

### Problem set 3

due Tuesday, October 12th by 9:30am

1. Suppose a chair manufacturer is producing in the short run (with its existing plant and equipment). The manufacturer has observed the following levels of production corresponding to different numbers of workers:

number of workers	number of chairs
1	10
2	18
3	24
4	28
5	30
6	28
7	25

- a. Calculate the marginal and average product of labor for this production function.
  - b. Does the production function exhibit diminishing returns to labor?
  - c. Explain intuitively what might cause the marginal product of labor to become negative.
2. Suppose you are the manager of a watchmaking firm operating in a competitive market. Your cost of production is given by  $C = 200 + 2q^2$ , where  $q$  is the level of output and  $C$  is total cost. (The marginal cost of production is  $4q$ ; the fixed cost is \$200.)
- a. If the price of watches is \$100, how many watches should you produce to maximize profit?
  - b. What will the profit level be?
  - c. What is the smallest the price can be for the firm to produce in the short-run? In the long-run?
3. A competitive firm has the following short-run cost function:  $C(q) = q^3 - 8q^2 + 30q + 5$ .
- a. Find  $MC$ ,  $AC$ , and  $AVC$ , and sketch them on a graph (hint:  $MC = 3q^2 - 16q + 30$ .)
  - b. At what range of prices will the firm supply zero output, in the short-run?
  - c. Identify the firm's supply curve on your graph.
  - d. At what price would the firm supply exactly 6 units of output?
4. Suppose that you are given the following information about a particular industry:

$$Q^D = 6500 - 100P \quad \text{Market demand}$$

$$Q^S = 1200P \quad \text{Market supply}$$

$$C(q) = 722 + \frac{q^2}{200} \quad \text{Each firm's total cost function}$$

$$MC(q) = \frac{2q}{200} \quad \text{Each firm's marginal cost function} \tag{1}$$

- a. Find the equilibrium price, the equilibrium quantity, the output supplied by the firm, and the profit of each firm.

- b.** Would you expect to see entry or exit from this industry in the long run? Explain. What effect will entry or exit have on market equilibrium?
- c.** What is the lowest price at which each firm would sell its output in the long run? Is profit positive, negative, or zero at this price? Explain.
- d.** What is the lowest price at which each firm would sell its output in the short run? Is profit positive, negative, or zero at this price? Explain.