Eco 202
Dr. Smith

$\boxed{\text{Problem Set 8 – Answer Key}}$

$\boxed{1}$ a) $P = 100 - \frac{1}{10}Q$

$MR = 100 - \frac{2}{10}Q$

$MR = MC$ to maximize profit.

$100 - \frac{2}{10}Q = 10$

$90 = \frac{2}{10}Q \qquad Q = \frac{900}{2} \qquad \boxed{Q = 450 \quad P = 55}$

b) $P = 100 - \frac{1}{10}Q$

$MR = 100 - \frac{2}{10}Q$

$MC = 4Q$

$MR = MC \rightarrow$ to maximize profit

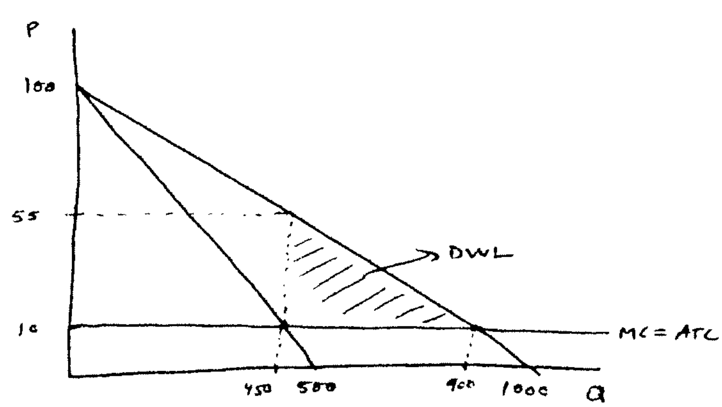
$100 - \frac{2}{10}Q = 4Q$

$1000 - 2Q = 40Q$

$42Q = 1000$

$\boxed{Q^* = 23.8 \quad P^* = 97.62}$

c)



$\pi = (P - ATC) * Q^*$

$\pi = (55 - 10)\,450$

$\pi = 20{,}250$

$DWL = 10{,}125$

[2]

$$P = \frac{MC}{\left(1 - \frac{1}{|E_d|}\right)} \Rightarrow 7 = \frac{MC}{1 - \frac{1}{5}} \qquad 7 = \frac{MC}{4/5}$$

$$7 \cdot 4/5 = MC \Rightarrow \boxed{MC = 5.60}$$

[3]

$$P = \frac{MC}{\left(1 - \frac{1}{|E_d|}\right)}$$

Let $E_d = z$ where $0 < z < 1$

Assume $P \geq 0$

Assume $MC \geq 0$

$$P = \frac{MC}{\frac{z-1}{z}} \Rightarrow \frac{MC}{P} = \frac{z-1}{z}$$

Since $0 < z < 1$, then $\frac{z-1}{z} < 0$.

Therefore, $\frac{MC}{P} = \frac{z-1}{z}$ <u>only</u> if $P <$ or

$MC < 0$ (not both). This can't happen. (by assumption.)

Therefore E_d <u>can't</u> be less than 1.

4

$$\pi = \left[4 - \frac{1}{100}(Q_1 + Q_2)\right](Q_1+Q_2) - \left[10 + \frac{Q_1^2}{10}\right] - \left[40 + \frac{Q_2^2}{20}\right]$$

$$\frac{d\pi}{dQ_1} = 4 - \frac{2}{100}(Q_1 + Q_2) - \frac{Q_1}{5} = 0 \Rightarrow 400 - 2(Q_1+Q_2) - 20Q_1 =$$

$$400 - 2Q_2 - 22Q_1 = 0$$

$$\boxed{Q_2 = 200 - 11Q_1}$$

$$\frac{d\pi}{dQ_2} = 4 - \frac{2}{100}(Q_1 + Q_2) - \frac{Q_2}{10} = 0 \Rightarrow 400 - 2(Q_1+Q_2) - 10Q_2 = 0$$

$$400 - 2Q_1 - 12Q_2 = 0$$

$$\boxed{Q_1 = 200 - 6Q_2}$$

$$Q_2 = 200 - 11(200 - 6Q_2) \rightarrow 200 - 2200 + 66Q = Q_2$$

$$65Q_2 = 2000$$

$$\boxed{Q_2 = 30.8}$$

$$Q_1 = 200 - 6(200 - 11Q_1) \rightarrow 200 - 1200 + 66Q_1 = Q_1$$

$$65Q_1 = 1000$$

$$\boxed{Q_1 = 15.4}$$

$$P = 4 - \frac{1}{100}(30.8 + 15.4) \qquad \boxed{P^* = 4 - .462 = \underline{3.54}}$$

$$\pi = (3.54)(30.8 + 15.4) - \left[10 + \frac{15.4^2}{10}\right] - \left[40 + \frac{30.8^2}{20}\right]$$

$$\pi = 163.55 - [33.72] - [87.43]$$

$$\boxed{\pi = 42.40}$$

7 a)

$P = 10 - \frac{Q}{50}$

$MR = 10 - \frac{Q}{25}$

$MC = 2 \rightarrow 2 = 10 - \frac{Q}{25}$

$\boxed{Q = 200 \quad P = 6}$

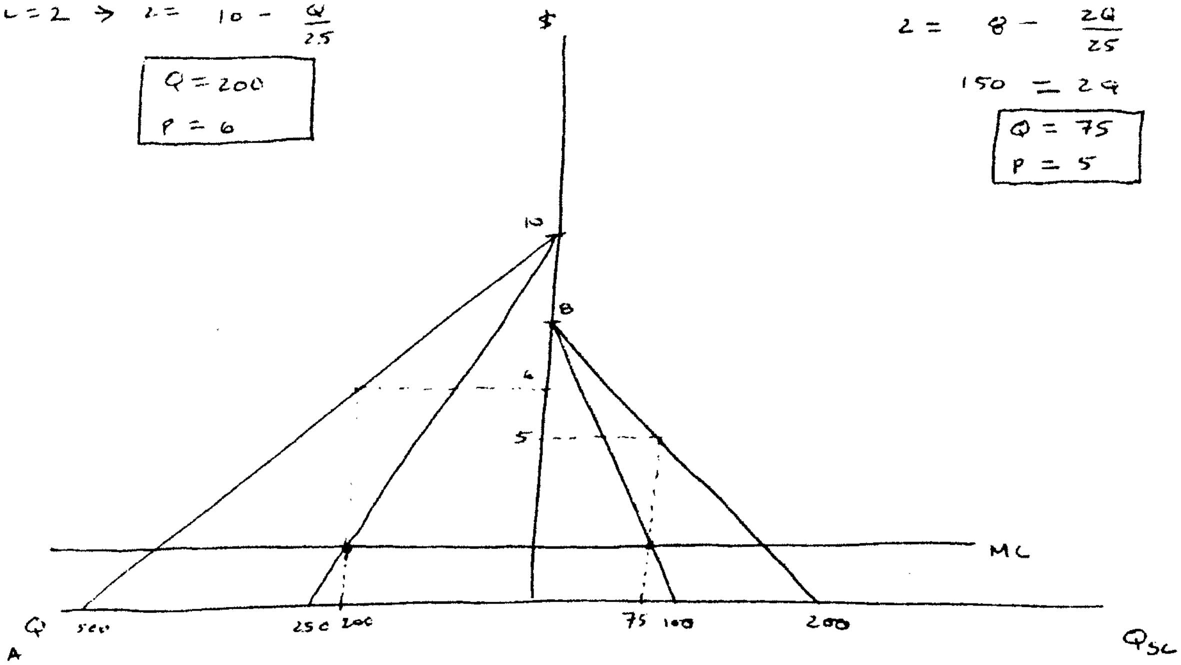
$P = 8 - \frac{Q}{25}$

$MR = 8 - \frac{2Q}{25}$

$2 = 8 - \frac{2Q}{25}$

$150 = 2Q$

$\boxed{Q = 75 \quad P = 5}$



b) Single Price Monopolist

$Q_A = 500 - 50P$

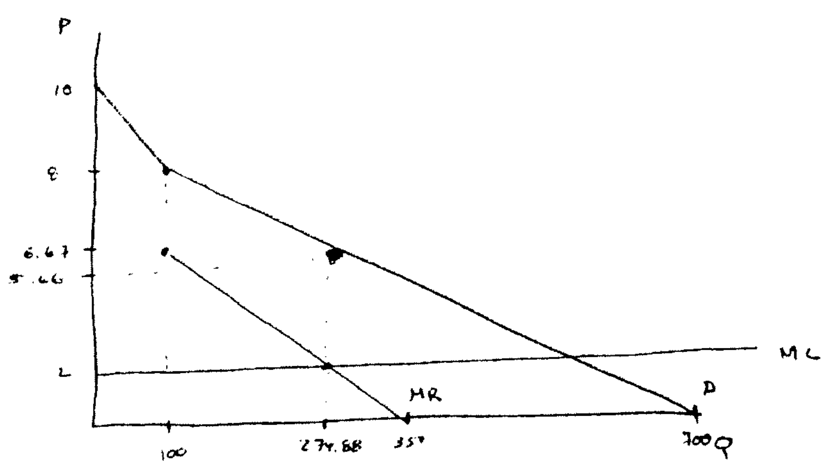
$Q_{SC} = 200 - 25P$

$Q_M = 700 - 75P$

$P = 9.33 - \frac{1}{75}Q$

$MR = 9.33 - \frac{2}{75}Q$

$MC = 2$



$2 = 9.33 - \frac{2}{75}Q$

$7.33 = \frac{2}{75}Q$

$\boxed{Q = 274.88} \quad \boxed{P = 5.66}$

π with single price

$\pi = (5.66)(274.88) - 100 + 2(274.88)$

$\boxed{\pi = 906.06}$

Continued

π with 3^{rd} Degree P.D

$\pi = [200 \cdot 6] + [75 \cdot 5] - [100 + 2 \cdot 275]$

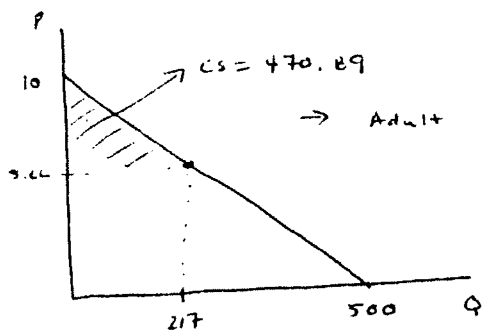
$\boxed{\pi = 925}$ $\rightarrow$ Additional $\boxed{\pi = 18.94}$

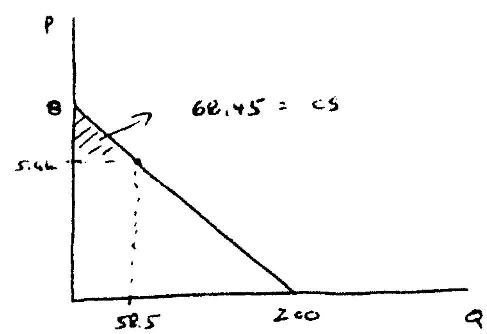
c) CS with P D

Adults $\Rightarrow \frac{1}{2} \cdot 200 \cdot 4 = 400$

S.C. $\Rightarrow \frac{1}{2} \cdot 75 \cdot 3 = 112.50$

CS without P.D





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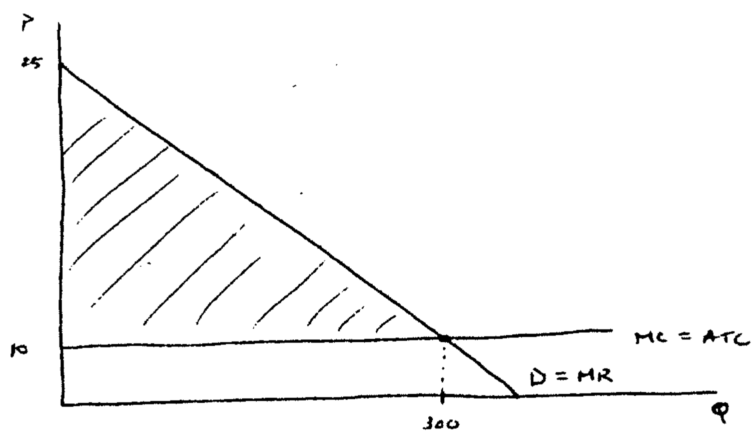

$P = 25 - \frac{1}{20} Q$

$25 - \frac{1}{20} Q = 10$

$\boxed{Q^* = 300}$

$\pi = \frac{1}{2} \cdot 300 \cdot 15$

$\boxed{\pi = 2250}$

6 1^{st} Degree P.D does lead to an economically efficient outcome, a standard monopoly gen DWL.

$\boxed{8}$

$$\pi = \left[(1000 - 4Q_B)Q_B + (800 - 2Q_L)Q_L\right] - \left[10{,}000 + 5(Q_B+Q_L)^2\right]$$

$$\frac{d\pi}{dQ_B} = \underbrace{1000 - 8Q_B}_{MR} - \underbrace{10(Q_B + Q_L)}_{MC} = 0$$

$$\frac{d\pi}{dQ_L} = 800 - 4Q_L - 10(Q_B + Q_L) = 0$$

$$1000 - 8Q_B = 10Q_B + 10Q_L$$

$$1000 - 8Q_B = 800 - 4Q_L$$

$$200 + 4Q_L = 8Q_B$$

$$\boxed{25 + \tfrac{1}{2}Q_L = Q_B}$$

$$1000 - 10Q_L = 18\left(25 + \tfrac{1}{2}Q_L\right)$$

$$1000 - 10Q_L = 450 + 9Q_L$$

$$\boxed{\begin{aligned} Q_L &= 29 \\ Q_B &= 40 \end{aligned}} \qquad \begin{aligned} P_L &= 742 \\ P_B &= 840 \end{aligned}$$

$$\pi = \$21{,}518 + \$33{,}600 - \left[10{,}000 + 5(69)^2\right]$$

$$\pi = \$55{,}118 - \$33{,}805 = \$21{,}313$$