Econ 311 - Intermediate Microeconomics
Final Exam

University of Oregon

June 11, 2025

Version 1 Answer Key

Give every question your best shot. Fear is the mind-killer.

Name: ______________________ 95#: ______________

You have a total of 1h 50min (110 minutes) to complete the exam.
The only items allowed on your desk at any time are pens/pencils, scratch paper, a 3x5 note card, and a calculator. Everything else must be stored in your bag underneath your desk.
If you need to use the bathroom during the exam, leave your phone on the table in the front of the classroom. Please wait until there are no phones currently on the table before you go to the bathroom.
Any form of cheating will result on a zero on the exam.

There are three sections to be completed:

- Multiple Choice: 10 Questions (worth 3 points each)
- Short-Answer Questions: 4 Questions (worth 10 points each)
- Multi-Part Analysis Questions: 1 Question (worth a total of 30 points)

Point totals and question specific instructions are listed for each section. Please ask for clarification if a question is not clear to you.

The exam is a total of 9 pages. Please verify you have all 9 in your exam. If you do not, let me know immediately.

Multiple Choice

Question 1. (3 P.)
What type of returns to scale does the production function $F(L, K) = L^{2/5}K^{1/5}$ feature?

a) increasing
b) constant
c) decreasing
d) not enough information

Question 2. (3 P.)
Suppose a firm with the production function $F(L, K) = L^2K^3$ is currently using 10 machines and 10 workers ($K = L = 10$). If the amount of labor decreases by 1 worker, how much **Capital** (approximately) would have to be added to keep the original level of production?

a) 2 machines
b) 1/2 machine
c) 3 machines
d) 2/3 machine

Question 3. (3 P.)
Currently, a firm with a cost function of $C(q) = \frac{1}{3}q^3$ is producing 10 units in a perfectly competitive market in which the market price is \$10 per unit. Is the firm producing *too much*, *too little*, or are they *profit-maximizing?*

a) Too much
b) Not enough information
c) Profit-maximizing
d) Too little

Question 4. (3 P.)
What is the **average total cost function** for a firm with the cost function $C(q) = 3q^3 + 6q^2 - 10q + 18$?

a) $3q^3 + 6q^2 - 10q$
b) $9q^3 + 12q^2 - 10$
c) $3q^2 + 6q^1 - 10 + 18/q$
d) $18/q$

Question 5. (3 P.)
How do monopolistic markets compare to perfectly competitive markets?

a) monopolies lead to higher price and higher quantity
b) monopolies lead to higher price and lower quantity
c) monopolies lead to lower price and lower quantity
d) monopolies lead to lower price and higher quantity

Answers: 1: **c**, 2: **d**, 3: **a**, 4: **c**, 5: **b**

Question 6. (3 P.)
For a **monopolist** with a marginal cost function of $C(Q) = 9Q^2$ who faces a market demand curve of $P = 20 - Q$, solve for their profit-maximizing quantity.

a) 1/2
b) 20
c) 2
d) 1

Question 7. (3 P.)
Imagine a short-run market made up of 10 firms who each have an individual supply curve of $q_s = 1/5P$. If the demand curve is $Q_D = 100 - 8P$, what is the market equilibrium price?

a) $P^* = 8$
b) $P^* = 1/5$
c) $P^* = 2$
d) $P^* = 10$

Question 8. (3 P.)
Which of the following would cause the short-run supply curve to shift **outward**?

a) Decrease in input prices
b) Increase in input prices
c) Decrease in number of firms
d) Increase in consumer incomes

Question 9. (3 P.)
If firms are producing *above* the minimum of their **average total cost** curve, what will happen in the **long-run**?

a) Existing firms will *exit* the market and drive the price **up**
b) New firms will *enter* the market and drive the price **up**
c) New firms will *enter* the market and drive the price **down**
d) Existing firms will *exit* the market and drive the price **down**

Question 10. (3 P.)
Which type of competition has firms compete on *price-setting* instead of *quantity-setting*?

a) Cournot
b) Monopoly
c) Bertrand
d) Stackelberg

Answers: 6: **d**, 7: **d**, 8: **a**, 9: **c**, 10: **c**

Short Answer

Question 11. (10 P.)
Imagine a firm with the cost function $C(Q) = \frac{1}{3}Q^3 - 270Q + 55$. Currently, the firm can sell its product for a price of \$30. What is the short-run profit maximizing quantity?

Price taking firm's profit is maximized when $P = MR = MC$:

$$\begin{aligned} 30 &= \frac{3}{3}Q^{3-1} - 270 \\ 30 + 270 &= Q^2 \\ Q^2 &= 300 \\ Q^S &= \sqrt{300} \approx \underline{17.32} \end{aligned}$$

Question 12. (10 P.)
Consider the behavior of a monopolist firm with no competitors. Suppose the demand curve they face is $P = 550 - Q$ where the single firm sets the entire market quantity supplied, Q. Also, for simplicity suppose that the firm's marginal cost is zero dollars per unit produced.

- Derive the monopolist firm's **marginal revenue** function.
- Use this to **solve for maximum amount of profit** (in dollars) they could earn.

Marginal revenue comes from the derivative of total revenue:

$$\begin{aligned} TR &= (550 - Q) \cdot Q \\ MR &= 550 - 2Q \end{aligned}$$

Monopolist profit maximized when $MR = MC$:

$$\begin{aligned} 550 - 2Q &= 0 \\ 550 &= 2Q \\ Q_M^S &= 550/2 = \underline{275} \end{aligned}$$

Use the monpolist's optimal quantity to solve for their max profit:

$$\begin{aligned} \pi_M^* &= (550 - (275)) \cdot 275 \\ &= \underline{75625} \end{aligned}$$

Question 13. (10 P.)

Consider a car assembly line that produces Q cars by combining robotic arms K, and human workers, L using the following production function:

$$Q = f(K, L) = K \cdot L$$

Suppose that each robotic arm costs \$60 per hour to rent and that each human worker is paid an hourly wage of \$15.

What is the cheapest combination of K and L to assemble $Q = 4$ cars per hour?

You could set up this way:

$$\frac{MP_L}{MP_K} = \frac{w}{r}$$
$$\Rightarrow \frac{K}{L} = \frac{15}{60}$$

Then plug in $K = \frac{1}{4}L$ into $K \cdot L = Q$:

$$4 = (\frac{1}{4}L) \cdot L$$
$$\Rightarrow L^* = 4$$
$$\Rightarrow K^* = \frac{1}{4}(4) = 1$$

Another correct way to solve:

$$\frac{MP_K}{MP_L} = \frac{r}{w}$$
$$\Rightarrow \frac{L}{K} = \frac{60}{15}$$

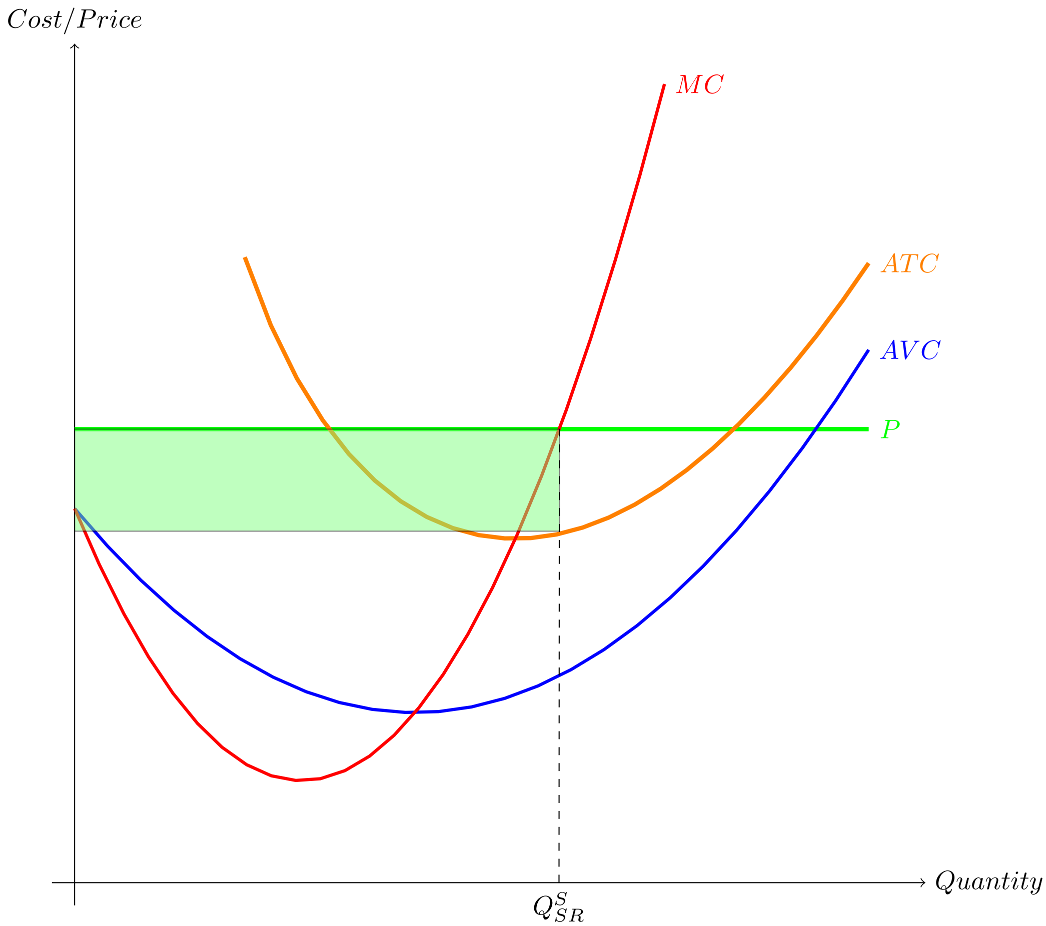
Then plug in $L = 4L$ into $K \cdot L = Q$:

$$4 = (4K) \cdot K$$
$$\Rightarrow K^* = 1$$
$$\Rightarrow L^* = 4$$

The cost minimizing bundle is **4 workers** and **1 robot**.

Question 14. (10 P.)
Consider the production decision of a firm who's production costs are represented by the marginal cost MC, average variable cost AVC, and average total cost ATC curves below.

- Suppose that in the **short-run**, the perfectly competitive market price is at a level represented by the horizontal line labelled P. Illustrate how much quantity the firm will produce in the short run on the graph.
- Now explain what will happen to this market in the **long-run** if firms are allowed to enter or exit. Use the graph to explain your answer.



- The profit maximizing level of quantity supplied in the short run Q^S_{SR} is where $P = MR$ intersects MC.
- In the short-run here, the firm's $MR > ATC$, so their profits are **positive**.

  On the graph this is the shaded rectangle which has a height of $P - ATC$ and a width of Q^S_{SR}. In the long-run other firms would **enter** until the price was driven **down** to the minimum of the ATC and all firms would be earning zero profit.

Long Answer

Question 15. (30 P.)
In this question, we will look at the different outcomes when two firms compete against each other. There are firm 1 and firm 2 and they have identical marginal cost functions of $MC_1(q) = MC_2(q) = 4q + 16$. Assume that the goods produced by each firm are identical and they both face the demand curve $P = 136 - Q^D$. The total market quantity supplied is equal to the sum of firm 1 and firm 2's production: $Q^S = q_1 + q_2$

(a) (8 P.) First, solve for what would happen in the market if both firms act as **price-takers**. Solve for the total market supply curve under this assumption and use it to find the P^* and Q^* in this 'perfect competition' equilibrium.

If neither firm can affect the price, they take it as a constant in their marginal revenue:

$$P = 4q + 16$$
$$\Rightarrow \frac{P-16}{4} = q$$

The total quantity supplied depends on the price and can be used to find the supply curve:

$$Q^S = \frac{P-16}{4} + \frac{P-16}{4}$$
$$Q^S + 8 = \frac{2P}{4}$$
$$P = 2Q^S + 16$$

So the equilibrium quantity can be found at the intersection of the supply and demand curves:

$$136 - Q^D = 2Q^S + 16$$
$$136 - 16 = 3Q$$
$$Q^*_{PC} = \underline{40}$$
$$P^*_{PC} = \underline{96}$$

(b) (4 P.) How likely do you think that the predicted market price and quantity will occur if these are the only firms in this market and there are high fixed costs which prevent any other firms entering the market.

Justify your answer based on what we have discussed in the second half of this class.

Answers may vary but should include some discussion of one of the models of imperfect competition from class.
For example, the price-taking equilibrium may be more likely if firms have to bid on prices (Bertrand model). In that model, if neither firm has an advantage in marginal costs, then they could both arrive at a Nash equilibrium in which they bid exactly their marginal cost because they know that any bid above that can be undercut by their rival.
Alternatively, the price-taking equilibrium may be unlikely if firms can bid on quantities like in Cournot or Stackelberg models.
These firms may be able to collude and jointly set their quantities as if they were a monopoly, although this depends on how much they trust each other and how much they care about sustaining the cooperative outcome in the future.

Now consider a Cournot duopoly model with the same two firms competing based on quantities.

(c) (3 P.) Write out the profit function for firm 1 based on their own production strategy q_1 as well as their rival firm's quantity q_2. Assume that they have to choose q_1 at the same time that firm 2 sets q_2.

$$\pi_1(q_1, q_2) = (136 - q_1 - q_2)q_1 - (\frac{4}{2}q_1^2 + 16q_1)$$

I made this prompt more confusing than I meant to. If they used the Marginal Cost instead of the Total cost function in the profit here, give them credit if they get the answer in red.

$$\pi_1(q_1, q_2) = (136 - q_1 - q_2)q_1 - (4q_1 + 16)$$

Grading Note: Anything of the form $\pi = P \cdot q - C(q)$ is correct as long as the student states in math or in writing that the total market Q is the sum of both firms' individual q (alternatively that the market price depends on both firm's quantity).

(d) (4 P.) Use your answer from part (c) to derive a best-response rule that tells firm 1 how much q_1 they should produce as a function of q_2.

$$\frac{\delta\pi}{\delta q_1} = 0 \Rightarrow 136 - 2q_1 - q_2 = 4q_1 + 16$$
$$\Rightarrow 6q_1 = 120 - q_2$$
$$BR_1(q_2) = \frac{120 - q_2}{6}$$

$$q_2 = \frac{132 - q_1}{2}$$

Grading Note: Give partial credit if the setup of taking the partial derivative of the profit from part (a) with respect to q_1 is there. Some students will probably get lost in the algebra of isolating q_1 on one side of the equation, but try to give them most of the points if they explain what they are trying to solve for (which is q_1 as a function of q_2).

(e) (3 P.) What is firm 2's best response rule?

You could go through the same process as part (d), or you could just say that because the firms have the same marginal cost functions and revenue structure, that the game is symmetric.
So,

$$BR_2(q_1) = \frac{120 - q_1}{6}$$

$$q_2 = \frac{132 - q_1}{2}$$

(f) (8 P.) Use your best response functions to solve for a Nash equilibrium in the simultaneous Cournot competition game.

A Nash equilibrium is where the best response rules intersect:

$$
\begin{aligned}
q_1 &= \frac{120 - (\frac{120-q_1}{6})}{6} \\
6q_1 &= 120 - (\frac{120 - q_1}{6}) \\
\frac{36q_1 - q_1}{6} &= 120 - 20 \\
35q_1 &= 600 \\
q_1^* &= \frac{600}{35}
\end{aligned}
$$

Then plug in $q_1^* = \frac{600}{35}$ into $BR_2(q_1^*)$:

$$q_2^* = BR_2(q_1) = \frac{120 - \frac{600}{35}}{6}$$

So the Nash equilibrium of this game is:

$$\{q_1^* = 600/35,\ q_2^* = 600/35\}$$

As a decimal, $600/35 \approx 17.1$

$$\{q_1^* = 44,\ q_2^* = 44\}$$

Grading Note: Final answer can be expressed in fractions or rounded decimal. Give full credit if the quantities are within one or two tenths of the correct answer. There are lots of ways to get lost in the algebra here, but the student should be able to use what they know about Cournot from class to see that the total of $q_1 + q_2$ should be less than the Q_P^*C they found in part (a). Give most of the points if it seems like the student understands the set-up and intuition of the model and only algebra mistakes held them back from finding the correct answer.