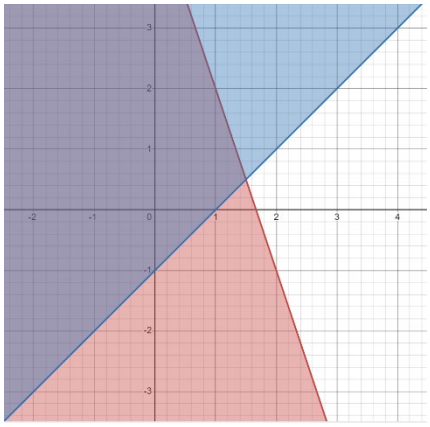
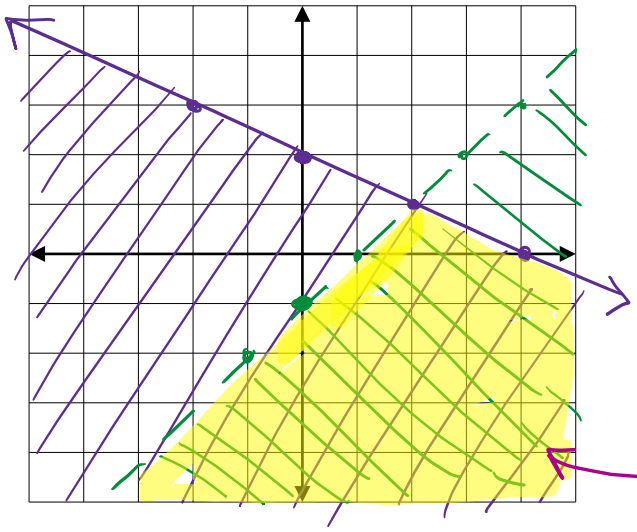
- The graph below is an example of a system of linear inequalities.



- when graphs of inequalities overlap, the region of overlap is called the ***intersection*** of the graphs

- use the following steps to graph a system of inequalities:
  1. determine the location of your boundary lines (intercept method or slope-intercept method) $y = mx + b$ $\leq$ $\geq$ $<$ $>$
  2. determine the type of boundary lines (**solid or dashed**)
  3. shade the appropriate side of each inequality (**above or below**)
  4. determine the intersection (**region of overlap**) $>$ $\geq$ $<$ $\leq$

e.g. Solve $x + 2y \leq 4$ and $x - y > 1$. *Rearrange each equation



$x + 2y \leq 4$

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

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

Solid Line
Shade Below

$x - y > 1$

$+y \quad > -x + 1$
$-1 \quad -1$

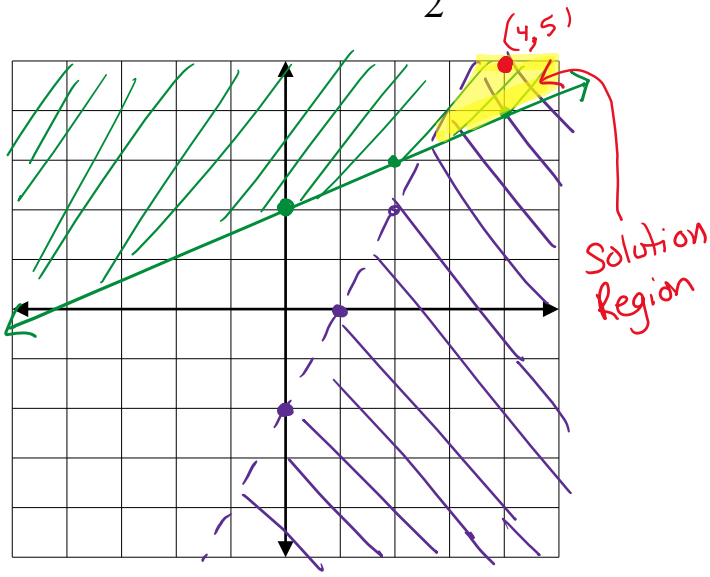
FLIP

$y < x - 1$

Dashed line
Shade Below

solution region.

e.g. Solve $y < 2x - 2$ and $y \geq \frac{1}{2}x + 2$.



Already in $y = mx + b$ form

$y < 2x - 2$ ↑ Dashed Line, Shade Below

$y \geq \frac{1}{2}x + 2$ ↑ Solid Line, Shade Above

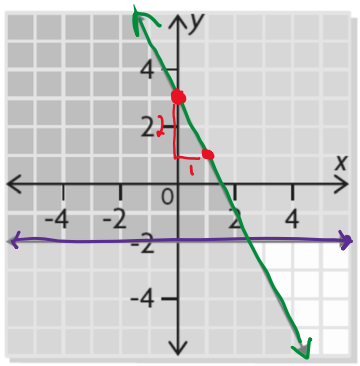
- we can confirm our solution by choosing a test point and plugging it into both inequalities.
- confirm the solution set for the system of inequalities above.

Test point (4,5)

$y < 2x - 2$
$5 < 2(4) - 2$
$5 < 8 - 2$
$5 < 6$
yes

$y \geq \frac{1}{2}x + 2$
$5 \geq \frac{1}{2}(4) + 2$
$5 \geq 2 + 2$
$5 \geq 4$
yes

Ex: Create a system of inequalities for the following graph:



Purple Line: $\geq$ {Solid Line, Shaded above}

$y \geq -2$

Green Line: {Solid Line, Shaded Below} $\leq$

Write in $y = mx + b$ form

$b = 3$

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

$y \leq -2x + 3$

e.g. To raise funds to buy new instruments, the band committee has at most (maximum) 500 T-shirts to sell. The T-shirts come in red or blue. Based on sales of the same T-shirts at a fundraiser five years ago, the committee expects to sell at least twice as many blue T-shirts as red T-shirts.

a) Define the variables and restrictions. Write a system (→ write 2 inequalities) of linear inequalities that models the situation.

① Define variables:
Let b = # of blue shirts
r = # of red shirts

② r has to be a whole number ($r \in W$)
b has to be a whole number ($b \in W$)

③ $b + r \leq 500$
$b \geq 2r$

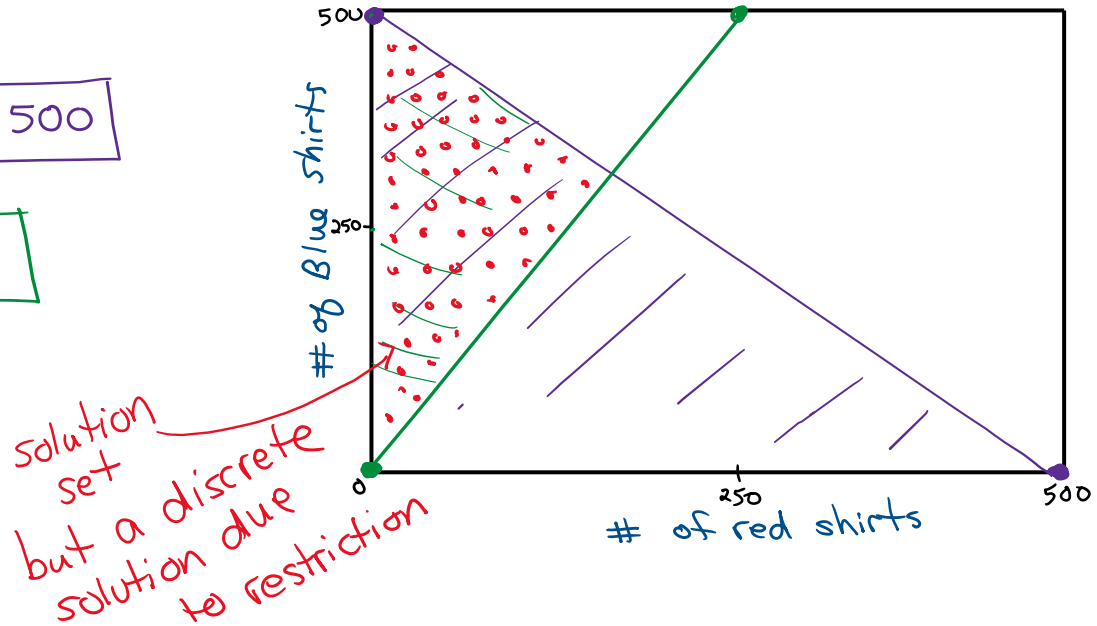
b) Graph the system of inequalities. **HINT:** Rearrange your inequalities

$r + b \leq 500$

$b \leq -r + 500$

$b \geq 2r$

slope



solution set but a discrete solution due to restriction

c) Suggest a combination of T-shirts sales that could be made.

100 red
300 blue

Test

$b \leq -r + 500$
$300 \leq -100 + 500$
$300 \leq 400$
yes

$b \geq 2r$
$300 \geq 2(100)$
$300 \geq 200$
yes.