Homework Set #2 (Due Date: April 17th, 2025)

BTM 210, Microeconomics, Spring 2025

1. (PR 6.1) The menu at Joe's coffee shop consists of a variety of coffee drinks, pastries, and sandwiches. The marginal product of an additional worker can be defined as the number of customers that can be served by that worker in a given time period. Joe has been employing one worker but is considering hiring a second and a third. Explain why the marginal product of the second and third workers might be higher than the first. Why might you expect the marginal product of additional workers to diminish eventually?

2. (PR 6.2) 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 this production function exhibit diminishing returns to labor? Explain.

c. Explain intuitively what might cause the marginal product of labor to become negative.

3. (PR 6.7) The marginal product of labor in the production of computer chips is 50 chips per hour. The marginal rate of technical substitution of hours of labor for hours of machine capital is 1/4. What is the marginal product of capital?

4. (PR Questions for Review 7.6) Why are isocost lines straight lines?

5. (PR Questions for Review 7.10) If a firm enjoys economies of scale up to a certain output level, and cost then increases proportionately with output, what can you say about the shape of the long-run average cost curve?

6. (PR 7.1) Joe quits his computer programming job, where he was earning a salary of $50,000 per year, to start. He opens his own computer software business store in a building that he owns and was previously renting out for $24,000 per year. In his first year of business, he has the following expenses: mortgage, $18,000; salary paid to himself, $40,000; rent, $0; other expenses, $25,000. Find the accounting cost and the economic cost associated with Joe's computer software business.

7. (PR 7.10) A chair manufacturer hires its assembly-line labor for $30 an hour and calculates that the rental cost of its machinery is $15 per hour. Suppose that a chair can be produced using 4 hours of labor or machinery in any combination. If the firm is currently using 3 hours of labor for each hour of machine time, is it minimizing its costs of production? If so, why? If not, how can it improve the situation? Graphically illustrate the isoquant and the two isocost lines for the current combination of labor and capital and for the optimal combination of labor and capital.

8. (PR 7.11) Suppose that a firm's production function is $q = 10L^{11/2}K^{1/2}$. The cost of a unit of labor is $20, and the cost of a unit of capital is $80.

- **a.** The firm is currently producing 100 units of output and has determined that the cost-minimizing optimal quantities of labor and capital are 20 and 5, respectively. Graphically illustrate this using isoquants and isocost lines.
- **b.** The firm now wants to increase output to 140 units. If capital is fixed in the short run, how much labor will the firm require? Illustrate this point graphically and find the firm's new total cost.
- **c.** Graphically identify the optimal cost-minimizing level of capital and labor in the long run if the firm wants to produce 140 units.
- **d.** If the marginal rate of technical substitution is K/L, find the optimal level of capital and labor required to produce the 140 units of output.

9. (PR 8.4) 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.** At what minimum price will the firm produce a positive output?

10. (PR 8.8) 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.
- **b.** At what range of prices will the firm supply zero output?
- **c.** Identify the firm's supply curve on your graph.
- **d.** At what price would the firm supply exactly 6 units of output?