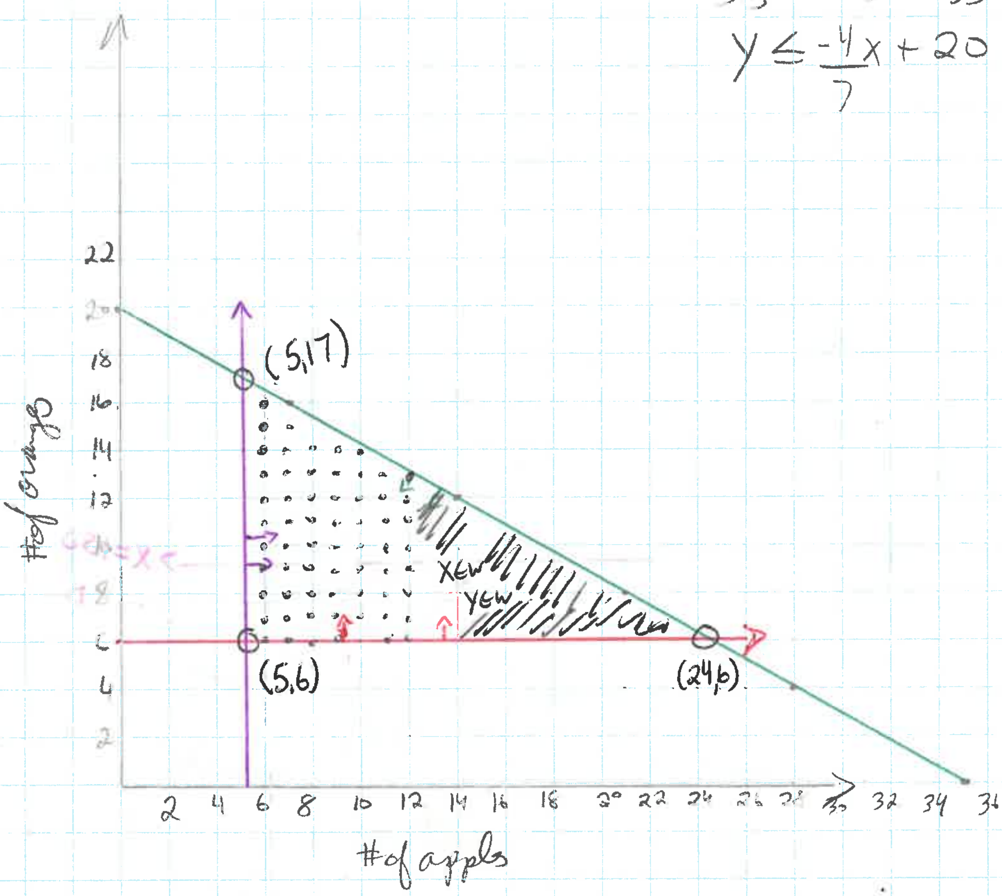
Pg 330 Foundations 20 Optimization Questions

① Let x = # of apples $x \in W$, $y \in W$
y = # of oranges

$x \geq 5$ $0.20x + 0.35y \leq 7$
$y \geq 6$

$20x + 35y \leq 700$
$\frac{35y}{35} \leq \frac{-20x}{35} + \frac{700}{35}$
$y \leq -\frac{4}{7}x + 20$



Objective Function = $X + Y = N$ Let N = Total # of fruit in each basket

vertex① (5,6) vertex② (5,17) vertex③ (24,6)

$5+6 = 11$ Fruit $5+17 = 22$ fruit $24+6 = 30$ fruit

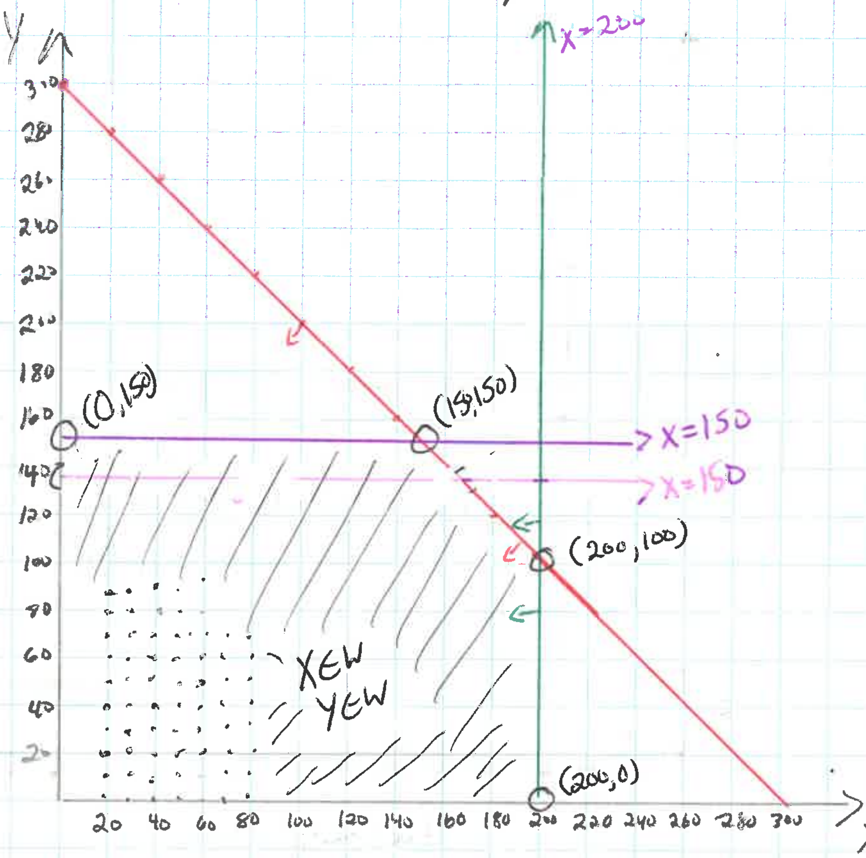
Check
$24 \geq 5$ ✓
$6 \geq 6$ ✓
$0.20(24) + 0.35(6) \leq 7$
$\$6.90 \leq \$7.00$

The maximum amount of fruit is 30 fruit in each basket. There will be 24 apples and 6 oranges, that cost \$6.90.

#2) Let x = # of hot dogs $\quad x \in W$
y = # of hamburgers $\quad y \in W.$

$x + y \leq 300 \qquad y \leq -x + 300$
$x \leq 200$
$y \leq 150$

Objective Function = $3.25x + 4.75y$ = Sales $\quad S$ = total sales.



Vertex 1 (0,150) $\quad$ Vertex 2 (150,150) $\quad$ Vertex 3 (200,0) $\quad$ Vertex 3 (200,100)

$3.25(0) + 4.75(150) = \$712.50$

$3.25(150) + 4.75(150) = \$1200$

$3.25(200) + 4.75(0) = \$650$

$3.25(200) + 4.75(100)$ $\$1125$

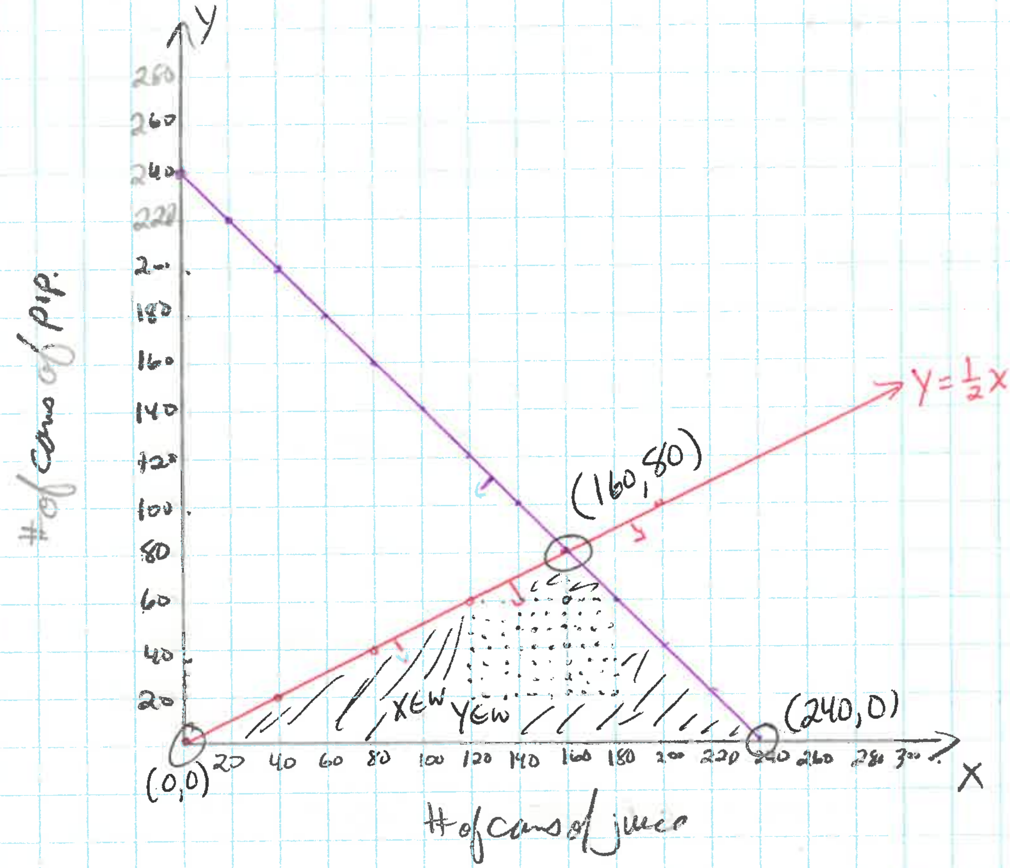
The maximum amount of sales would be $1125 if 200 hotdogs sold and 100 hamburgers.

#3/ Let x = # of cans of juice $x \in W$
y = # of cans of pop $y \in W$

$$x + y \leq 240 \qquad y \leq -x + 240$$

$$x \geq 2y \qquad 2y \leq x \qquad y \leq \frac{1}{2}x$$

Objective Function = $\$1.00x + 1.25y = R$ Let R = revenue



$\$1.00x + \$1.25y = R$

Vertex ① $(0,0)$
$1.(0) + 1.25(0) = R$
$= \$0$

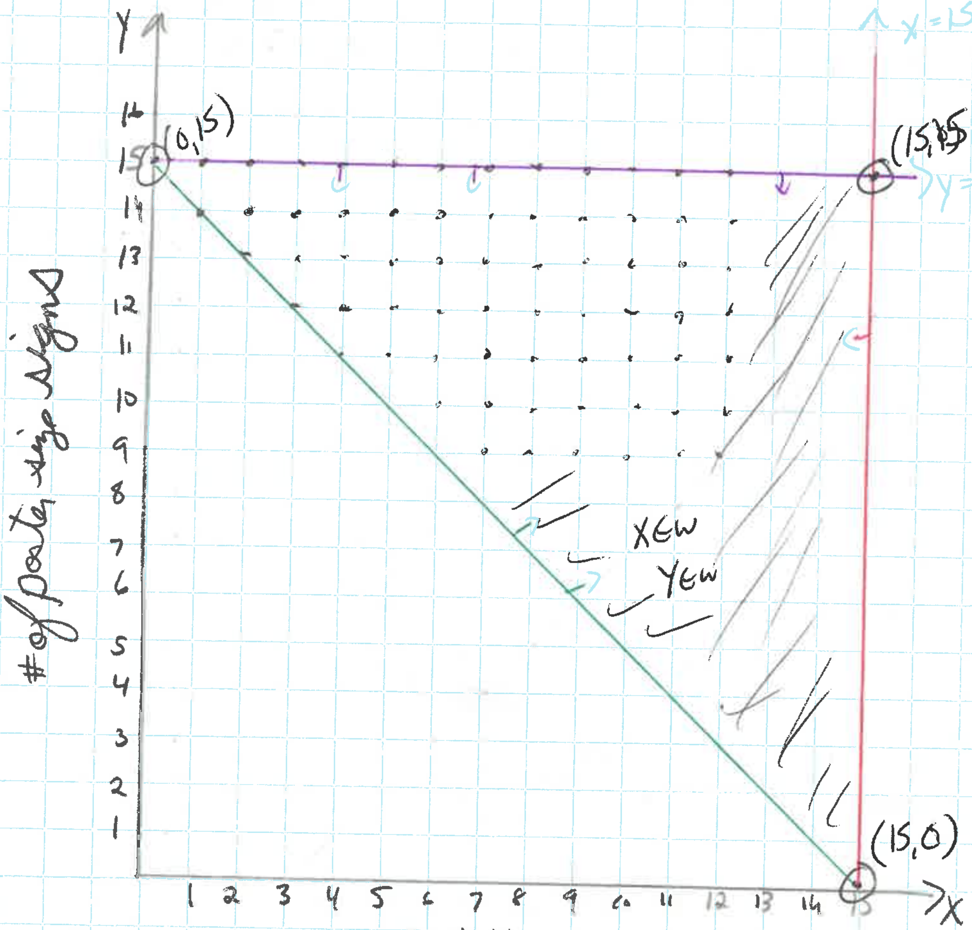
Vertex 2 $(160, 80)$
$1.00(160) + 1.25(80)$
$= \boxed{\$260}$
Max

Vertex 3 $(240, 0)$
$1.00(240) + 1.25(0)$
$= \$240$

The maximum revenue from the vending machine would be \$260, if 160 cans of juice were sold and 80 cans of pop.

#4/ Let x = # of letter size signs $x \in W$
y = # of poster size signs $y \in W$

Constraint inequalities: ① $x \le 15$ ② $y \le 15$
③ $x + y \ge 15$



# of letter size signs

Objective Function: $9.80x + 15.75y = C$
Let C = Total cost of the two sizes of signs

Vertex 1 (0, 15)
$9.80(0) + 15.75(15)$
$= \$236.25$

Vertex 2 (15, 15)
$9.80(15) + 15.75(15)$
$= \$383.25$

Vertex 3 (15, 0)
$9.80(15) + 15.75(0) =$
$\boxed{= \$147}$
min

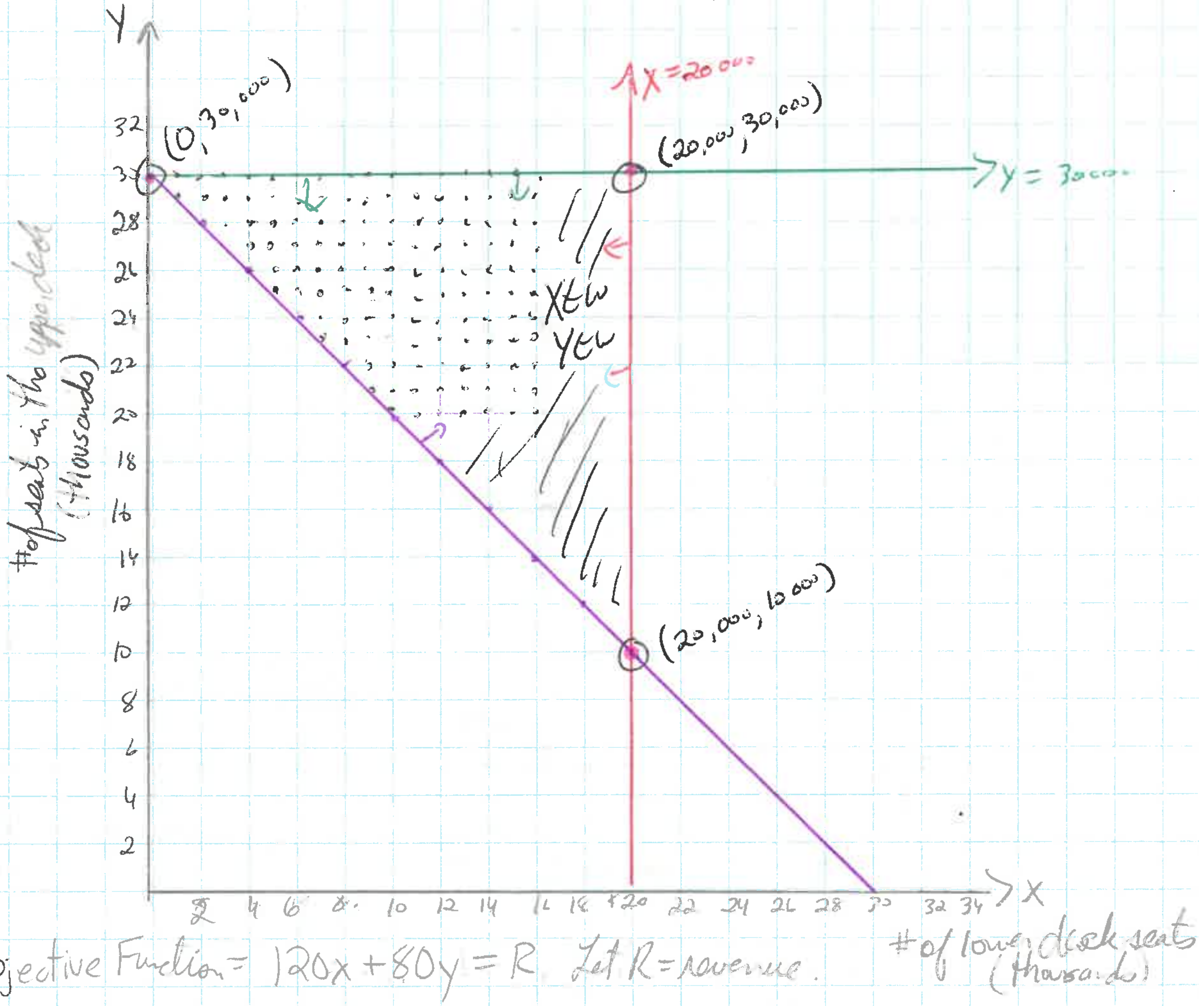
The lowest cost to the council would be $147, if they purchased 15 letter size signs and 0 poster size signs

#5/ Let x = # of seats in the lower deck $x \in W$
y = # of seats in the upper deck $y \in W$

$\frac{2}{5}(50000) = 20000$ seats on the lower deck

$\frac{3}{5}(50\,000) = 30\,000$ seats on the upper deck.

$x \leq 20\,000$ $\quad y \leq 30\,000$ $\quad x + y \geq 30\,000$



Objective Function = $120x + 80y = R$ Let R = revenue.

Vertex 1 $(0, 30\,000)$ Vertex 2 $(20\,000, 30,000)$ Vertex 3 $(20,000, 10,000)$

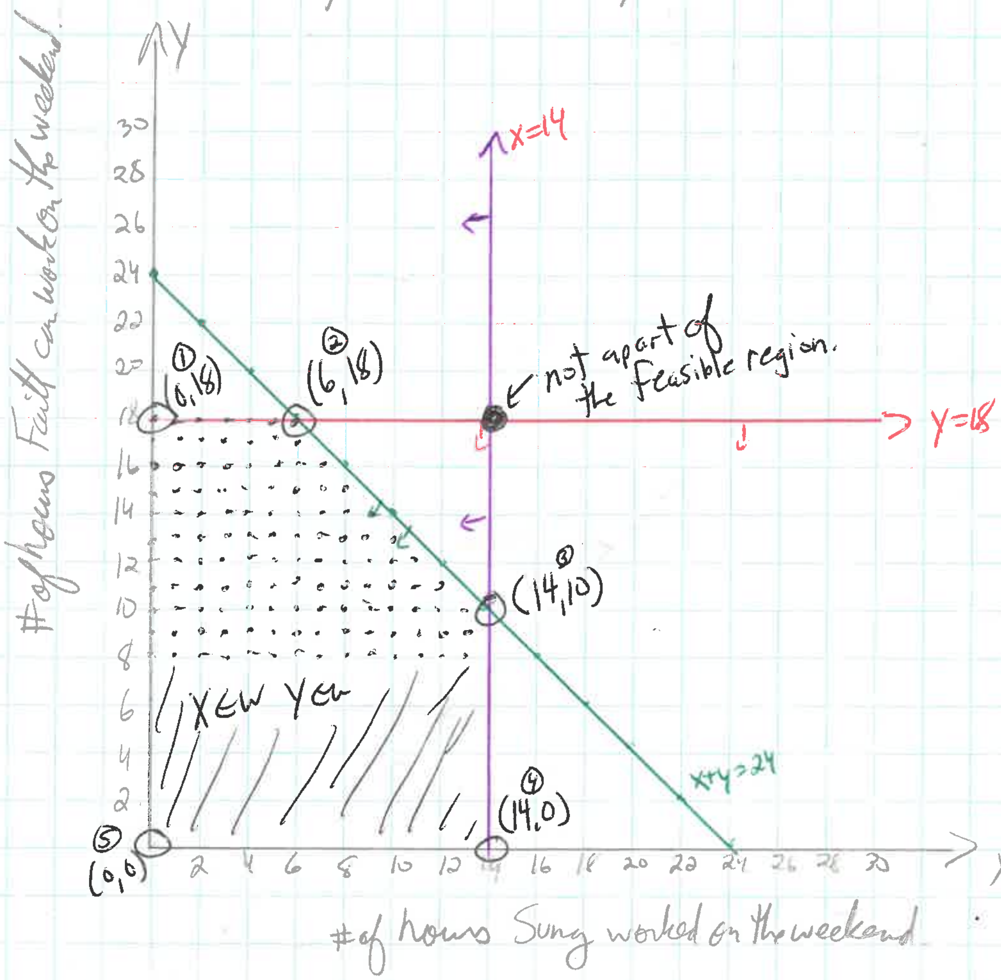
$120(0) + 80(30000) =$ $120(20\,000) + 80(30\,000)$ $120(20,000) + 80(10,000)$

\$ 2,400000 $= \$4,800000$ \$ 3200000

To maximize revenue 20,000 in the lower deck and 30,000 tickets in the upper deck need to be sold to make a revenue of \$ 4,800,000

#6/ Let x = # of hours Sung can work $x \in W$
y = # of hours Faith can work. $y \in W$

$x \le 14$ $y \le 18$ $x + y \le 24$



Objective Function: $\frac{1}{3}x + \frac{1}{4}y = N$ $N \in W$.
Let N = Total # of boats painted each weekend.

Vertex ① (0,18)
$\frac{1}{3}(0) + \frac{1}{4}(18) = 4.5$
4 boats.

Vertex ② (6,18)
$\frac{1}{3}(6) + \frac{1}{4}(18)$
$2 + 4.5$ ← round below as boats are whole #'s
$= 6$ boats.

Vertex 3 (14,10)
$\frac{1}{3}(14) + \frac{1}{4}(10)$
$4.6 + 2.5$
$= 6$ boats

Vertex 4 (14,0)
$\frac{1}{3}(14) + \frac{1}{4}(0)$
$= 4$ boats

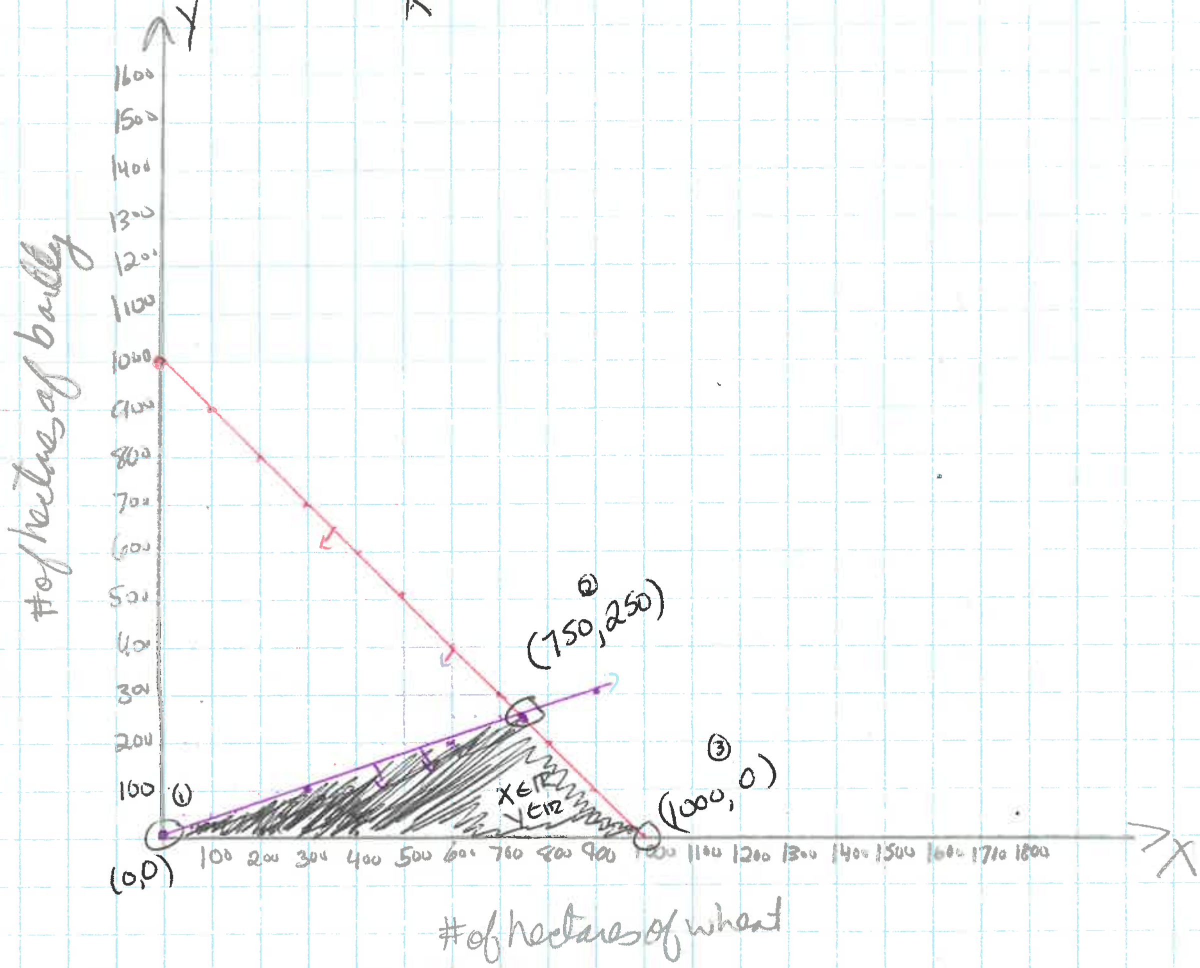
The maximum # of boats are 6 boats when Sung works 6 hours and Faith 18 hours. Or Sung works 14 hours and Faith works 10

#7/ Let x = # of hectares of wheat $x \in \mathbb{R}$ or $x \in \mathbb{Q}$ ← rational #'s
y = # of hectares of barley $y \in \mathbb{R}$ or $y \in \mathbb{Q}$

$y \le -x + 1000$

$x + y \le 1000$ $x \ge 3y$ $y \le \frac{1}{3}x$

Objective Function = $\$5.25(50)x + \$3.61(38)y = R$
Let R = Total revenue
R



$\$5.25(\underline{50})x + \$3.61(\underline{38})y = R$

Vertex ① (0,0)

\$0

Vertex ② (750, 250)

$[5.25(50)(750)] + [3.61(38)(250)]$
$= \$231170$

Vertex ③ (1000, 0)

$[5.25(50)(1000)] + 0$
$\boxed{= \$262,500}$
Max

To maximize revenue the farmer will need to plant 1000 ha of wheat to earn \$262,500.