**Chapter Five**

**The Production Process**

1. A firm can manufacture a product according to the production function

Q = F(K,L) = K3/4L1/4

a. Calculate the average product of Labor, APL, when the level of capital is fixed at 16 units and the firm uses 16 units of labor. How does the average product of labor change when the firm uses 16 units of labor. How does the average product of labor change when the firm uses 81 units of labor?

b. Find an expression for the marginal product of labor, MPL, when the amount of capital is fixed at 16 units. Then, illustrate that the marginal product of labor depends on the amount of labor hired by calculating the marginal product of labor for 16 and 81 units of labor.

c. Suppose the capital is fixed at 16 units. If the firm can sell its output at a price of $100 per unit and can hire labor at $25 per unit, how many units of labor should e firm hire in order to maximize profits?

2. A firm’s product sells for $2 per unit in a highly competitive market. The firm produces output using capital (which it rents at $75 per hour) and labor (which is paid a wage of $15 per hour under a contract for 20 hours of labor services). Complete the following table and use that information to answer the questions that follow.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| K | L | Q | MPK | APK | APL | VMPK |
| 0 | 20 | 0 |  |  |  |  |
| 1 | 20 | 50 |  |  |  |  |
| 2 | 20 | 150 |  |  |  |  |
| 3 | 20 | 300 |  |  |  |  |
| 4 | 20 | 400 |  |  |  |  |
| 5 | 20 | 450 |  |  |  |  |
| 6 | 20 | 475 |  |  |  |  |
| 7 | 20 | 475 |  |  |  |  |
| 8 | 20 | 450 |  |  |  |  |
| 9 | 20 | 400 |  |  |  |  |
| 10 | 20 | 300 |  |  |  |  |
| 11 | 20 | 150 |  |  |  |  |

a. Identify the fixed and variable inputs.

b. What are the firm’s fixed cost?

c. What is the variable cost of producing 475 units of output?

d. How many units of the variables input should be used to maximize profits?

e. What are the maximum profits this firm can earn?

f. Over what range of the variable input usage do increasing marginal returns exist?

g. Over what range of the variable input usage do decreasing marginal returns exist?

h. Over what range of input usage do negative marginal returns exist?