☐ Review Emergency Procedures.

Section 5.4 – Applications of Linear Programming

☐ Test Tuesday next week

- Optimization problems can be used in the business world
- When companies are developing business plans they generally want to make sure they have detailed plans to optimize success
- We can use the techniques we just learned to solve optimization problems

Example 1:

A parkade can fit at most 100 cars and trucks on its lot. A car covers 100 $sqft$, and a truck 200 $sqft$, and there is 12 000 $sqft$ of space. It charges \$20 $per\ car$ and \$35 $per\ truck$ to park each week. How many of each vehicle will bring the maximum revenue?

Let C = number cars
T = number trucks

Solution 1:

Maximize: $R = 20C + 35T$

where the constraints are:

$C + T \leq 100$

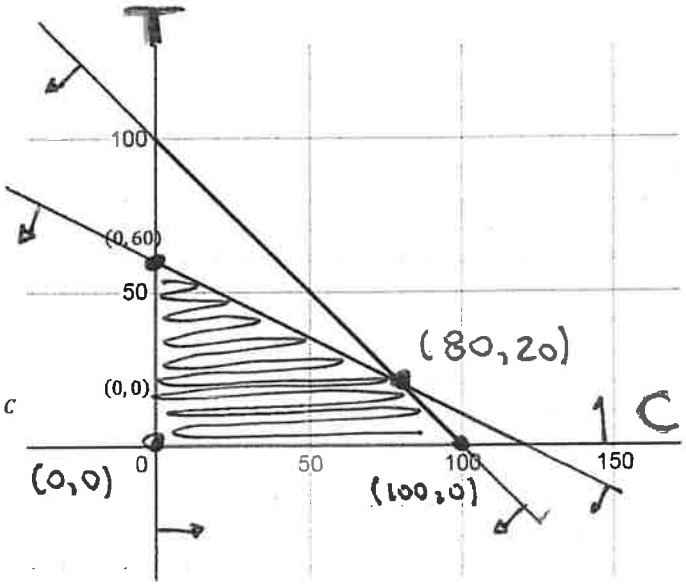
$T \leq -C + 100 \quad \ldots 1$

$100C + 200T \leq 12000$

$C + 2T \leq 120 \quad \ldots 2$

$T \leq -\frac{1}{2}C + 60$

$C \geq 0 \quad \ldots 3 \qquad T \geq 0 \quad \ldots 4$



Vertex	Value of $R = 20C + 35T$
(0,0)	$R = 20(0) + 35(0) = 0$
(0,60)	$R = 20(0) + 35(60) = 2100$
(80,20)	$R = 20(80) + 35(20) = 2300$ Max
(100,0)	$R = 20(100) + 35(0) = 2000$

So, the maximum strategy would be to park 80 cars and 20 trucks.

Example 2: NH_4NO_3 H_3PO_4 K_2CO_3

A lawn needs at least $120kg$ nitrogen, at least $16kg$ of phosphoric acid, and at least $12kg$ of potash. Brand A costs \$22 a bag and Brand B cost \$18 per bag. How many bags of each brand should be used to minimize the cost? What is the minimum cost?

The fertilizer Brand are as follows:

	Brand A (kg/bag)	Brand B (kg/bag)
Nitrogen	30	20
Phosphoric Acid	2	4
Potash	1	4

120
16
12

Let A = # bags A
B = # bags B

Solution 2:

Minimize: $C = 22A + 18B$

$A \geq 0$

$B \geq 0$

where the constraints are:

$30A + 20B \geq 120$

$3A + 2B \geq 12 \quad \ldots 1$

$B \geq -\frac{3}{2}A + 6$

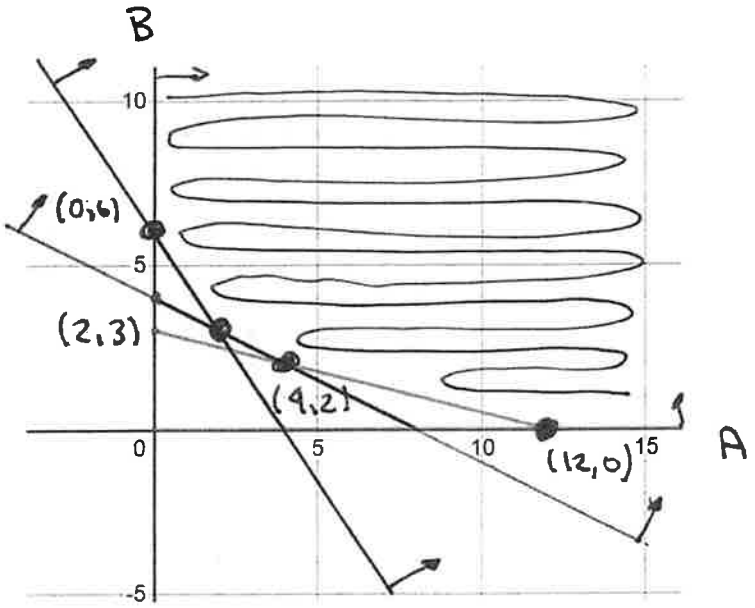
$2A + 4B \geq 16$

$A + 2B \geq 8 \quad \ldots 2$

$B \geq -\frac{1}{2}A + 4$

$A + 4B \geq 12 \quad \ldots 3$

$B \geq -\frac{1}{4}x + 3$



Vertex	Value of $C = 22A + 18B$
(0,6)	$C = 22(0) + 18(6) = 108$
(2,3)	$C = 22(2) + 18(3) = 98$ Min
(4,2)	$C = 22(4) + 18(2) = 124$
(12,0)	$C = 22(12) + 18(0) = 264$

Buy 2 *bags* of brand A and 3 *bags* of brand B for a cost of \$98.

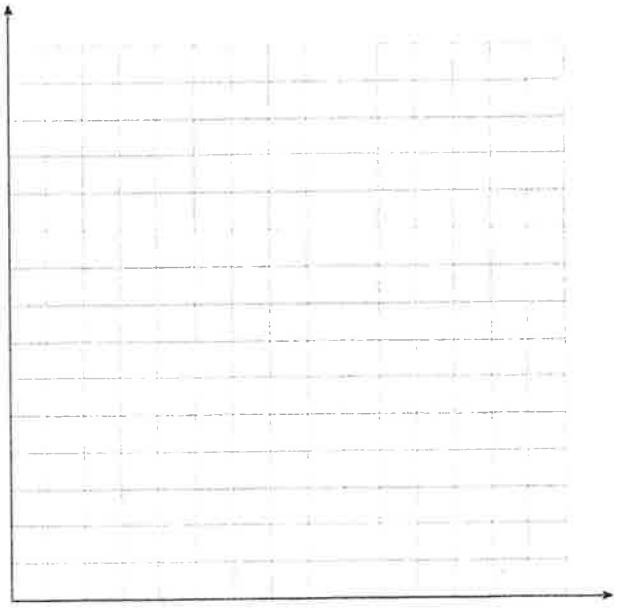
Practice Questions #1-5

Section 5.4 – Practice Questions

The following word problems are about maximizing and minimizing profits, costs, etc.

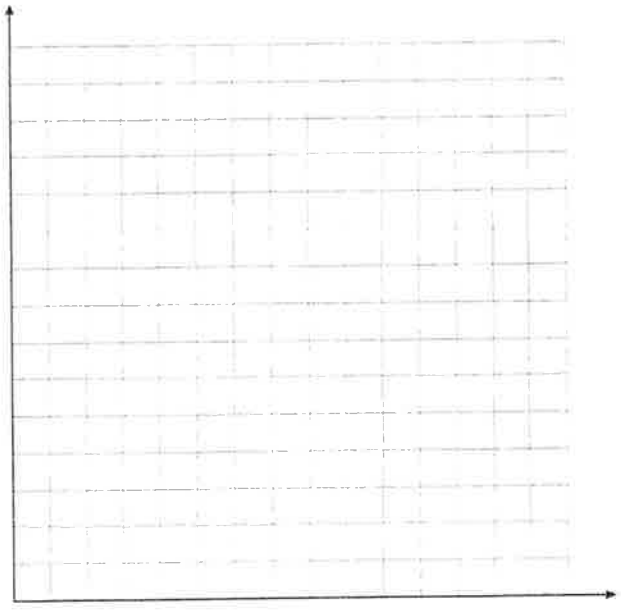
1. A manufacturer makes two types of bikes: downhill and all-terrain. Use the following information to determine the maximum profit.

	Downhill	All-terrain	Max Time Available
Assembly	$2\ hrs$	$1\ hr$	$40\ hrs$
Finish	$1\ hr$	$1hr$	$32\ hrs$
Profit	$70	$50	



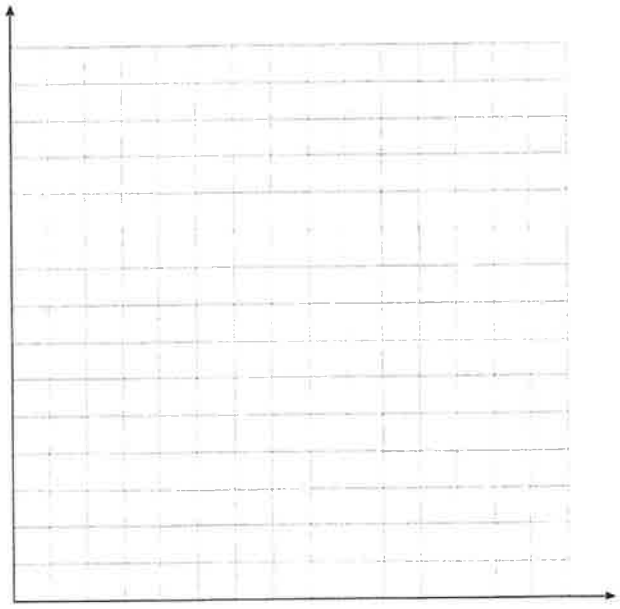
2. A farmer has 10 *acres* of land for planting wheat and corn. The cost and time are listed below. Find the maximum profit

	Wheat	Corn	Max
Prep Cost per Acre	$60	$30	$1800
Work per Acre	3	4	120
Profit per Acre	$180	$100	



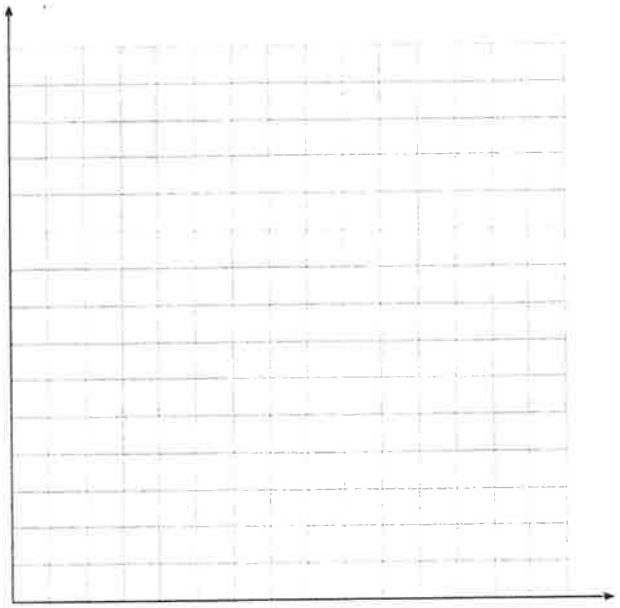
3. A small manufacturer makes toy cars and boats. The information given shows maximum assembly and finish time allowed, plus the profit. How many toy cars and boats should be made per day to maximize profit, and how much is it.

	Car	Boats	Max Hours per Day
Assembly	$1/2\ hr$	$2\ hrs$	$8\ hrs$
Finish	$1\ hr$	$2\ hrs$	$12\ hrs$
Profit	$20	$50	



4. Two vitamin pills, A and B, have the following units of carbohydrates, protein and fats. The minimum units needed each day is listed in the table.

	A	B	Min. Units
Carbs	2	1	6
Protein	4	1	8
Fat	1	2	6
Cost per pill	40 *cents*	30 *cents*	



5. A company produces three models of TV's at two production lines, A and B. The following table shows the minimum number of each TV needed to meet production quota with the cost. How many TV's should be produced on assembly lines A and B to minimize cost, and what is it?

	A	B	Min.
32 inch	400	400	4000
46 inch	200	400	2400
60 inch	300	100	1800
Cost per Week	$15 000	$20 000