

Sample Midterm

Question 1: Suppose a firm is producing a single output y using a single input k and takes input and output price as given. Its production technology exhibits increasing returns to scale for low output levels but decreasing returns past some quantity of production.

- a) Graph its production function.
- b) Illustrate how one can graphically derive its profit-maximizing output supply curve from this production function.
- c) Illustrate how one can graphically derive the cost function from the production function.
- d) Show how one can derive the marginal and average cost functions from your answer to c).
- e) Graphically derive the supply curve from your answer to d).
- f) Are the two supply curves derived above identical (or should they be identical)? Why or why not?

Question 2: Consider a firm with the Cobb-Douglas production function $Y = F(K, L) = K^\alpha L^\beta$. Let r and w denote the prices of the two input factors and p the price of the firm's output.

- a) Find the conditions on the two parameters α and β ensuring that:
 - (a) the marginal products MP_K and MP_L are diminishing;
 - (b) there are constant/increasing/decreasing returns to scale.
- b) For $\alpha + \beta = 1$ find the firm's minimum cost $C(r, w, Y)$ and cost-minimizing input demands $K(r, w, Y)$ and $L(r, w, Y)$.

Now assume $\alpha + \beta < 1$.

- c) Describe in minute detail one way of obtaining the profit maximizing output supply and the unconditional input demands as functions of r , w , and p .
- c) Do you know of another way - also describe in minute detail.
- c) Discuss the profit maximizing output supply when $\alpha + \beta \geq 1$.

Question 3: Consider a well-known software monopolist. The marginal cost of its flagship product WindowlessXY is zero. The demand curve for this product takes the form $Q = 2,000,000 - 5,000P$. Suppose the fixed cost of developing the software was 20 million.

- a) Find the profit-maximizing output and the price they will charge.
- b) Calculate the monopolist's profit, the consumer surplus, and the deadweight loss under both the monopoly and the competitive outcome.
- c) Analyze a price ceiling and discuss its pros and cons.

Question 4: Consider the labor market in Peoria. There is only one buyer in that market, namely Caterpillar. The supply of labor is given as $L = w - 1,000$, where w is the wage. On the output side, Caterpillar takes the price p for its machines as given due to intense competition in that market.

- a) Find Caterpillar's profit-maximizing labor demand. What wage does it have to pay?
- b) What would be the competitive wage in Peoria if there were many baby-Caterpillars?
- c) Compare the welfare implications for workers, Caterpillar, and Peoria of a) versus b).