Algebra 2

Lesson 3-3: Systems of Inequalities

Mrs. Snow, Instructor

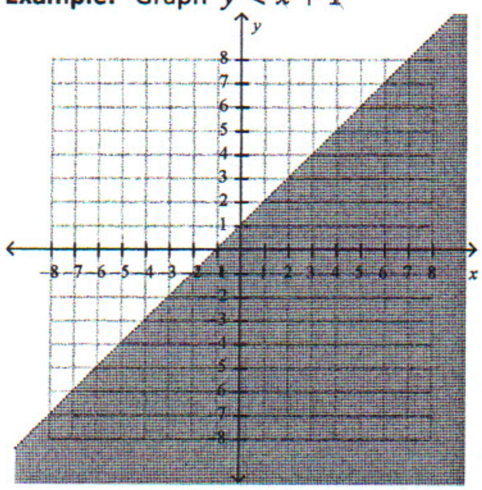
A **linear inequality** divides a graph into two regions – one that will contain only true solutions and one that will contain only false solutions. The **boundary line** that divides both regions may, at times, be a part of the solution.

Rules to remember when graphing inequalities and absolute values:

<u>First and foremost</u>: ALWAYS SOLVE FOR Y AND THEN GRAPH USING SLOPE INTERCEPT!!!

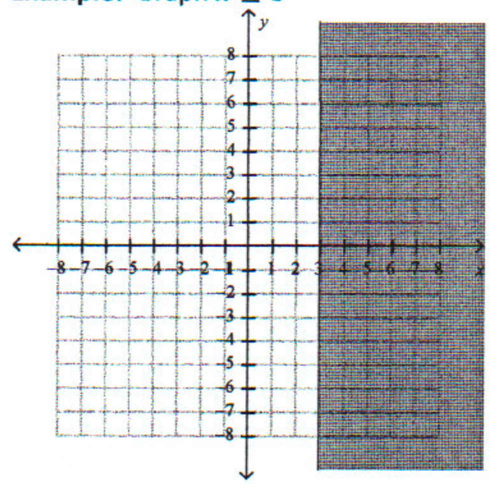
1. Inequalities with a $<$ *or* $>$ is drawn as a dotted line.
2. Inequalities with a $\leq$ *or* $\geq$ is drawn as a solid line.
3. Inequalities with a $<$ *or* $\leq$ are shaded downward. $y < mx + b$ $y \leq mx + b$
4. Inequalities with a $>$ *or* $\geq$ are shaded upward.

Example: Graph $y < x + 1$



This line is dotted and shaded down. Check: Pick (0,0); and plug values in. You get $0 < 1$, a true statement.

Example: Graph $x \geq 3$



This line is solid and shaded right. Check: Pick (0,0); plug into equation. You get $0 \geq -3$, a false statement, thus, you shade on the other side of the line. Pick a point there and check.

A simple way to check a graph is to pick a point (x,y) not on the line, but found in the shaded region. Plug it into the given equation. If the result is a true statement, then you have shaded the graph correctly.

REMEMBER: Arrow points **LEFT** ($<$ *or* $\leq$), you shade **DOWN**

Arrow points **RIGHT** ($>$ *or* $\geq$), you shade **UP**

Now consider two inequalities in the same coordinate grid. The solution in such cases is the area that both equations have in common – overlap.

Example

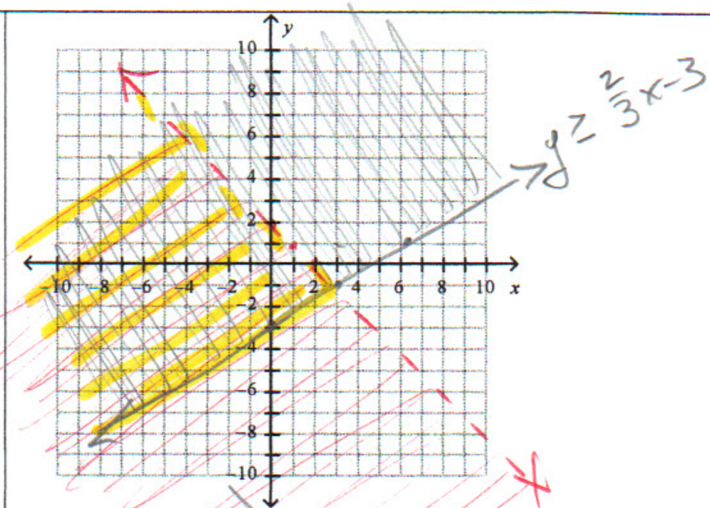
$$\begin{cases} y \geq \frac{2}{3}x - 3 & ① \\ x + y < 2 & ② \end{cases}$$

$y < -x + 2$

①

$m = \frac{2}{3}$	$b = -3$	$m = -1$	$b = 2$
solid	above	dashed	below

Notice that one line is solid and the other is dotted. Also notice the common solution area is double shaded.



$$\begin{cases} -x - y \leq 2 \\ y - 2x > 1 \end{cases}$$

$\div$ or $\times$

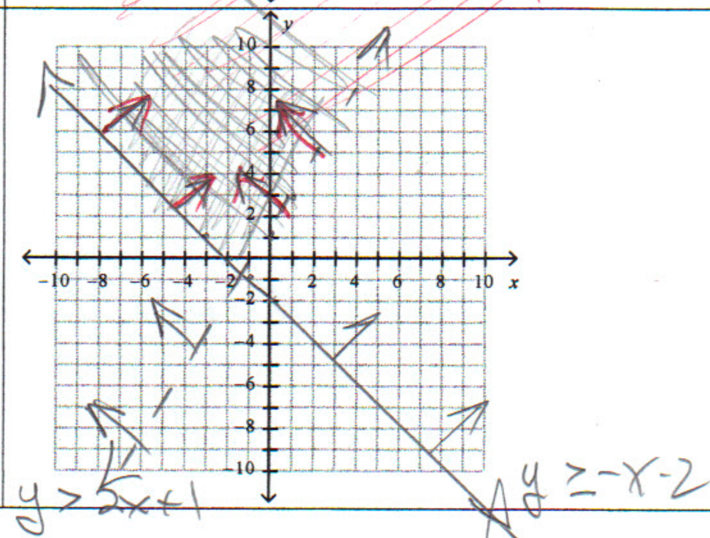
$(-1) - y \leq x + 2(-1)$

$y \geq -x - 2$

Multiply by neg flip inequality

$m = -1$	$b = -2$	$m = 2$	$b = 1$
solid	above	dash	above

$y > 2x + 1$



You can graph as many linear inequalities on a single graph as you need. Notice: the common area shrinks or gets "shaved" by succeeding inequalities. A system of four linear inequalities is sometimes called a linear programming problem. More on this idea in Section 3-4!!

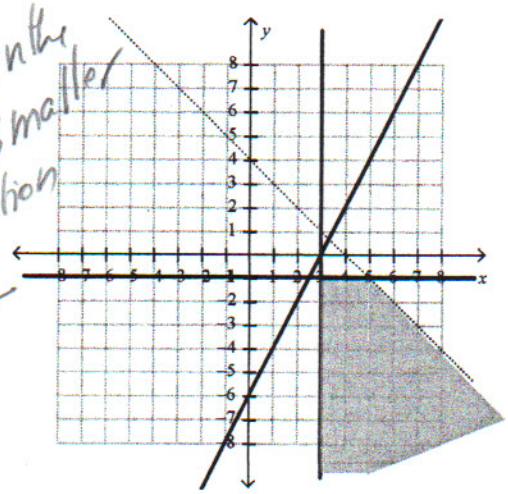
FYI

Example: Graph the system of inequalities

$$\begin{cases} x \geq 3 \\ y \leq -1 \\ y \leq 2x - 6 \\ y < -x + 4 \end{cases}$$

the more inequalities in the system the smaller the solution area

What happens to the solution area when you add more equations?



To check the system you pick a point inside the common area. Put these (x,y) coordinates into each of the four equations. You should get four true statements.