University of Notre Dame
Department of Finance
Economics of the Firm
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Self Assessment Quiz #2:

1) Consider the following production function (capital is fixed in this example):

Labor Hours	Quantity	MPL	APL	Elasticity
1	10	10	10	1
2	20	10	10	1
3	25	5	8.3	.60
4	28	3	7	.43
5	30	2	6	.33

a) Calculate marginal product of labor, average product of labor, and the elasticity of production with respect to labor.

Recall,

$$MPL = \frac{\Delta Q}{\Delta L}$$

$$APL = \frac{Q}{L}$$

$$\varepsilon = \frac{MPL}{APL}$$

See chart above for solutions.

b) What value for the elasticity of production with respect to labor is associated with the maximum value for average product?

An elasticity of 1 corresponds to the maximum value for APL.

2) Suppose that you have the following production function:

$$Q = \sqrt{KL}$$

Assume that capital (K) is fixed at 4. The price of capital 1s $100 per unit and labor costs $20 per hour. You have a production target of 20.

a) Calculate the number of labor hours required to meet your production target.

We know that capital is equal to 4 and that total production is 20. We can solve for Labor

$$20 = \sqrt{4L}$$
$$400 = 4L$$
$$L = 100$$

b) Calculate your total cost of producing 20 units.

Total costs will be capital plus labor costs.

$$TC = \$100K + \$20L = \$100(4) + \$20(100) = \$2400$$

c) Calculate your average cost of producing 20 units.

$$AC = \frac{TC}{Q} = \frac{\$2400}{20} = \$120$$

d) Calculate your marginal cost of producing and additional unit (There are several ways to do this, but you can think about it this way: how much labor would you require to accomplish that and then how much your costs increase would?).

$$MC = \frac{w}{MPL}$$

We first need to figure out how much labor would be needed to produce one more unit of output (i.e. repeat part (a) with Q = 21)

$$21 = \sqrt{4L}$$
$$441 = 4L$$
$$L = 110.25$$

Therefore, we would need to hire 10.25 more hours of labor at a cost of $20 per hour. (note: 10.25 is 1/MPL)

MC = $20*10.25 = 205

e) Given you answers to (c) and (d), are average costs increasing or decreasing?

If MC > AC, then AC is increasing.

3) Suppose that you observe the following data with regards to your production process:

$MP_L = 20$
$MK_K = 40$
$w = 10$
$P_K = 25$

Given this data, is your production process too capital intensive or to labor intensive (i.e. to lower costs would you use more labor or less)? Explain.

If we were to increase output slightly by hiring more labor, our MC would be

$$MC = \frac{w}{MP_L} = \frac{10}{20} = .5$$

If we were to increase output slightly by hiring more capital, our MC would be

$$MC = \frac{P_k}{MP_k} = \frac{25}{40} = .625$$

Given that the marginal cost of production from capital is higher than that from labor, we should scale back capital and increase labor.