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.

		PH AC	NIT	POTASH
x	A	20	30	5
y	B	10	30	10
	MIN	460	960	220

TOTAL PH AC $(20x + 10y \geq 460) \div 10$ $x \geq 0$

TOTAL NIT. $(30x + 30y \geq 960) \div 30$ $y \geq 0$

TOTAL POTASH $(5x + 10y \geq 220) \div 5$

GRAPH SOLUTION REGION (PTS THAT SATISFY ALL 5 INEQUALITIES SIMULTANEOUSLY)

$y \geq 46 - 2x$

$2x + y \geq 46$

$x + y \geq 32$

$x + 2y \geq 44$

UPPER HALF PLANE

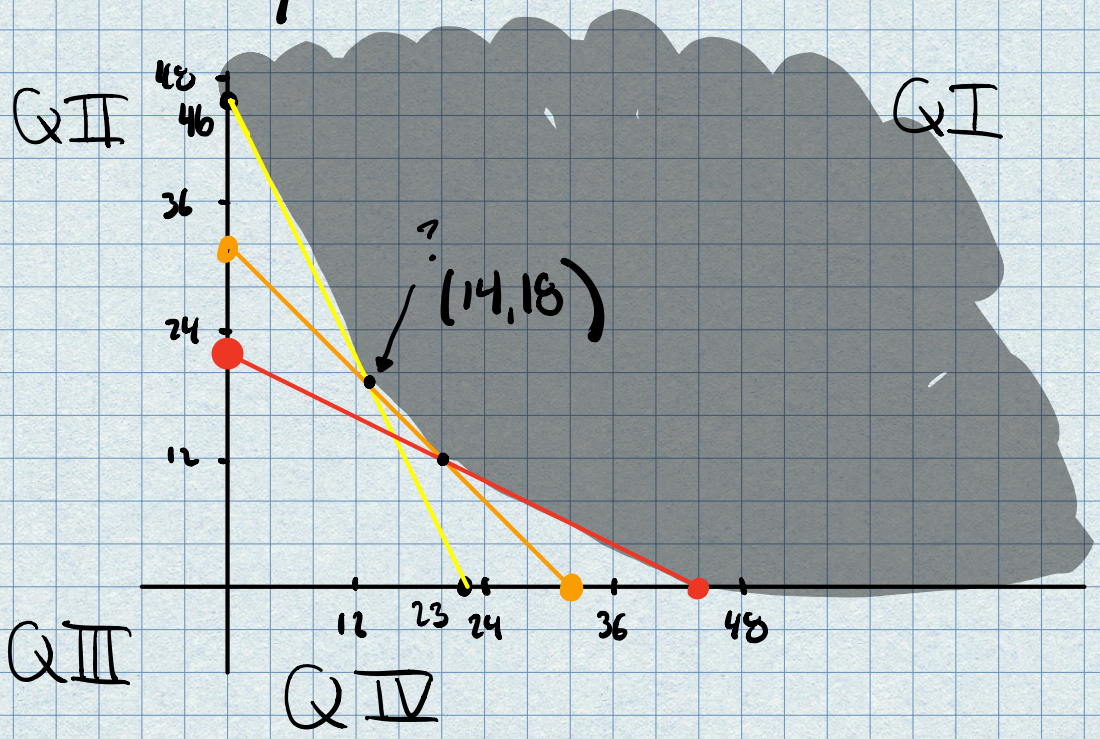
$x \geq 0$

$y \geq 0$

Q I

y-INT: SET $x = 0$, SOLVE FOR y

x-INT: SET $y = 0$, SOLVE FOR x



(14,18)

INTERSECTION OF 2 LINES.

SOLVE $\begin{cases} 2x + y = 46 \\ x + y = 32 \end{cases}$

$x + y = 32 \rightarrow x = 32 - y$

$x = 32 - 18 = 14$

SUBSTITUTE INTO FIRST EQ.

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

$64 - 2y + y = 46$

$64 - y = 46 \longrightarrow y = 64 - 46 = 18$

NONLINEAR INEQUALITIES:

$x^2 + y^2 < r^2$

INTERIOR OF CIRCLE

(BOUNDED)

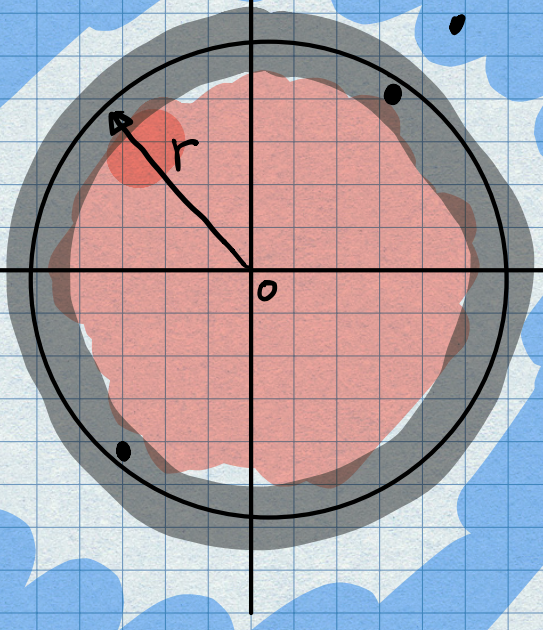
DISTANCE BETWEEN ANY 2 POINTS IS BOUNDED (HAS A MAXIMUM)

(EQUALITY: $x^2 + y^2 = r^2$

$(x-a)^2 + (y-b)^2 = r^2$

RADIUS r

CENTER (a, b))



$x^2 + y^2 > r^2$

EXTERIOR

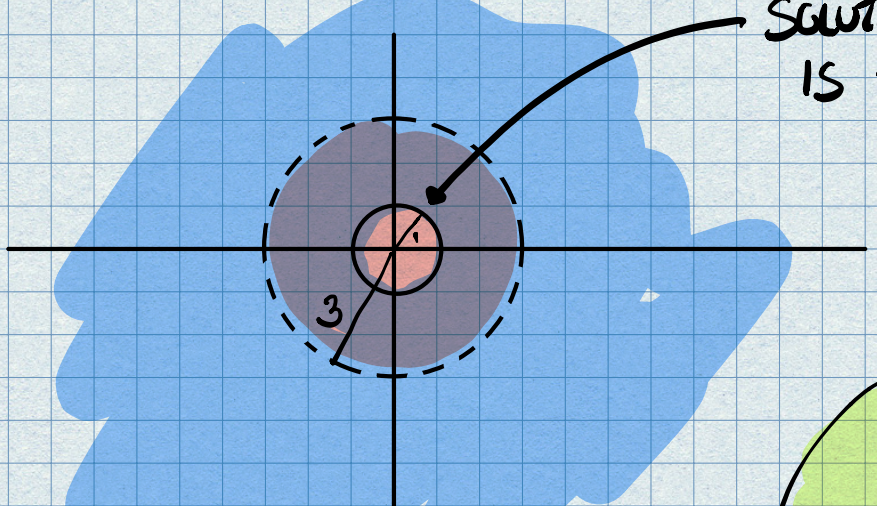
(UNBOUNDED)

NO LIMIT (MAX VAL) FOR HOW FAR APART 2 POINTS CAN BE.

ex. $1 \leq x^2 + y^2 < 9$

$x^2 + y^2 = 3^2$

GRAPH THE SOLUTION REGION:

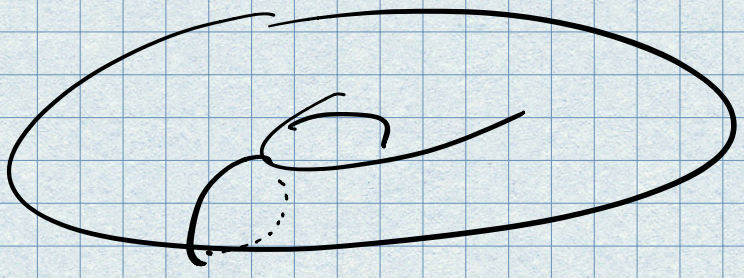


TWO BOUNDARIES : EACH IS A CIRCLE

"WASHER" "DONUT"

ANNULUS (TECH)

TORUS



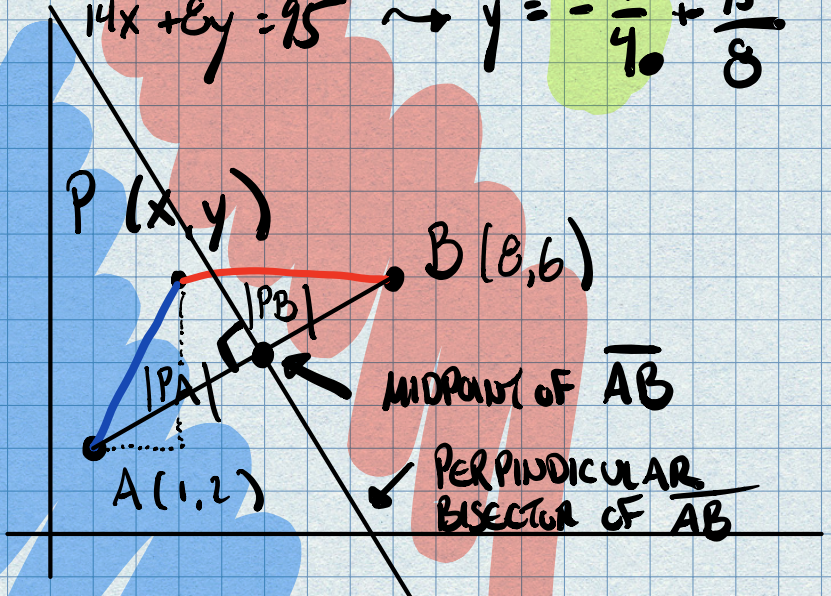
PROBLEM: 2 FARMERS WITH HOUSES

$A(1,2)$ & $B(8,6)$

WANT TO DIVIDE THE LAND SO THAT A OWNS ALL LAND CLOSER TO A THAN TO B & B OWNS ALL LAND CLOSER TO B THAN TO A.

$14x + 8y = 95 \rightsquigarrow y = -\frac{7}{4}x + \frac{95}{8}$

SLOPE OF $\overline{AB}$: $\frac{4}{7}$ $\frac{\Delta y}{\Delta x}$



WHERE & HOW DO WE BUILD THE FENCE?

BOUNDARY?

↑

PTS EQUIDISTANT FROM A & B.

BOUNDARY EQ: $|PA| = |PB|$ POINTS P SATISFYING THIS EQ

$$\sqrt{(x-1)^2+(y-2)^2} = \sqrt{(x-8)^2+(y-6)^2}$$

SQ. BOTH SIDES

$$(x-1)^2+(y-2)^2 = (x-8)^2+(y-6)^2$$

$$x^2-2x+1+y^2-4y+4 = x^2-16x+64+y^2-12y+36$$

$$-2x-4y+16x+12y = 64+36-1-4$$

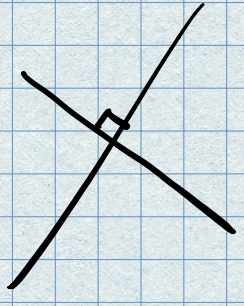
$$14x+8y = 95$$

x-INT: $\frac{95}{14}$

y-INT: $\frac{95}{8}$

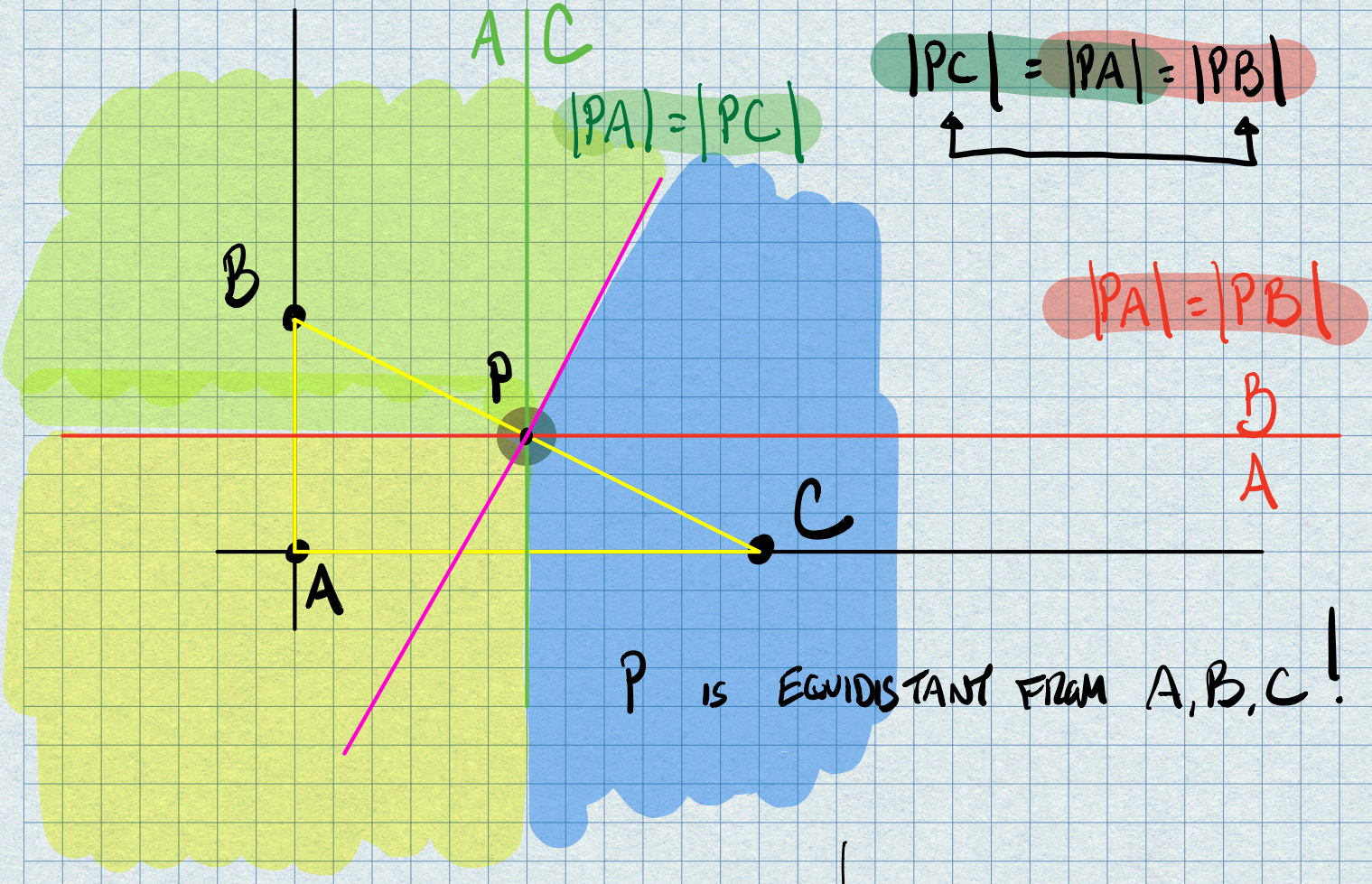
⊥ LINES HAVE SLOPES THAT ARE NEGATIVE RECIPROCALS

e.g. $\frac{4}{7}$ & $-\frac{7}{4}$



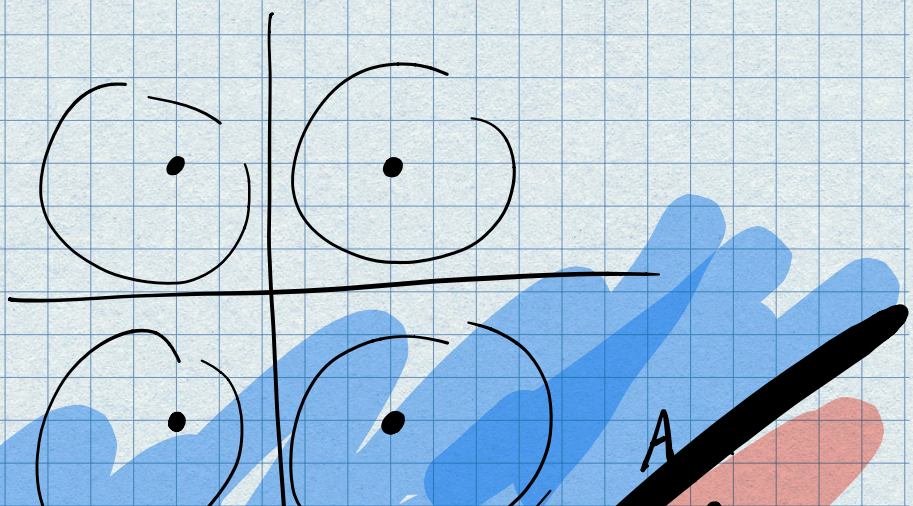
Problem: Suppose 3 farmers A, B, C with houses at A (0,0), B (0,6), C (12,0).

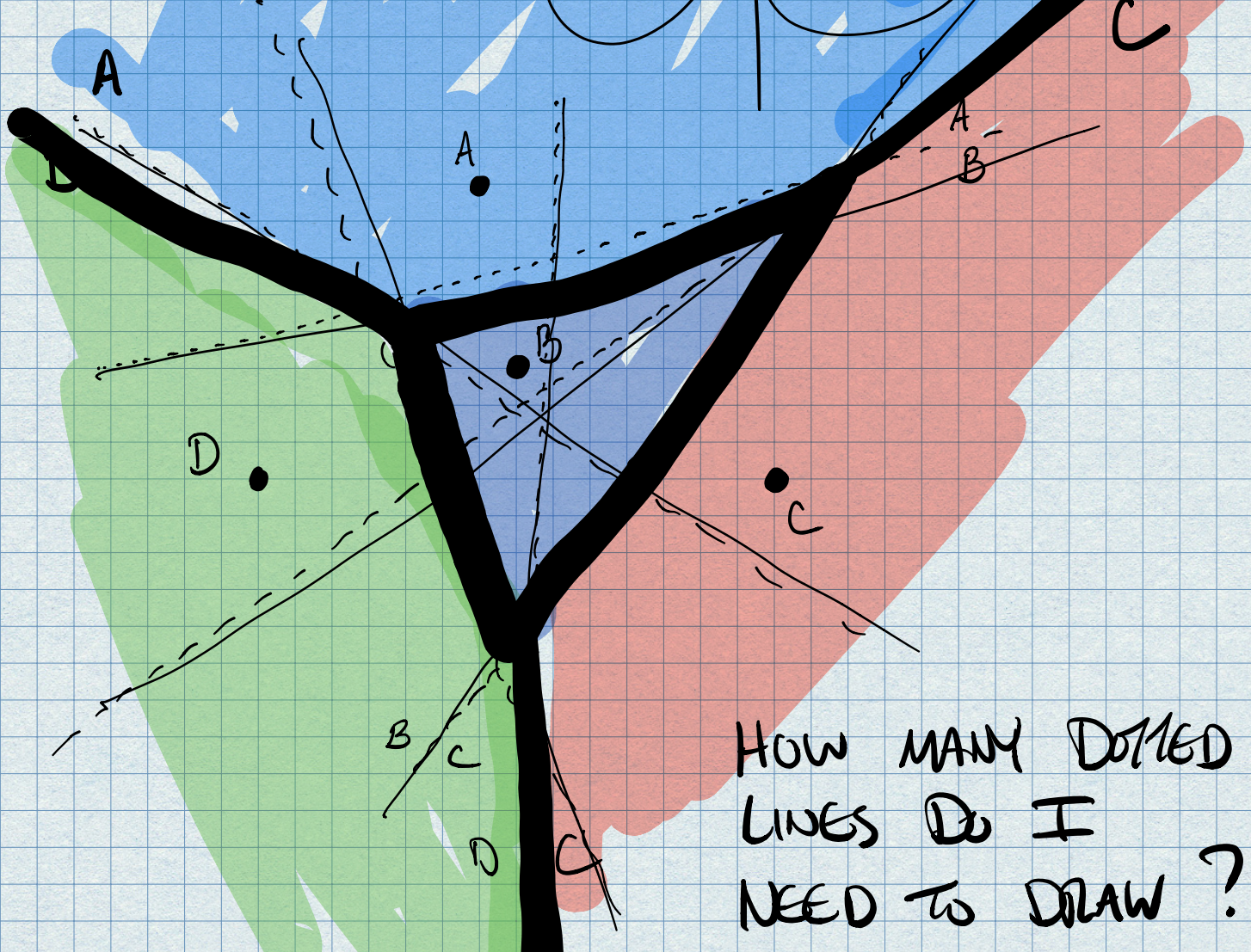
How do these farmers divide the land so that each owns the land closer to her than to either of the other farmers?



P is equidistant from A, B, C!

Four farmers





HOW MANY DOTTED LINES DO I NEED TO DRAW?

4 OBJECTS, CHOOSE 2

WAYS TO DO THIS $\binom{4}{2} = \frac{4!}{2!(4-2)!}$

COMBINATION: $\frac{4 \cdot 3 \cdot 2 \cdot 1}{2 \cdot 1 \cdot 2 \cdot 1} = 6$