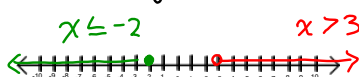§6-1 Graphing Linear Inequalities in Two Variables

Inequality – compares the values of
   two expressions.

Solution set – used to describe the
   solution of a statement. It contains
   all the values that satisfy the inequality statement.
   This can be represented on a graph:

① numberline: $x \leq -2$ $x > 3$

   $x > 3$

   $x \leq -2$

② coordinate axis:

   $y > 2x - 1$

   $(y = mx + b)$
       ↑ slope   ↑ y-intercept

dashed line $> <$
solid line $\geq \leq$

solution set contains (0,0)
since point satisfies
the inequality.

   test (0,0) $y > 2x - 1$
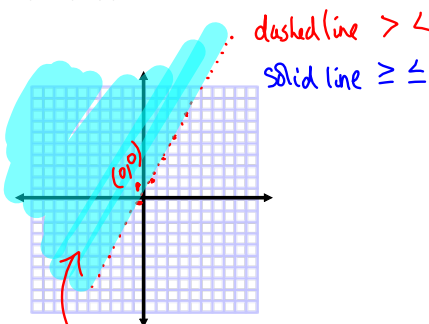
                     $0 > 2(0) - 1$

                     $0 > 0 - 1$

                     $0 > -1$ ✓ ← (0,0) is in the solution
                                    set .... shade
                                    the part of the graph
                                    the contains (0,0)

Graphing an inequality:

   1. Graph the boundary line for the inequality

      ⓐ $y = mx + b$
              ↑ slope   ↑ y intercept

      ⓑ $Ax + By = C$
              find the x and y-intercepts

   2. Use a dashed line or solid line
          $(> <)$ $(\geq \leq)$

   3. Shade the solution set → test point (often (0,0))

Example

For which inequalities is $(3,1)$ a possible solution? How do you know?

(x,y)

a) $13 - 3x > 4y$ ✗

b) $2y - 5 \leq x$ ✓

c) $y + x < 10$ ✓

d) $y \geq 9$ ✗

a) $13 - 3x > 4y$

$13 - 3(3) > 4(1)$

$13 - 9 > 4$

$4 > 4$ ✗

$(3,1)$ is not in the solution set

b) $2y - 5 \leq x$

$2(1) - 5 \leq 3$

$2 - 5 \leq 3$

$-3 \leq 3$ ✓

$(3,1)$ is in the solution

Example

Graph the solution set for the linear inequality :

$$-2x + 5y \geq 10$$

Use intercept method :

$$-2x + 5y = 10 \quad \text{(boundary line)}$$

$(0,0)$ ← not a solution

let $x = 0$ to find y-int :

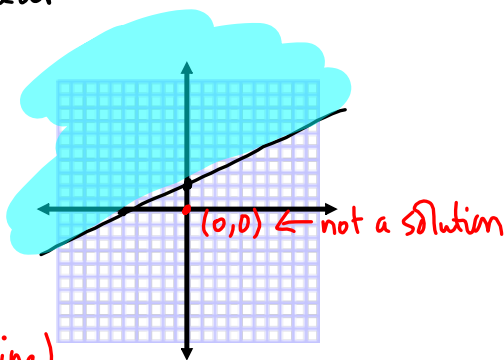$-2(0) + 5y = 10$

$5y = 10$

$\boxed{y = 2}$

let $y = 0$ to find x-int :

$-2x + 5(0) = 10$

$-2x = 10$

$\boxed{x = -5}$

Test $(0,0)$: $-2x + 5y \geq 10$

$-2(0) + 5(0) \geq 10$
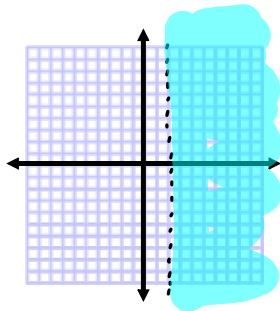
$0 \not\geq 10$

$(0,0)$ is not in the solution set

Example

Graph the solution set for the linear inequality:

$$\{(x,y) \mid x - 2 > 0, x \in R, y \in R\}$$

can also rearrange:

$$x - 2 > 0$$

$$\boxed{x > 2}$$

Boundary Line:

$$x - 2 = 0$$

$$x = 2$$

Test point $(0,0)$:

$$0 - 2 > 0$$

$$-2 > 0 \; \textcolor{red}{\times}$$

Example:

Graph the solution set for the linear inequality:

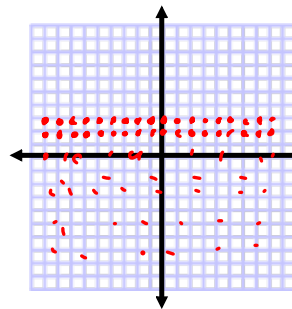$$\{(x,y) \mid -3y + 6 \geq -6 + y, \; x \in I, \; y \in I\}$$

rearrange:

$$-3y + 6 \geq -6 + y$$
$$\quad \textcolor{red}{-6} \quad\quad \textcolor{red}{-6}$$

$$-3y^{\textcolor{red}{-y}} \geq -12 + y^{\textcolor{red}{-y}}$$

$$-4y \geq -12 \quad \textcolor{red}{\leftarrow \text{divide/multiply by a neg \# the inequality switches}}$$

$$\boxed{y \leq 3}$$

$\textcolor{red}{\leftarrow \text{Stippling for discrete data.}}$

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