

3.5 Graphing Linear Inequalities in Two Variables

First, solving inequalities is a lot like solving equations: $\rightarrow$ Use inverse operations!

Lots of answers!

$$\begin{array}{r} x+3 < -5 \\ -3 \quad -3 \\ \hline x < -8 \end{array}$$

$$\begin{array}{r} 5n \geq 30 \\ 5 \quad 5 \\ \hline n \geq 6 \end{array}$$

$$\begin{array}{r} 3p-2 \leq 13 \\ +2 \quad +2 \\ \hline 3p \leq 15 \\ 3 \quad 3 \\ \hline p \leq 5 \end{array}$$

BUT... there's ONE BIG RULE!

When using inverse operations to solve inequalities, if you multiply or divide by a negative, you have to:

flip the inequality symbol!

$$\begin{array}{r} x-7 \leq -8 \\ +7 \quad +7 \\ \hline x \leq -1 \end{array}$$

No flip

$$\begin{array}{r} -2n-1 > 7 \\ +1 \quad +1 \\ \hline -2n > 8 \\ -2 \quad -2 \\ \hline n < -4 \end{array}$$

Divide by a neg.
Flip the symbol

$$\begin{array}{r} 3x < -18 \\ 3 \quad 3 \\ \hline x < -6 \end{array}$$

No flip
(Divided by 3, not by a neg.)

Now you are ready to graph linear inequalities, by first solving for y.

Inequality symbols		Shading rules	
< Less than	Dotted Line	$y < mx + b$	shade down/below the line
> Greater than	Solid Line	$y > mx + b$	shade up/above the line
		greater	

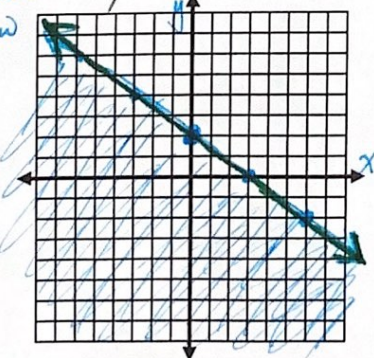
Example 1: Graph the following inequalities. Solve for y!

a) $2x + 3y \leq 6$

$$\begin{array}{r} -2x \quad -2x \\ \hline 3y \leq \frac{-2x+6}{3} \\ \hline y \leq -\frac{2}{3}x + 2 \end{array}$$

• solid line
• shade below

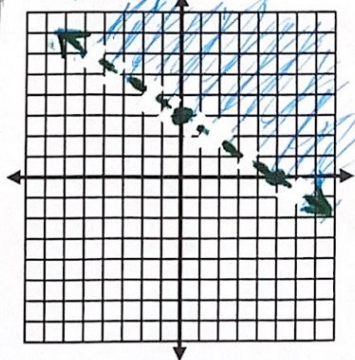
$y = mx + b$ y -int $(0, 2)$



b) Graph $3x + 5y > 15$

$$\begin{array}{r} -3x \quad -3x \\ \hline 5y > \frac{-3x+15}{5} \\ \hline y > -\frac{3}{5}x + 3 \end{array}$$

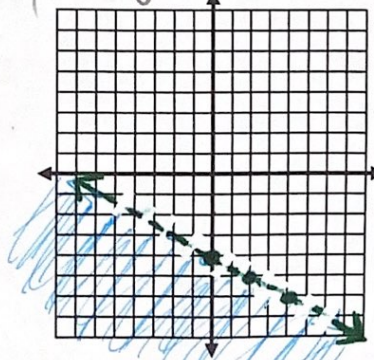
• dotted line
• shade up



c) $x + 2y < -8$

$$\begin{array}{r} -x \quad -x \\ \hline 2y < \frac{-x-8}{2} \\ \hline y < -\frac{1}{2}x - 4 \end{array}$$

• dotted line
• shade below



Example 2:

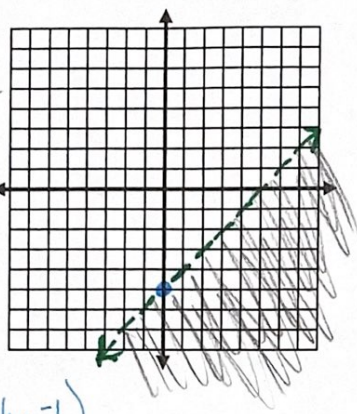
a) $x - y > 5$

$$\begin{array}{r} -x \quad -x \\ -y > -x + 5 \end{array}$$

$$\begin{array}{r} -1y > -1x + 5 \\ -1 \quad -1 \quad -1 \end{array}$$

$$y < x - 5$$

↑
Flip! (Divided by -1)



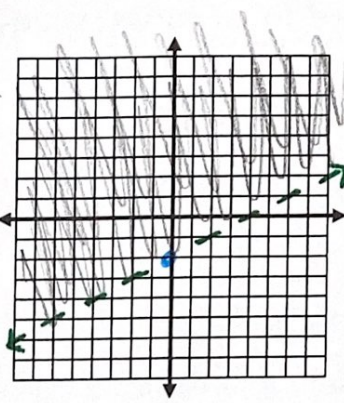
b) $2x - 4y < 8$

$$\begin{array}{r} -2x \quad -2x \\ -4y < -2x + 8 \end{array}$$

$$\begin{array}{r} -1y < -1/2x + 2 \\ -4 \quad -4 \quad -4 \end{array}$$

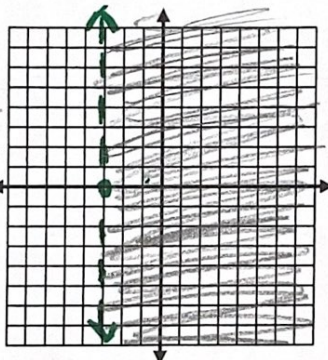
$$y > \frac{1}{2}x - 2$$

↑
Flip!



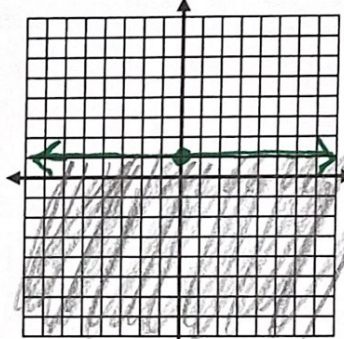
c) $x > -3$

x is greater
⇒ shade to the right



Recall: $x = -3$ Vertical line

d) $y \leq 1$

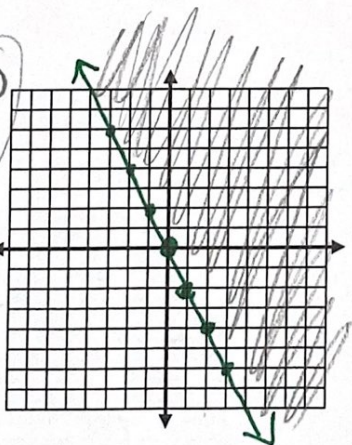


Recall: $y = 1$ Horizontal

e) $y \geq -2x + 0$

$$y \geq mx + b$$

$$m = \frac{-2 \text{ rise}}{1 \text{ run}}$$



f) $y < \frac{1}{3}x + 0$

