

# Math in Living **C O L O R !!**

## 5.05 Inequalities in Two Variables Systems of Inequalities

*Intermediate Algebra: One Step at a Time*

Pages 418-426: #8,10, 27, 30, Extra Problem

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See Section 5.05, with explanations, examples, and exercises, coming soon!

Explanation from Basic Algebra, coming soon!

See also Math in Living **C O L O R** from Basic Algebra, coming soon!

In each problem involving inequalities, there are three steps. **First**, you must get the line in place, by graphing the corresponding equation. **Second**, you must decide whether the line should be included or not--that is, should it be a dotted or solid line. **Third**, you must decide whether to shade above or below the line. In later problems, there is a **fourth** step, in which, when there are two or more inequalities, you must decide whether to shade the **Union** or the **Intersection** of the areas.

**Step 1: Graph the Line!**

(Use methods of previous sections!)

**Step 2: Dotted ( $<$  or  $>$ ) or Solid ( $\leq$  or  $\geq$ )!**

**Step 3: Shade ABOVE or BELOW!**

**+ Y  $>$   $\geq$  Shade ABOVE the Line!**

**+ Y  $<$   $\leq$  Shade BELOW the Line!**

**NOTE: You MUST have a positive Y coefficient!!**

**If you have a negative Y coefficient,  
this REVERSES the RULE!!**

Unfortunately, in the format of this website, I have not learned how to make a dotted line. I will have to ask YOU to make the lines dotted that have either a  $<$  or  $>$  symbol.

**P. 421 #8.** Graph the inequality:  $3x + 2y > -12$

**Solution:**

**Step 1:** Graph the line:  $3x + 2y = -12$

Since this is in standard form, find the x and y intercepts.

$$\text{If } x = 0, \text{ then } 2y = -12$$

$$y = -6$$

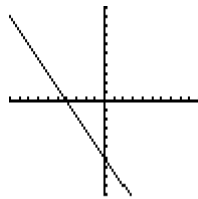
$$\text{If } y = 0, \text{ then } 3x = -12$$

$$x = -4$$

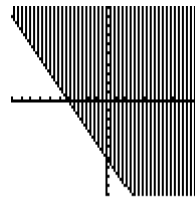
**Step 2:** Graph this line with a dotted line.

(You will have to do this for me, since I don't know how to graph a dotted line in this format).

$$3x + 2y = -12$$



$$3x + 2y > -12$$



(Dotted Line!)

**Step 3:** Shade above the line. Don't forget to make this line dotted!!

**P. 421 #10.** Graph the inequality:  $-2x + y \leq 8$

**Solution:**

**Step 1:** Graph the line:  $-2x + y = 8$

Since this is in standard form, find the x and y intercepts.

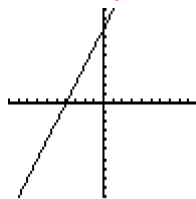
$$\text{If } x = 0, \text{ then } y = 8$$

$$\text{If } y = 0, \text{ then } -2x = 8$$

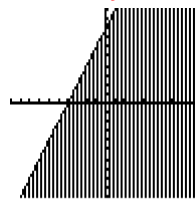
$$x = -4$$

**Step 2:** Graph this line with a solid line.

$$-2x + y = 8$$



$$-2x + y \leq 8$$



(Solid Line!)

**Step 3:** Shade below the line. Don't forget to make this line solid!!

**P. 425 #27.**       $2x - 3y \geq -12$   
                           $-y \leq 4x - 8$

**Solution:**

**Preliminary Step:** Multiply both sides of the second equation by -1:

$$2x - 3y \geq -12$$

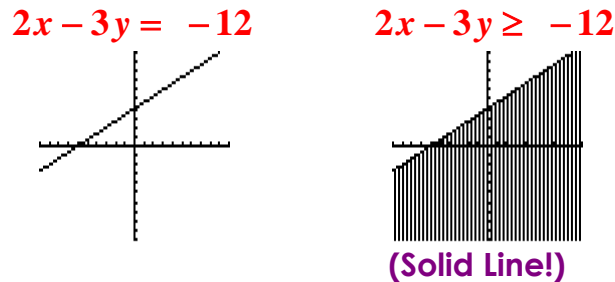
$$y \geq -4x + 8$$

**Step 1:** Graph the first line:  $2x - 3y = -12$

Since the first line is in standard form, find the x and y intercepts.

If  $x = 0$ , then  $-3y = -12$   
 $y = 4$   
 If  $y = 0$ , then  $2x = -12$   
 $x = -6$

**Step 2:** Graph this line with a solid line.



**Step 3:** Since this is a negative y coefficient, the rule is reversed. Shade below the line! Don't forget to make this line solid!!

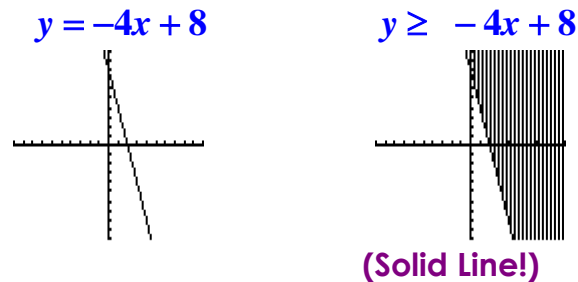
Now, do the same process with the second inequality, using the same xy axes.

**Step 1:** Graph the second line:  $y = -4x + 8$

Since the second line is in slope intercept form, find the y intercept and the slope.

The y intercept is 8, and the slope is -4.

**Step 2:** Graph this line with a solid line.

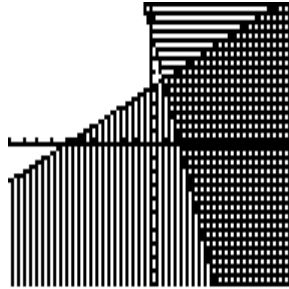


**Step 3:** Shade above this line! Don't forget to make this line solid!!

**P. 425 #27 continued.**      $2x - 3y \geq -12$   
     $-y \leq 4x - 8$

**Step 4:** Shade the **UNION** of the two regions. This includes **EVERYTHING** that was shaded in either of the two graphs.

It should look like this:



**Final Answer:** You must shade everything that is shaded on this graph, bounded by solid lines !

**P. 425 #30.**      $4x - y > -8$   
     $x + 2y < -4$

**Solution:**

**Step 1:** Graph the first line:      $4x - y = -8$

Since the first line is in standard form, find the x and y-intercepts.

If  $x = 0$ , then      $-y = -8$

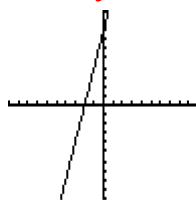
$y = 8$

If  $y = 0$ , then      $4x = -8$

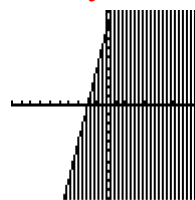
$x = -2$

**Step 2:** Graph this line with a dotted line.

$4x - y = -8$



$4x - y > -8$



(Dotted Line!)

**Step 3:** Since this is a negative y-coefficient, the rule is reversed. Shade below the line! Don't forget to make this line dotted!!

**P. 425 #30 continued.**     $4x - y > -8$   
 $x + 2y < -4$

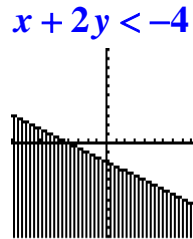
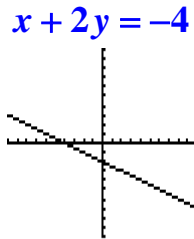
Now, do the same process with the second inequality, using the same xy axes.

**Step 1:** Graph the second line:  $x + 2y = -4$

Since the second line is in standard form, find the x and y-intercepts:

If  $x = 0$ , then  $2y = -4$                       If  $y = 0$ , then  $x = -4$ .  
 $y = -2$

**Step 2:** Graph this line with a dotted line.



(Dotted Line!)

**Step 3:** Shade below this line! Don't forget to make this line dotted!!

**Step 4:** Shade the **INTERSECTION** of the two regions.  
 This includes **ONLY** the region common to both, the cross-shaded area **ONLY**. It should look like this:



**Final Answer:** You must shade **ONLY** the cross-shaded region on this graph!  
 This is the lower right corner of the graph **ONLY**, bounded by dotted lines!

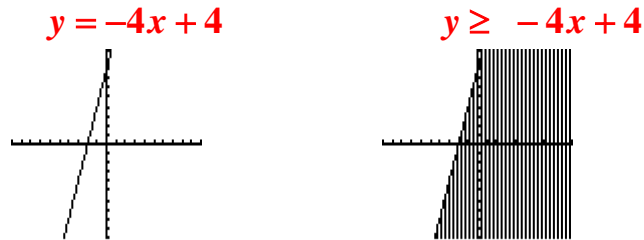
**P. 425 #32.**  $y \geq -4x + 4$   
 $y \leq 2x - 4$

**Solution:**

**Step 1:** Graph the first line:  $y = -4x + 4$

The first line is in slope intercept form, so find the slope and y intercept.  
 The y-intercept is 4 and the slope is -4.

**Step 2:** Graph this line with a solid line.



(Solid Line!)

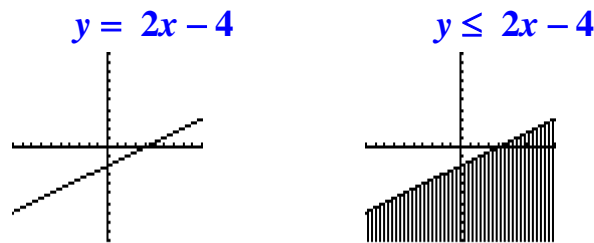
**Step 3:** Shade above the line! Don't forget to make this line solid!!

Now, do the same process with the second inequality (use the same xy axes):

**Step 1:** Graph the second line:  $y = 2x - 4$

The first line is in slope intercept form, so find the y intercept and the slope.  
 The y intercept is 8, and the slope is -4.

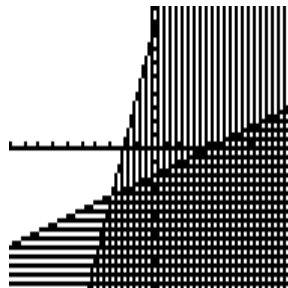
**Step 2:** Graph this line with a solid line.



(Solid Line!)

**Step 3:** Shade below this line! Don't forget to make this line solid!!

**Step 4:** Shade the **INTERSECTION** of the two regions. This includes **ONLY** the region common to both, the cross-shaded area **ONLY**.  
 It should look like this:



**Final Answer:** You must shade **ONLY** the cross-shaded region on this graph!  
 This is the lower right corner of the graph **ONLY**, bounded by solid lines!

**EXTRA PROBLEM:** Find the INTERSECTION of the regions.

$$3x - y < 2$$

$$x + y > 2$$

**Solution:**

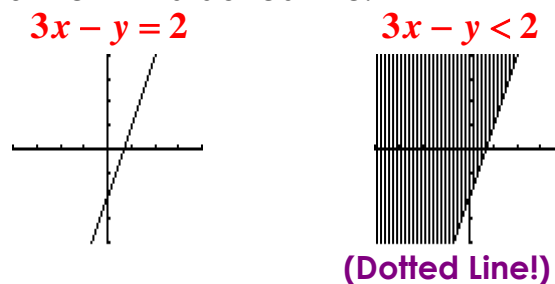
**Step 1:** Graph the first line:  $3x - y = 2$

Since the first line is in standard form, find the x and y-intercepts.

$$\begin{aligned} \text{If } x = 0, \text{ then } -y &= 2 \\ y &= -2 \end{aligned}$$

$$\begin{aligned} \text{If } y = 0, \text{ then } 3x &= 2 \\ x &= 2/3 \end{aligned}$$

**Step 2:** Graph this line with a dotted line.



**Step 3:** Since this is a negative y-coefficient, the rule is reversed. Shade above the line! Don't forget to make this line dotted!!

Now, do the same process with the second inequality, using the same xy axes.

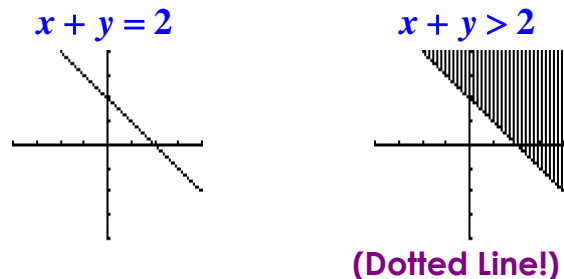
**Step 1:** Graph the second line:  $x + y = 2$

Since the second line is in standard form, find the x and y-intercepts.

$$\text{If } x = 0, \text{ then } y = 2$$

$$\text{If } y = 0, \text{ then } x = 2$$

**Step 2:** Graph this line with a dotted line.

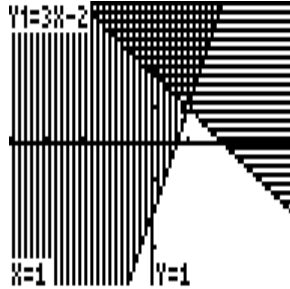


**Step 3:** Shade above this line! Don't forget to make this line dotted!!

## EXTRA PROBLEM continued.

**Step 4:** Shade the **INTERSECTION** of the two regions.  
This includes **ONLY** the region common to both, the cross-shaded area **ONLY**.

It should look like this:



**Final Answer:** You must shade **ONLY** the cross-shaded region on this graph!  
This is the triangular-shaped region in the upper middle of the graph, bounded by dotted lines!