

Intermediate Microeconomics: 2020, Sec. H

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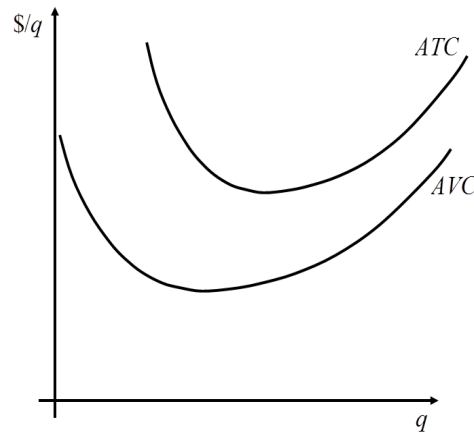
Name: _____

Exam 2

Always show your work and/or provide explanation for your answers. (I need to know how you arrived at the correct answer. In parts where I say “explain” or “show work” or “justify your answer” stating just the correct answer without any further explanation will not earn you a full credit.)

[These answers do not include pictures you were supposed to draw – I show only calculations here, but pictures are straight forward.]

Problem 1. On the picture below you see a cost structure of a firm operating in the competitive market. The firm is making zero economic profit.



First copy the picture into your answer booklet. Then answer the following questions:

a) (3 pts) On the picture are these long-run or short-run cost curves? Explain.

Answer: These are short-run curves. In the long-run $AC = AVC$. In other words there are only variable costs in the long run.

b) (3 pts) Find the market price and the quantity produced. Please mark them on the graph (above) as p^* and q^* . Justify your answer.

Answer: Since the firm is making zero economic profit the price is determined by the intersection of MC and AC . We know that MC intersects AC at the

“bottom of the valley” (the lowest point) of the AC curve. Therefore, p^* is equal the lowest value on the AC curve. q^* is the corresponding quantity produced.

c) (3 pts) What is the lowest price at which the firm would still keep producing (and not shut down)? Please mark it on the graph as p^{sd} . Explain.

Answer: A competitive firm in the short-run shuts down when it cannot cover its operating expenditures (variable costs). Therefore, the shut-down price p^{sd} is equal the lowest value on the AVC curve.

Problem 2. Suppose that in the short-run there are 12 identical firms in the market. Each firm has a cost function:

$$C(q) = 18 + 2q^2.$$

The market demand function is:

$$Q = 60 - p.$$

a) (3 pts) Write down and draw the inverse supply curve of an individual firm.

Answer: Supply curve is the portion of the MC that lies above the AVC curve

$$AVC(q) = 2q.$$

The marginal cost is:

$$MC(q) = 4q.$$

Because $4q \geq 2q$ then $MC \geq AVC$, the inverse supply curve is the same as $MC(q)$:

$$p = 4q.$$

b) (3 pts) Write down the market inverse supply curve.

Answer: First realize that the market supply curve is the sum of the supply curves of all firms in the market. The supply curve of an individual firm is:

$$q = p/4.$$

Multiplying by 12 one gets the market supply Q :

$$Q = 12 \times p/4 = 3p.$$

The inverse market supply is

$$p = Q^{sr}/3.$$

c) (3 pts) Draw the market inverse demand and inverse supply functions and write down the short-run competitive market price p^{sr} and quantity Q^{sr} ?

Answer: Market quantity is determined by the intersection of market (inverse) demand and (inverse) supply.

$$\begin{aligned} 60 - Q^{sr} &= Q^{sr}/3 \\ 180 - 3Q^{sr} &= Q^{sr} \\ Q^{sr} &= 45 \end{aligned}$$

Market price is

$$\begin{aligned} p^{sr} &= 60 - Q^{sr} = 60 - 45 \\ &= 15. \end{aligned}$$

For parts d) and e) suppose the market is in the long-run.

d) (3 pts) What is the long-run competitive market price and quantity?

Answer: In the long-run all firms make zero profits. This means that the price has to equal the lowest value on the AC curve. The AC curve is:

$$AC(q) = \frac{18}{q} + 2q.$$

Minimizing this by setting its derivative to zero

$$\begin{aligned} -\frac{18}{q^2} + 2 &= 0 \\ \hat{q}^2 &= 9 \\ \hat{q} &= 3. \end{aligned}$$

This means the long-run competitive market price is:

$$p^{lr} = AC(3) = 12.$$

The long-run quantity is:

$$\begin{aligned} p^{lr} &= 60 - Q^{lr} \\ 12 &= 60 - Q^{lr} \\ Q^{lr} &= 48. \end{aligned}$$

e) (3 pts) How many firms produce in the long-run competitive market?

Answer: In part d) we have calculated that each firm produces 3 units and therefore there are

$$48/3 = 16$$

firms in the market.

Problem 3. A monopolist faces a market demand $q = 60 - p$.

a) (3 pts) What is the lowest possible price that could be charged by a profit-maximizing monopolist that is in business (and not shut down)? Explain.

Answer: The lowest possible price is where elasticity of demand is equal to 1:

$$\begin{aligned}\varepsilon_D &= 1 = \left| \frac{1}{\text{slope}} \frac{p(q)}{q} \right| = \left| -1 \frac{60 - q}{q} \right| \\ q &= 30.\end{aligned}$$

or where $MR = 0$ for a firm with zero costs

$$\begin{aligned}MR(q) &= \frac{d[(60 - q)q]}{dq} = 60 - 2q = 0 \\ q &= 30.\end{aligned}$$

For the next three parts below suppose the monopolist's cost function is $C(q) = 100 + 2q^2$.

b) (3 pts) Please calculate and show on the graph: optimal output q^M .

Answer: First calculate marginal revenue.

$$MR(q) = \frac{d[(60 - q)q]}{dq} = 60 - 2q.$$

Calculate marginal cost

$$MC(q) = 4q.$$

Optimality condition implies that

$$\begin{aligned}MR(q^M) &= MC(q^M) \\ 60 - 2q &= 4q \\ q^M &= 10.\end{aligned}$$

c) (3 pts) Please calculate and show on the graph: profit π^M .

Answer: Optimal price is

$$p^M = 60 - q^M = 60 - 10 = 50.$$

The revenue is

$$p^M \times q^M = 50 \times 10 = 500.$$

The cost of production: first we calculate the $MC(q^M) = MC(10) = 60 - 2q^M = 60 - 2 \times 10 = 40$. Then,

$$C(q^M) = C(10) = (MC(q^M) \times q^M)/2 = (40 \times 10)/2 = 200.$$

The profit from operations is:

$$500 - 200 = 300$$

less fixed cost:

$$300 - 100 = 200.$$

d) (3 pts) Please clearly show on the graph (no need to calculate): dead-weight loss. Please explain how you found it.

Answer: It is the difference between in the outcome of the would-be competitive market and the monopoly market. The total surplus under the would-be competitive market is the triangular area between the (inverse) demand curve and the marginal cost curve for $0 \leq q \leq 12$. The total surplus under monopoly is the area between the (inverse) demand curve and the marginal cost curve for $0 \leq q \leq 10$. The difference is the triangular area between the (inverse) demand curve and the marginal cost curve for $10 \leq q \leq 12$. This is marked on the picture.