

Sec. 12.8 Systems of Inequalities

Steps for Graphing an Inequality by Hand:

1. Replace the inequality symbol by an equal sign and graph the resulting equation. If the inequality is strict, use dashed lines, if it is not strict use a solid mark. This graph separate the plane into two regions.
2. Select a test point P in each of the regions.
 - a. If the coordinates of P satisfy the inequality, then so do all the points in that region. Indicate this by shading the region.
 - b. If the coordinates of P do not satisfy the inequality, then none of the points in that region do so, so shade the opposite region.

Steps for Graphing an Inequality using a Calculator:

1. Replace the inequality symbol by an equals sign and graph the resulting equation.
2. Select a test point P in one of the regions.
 - a. Use a graphing utility to determine if the test point P satisfies the inequality. If the test point satisfies the inequality, then so do all of the points in this region. Indicate this by using the graphing utility to shade the region.
 - b. If the coordinates of P do not satisfy the inequality, then none of the points in that region do, so shade the opposite region.

Ex: Graph $3x + y \leq 6$ by hand.

$$y \leq -3x + 6$$

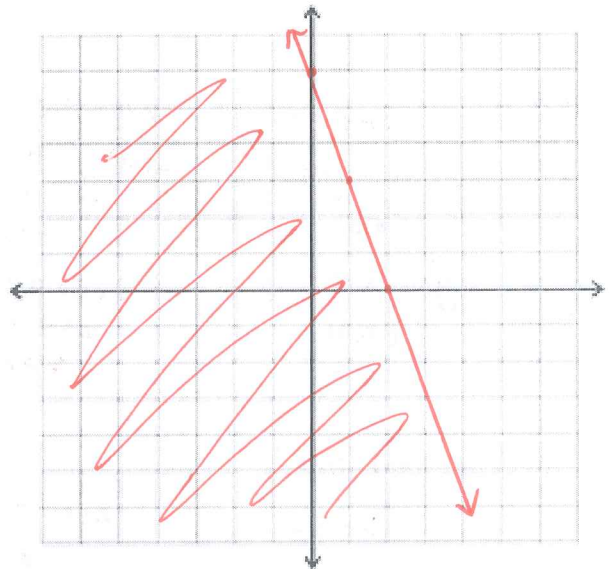
or use intercepts

y-int: $x=0$ $3(0)+y=6$ $(0,6)$
 $y=6$

x-int: $y=0$ $3x+0=6$ $(2,0)$
 $3x=6$
 $x=2$

Check a point $(0,0)$: $3(0)+0 \leq 6$
 $0 \leq 6$ True!

Shade that direction!



Ex: Graph $x^2 + y^2 \leq 4$ by hand.

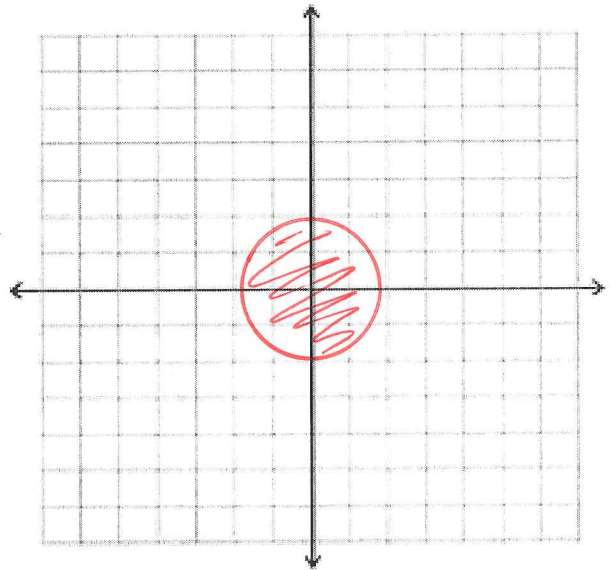
CIRCLE RADIUS 2
CENTER AT (0,0)

CHECK A POINT (0,0):

$$0^2 + 0^2 \leq 4$$

$$0 \leq 4 \text{ TRUE}$$

SHADE INSIDE



To Graph a System of Inequalities:

1. Graph each equation separately but on the same graph.
2. The answer will be in the region that is shaded for both equations.
3. Use different shading techniques so this will be easy to see.

Ex: Graph the system $\begin{cases} x + y \geq 2 \\ 2x - y \leq 4 \end{cases}$

$$x + y = 2$$

$$x = 0 \quad 0 + y = 2$$

$$(0, 2)$$

$$y = 0 \quad x + 0 = 2$$

$$(2, 0)$$

$$2x - y = 4$$

$$2(0) - y = 4$$

$$-y = 4$$

$$y = -4$$

$$(0, -4)$$

$$2x - 0 = 4$$

$$2x = 4$$

$$x = 2 \quad (2, 0)$$

Check Point (0,0):

$$0 + 0 \geq 2$$

$$0 \geq 2$$

FALSE

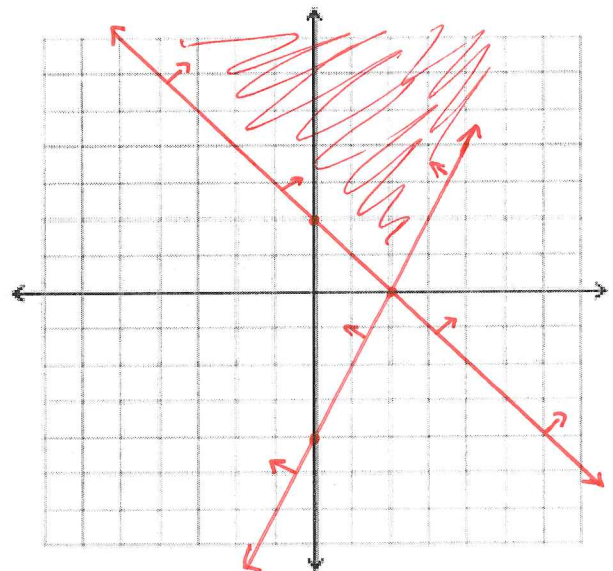
(Shade other side)

$$2(0) - 0 \leq 4$$

$$0 \leq 4$$

TRUE

(Shade that side)



Ex: Graph the system $\begin{cases} x+2y \leq 2 \\ x+2y \geq 6 \end{cases}$

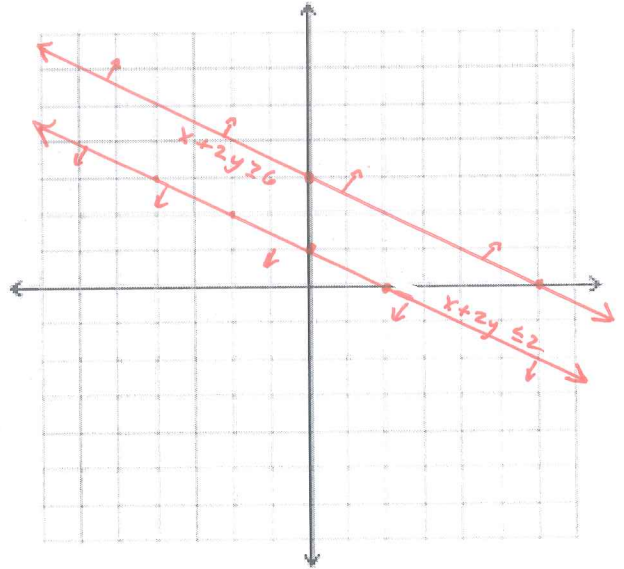
$x+2y \leq 2$
 (0,1) (2,0)

$x+2y \geq 6$
 (0,3) (6,0)

Check (0,0): $0 \leq 2$
 TRUE

$0 \geq 6$
 FALSE

NO SOLUTION



Ex: Graph the system $\begin{cases} x+y \leq 2 \\ y \geq x^2 - 4 \end{cases}$

$x+y \leq 2$
 (2,0) (0,2)

$y \geq x^2 - 4$

$0+0 \leq 2$
 TRUE
 (shade below)

$0 \geq 0^2 - 4$
 $0 \geq -4$
 TRUE
 (shade inside)

