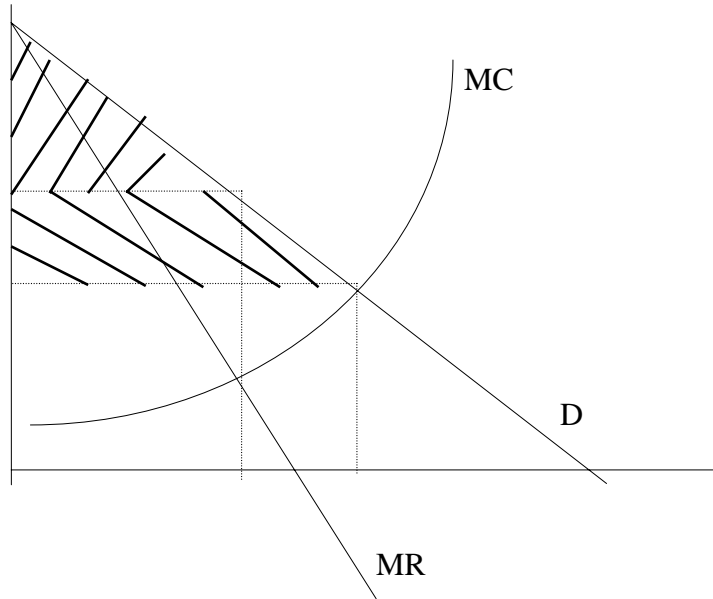



Problem Set #8, Solutions
Econ 2106H, J.L. Turner

1. A monopolist produces where $MR = MC$ in order to maximize profit.
- 2.



 = region of CS when there *is* a monopolist.

The *entire* shaded region is consumer surplus in the presence of competition.

3 a) Monopolist produces at $MR = MC$

$$\text{so } 24 - 2Q = 2Q$$

$$\rightarrow Q = 6$$

and

$$P = 24 - 6$$

$$\rightarrow P = 18$$

$$\text{Consumer Surplus} = \frac{1}{2} (24-18)(6) = 18$$

The AC at $Q = 6$ is...

$$AC = (Q^2+4)/Q = Q + 4/Q = 6 + 4/6 = 6 \frac{2}{3}.$$

$$\text{Profit} = (18 - 6 \frac{2}{3})(6) = 68$$

b) In the perfectly competitive market,
 $P = MC \rightarrow 24 - Q = 2Q \rightarrow Q = 8$

when $Q = 8, P = 24 - 8 = 16$

Consumer Surplus = $\frac{1}{2}(24-16)(8) = 32$

AC at $Q = 8$ is...

$$\begin{aligned} AC &= Q^2/Q + 4/Q \\ &= Q + 4/Q \\ &= 8 + 4/8 \\ &= 8 \frac{1}{2} \end{aligned}$$

Profit = $(16 - 8 \frac{1}{2})(8) = 60$

c) AC for part a) = $6 \frac{2}{3}$
b) = $8 \frac{1}{2}$
(these were found above)

d) First establish the competitive *market* equilibrium with 6 firms.

For each firm $MC = 2Q_i$, which we can solve for $Q_i = MC/2$

The industry supply Q_M is $Q_1 + Q_2 + \dots + Q_6$, which is $Q_M = 3MC$

Which directly gives us $Q_M = 3P$, or $P = (1/3)Q_M$. This last equation is the supply equation. Industry equilibrium output sets Industry Supply = Industry Demand doing this yields...

$$(1/3)Q_M = 24 - Q_M$$

which can be solved for...

$$Q_M = 18$$

Putting this into the demand equation

$$P = 24 - (18) = 6$$

$$Q_M^* = 18$$

$$P^* = 6$$

(cont'd)

i) Each firm sets $MC = P$ in a competitive industry. So,

$$2Q_i = 6$$

$$Q_i = 3$$

ii) Market output is $(3)(6) = 18$

iii) Equilibrium Price is 6.

iv) Consumer Surplus = $(24-6)(18)(1/2) = 162$

v) Firm Profit = $(P - AC_i)(Q_i)$

$$AC = Q^2/Q + 4/Q$$

$$= Q + 4/Q$$

$$= 3 + 4/3$$

$$= 4 \frac{1}{3}$$

so,

$$\text{Profit} = (6 - 4 \frac{1}{3})(3) = 5$$

vi) Total Profits = $6 * 5 = 30$

e) AC is below equilibrium price

f) because of e) firms will continue to enter the market.

g) this is done in exactly the same manner as previously.

4)

	Firm Profits	Consumer Surplus	Welfare
Monopoly	68	18	86
1 Firm Competition	60	32	92
6 firm Competition	5	162	$6 * 5 + 162$ =192

5)

a)

$$AC = C/Q = (2 + 2Q^2)/Q = 2Q + 2/Q$$

b-d) The long run equilibrium quantity will be set where $MC = AC$.

$$4Q = 2/Q + 2Q$$

$$2Q = 2/Q$$

$$Q^2 = 1$$

$$Q = 1 \quad (Q = -1 \text{ is ruled out on economic grounds...it doesn't make sense})$$

so each *firm* will produce one unit.

In equilibrium (long run), profits are zero. By definition, the equation

$$\text{Profit} = (P - AC)Q_i = 0$$

represents the profits to a single firm. Using the demand curve, and the average cost curve, and denoting the market quantity as Q_M , we get...

$$\text{Profits}_i = [(20 - Q_M) - AC]Q_i = 0$$

where Q_i = the quantity produced by firm i . Note that the AC evaluated at the optimal firm output of 1 is $2(1) + 2/1 = 4$. So,

$$\text{Profits}_i = [(20 - Q_M) - 4](1) = 0$$

which can be solved for...

$$Q_M = 16$$

Since market output is 16, and each firm produces 1 unit, **there are 16 firms in the industry.**

Since $Q_M = 16$, and the demand curve is $P = 20 - Q_M$, the equilibrium price is 4.

e) $MC = 4Q_i$

To find the industry supply curve...

$$MC = 4Q_i$$

$$Q_i = (1/4)MC, \quad \text{so } Q_1 + Q_2 + \dots + Q_{20} = Q_M = (1/4)(20)MC = 5MC$$

$$Q_M = 5MC \rightarrow Q_M = 5P \rightarrow P = (1/5)Q_M \quad \text{which is the industry supply curve}$$

To find equilibrium, supply = demand:

$$20 - Q_M = (1/5)Q_M$$

$$20 = (1 + 1/5)Q_M \rightarrow Q_M^* = 16 \frac{2}{3}$$

which, when put back into the demand equation, yields...

$$P = 20 - (16 \frac{2}{3}) = 3 \frac{1}{3}$$

Each firm will produce where $MC = P$, which is expressed

$$4Q_i = 3 \frac{1}{3}$$

$$Q_i = 10/12 \approx .833$$

At $Q_i = .833$,

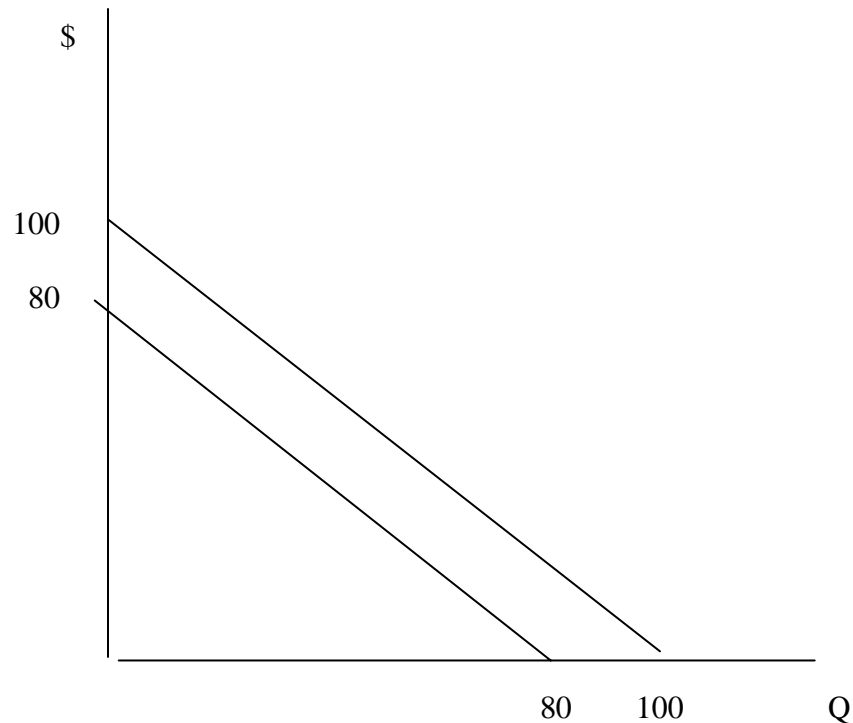
$$AC = 2(.833) + 2/.833$$

$$= 4.067$$

$$\text{Profit} = (P - AC)Q_i = (3 \frac{1}{3} - 4.067).833 = -.611$$

f) the same process is done as above.

6. a.



b. Students \$32, Executives \$50.

c. \$48. This is the area under the upper demand curve between $Q=0$ and $Q=80$.

d. Solve $50 - P = 48 - 32$, to get $P = \$34$. If P is higher, Executives buy the student package.

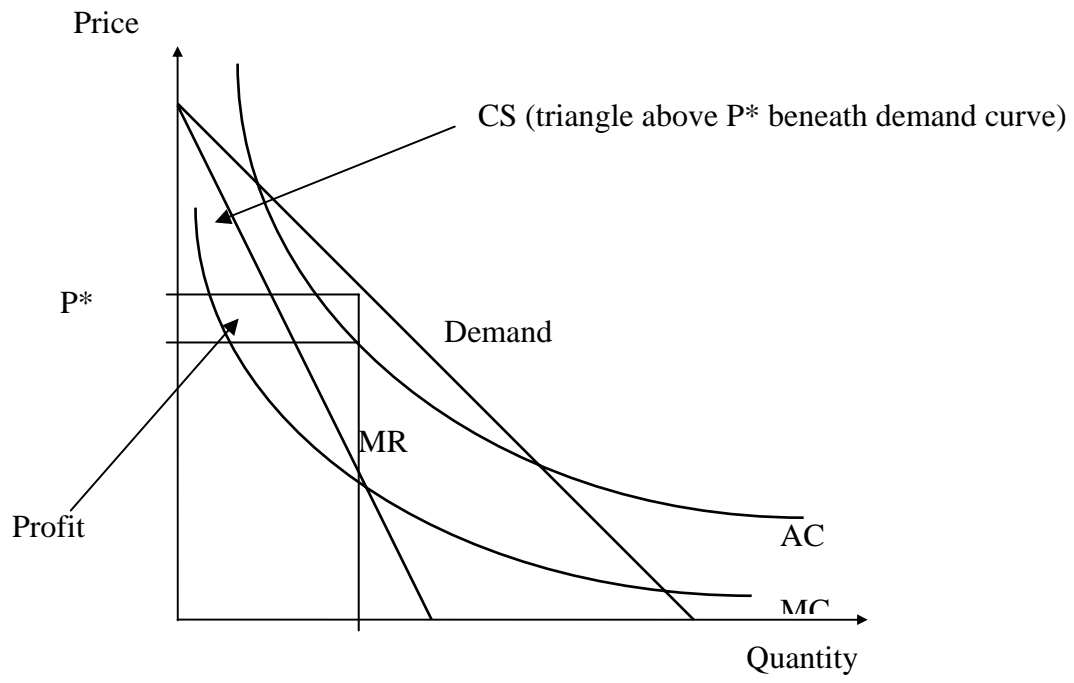
e. Students will pay at most \$30. Executives would get \$12 in net consumer surplus. Hence, the Journal can charge at most \$38 for the 100-article package if it wants executives to buy it.

f. It earns more with a 60-article student package. On average, it gets $.5(30) + .5(38) = \$34$ if it does this. If it instead sold an 80-article student package, it would sell that for \$32 and the 100-article package for \$34, so the average price is $\$33 < \34 .

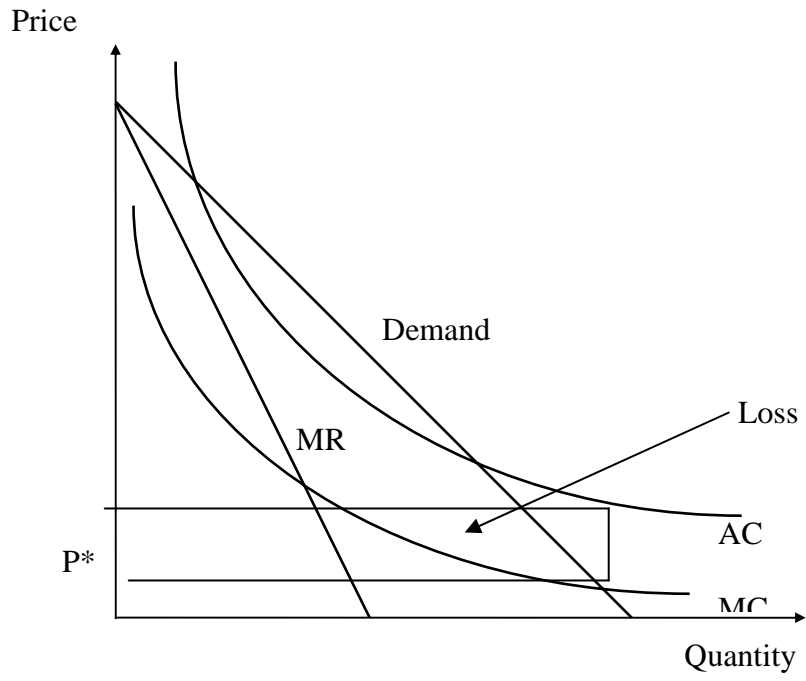
7. a. A declining average cost of production.

b. One firm can produce at lower average cost.

c.



d.



e.

