

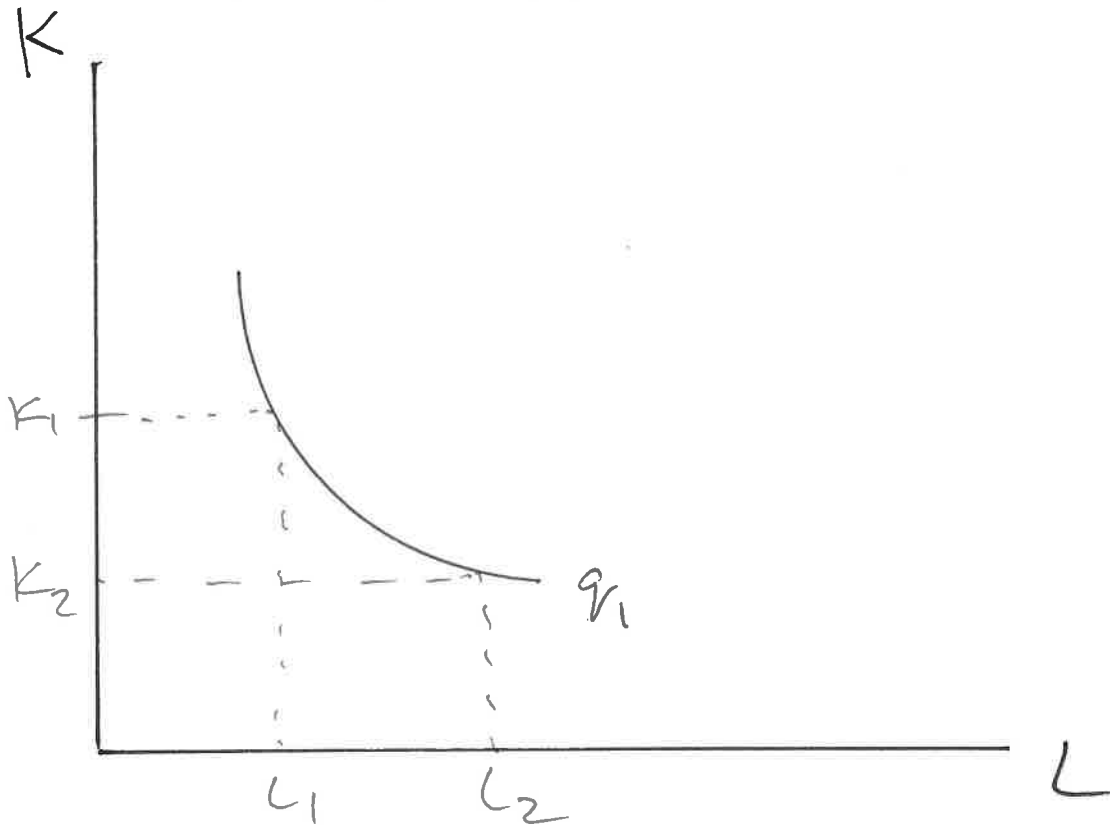
Economics 308: Intermediate Microeconomics  
Department of Economics, Finance and Legal Studies  
University of Alabama  
Spring, 2020

Midterm II

Key

The exam is worth 100 points. Each question (six questions on six pages) is of equal value. There will be no communication with the exam proctors; if you believe a question contains an error or ambiguity, say so on your written examination, make an assumption to correct the alleged error or to resolve the ambiguity, and answer the question as well as you can.

1. Consider a firm that produces output ( $q$ ) with two inputs, capital and labor ( $K$  and  $L$ ). If we observe a firm producing  $q_1$  units of output with  $(K_1, L_1)$  when  $(K_2, L_2)$  is available, are we justified in concluding that  $(K_1, L_1)$  produces more output than  $(K_2, L_2)$  for this firm? Explain briefly and use a graph.



In this scenario, the two points are on the same isoquant & produce the same amount of output.

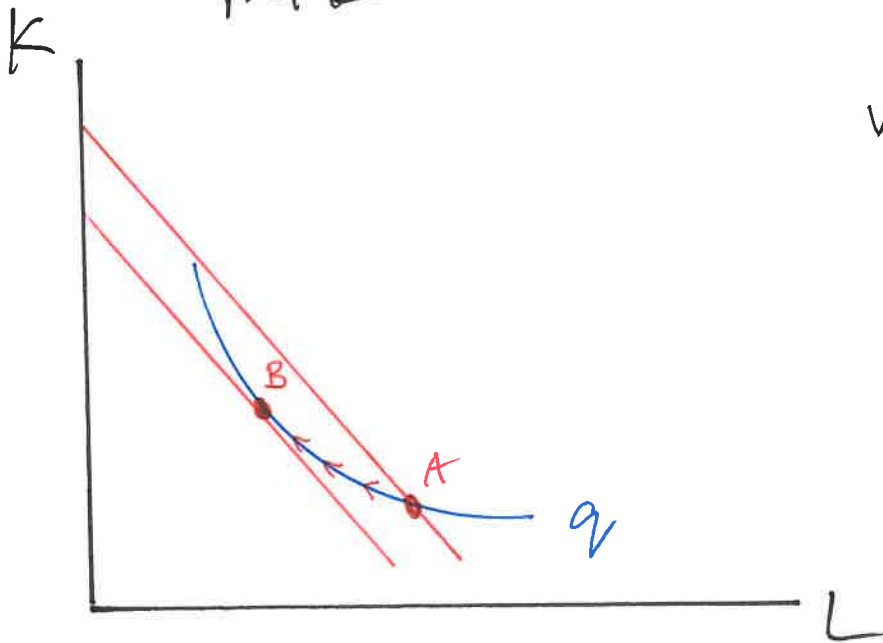
2. A firm purchases capital (K) and labor (L) in competitive markets where the rental rate (r) is 6 and the wage rate (w) is 12. With the firm's current input mix, the marginal product of capital (MP<sub>K</sub>) is 4 and the marginal product of labor (MP<sub>L</sub>) is 6. Does this firm satisfy the necessary condition for profit maximization (i.e., cost minimization)? If so, explain how you know. If not, explain what the firm ought to do. Use a graph.

$$\frac{MP_L}{MP_K} \stackrel{?}{=} \frac{w}{r} \quad ?$$

$$\frac{3}{2} = \frac{6}{4} < \frac{12}{6} = 2$$

thus we need to  $\downarrow L \Rightarrow \uparrow MP_L$   
 $\& \uparrow K \Rightarrow \downarrow MP_K$  until

$$\frac{MP_L}{MP_K} = \frac{w}{r}$$



visually this is  
the movement  
from A to B

3. A machine that costs \$100 will yield returns of \$25 at the end of each of the next 3 years, at which time it will be sold as scrap for \$25. If the interest rate facing this firm is zero percent and there are no maintenance costs, should it purchase this machine? Now, suppose the return doubles each year, should it purchase this machine?

$$PV = \frac{R-M}{(1+r)} + \frac{R-M}{(1+r)^2} + \frac{R-M}{(1+r)^3} + \frac{S}{(1+r)^3}$$

$$= \frac{25-0}{1+0} + \frac{25-0}{(1+0)^2} + \frac{25-0}{(1+0)^3} + \frac{25}{(1+0)^3}$$

$$= 25 + 25 + 25 + 25$$

$= 100 = \text{cost} \Rightarrow$  it does not matter as  $PV = C$  either choice is fine

Returns double each year

$$R_1 = 25, R_2 = 50, R_3 = 100$$

$$PV = \frac{25}{1} + \frac{50}{1^2} + \frac{100}{1^3} + \frac{25}{1^3}$$

$$= 25 + 50 + 100 + 25$$

$= 200 > 100 = \text{cost} \Rightarrow$  you should purchase the capital

4. Consider the following production function:  $q = K/L$ . Show whether this production function exhibits increasing, decreasing or constant returns to scale.

$$\text{is } q(\lambda K, \lambda L) \begin{cases} = \lambda q & \text{CRS} \\ > \lambda q & \text{IRS} \\ < \lambda q & \text{DRS} \end{cases}$$

$$\begin{aligned} q(\lambda K, \lambda L) &= \frac{\lambda K}{\lambda L} \\ &= \frac{K}{L} \\ &= q \\ &< \lambda q \Rightarrow \text{DRS} \end{aligned}$$

5. Suppose a price taking firm produces widgets. If the market price is \$20 per widget and the firm's marginal cost curve is given by  $MC = 2q$ , where  $q$  is the widget production for the firm, how many widgets will the firm produce?

price taker

$$P = MR$$

$\pi$ -max firm

$$MR = MC$$

$$P = MC$$

$$20 = 2q$$

$$q^* = 10$$

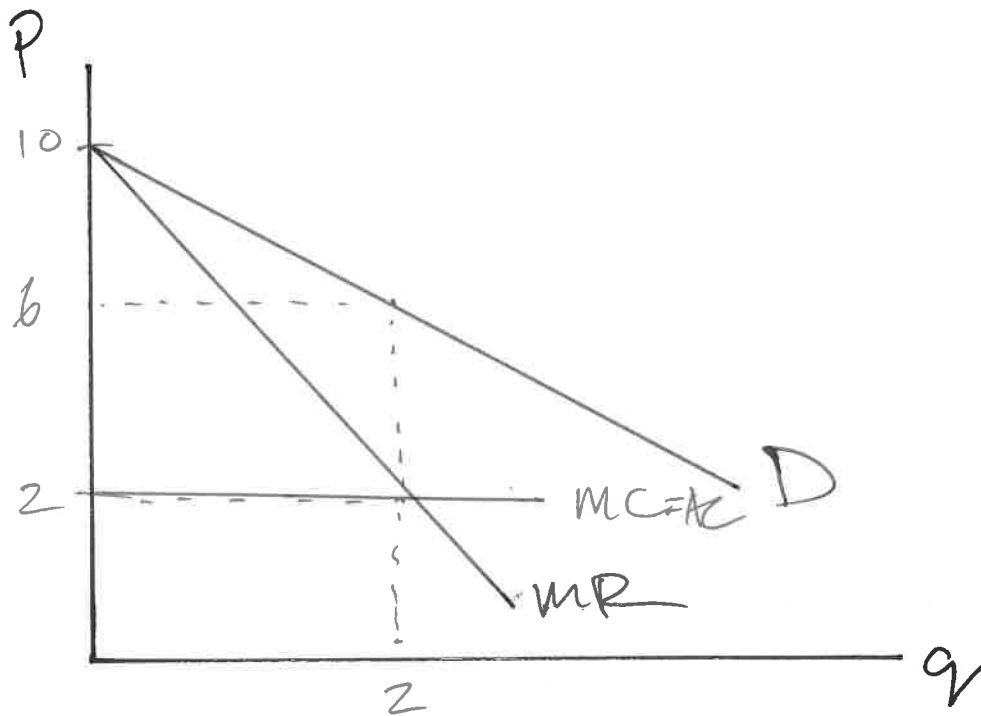
6. A firm faces a demand curve given by  $p = 10 - 2q$ . Marginal and average costs for the firm are constant at \$2 per unit. Derive the marginal revenue curve. Plot both the demand curve and marginal revenue curves on one graph. What is the profit maximizing level of output? How much profit does the firm earn?

$$D: p = 10 - 2q$$

$$TR = pq = (10 - 2q)q = 10q - 2q^2$$

$$MR = \frac{\partial TR}{\partial q} = 10 - 4q$$

$$\pi\text{-max} : MR = MC \Rightarrow 10 - 4q = 2 \Rightarrow q^* = 2$$



$$\begin{aligned} \pi &= q(P - AC) \\ &= 2(6 - 2) \\ &= 8 \end{aligned}$$