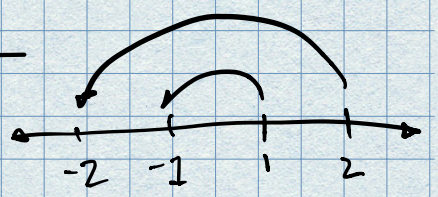
Plant food. A farmer can buy two types of plant food, mix *A* and mix *B*. Each cubic yard of mix *A* contains 20 pounds of phosphoric acid, 30 pounds of nitrogen, and 5 pounds of potash. Each cubic yard of mix *B* contains 10 pounds of phosphoric acid, 30 pounds of nitrogen, and 10 pounds of potash. 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.

$x \geq 0$

$y \geq 0$

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



$20x + 10y \geq 460 \quad (\div 10)$

$30x + 30y \geq 960 \quad (\div 30)$

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

IF WE DIVIDE BY NEG #, THE INEQUALITY FLIPS:

$1 \leq 2$ *

$-1 \geq -2$

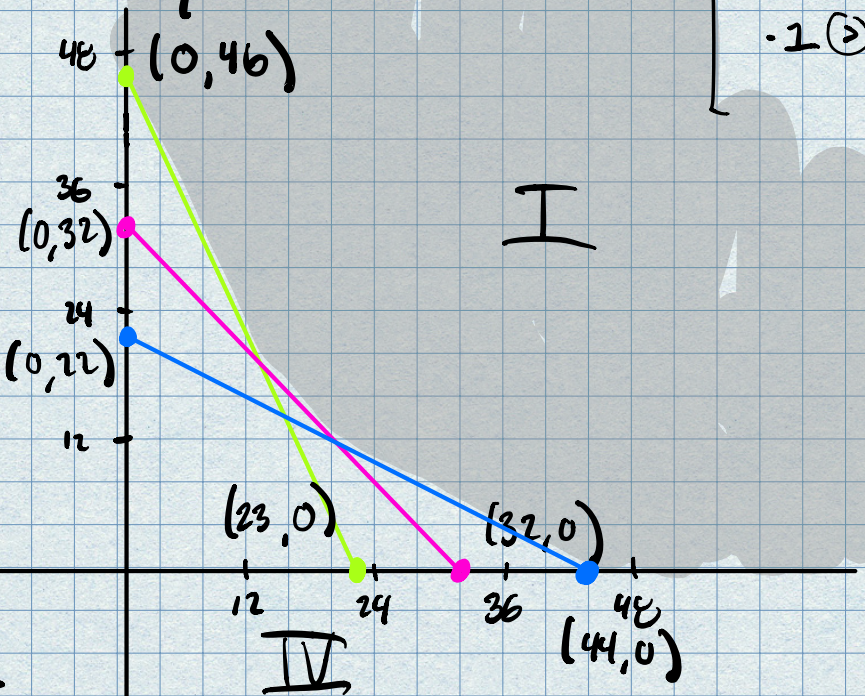
$2x + y \geq 46$

$x + y \geq 32$

$x + 2y \geq 44$

$y \geq 32 - x$

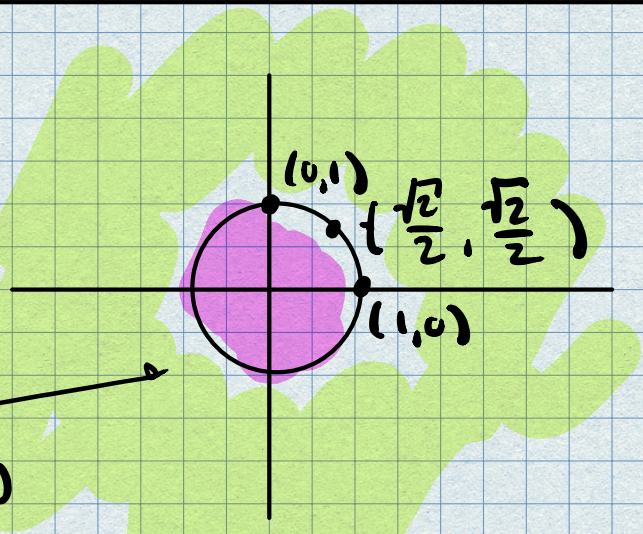
"UPPER HALF PLANE"



SOLUTION REGION IS ABOVE ALL 3 LINES + IN QI

GRAPHS OF OTHER INEQUALITIES WITH 2 VARIABLES:

$x^2 + y^2 = 1$



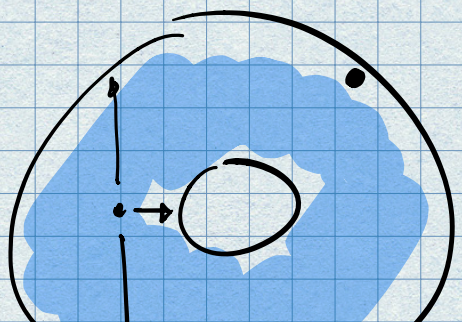
POINTS ON THE GRAPH SATISFY THE EQUATION

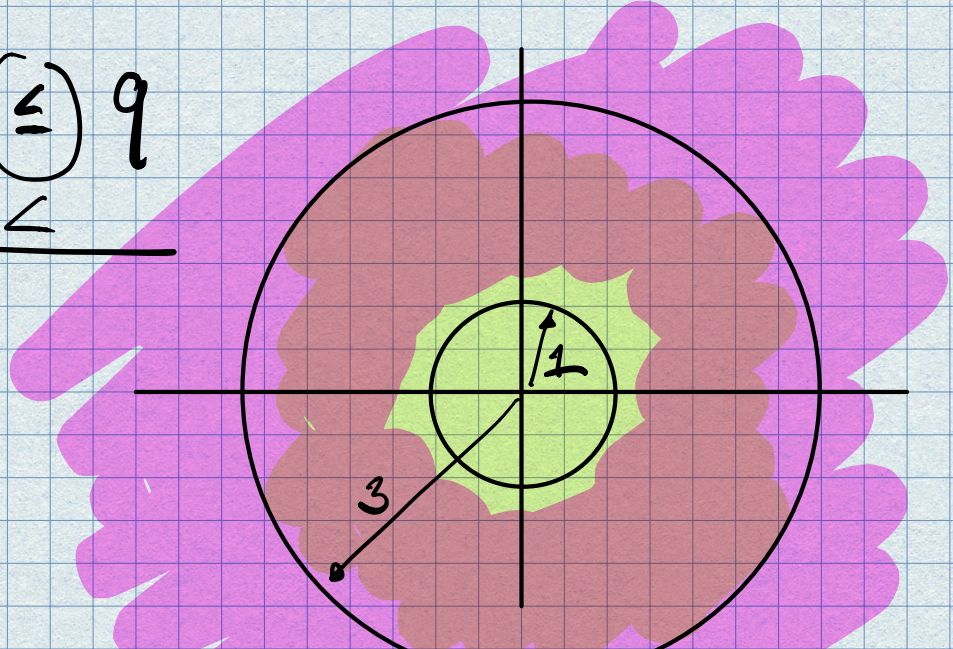
$x^2 + y^2 < 1$ BOUNDED

$x^2 + y^2 > 1$ UNBOUNDED - NO MATTER WHAT NUMBER N YOU PICK, THERE ARE POINTS IN THE REGION MORE THAN N UNITS APART.

EXTERIOR OF CIRCLE WITH CENTER (0,0), r=1

$1 \leq x^2 + y^2 \leq 9$



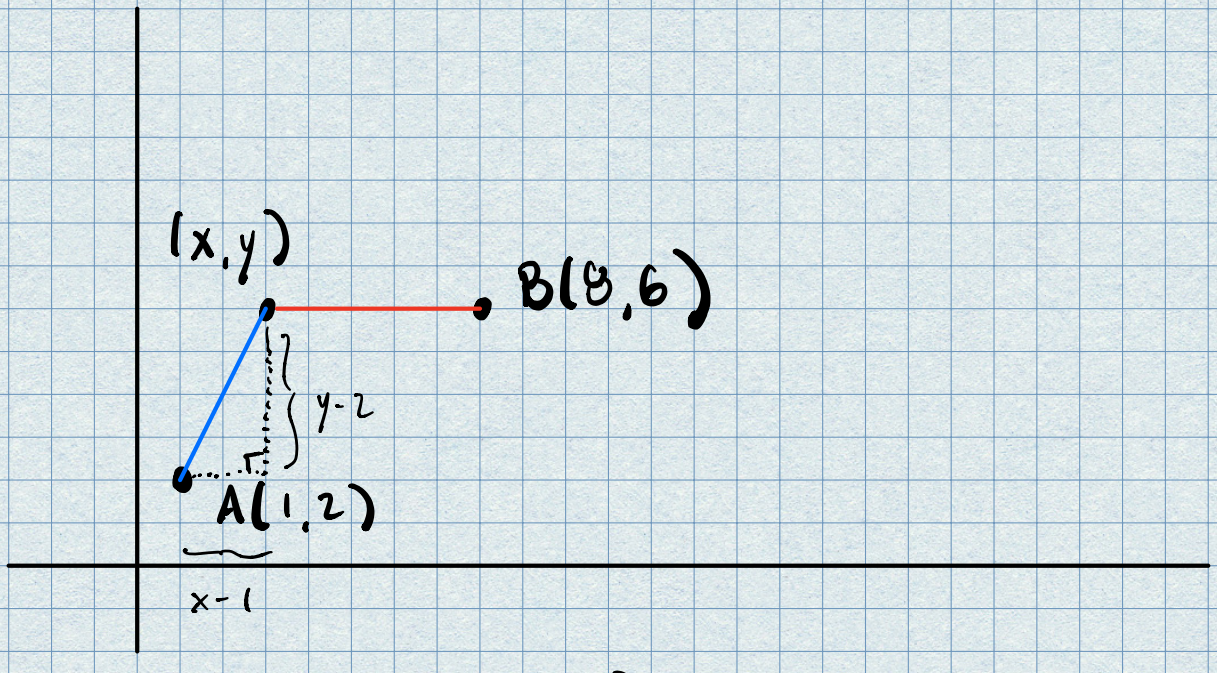


↳ BOUNDED ✓

TWO BOUNDARIES ✓

GEOMETRIC PROBLEM:

GIVEN TWO PTS $A(1,2)$ & $B(8,6)$
FIND THE SET OF ALL PTS CLOSER TO A THAN TO B. "SPLIT UP THE LAND"

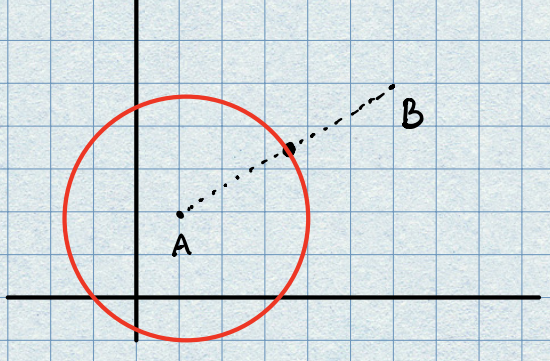


DISTANCE FROM (x,y) TO $A(1,2)$

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

DISTANCE FROM (x,y) TO $B(8,6)$

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



Points (x,y) closer to A satisfy

Dist. to A $<$ Dist. to B

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

Square both sides...

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

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

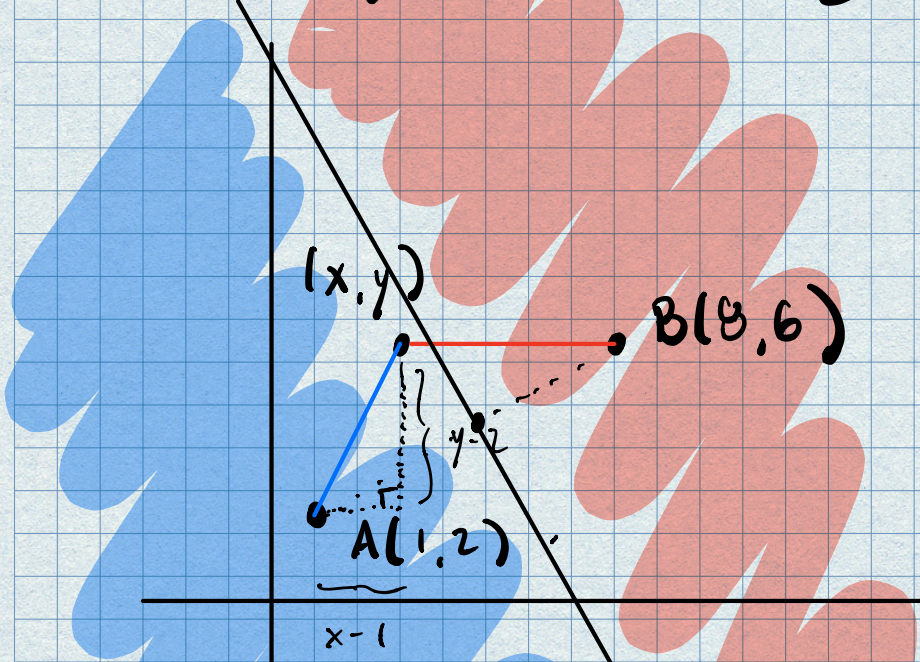
$$16x-2x+12-4y < 64+36-1-4$$

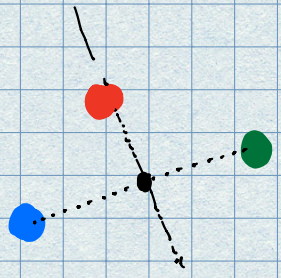
$$14x+8y < 95$$

$$8y < -14x+95$$

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

↑ slope $-\frac{7}{4}$ is neg. recip. of slope of $\overline{AB}$ (perpindicular bisector)





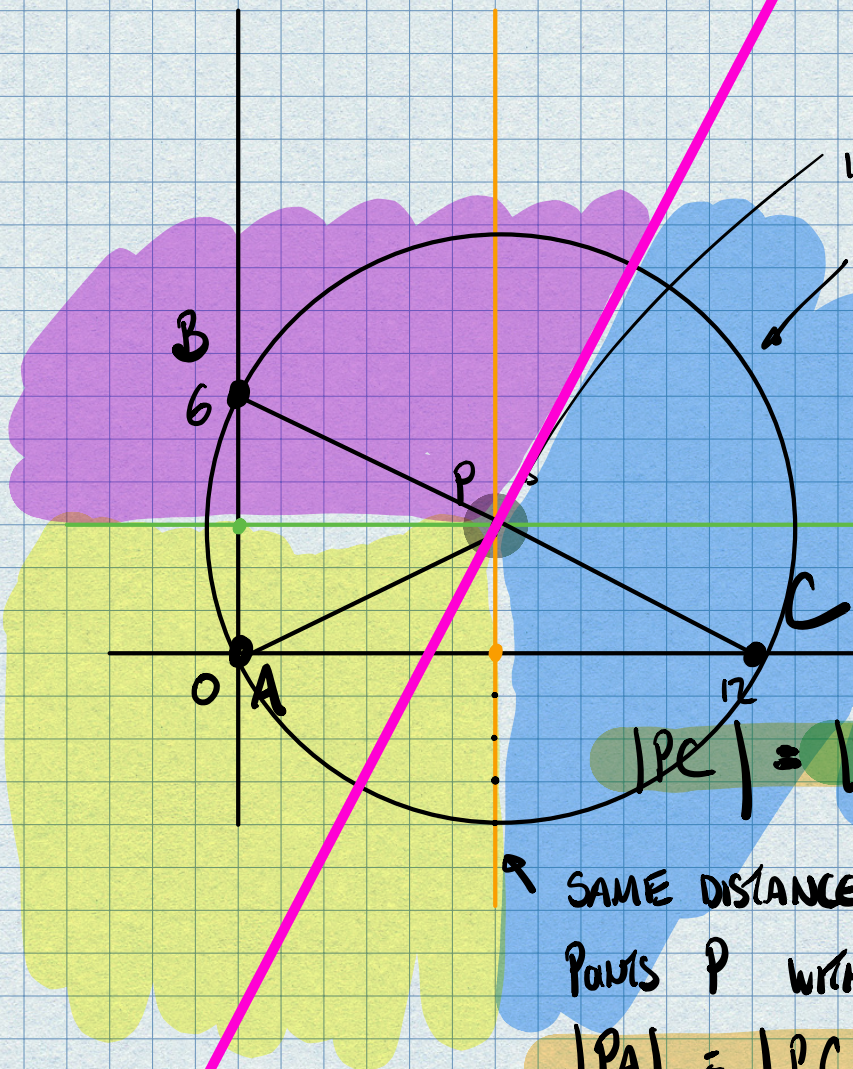
CHALLENGE:

GIVEN 3 PTS $A(0,0)$
$B(0,6)$
$C(12,0)$

DETERMINE HOW THESE PTS DIVIDE THE XY-PLANE INTO REGIONS

- PTS CLOSEST TO A
- PTS CLOSEST TO B
- PTS CLOSEST TO C

EQUICENTER



INTERSECTION:

A, B, C ALL LIE ON CIRCLE WITH CENTER P.

SAME DISTANCE FROM A & B

$|PA| = |PB|$

$|PC| = |PA| = |PB|$

SAME DISTANCE FROM A & C

POINTS P WITH

$|PA| = |PC|$