

Intermediate Microeconomics
Homework 3

1. For each of the following production functions, determine if the technology exhibits increasing, decreasing, or constant returns to scale.

- a. $f(L, K) = L + K$
- b. $f(L, K) = \sqrt{L} + \sqrt{K}$
- c. $f(L, K) = LK + L + K$
- d. $f(L, K) = \sqrt{KL} + L + K$

2. Draw isoquant maps for the following technologies.

- i) $f(L, K) = LK$
- ii) $g(L, K) = L + 2K$
- iii) $h(L, K) = \min(2L, K)$

3. Frisbees are produced according to the production function $q = 2K + L$ where q = output of frisbees per hour, K = capital input per hour, L = labor input per hour.

- a) If $K = 10$, how much L is needed to produce 100 frisbees per hour?
- b) If $K = 25$, how much L is needed to produce 100 frisbees per hour?
- c) Graph the $q = 100$ isoquant. Indicate the points on that isoquant defined in part a and part b. What is the RTS along this isoquant? Explain why the RTS is the same at every point on the isoquant.
- d) Graph the $q = 50$ and $q = 200$ isoquants for this production function also. Describe the shape of the entire isoquant map.
- e) Suppose technical progress resulted in the production function for frisbees becoming $q = 3K + 1.5L$. Answer part a through part d for this new production function and discuss how it compares to the previous case.

4. Consider the production function $f(L, K) = L + K$.

- a. Suppose K is fixed at 2. Find algebraic expressions for the total product of labor function $TP(L)$, the average product of labor $AP(L)$, and the marginal product of labor $MP(L)$.
- b. Graph the functions in part a.

5. A firm uses capital and labor to produce output according to the production function $q = 4\sqrt{KL}$, for which $MP_L = 2\sqrt{K/L}$ and $MP_K = 2\sqrt{L/K}$.

- a. If the wage $w = \$4$ and the rental rate of capital $r = \$1$, what is the least expensive way to produce 16 units of output?

- b. What is the minimum cost of producing 16 units?
- c. Show that for any level of output q , the minimum cost of producing q is $\$q$.
- d. Explain how a 10% wage tax would affect the way in which the firm chooses to produce any given amount of output