

The Digital Economist

Intermediate Microeconomics

Worksheet #4: **Production and Costs** Name: _____

1. Given the following data, complete the table below:

- $Q_x = 18L^2 - L^3$ -- Production Function
- $w = \$5.00$ -- Labor Costs/per unit
- $FC = \$100.00$ -- Fixed Costs of Production

L	Q _x	AP _L	MP _L	VC	FC	TC	ATC	MC	Stage of Production
0									
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									

- a. How many units of labor would you hire if your goal is to minimize average total costs (ATC)? _____
- b. Differentiate the production function to derive an equation for the marginal productivity of labor (MP_L):
- c. Derive an expression for the average productivity of labor (AP_L):
- d. Find the quantity of labor input where average productivity is a maximum (i.e., where AP_L = MP_L):
- e. Find the quantity of labor input (to be hired) if your goal is to maximize profits given a market price (P_x) = \$0.08/unit. What is the dollar amount of profits in this case?

2. Given the following production function:

$$Q_x = 30L^2 - 2L^3$$

a. Derive the Average Product and Marginal Product functions:

b. Given a wage rate of \$48.00 per unit of labor, derive the average variable cost function and compute average variable costs for 8 units of labor. What is the corresponding level of output for this quantity of labor input?

c. Using a market price of \$0.50/unit and the above wage rate of \$48.00, derive and differentiate the profit function with respect to labor (assuming that labor is the only factor of production) and find the profit maximizing amount of labor input.

3. Given the following Cobb-Douglas production function:

$$Q_x = 10L^{0.80}K^{0.20}$$

a. Does this production technology exhibit *Increasing/ Constant/ or Decreasing* returns to scale? _____ Explain:

b. Derive the average product function of labor:

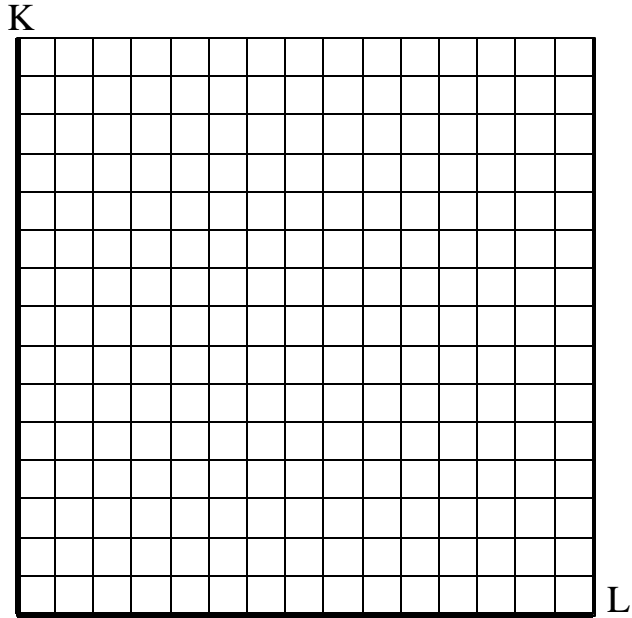
c. Partially differentiate the above production function to find the marginal productivity of labor (MP_L) and Capital (MP_K). Holding one input constant, does this production function exhibit *diminishing/constant/or increasing* marginal productivity _____

d. Calculate the output elasticity of labor input :

4. Given the following production function:

$$Q_x = KL$$

a. Plot production isoquants for $Q=24$, $Q=36$, $Q=48$, & $Q=72$.



b. Does this production function exhibit: *Increasing/ Constant/ or Decreasing* returns to scale? _____

c. If the cost function is defined by:

$$C = 3L + 12K$$

find the optimal amount of labor and capital for 36 units of output:

d. By how much will costs increase if output is doubled to 72 units? _____ Do costs also double? _____ Explain: