

Economics 500: Microeconomic Theory  
State University of New York at Binghamton  
Department of Economics  
Fall, 2004

Problem Set #7

1. Explain why the assumption of cost minimization implies that the total cost curve must have a positive slope: An increase in output must always increase total cost.
2. A firm purchases capital and labor in competitive markets at prices of  $r = 6$  and  $w = 4$ , respectively. With the firm's current input mix, the marginal product of capital is 12 and the marginal product of labor is 18. Is this firm minimizing its costs? If so, explain how you know. If not, explain what the firm ought to do.
3. A widget manufacturer has an infinitely substitutable production function of the form
$$q = 2K + L$$
  - a. Graph the isoquant maps for  $q = 20$ ,  $q = 40$ , and  $q = 60$ . What is the MRTS along these isoquants?
  - b. If the wage rate ( $w$ ) is \$1 and the rental rate on capital ( $r$ ) is \$1, what cost-minimizing combination of  $K$  and  $L$  will the manufacturer employ for the three different production levels in part (a)?
  - c. How would your answer change to part (b) if  $r$  rose to \$3 with  $w$  remaining at \$1?
4. A stuffed-wombat manufacturer determined that the lowest average production costs were achieved when eight wombats were produced at an average cost of \$1,000 each. If the marginal cost curve is a straight line intersecting the origin, what is the marginal cost of producing the ninth wombat?
5. The long-run total cost function for a firm producing skateboards is
$$TC = q^3 - 40q^2 + 430q$$
where  $q$  is the number of skateboards per week.
  - a. What is the general shape of this total cost function?
  - b. Calculate the average cost function for skateboards. What shape does the graph of this function have? At what level of skateboard output does average cost reach a minimum? What is the average cost at this level of output?
  - c. Determine the marginal cost for skateboards, show that this marginal cost curve intersection average cost at its minimum value.
  - d. Graph the average and marginal cost curves for skateboard production.

6. Professor Smith and Professor Jones are going to produce a new introductory textbook. As true scientists, they have laid out the production function for the book as
- $$q = S^{1/2} J^{1/2}$$

where  $q$  is the number of pages in the finished book,  $S$  is the number of working hours spent by Smith and  $J$  is the number of hours spent working by Jones.

Smith values his labor as \$3 per working hour. He has spent 900 hours preparing the first draft. Jones, whose labor is valued at \$12 per working hour, will revise Smith's draft to complete the book.

- a. How many hours will Jones have to spend to produce a finished book of 150 pages? Of 300 pages? Of 450 pages?
  - b. What is the marginal cost of the 150<sup>th</sup> page of the finished book? Of the 300<sup>th</sup> page? Of the 450<sup>th</sup> page?
7. A firm producing hockey sticks has a production function given by

$$q = 2(KL)^{1/2}$$

In the short run, the firm's amount of capital equipment is fixed at  $K = 100$ . The rental rate for  $K$  is  $r = \$1$ , and the wage rate for  $L$  is  $w = \$4$ .

- a. Calculate the firm's short-run total cost curve. Calculate the short-run average cost curve.
- b. What is the firm's short-run marginal cost function? What are the SRTC, SRATC and SRMC for the firm if it produces 25 hockey sticks? Fifty hockey sticks? One hundred hockey sticks?
- c. Graph the SRATC and the SRMC curves for the firm. Indicate the points found in part (b).
- d. Where does the SRMC curve intersect the SRATC curve? Explain why the SRMC curve will always intersect the SRATC at its lowest point.