Practice Final Exam Answer Key (Problems)

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12. Suppose you are a restaurant operating in the very competitive high-end restaurant market in downtown Frederick. You have a cost structure as follows, where q is hundreds of premium meals served per day.

$$\begin{aligned} C(q) &= 4q^2 + 8q + 36 \\ MC(q) &= 8q + 8 \end{aligned}$$

a. **Write the equations for (i) fixed costs, (ii) variable costs, (iii) average fixed costs, (iv), average variable costs, and (v) average (total) costs.**

Cost	Equation
Fixed Costs	\$f=18
Average Fixed Costs	$AFC(q) = \frac{36}{q}$
Variable Costs	$VC(q) = 4q^2 + 8q$
Average Variable Costs	$AVC(q) = 4q + 8$
Average (Total) Costs	$AC(q) = 4q + 8 + \frac{36}{q}$

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b. **The market price of premium meals is currently \$40. Calculate the profit-maximizing quantity of meals to serve.**

Because the industry is competitive, $Demand = MR(q) =$ market price of \$40.

The profit-maximizing quantity is always where:

$$\begin{aligned} MR(q) &= MC(q) \\ 40 &= 8q + 8 \\ 32 &= 8q \\ 4 &= q^* \end{aligned}$$

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c. **At the profit-maximizing quantity, calculate the average cost.**

$$\begin{aligned} AC(q) &= 4q + 8 + \frac{36}{q} \\ AC(4) &= 4(4) + 8 + \frac{36}{4} \\ AC(4) &= 16 + 8 + 9 \\ AC(4) &= \$33 \end{aligned}$$

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d. **At the profit-maximizing price and quantity, calculate the total profit. Should your restaurant stay or exit the market in the long run?**

$$
\begin{aligned}
\pi &= [p - AC(q)]q \\
\pi &= [40 - 25]9 \\
\pi &= 15(9) \\
\pi* &= \$135
\end{aligned}
$$

Since your firm is earning profits, it should stay the long run.

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e. **Below what price should you stop production in the short run?**

The shut down price is where:

$$
\begin{aligned}
MC(q) &= AVC(q) \\
8q + 8 &= 4q + 8 \\
8q &= 4q \\
q &= 0
\end{aligned}
$$

At an output of 0, the MC or AVC is (using MC):

$$
\begin{aligned}
MC(0) &= 8(0) + 8 \\
MC(0) &= \$8
\end{aligned}
$$

The shutdown price is \$8.

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f. **What is the lowest price you need to charge in order to break even?**

The breakeven price is where:

$$
\begin{aligned}
MC(q) &= AC(q) \\
8q + 8 &= 4q + 8 + \frac{36}{q} \\
8q &= 4q + \frac{36}{q} \\
4q &= \frac{36}{q} \\
4q^2 &= 36 \\
q^2 &= 9 \\
q &= 3
\end{aligned}
$$

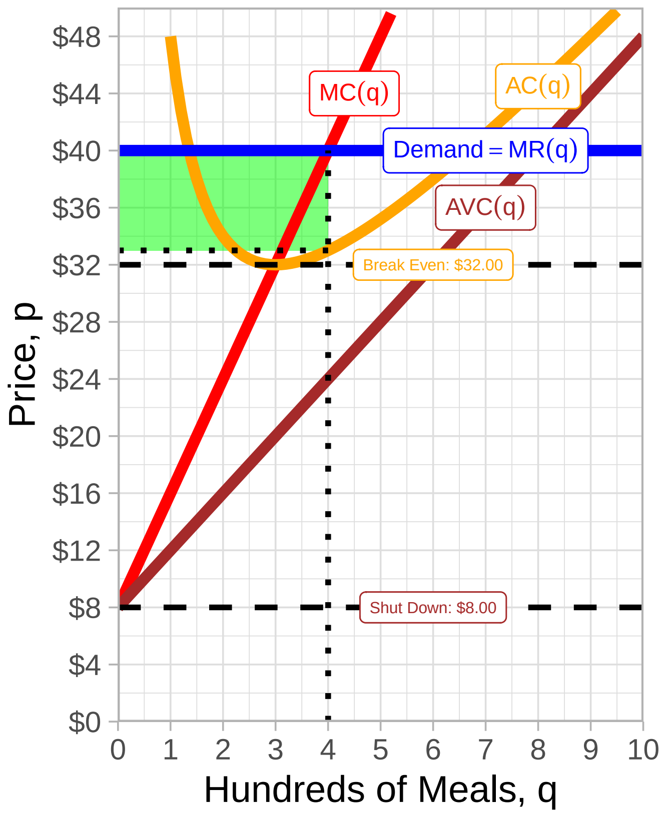
At an output of 3, the MC or AC is (using MC):

$$
\begin{aligned}
MC(3) &= 8(3) + 8 \\
MC(3) &= \$32
\end{aligned}
$$

The breakeven price is \$32.

g. **What must the long run equilibrium market price be for this industry, and why?**

As this is a competitive industry, in the long run, profits must fall to zero. This would imply a price that is equal to (the minimum of the) average cost (curve), i.e. the break-even price, which is \$32. Thus, the market equilibrium price will ultimately settle at \$32.



13. *Tweed Screeds* is publisher of obscure academic books. It has the following cost structure, where q is hundreds of copies:

$$C(q) = 2q^2 + 100q + 200$$
$$MC(q) = 4q + 100$$

It estimates that market demand for its new book release is estimated to be:

$$q = 17.5 - 0.125p$$

a. **Calculate the profit-maximizing quantity of copies and price per copy.**

To find the quantity, we set marginal revenue equal to marginal cost, but we first need to find marginal revenue.

Recall if we know inverse demand, we can simply double the slope. So in fact, we first need to take demand and solve it for p to get inverse demand:

$$\begin{aligned} q &= 17.5 - 0.125p \\ q + 0.125 &= 17 \\ 0.125p &= 17 - q \\ p &= 140 - 8q \end{aligned}$$

Now we know marginal revenue is then

$$MR(q) = 140 - 16q$$

So now we can find q^* by setting

$$\begin{aligned} MR(q) &= MC(q) \\ 140 - 16q &= 4q + 100 \\ 140 &= 20q + 100 \\ 40 &= 20q \\ 2 &= q^* \end{aligned}$$

Next, we need to find the price. Since it has market power, the firm raises the price all the way to demand (Max WTP) at q^*:

$$\begin{aligned} p &= 140 - 8q \\ p &= 140 - 8(2) \\ p^* &= \$124 \end{aligned}$$

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b. **Calculate the publisher's total profits.**

We can take total revenues minus total costs, or our usual $\pi = [p - AC(q)]q$. I'll do the latter so you can see it on the graph. First, find the function for average cost, and then find average cost at $q^* = 2$:

$$
\begin{aligned}
AC(q) &= 2q + 100 + \frac{200}{q} \\
AC(2) &= 2(2) + 100 + \frac{200}{(2)} \\
AC(2) &= 4 + 100 + 100 \\
AC(2) &= \$204
\end{aligned}
$$

Now plug in:

$$
\begin{aligned}
\pi &= [p - AC(q)]q \\
\pi &= [124 - 204]2 \\
\pi &= [-80]2 \\
\pi &= -\$160
\end{aligned}
$$

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c. **Should this publisher stay or exit the industry in the long run?**

Since it is earning losses, it should exit in the long run.

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d. **What is the lowest price it would need to charge in order to break even?**

We know a firm breaks even when $p = AC$, and the lowest part of the average cost curve is at the quantity where:

$$
\begin{aligned}
AC(q) &= MC(q) \\
2q + 100 + \frac{200}{q} &= 4q + 100 \\
2q + \frac{200}{q} &= 4q \\
\frac{200}{q} &= 2q \\
200 &= 2q^2 \\
100 &= q^2 \\
10 &= q
\end{aligned}
$$

At an output of 0, the MC or AC is (using MC):

$$
\begin{aligned}
MC(10) &= 4(10) + 100 \\
MC(0) &= \$140
\end{aligned}
$$

The breakeven price is $140.

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e. **Should it shut down production in the short run?**

We need to find the average variable cost function first, which is $AVC(q) = 2q + 100$, and set it equal to MC to find the breakeven price:

$$
\begin{aligned}
AVC(q) &= MC(q) \\
2q + 100 &= 4q + 100 \\
2q &= 4q \\
q &= 0
\end{aligned}
$$

At an output of 0, the MC or AVC is (using MC):

$$
\begin{aligned}
MC(0) &= 4(0) + 100 \\
MC(0) &= \$100
\end{aligned}
$$

The shutdown price is \$100.

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f. **Calculate how much of the publisher's price is markup above cost.**

We'll use the Lerner index, which needs the profit maximizing price, and the marginal cost at the profit-maximizing quantity, which we need to find first:

$$
\begin{aligned}
MC(q) &= 4q + 100 \\
MC(2) &= 4(2) + 100 \\
MC(2) &= 108
\end{aligned}
$$

Now plug this into the lefthand side of the Lerner index equation:

$$
\begin{aligned}
L &= \frac{p^* - MC(q^*)}{p^*} \\
L &= \frac{124 - 108}{124} \\
L &= \frac{16}{108} \\
L &\approx 0.15
\end{aligned}
$$

About 15% of the price is markup above marginal cost (despite the fact the firm is still losing money!)

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g. **Estimate the elasticity of demand for this book at the price you found in part a.**

We can simply find elasticity using the righthand side of the Lerner index equation:

$$
\begin{aligned}
L &= -\frac{1}{\epsilon} \\
0.15 &= -\frac{1}{\epsilon} \\
0.15\epsilon &= -1 \\
\epsilon &\approx -6.67
\end{aligned}
$$

Demand is relatively elastic. For every 1% the price rises (falls), consumers will buy 6.67% less (more).