

## Problem Set 6

***Instructions:*** Please write your answers on a separate sheet of paper, showing all necessary work. Upload a single PDF to the assignments folder in Brightspace. The problem set is worth a total of 10 points – 5 for completion and 5 for correctness of one (or more) question(s) selected by me.

1. A firm's production function is just a function of labor (there is no capital).  $F(L) = 100L - L^2$ .
  - a. What is the marginal productivity of labor at  $L=2$ ?
  - b. What is the average productivity of labor at  $L=2$ ?
  
2. A firm's production function is given by  $F(L,K) = L^2 + K$ .
  - a. What is the MRTS of the function?
  - b. Does this function exhibit diminishing MRTS?
  - c. Does this function exhibit increasing, decreasing, or constant returns to scale?
  
3. Suppose a production function is given by the equation  $Q = LK^{\frac{1}{2}}$ .
  - a. Graph the isoquants corresponding to  $Q=10$ ,  $Q=20$ , and  $Q=50$ .
  - b. Find the marginal Rate of Technical Substitution (MRTS).
  - c. Do these isoquants exhibit diminishing MRTS?
  - d. Does this production function exhibit constant, increasing or decreasing returns to scale?
  
4. Suppose the production function for hamburgers is characterized by  $Q = LK$ . If the wage is \$10 and rent is \$1, find the cost minimizing combination of labor and capital that will produce 121,000 hamburgers.
  
5. Suppose there are two inputs in the production function – labor and capital – and that these two inputs are perfect substitutes. The existing technology permits one machine to do the work of three persons. The firm wants to produce 100 units of output. Suppose that the price of capital is \$750 per machine per week and that the weekly salary of each worker is \$300.
  - a. Which combination of inputs should the firm use?
  - b. Suppose that a worker's weekly salary is \$225. Which combination of inputs should the firm use?
  
6. A firm produces a good with the production function  $Q = 10LK$ . Rent is \$4 and the wage is \$2. The firm is currently using  $K = 16$ . And just enough  $L$  to produce  $Q=320$ . How much could the firm save if it were to adjust  $K$  and  $L$  to produce in the least costly way? Graph the original input ratio with an isoquant and isocost curve, then show the optimal point on the same graph.