

Economics 308: Intermediate Microeconomics  
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Problem Set #4

1. John's Lawn Mowing Service is a small business that acts as a price taker ( $MR = P$ ). The prevailing market price of lawn mowing is \$20 per acre. John's costs are given by

$$TC = 0.1q^2 + 10q + 50$$
$$MC = 0.2q + 10$$

where  $q$  is the number of acres John chooses to cut a day.

- a. How many acres should John choose to cut in order to maximize profit?
  - b. Calculate John's maximum daily profit.
  - c. Graph these results and label John's supply curve.
2. Consider again the profit-maximizing decision of John's Lawn Mowing Service from problem 1. Suppose John's greedy father decides to charge John for the use of the family lawn mower.
- a. If the lawn mower charge is set at \$100 per week, how will this affect the acres of lawns John chooses to mow? What will his profits be? (Hint: the MC will not change).
  - b. Suppose that instead that John's father requires John to pay 50 percent of his weekly profits as a mower charge. How will this affect John's profit maximizing condition?
  - c. If John's greedy father imposes a charge of \$2 per acre for use of the family mower, how will this affect John's marginal cost function? How will it affect his profit-maximizing decision? What will his profits be now? How much will John's greedy father get?
  - d. Suppose finally that John's father collects his \$2 per acre by collecting 10 percent of the revenues from each acre John mows. How will this affect John's profit maximizing decision? Explain why you get the same result here as for part c.

3. Widgets International faces a demand curve given by

$$q = 10 - p$$

and has a constant marginal and average cost of \$3 per widget produced. For  $q = 1, 2, \dots, 9, 10$ , determine  $p$ ,  $TR$ ,  $MR$ ,  $MC$ ,  $AC$ ,  $TC$  and profit. Graph your results.

4. A firm faces a demand curve given by

$$q = 100 - 2p$$

Marginal and average costs for the firm are constant at \$10 per unit.

- a. What output level should the firm produce to maximize profits? What are profits at that output level?
- b. What output level should the firm produce to maximize revenues? What are profits at that output level?

- c. Suppose the firm wishes to maximize revenues subject to the constraint that it earns \$12 in profits for each of the 64 machines it employs. What level of output should it produce?
  - d. Graph your results.
5. Offer an example of both adverse selection and moral hazard in production. Discuss the related impact on market outcomes of each of these examples.
6. When there is asymmetric information regarding how hard workers work, equilibrium in the labor market may contain efficiency wages and involuntary unemployment. Explain. Why don't firms reduce wage they pay workers in response to the excess supply of labor?
7. A machine that costs 100 will yield returns of 30 at the end of each of the next 3 years, at which time it will be sold as scrap for 30. If the interest rate facing this firm is 10 percent (note that it does not change over time), should it purchase this machine? Now suppose the interest rate decreases by ten percent each year, should it purchase this machine?
8. Assume an individual expects to work for 40 years and then retire with a life expectancy of an additional 20 years. Suppose also that the individual's earning rise at a rate of 3 percent per year and that the interest rate is also 3 percent (the overall price level is constant in this problem). What (constant) fraction of income must the individual save in each working year to be able to finance a level of retirement income equal to 60 percent of earnings in the year just prior to retirement?
9. Suppose that a monopoly farmer of Wonder Grain must pay all of its costs of production in this year but that it must wait until next year to sell its output. Why would the farm's profit-maximizing output level be the level for which  $MR = MC(1 + r)$ ? Explain why this profit-maximizing condition takes all costs into account. Would this farmer produce more or less output if he or she could defer paying costs until next period? Explain why the firm should also hire any input, such as labor, up to the point at which  $MP_L = w^*(1 + r)$ .