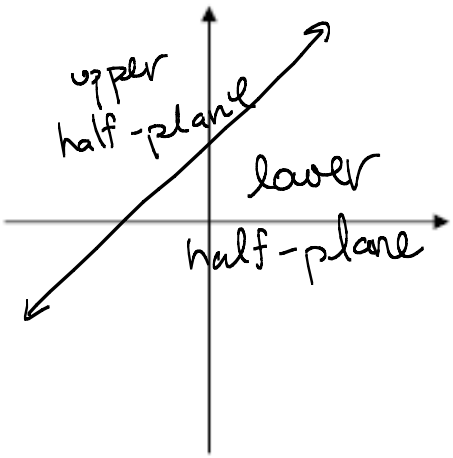
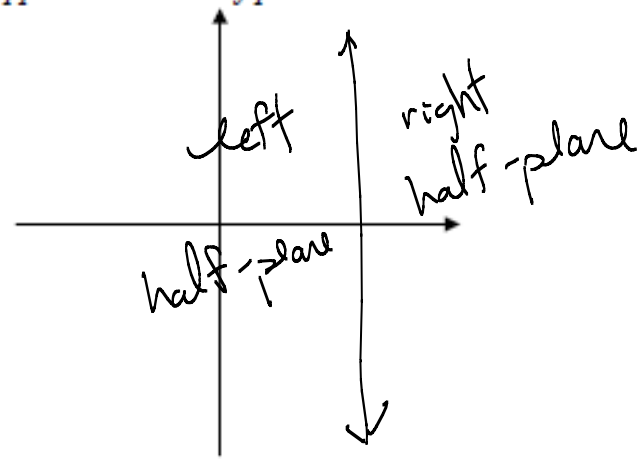
5.1: Linear Inequalities in Two Variables

Half-planes:

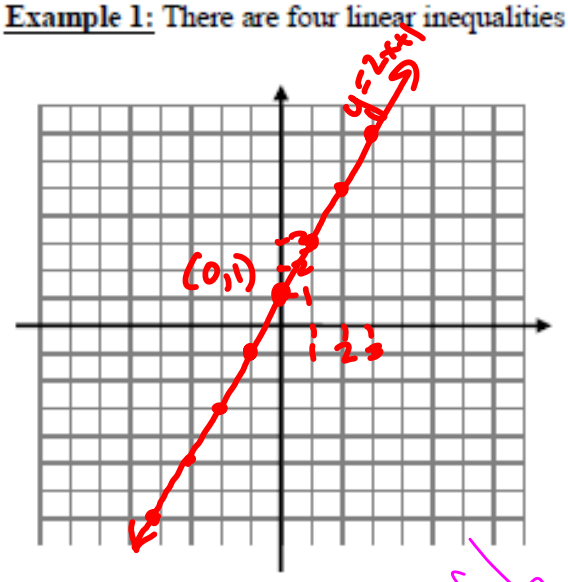
A line divides the plane into two *half-planes*. A vertical line divides it into *left* and *right half-planes*; a non-vertical line divides it into *upper* and *lower half-planes*.





Graphing linear inequalities:

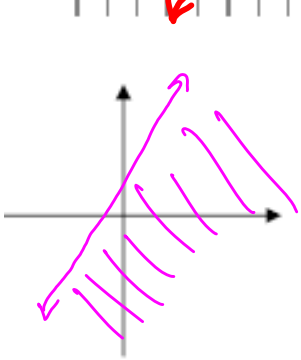
Example 1: There are four linear inequalities related to the line $y = 2x+1$.



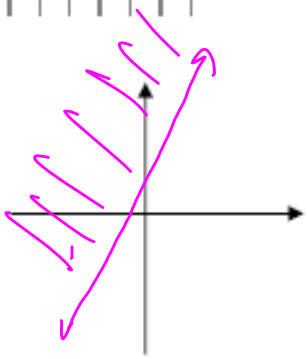
$y = 2x + 1$

slope: $m = 2 = +\frac{2}{1}$ ↗ +

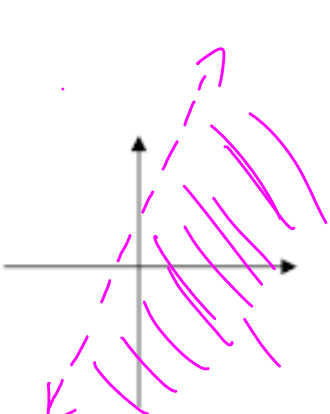
y-intercept: $b = 1$



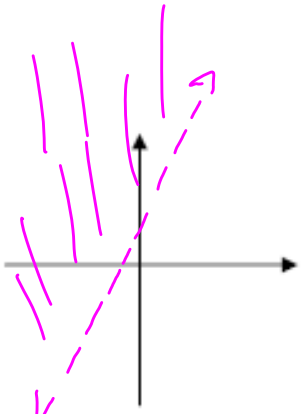
$y \leq 2x+1$



$y \geq 2x+1$



$y < 2x+1$



$y > 2x+1$

Steps for Graphing a Linear Inequality:

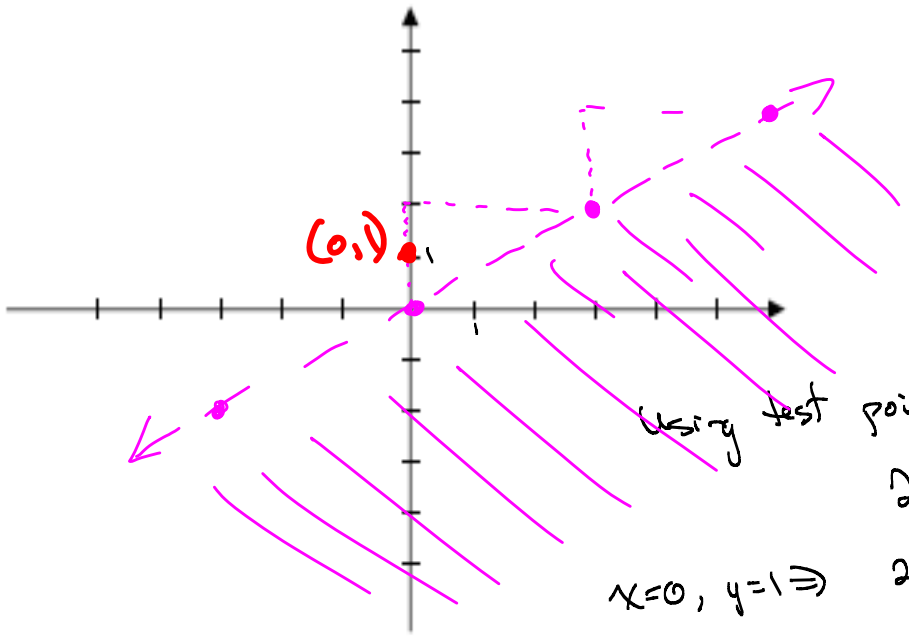
Step 1: First graph the line $Ax + By = C$ Use a solid line if equality is included ($\leq$ or $\geq$) and a dashed line if equality is not included ($<$ or $>$).

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 $2x > 3y$.



Graph the line $2x = 3y$

$3y = 2x$

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

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

slope: $m = +\frac{2}{3}$

y-int: $b = 0$

Using test point $(0,1)$:

$2x > 3y$

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

$0 > 3$ False!

Shade half-plane <u>not</u> containing $(0,1)$