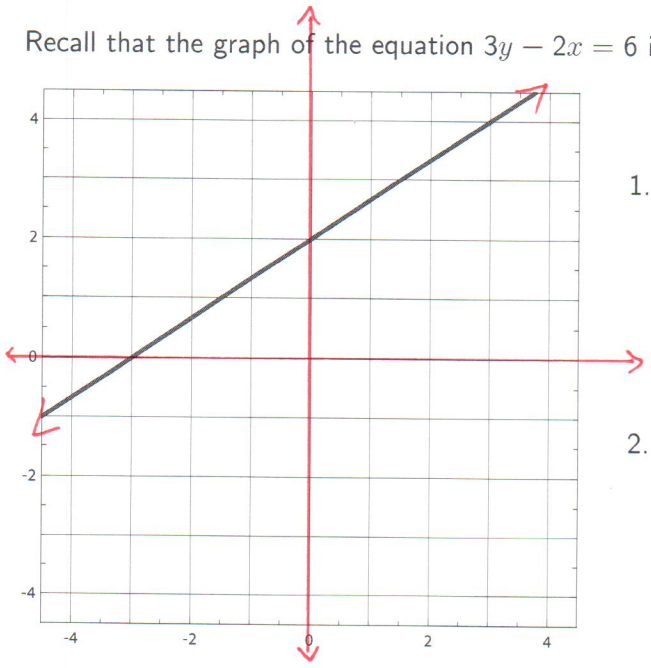
## SECTION 5.3 SYSTEMS OF LINEAR INEQUALITIES

**Name:** Key **Date:** _____ **Period:** _____

### EXPLORATION 1

Recall that the graph of the equation $3y - 2x = 6$ is a line:




1. List the $x$-intercept and the $y$-intercept of this line. What is the slope of the line?

   x-intercept: $(-3, 0)$

   y-intercept: $(0, 2)$

2. Identify three points on this line other than the $x$-intercept and $y$-intercept. Explain how you found these points.

   $(3, 4)$ ← graph $(6, 6)$ $(9, 8)$ ← pattern

   equation: $y = \frac{2}{3}x + 2$ or

3. You probably noticed that there are infinitely many points on this line. However, there are many other points in the coordinate plane that are not on this line. Identify three points that are not on the line. Where are these points in relation to the line?

   $(-4, 4)$ $(0, 1)$ $(2, 3)$ answers will vary

   above or below

4. If we write the equation $3y - 2x = 6$ in slope-intercept form, we get $y = \frac{2}{3}x + 2$. How can we use this form of the equation to determine whether the point $(0, 2)$ is on, above, or below the line? Plug in $(0, 2)$ for $(x, y)$ $2 = \frac{2}{3}(0) + 2$

   $2 = 2$ ✓ point is on the line

5. If we change the equality in $y = \frac{2}{3}x + 2$ into an inequality, we can get the inequality $y < \frac{2}{3}x + 2$ or $y > \frac{2}{3}x + 2$. Does the point $(0, 2)$ satisfy either of these inequalities? How about $(0, 0)$?

   No, since $2 = 2$ above $0 \stackrel{?}{} \frac{2}{3}(0) + 2$

   $0 \stackrel{?}{} 2$

   $0 < 2$ so $y < \frac{2}{3}x + 2$ when $(0, 0) = (x, y)$

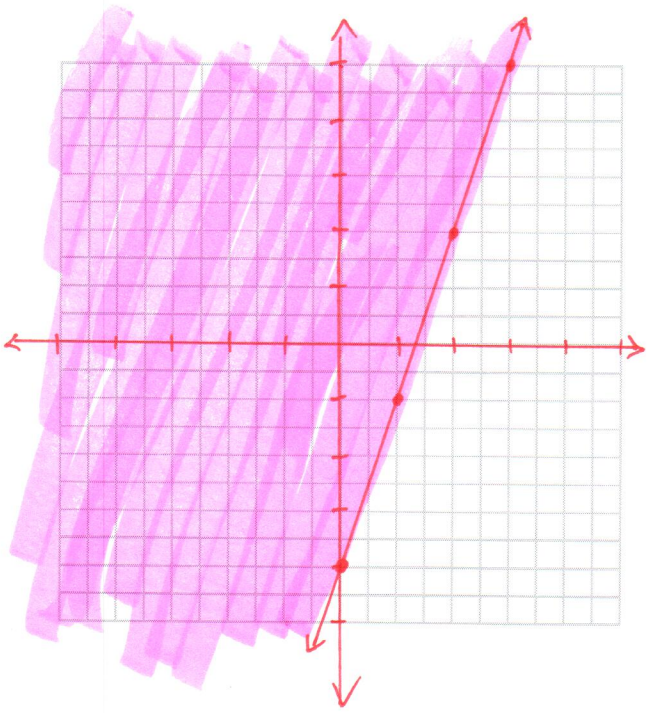
6. The point $(0, 0)$ is on which side of the line $3y - 2x = 6$? Pick another point on this side of the line, and see if it satisfies either of the inequalities $y < \frac{2}{3}x + 2$ or $y > \frac{2}{3}x + 2$. Then try it with another point on the same side of the line.

   below $(2, 0)$ $(1, 1)$

   $0 < \frac{2}{3}2 + 2$ ✓ $0 > \frac{2}{3}2 + 2$ ✗ $1 < \frac{2}{3}(1) + 2$ ✓ $1 > \frac{2}{3}(1) + 2$ ✗

**EXAMPLE 1**

Graph the inequality $3x - y \leq 4$.



$3x - y \leq 4$

$3x - y - 3x \leq 4 - 3x$

$-y \leq -3x + 4$

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

$y \geq 3x - 4$

$\geq$ means greater than or equal to

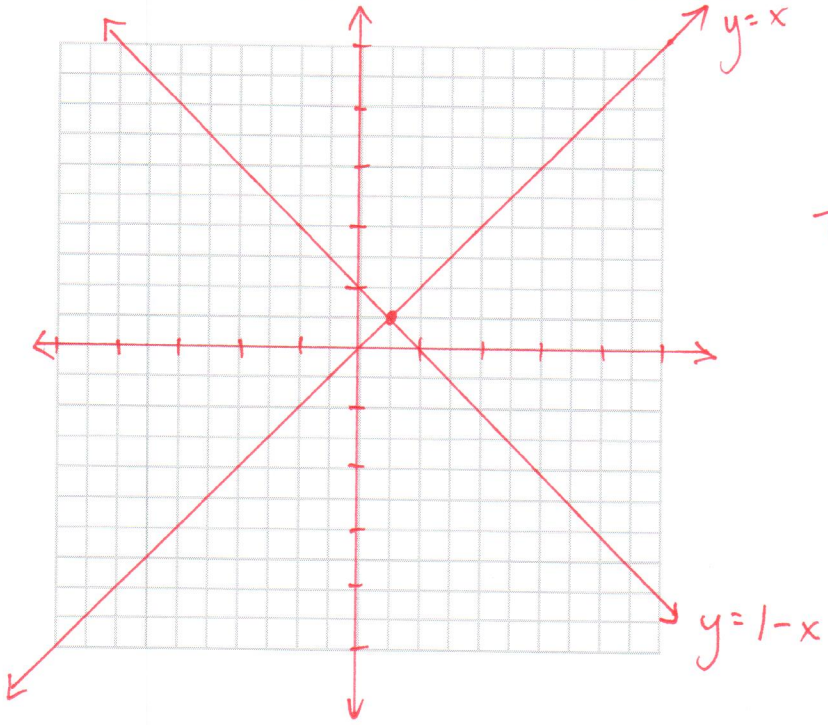
so we draw a solid line.

$\geq$ means greater than or equal to

so we shade above the line.

## EXAMPLE 2

Solve the following system of equations by graphing:




$y = x$

$y = 1 - x$

The intersection is $\left(\frac{1}{2}, \frac{1}{2}\right)$, so the solution set is

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

## EXPLORATION 2

Consider the system of inequalities:

$$y < x$$
$$y < 1 - x$$

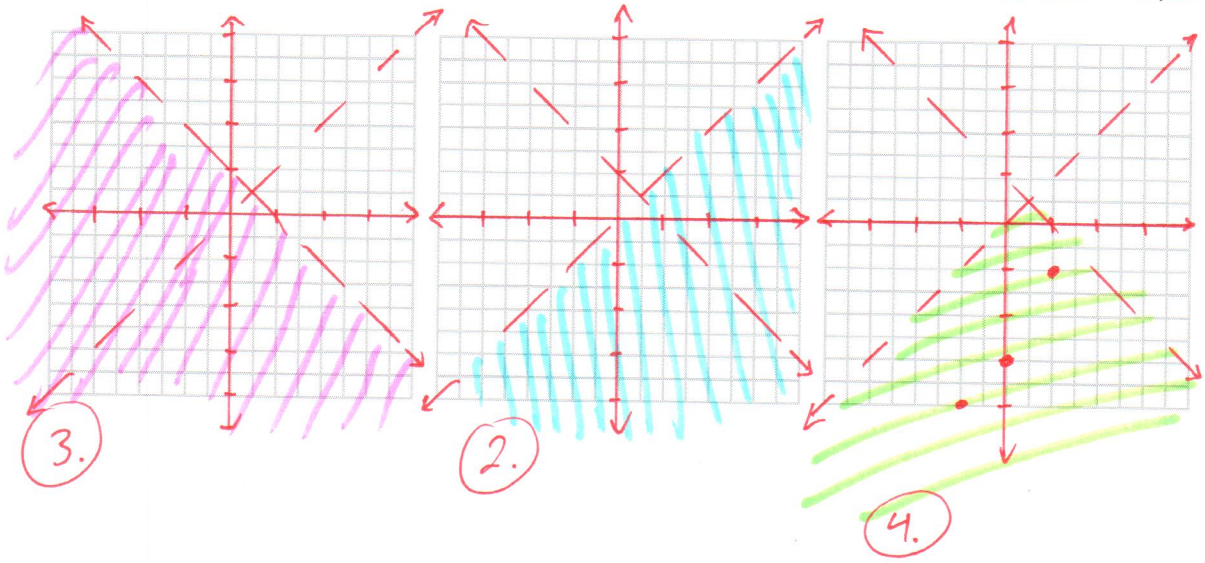
1. Graph the equations $y = x$ and $y = 1 - x$ on the same set of axes. Use dotted lines for these, since the given inequalities are strict inequalities. > or <, not ≥ or ≤

2. On this set of axes, graph the solution set of the inequality $y < x$.

3. On another set of axes, draw the lines $y = x$ and $y = 1 - x$ using dotted lines again, and graph the solution set of the inequality $y < 1 - x$.

4. On a third set of axes, graph the set of points that satisfy both inequalities.

5. Pick some points in the region you shaded, and check that they satisfy both inequalities.



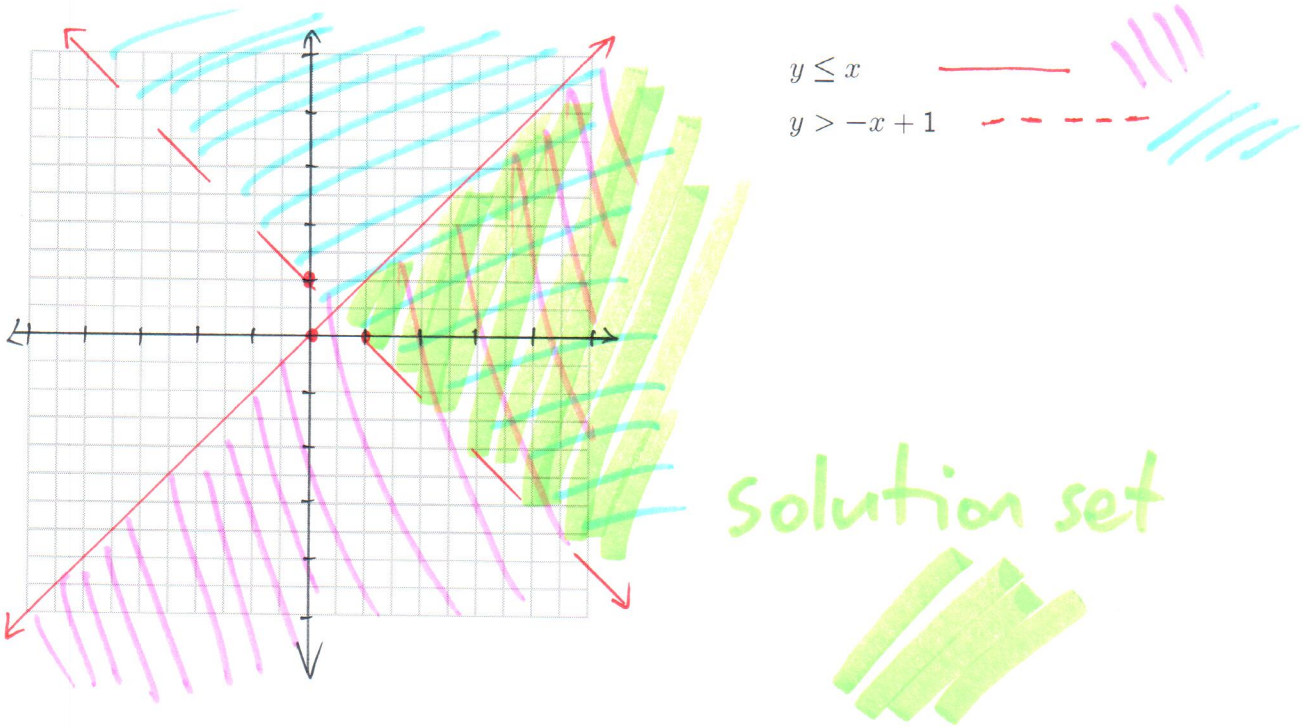

5. (1, -1) $-1 < 1$ ✓ $-1 < 1-1 \rightarrow -1 < 0$ ✓

(0, -3) $-3 < 0$ ✓ $-3 < 1-0 \rightarrow -3 < 1$ ✓

(-1, -4) $-4 < -1$ ✓ $-4 < 1--1 \rightarrow -4 < 2$ ✓

## EXAMPLE 3

Graph the solution set for the following system of inequalities:




## SUMMARY (What I learned today)