

Homework 1, Solutions
Managerial Economics: Eco 685

Question 1

- a. When firms maximize profits, they benefit consumers by producing goods consumers want (as evidenced by their willingness to pay for those goods).
- b. When firms maximize profits, they generate income for stockholders and workers.

Question 2

Economic profits are zero in the long run because of competition. When economic profits are greater than zero, a firm is making a return above the market return. This will attract competition, which will drive prices down until eventually economic profits are zero.

Question 3

- a. No. The warehouse manager has an incentive to reduce inventory to zero, even if profitable sales are lost. Similarly, the sales force has an incentive to sell additional product even when it is very costly to produce the extra product, leading to negative profits.
- b. What happened in this case is the sales force sold a lot of product the firm did not have. This led to long delays in filling customer orders. Many irate customers ended up going elsewhere. Indeed no one was really happy under this system (see question 1): the sales force were upset at the lost customers (and lost commissions) and the warehouse manager was upset at suppliers who could not deliver the large orders on short notice required to keep inventories small. Another result was retail offices started keeping their own inventories by ordering large quantities of whatever the warehouse manager had in stock and then hoarding the goods in the back of the retail stores.

Question 4

Marginal revenue product is the additional *revenue* from an additional unit of an input (eg. an additional worker), while marginal product is the additional *production* from an additional unit of an input. Thus to maximize profits, we add additional inputs until the *marginal revenue product* equals the cost of adding another unit of the input. To maximize production, we add additional inputs until the *marginal product* equals zero, at which point additional workers do not add to the total quantity produced.

Question 5

- a. We maximize profits which are total revenues less total costs:

$$\pi = \max_L \$4 \cdot (4L - 0.25L^2) - \$6L \quad (1)$$

$$= \max_L \$16L - \$1L^2 - \$6L \quad (2)$$

The maximum is where the slope or derivative equals zero:

$$\frac{\partial \pi}{\partial L} = \$16 - \$2L - \$6 = 0 \rightarrow L = 5 \quad (3)$$

- b. We maximize profits with 5 workers. To compute the maximum profit, we plug 5 into the profit equation.

$$\pi(5) = \$16 \cdot 5 - \$1 \cdot 5^2 - \$6 \cdot 5 \quad (4)$$

$$\pi(5) = \$25 \quad (5)$$

- c. Recall we have two ways of computing the marginal revenue product. If we allow fractional workers (part timers) and are considering whether or not to increase L by a small amount, then we want to use the derivative, which measures the change in total revenue with a very small increase in L . In this case:

$$MRP = \frac{\partial TR}{\partial L} = \$16 - \$2L \quad (6)$$

$$MRP(6) = \$16 - \$2 \cdot 6 = \$4 \quad (7)$$

So the marginal revenue product is \$4, which is less than the marginal expenditure of \$6. Hiring the sixth worker would generate \$4 of revenue but increase labor costs by \$6 and would therefore lower profits. Thus we do not hire the sixth worker.

Alternatively, you can view this problem as going from 5 to 6 workers. In that case, we have more than a small change in the number of workers, so we need to directly compute the change in total revenue from a one unit increase in L .

$$MRP = \frac{\Delta TR}{\Delta L} = \frac{\$4 \cdot (4 \cdot 6 - 0.25 \cdot 6^2) - \$4 \cdot (4 \cdot 5 - 0.25 \cdot 5^2)}{6 - 5} \quad (8)$$

$$= \$4 \cdot (4 - 0.25 \cdot 11) = \$5 \quad (9)$$

So the MRP is \$5, which is still less than the ME of \$6, so we do not move from 5 to 6 workers.

d. We have:

$$Q = \max_L 4L - 0.25L^2 \quad (10)$$

$$\frac{\partial Q}{\partial L} = 4 - 0.5L = 0 \quad (11)$$

$$L = 8 \quad (12)$$

So although workers 6-8 cost more than they bring in in terms of revenue, they still produce something. Only when we increase above 8 workers do we see the deli so crowded that workers just get in each other's way and total production start to decline.

Question 6

The most straightforward answer is that the inputs are pipeline diameter and horsepower, and the output is throughput (barrels per day moved 1000 miles). Alternatively, one could state that the inputs are "metal" which is proportional to the diameter of the pipeline, and "pumps" the size of which is related to horsepower (a bigger pump motor is required for more horsepower).

Question 7

See the attached spreadsheet.