

Economics 308: Intermediate Microeconomics
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Problem Set #3

1. Roy Dingbat is the manager of a hot dog stand that uses only labor and capital to produce hot dogs. The firm usually produces 1,000 hot dogs a day with 5 workers and 4 grills. One day a worker is absent but the stand still produces 1,000 hot dogs. What does this imply about the 1,000 hot dog isoquant? What does this imply about Roy's management skills?
2. Marjorie Cplus wrote the following answer on her micro examination: "Virtually every production function exhibits diminishing returns to scale because my professor said that all inputs have diminishing marginal productivities. So when all inputs are doubled, output must be less than double." How would you grade Marjorie's answer?
3. Can a fixed-proportions production function exhibit increasing or decreasing returns to scale? What would its isoquant map look like in each case?

4. Digging clams by hand in Sunset Bay requires only labor input. The total number of clams obtained per hour (q) is given by

$$q = 100(L)^{1/2}$$

where L is labor input per hour.

- a. Graph the relationship between q and L .
 - b. What is the average productivity of labor in Sunset Bay? Graph this relationship and show that AP_L diminishes for increases in labor input.
 - c. Determine the marginal productivity of labor. Graph this relationship and show that $MP_L < AP_L$ for all values of L . Explain why this is so.
5. The production function for puffed rice is given by
$$q = 100(KL)^{1/2}$$
where q is the number of boxes produced per hour, K is the number of puffing guns used each hour, and L is the number of workers hired each hour.
 - a. Calculate $q = 1,000$ isoquant for this production function and show it on a graph.
 - b. If $K = 10$, how many workers are required to produce $q = 1,000$? What is the average productivity of puffed-rice workers?
 - c. Suppose technical progress shifts the production function to $q = 200(KL)^{1/2}$, answer part a and b for this case.
 6. 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.
 7. 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.

8. A widget manufacturer has an infinitely substitutable production function of the form
- $$q = 2K + L$$
- Graph the isoquant maps for $q = 20$, $q = 40$, and $q = 60$. What is the MRTS along these isoquants?
 - 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)?
 - How would your answer change to part (b) if r rose to \$3 with w remaining at \$1?

9. 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?

10. 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 $w = \$4$.

- Calculate the firm's short-run total cost curve. Calculate the short-run average cost curve.
- 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?
- Graph the SRATC and the SRMC curves for the firm. Indicate the points found in part (b).

Where does the SRMC curve intersect the SRATC curve? Explain why the SRMC curve will always intersect the SRATC at its lowest point.

11. 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.

- What is the general shape of this total cost function?
- 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?
- Determine the marginal cost for skateboards, show that this marginal cost curve intersection average cost at its minimum value.

Graph the average and marginal cost curves for skateboard production.

12. Suppose a firm's CRS production function requires it to use capital and labor in a fixed ratio of two workers per machine to produce 10 units and that the rental rates of capital and labor are given by $r = 1$, and $w = 3$. Calculate the firm's long run and short run total and average cost curves. What is the marginal cost of the 10th unit, the 25th unit, the 50th unit, and the 100th unit?