Finite Math Section 3_1
Solutions and Hints

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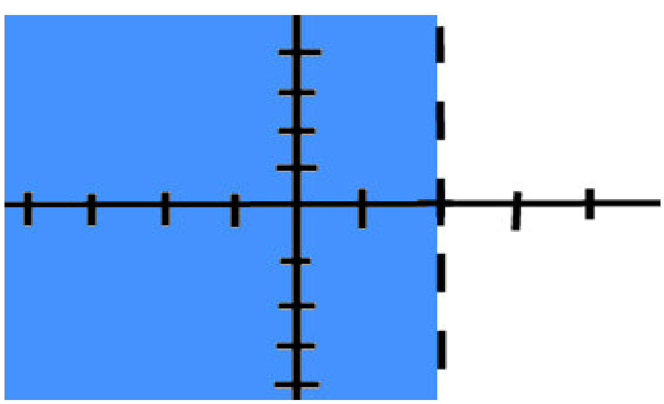
for the book:
Finite Mathematics, 7th Edition
by S. T. Tan.

DO NOT PRINT THIS OUT AND TURN IT IN !!!!!!!!
This is designed to assist you in the event you get stuck.
If you do not do the work you will NOT pass the tests.

Section 3.1:

Problem 1:
Find the graphical solution to the inequality: $4x - 8 < 0$

Do not panic this is actually easy, you just need to rearrange stuff.
Now most of the time you will want to get stuff into a form like:
$y < mx + b$ or $y > mx + b$
However, this problem has no y, so get it into a form of:
$x < b$ or $x > b$
Like so:
$4x - 8 < 0$ → $4x < 8$ → $\mathbf{x < 2}$
Which is much easier to see how to graph than what you started with:



Problem 8:
Find the graphical solution to the inequality: $-3x + 6y \geq 12$

Reorganize the equation into the form $y \geq mx + b$

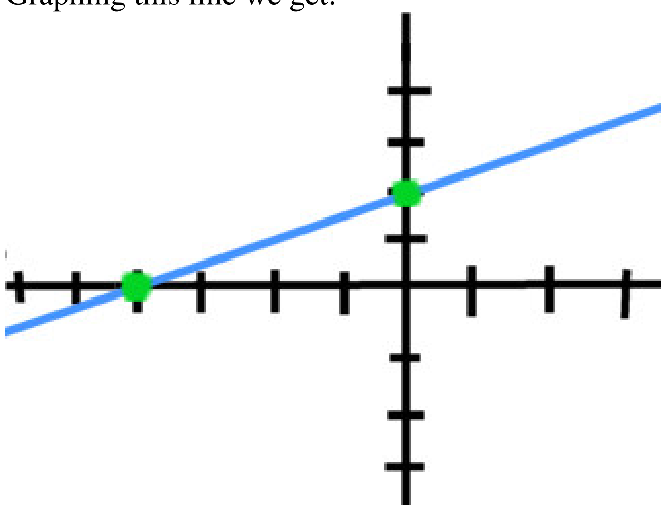
$-3x + 6y \geq 12 \rightarrow 6y \geq 3x + 12$
$\rightarrow y \geq (1/6)*(3x + 12)$
$\rightarrow y \geq (1/2)x + 2$

Now get two points to draw a line through by first putting in zero for x and then 0 for y.

Let $x = 0$ gives:
$y = (1/2)*0 + 2 \rightarrow y = 2$ So one of our points is (0, 2)

Let $y = 0$ gives:
$0 = (1/2)x + 2 \rightarrow -2 = (1/2)x$
$\rightarrow -4 = x$ So our second point is (-4, 0)

Graphing this line we get:

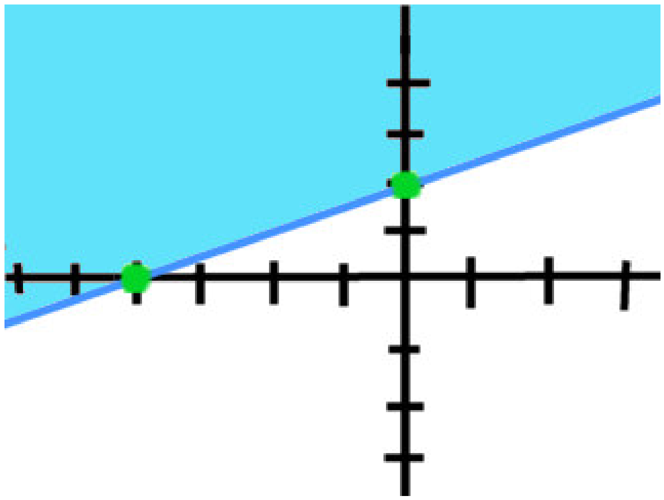


And we need to determine which side of the line to shade.
For this we go back to the ORIGINAL EQUATION $-3x + 6y \geq 12$.
As it would seem likely that 'greater than' would imply above the line we pick a point above our line – say (0, 4) and put it into the original equation:

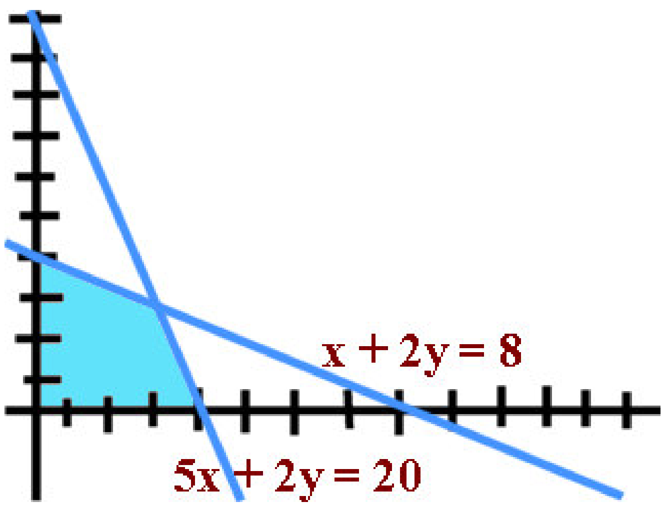
$-3x + 6y \geq 12 \rightarrow -3*0 + 6*4 \geq 12 \rightarrow 0 + 24 \geq 12 \rightarrow 24 \geq 12$

As we arrived at a true statement, 24 is greater than or equal to 12, we have confirmed that we should shade ABOVE the line (as our point (0, 4) was above the line).

So our final answer is drawn as:



<u>Problem 14</u>:
Write a system of linear inequalities that describe the shaded region.



Notice in addition to the two stated equations the region is also bounded by x = 0 and y = 0 (the y-axis and the x-axis).

So clearly we have **x > 0** (because stuff is shaded to the right of the y-axis)
and we also have **y > 0** (because stuff is shaded to the above the x-axis)

Now let's pick a point inside the shaded area to test the other two equations.
Let's pick (2, 2).
So we put x =2 and y = 2 into the equation x + 2y = 8:
x + 2y = 8 → 2 + 2*2 = 8 → 6 = 8

Obviously 6 does not equal 8, but it is LESS THAN 8 so we know the shaded region is also bounded by: **x + 2y ≤ 8**
Notice we use ≤ because the bounding line is solid. If it was dashed we would only use <

Now we put x = 2 and y = 2 into the equation 5x + 2y = 20:
5x + 2y = 20 → 5*2 + 2*2 = 20 → 14 = 20

Again it is obvious 14 does not equal 20 but 14 is LESS THAN 20 so we know the shaded region is bounded by: **5x + 2y ≤ 20**

So the full system of inequalities is:

$x > 0$
$y > 0$
$x + 2y \le 8$
$5x + 2y \le 20$

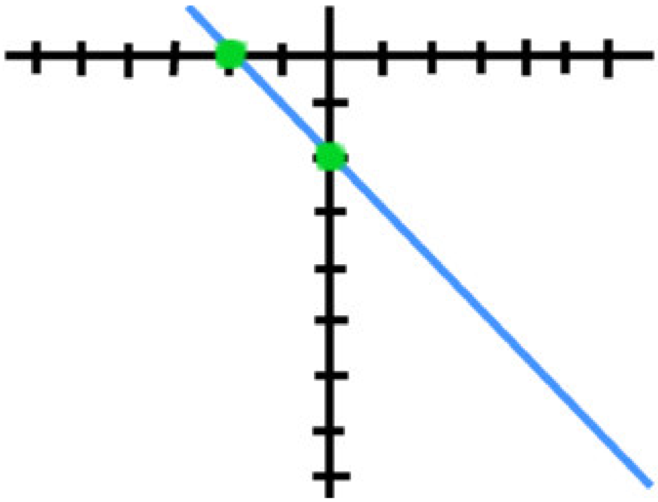
Problem 22:
Determine graphically the solution set for the system of inequalities and indicate if the solution set is bounded or unbounded.

$x + y \ge -2$
$3x - y \le 6$

First graph the line (using a solid line) x + y = -2:
To do this you must find two points on the line so I would get the first point by putting zero in for x and solve for y:
x + y = -2 → 0 + y = -2 → y = -2 → our first point is (0, -2)

To get the second point I would put zero in for y and solve for x:
x + y = -2 → x + 0 = -2 → x = -2 → our second point is (-2, 0)

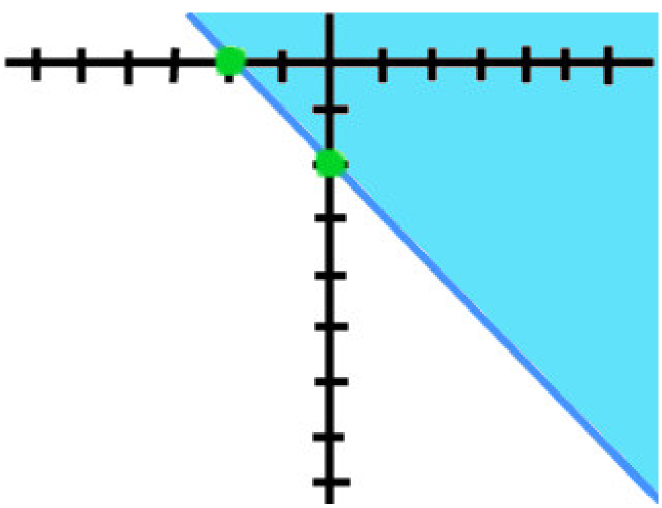
This gives us the graph:



Now we must determine which side of that line to shade on.
As the inequality is x + y ≥ -2, it is likely we will shade above the line.
So we select the point (0, 0) to test this:

x + y ≥ -2 → 0 + 0 ≥ -2 → 0 ≥ -2

As it is true that 0 is greater than or equal –2 we have verified we shade above this line.
So our graph becomes:



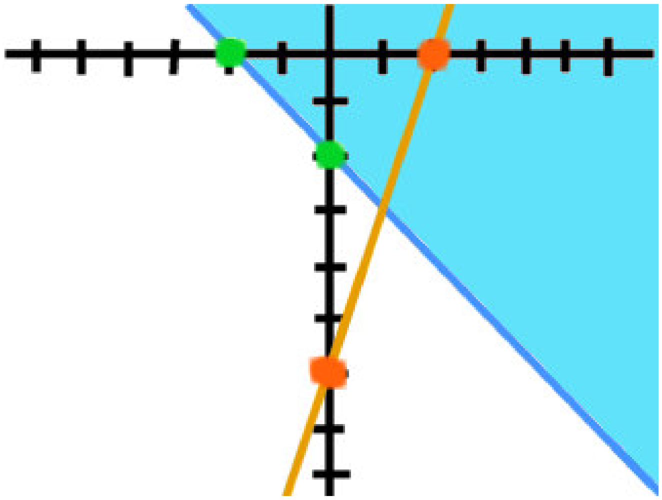
Now we need to draw the second line for 3x – y = 6.
Again we will first sub in x = 0 and solve for y:

3x – y = 6 → 3*0 – y = 6 → -y = 6 → y = -6 → our first point is (0, -6)

Now we sub in y = 0 and solve for x:

3x – y = 6 → 3x – 0 = 6 → 3x = 6 → x = 2 → our 2^{nd} point is (2, 0)

This gives the graph:

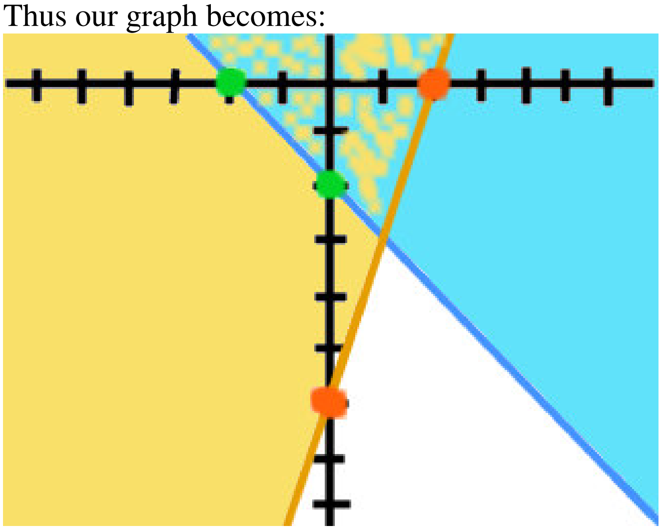


And again we must determine which side of this second line to shade on.
As the inequality was $3x - y \le 6$ it is likely we will shade below the line.
So we will pick a test point of (0, -7):

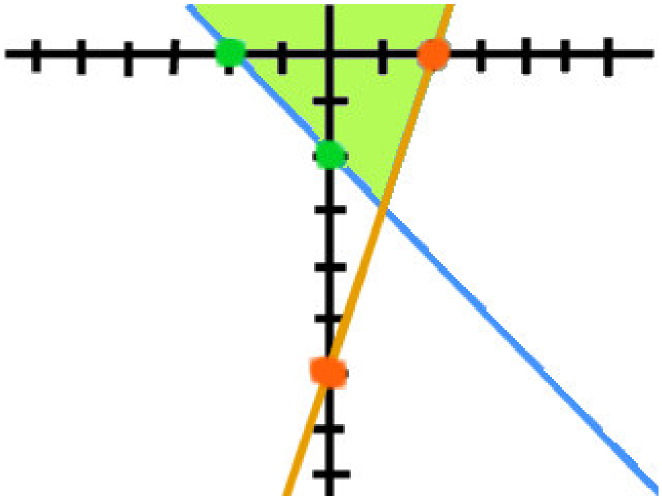
$3x - y \le 6 \rightarrow 3*0 - (-7) \le 6 \rightarrow 7 \le 6$

And we say oops, we guessed wrong because 7 is NOT less than 6. So we will actually need to shade ABOVE the line.

Thus our graph becomes:



And our answer is the intersection of the shaded areas:



Notice this area is UNBOUNDED.

(it escapes out the top)

(It would take at least 3 lines for the area to even have the possibility of be bounded)
