MATH 101: PRACTICE PROBLEMS IN LINEAR PROGRAMMING

① A company makes gadgets A and B. The production of each requires time on machines I, II, and III. Gadget A requires 2 hours on I, 1 hour on II, and 1 hour on III; gadget B requires 1 hour on I, 1 hour on II, and 2 hours on III. The time available on these machines per week is 200 hours on I, 140 hours on II, and 240 hours on III. The profit on each A is $90, and the profit on each B is $120. The company can sell all it produces. How many of each should it make per week to maximize profit? What is that profit?

[A: 40 ; B: 100
Max. profit = $15,600]

② A dairy company processes milk at two locations. Its Arlington plant produces 50 gallons of 4% and 100 gallons of 2% milk per hour and costs $168 per hour to operate, while the Marysville plant produces 100 gallons of 4% and 150 gallons of 2% milk per hour and costs $288 per hour to operate. The company needs a total daily production of at least 1200 gallons of 4% and 2250 gallons of 2% milk. How many hours per day should each plant operate to minimize cost?

[Arlington: 18 hrs
Marysville: 3 hrs]

③ A farmer has 150 acres of land on which he may grow corn and wheat. His costs to plant the wheat and the corn are $20 per acre and $10 per acre, respectively. He has at most $2000 to spend for planting his crops. He already has accepted orders which require that he plant at least 10 acres of wheat and 20 acres of corn. His profit per acre is $150 for wheat and $120 for corn. How many acres of each should he plant to maximize his profit?

[50 acres of wheat and 100 acres of corn]

④ **Production for Maximum Profit**   A toy manufacturer preparing a production schedule for two new toys, trucks and spinning tops, must use the information concerning their construction times given in the following table:

→ [10 trucks; 20 spinning tops; $110]

	Machine A	Machine B	Finishing
Truck	2 hr	3 hr	5 hr
Spinning Top	1 hr	1 hr	1 hr

For example, each truck requires 2 hours on machine A. The available employee hours per week are as follows: for operating machine A, 80 hours; for B, 50 hours; for finishing, 70 hours. If the profits on each truck and spinning top are $7 and $2, respectively, how many of each toy should be made per week in order to maximize profit? What would the maximum profit be?

⑥ **Mineral Extraction**   A company extracts minerals from ore. The numbers of pounds of minerals A and B that can be extracted from each ton of ores I and II are given in the following table, together with the costs per ton of the ores:

	Ore I	Ore II
Mineral A	100 lb	200 lb
Mineral B	200 lb	50 lb
Cost per ton	$50	$60

If the company must produce at least 3000 lb of A and 2500 lb of B, how many tons of each ore should be processed in order to minimize cost? What is the minimum cost?

[Ore I: 10 tons ; Ore II: 10 tons ; $1100]

⑤ **Diet Formulation**   A diet is to contain at least 16 units of carbohydrates and 20 units of protein. Food A contains 2 units of carbohydrates and 4 of protein; food B contains 2 units of carbohydrates and 1 of protein. If food A costs $1.20 per unit and food B costs $0.80 per unit, how many units of each food should be purchased in order to minimize cost? What is the minimum cost?

[A: 4 ; B: 4 ; $8]