***AAT (IC/HW)-Day 1**

Chapter 9: 9-4 Linear Programming

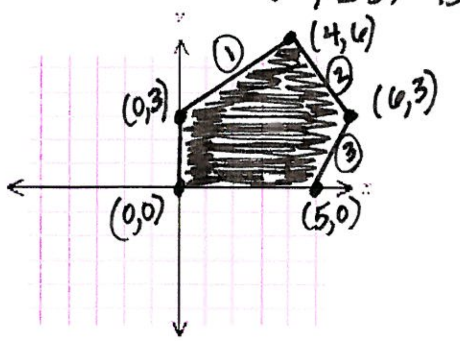
Name: Key

Date: ____________ Period: ____________

Sketch the region R determined by the given constraints, and label its vertices. Find the maximum value of C on R.

1. C = 3x + y;

$$\begin{cases} x \geq 0 \\ y \geq 0 \\ 3x - 4y \geq -12 \rightarrow y \leq \frac{3}{4}x + 3 \\ 3x + 2y \leq 24 \rightarrow y \leq -\frac{3}{2}x + 12 \\ 3x - y \leq 15 \rightarrow y \geq 3x - 15 \end{cases}$$

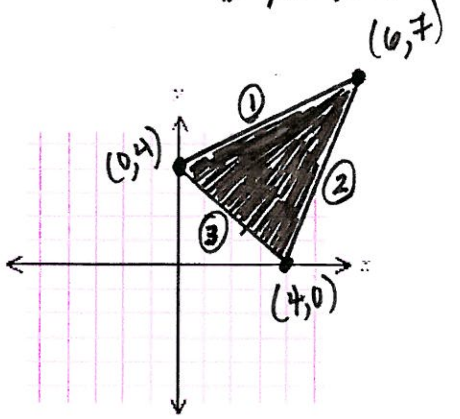


(x, y)	(0,0)	(0,3)	(4,6)	(6,3)	(5,0)
C	0	3	18	21 ★	15

maximum of 21 at (6,3)

2. C = 4x-2y;

$$\begin{cases} x - 2y \geq -8 \rightarrow y \leq \frac{1}{2}x + 4 \\ 7x - 2y \leq 28 \rightarrow y \geq \frac{7}{2}x - 14 \\ x + y \geq 4 \rightarrow y \geq -x + 4 \end{cases}$$



(x, y)	(0,4)	(6,7)	(4,0)
C	-8	10	16 ★

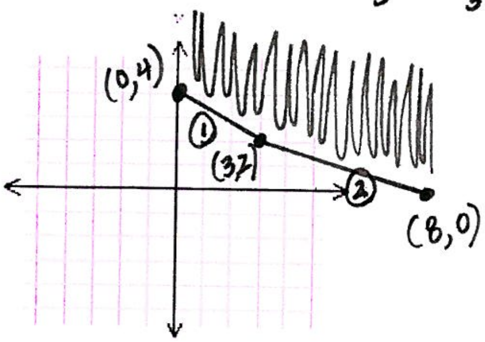
maximum of 16 at (4,0)

3. **Sketch the region R determined by the given constraints, and label its vertices. Find the minimum value of C on R.**

C = 3x+6y;

$$\begin{cases} x \geq 0 \\ y \geq 0 \\ 2x + 3y \geq 12 \rightarrow y \geq -\frac{2}{3}x + 4 \\ 2x + 5y \geq 16 \rightarrow y \geq -\frac{2}{5}x + \frac{16}{5} \end{cases}$$

(1) and (2) label the third and fourth constraints.



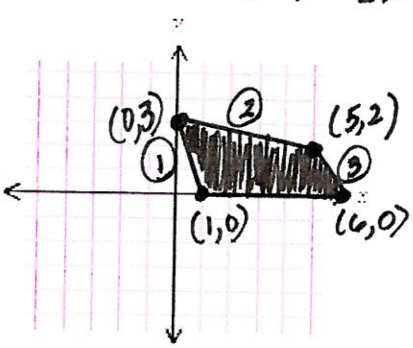
(x,y)	(8,0)	(3,2)	(0,4)
C	24	21 ★	24

minimum of 21 at (3,2)

4. C = 6x+y;

$$\begin{cases} y \geq 0 \\ 3x + y \geq 3 \rightarrow y \geq -3x + 3 \\ x + 5y \leq 15 \rightarrow y \leq -\frac{1}{5}x + 3 \\ 2x + y \leq 12 \rightarrow y \leq -2x + 12 \end{cases}$$

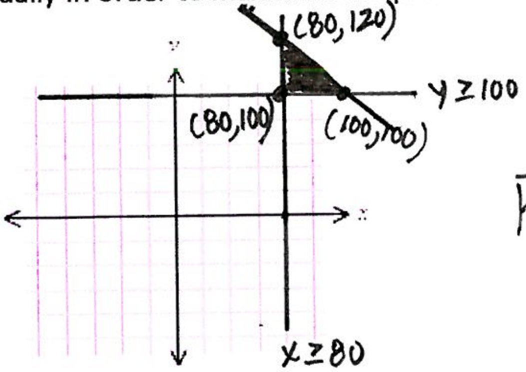
(1), (2) and (3) label the second, third and fourth constraints.



(x,y)	(0,3)	(5,2)	(6,0)	(1,0)
C	3 ★	32	36	6

minimum of 3 at (0,3)

5. A manufacturer of CB radios makes a profit of \$25 on a deluxe model and \$30 on a standard model. The company wishes to produce at least 80 deluxe models and at least 100 standard models per day. To maintain high quality, the daily production should not exceed 200 radios. How many of each type should be produced daily in order to maximize the profit?



x = # of deluxe

y = # of standard

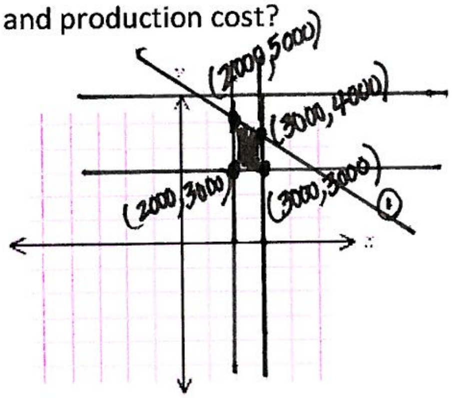
Profit $= 25x + 30y$

$$\begin{cases} x + y \le 200 \rightarrow y \le -x + 200 \\ x \ge 80 \\ y \ge 100 \end{cases}$$

(x,y)	$(80,100)$	$(100,100$	$(80,120)$
P	5000	5500	5600 ★

maximum profit of \$5600 at 80 deluxe & 120 standard

6. A stationery company makes two types of notebooks: a deluxe notebook with subject dividers, which sells for \$1.25, and a regular notebook, which sells for \$0.90. The production cost is \$1.00 for each deluxe notebook and \$0.75 for each regular notebook. The company has the facilities to manufacture between 2000 and 3000 deluxe and between 3000 and 6000 regular notebooks, but not more than 7000 altogether. How many notebooks of each type should be manufactured to maximize the difference between the selling prices and production cost?



x = # of deluxe

y = # of regular

Difference $= \underbrace{.25}_{(1.25-1.00)}x + \underbrace{.15}_{(.90-.75)}y$

maximum diff. of \$1350 at 3000 deluxe & 4000 regular

$2000 \le x \le 3000$

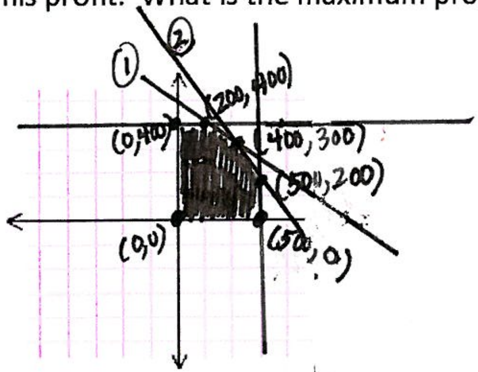
$3000 \le y \le 6000$

① $x + y \le 7000 \rightarrow y \le -x + 7000$

(x,y)	$(2000,3000)$	$(3000,3000)$	$(3000,4000)$	$(2000,5000)$
D	950	1200	1350 ★	1250

7. A man plans to operate a stand at a one-day fair at which he will sell bags of peanuts and bags of candy. He has $400 available to purchase his stock, which will cost $.40 per bag of peanuts and $.80 per bag of candy. He intends to sell the peanuts at $1.00 and the candy at $1.60 per bag. His stand can accommodate up to 500 bags of peanuts and 400 bags of candy. From past experience he knows that he will sell no more than a total of 700 bags. Find the number of bags of each that he should have available in order to maximize his profit. What is the maximum profit?

x = # of bags of peanuts
y = # of bags of candy



$$\text{Profit} = .60x + .80y$$
$$(1.00-.40) \quad (1.60-.80)$$

1. $x + y \le 700 \rightarrow y \le -x + 700$
2. $.40x + .80y \le 400 \rightarrow 40x + 80y \le 40000$
   $x + 2y \le 1000$
   $y \le -\frac{1}{2}x + 500$

$0 \le x \le 500$

$0 \le y \le 400$

Max profit of $480 occurs at 400 peanuts & 300 candy

(x, y)	(500,0)	(500,200)	(400,300)	(200,400)	(0,400)	(0,0)
P	300	460	480 *	440	320	0

8. A fish farmer will purchase no more than 5000 young trout and bass from the hatchery and will feed them a special diet for the next year. The cost of food per fish will be $.50 for trout and $.75 for bass, and the total cost is not to exceed $3000. At the end of the year, a typical trout will weigh 3 pounds, and a bass will weigh 4 pounds. How many fish of each type should be stocked in the pond in order to maximize the total number of pounds of fish at the end of the year?

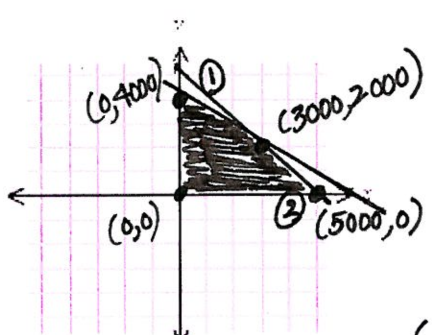
x = # of trout
y = # of bass

$$\text{Pound} = 3x + 4y$$

1. $x + y \le 5000 \rightarrow y \le -x + 5000$
2. $.50x + .75y \le 3000 \rightarrow y \le \frac{-2}{3}x + 4000$

$x \ge 0$

$y \ge 0$



(x, y)	(5000,0)	(3000,2000)	(0,4000)	(0,0)
P	15,000	17,000 *	16,000	0

Max. pounds of 17,000 occurs at 3000 trout & 2000 bass