Micro Theory: Exam Two Answers
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1. Below are six economic concepts (*i* – *vi*) that can all be graphed. Below the six concepts are eight descriptions (A – H). To the right of each concept, list all descriptions that apply to that concept. Each description can be used more than once, and a concept may be associated with more than one description (and possibly many more than just one description). Each concept is associated with at least one description, but some descriptions might not apply to any of the concepts

Concepts:

- *i*. Isoquants A, E
- *ii*. Isocost Lines A, B, E
- *iii*. Marginal Product of Labor F, H
- *iv*. Short-run Total Cost Function D, F, G
- *v*. Short-run Average Variable Cost Function D, F
- *vi*. Short-run Average Fixed Cost Function D, E, F

Descriptions:

- A. Typically graphed with labor on the x-axis and capital on the y-axis.
- B. Constant slope in the typical case.
- C. Has a zero slope when profits are maximized.
- D. Typically graphed with quantity on the x-axis and dollars on the y-axis.
- E. Negatively sloped in the typical case.
- F. Assumes capital (or at least one factor of production) is being held fixed.
- G. Positively sloped in the typical case.
- H. Can be used to determine when labor exhibits diminishing returns.

2. Consider a standard two-good economy and answer the following questions.

A. In a two-good economy, if good one is normal and good two is inferior, is it true that the two goods must then behave like substitutes when the price of good one falls? (You may find it useful to think about income and substitution effects and/or to include a graph.)

$p_1 \downarrow \;\rightarrow$ S.E.: $x_1 \uparrow$ and $x_2 \downarrow$.
I.E.: $x_1 \uparrow$ and $x_2 \downarrow$ as real income $\uparrow$ and x_1 is normal while x_2 is inferior.

Thus, when $p_1 \downarrow$ and x_2 is inferior, we have that $x_1 \uparrow$ and $x_2 \downarrow$, which is required for substitutes. Thus, the statement is true in that the two goods must behave like substitutes when the price of good one falls.

B. In an economy with two normal goods, suppose the price of good one doubles at the same time the price of good two increases by eighty percent. How will the consumer adjust her consumption of the two goods? Explain in terms of income and substitution effects.

First, both prices $\uparrow$, so real income must $\downarrow$. Second, the price of good two increases less than the price of good one. Letting the original prices be denoted by p_1 and p_2, then the new price ratio is $2p_1 / 1.8p_2$ which is greater than p_1 / p_2. Thus, relative price have changed to make good one relatively more expensive than good two. Thus, we have:
S.E.: Good one is relatively more expensive $\rightarrow$ $x_1 \downarrow$ and $x_2 \uparrow$.
I.E.: Real income has fallen $\rightarrow$ $x_1 \downarrow$ and $x_2 \downarrow$.
The total effect, therefore, is that $x_1 \downarrow$ for sure, and we are unclear if $x_2 \uparrow$ or $\downarrow$.

3. Suppose beets are produced in a perfectly competitive industry. The price of each 10 pound bag of beets is \$1.80. A typical farmer's yearly cost function in dollars is

$$C(q) = 180{,}000 + 0.3q + 0.000002q^2$$

where q is the number of 10 pound bags of beets the farmer producers during the year. Given this cost function, the marginal cost for each bag of beets is $MC(q) = 0.30 + 0.000004q$. For the current year, the farmer is in the short-run.

   A. How many bags of beets should the farmer make during the year? How much profit does the farmer earn for the year?

      $MR(q^*) = MC(q^*)$
      $1.80 = 0.30 + 0.000004q^*$
      $1.50 = 0.000004q^*$
      $q^* = 375{,}000$ bags of beets

      $R(q^*) = p \times q^* = \$1.80 \times 375{,}000 = \$675{,}000$
      $C(q^*) = 180{,}000 + 0.3(375{,}000) + 0.000002(375{,}000)^2 = \$573{,}750$
      $\pi(q^*) = R(q^*) - C(q^*) = \$675{,}000 - \$573{,}750 = \$101{,}250.$

   B. Suppose instead that the farmer's fixed costs are \$680,000. How many bags of beets should the farmer make during the year? How much profit does the farmer earn for the year?

      All that has changed from part A is that fixed costs have increased by \$500,000. As fixed costs do not affect marginal revenue or marginal cost, q^* will be the same, and all that will change is the actual profit calculation. Thus, $q^*= 375{,}000$ bags of beets and $\pi(q^*) = \$101{,}250 - \$500{,}000 = -\$398{,}750$. The firm stays open in the short-run, because it recuperates its variable costs. Put differently, if this firm would shut-down, it would lose \$680,000 rather than just the \$398,750 it loses by staying open in the short-run.

4. Suppose volleyballs are produced in a perfectly competitive market. In 2003, the market for volleyballs was in long-run equilibrium wherein the price of each volleyball was \$5 and two million volleyballs were produced each year by forty firms producing 50,000 balls each. Then, in the summer of 2004, Misty May and Kerri Walsh won the gold medal in women's beach volleyball for the U.S.A. As a result, volleyball became very popular throughout the country (and will continue to remain popular).

   A. What would you expect to happen to the price of volleyballs, total quantity of volleyballs sold, the number of volleyballs produced by each volleyball-making firm, and the number of volleyball-making firms in the short-run. (You may wish to include a graph or two.)

      From the notes, we know that the increase in demand will cause price to increase above \$5 per ball in the short-run. Each firm will make more than 50,000 volleyballs (say 75,000), and the total number of volleyballs made will increase to more than two million (say to three million). The number of volleyball-making firms will not change in the short-run, as entry is prohibited in the short-run.

B. What would you expect to happen to the price of volleyballs, total quantity of volleyballs sold, the number of volleyballs produced by each volleyball-making firm, and the number of volleyball-making firms in the long-run. Be as precise as possible. (You may wish to include a graph or two.)

In the long-run, new firms will enter the industry and compete the newly realized short-run profits away. Thus, the number of volleyball-making firms will increase. This competition will drive the price of a volleyball back to $5 per ball. Each firm will return to making 50,000 volleyballs, but the total number of volleyballs sold in the marketplace will increase to even more than in part A (say, to even more than three million).

5. Suppose a firm's production function is:

$$q = f(K,L) = 40 \min \{ \tfrac{1}{2} K , \tfrac{1}{3} L \}.$$

Factor markets are competitive in which each unit of labor sells for $20 and each unit of capital sells for $50. (Parts D & E are on the backside of this piece of paper.)

A. Describe the production function in words.

The production function stipulates that every two units of capital and three units of labor combine to make 40 units of output.

B. What is the marginal rate of transformation?

MRT = $-w / r$ = - $20 / $50 = -0.40.

C. How much capital and labor should the firm manager employ if she is told by the board of directors to produce 10,000 units of output?

To make 40 units of output, the firm must employ 2 units of capital and 3 units of labor. Thus, in order to make 10,000 units of output, the firm must duplicate this process 250 times as 250 x 40 = 10,000. So, in order to make 10,000 units of output, the firm must employ 500 units of capital and 750 units of labor.

D. Suppose the firm can sell each unit of output at a price of $9. How much profit does the firm earn if its only costs are capital and labor?

$$\begin{aligned} \text{Profit} = pq - wL - rK &= \$9(10{,}000) - \$20(750) - \$50(500) \\ &= \$90{,}000 - \$15{,}000 - \$25{,}000 \\ &= \$50{,}000 \end{aligned}$$

E. Does the firm face increasing, constant, or decreasing returns to scale? Explain how you know.

This production function exhibits constant returns to scale as:

$$\begin{aligned} f(\lambda K, \lambda L) &= 40 \min \{ \tfrac{1}{2} \lambda K , \tfrac{1}{3} \lambda L \} \\ &= 40\lambda \min \{ \tfrac{1}{2} K , \tfrac{1}{3} L \} \\ &= \lambda f(K, L). \end{aligned}$$