

Please ensure that you include your full name at the upper portion of this page. Carefully review all the instructions and write your answers in space provided. To receive maximum credit, it is imperative that you show all your work.

SECTION I: MULTIPLE CHOICE QUESTIONS (40 POINTS)

1. (5 points) Which of the following best describes increasing returns to scale in production?
 - a. Output more than doubles when all inputs are doubled
 - b. Output exactly doubles when all inputs are doubled
 - c. Output less than doubles when all inputs are doubled
 - d. Output decreases when all inputs are doubled

2. (5 points) If the marginal product of x_1 is 16 and the marginal product of x_2 is 64, does the firm use the cost-minimizing combination of x_1 and x_2 when the price of x_1 is \$2 and the price of x_2 is \$8?
 - a. Yes, because the slope of the indifference curve equals the slope of the isocost line.
 - b. No, because the marginal product of x_1 does not equal the marginal product of x_2 .
 - c. Yes, because the additional output per dollar value from input x_1 equals the additional output per dollar value from input x_2 .
 - d. Uncertain, because additional information about the conditional factor demands $x_1^*(y)$ and $x_2^*(y)$ is required.

3. (5 points) Consider a production function given by $f(x) = (x_1x_2)^2$. If $x_2^0 = 1$, which of the following statements accurately describes the behavior of MP_1 ?
 - a. MP_1 is decreasing in x_1 .
 - b. MP_1 is increasing in x_1 .
 - c. MP_1 is constant in x_1 .
 - d. The behavior of MP_1 cannot be determined from the given information.

4. (5 points) The inverse production function with one input and two outputs is $x = y_1^2 + y_2^2 + y_1y_2$. Assume the price of x is $w = \$1$. If $p_1 = \$1$ and $p_2 = \$2$, what is the firm's profit?
 - a. -\$2
 - b. -\$1
 - c. \$0
 - d. \$1
 - e. \$2

5. (5 points) Suppose the production function is $f(x) = x^2$. Which statements correctly describe the relationship between $MP(x)$ and $AP(x)$?
 - a. $MP(x)$ is increasing and above $AP(x)$.

- b. $MP(x)$ is decreasing and above $AP(x)$.
 - c. $MP(x)$ is increasing and below $AP(x)$.
 - d. $MP(x)$ is decreasing and below $AP(x)$.
6. (5 points) A firm's production function is $f(x_1, x_2) = 10x_1^{0.5}x_2^{0.5}$. The price of x_1 is \$10 and the price of x_2 is \$5. In the short run x_2^0 is fixed. If the firm is using 16 units of x_1 in the short run and is producing 200 units of output, what is the firm fixed cost? (You can assume that the firm is maximizing profit.)
- a. \$25
 - b. \$100
 - c. \$125
 - d. \$160
 - e. \$185
7. (5 points) Along a given isoquant,
- a. both the combination of inputs and the producer's total cost of production remain the same.
 - b. the combination of inputs remains the same.
 - c. the combination of inputs remains the same but the level of output varies.
 - d. the combination of inputs varies but the level of output remains the same.
8. (5 points) In a perfectly competitive market, the long-run market supply curve for a representative firm is
- a. vertical.
 - b. horizontal.
 - c. upward-sloping.
 - d. downward-sloping.

SECTION II: LONG ANSWER QUESTIONS (60 POINTS)

1. (20 points) Suppose a firm's production function is $y = x_1^{0.5}x_2^{0.5}$. The cost of x_1 is \$8 per unit and the cost of x_2 is \$2 per unit.

a. (2 points) Does the production function exhibit constant, increasing, or decreasing returns to scale? *Use numerical example to show your work.*

b. (6 points) What are the cost-minimizing conditional factor demands $x_1^*(y)$ and $x_2^*(y)$?

c. (4 points) Use your answer in part (b) to find the long-run cost function for this firm ($C(y)$).

d. (2 points) Using your answer in part (c), is $MC(y)$ constant, increasing, or decreasing in y .

e. (6 points) Suppose this firm wants to produce 100 units of output. Using your answer in part (b), how many units of x_1 and x_2 will be needed? Plot the cost-minimizing combination inputs on a graph. *Label your graph correctly.*

2. (40 points) Suppose there is a perfectly competitive market for headphones where all the stores are identical with identical cost curves. Furthermore, suppose that a representative store's total cost of production is given by the equation $C(y_i) = 100 + y_i^2 + y_i$ where y_i is the quantity of headphones produced by store i . You also know that the market for headphones is given by the equation $p = 1000 - 2Q$ where Q is the market quantity.
- a. (5 points) If the market price of headphone is $p = \$400$, how many headphones will each store sell?
- b. (5 points) Given your answer in part (a) and the information provided, what is each store's profit?
- c. (5 points) Based on your answer in part (b), is this a short-run or long-run equilibrium? Explain your answer.

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- d. (5 points) Given your answer in part (c), what do you anticipate will happen in this market in the long-run?
- e. (5 points) In this market, what is the long-run equilibrium quantity and price for a representative store to produce?
- f. (5 points) Given the long-run equilibrium quantity and price you calculated in part (e), how many stores are in the market?

Now, consider another scenario where technology advancement changes the cost function of each representative store. The market demand is still the original one. The new cost function is $C(y_i) = 50 + 0.5y_i^2 + y_i$.

g. (5 points) What will be the new long-run equilibrium price? Is it higher or lower than the original? Why?

h. (5 points) In the long-run given this technological advance, how many stores will there be in the market? Is it higher or lower than the answer you found in part (f)? Why?

i. (2 points bonus) What is producer surplus? Show your work.