Intermediate Microeconomic Theory
ECN 100B (Section A), Fall 2019

Professor Brendan Price

Midterm Exam #1

Name: _____

ID number: _____

- Write your answers on the exam itself, using only the space provided for each question.
  - If you run out of space for a given question, write "see extra space" in the space provided for that question, then finish your answer on the extra graded pages. Make sure to write the problem number. You may lose credit if we can't tell which question you're answering.
  - We've also included ungraded scrap pages for pure scrap work. Answers written on these ungraded pages will not be graded under any circumstances.
- You must show your work on every question that requires a calculation. We will award partial credit as appropriate. Correct results without adequate work will receive little or no credit.
- Simplify all mathematical expressions as much as possible.
- The exam is graded out of 50 points. Each question is worth the indicated number of points.
- You will have 80 minutes. You must drop your pen/pencil immediately when time is up.
- As a reminder: UC Davis has a strict code of Academic Conduct. Any violations, including copying or attempting to copy from another student, will result in a score of 0.
- Good luck!

Do not turn this page until I tell you to start.

1. **True or false (10 points total)**

Indicate whether each of the following statements is true or false. Provide a brief explanation (1–3 sentences) justifying your answer.

a. (2 pts.) Allowing a firm to engage in price discrimination (if it chooses to do so) can sometimes reduce its profits.

b. (2 pts.) In an optimization problem with one choice variable, the solution to the first-order condition is always the optimal choice.

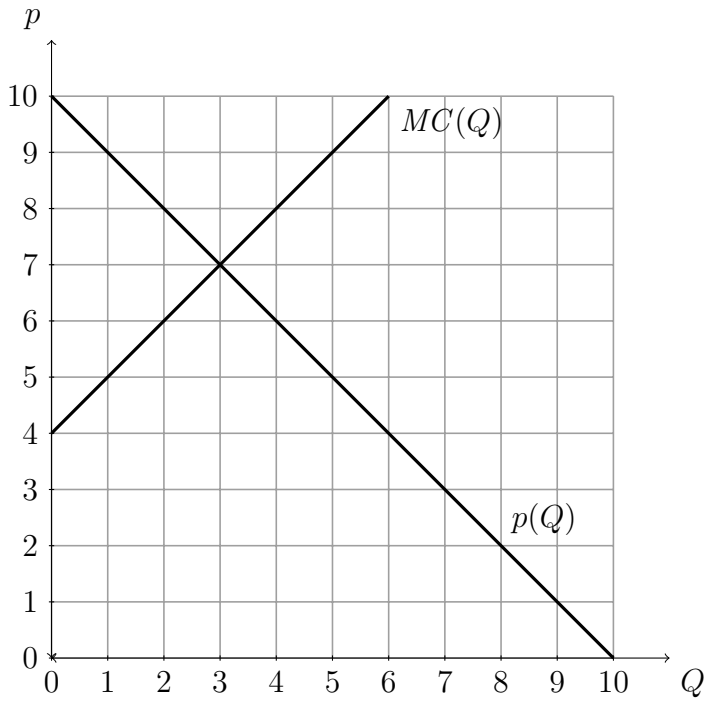
c. (2 pts.) Boeing produces aircraft using a combination of labor (L) and capital (K). If the cost of renting capital goes up ($r \uparrow$), Boeing might reduce its demand for labor ($L^* \downarrow$).

d. (2 pts.) If a car dealership engages in perfect price discrimination, it sells a car to everyone who has positive willingness to pay.

e. (2 pts.) Sometimes imposing a price cap increases total surplus.

2. **Graphical questions (10 points total)**

Fill in the blanks using the graph below. (You do not need to show your work here.)



a. Suppose that the market shown above is perfectly competitive.

   i. (2 pts.) The equilibrium price is _____. The producer surplus is _____.

   ii. (1 pt.) If producers have to pay a $2 tax for each unit sold, the DWL is _____.

b. Now suppose that the market shown above represents perfect price discrimination.

   i. (1 pt.) The firm sells to anyone with a reservation price between _____ and _____.

   ii. (1 pt.) The total revenue from the firm's sales is _____.

c. Now suppose that the market shown above represents a uniform-pricing monopoly.

   i. (2 pts.) The monopoly quantity is _____. The monopoly profit is _____.

   ii. (1 pt.) At the monopoly's optimal price, the markup equals _____.

   iii. (1 pt.) We can get the monopoly to produce the competitive quantity by setting a price $\underbrace{\text{\_\_\_\_\_}}_{\text{(floor or ceiling)}}$ equal to _____.

   iv. (1 pt.) Total *revenue* is maximized at the point where $Q =$ _____ units.

3. **Scraping by (10 points total)**

Sunil runs a pizzeria, which faces demand given by $p(Q) = 20 - \frac{1}{2}Q$. His variable costs are $VC(Q) = 10Q$. He has already paid a fixed cost $FC = 120$ to enter the market.

a. (3 pts.) Compute the elasticity of demand as a function of Q. For what value of Q are consumers least price-sensitive? For what value of Q is demand unit elastic?

b. (5 pts.) Suppose that Sunil is a uniform-pricing monopolist.

i. Write Sunil's profits as a function of Q. (Include the fixed cost.)

ii. Assuming he stays in business, what quantity (Q_m) and price (p_m) will he choose?

iii. If his fixed cost is (100%) recoverable, will he stay in business or exit?

iv. If his fixed cost is (100%) sunk, will he stay in business or exit?

c. (2 pts.) Sunil takes ECN 100B, studies hard, and learns how to perfectly price discriminate.

i. Assuming he stays in business, how many pizzas will he sell (Q^*)?

ii. If he can recover 50% of his fixed costs, will he stay in business or exit?

4. **Cheap talk (4 points total)**

In each of the following cases, find the cheapest combination of labor and capital needed to produce 1 unit of output. (L and K don't have to be integers: for example, L^* could equal $\frac{3}{2}$.) Also state whether labor and capital are perfect substitutes, perfect complements, or neither.

a. (2 pts.) $q(L, K) = \sqrt{LK}$, with $w = 2$, $r = 32$

b. (2 pts.) $q(L, K) = \min\{3L, 2K\}$, with $w = 4$, $r = 6$

5. **Not *another* Starbucks... (6 points total)**

Starbucks produces coffee according to the production function $q(L) = 8\sqrt{L}$. It's a price-taker in the product market, at price $p = 10$, and a wage-taker at wage $w = 10$.

a. (2 pts.) Compute the marginal physical product of labor in terms of L. Then compute the marginal revenue product of labor.

b. (2 pts.) Find the profit-maximizing choice of labor L^*. Then compute Starbucks's profits.

c. (2 pts.) Suppose that Starbucks is deciding whether to enter this market. If it enters, it must pay a fixed cost $FC = 40$. What is the smallest value of p for which Starbucks enters?

6. **Tutor time (10 points total)**

Jo runs a tutoring agency that tutors students both in-person ("good 1") and online ("good 2").

- Demand for in-person tutoring is given by $p_1(Q_1) = 24 - 3Q_1$.
- Demand for online tutoring is perfectly elastic, given by $p_2 = 12$.
- Jo can provide any combination of the two goods at a cost $C(Q_1, Q_2) = (Q_1 + Q_2)^2$.
- Jo must charge all in-person customers the same price.

a. (3 pts.) Write Jo's profits as a function of Q_1 and Q_2. What is $MR_1(Q_1)$? What is $MR_2(Q_2)$?

b. (3 pts.) Find Q_1^*, Q_2^*, and p_1^*.

c. (2 pts.) Suppose that p_2 increases. How will this affect Q_1^*, Q_2^*, and p_1^*? (Indicate whether each outcome increases, decreases, or stays the same. To receive credit, you must get all three comparative statics correct. You don't have to show your work on this part.)

d. (2 pts.) Now suppose Jo has to charge in-person and online customers the same price p. Find all profit-maximizing prices p^*. (There may be only one, but there may be two.)

EXTRA GRADED PAGE #1: DO NOT TEAR OFF

If you need to use this extra space:

- On the exam itself, write "see extra space" next to the relevant question(s).
- On this page, clearly indicate which question(s) you are answering.

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