The following problems are found in the Hirschey text at the end of chapter 7 (pp276 – 280):

1. P7.1 B-E
2. P7.2 B - E
3. P7.3

Answers:

7.1B: calculating marginal product (MP), average product (AP), and marginal revenue product (MRP) is straightforward.

7.1C: Using the answers derived in 8.1B, the MRP of the 3rd unit of y = 138 and that of the 4th unit = 114. At a cost of $120 per unit, only 3 units of y should be employed (the firm’s costs rise more than its revenue rises if the 4th unit of y is employed).

7.1D: For the input combination to be optimal, it must be the case that the relative price of x in terms of y equals the marginal rate of substitution: \( \frac{P_x}{P_y} = \frac{MP_x}{MP_y} \).
Since the input prices are the same, \( \frac{P_x}{P_y} = 1 \) which tells us that to obtain 1 more unit of x, the firm must sacrifice (not employ) one more unit of y. But the first unit of x (assuming Qy is fixed at 3) yields MPx = 162 while the 3rd unit of y used (assuming Qx is fixed at 1) yields MPy = 32. Hence MRS = 162/32 = 5.06 > 1 = Px/Py. This tells us that the current input mix is not optimal. Moreover, it tells us that the last unit of x was 5.06 times as productive as the last unit of y although it was just as costly – meaning the firm is employing too much y and not enough x.

Another way to see this is to look at the marginal product per dollar spent on the last unit of each input (MP/P). The last dollar spent on x yields \( \frac{MP_x}{P_x} = \frac{162}{120} = 1.35 \) units of output while the last dollar spent on y yields \( \frac{MP_y}{P_y} = \frac{32}{120} = 0.267 \) units of output. For the marginal money spent, x is more productive at the margin and the firm should employ more x and less y.

Indeed, if the firm employs Qx = 2 and Qy = 2 (1 less unit of y and 1 more unit of x), the firm can increase its output to 188 units while incurring the same costs.

7.1E: When the firm employs 1 unit of x and 1 unit of y, it gets 94 units of output. Using this input combination as the benchmark, note that a doubling of both inputs yields a doubling of output, a tripling of both inputs yields a doubling of output, and so on. Therefore the production function exhibits constant returns to scale.

7.2 B-E
B. True: This is simply the definition of decreasing returns
C. False: L-shaped isoquants suggests that the factors are perfect complements.
D. False: MRP merely shows the change in revenue when an input is used in increasing amounts. It reflects nothing about costs and, therefore, profit margins.
E. False: consider two factors, skilled and unskilled labor (S and U respectively). Suppose that initially MP_S = 200 and MP_U = 20. Therefore the marginal rate of technical substitution of skilled labor is MP_S / MP_U = 200/20 = 10. At the margin, skilled labor is 10 times as productive as unskilled labor meaning the firm finds one skilled worker to be “worth” 10 skilled workers in the production process.

Now suppose the marginal productivity of both types of workers doubles. So MP_S = 2*200 = 400 and MP_U = 2*20 = 40. But the MRTS remains at 10: a skilled worker is “worth” 10 unskilled workers in the production process.

Generally speaking, suppose that MP_S = \alpha and MP_U = \beta. Therefore the marginal rate of technical substitution of skilled labor is MP_S / MP_U = \alpha/\beta. Now suppose both marginal product values change by a factor of x. Therefore MP_S = x\alpha and MP_U = x\beta. Therefore the marginal rate of technical substitution of skilled labor is MP_S / MP_U = x\alpha/x\beta = \alpha/\beta.

P7.3 According to the theory of resource demand, when profits are maximized factors are paid an amount equal to their MRP. MRP, marginal revenue product, is the change in revenue when an additional unit of a resource is employed. Since MRP = MR*MP, anything that alters MR or MP will alter MRP. Things that do not change MR or MP will not affect MRP.

Moreover, what constitutes “payment” does not merely include wages/salaries. It could include the value of fringe benefits or other things of value.

a. government-mandated health insurance does not alter MRP but it does change how workers will be compensated. Therefore we would expect wages to fall although overall compensation (wages + health insurance) would not change. What’s changed is the composition of compensation, not the amount.

b. Since MP has increased, MRP has necessarily increased. Since workers generate more revenue at the margin, they can receive higher wages.

c. same as b above.

d. a lower price means that MRP has fallen, meaning less money available for pay.

e. like “a”, the uniform stock options will not affect worker productivity* or MR. They will, therefore, not alter MRP. Since uniform stock options are a different type of payment, the amount of money left over for wages falls.