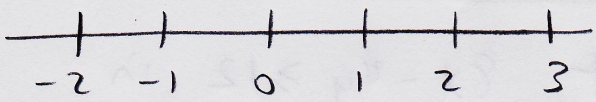
1.2 Linear Inequalities

$3 \geq 2$ $\quad$ $2 \leq 3$

$3 \geq 3$ $\quad$ $3 \leq 3$

$-1 \geq -2$ $\quad$ $-2 \leq -1$



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Ex: Solve $6 - 2x \geq 8$

Can add / subtract / multiply / divide both sides

Caution: Multiplying or dividing by a negative # reverses inequality

$-2 \leq 4$

$\div(-2)$ $\quad$ $1 \geqslant -2$

$6 - 2x \geq 8$

$-2x \geq 2$

$\div(-2)$ $\quad$ $x \leqslant -1$

Ex: Solve $3x + 4 \geq 16$

$3x \geq 12$

$x \geq 4$

Standard form for linear inequality

$y \leq mx + b$ or $y \geq mx + b$

Ex: a) put $8x - 4y \geq 12$ in standard form

$-4y \geq -8x + 12$

$\div(-4)$ $\quad y \leq \frac{-8x}{-4} + \frac{12}{-4}$

$y \leq 2x - 3$

b) does $(0,0)$ satisfy it?

Sub $x = 0$, $y = 0$ $\quad 0 \leq -3$? $\quad$ No

c) does $(2,-1)$ satisfy it?

Sub $x = 2$, $y = -1$ $\quad -1 \leq 1$? $\quad$ Yes

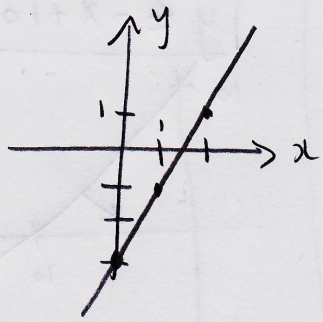
Ex: Graph $8x - 4y \geq 12$

1) Standard form

$$y \leq 2x - 3$$

2) Graph the associated line

$y = 2x - 3$

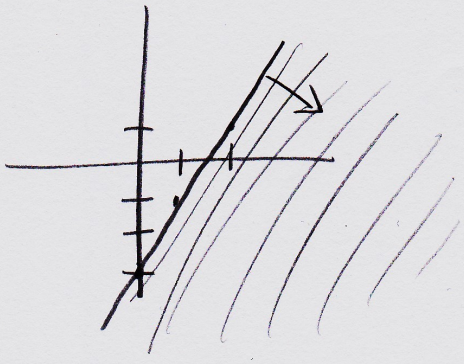


3) The points that satisfy the inequality are on one side of the line

Test any point not on the line

e.g. test $(0,0)$ $\rightarrow$ $y \leq 2x - 3$

$0 \leq -3$? **No**



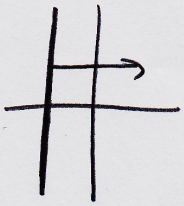
all shaded points satisfy $8x - 4y \geq 12$

Ex: Graph the feasible set for the system

$$\begin{cases} x+1 \geq 0 \\ x+y \leq 10 \\ -x+0.5y \geq 0.5 \end{cases}$$

$x+1 \geq 0$

$\boxed{x \geq -1}$

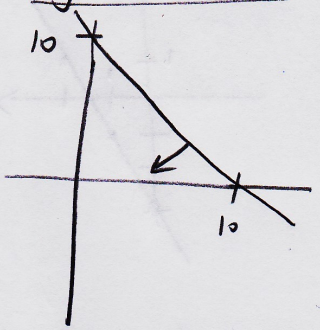


$x=-1$

Test $(0,0)$: True

$x+y \leq 10$

$\boxed{y \leq -x+10}$



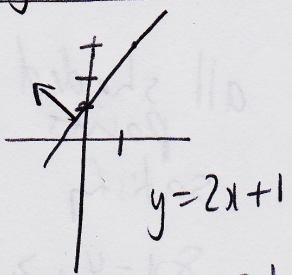
$y=-x+10$

Test $(0,0)$: True

$-x+0.5y \geq 0.5$

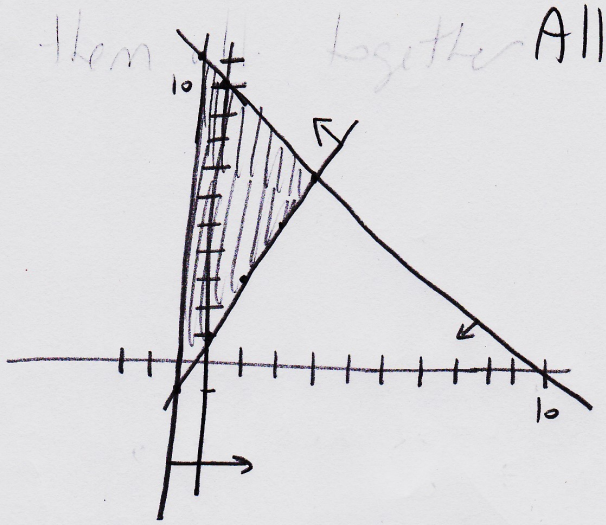
$0.5y \geq x+0.5$

$\boxed{y \geq 2x+1}$



Test $(0,0)$: False

All together:



Shaded points satisfy all the inequalities

Ex: Put in standard form

$$0,3x - 0,4y \leq 2$$

$$\frac{3}{10}x - \frac{4}{10}y \leq 2$$

$$3x - 4y \leq 2$$

$$-4y \leq -3x + 2$$

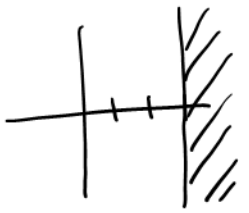
$\div(-4)$ $\qquad y \geq \frac{-3x}{-4} + \frac{2}{-4}$

$$y \geq \frac{3}{4}x - 5$$

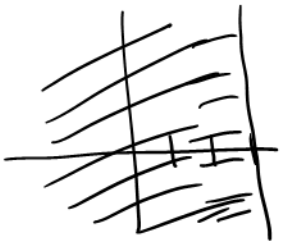
Caution: Coursepack shades inequalities in opposite way.

Ex: $x \geq 3$

Our method (shade points that are included)



Coursepack method (shade points that are excluded)



Our method works better when working with multiple inequalities