

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.

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

$$y = -6$$

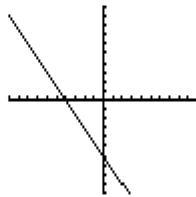
$$\text{If } y = 0, \text{ then } 3x = -12$$

$$x = -4$$

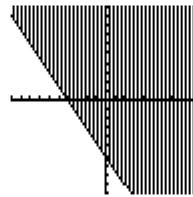
Step 2: Graph this line with a dotted line.

(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.

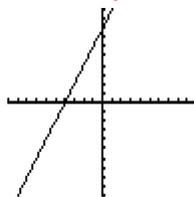
$$\text{If } x = 0, \text{ then } y = 8$$

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

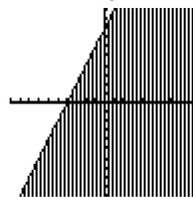
$$x = -4$$

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:

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

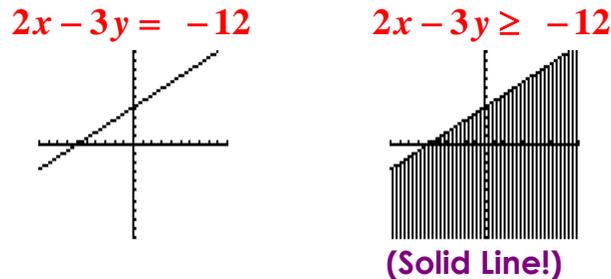
$$y \geq -4x + 8$$

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!!

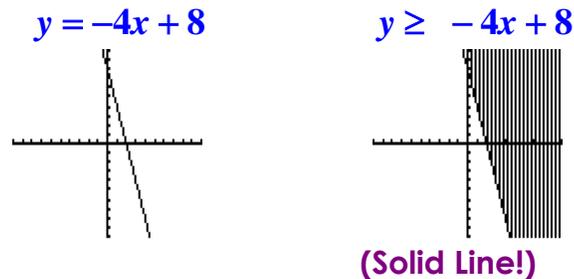
Now, do the same process with the second inequality, using the same xy axes.

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.

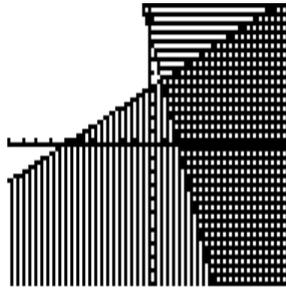


Step 3: Shade above this line! Don't forget to make this line solid!!

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 $-y = -8$

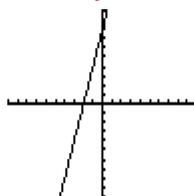
$y = 8$

If $y = 0$, then $4x = -8$

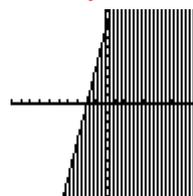
$x = -2$

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. $4x - y > -8$
 $x + 2y < -4$

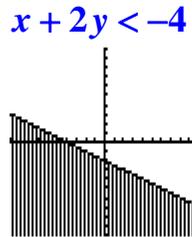
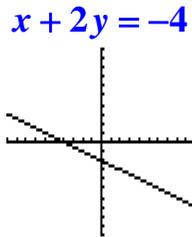
Now, do the same process with the second inequality, using the same xy axes.

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!

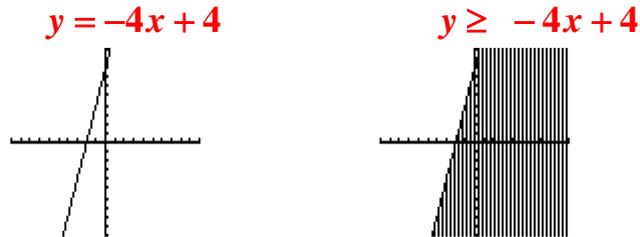
P. 425 #32. $y \geq -4x + 4$
 $y \leq 2x - 4$

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!)

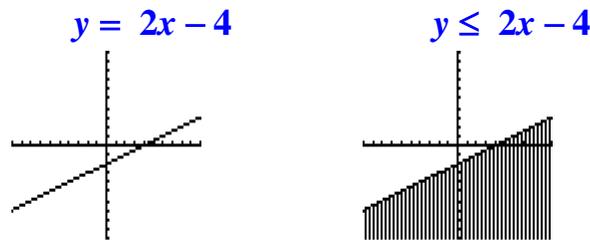
Step 3: Shade above the line! Don't forget to make this line solid!!

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.

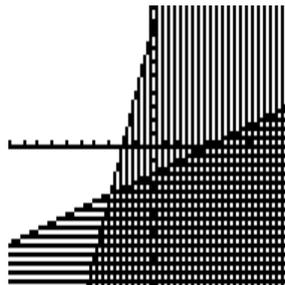
Step 2: Graph this line with a solid line.



(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:

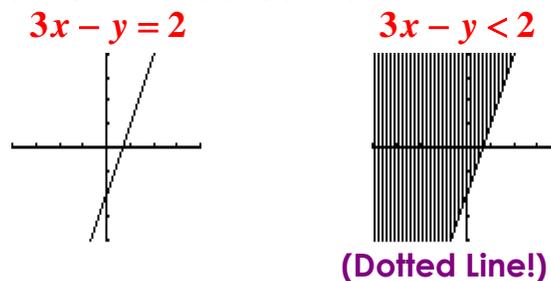
Step 1: Graph the first line: $3x - y = 2$

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.

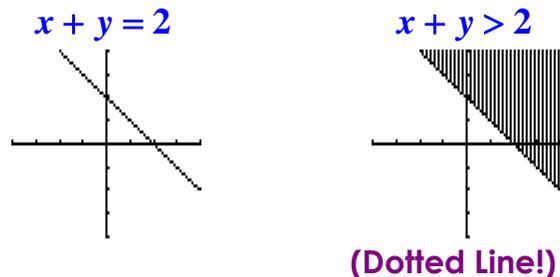
Step 1: Graph the second line: $x + y = 2$

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.

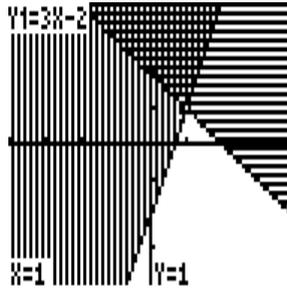


Step 3: Shade above this line! Don't forget to make this line dotted!!

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!