

## Problem Set 7

### Profit Maximization and Supply

1. Suppose  $LTC(Q, w, r) = wrQ^2$ 
  - a. Find  $LMC(Q, w, r)$
  - b. Find the firm's supply function  $Q(P, w, r)$ .
  - c. Let  $w=2$  and  $r=2$  and  $P=4$ . What is the firm's profit maximizing level of production?

2.  $LMC(Q, w, r) = .5 (wrQ)^{1/2}$ . It currently faces  $w=4$ ,  $r=4$  and the price of output is  $P=17$ . It is currently producing 100 units/week. Should it increase production? Explain intuitively why or why not.

3. Suppose  $Q=L^{1/2}$  is the firm's production function. (It uses labor and no capital.) Suppose the wage rate is 4. What is its supply function?

4. If a firm's long run supply function is given by the formula  $Q^*(P, w, r) = [P/(w+r)]^{1/2}$ , what is the formula for its marginal cost function?

5. Is the condition

“Output price is greater than or equal to minimum short run average cost”

a **necessary condition** for a profit-maximizing firm to be willing to produce a positive level of output in the short run? Is it a **sufficient condition**? Explain.

6. A firm with production function  $F(L, K) = \min(L, K)$  faces input prices  $w=2$  and  $r=3$ . For what range of output prices (that is, from  $P=0$  to ??) would this firm want to shut down in the **long run**?

7. At current factor prices and given its current level of capital, a firm's short-run profit-maximizing level of output is  $Q^*=20$ , at which point it is losing money. If

$$SMC(Q^*, w, r, \bar{K}) = 5 \quad SAVC(Q^*, w, r, \bar{K}) = 8 \quad SAFC(Q^*, w, r, \bar{K}) = 9$$

what is the most you can say about its level of profits in the short run?

8. Consider a firm whose long run total cost function is given by

$$LTC(Q, w, r) = [Q^3 - Q^2 + Q]w^{1/2}r^{1/2}$$

At what value of **P**, the output price, is the firm just on the borderline between shutting down in the long run and producing in the long run? (Your answer may be expressed in terms of  $w$  and  $r$ .)

9.

- a. Draw the response of a **typical firm** to a **decrease** in Demand in a constant cost perfectly competitive industry. Show the response in the Very Short Run, the Short Run, and the Long Run.
- b. Draw the response of the **total market** to a **decrease** in Demand in a constant cost perfectly competitive industry. Show the response in the Very Short Run, the Short Run, and the Long Run.
- c. Explain the changes indicated by your graphs.

10.

- a. Suppose  $F(L, K) = 24L^{1/3}K^{1/3}$ . The output price,  $P$ , is 3\$ per unit and the factor prices,  $w$  and  $r$ , are \$16 and 2\$, respectively. What is the numerical value of the (unconstrained) demand for labor  $L(P, w, r)$ ?
- b. Explain the difference between Output Constrained Factor Demand Functions  $L(Q, w, r)$ ,  $K(Q, w, r)$  and (Unconstrained) Factor Demand functions  $L(P, w, r)$ ,  $K(P, w, r)$ .