

Warm Up (9/19/17)

Solve and graph the following compound inequalities:

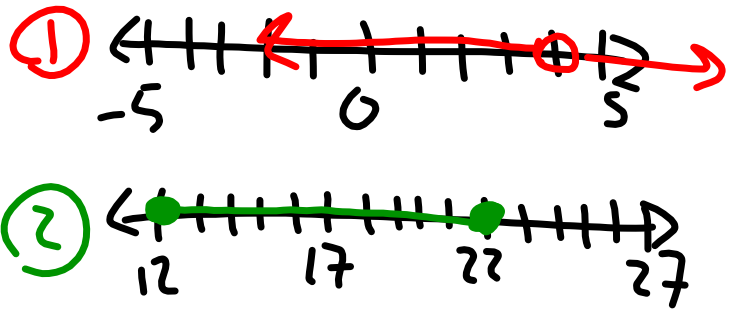
$$1. \quad 9 + 2x < 17 \quad \text{or} \quad 7 - 4x < -9$$

$$\begin{array}{r} -9 \\ \hline 2x < 8 \\ \frac{2x}{2} < \frac{8}{2} \\ x < 4 \end{array} \quad \text{or} \quad \begin{array}{r} -7 \\ \hline -4x < -16 \\ \frac{-4x}{-4} < \frac{-16}{-4} \\ x > 4 \end{array}$$

$$2. \quad 6 \leq \frac{x}{2} \leq 11$$

$$2 \left( 6 \leq \frac{x}{2} \leq 11 \right)$$

$$12 \leq x \leq 22$$



Module 1: Lesson 21

# Solution Sets to Inequalities with Two Variables

Let's begin by solving the following equation for  $y$ :

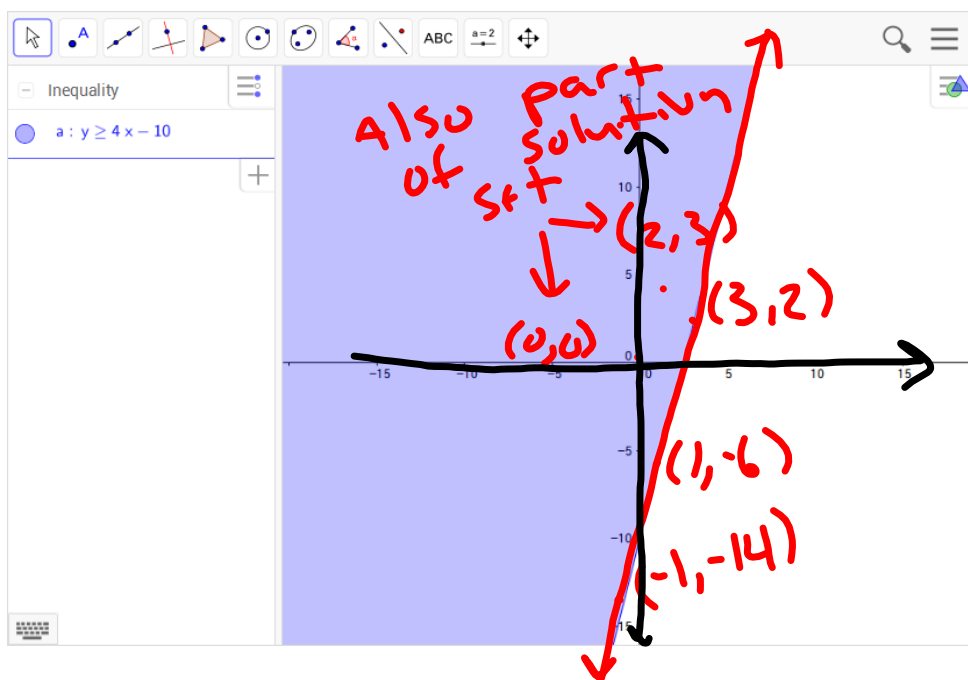
$$\begin{array}{r}
 4x - y = 10 \\
 \underline{-4x \quad -4x} \\
 -y = 10 - 4x \\
 \underline{-1 \quad -1} \\
 y = -10 + 4x \\
 \hline
 y = 4x - 10
 \end{array}$$

Now we're going to choose each ordered pair that works for the solution to the equation:


$(3, 2)$	$(2, 3)$	$(-1, -14)$	$(0, 0)$	$(1, -6)$
$2 = 4(3) - 10$ $2 = 12 - 10$ $2 = 2 \checkmark$	$3 = 4(2) - 10$ $3 = 8 - 10$ $3 = -2 \times$	$-14 = 4(-1) - 10$ $-14 = -4 - 10$ $-14 = -14 \checkmark$		$-6 = 4(1) - 10$ $-6 = 4 - 10$ $-6 = -6 \checkmark$


Are these also solutions for  $y \geq 4x - 10$ ? *Yes*

Are there more solutions? How can we express our solution set? *(By graphing)*



The solution set of an inequality with two variables is ALL of the ordered pairs that satisfy the inequality. We show this by shading the correct region of the graph.

If  $<$  or  $>$ , use a dashed line to indicate we're NOT including those points 

If  $\leq$  or  $\geq$ , we use a Solid line to indicate we're including those points. 

Examples of different solution sets:

Type of equation

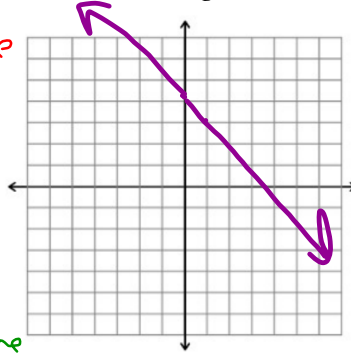
The graph

\* Remember to solve for y first!

$$\begin{array}{r} x + y = 20 \\ -x \quad -x \\ \hline y = 20 - x \end{array}$$

"y is greater than"  
↳ shade above line

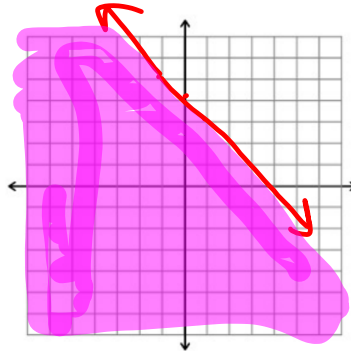
"y is less than"  
↳ shade below line



$$x + y \leq 20$$

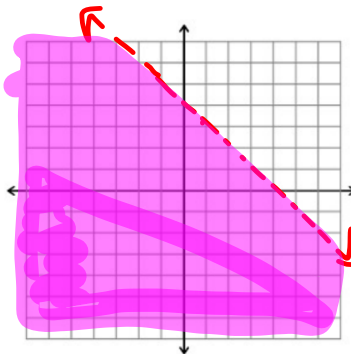
$$y \leq 20 - x$$

"y is less than or equal to..."  
Solid line



$$x + y < 20$$

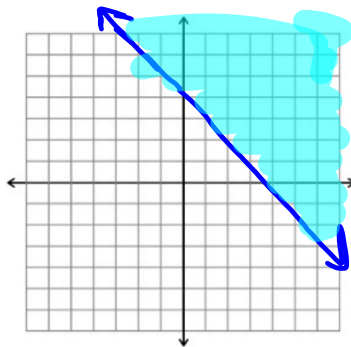
"y is less than..."  
dashed line



$$x + y \geq 20$$

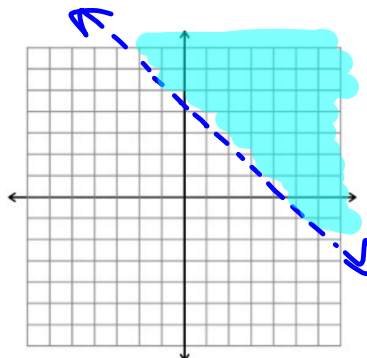
$$y \geq 20 - x$$

"y is greater than or equal to..."



$$x + y > 20$$

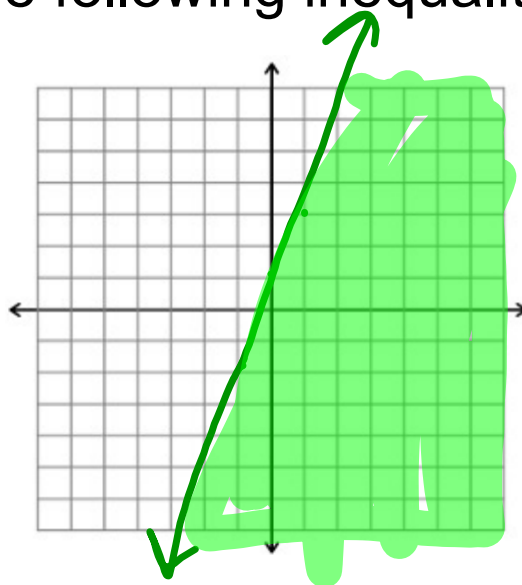
"y is greater than..."



Plot the solution set of the following inequality:

$$y \leq 2x + 1$$

We are shading  
in the correct  
region

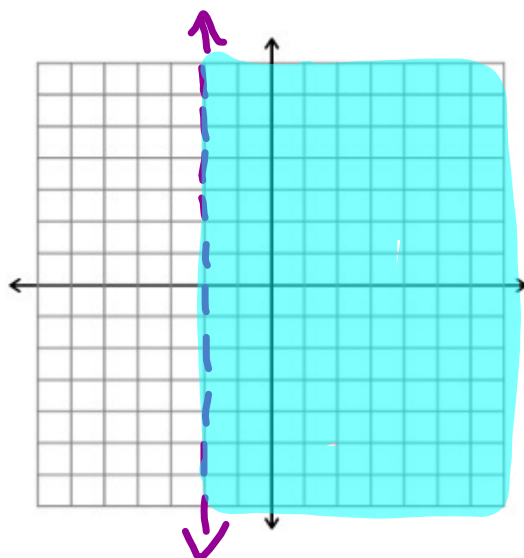


More Practice

Plot the solution set of the following inequality

$$x > -2$$

dashed line



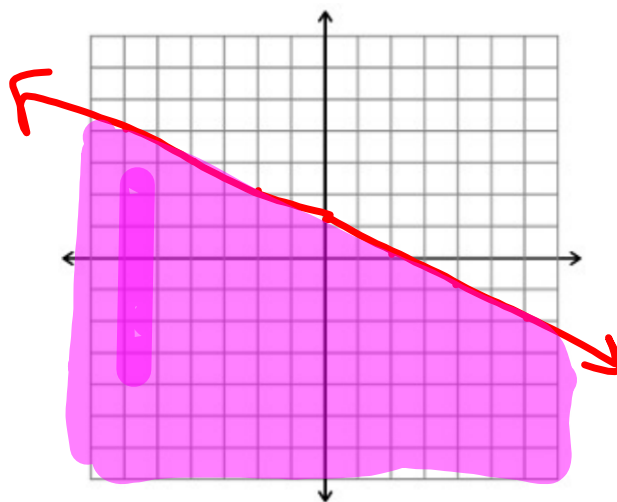


Plot the solution set of the following inequality:

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

- Solid line
- Solve for  $y$

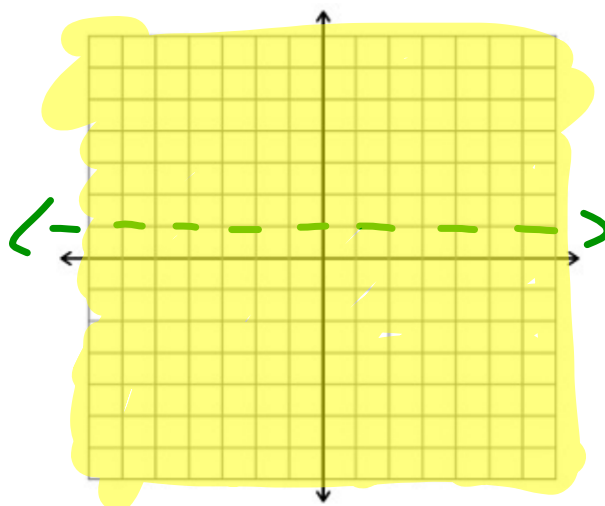
$$y \leq -\frac{1}{2}x + 1$$



## More Practice

Plot the solution set of the following inequality

$$y \neq 1$$



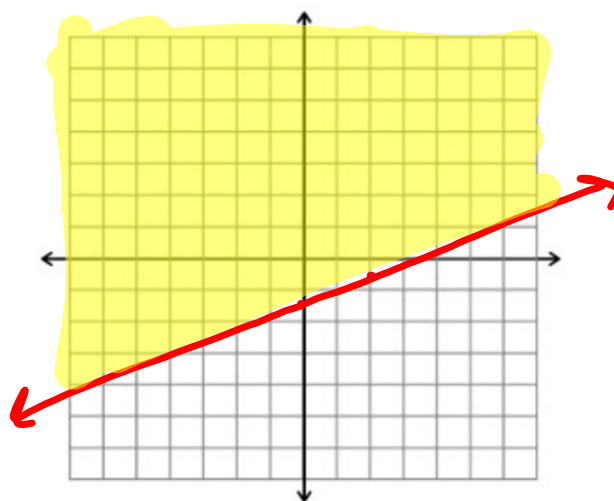
Solve and graph the solution set of the following inequality:

$$-2(x + 2y) \leq 6$$

$$\begin{array}{r} -2x - 4y \leq 6 \\ +2x \qquad +2x \end{array}$$

$$\frac{-4y}{-4} \leq \frac{2x+6}{-4}$$

$$y \geq -\frac{1}{2}x - \frac{3}{2}$$



What about solution sets of more than one linear inequality?

## Module 1: Lesson 22

Solution sets to Simultaneous Equations  
(or Inequalities)

Slope:  $\frac{\text{Rise} = \text{Y-direction}}{\text{Run} = \text{X-direction}}$

$Y = m x + b$

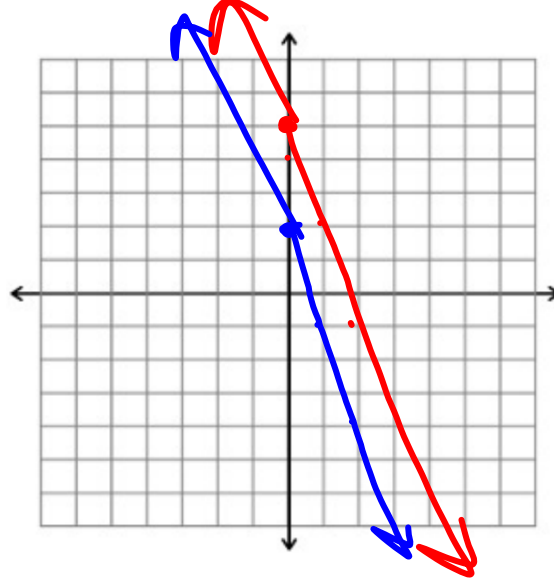
$Y = 3x + 1$       Slope:  $\frac{3 \text{ up}}{1 \text{ Right}}$

$Y = -2 - \frac{1}{2}x$       Slope:  $-\frac{1}{2}$

Before dealing with simultaneous inequalities we'll first review systems of equations.

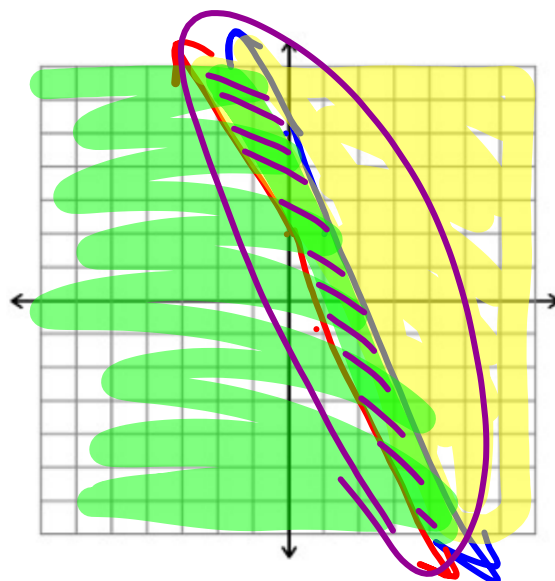
Solve the following system of linear equations by graphing:  $y = mx + b$

$$\begin{aligned} 3x + y &= 5 \\ -6x &= 2y - 4 \\ \rightarrow y &= 5 - 3x \\ y &= 5 - 3x \\ \rightarrow -6x &= 2y - 4 \\ \frac{-6x}{2} &= \frac{2y - 4}{2} \\ -3x &= y - 2 \\ +2 & \quad +2 \\ \hline -3x + 2 &= y \end{aligned}$$

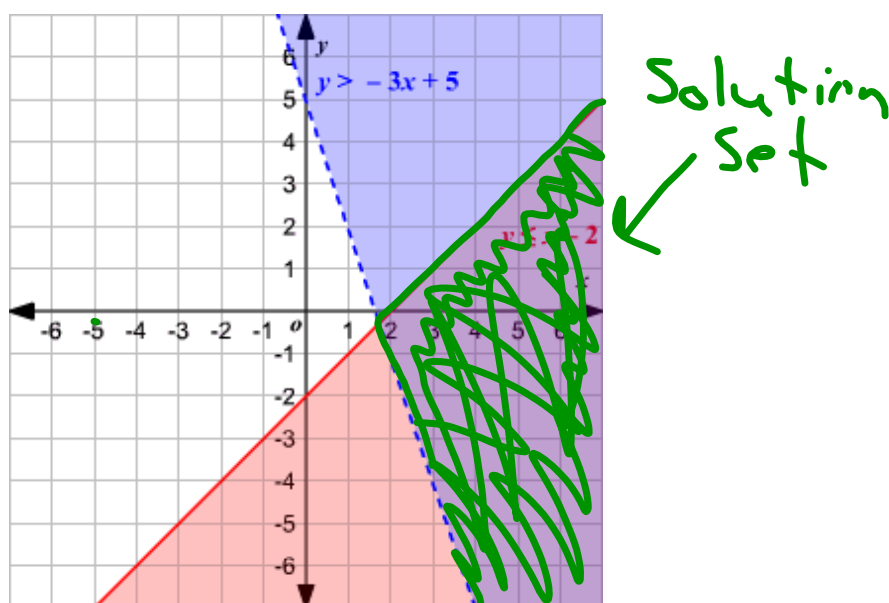


Now let's take the same equations and make them into a system of inequalities. How does our solution change?

- $y \leq -3x + 5$  .
- $y \geq -3x + 2$  .



The solution set to a system of linear inequalities is where the shaded region of each inequality intersect.



Example

Graph the solution set of the following system of inequalities:  $Y = mx + b$

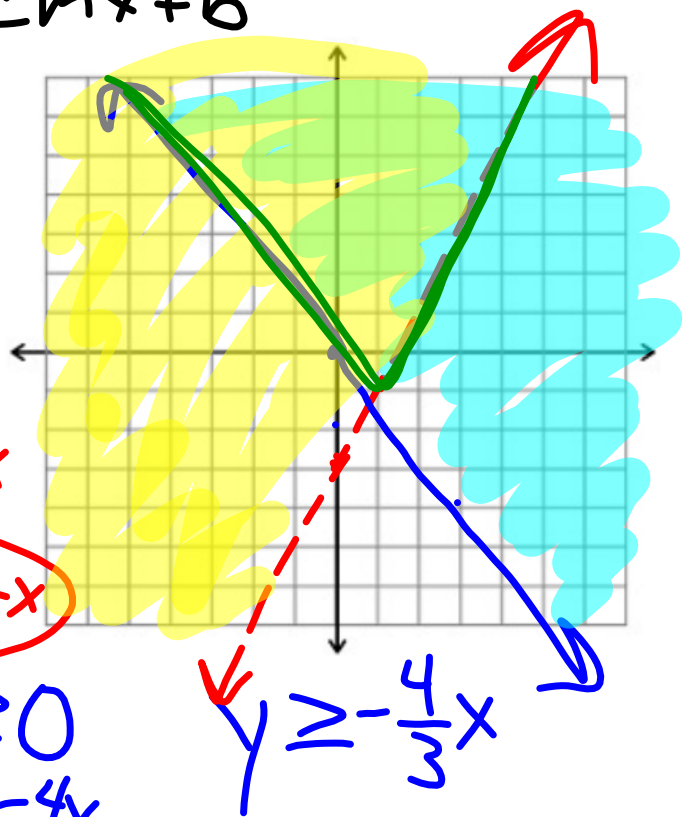
$2x - y < 3$

$4x + 3y \geq 0$

$$\begin{array}{r} 2x - y < 3 \\ -2x \quad -2x \\ \hline -y < 3 - 2x \end{array}$$

$y > -3 + 2x$

$$\begin{array}{r} 4x + 3y \geq 0 \\ -4x \quad -4x \\ \hline 3y \geq -4x \\ \frac{3y}{3} \geq \frac{-4x}{3} \end{array}$$





## Example

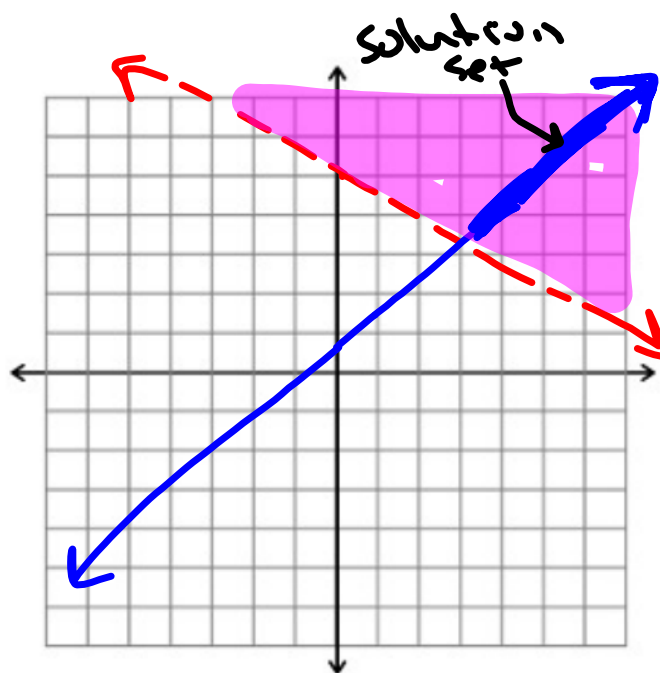
Graph the solution set of the following system of inequalities:

$$x + y > 10$$

$$y = 2x + 1$$

$$y > 10 - x \quad \bullet$$

$$y = 2x + 1 \quad \bullet$$



## Example

Graph the solution set of the following system of inequalities:

•  $y \leq x + 4$  ●

•  $y \leq 4 - x$  ●

$y \geq 0$

