MA162: Finite mathematics

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SCHEDULE:

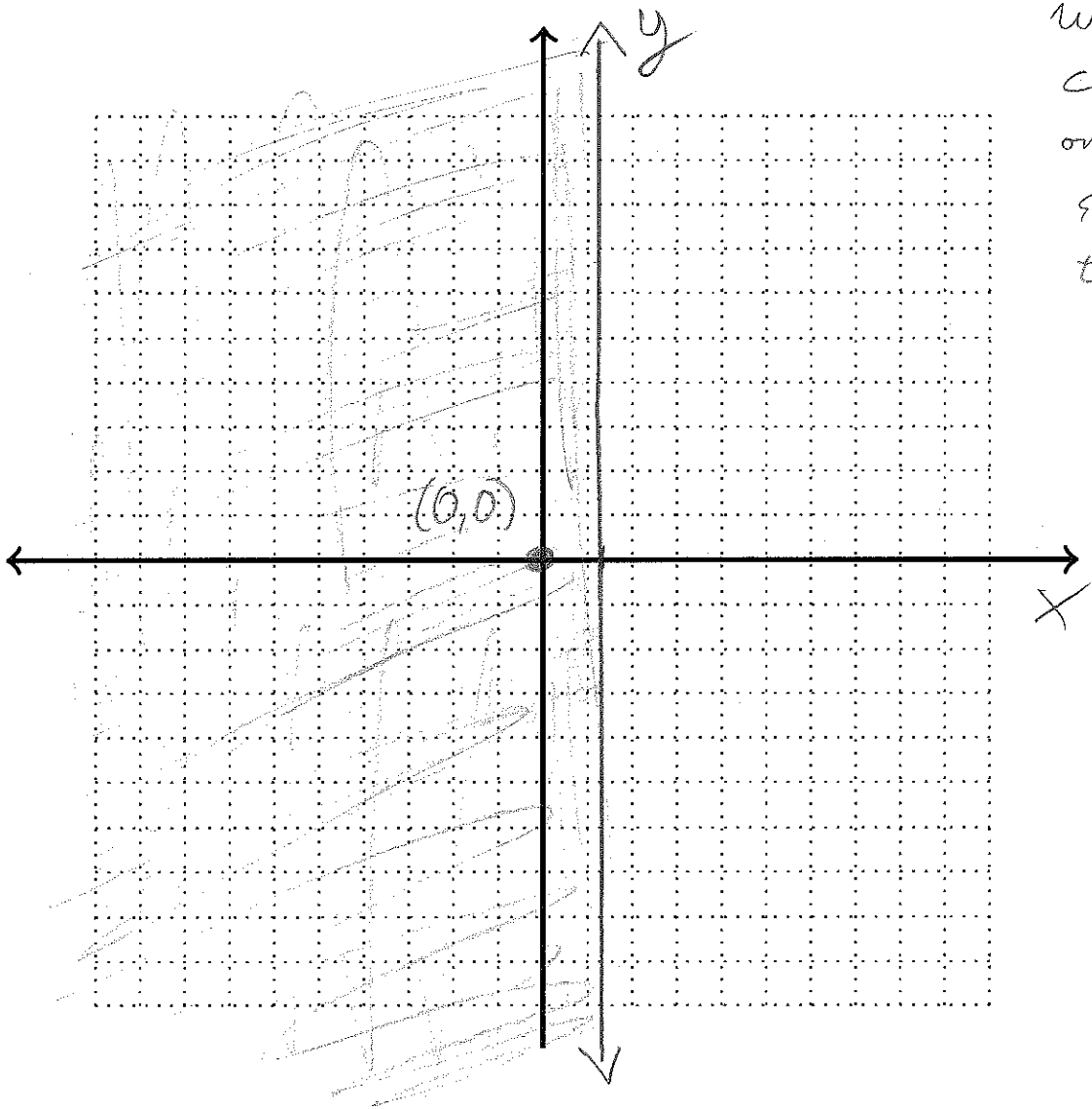
- Web Assign assignment (Chapter 3.1) due on Tuesday, October 8 by 6:00 pm.
- Web Assign assignment (Chapter 3.2) due on Tuesday, October 11 by 6:00 pm.

Today we cover Chapter 3.1: Linear Inequalities in two variables.

Graphing a single inequality

Graph the solution to the inequality

$3x \leq 4 \Rightarrow x \leq \frac{4}{3}$



Which side? choose point not on line, say (0,0) & test the inequality

$x=0, y=0$

$3 \cdot 0 \leq 4$?

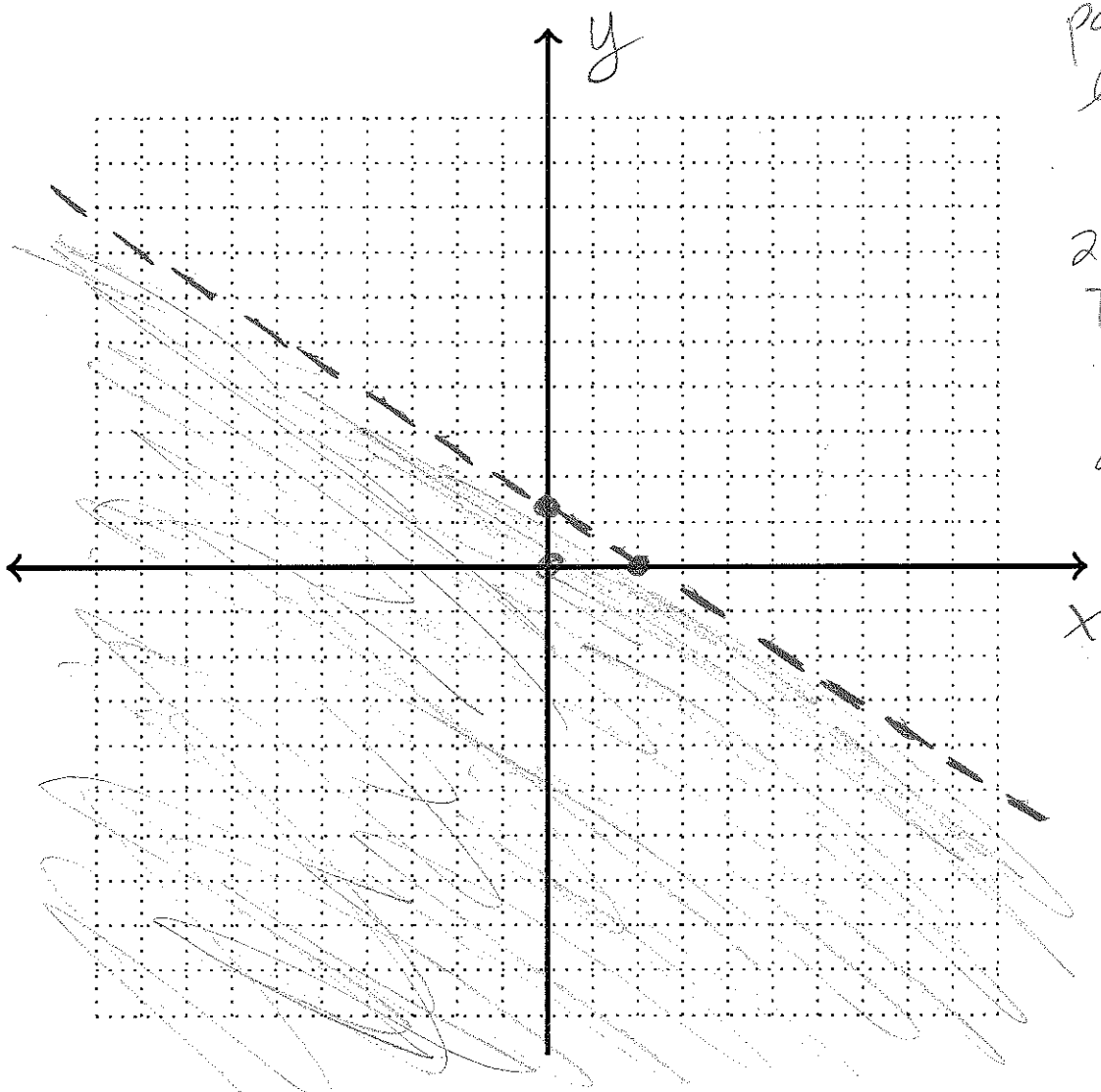
Yes

so shade side of line with (0,0)

Graphing single inequality some more

Graph the solution to the inequality

$$2x + 3y < 4$$



First, graph line:
Find intercepts

$x = 0 \Rightarrow y = \frac{4}{3}$

$y = 0 \Rightarrow x = 2$

Next, use dashed line to represent strict inequality (i.e., $<$ instead of $\leq$)

Now plug in point not on line:
(0,0)

$2 \cdot 0 + 3 \cdot 0 < 4$?
True, so shade region on same side as (0,0)

The return of the son of graphing a single inequality

Graph the solution to the inequality

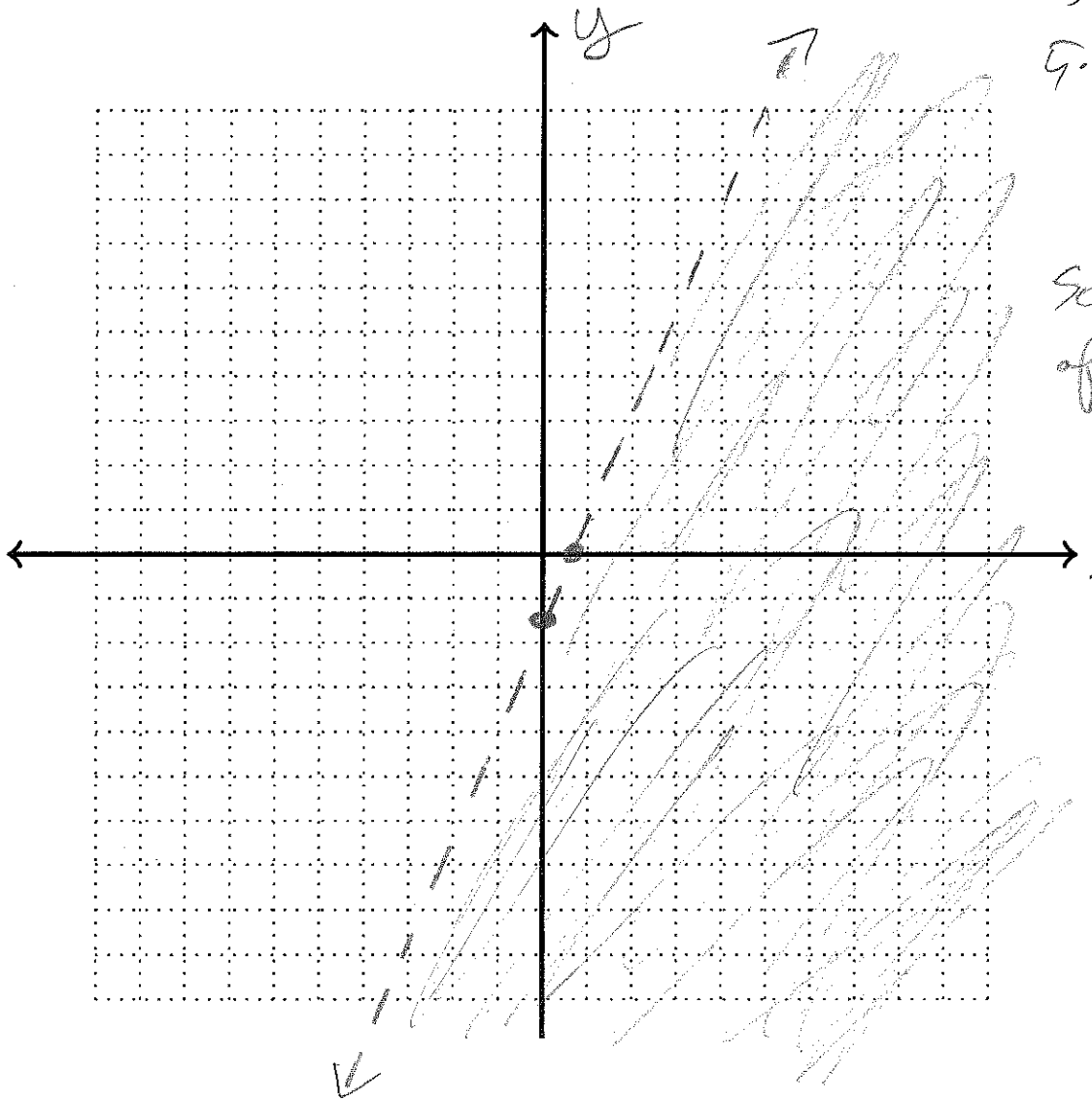
$$5x - 2y > 3$$

Graph line:

$x = 0 \Rightarrow y = -\frac{3}{2}$

$y = 0 \Rightarrow x = \frac{3}{5}$

Use dotted line to represent the strict inequality



Now plug in point not on line: (0,0)

$5 \cdot 0 - 2 \cdot 0 > 3$?

$0 > 3$

FALSE

So shade side of line which does not contain sample point

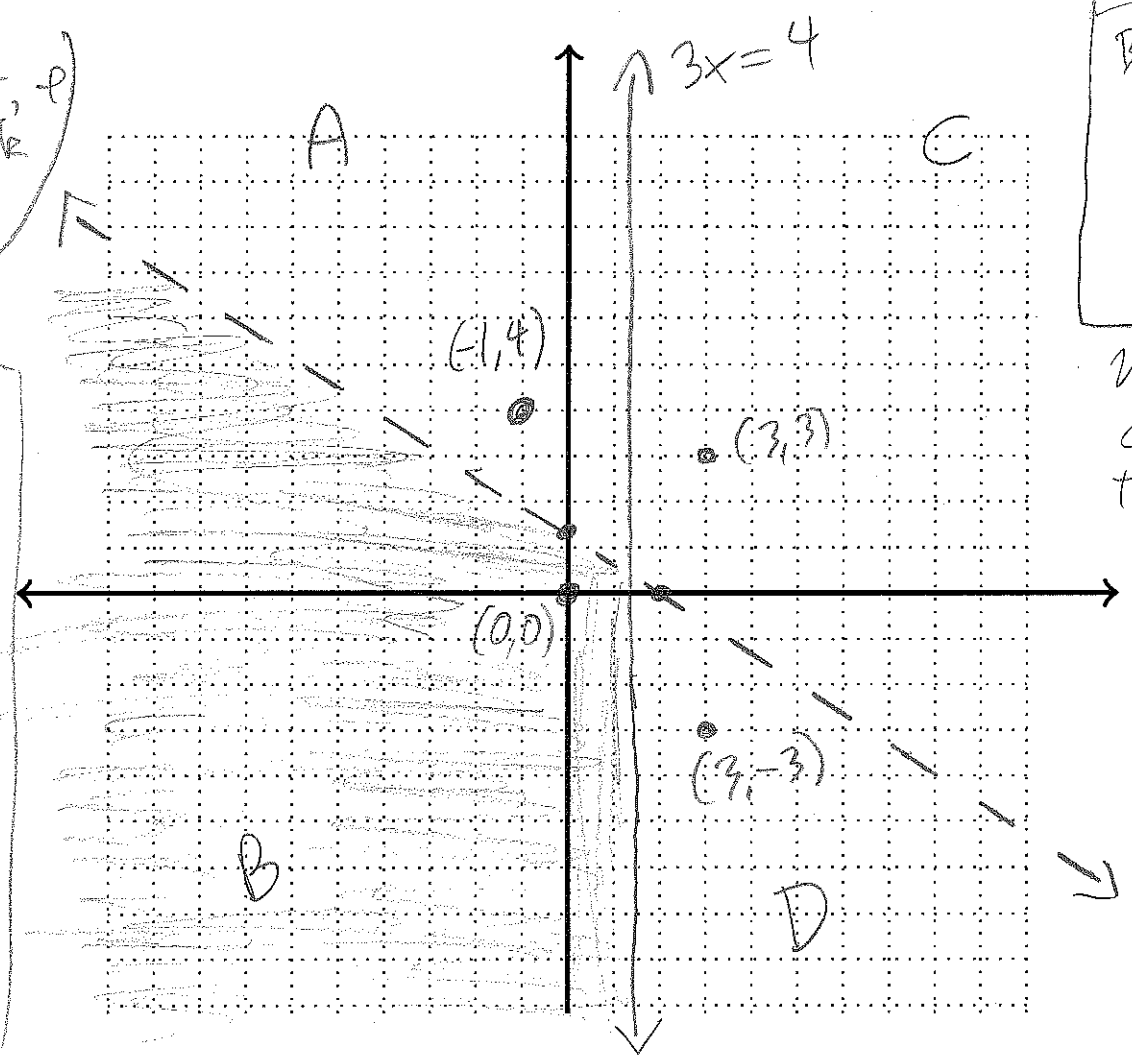
Graphing a system of inequalities

Graph the solution to the system of inequalities

$$\begin{aligned} 3x &\leq 4 \\ 2x+3y &< 4 \end{aligned}$$

First, graph both lines

(Here we can cheat, & just copy our work on first two examples)



This divides plane into 4 regions

Pick a test point in each region:

A: (-1, 4)

B: (0, 0)

C: (3, 3)

D: (3, -3)

A: $\begin{cases} 3(-1) \leq 4 \ ? \\ 2(-1)+3\cdot 4 < 4 \ ? \end{cases}$

False

Don't shade A

B: $3\cdot 0 \leq 4$

$2\cdot 0 + 3\cdot 0 < 4$

Both TRUE

So region B is the desired region

We don't need to check C & D in this case. Once you find correct region, you can stop.

↘ $2x+3y<4$

Graphing a system of inequalities

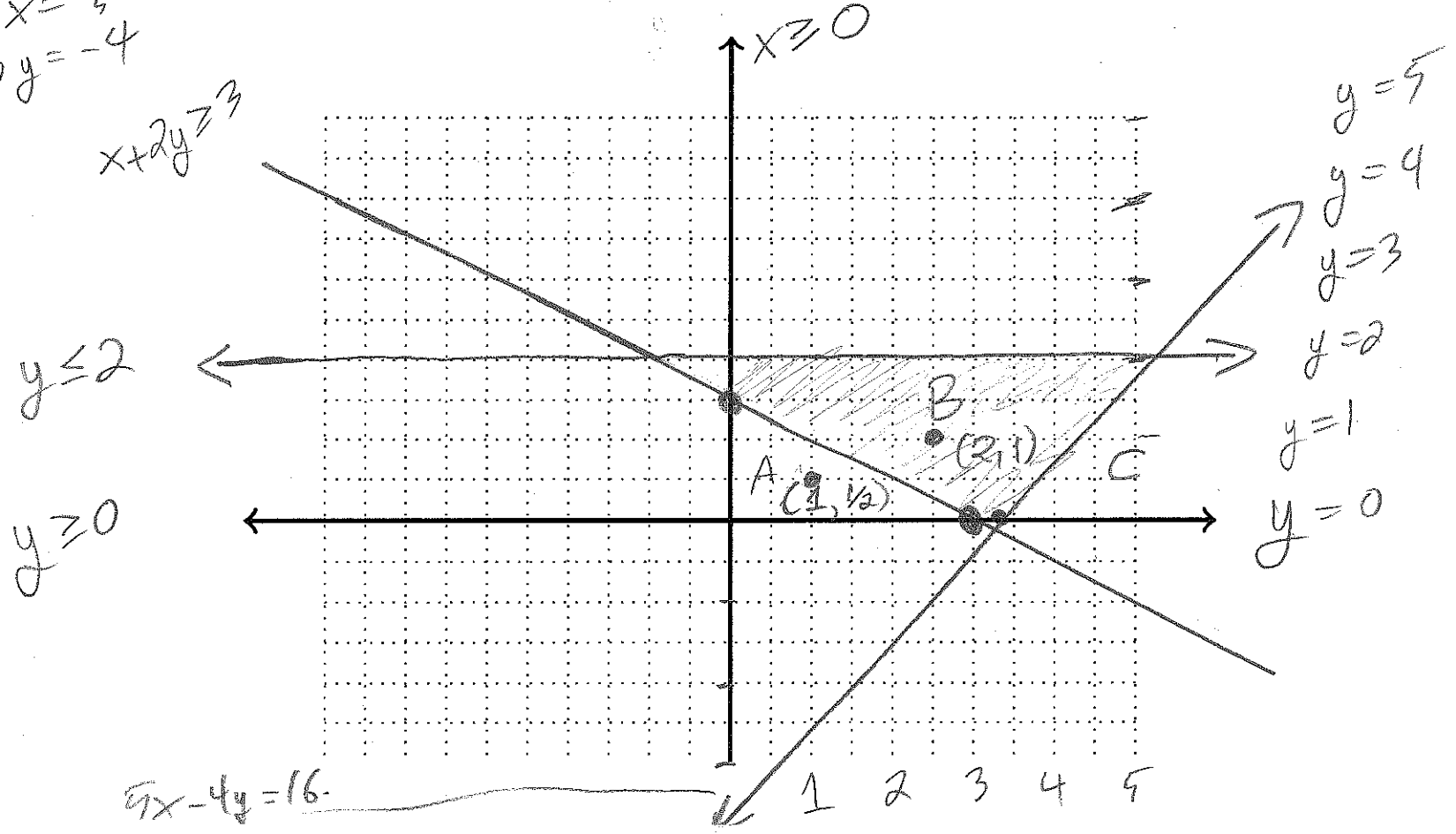
Graph the solution to the system of inequalities

$$\begin{array}{rcrcr} x & + & 2y & \geq & 3 \\ 5x & - & 4y & \leq & 16 \\ 0 & \leq & y & \leq & 2 \\ & & x & \geq & 0 \end{array}$$

Height between 0 & 2

Right side

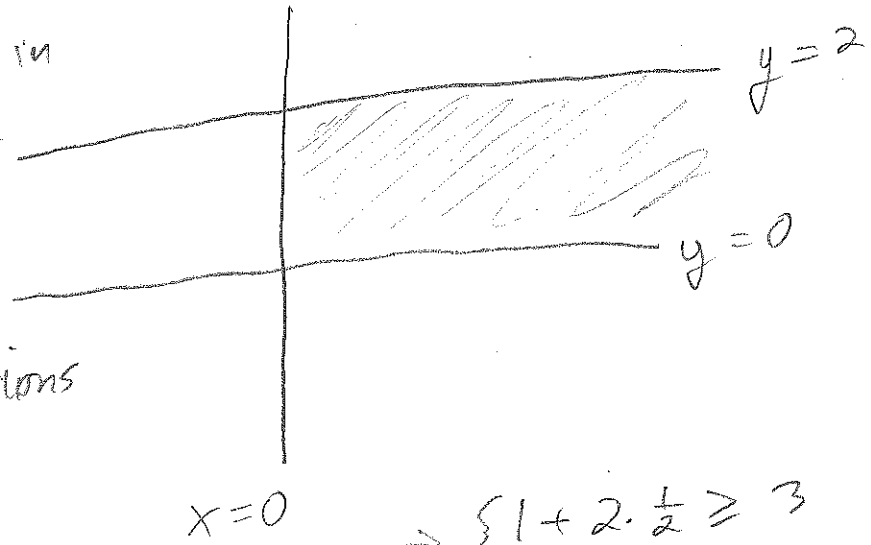
- $x+2y=3$
  $x=0 \Rightarrow y=3/2$
  $y=0 \Rightarrow x=3$
- $5x-4y=16$
  $y=0 \Rightarrow x=\frac{16}{5}=3.2$
  $x=0 \Rightarrow y=-4$



In this case there are twelve regions, so if we aren't careful we may need to check (12) sample points.

However $0 \le y \le 2$ & $x \ge 0$ tell us we only need to look in this band.

Thus, only need to consider regions A, B, C

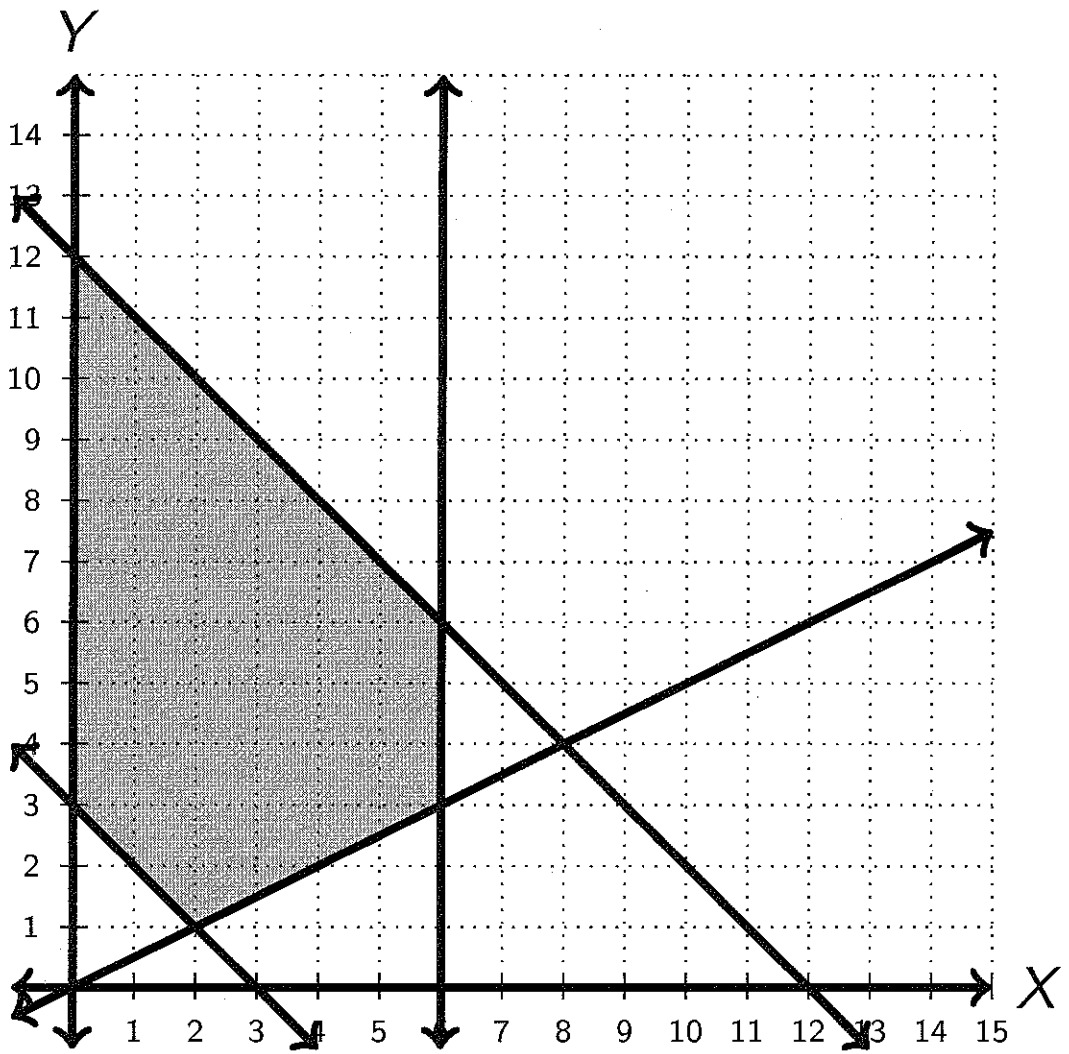


A: use $(1, \frac{1}{2})$ → $\begin{cases} 1 + 2 \cdot \frac{1}{2} \ge 3 \\ 9 \cdot 1 - 4 \cdot \frac{1}{2} \le 16 \end{cases}$ False Don't shade A

B use $(2,1)$ → $\begin{cases} 2 + 2 \cdot 1 \ge 3 \\ 9 \cdot 2 - 4 \cdot 1 \le 16 \end{cases}$ True ✓ shade B

Find the inequalities

Find the system of inequalities which describe the given region:



5-sided region, will need 5 inequalities.

$x+y=12$
Want below
$x+y=12$,
so
$x+y \leq 12$

$x+2y=0$
Want region above
$x+2y=0$, so
use $x+2y \geq 0$

$x+y=3$
Want above
$x+y=3$, so
$x+y \geq 3$

System

$$\begin{cases} x+2y \geq 0 \\ 3 \leq x+y \leq 12 \\ 0 \leq x \leq 6 \end{cases}$$

$x=0 \Rightarrow x \geq 0$
Right side

$x=6 \Rightarrow x \leq 6$
Left side