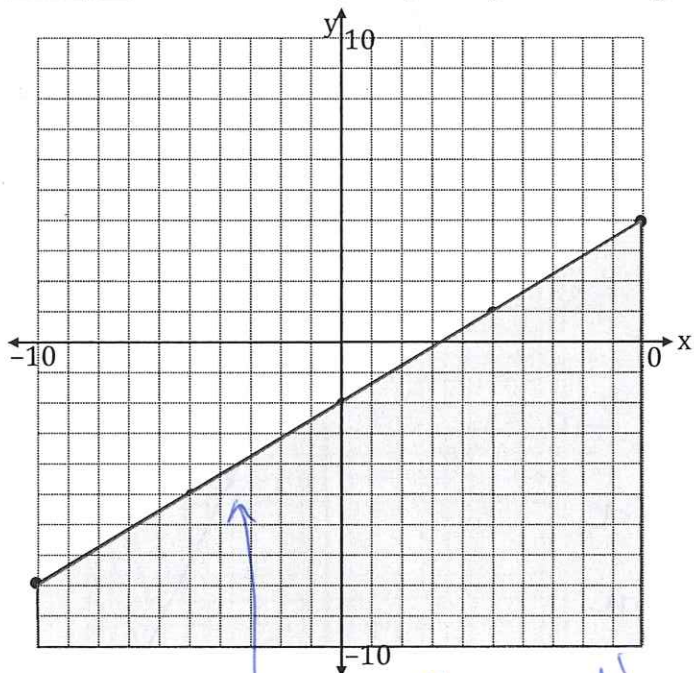
$-3y > -x - 6$
 $y < \frac{1}{3}x + 2$

Test (0,0)

$0 - 3(0) > -6$
 $0 > -6 \checkmark$



Example: Write an inequality to represent the graph.



Boundary line is solid!

Boundary Line: $y = \frac{3}{5}x - 2$

Inequality:

$y \square \frac{3}{5}x - 2$

Use a test point: (0,0)

$0 \square \frac{3}{5}(0) - 2$

$0 \square -2$

Since (0,0) is NOT in the solution (shaded) region we use $<$.

$y \leq \frac{3}{5}x - 2$