PROBLEM SET TWO --ECON 3010

- <u>1</u>. Suppose a competitive firm has $TC = \$1800 + 2q^2 \& P = \100 .
 - a) Find the firm's profit-maximizing q & its π .
 - b) If each firm has identical cost, is the market in long run equilibrium? If it is not, what will happen, & what will P equal in the long run? If $\pi < 0$ currently, *will* each firm operate?
- <u>2</u>. Suppose $MP_K = 100$, $MP_L = 20$, r = \$50, & w = \$20. Does the combination of K & L now employed minimize the cost of producing the firm's current output? Show what occurs using an isoquant & an isocost line.
- <u>3</u>. With 2 inputs, X & Y, one unit of X is equivalent to 2 units of Y—they are perfect substitutes. How much X & Y should a firm use?
- <u>4</u>. Why do less developed countries use more L & less K than developed countries to produce the same output of a good? Can both types choose inputs to minimize cost when they use different input combinations?
- 5. Firm X in a competitive market has a superior manager & earns $\pi = $10,000$ per year. All other firms earn $\pi = 0$.
- a) What will happen in the long run in this market?
- b) How could the example change (still with $\pi = 0$ for all but X initially) to get a different long run answer?

Answers

1. a) MC =
$$\frac{\partial TC}{\partial q}$$
 = 4q. A price taker has MR = P, so MR = \$100 & π is max when 100 = 4q, so q = 25. π = TR - TC = Pq - TC = 100(25) - 1800 - 2(25)² = - \$550.

b) Since $\pi < 0$, this is not a long run \underline{e} (\underline{e} means equilibrium). Firms will operate in the short run because AVC = 2q = \$50 < P = \$100. In the long run, exit will occur, & fewer firms \Rightarrow market supply decreases, $Q\downarrow$, & $P\uparrow$. For the long run ($\pi = 0$), P must = AC, which (since P = MR = MC for a π -maximizing price taker) only happens if MC = AC, which occurs at the minimum point of AC. To find the minimum pt. of AC, set MC = AC:

4q = 1800/q + 2q, or $q^2 = 900$, so q = 30.

Insert 30 into MC or AC to find MC = AC = 120---P in long run <u>e</u>.

<u>2</u>. |Slope_{isoquant}| = $\frac{MP_L}{MP_K}$ & |Slope_{isocost}| = $\frac{W}{r}$, so here |Slope_{isoquant}| = 1/5 & |Slope_{isocost}| = 2/5. Thus, the isocost line is steeper than the isoquant, so we are at point <u>a</u> in **Figure 1**. Since $\frac{MP_L}{MP_K} < \frac{W}{r}$, rearrange & find $\frac{MP_L}{W} = 1 < \frac{MP_K}{r} = 2$: spending \$1 more on K increases output by 2 units, & spending \$1 more on L increases output by 1 unit. Thus, spending \$1 more on K & \$1 less on L ⇒ Δq = 1 & ΔTC = 0: we move up TC₁ to the left from point <u>a</u>. As we continue to increase K & decrease L, MP_K↓ & MP_L↑ until $\frac{MP_L}{W} = \frac{MP_K}{r}$ --somewhere between points <u>a</u> & <u>c</u>, say at <u>b</u>.



<u>3</u>. From the information, $MP_X = 2MP_Y$. Suppose $P_X \& P_Y$ equal the prices of these inputs. Then if $\frac{P_X}{P_Y} = 2$, a firm is completely indifferent to how much X & Y it hires. If it takes 10 units of X or 20 units of Y to produce a given q, a firm could have X = 10 & Y = 0, X = 0 & Y = 20, X = 5 & Y = 10, etc.

- If $\frac{P_X}{P_Y} < 2$ ---even slightly---a firm will hire only X.
- If $\frac{P_X}{P_Y} > 2$ ---even slightly---a firm will hire only Y.
- <u>4</u>. Labor is much cheaper, even given productivity, in less developed countries. Producers in all countries want to hire inputs so $\frac{MP_L}{w} = \frac{MP_K}{r}$. A lower w, other things equal, implies $\frac{MP_L}{w} > \frac{MP_K}{r}$, so the producers where L is cheaper use more L & less K (than elsewhere) until $\frac{MP_L}{w} = \frac{MP_K}{r}$.
- 5. a) Other firms will compete for the superior manager now hired by X. The superior individual will be paid \$10,000 more than other managers, which means whoever hires the superior manager will have the same π as others---zero. Whether the superior manager lowers cost or raises revenue by \$10,000, this is offset by the higher salary paid this person. If this person is an owner/manager, & cannot be bid away from X, then the \$10,000 does not represent π . It is Ricardian rent.
 - b) If the \$10,000 in π for X is due to a superior production team, the π may remain if it is difficult to bid away the entire team.