

## 6.5 – Graphing Systems of Inequalities:

Objectives:

1. Review linear inequalities and the solution of an inequality, including multiplying and dividing by a negative number.
2. Write inequalities to describe given real-world restraints.
3. Graph systems of inequalities.
4. Interpret the meaning of the points within a feasible region.
5. Find the vertices of a feasible region.

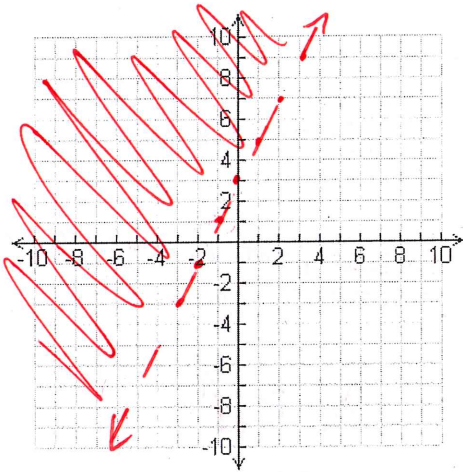
Review graphing linear inequalities

When graphing  $\leq$  or  $\geq$  use a **SOLID** line.

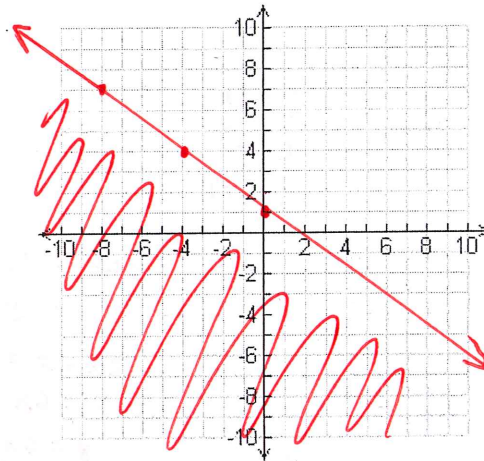
When graphing  $>$  or  $<$  use a **DOTTED** line.

**Example 1:** Graph the following inequalities:

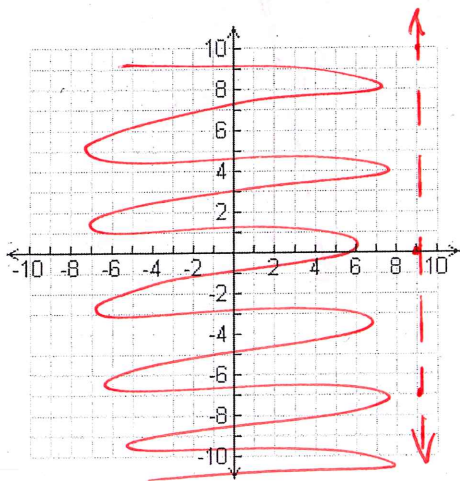
a.  $y > 2x + 3$



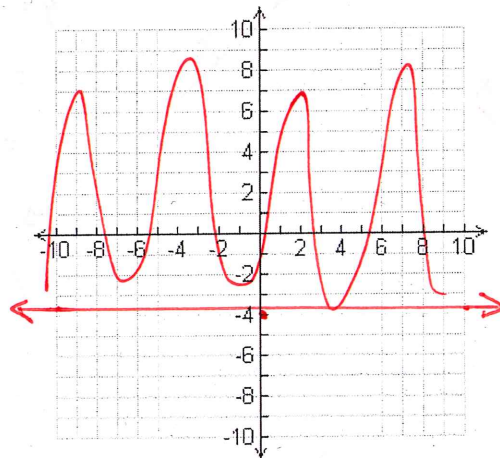
b.  $y \leq -\frac{3}{4}x + 1$



c.  $x < 9$



d.  $y \geq -4$



**Example 2:** Solve each inequality for y:

a.  $-2y > 10x - 18$   
 $\frac{-2y}{-2} > \frac{10x - 18}{-2}$   
 $y < -5x + 9$

b.  $3y + 2x < 24$   
 $-2x \quad -2x$   
 $\frac{3y}{3} < \frac{-2x + 24}{3}$   
 $y < -\frac{2}{3}x + 8$

c.  $10x - 8y \geq 28$   
 $-10x \quad -10x$   
 $\frac{-8y}{-8} \geq \frac{-10x + 28}{-8}$   
 $y \leq \frac{5}{4}x - 3\frac{1}{2}$

**Feasible Region:** The set of points that satisfies a system of equations or inequalities. It can be shown graphically, be part of a plane, or described as a shape with given vertices.

**Vertex:** the points that create a boundary for a feasible region

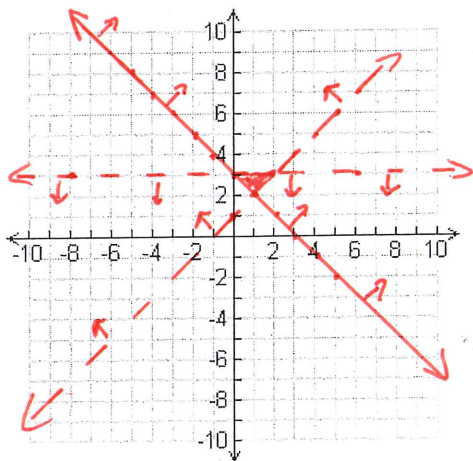
**Example 3:** Graph the following system of inequalities and find the vertices.

a.  $y < 3$   
 $y \geq 3 - x$   
 $y > x + 1$

$(2, 3)$   
 $(1, 2)$   
 $(0, 3)$

b.  $x \geq 0$   
 $y + 2x < 5$   
 $y > 4x - 3$

$y < -2x + 5$



Solve!  $y = -2x + 5$   
 $y = 4x - 3$

$-2x + 5 = 4x - 3$

$5 = 6x - 3$

$\frac{8}{6} = \frac{6x}{6}$

$\frac{4}{3} = x$

$y = \frac{4}{1} \cdot \frac{4}{3} - 3$

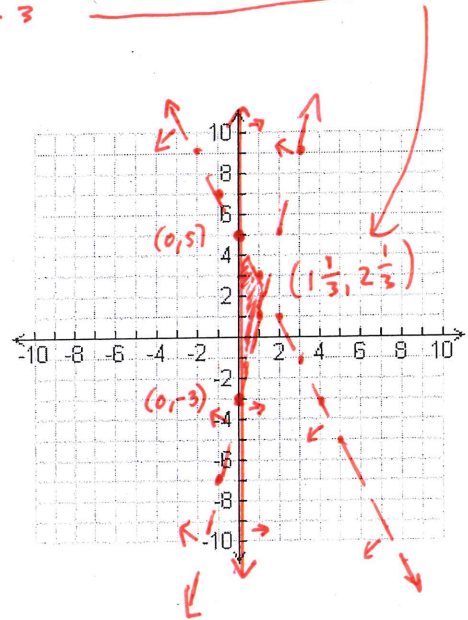
$= \frac{16}{3} - 3$

$= 5\frac{1}{3} - 3$

$y = 2\frac{1}{3}$

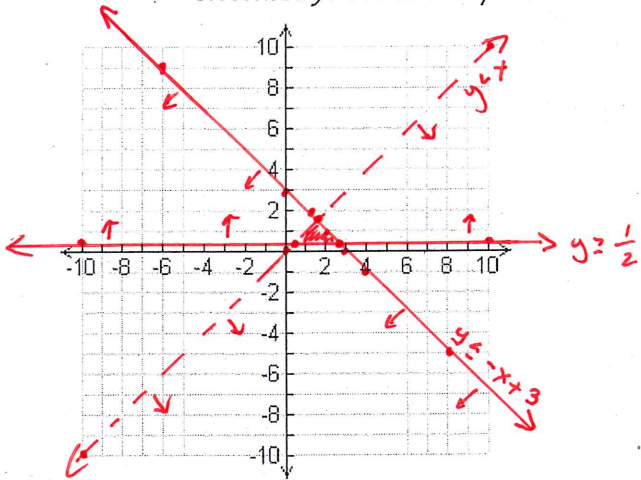
$(1\frac{1}{3}, 2\frac{1}{3})$

to find point of intersection



**Example 3:** Rachel has 3 hours to work on her homework tonight. She wants to spend more time working on math than on chemistry, and she must spend at least a half-hour working on chemistry.

a. Let  $x$  represent time in hours spent on math, and let  $y$  represent time in hours spent on chemistry. Write inequalities to represent the three constraints of the system.



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

$$y < x$$

$$y \geq \frac{1}{2}$$

b. Graph the inequalities and find the coordinates of the vertices of the feasible region.

Solve:  $y = \frac{1}{2}$   
 $y = x$   
 $\frac{1}{2} = x$   
 $(\frac{1}{2}, \frac{1}{2})$

$$y = \frac{1}{2}$$

$$y = -x + 3$$

$$\frac{1}{2} = -x + 3$$

$$x + \frac{1}{2} = 3$$

$$x = 3 - \frac{1}{2}$$

$$x = 2\frac{1}{2}$$

$$(2\frac{1}{2}, \frac{1}{2})$$

$$y = x$$

$$y = -x + 3$$

$$x = -x + 3$$

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

$$x = 1\frac{1}{2}$$

$$y = 1\frac{1}{2}$$

$$(1\frac{1}{2}, 1\frac{1}{2})$$