

3.9 - Linear Inequalities

Linear Inequalities

y - linear inequality → describes a region of a coordinate plane that has a BOUNDARY LINE

- solution of a linear inequality - is all the ordered pairs that make the inequality TRUE
- * Solutions are located in the SHADED REGION and sometimes on the Boundary Line.

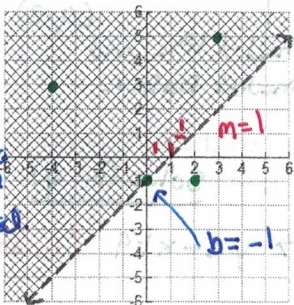
Shading and Type of Line Rules:

Slope-Intercept Form $y \leq mx + b$ Inequality Symbol

- To use these rules → inequality must be solved for "y" and "y" must be on the LEFT SIDE!
- Remember → If MULTIPLY or DIVIDE by a NEGATIVE #, you must reverse the inequality symbol
 - $y >$ → shade above line and have a dotted line
 - $y \geq$ → shade above line and have a solid line
 - $y <$ → shade below line and have a dotted line
 - $y \leq$ → shade below line and have a solid line

Any points on a dotted line are NOT included in the solution.

Example 1: Determine the points that could represent solutions for each graphed linear inequality.



Shaded above the line and it is dotted.
 $y >$ or \times
 What is the linear inequality?
 $y > mx + b$
 $y > 1x - 1$

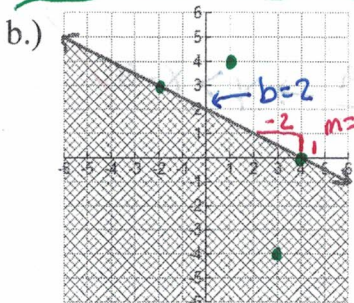
(2, -1) → solution? Circle one: Yes No Explain: b/c the point is not in the shaded region.

(-4, 3) → solution? Circle one: Yes No Explain: b/c the point is in the shaded region.

(0, -1) → solution? Circle one: Yes No Explain: b/c point is ON a DOTTED LINE.

(3, 5) → solution? Circle one: Yes No Explain: b/c the point is in the shaded region.

Is (4, 6) a solution for $y > x - 1$? Plug in the ordered pair!
 Yes $6 > 4 - 1 \rightarrow 6 > 3 \checkmark$ True



What is the linear inequality?
 \times or \leq
 $y \leq -\frac{1}{2}x + 2$

(-2, 3) → solution? Circle one: Yes No Explain: b/c the point is ON a SOLID LINE.

(1, 4) → solution? Circle one: Yes No Explain: b/c point is not in the shaded region.

(3, -4) → solution? Circle one: Yes No Explain: b/c point is in the shaded region.

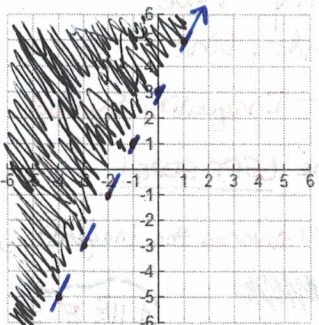
(4, 0) → solution? Circle one: Yes No Explain: b/c point is ON a SOLID LINE.

Example 2: Graph each linear inequality. Make sure to have the correct type of line and shading.

** You want the inequality in Slope-Intercept Form. **

a.) $y > 2x + 3$

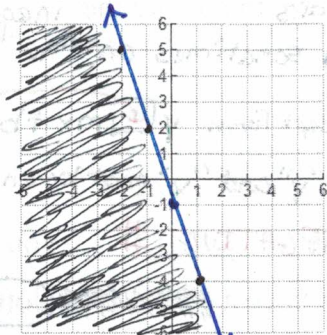
dotted line and shaded above the line!



$m=2$ $b=3$
(0,3)

b.) $y \leq -3x - 1$

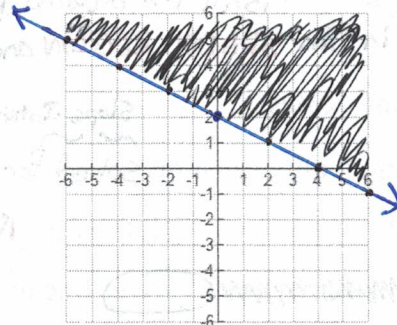
Solid line and shaded below the line.



$m=-3$ $b=-1$
(0,-1)

c.) $2x + 4y \geq 8$

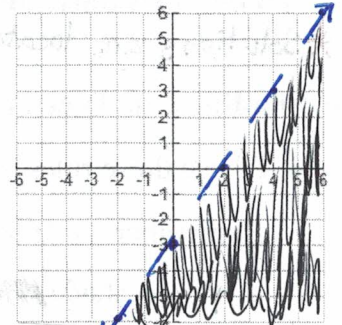
Standard Form \rightarrow Slope-Intercept



$$\begin{aligned} 2x + 4y &\geq 8 \\ -2x &\quad -2x \\ \hline 4y &\geq -2x + 8 \\ \frac{4y}{4} &\geq \frac{-2x}{4} + \frac{8}{4} \end{aligned}$$

Solid line and shaded above!
 $y \geq -\frac{1}{2}x + 2$
 $m = -\frac{1}{2}$ $b = 2$
(0,2)

d.) $3x - 2y > 6$

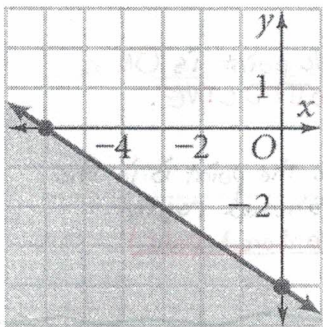


$$\begin{aligned} 3x - 2y &> 6 \\ -3x &\quad -3x \\ \hline -2y &> -3x + 6 \\ \frac{-2y}{-2} &> \frac{-3x}{-2} + \frac{6}{-2} \\ y &< \frac{3}{2}x - 3 \end{aligned}$$

dotted line and shaded below.
 $m = \frac{3}{2}$ $b = -3$
(0,-3)

Examples: Answer each multiple choice question.

3.) Which linear inequality describes the graph below?



- ~~A.) $y < -\frac{2}{3}x - 4$~~
 - ~~B.) $y > -\frac{2}{3}x - 4$~~
 - C.) $y \leq -\frac{2}{3}x - 4$**
 - ~~D.) $y \geq -\frac{2}{3}x - 4$~~
- Give a dotted line!
Shade above

4.) The graph of which of the following is shaded above the line? Solve for y!

- ~~A.) $x + y < 9 \rightarrow y < -x + 9$ (Below)~~
 - ~~B.) $x + y < -9 \rightarrow y < -x - 9$ (Below)~~
 - ~~C.) $y - x < 9 \rightarrow y < x + 9$ (Below)~~
 - D.) $x - y < 9$**
- $$\begin{aligned} -x &\quad -x \\ \hline -y &< -x + 9 \\ \frac{-y}{-1} &\frac{-x}{-1} + \frac{9}{-1} \\ y &> x - 9 \checkmark \end{aligned}$$