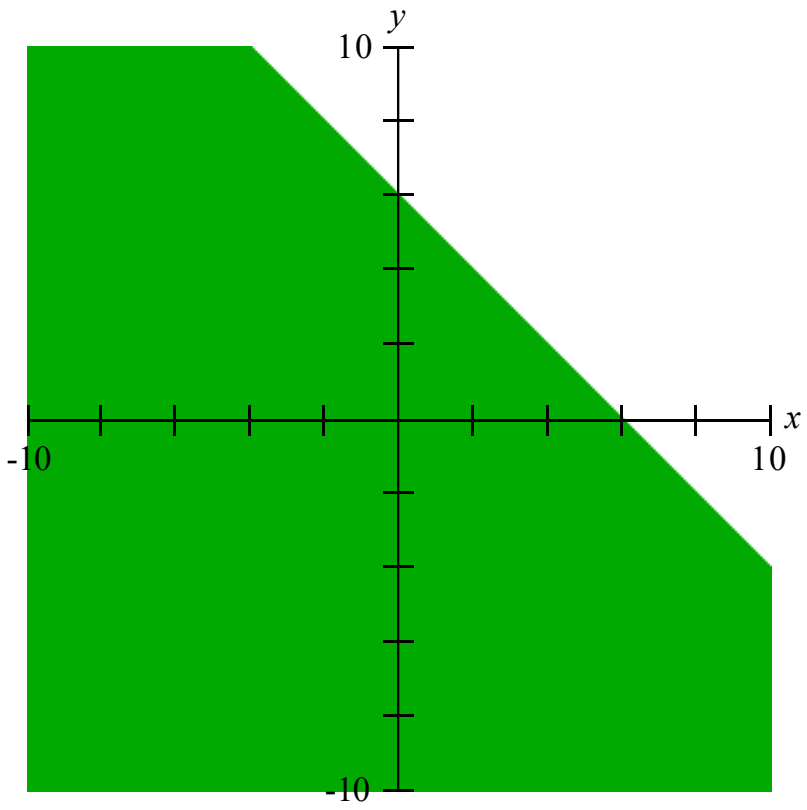
Graphing Systems of Inequalities

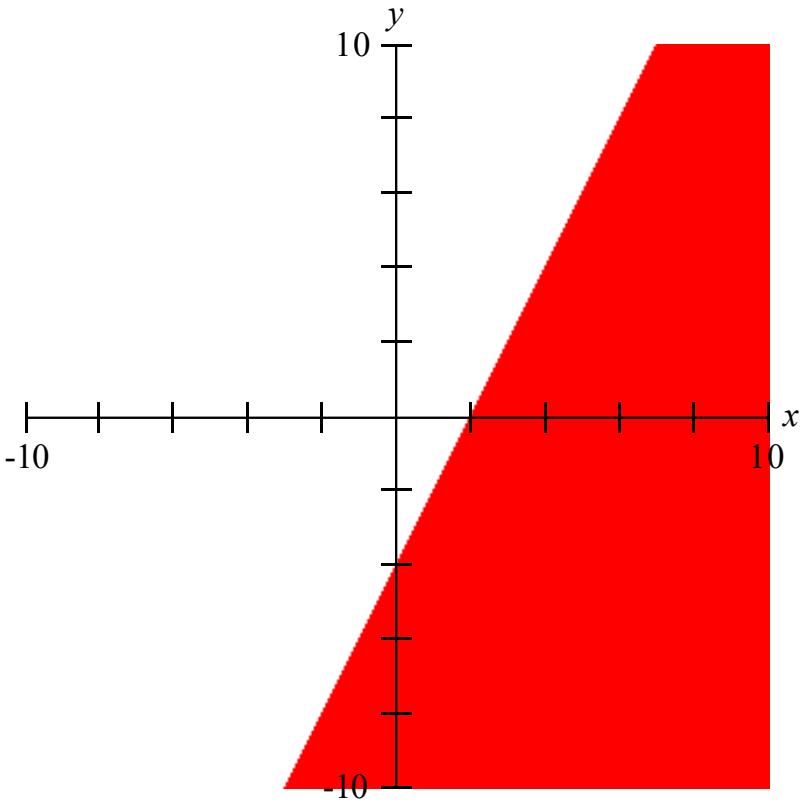
Graphing Method

- Example: Graph the inequalities on the same plane: $x + y \leq 6$ and $2x - y > 4$.
- Before we graph them simultaneously, let's look at them separately.
- Graph of $x + y \leq 6$. --->



Graphing Method

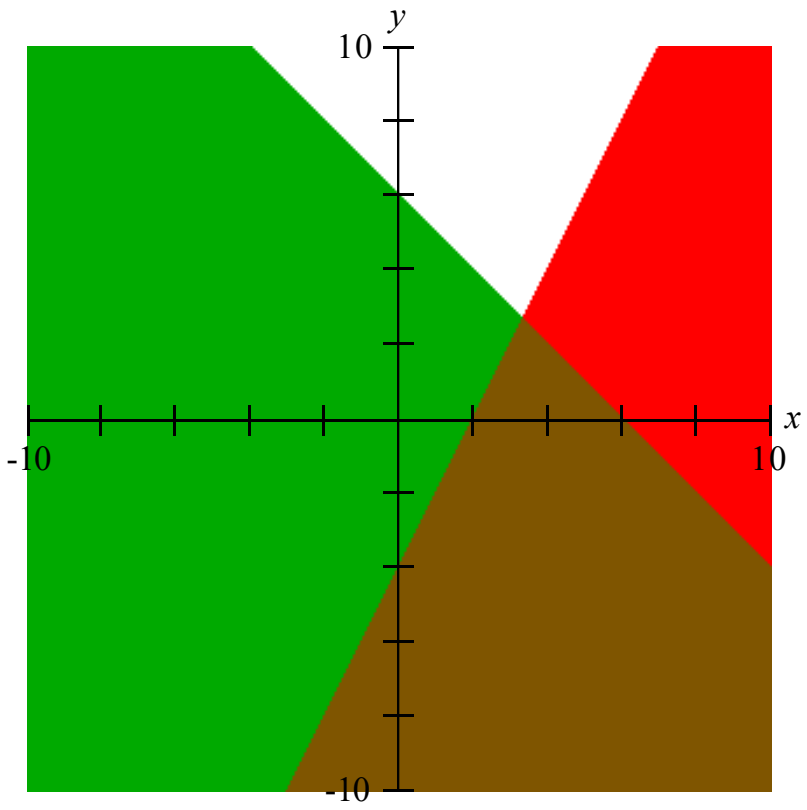
- This is: $2x - y > 4$.



So what happens when we graph both inequalities simultaneously?

Coolness Discovered!

- Wow!
- The **solution** to the system is the **brown** region - where the two shaded areas coincide.
- The **green region** and **red regions** are **outside the solution set**.



So what were the steps?

- Graph first inequality
  - Shade lightly (or use **colored** pencils)
- Graph second inequality
  - Shade lightly (or use **colored** pencils)
- Shade darkly over the common region of intersection.
- That is your solution!

Graphing System of Inequalities

1. Write the inequalities in slope-intercept form.
2. Use the slope and y-intercept to plot the lines.
3. Draw in the line. Use a solid line for less than or equal to (≤) or greater than or equal to (≥). Use a dashed line for less than (<) or greater than (>).
4. Pick a point above the line or below the line. Test that point in the inequality. If it makes the inequality true, then shade the region that contains that point. If the point makes the inequality false, shade the region on the other side of the line.

(Don't forget to flip the sign if you divide by a negative #)

-Hint: > or ≥ shade above

< or ≤ shade below

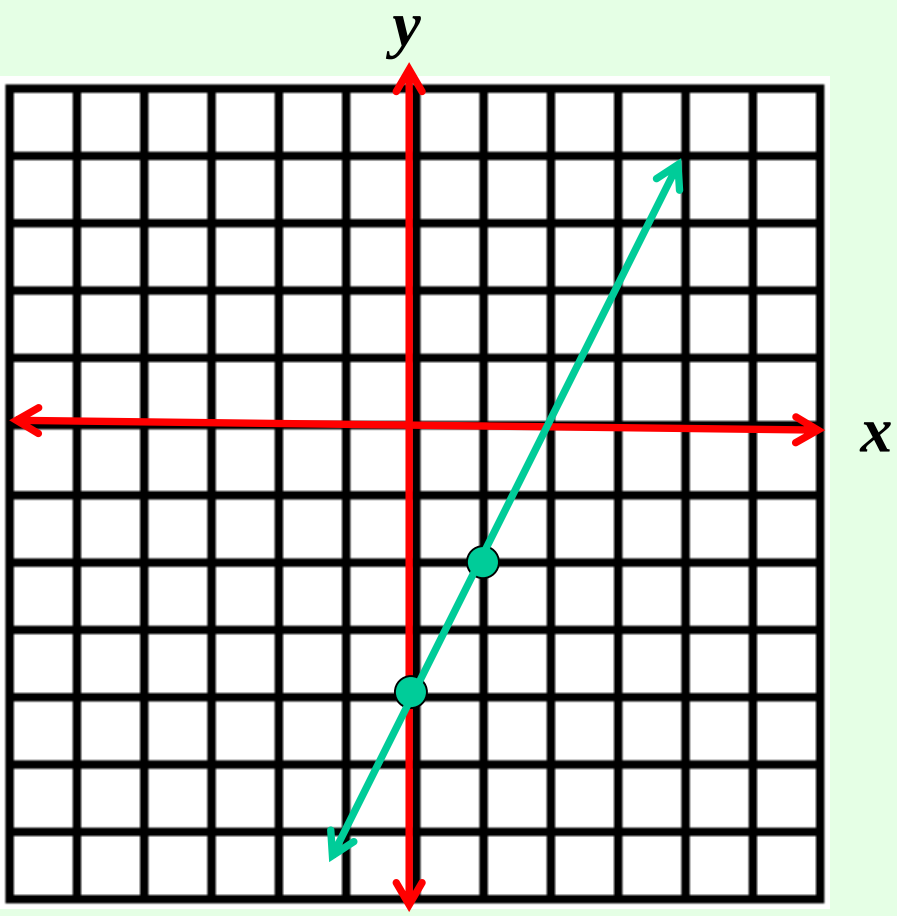
1. **<u>Systems of inequalities</u>** – Follow steps 1-4 for each inequality. Find the region where the solutions to the two inequalities would **<u>overlap</u>** and this is the region that should be **<u>shaded</u>**.

Example

Graph the following linear system of inequalities.

$$y \geq 2x - 4$$

$$y < -3x + 2$$



Use the slope and y-intercept to plot two points for the first inequality.

Draw in the line. For ≥ use a solid line.

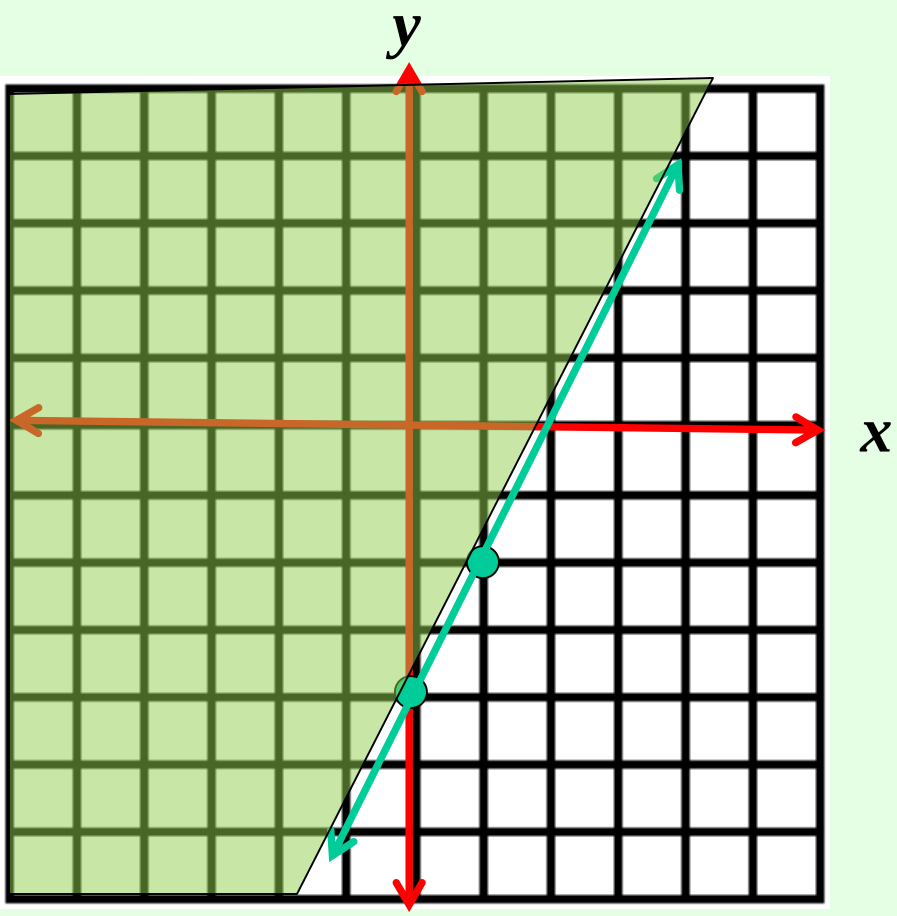
Pick a point and test it in the inequality. Shade the appropriate region.

Example

Graph the following linear system of inequalities.

$y \geq 2x - 4$

$y < -3x + 2$



$y \geq 2x - 4$ Point (0,0)

$0 \geq 2(0) - 4$

$0 \geq -4$

The region above the line should be shaded.

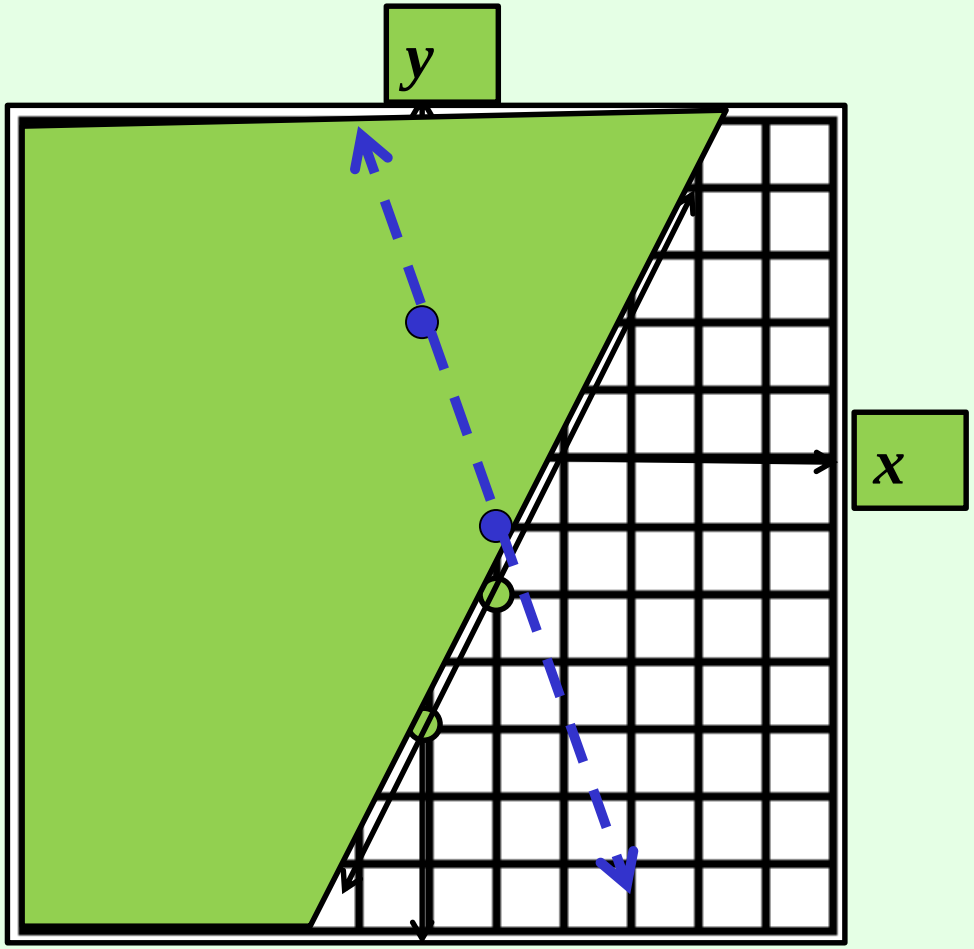
Now do the same for the second inequality.

Example

Graph the following linear system of inequalities.

$$y \geq 2x - 4$$

$$y < -3x + 2$$



Use the slope and y-intercept to plot two points for the second inequality.

Draw in the line. For < use a dashed line.

Pick a point and test it in the inequality. Shade the appropriate region.

Example

Graph the following linear system of inequalities.

$y \geq 2x - 4$

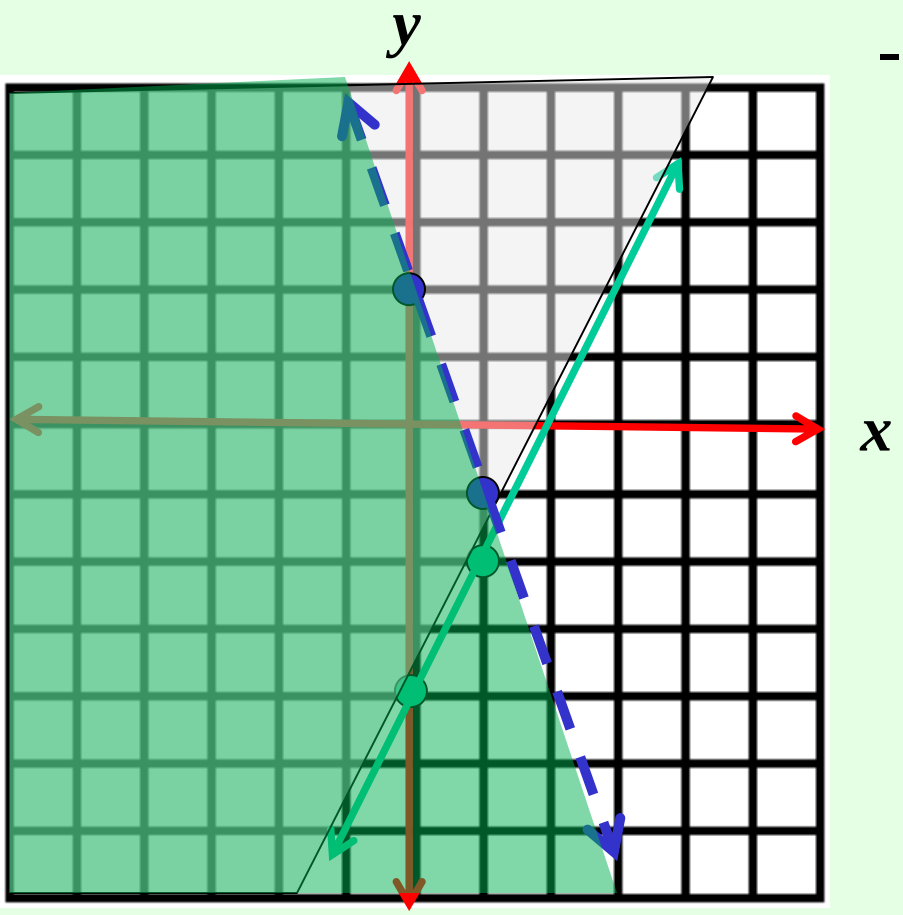
$y < -3x + 2$

$y < -3x + 2$ Point (-2,-2)

$-2 \geq -3(-2) + 2$

$-2 < 8$

The region below the line should be shaded.

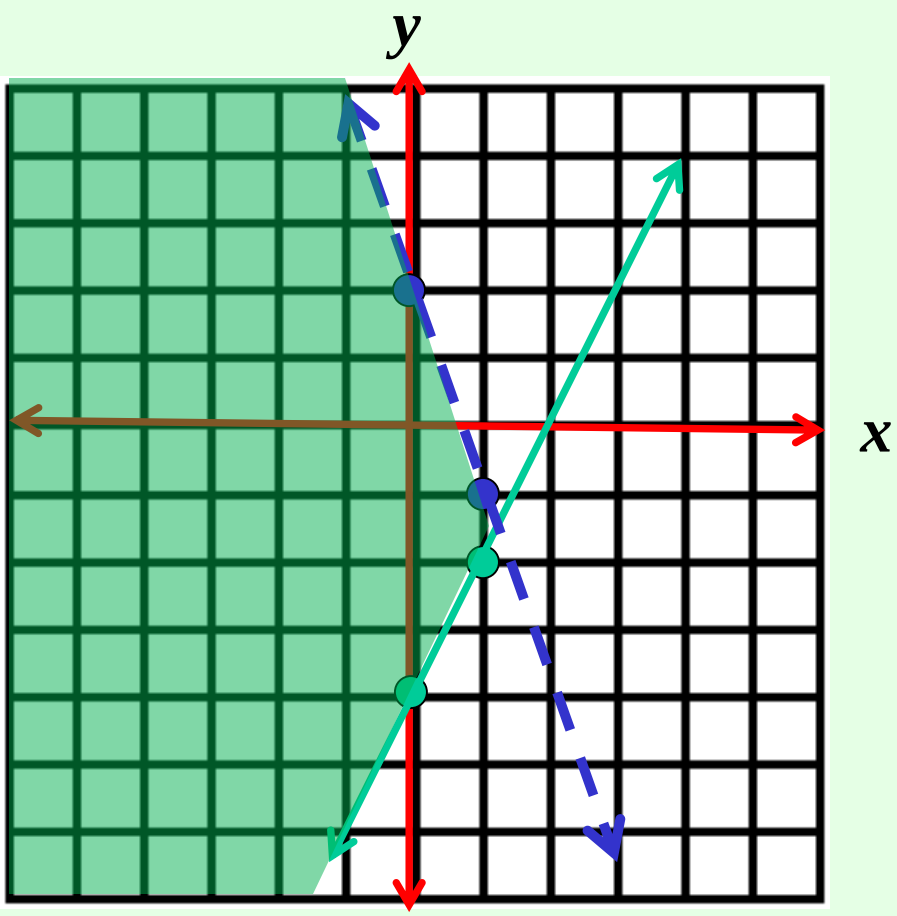


Example

Graph the following linear system of inequalities.

$$y \geq 2x - 4$$

$$y < -3x + 2$$



The solution to this system of inequalities is the region where the solutions to each inequality overlap. This is the region above or to the left of the green line and below or to the left of the blue line.

Shade in that region.

You Try It

Graph the following linear systems of inequalities.

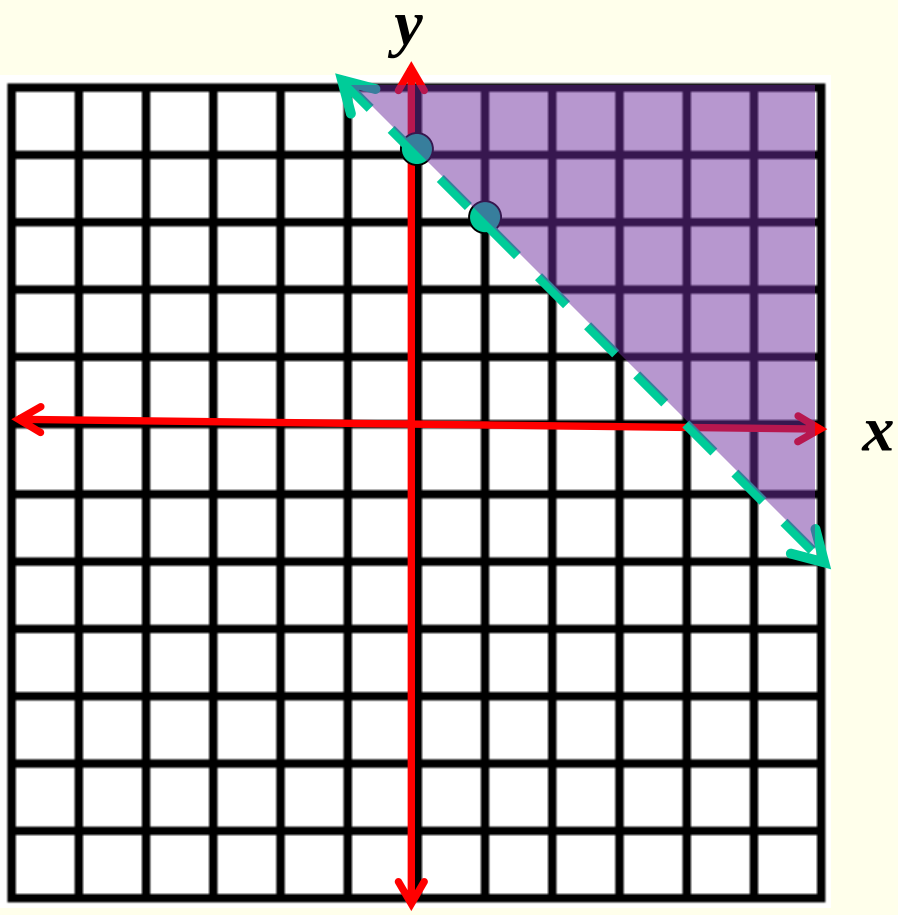
1. $y > -x + 4$

   $y > x - 2$

Problem 1

$$y > -x + 4$$

$$y > x - 2$$



Use the slope and y-intercept to plot two points for the first inequality.

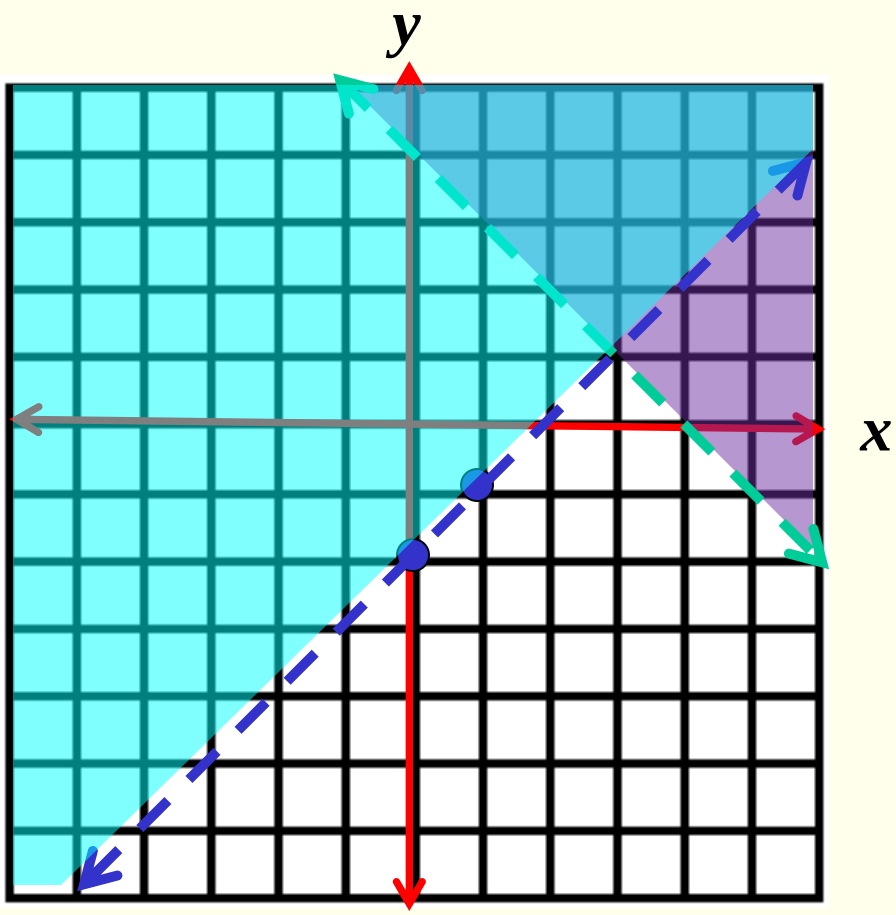
Draw in the line.

Shade in the appropriate region.

Problem 1

$y > -x + 4$

$y > x - 2$



Use the slope and y-intercept to plot two points for the second inequality.

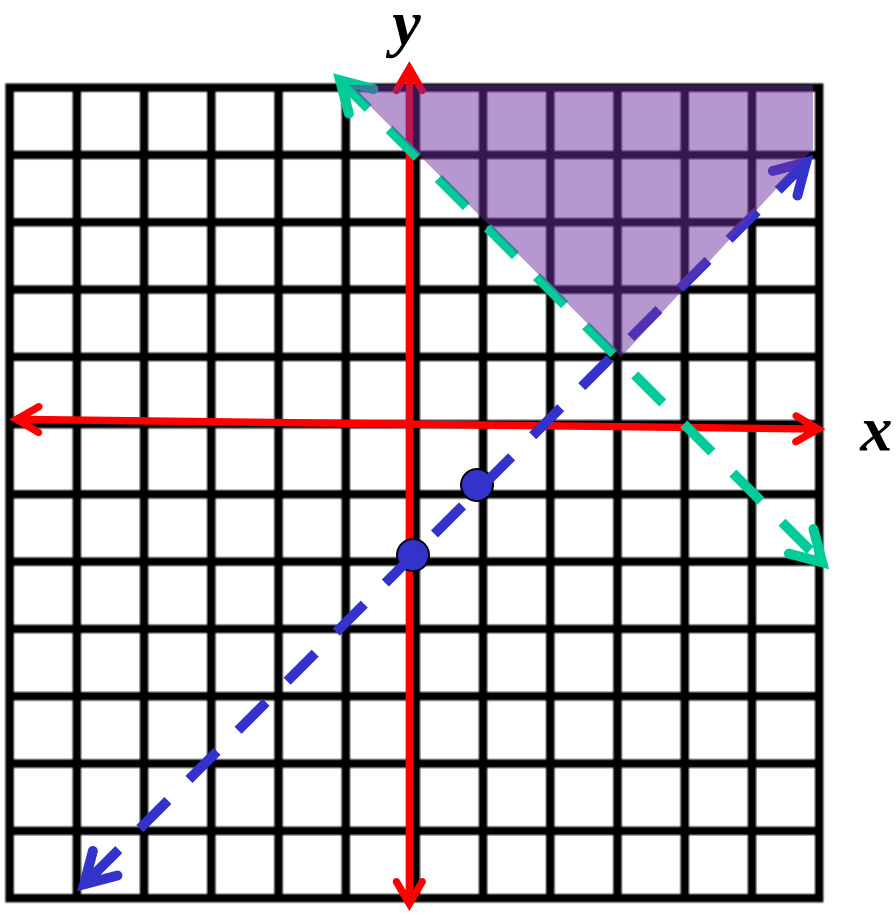
Draw in the line.

Shade in the appropriate region.

Problem 1

$$y > -x + 4$$

$$y > x - 2$$



The final solution is the region where the two shaded areas overlap (purple region).

Graphing a System of Two Inequalities

Graph the system of linear inequalities.

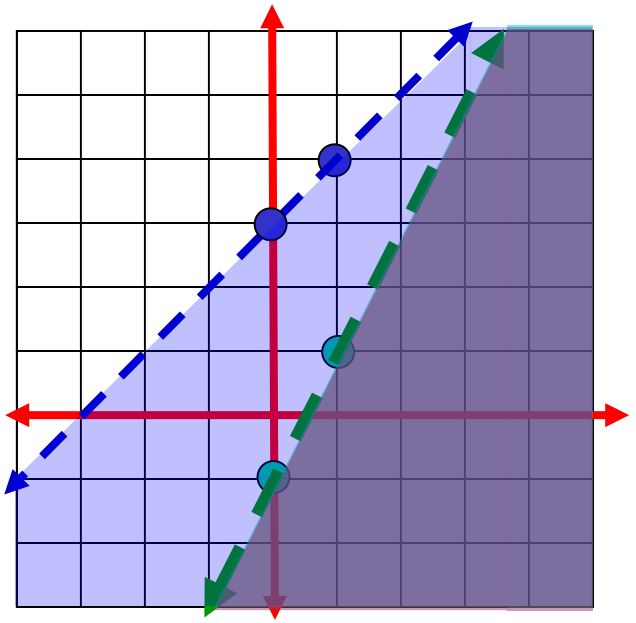
2. $y + 2 < 2x$

$y < 2x - 2$

Dotted line

$y < x + 6$

Dotted line



$0 < 6$

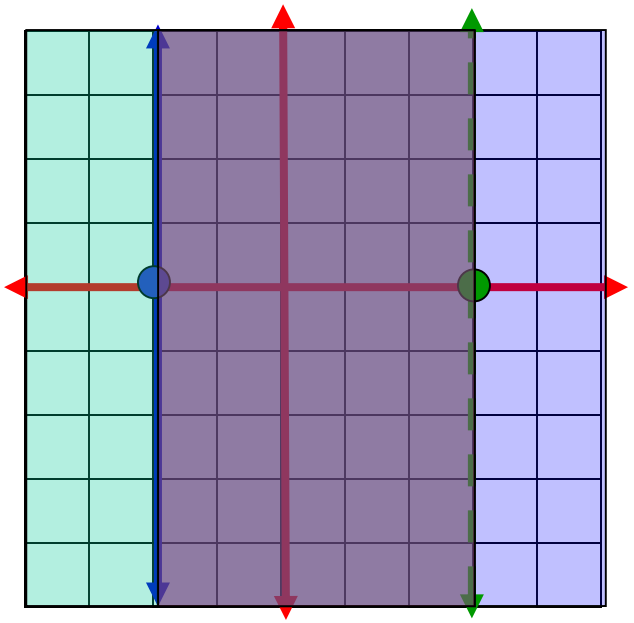
True

Graphing a System of Two Inequalities

Graph the system of linear inequalities.

1. $x \geq -2$ **Solid line**

$x < 3$ **Dotted line**



$0 < 3$

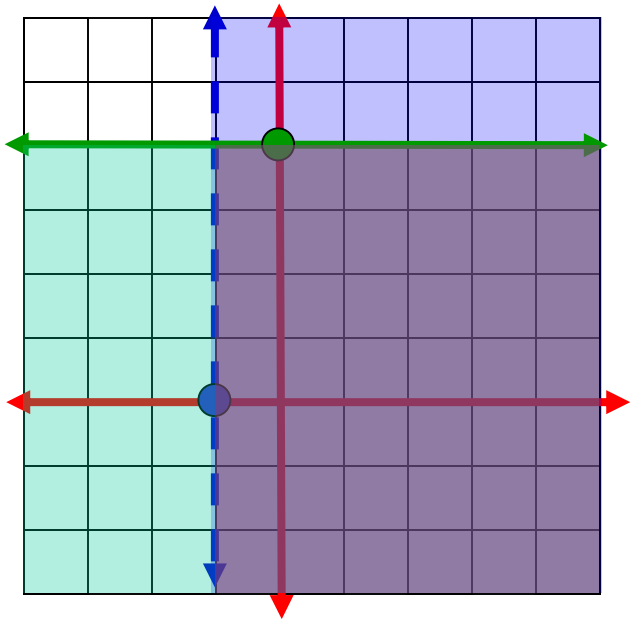
True

Graphing a System of Two Inequalities

Graph the system of linear inequalities.

3. $y \leq 4$ **Solid line**

$x > -1$ **Dotted line**

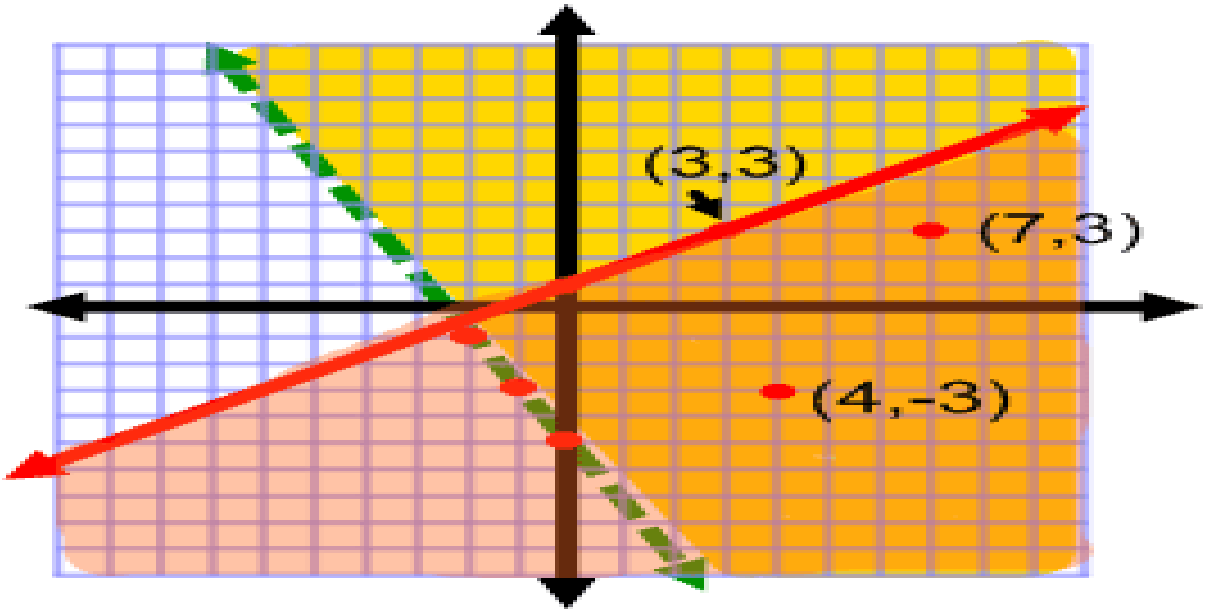


$0 > -1$

True

Graphing a Systems of Inequalities

Step 4: Three solutions to the system are:



(3,3)

$y > -2x - 5$

$3 > -2(3) - 5$

$3 > -11$ ☺

$y \leq 2/3x + 1$

$3 \leq 2/3(3) + 1$

$3 \leq 3$ ☺

(7,3)

$y > -2x - 5$

$3 > -2(7) - 5$

$3 > -19$ ☺

$y \leq 2/3x + 1$

$3 \leq 2/3(7) + 1$

$3 \leq 5.67$ ☺

(4, -3)

$y > -2x - 5$

$-3 > -2(4) - 5$

$-3 > -13$ ☺

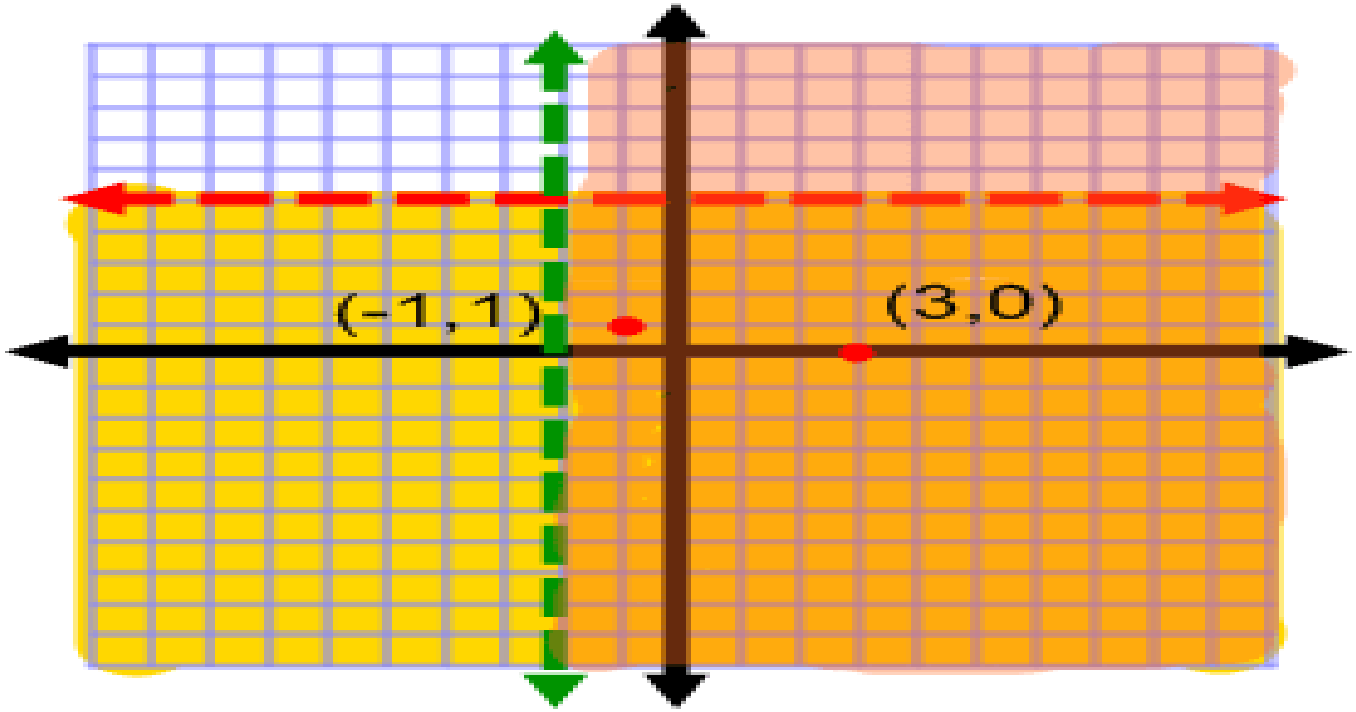
$y \leq 2/3x + 1$

$-3 \leq 2/3(4) + 1$

$-3 \leq 3.67$ ☺

You must check both inequalities with your solutions!

Step 4: Two solutions to the system are:



Since both lines are dotted, points on the lines are not solutions to this system of inequalities!

(-1,1)

y < 5

1 < 5 ☺

x > -2

(3,0)

y < 5

0 < 5 ☺

x > -2

Graphing a System of Three Inequalities

Graph the system of linear inequalities.

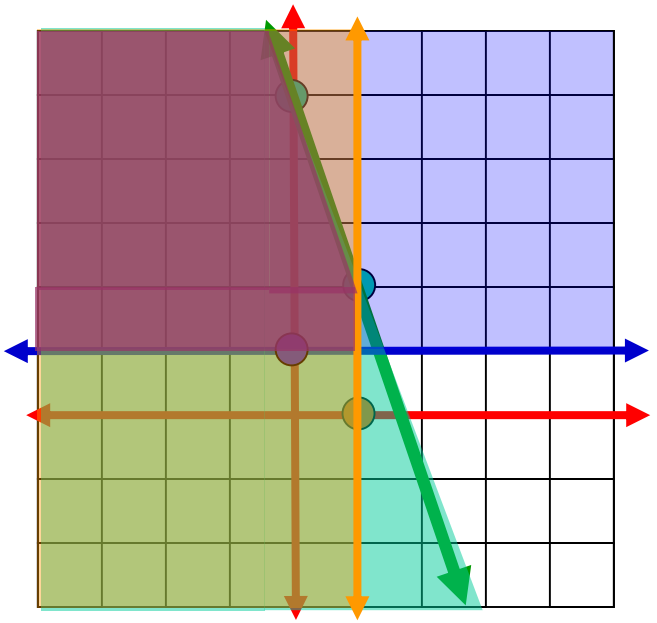
4. $3x + y \leq 5$

$y \leq -3x + 5$

Solid lines

$y \geq 1$

$x \leq 1$



$0 \leq 1$

True

Graphing a System of Three Inequalities

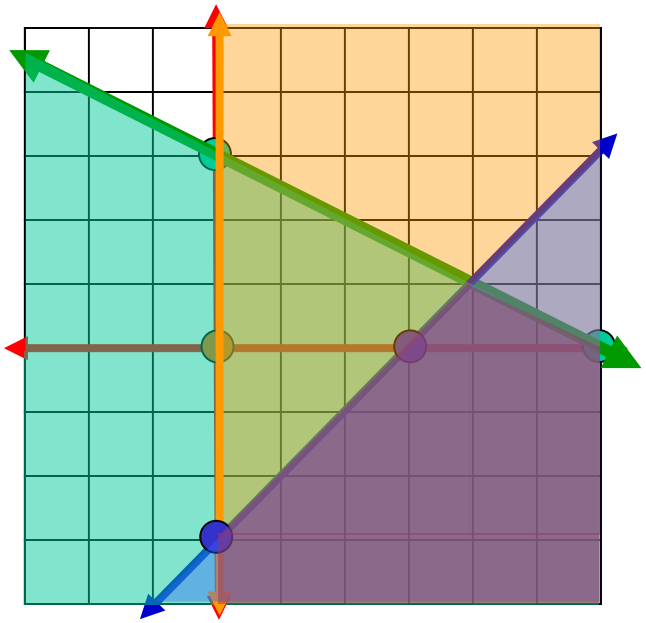
Graph the system of linear inequalities.

5. $x + 2y \leq 6$

$x - y \geq 3$

$x \geq 0$

Solid lines



$1 \geq 0$

True

Graphing a System of Three Inequalities

Graph the system of linear inequalities.

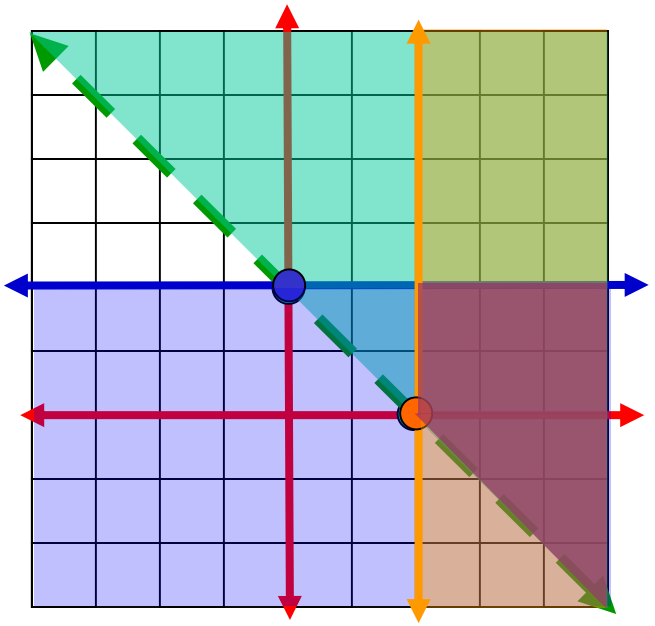
6. $x + y > 2$

$y \geq -x + 2$

Dotted lines

$y \leq 2$

$x \geq 2$ **Solid lines**



$0 \geq 2$

False