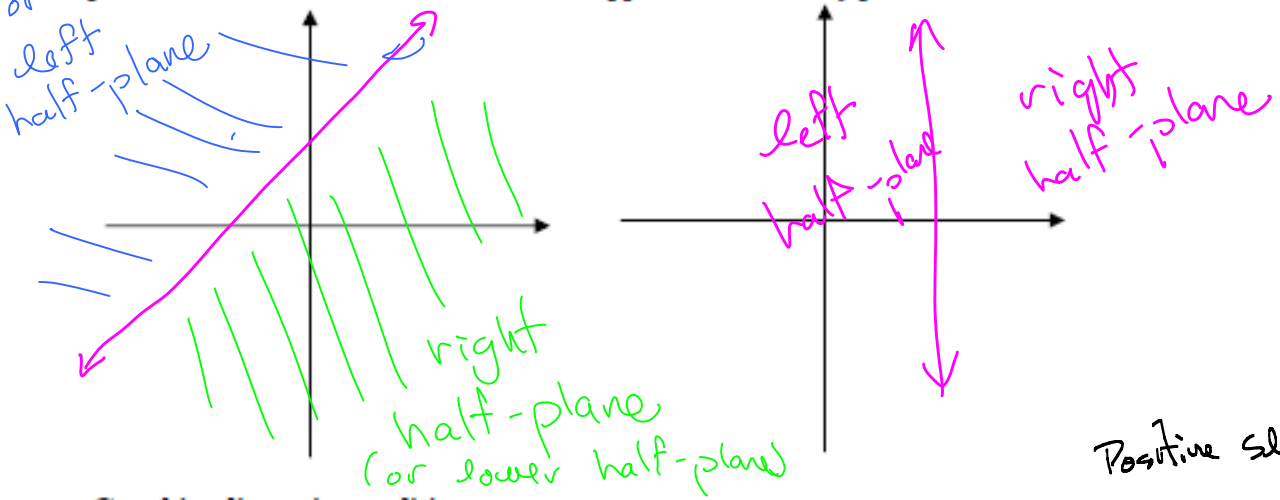
5.1: Linear Inequalities in Two Variables

Half-planes:

A line divides the plane into two *half-planes*. A vertical line divides it into *left* and *right half-planes*; a non-vertical line divides it into *upper* and *lower half-planes*.

upper half-plane or

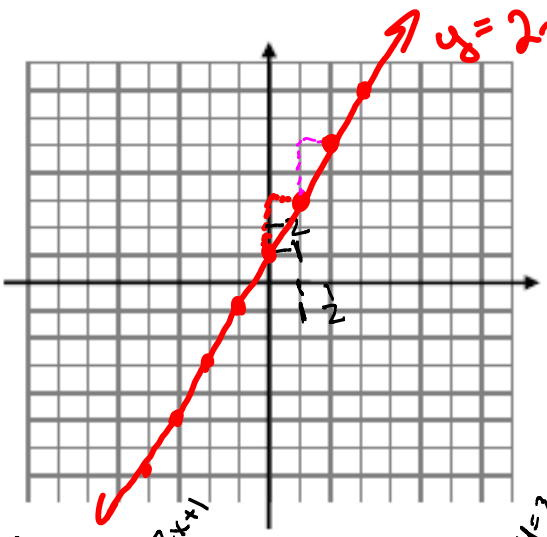


Graphing linear inequalities:

Positive slope: ↗

Negative slope: ↘

Example 1: There are four linear inequalities related to the line $y = 2x+1$.



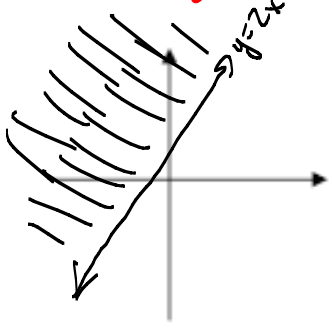
$y = 2x + 1$

b: $b = 1$ This is the y-intercept

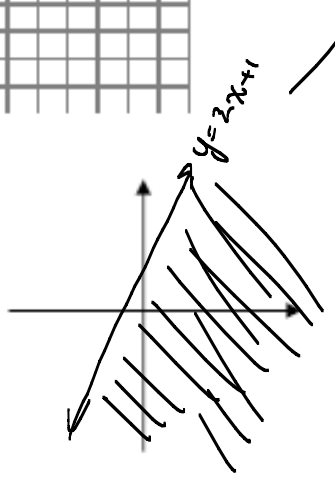
point: $(0, 1)$

$m = 2 = \frac{2}{1}$. This is the slope.

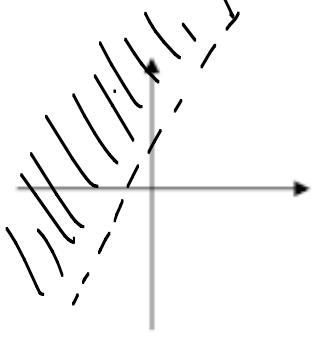
m = slope = $\frac{\text{rise}}{\text{run}} = \frac{\text{change in } y}{\text{change in } x}$



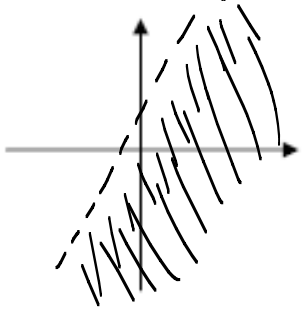
$y \geq 2x+1$



$y \leq 2x+1$



$y > 2x+1$



$y < 2x+1$

Steps for Graphing a Linear Inequality:

Step 1: First graph the line $Ax + By = C$ Use a solid line if equality is included ($\leq$ or $\geq$) and a dashed line if equality is not included ($<$ or $>$).

Step 2: Choose a test point not on the line and substitute the coordinates into the inequality. Determine whether this gives a true or a false statement.
Note: The origin $(0,0)$ is usually a good choice, as long as it is not on the line.

Step 3:

- If your test point makes the inequality *true*, shade the half-plane containing the test point.
- If your test point makes the inequality *false*, shade the half-plane not containing the test point.

Example 2: Graph the inequality $2x > 3y$.

$2x > 3y$

1st graph the equation: $2x = 3y$

Solve for y: $3y = 2x$

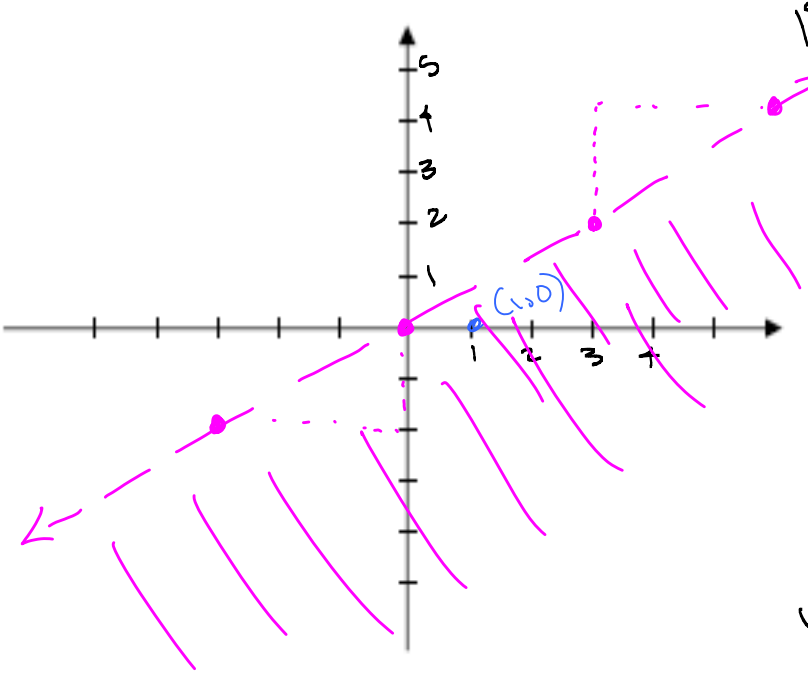
$\frac{3y}{3} = \frac{2x}{3}$

$y = \frac{2}{3}x$

$y = \frac{2}{3}x + 0$

y-intercept: $b = 0 \Rightarrow (0,0)$

slope: $m = \frac{2}{3}$ ↗ +



Choose test point: $(1,0)$

$2x > 3y$

$x=1, y=0 \Rightarrow 2(1) > 3(0)$

$2 > 0$ True statement.

Shade the half that contains $(1,0)$.