Foundations 11 - Week 6: May 19 – May 22

Anticipated time required: 2 hours

New learning objective: **Solving solution regions from graphing linear inequalities**

Goals to be completed:

1. Review how to graph a line in slope y-intercept form
2. Transfer this skill to graphing linear inequalities
3. Solve solution regions for a system of linear inequalities

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This PDF package contains several notes, examples and practice problems. The only formal portion that you are required to submit is the section at the end of this package. This can be sent to Charlie.feht@yesnet.yk.ca either as a scanned and uploaded PDF attachment to email, or as a jpeg image file. Midterm assignments will be scored and sent back to you as I receive them.

Upcoming next week:

Statistics

FOM 11 **Graphing Linear Functions - Review**

$y = mx + b$ (m = slope, b = y-int)

Sketch the graph of each line

$y = mx + b$

1. $y = \frac{3}{5}x - 6$ → slope: $\frac{3}{5}$, y-int.

If slope is $\frac{3}{5}$ then we rise 3 and run 5 to the right

If y-int is -6 then we put our first point at $y = -6$.

run 5 to the right

rise up 3 → Next point!

$y = -6$ here!

2. $y = -4x + 1$

① Always start with your y-int

② Apply the $\frac{rise}{run}$ slope

③ Once you have 2 point connect them

④ Extend the li

* Slope is -4 so we rise down 4 un

3. $3y - x = 12$

bring over

$3y = x + 12$

* Must * rearrange to $y = mx + b$

eliminate coefficient of 3 by dividing

$y = \frac{1}{3}x + 4$

slope, y-int

4. $2x + 7y = -\frac{35}{2}$

$7y = -2x - \frac{35}{2}$

$2(7y = -2x - \frac{35}{2}$

$\frac{14y}{14} = \frac{-4x}{14} - \frac{35}{14}$

$y = -\frac{2}{7}x - 2.5$

Important

→ you always want to graph as $y = mx + b$, so if you don't start with a $y = mx + b$ equation then you must perform algebra to get there

→ plot your y-int first, then apply your slope ($\frac{rise}{run}$)

→ A positive slope should increase left to right: ↗

→ A negative slope should decrease left to right: ↘

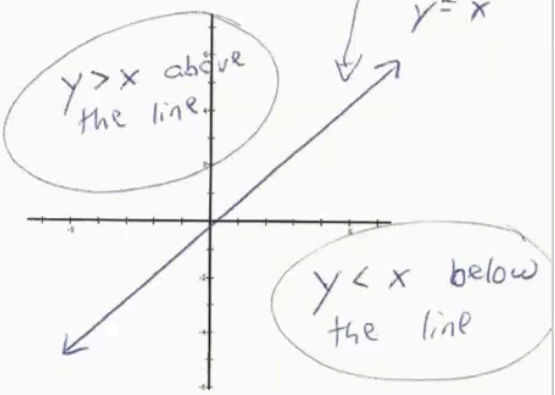
FOM 11 **6.1 Graphing Linear Inequalities In Two Variables**

This is the graph of $y = x$

Look at the graph of $y = x$.

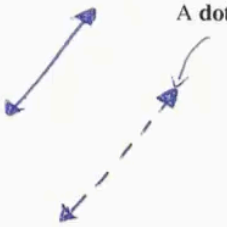
The line divides the plane into two half-planes:

- $y < x$ is the region below the line. (y is less than x)
- $y > x$ is the region above the line. (y is greater than x)
- $y = x$ is the boundary line.



A **solid boundary line** is used to represent $\leq$ or $\geq$.

A **dotted boundary line** is used to represent $<$ or $>$.



To graph an inequality:

1. Graph the boundary line.
2. Pick a point not on the line and substitute it into the inequality.
3. If the inequality is satisfied, shade the region containing the point. If not, shade the other region.

Inequalities have solution regions that need to be shaded.

Example 1: Graph $4x - 5y < 20$.

① Rearrange to $y = mx + b$

$4x - 5y < 20$

$+5y \quad +5y$

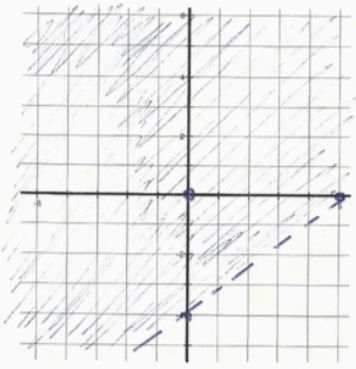
$4x < 20 + 5y$

$-20 \quad -20$

$\frac{-20}{5} \quad \frac{4x}{5} < \frac{5y}{5}$

$-4 \quad \frac{4}{5}x < y$ or $y > \frac{4}{5}x - 4$

Dotted line



② Pick point (0,0) to substitute for (x, y)

$0 > \frac{4}{5}(0) - 4$

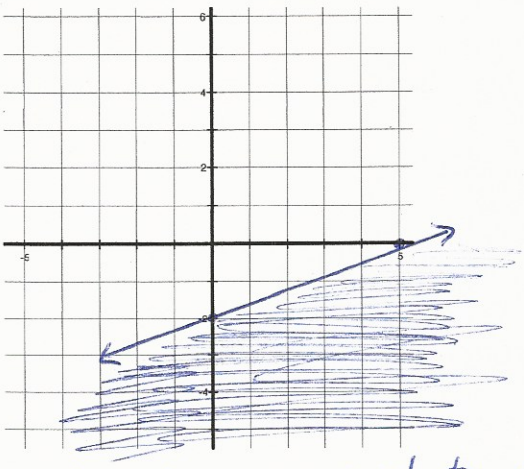
$0 > -4$ True! 0 is greater than -4

③ Since (0,0) satisfies the inequality, that point is in the solution region so we shade area where that point lies.

→ If it were false, we would shade the opposite region

solid line

Example 2: Graph $2x - 5y \geq 10$.



Shade below

① $2x - 5y \geq 10$

$-5y \quad -5y$

$2x \geq 5y + 10$

$-10 \quad -10$

$\frac{2x}{5} - \frac{10}{5} \geq \frac{5y}{5}$

$\frac{2}{5}x - 2 \geq y$ or $y \leq \frac{2}{5}x - 2$

② Sub (0,0)

$0 \leq \frac{2}{5}(0) - 2$

$0 \leq -2$

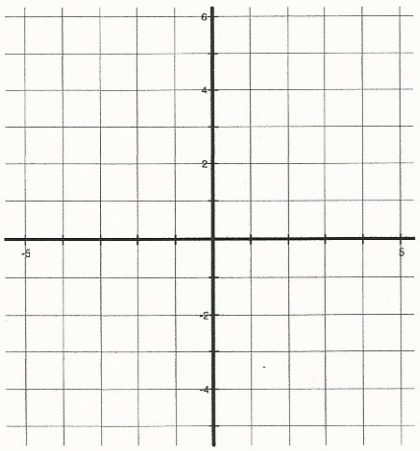
Is zero less than or equal to negative 2?

No! so that point is not in solution region.

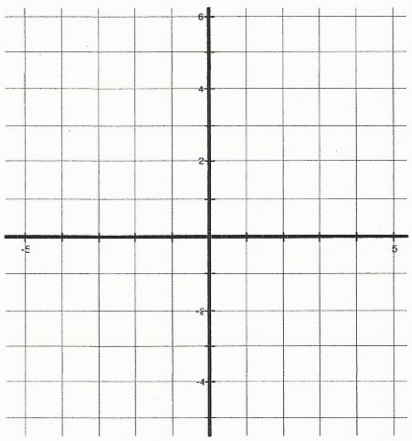
You try!

Example 3: Graph the solution set for each linear inequality on a Cartesian plane:

a. $x - 3 > 0$

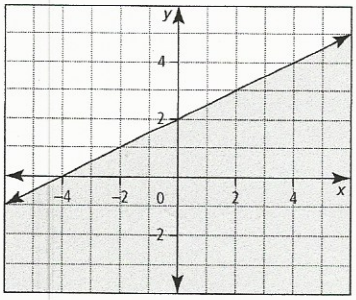


b. $-3y + 9 \geq -3 + y$

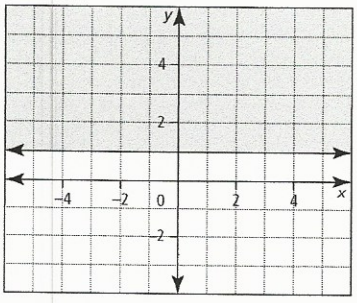


Example 4: Write an inequality to represent the graph:

a. You try ↳



b.



Boundary line:

Slope = 0 (no slope)

y-int = 1

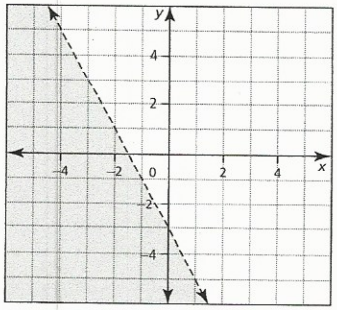
$y = 0x + 1$

$y = 1$ ↳ linear equality

Solid line and shade above the boundary line ↓

linear inequality ↳ $y \geq 1$

c. You try ↳



FOM 11 **6.3 Graphing to Solve Systems of Linear Inequalities**

In Grade 10 you studied systems of linear equations in two variables. The solution is the point(s) of intersection of the lines.

Grade 10

Eg. Solve the linear system by graphing:

$2x - y = -1$

$x + y = -2$

$2x - y = -1$

$-2x \quad -2x$

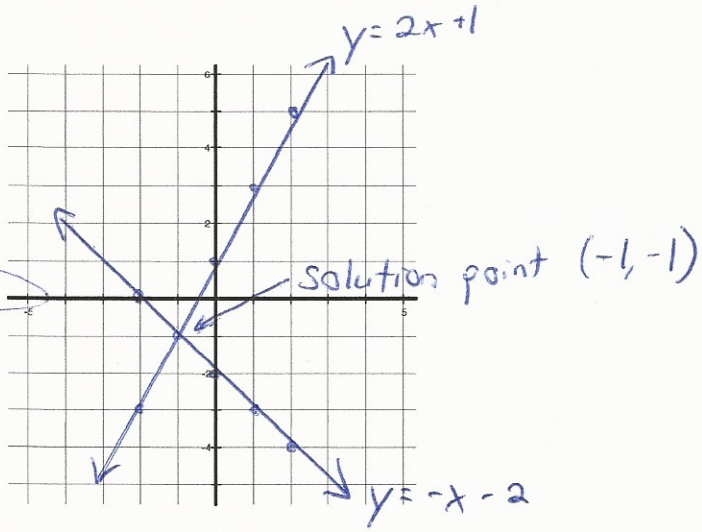
$\frac{-y}{-1} = \frac{-2x}{-1} - \frac{1}{-1}$

$y = 2x + 1$

$x + y = -2$

$-x \quad -x$

$y = -x - 2$



Grade 11

Here, we look at systems of linear **inequalities**. The solution is the region where the corresponding half-planes intersect or overlap.

Eg. Graph the region defined by these inequalities:

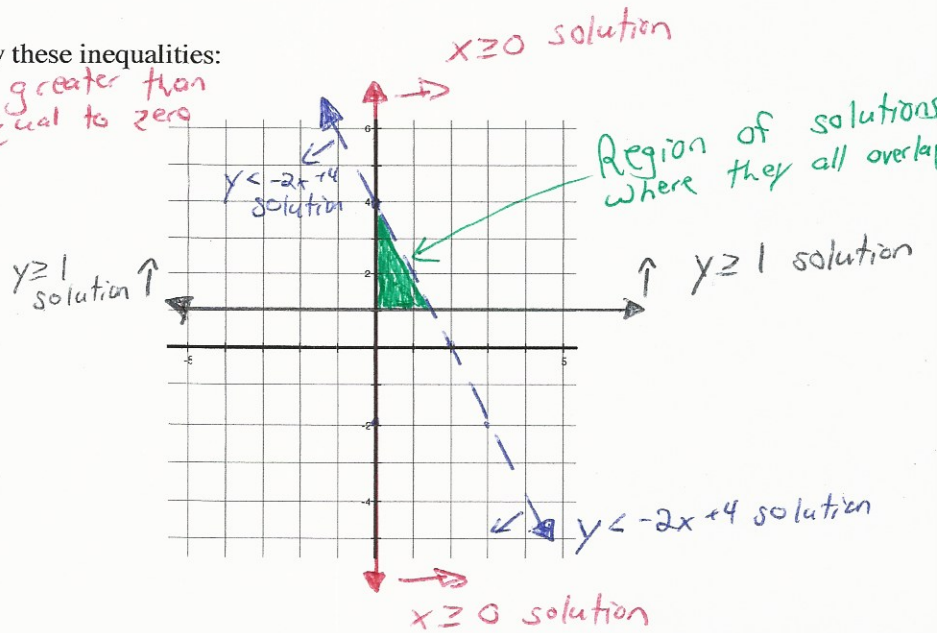
$x \geq 0$ → x is greater than or equal to zero

$y \geq 1$ ← y is greater than or equal to 1

$2x + y < 4$

$y < -2x + 4$

y is less than $-2x + 4$



Example 1: A sporting goods manufacturer makes footballs and soccer balls. Each football takes 3 min on a cutting machine and 1 min on a stitching machine. A soccer ball takes 3 min on a cutting machine and 4 min on a stitching machine. What combinations of balls can be made in 1 hour or less? → various combos: 15 footballs an 5 soccer balls (5, 15) is one example

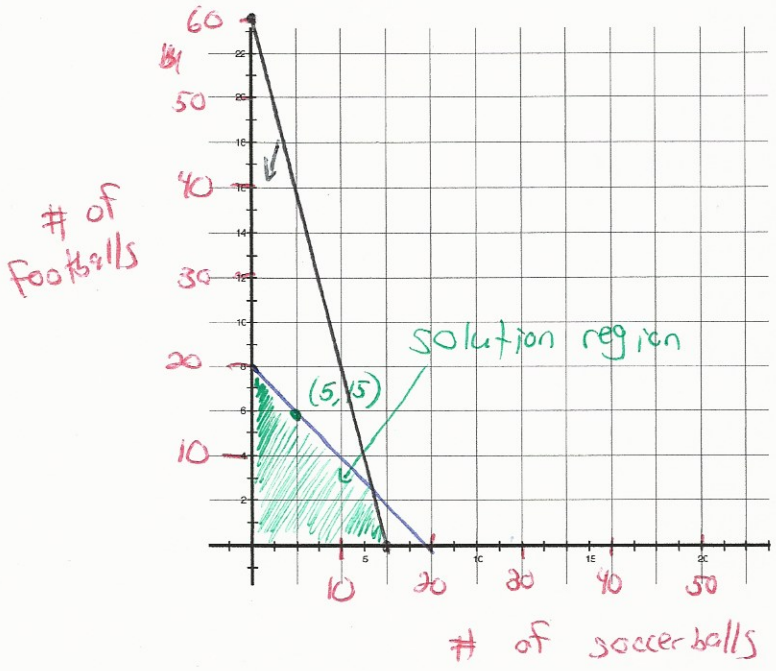
let x = # of soccer balls
let y = # of footballs

Cutting minutes:

$3x + 3y \leq 60$
$-3x \quad -3x$
$\frac{3y}{3} \leq \frac{-3x}{3} + \frac{60}{3}$
$y \leq -x + 20$

Stitching minutes:

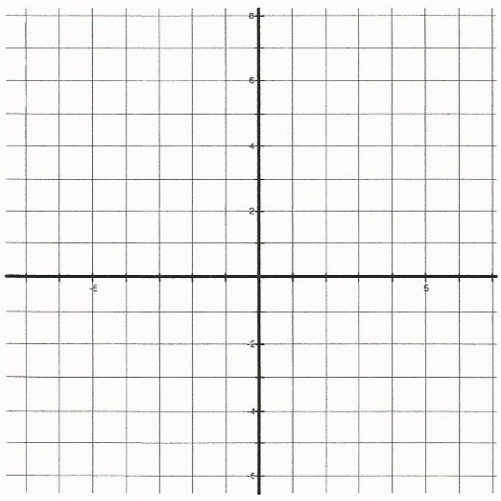
$4x + y \leq 60$
$-4x \quad -4x$
$y \leq -4x + 60$



you try →

Example 2: Graph the solution set for the following system of inequalities. Choose two possible solutions from the set.

$x + 2y < 8$
$3x - y \leq -6$



Name_____

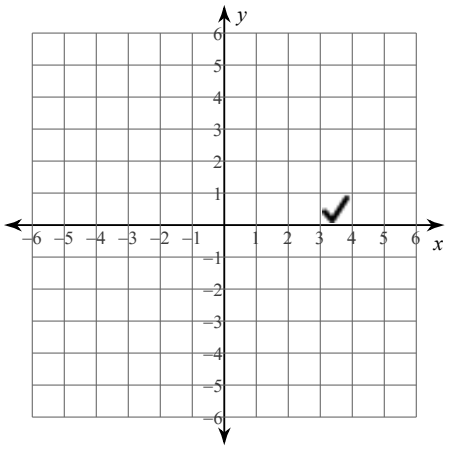
Graphing Linear Inequalities

Practice

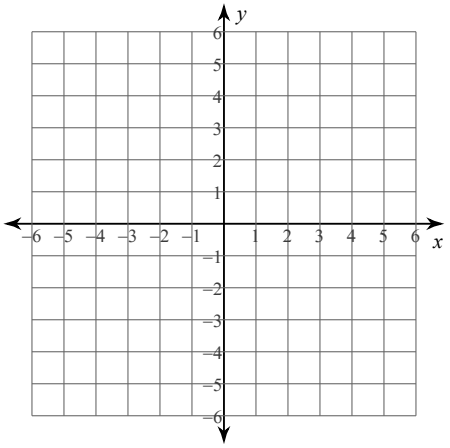
Date_____ Period____

Sketch the graph of each linear inequality.

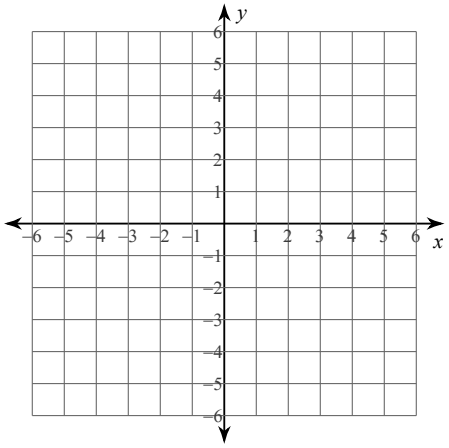
1) $y \geq -3x + 4$



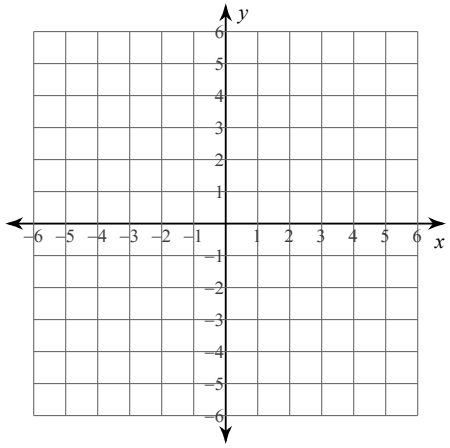
2) $y \leq \frac{3}{5}x - 5$



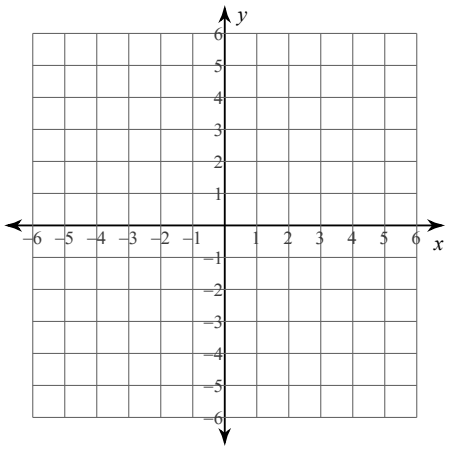
3) $y > -x - 5$



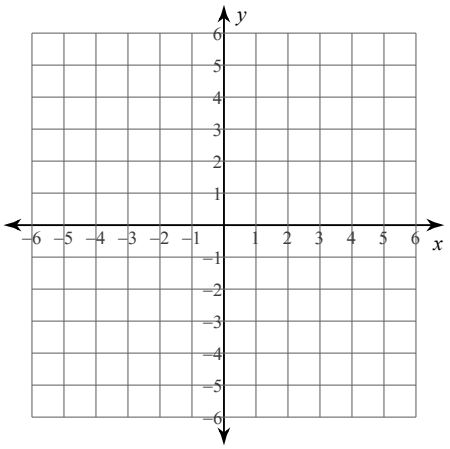
4) $y > -4$



5) $y > 2x - 5$

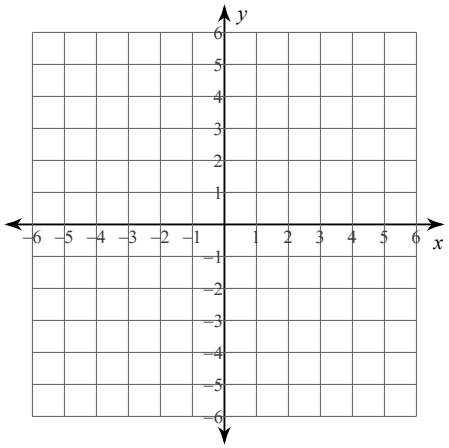


6) $y \geq \frac{7}{4}x + 2$

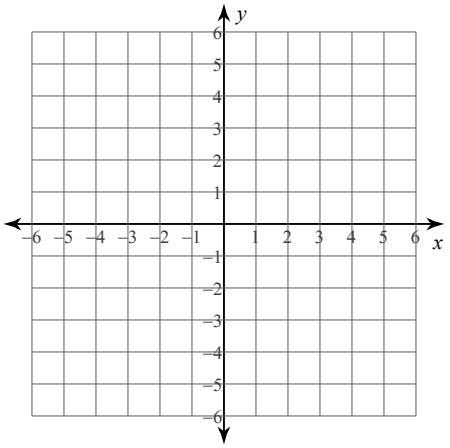


Practice

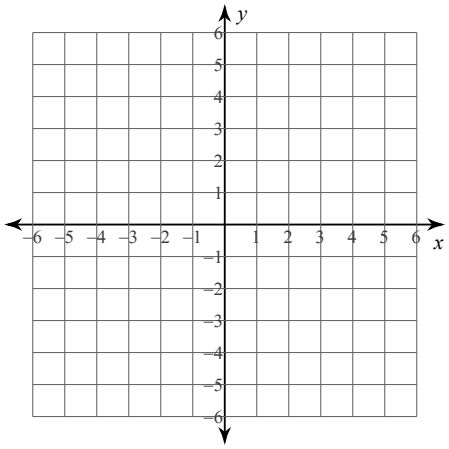
7) $x < -5$



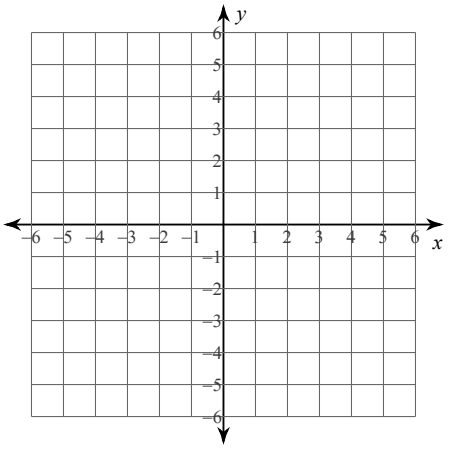
8) $y \leq \frac{4}{3}x - 4$



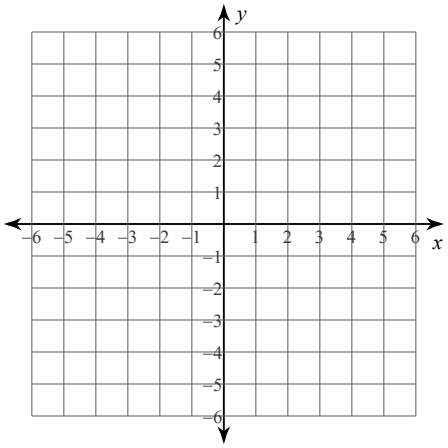
9) $3x - 2y < 10$



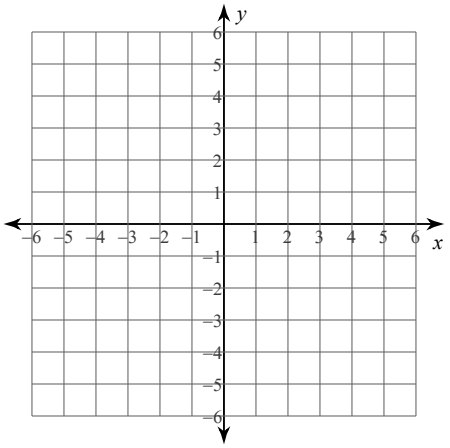
10) $5x - 3y \leq -15$



11) $y \geq 4$



12) $x - y > 2$



ASSIGNMENT

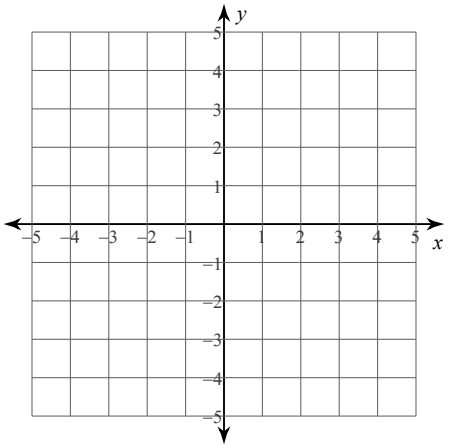
Name_____

Solving Systems of Inequalities

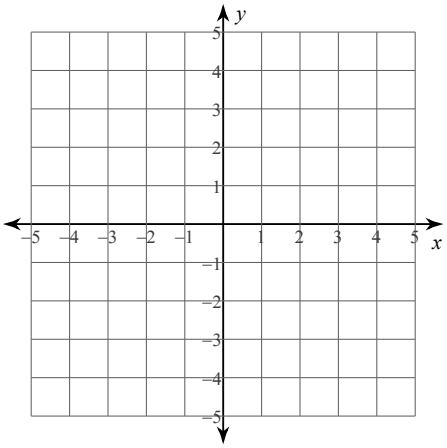
Date_____ Period____

Sketch the solution to each system of inequalities.

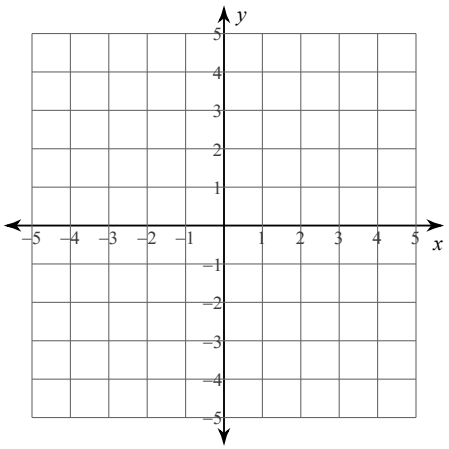
1) $y \le -x - 2$
$y \ge -5x + 2$



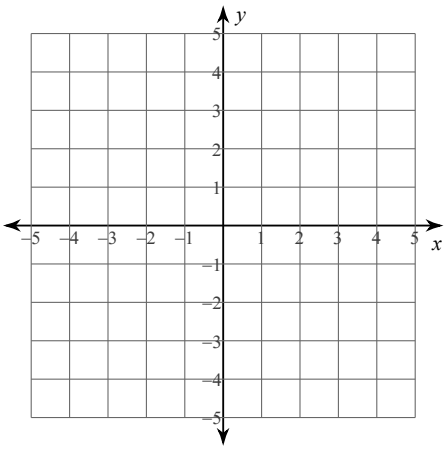
2) $y > -x - 2$
$y < -5x + 2$



3) $y \le \frac{1}{2}x + 2$
$y < -2x - 3$



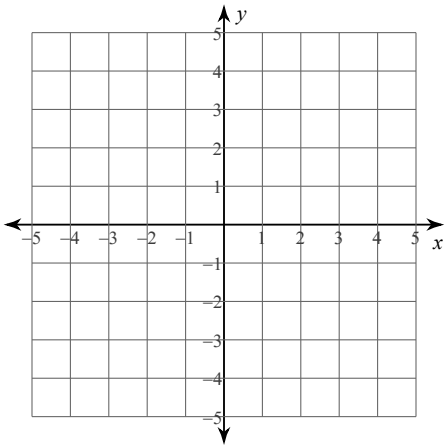
4) $x \le -3$
$y < \frac{5}{3}x + 2$



ASSIGNMENT

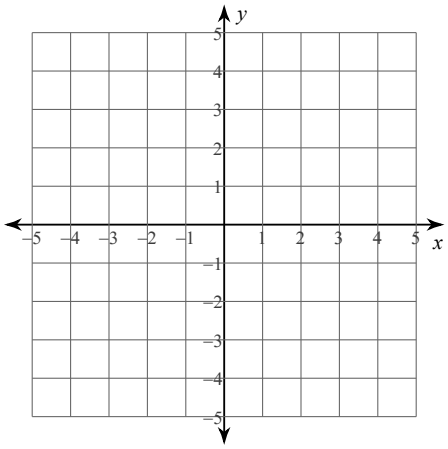
5) $y \le -\frac{5}{2}x - 2$

$y < -\frac{1}{2}x + 2$



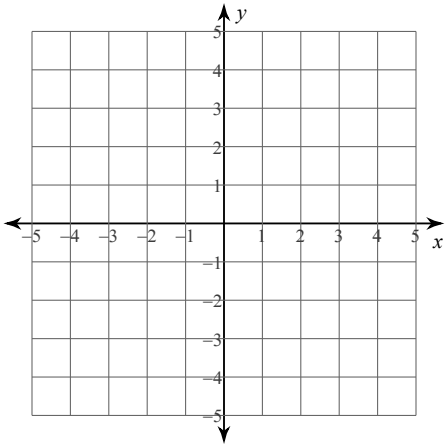
6) $y \ge \frac{2}{3}x + 3$

$y > -\frac{4}{3}x - 3$



7) $4x + y < 2$

$y > -2$



8) $3x + 2y \ge -2$

$x + 2y \le 2$