

Section 5.4 – Applications of Linear Programming

This booklet belongs to: _____ Block: _____

- 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?

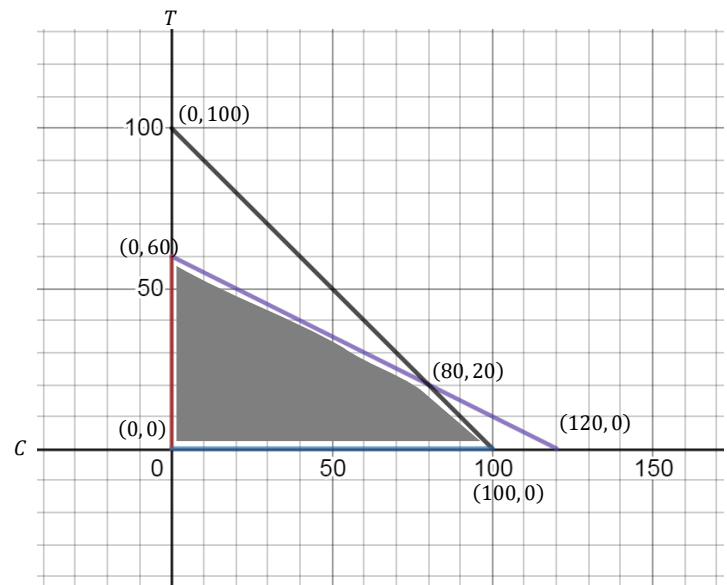
Solution 1:

Maximize: $M = 20C + 35T$, where the constraints are:

$$100C + 200T \leq 12\,000 \rightarrow C + 2T \leq 120$$

$$C + T \leq 100, \quad C \geq 0, \quad T \geq 0$$

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



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

Example 2:

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

Solution 2:

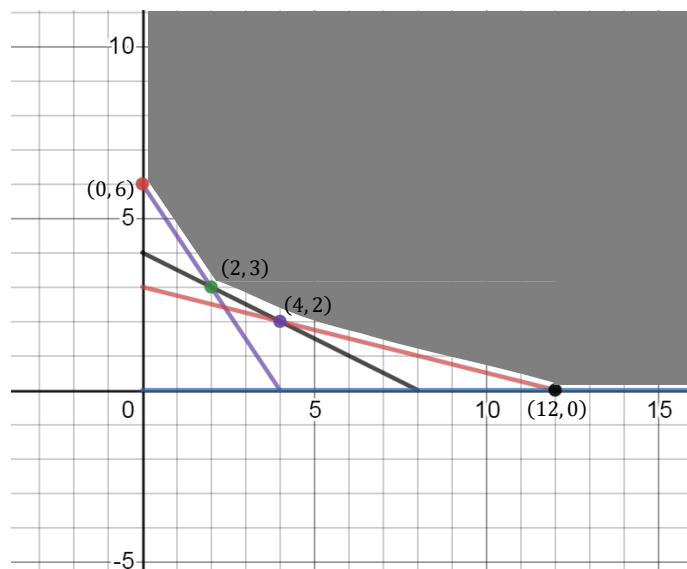
Maximize: $M = 22A + 18B$, where the constraints are:

$$30A + 20B \geq 120 \rightarrow 3A + 2B \geq 12$$

$$2A + 4B \geq 16 \rightarrow A + 2B \geq 8$$

$$A + 4B \geq 12$$

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



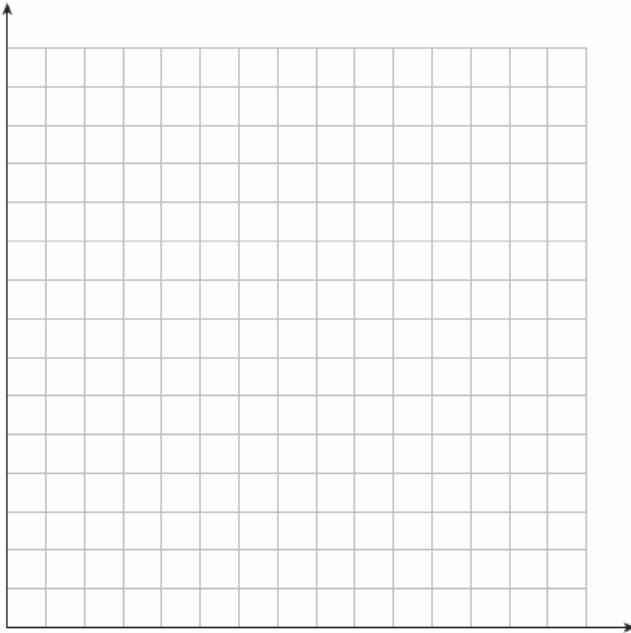
Buy 2 bags of brand A and 3 bags of brand B for a cost of \$98.

Section 5.4 – Practice Questions

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

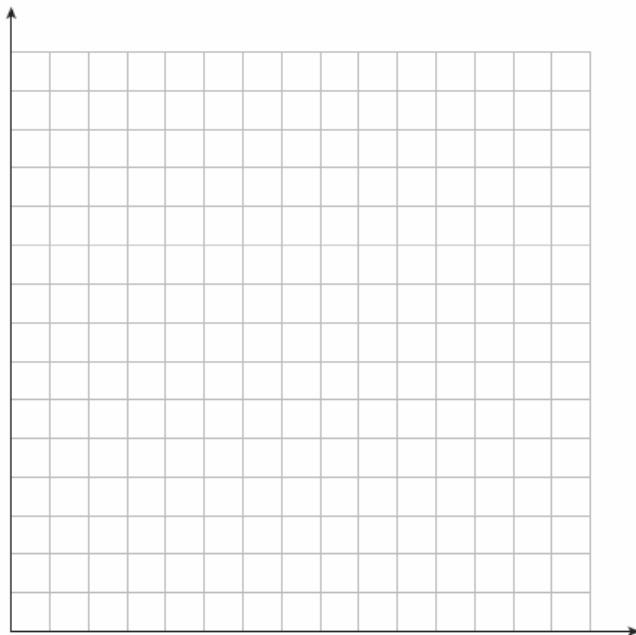
1. A manufacturer makes two types of bikes: downhill and all-terrain. Use the following information to determine the maximum profit.

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



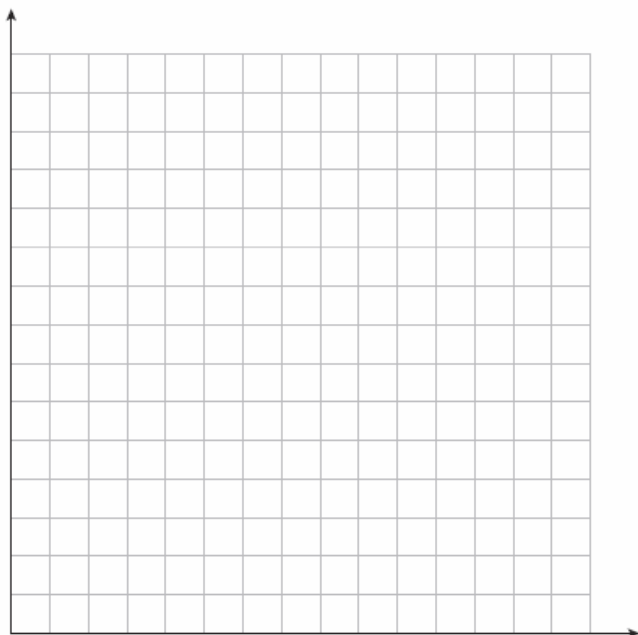
2. A farmer has 10 *acres* of land for planting wheat and corn. The cost and time are listed below. Find the maximum profit

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



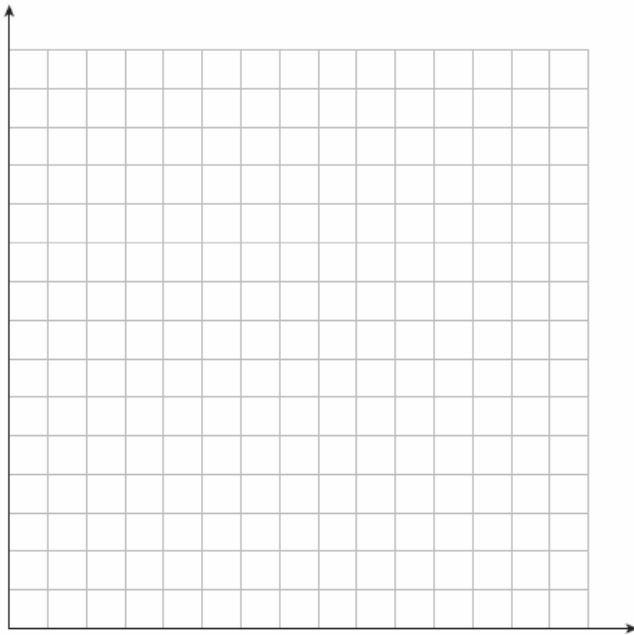
3. A small manufacturer makes toy cars and boats. The information given shows maximum assembly and finish time allowed, plus the profit. How many toy cars and boats should be made per day to maximize profit, and how much is it.

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



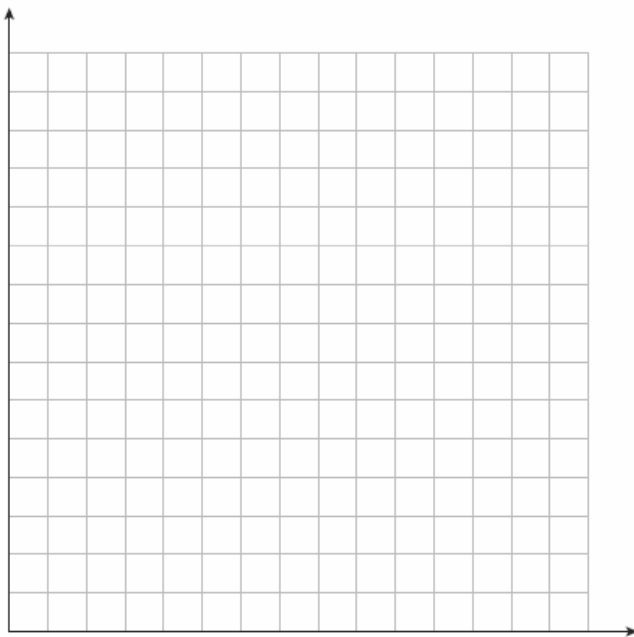
4. Two vitamin pills, A and B, have the following units of carbohydrates, protein and fats. The minimum units needed each day is listed in the table.

	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	



Answer Key – Section 5.4

See Website for Detailed Answer Key

Extra Work Space