MA 162: Finite Mathematics - Sections 3.1/3.2

Fall 2014

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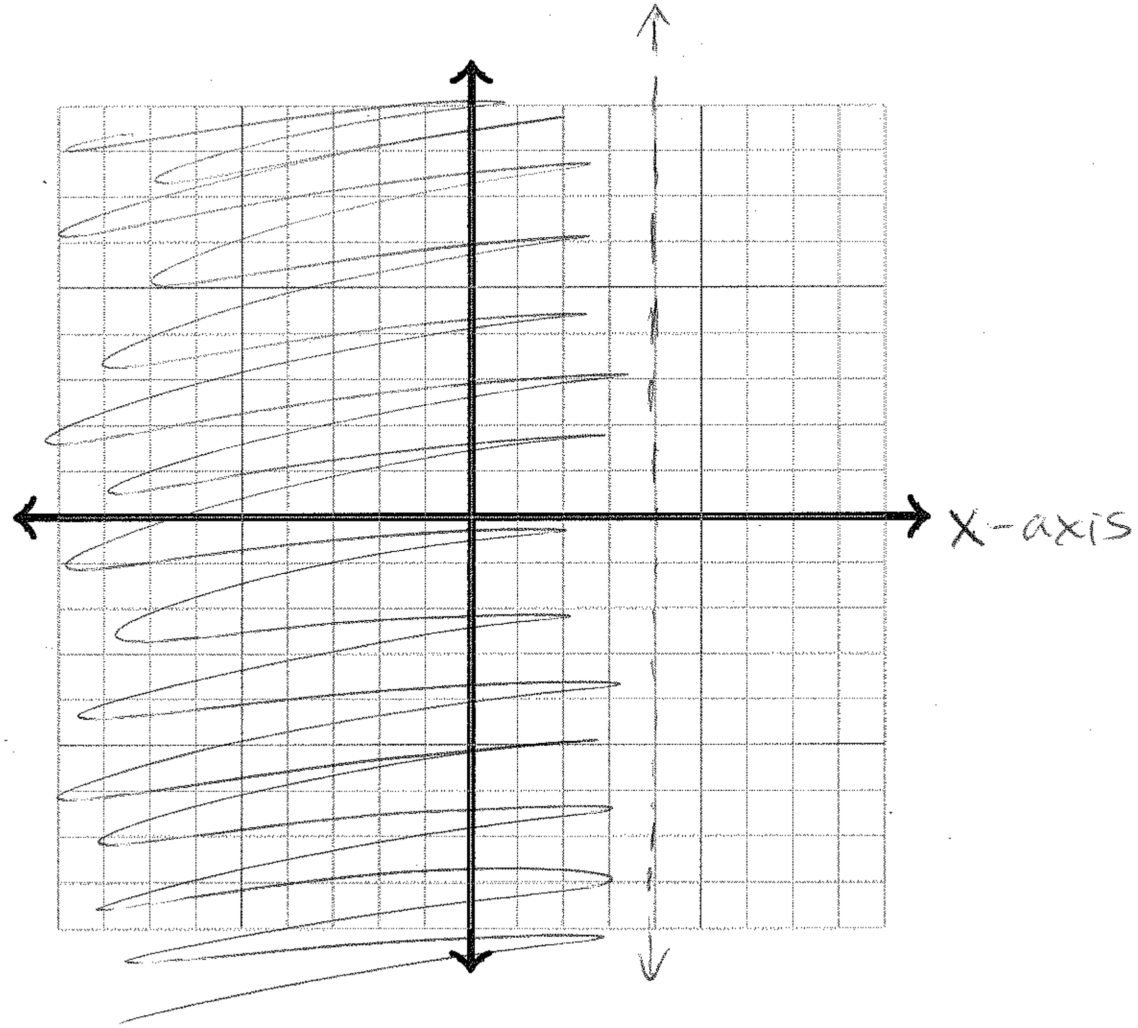
Announcements:

- Homework 2.6 due Tuesday at 6pm.
- Homework 3.1/3.2 due Friday at 6pm (will be posted today).

Graphing Inequalities

- Graph the solution to the inequality

$$x < 4$$



Graphing Inequalities (Tan 3.1 #10)

- Graph the solution to the inequality

$$5x - 3y \boxed{\geq} 15$$

→ solid

① Graph line

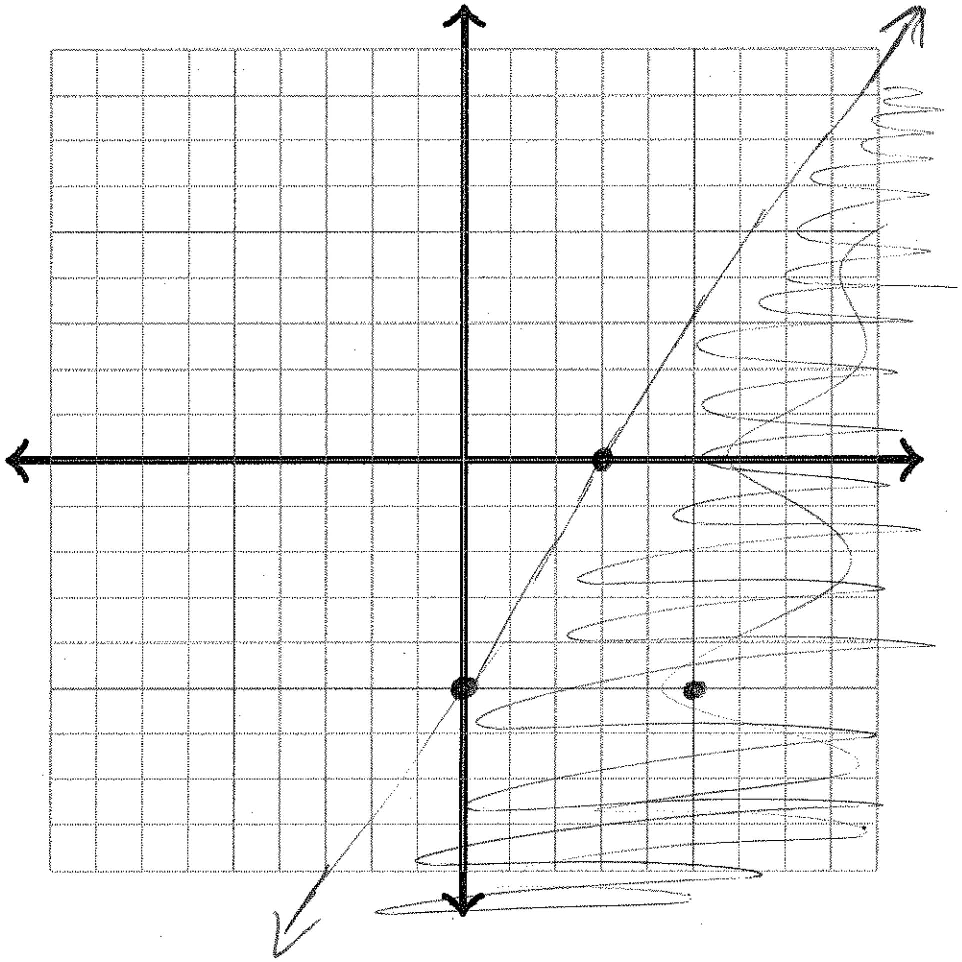
$5x - 3y = 15$

x-int : $(3, 0)$

y-int : $(0, -5)$

② Determine if line is solid or dashed.

③ Determine which side of the line to shade.



Look at $(0,0)$.

If $x=0, y=0$

then this inequality

says $0 \geq 15$.

FALSE

Look at $(5,-5)$.

If $x=5, y=-5$

then

$25 + 15 = 40 \geq 15$

TRUE

Graphing a System of Inequalities (Tan 3.1 #24)

- Graph the solution to the system of inequalities

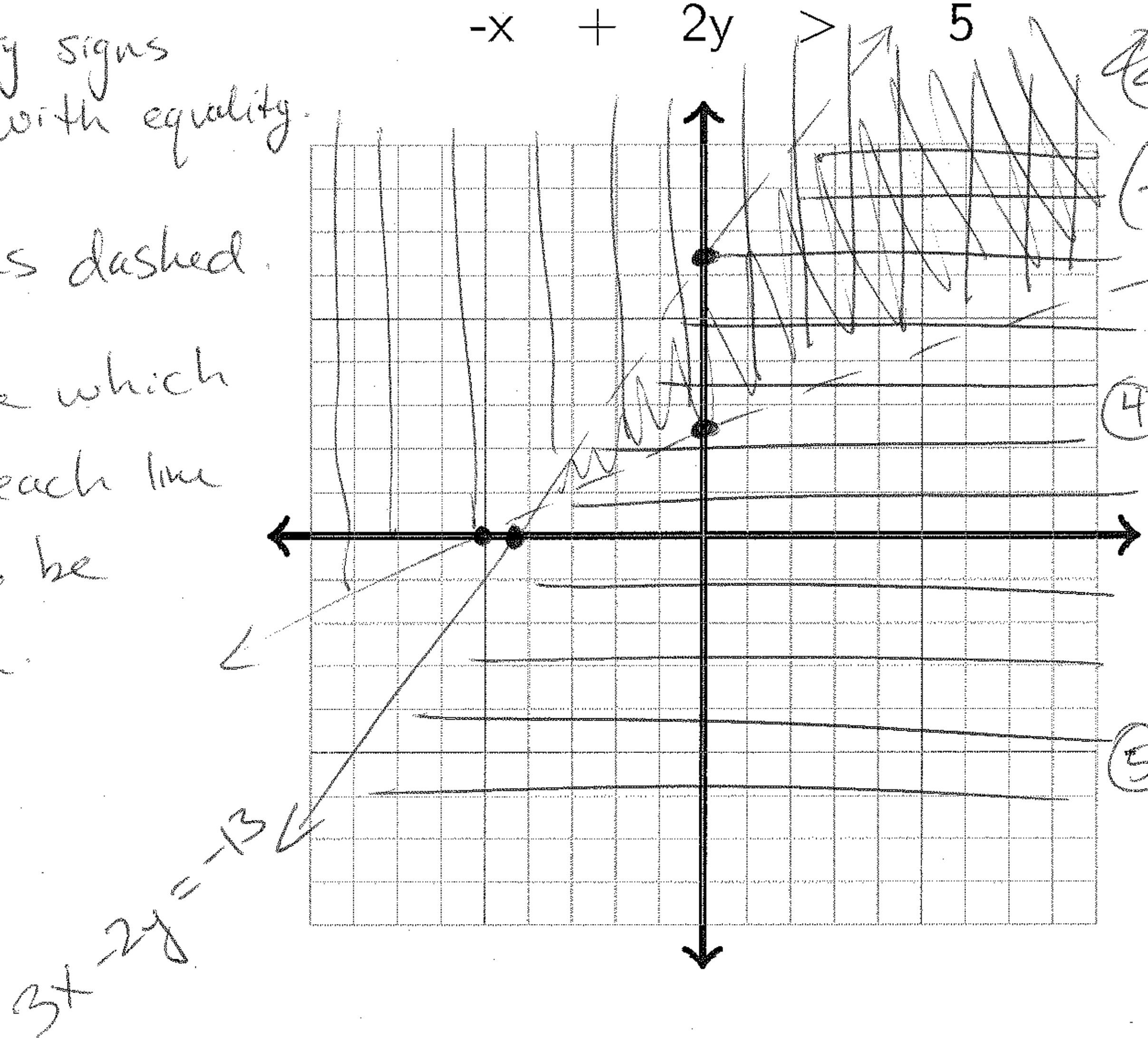
$$3x - 2y > -13$$
$$-x + 2y > 5$$

① Graph both lines w/inequality signs replaced with equality.

② Both lines dashed.

③ Determine which side of each line needs to be shaded.

x-int	y-int
$(\frac{-13}{3}, 0)$	$(0, \frac{13}{2})$
~~[illegible]~~ $(-5, 0)$	$(0, \frac{5}{2})$



④ Test $(0,0)$ in $3x-2y>-13$

$0>-13$

TRUE

⑤ Test $(0,0)$ in $-x+2y>5$

$0>5$

FALSE

Graphing a System of Inequalities (Tan 3.1 #36)

- Graph the solution to the system of inequalities

x-int	y-int
(4,0)	(0,4)
(3,0)	(0,6)
$(-\frac{1}{2},0)$	(0,1)

① $x + y \leq 4$

② $2x + y \leq 6$

③ $2x - y \geq -1$

$x \geq 0$ (right of y-axis)

$y \geq 0$ (above x-axis)

Test (0,0) in ①

$0 \leq 4$ TRUE

Test (0,0) in ②

$0 \leq 6$ TRUE

Test (0,0) in ③

$0 \geq -1$ TRUE

Corner Pts

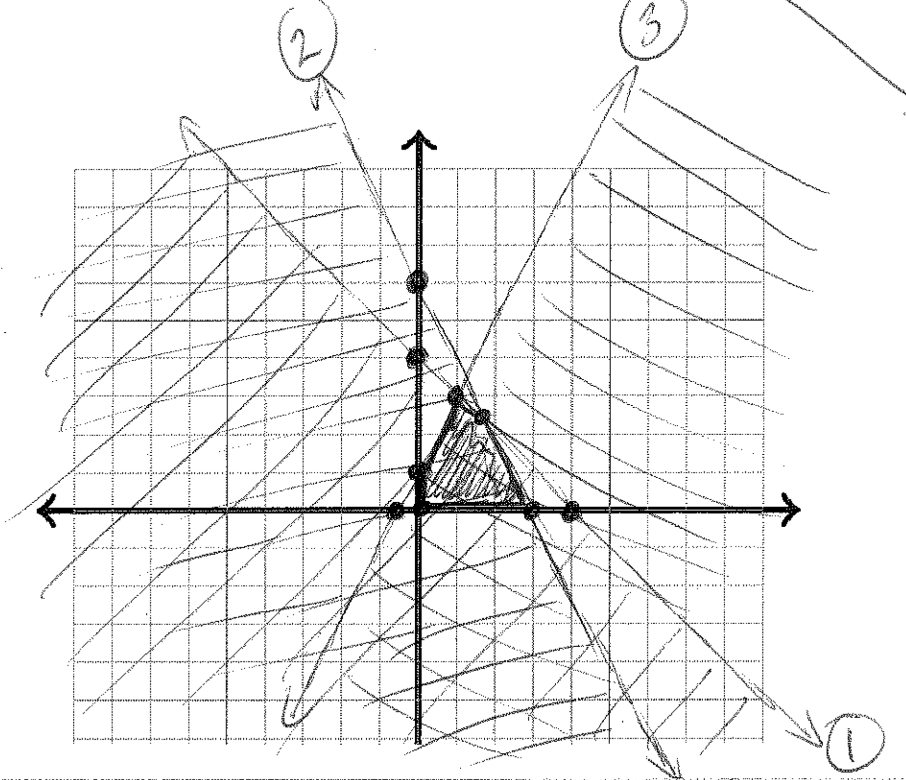
(0,0)

(0,1)

(3,0)

Intersection of ① & ③

Intersection of ① & ②



3.2 - Linear Programming Problems

A linear programming problem consists of:

- An objective function (what are we trying to maximize/minimize?)
- Constraints (linear equalities or inequalities)

The goal of a linear programming problem is to maximize or minimize the objective function while satisfying all the constraints.

Setting up a Linear Programming Problem (Tan 3.2 #14)

A farmer uses two types of fertilizers. A 50-lb bag of Fertilizer A contains 8 lb of nitrogen, 2 lb of phosphorus, and 4 lb of potassium. A 50-lb bag of Fertilizer B contains 5 lbs each of nitrogen, phosphorus, and potassium. The minimum requirements for a field are 440 lb of nitrogen, 260 lb of phosphorus, and 360 lb of potassium. If a 50-lb bag of Fertilizer A costs \$30 and a 50-lb bag of Fertilizer B costs \$20, find the amount of each type of fertilizer the farmer should use to minimize his cost while still meeting the minimum requirements.

↳ overall goal.

Let x = # of 50-lb bags of Fertilizer A

Let y = # of 50-lb bags of Fertilizer B

Objective: Minimize $C = 30x + 20y$ (cost)

Constraints: (Nitrogen) $8x + 5y \geq 440$

(Phosphorus) $2x + 5y \geq 260$

(Potassium) $4x + 5y \geq 360$

$x \geq 0$

$y \geq 0$

Setting up a Linear Programming Problem (Tan 3.2 #24)

A financier plans to invest up to $2 million ④ in three projects. She estimates that Project A will yield a return of 10% on her investment, Project B will yield a return of 15% on her investment, and Project C will yield a return of 20% on her investment. Because of the risks associated with the investments, she decided not to put more than 20% of her total investment in Project C. ① She also decided that her investments in Projects B and C should not exceed 60% of her total investment. ② Finally, she decided that her investment in Project A should be at least 60% of her investments in Projects B and C. ③ How much should the financier invest in each project if she wishes to maximize the total returns on her investments?

x = amount invested in Project A

y = " " " " B

z = " " " " C

Objective: Maximize $R = .1x + .15y + .2z$

Constraints: $x + y + z \le 2000000$ ④

$.2(x+y+z) \le z$ ①

$y + z \le .6(x+y+z)$ ②

$x \ge .6(y+z)$ ③

$x \ge 0 \quad y \ge 0 \quad z \ge 0$

If you assume that the financier invests all \$2000000 then ④ becomes

$$x + y + z = 2000000$$

Then $z = 2000000 - x - y$.

Substituting this into each constraint reduces the problem to two variables.