

**EC302 - INTERMEDIATE MICROECONOMICS**  
**Loyola University**  
**Fall 2016**

**Problem Set 3**  
**Discussion Due Date: November 8, 2016**

Answer all questions succinctly and thoroughly.

1. A steel plant's production function is  $Q = 0.025LK$ , where  $Q$  is the daily output rate,  $L$  is the number of workers it uses per day, and  $K$  is the unit of daily capital employment. According to this production function, the marginal products of capital and labor are, respectively,

$$MP_K = 0.025L$$

$$MP_L = 0.025K$$

Suppose that the price of labor is \$100 per worker per day, and that the price of capital is \$200 per unit per day.

- a. The firm's vice president for manufacturing hires you to figure out what combination of inputs the plant should use to produce 20 units of output per day. What advice would you give?
  - b. How much would it cost per day to produce this level of output?
  - c. Now suppose that the firm increases this plant's budget to \$120,000 a day and instructs the plant manager to produce as much steel as possible while not exceeding this budget. Again your advice is sought. How much capital and labor would you advise employing? How much output should the firm expect from this plant?
2. Suppose you are assured by the owner of a plant that his plant is subject to constant returns to scale, with labor and capital the only inputs. He claims that output per worker in his plant is a function of capital per worker only. Is he right? Prove.
3. Do the following production functions exhibit decreasing, constant or increasing returns to scale?
- a.  $Q = 0.5KL$
  - b.  $Q = 2K + 3L$

4. The production function for the personal computers of DISK, Inc., is given by

$Q = 10K^{0.5}L^{0.5}$ , where  $Q$  is the number of computers produced per day,  $K$  is hours of Machine time, and  $L$  is hours of labor input. DISK's competitor, FLOPPY, Inc., is using the production function  $Q = 10K^{0.6}L^{0.4}$ .

If both companies use the same amounts of capital and labor, which firm will generate more output?

5. A firm's production function for footballs is given by  $q = 4L^{1/2}K^{1/2}$ .

Answer the following questions with regard to the firm's output and costs. If the price of capital is 100, the price of labor is 1, and the firm has 4 units of capital, derive the firm's total cost, fixed cost, variable cost, average total cost, average fixed cost, average variable cost, and marginal cost functions.

(Remember, these cost functions express cost as a function of output,  $q$ , not labor).