

PROBLEM SET 1 (due Thursday March 26th)

1. Blowdryer businessman Max Power is starting a new hairdryer business. Max estimates his production function to be $q=KL^{0.5}$. Max has 60 units of capital ($K=60$). Derive Max's MP and AP of labor for the current level of capital.

2. Kike and Fátima are starting a new restaurant in Teruel. While Kike plans to do the cooking himself, he will need to employ workers and machinery to produce food. He estimates his production function as:

$$q = 15L^{1/4}K$$

Kike is able to accumulate €10,000 to finance the business. Workers cost €10 and capital costs €50.

a) If Kike wishes to produce the most output with the finances available, how much labor and capital should Kike employ? Use a Lagrangian to solve this problem.

b) Does this bundle of capital and labour also minimize the costs? Explain using a graph.

3. A firm uses labour and machines to produce output according to the production function $f(L,M) = 4L^{1/2}M^{1/2}$, where L is the number of units of labour used and M is the number of machines. The cost of labour is 40€ per unit and the cost of using a machine is 10€.

a) Draw an isocost line for this firm, showing combinations of machines and labor that cost 400€ and another isocost line showing combinations that cost 200€. What is the slope of these isocost lines?

b) Suppose that the firm wants to produce its output in the cheapest possible way. Find the number of machines it would use per worker.

c) Calculate the amount of labour and the number of machines that are used to produce 40 units of output in the cheapest possible way, given the above factor prices. What is the minimal cost of producing 40 units of output?

d) How many units of labour and how many machines would the firm use to produce y units in the cheapest possible way? How much would this cost? [i.e. calculate the cost function]

4. FCC's construction company has the following short-run cost function:

$$q^3 - 10q^2 + 36q + 10.$$

a) What level of output will minimize the average cost? What is the AC at this point?

b) Does the production process indicate diminishing returns in the variable input? How can you tell?

PROBLEM SET 2 (due Thursday 23rd May)

1. The firm Space Adventures sells multipasses to space cruises. Her short-run cost function is given by $C(q) = q^2 + 25q + 144$.

- If the market price is €75/pass, how many units will Space Adventures produce?
- At what price will Space Adventures earn zero profits?
- If the price is below the level you found in b, will Space Adventures shut down? If so, explain.

2. A monopolist faces an inverse demand given by $p = 400 - 4Q$, and its marginal cost is constant and equal to 200.

- Calculate the deadweight loss of this monopoly.
- If the monopolist were charged a €100 per unit tax, by how much would price increase? Represent graphically parts a-b.

3. Suppose the airline industry consisted of only two firms: Iberia and Air France. Let the two firms have identical cost functions, $C(y) = 40y$. Assume the demand curve for the industry is given by $P = 100 - Y$, where $Y = y_1 + y_2$.

- Calculate the Cournot-Nash equilibrium for each firm, assuming that each chooses the output level that maximizes its profits when taking its rival's output as given. What are the profits of each firm?
- What would be the equilibrium quantity if Iberia had constant marginal and average costs of €25, and Air France had constant marginal and average costs of €40? Compare your results with part a).
- Calculate the Stackelberg equilibrium where Iberia plays the role of the leader firm and the costs are as in b). What do consumers prefer, the Cournot equilibrium or the Stackelberg equilibrium when costs are as in b)?

4. Suppose that two identical firms produce watches and that they are the only firms in the market. Their costs are given by $C_1 = 60Q_1$ and $C_2 = 60Q_2$, where Q_1 is the output of Firm 1 and Q_2 the output of Firm 2. Price is determined by the following demand curve: $P = 300 - Q$, where $Q = Q_1 + Q_2$.

- Suppose the two firms form a cartel to maximize joint profits. How many watches will be produced? Calculate each firm's profit. Compare with the solution under monopoly.
- Returning to the duopoly of part (a), suppose Firm 1 abides by the agreement, but Firm 2 cheats by increasing production. How many watches will Firm 2 produce? What will be each firm's profits?