

Plant food. A farmer can buy two types of plant food, mix A and mix B. Each cubic yard of mix A contains 20 pounds of phosphoric acid, 30 pounds of nitrogen, and 5 pounds of potash. Each cubic yard of mix B contains 10 pounds of phosphoric acid, 30 pounds of nitrogen, and 10 pounds of potash. The minimum monthly requirements are 460 pounds of phosphoric acid, 960 pounds of nitrogen, and 220 pounds of potash. If x is the number of cubic yards of mix A used and y is the number of cubic yards of mix B used, write a system of linear inequalities that indicates appropriate restraints on x and y . Find the set of feasible solutions graphically for the amounts of mix A and mix B that can be used.

INFO → MATH
↓
SOLVE.

$$x \geq 0$$

$$y \geq 0$$

		Ph Ac	NIT	POTASH
x	A	20	30	5
y	B	10	30	10
	MIN	460	960	220

DIVIDE ALL TERMS BY GCD

LESS LIKELY TO MAKE MISTAKES WITH SMALL #'S:

TOTAL PH AC : $(20x + 10y \geq 460) \div 10$
 TOTAL NIT : $(30x + 30y \geq 960) \div 30$
 POTASH : $(5x + 10y \geq 220) \div 5$

$$2x + y \geq 46$$

$$x + y \geq 32$$

$$x + 2y \geq 44$$

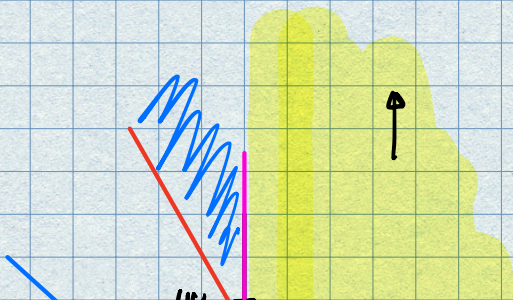
$$x \geq 0$$

$$y \geq 0$$

GRAPHING INEQUALITIES:

- GRAPH ASSOCIATED EQUATION (=) → BOUNDARY
- CONSIDER WHETHER OR NOT THE BOUNDARY AND THE OTHER REGIONS THAT APPEAR SATISFY THE INEQUALITY

LINE IS DETERMINED BY TWO POINTS:



↑

$$(0, 46)$$

$$(23, 0)$$

$$2x + y \geq 46$$

$$(0, 32)$$

$$x + y \geq 32$$

To FIND A:

$$2x + y = 46$$

$$x + y = 32$$

$$\hookrightarrow y = 32 - x$$

$$2x + (32 - x) = 46$$

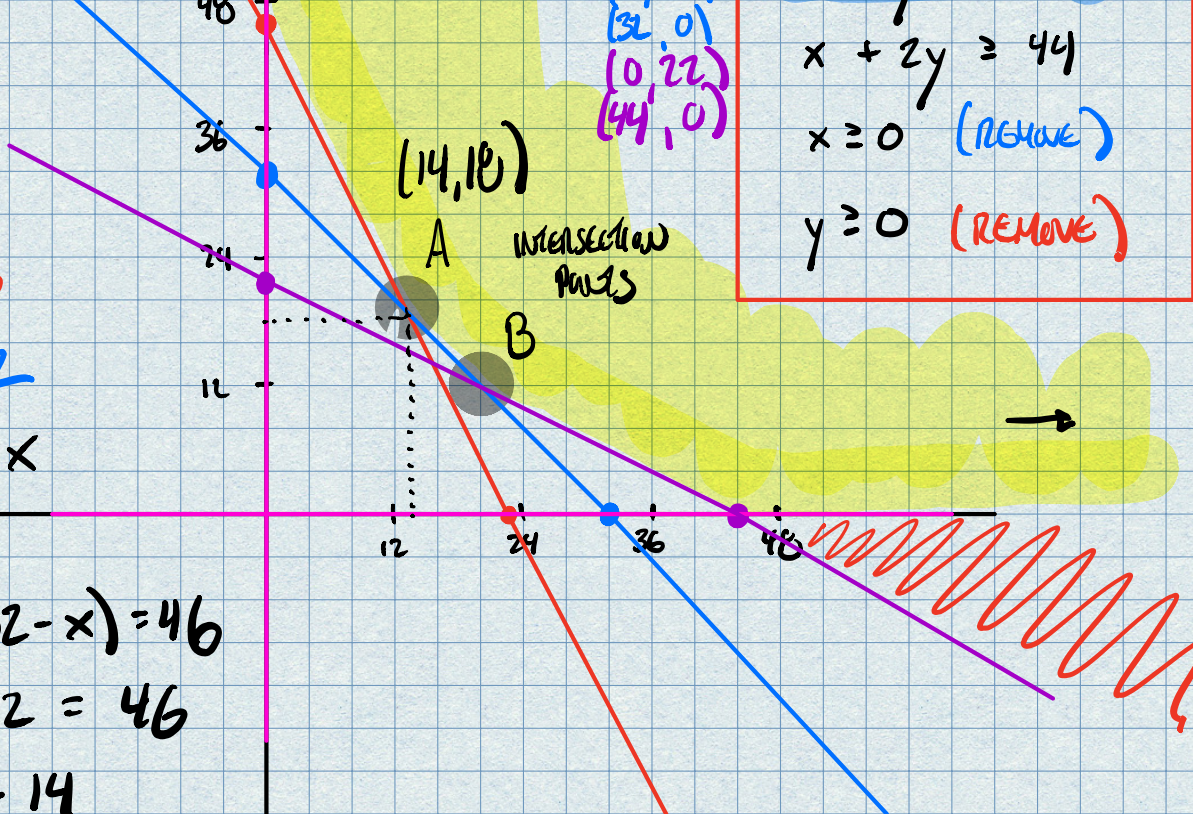
$$x + 32 = 46$$

$$x = 14$$

$$y = 32 - x$$

$$= 32 - 14 = 18$$

A (14, 18)



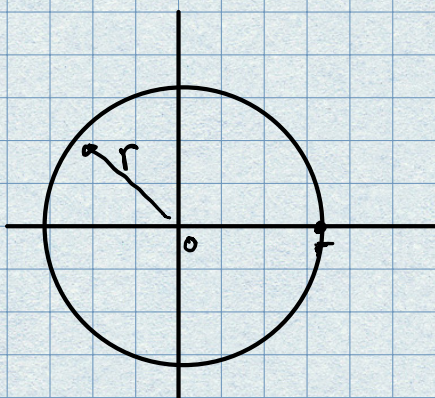
(32, 0)
(0, 22)
(44, 0)

$$x + 2y \geq 44$$

$$x \geq 0 \text{ (REMOVE)}$$

$$y \geq 0 \text{ (REMOVE)}$$

RECALL: EQUATION OF CIRCLE CENTERED AT THE ORIGIN (0,0) WITH RADIUS r:



$$x^2 + y^2 = r^2$$

Now - LINEAR INEQUALITIES

POINTS THAT SATISFY THIS EQUATION ARE DISTANCE 2 FROM ORIGIN.

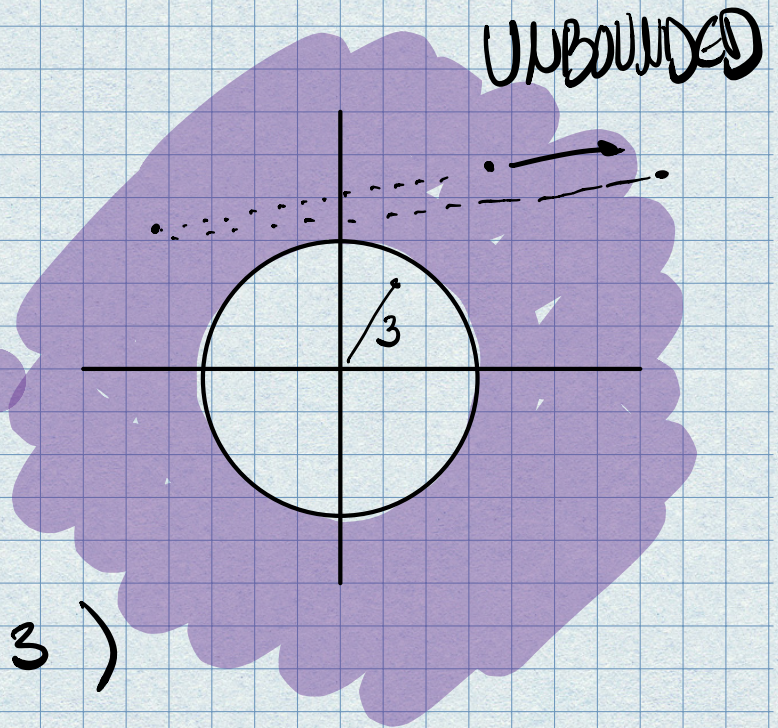
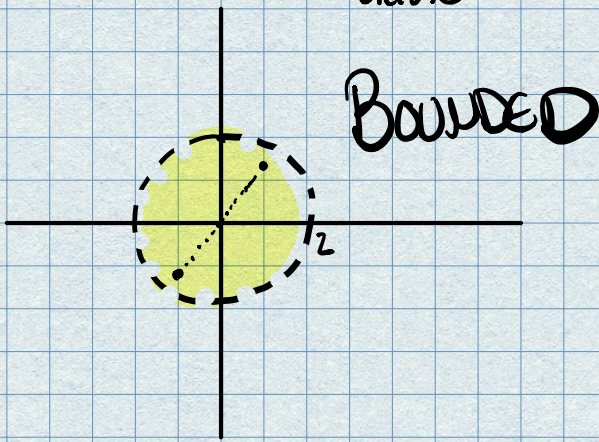
$$x^2 + y^2 < 4$$

DISTANCE < 2 FROM

$$x^2 + y^2 = 2^2$$

(BOUNDARY) (=)

circle



ex.

$$x^2 + y^2 \geq 9$$

$$x^2 + y^2 \geq 3^2$$

(Dist. to origin ≥ 3)

Def: A REGION IN XY-PLANE IS **BOUNDED** IF IT CAN BE CONTAINED INSIDE A DISK.

CRUX: IF THERE IS A MAXIMUM DISTANCE THAT TWO PTS CAN BE FROM EACH OTHER.

UNBOUNDED = NOT BOUNDED

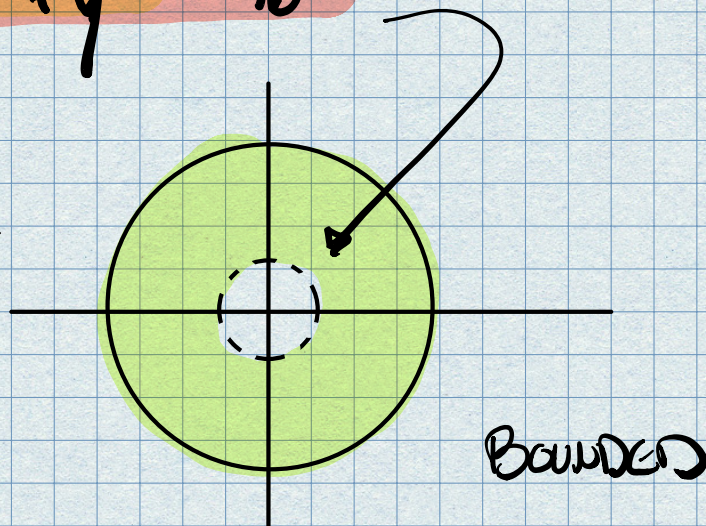
NO MAX DISTANCE

ex.

$$1 < x^2 + y^2 \leq 16$$

(1) exterior of $x^2 + y^2 = 1$

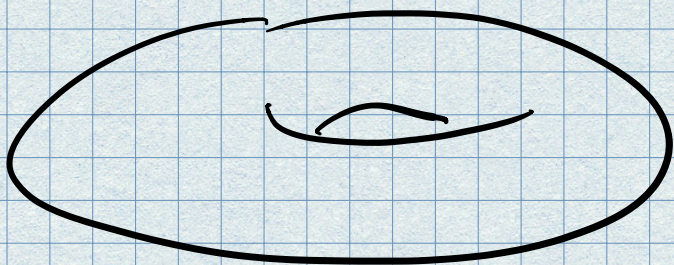
(2) interior of $x^2 + y^2 = 4^2$



REGION BETWEEN TWO CONCENTRIC CIRCLES:

BAGELS / DONUTS

WASHER. (DISK)



"ANNULUS"

Solving Geometric Problems with Linear Inequalities.



MEASURING LAND

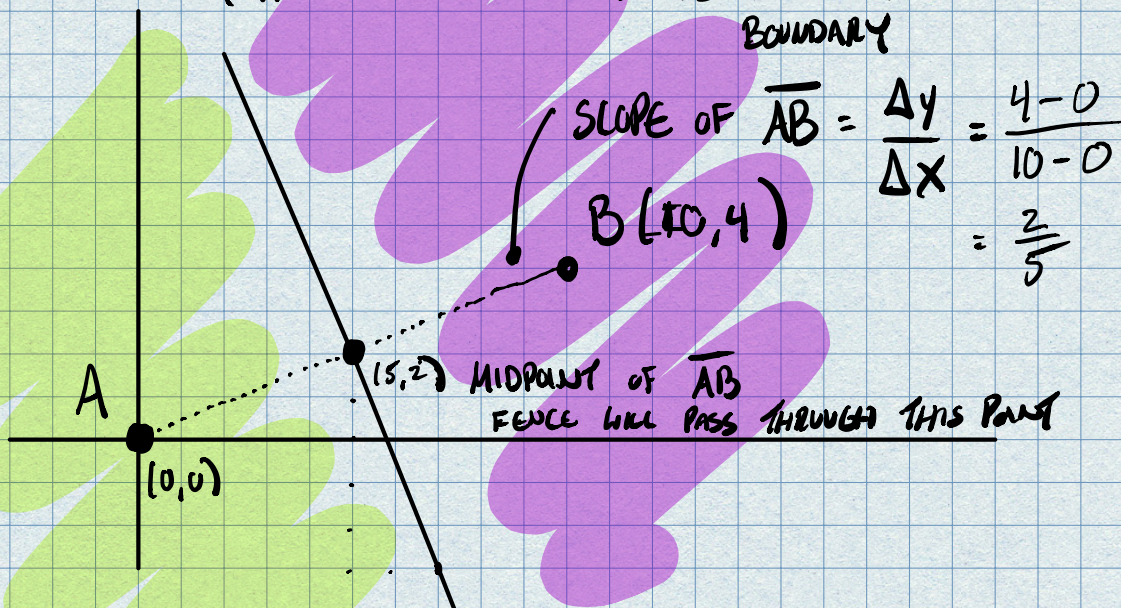
PROBLEM: FARMERS A & B HAVE HOUSES AT
 $A(0,0)$ & $B(10,4)$.

THEY WANT TO SPLIT THE LAND SO THAT
A OWNS WHAT'S CLOSEST TO HIM & B
OWNS WHAT'S CLOSER TO HER.

HOW DO THEY SPLIT THE LAND?

(WHERE DO THEY BUILD THE FENCE)

BOUNDARY



FACT:

THE SET OF POINTS EQUAL DISTANCE FROM 2 POINTS A, B LIE ON THE PERPENDICULAR BISECTOR OF AB.

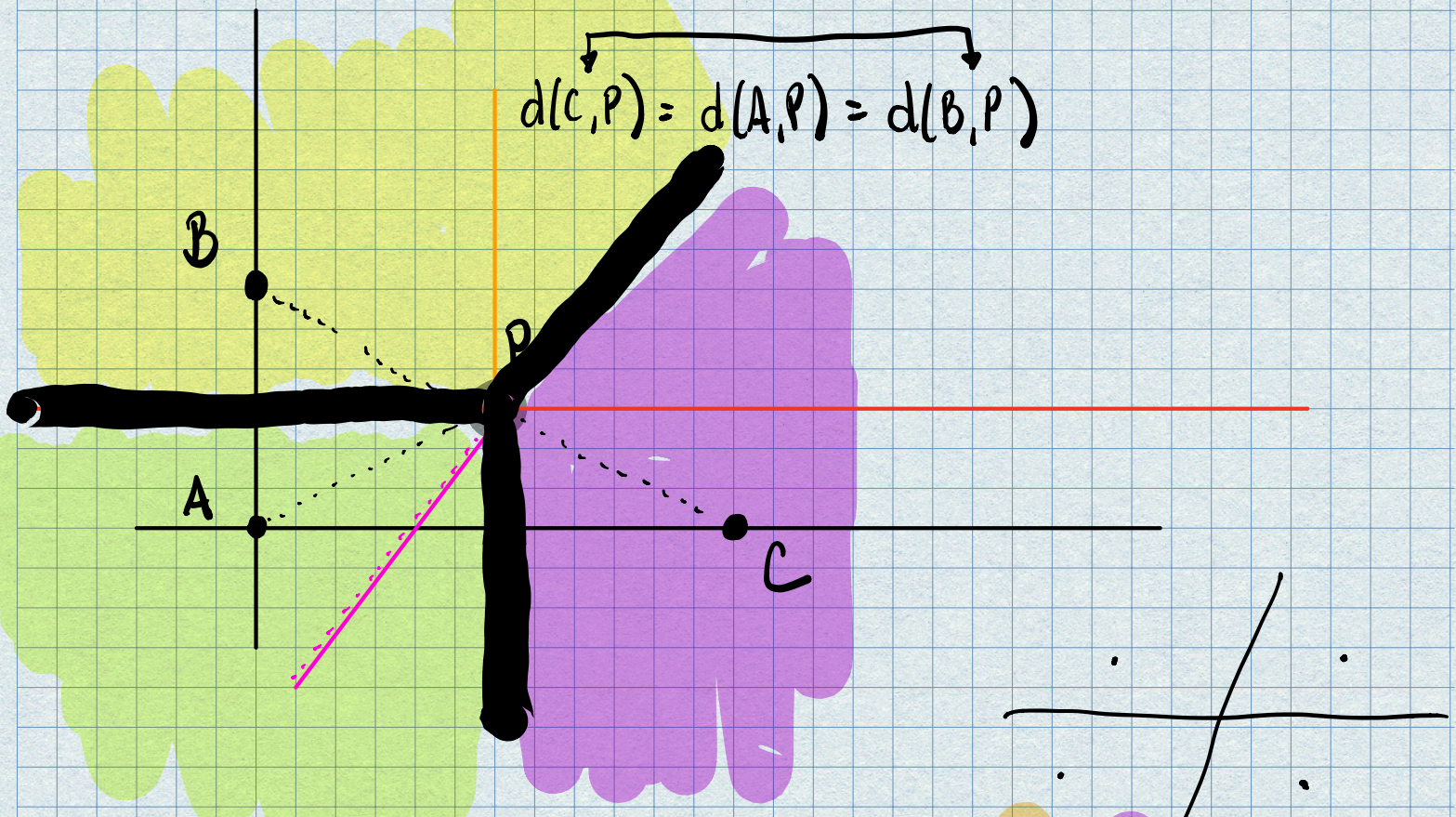
SPLITS AB IN HALF

SLOPES OF \perp LINES ARE NEG. RECIPROCAL OF EACH OTHER.

$$\frac{2}{5} \rightarrow -\frac{5}{2}$$

PROBLEM 2: 3 FARMERS A(0,0)
B(0,6)
C(12,0)

HOW DO THEY SPLIT THE LAND / BUILD A FENCE(S)



PROBLEM: 4 FARMERS:



$A(0,0)$, $B(0,6)$, $C(12,0)$, $D(3,2)$

How do these 4 farmers split the land

