$P = 50 - Q$; MC: $c = 5$

Renting

$P = 50 - Q$

$MR = 50 - 2Q$

$MC = 5$

$\therefore 50 - 2Q = 5$

or, $Q = 45/2 = 22.5$

$P = 50 - 22.5 = 27.5$

$\pi = \pi_1 + \pi_2 = 2\pi_1 = 2\left[PQ - cQ\right]$

$= 2\left[(27.5 \times 22.5) - 5(22.5)\right]$

$= 1012.5$

Selling:

2nd Pd. dd. $q_2 = 50 - \bar{q}_1 - P_2$

or, $P_2 = 50 - \bar{q}_1 - q_2$

$TR(q_2) = P_2 q_2 = (50 - \bar{q}_1 - q_2)q_2$

$MR(q_2) = 50 - \bar{q}_1 - 2q_2$

$MR = MC \Rightarrow 50 - \bar{q}_1 - 2q_2 = 5$

or, $2q_2 = 45 - \bar{q}_1$

or, $q_2 = 22.5 - \frac{\bar{q}_1}{2}$

$P_2 = (50 - \bar{q}_1) - \left(22.5 - \frac{\bar{q}_1}{2}\right)$

$= 27.5 - \frac{\bar{q}_1}{2}$

$\pi_2 = P_2 q_2 - c q_2 = \left(27.5 - \frac{\bar{q}_1}{2}\right)\left(22.5 - \frac{\bar{q}_1}{2}\right) - 5\left(22.5 - \frac{\bar{q}_1}{2}\right)$

$= \left(22.5 - \frac{\bar{q}_1}{2}\right)^2$

Indifference:

$2(50 - \bar{q}_1) - P_1 = (50 - \bar{q}_1) - P_2$

$(100 - 2\bar{q}_1) - P_1 = (50 - \bar{q}_1) - \left(27.5 - \frac{\bar{q}_1}{2}\right)$

$-P_1 = 50 - 27.5 - \bar{q}_1 + \frac{\bar{q}_1}{2} - 100 + 2\bar{q}_1 = -77.5 + \frac{3}{2}\bar{q}_1$

or, $P_1 = 77.5 - \frac{3}{2}\bar{Q}_1$

$\Pi_1 = P_1\bar{Q}_1 - C\bar{Q}_1 = (77.5 - \frac{3}{2}\bar{Q}_1)Q_1 - 5Q_1$

$= 77.5Q_1 - 5Q_1 - \frac{3}{2}Q_1^2$

$= 72.5Q_1 - \frac{3}{2}Q_1^2$

$\underset{Q_1}{\text{Max}}(\Pi_1 + \Pi_2) = 72.5Q_1 - \frac{3}{2}Q_1^2 + (22.5 - \frac{Q_1}{2})^2$

$= 72.5Q_1 - \frac{3}{2}Q_1^2 + \frac{1}{4}Q_1^2 + 506.25 - 22.5Q_1$

$\frac{\partial \Pi}{\partial Q_1} : 72.5 - \cancel{2}\cdot\frac{3}{\cancel{2}}Q_1 + \cancel{2}\cdot\frac{1}{\cancel{4}_2}Q_1 - 22.5 = 0$

or, $50 - 3Q_1 + \frac{1}{2}Q_1 = 0$

or, $2.5Q_1 = 50$

or, $Q_1 = \frac{50}{2.5} = 20$

$\therefore P_1 = 77.5 - \frac{3}{\cancel{2}}(\overset{10}{\cancel{20}}) = 47.5$ $\Rightarrow \Pi_1 = \begin{matrix}(20 \times 47.5) \\ -100\end{matrix} = 850$

$Q_2 = 22.5 - \frac{Q_1}{2} = 22.5 - 10 = 12.5$

$P_2 = 27.5 - \frac{Q_1}{2} = 27.5 - 10 = 17.5$

$\Rightarrow \Pi_2 = (12.5 \times 17.5) - 5(12.5)$

$= 156.25$

$\Pi = \Pi_1 + \Pi_2 = 1006.25$

$\Pi_R = 1012.5$

$\Pi_S = 1006.25$

$$P = 65 - \frac{Q}{3} \quad ; \quad Q = q_o + q_n \qquad (o \Rightarrow \text{OPEC} \; ; \; N \Rightarrow \text{non-OPEC})$$

$$\pi_o = \left[65 - \frac{q_o + q_n}{3}\right] q_o - 5 q_o$$

$$\frac{\partial \pi_o}{\partial q_o} = 0 \Rightarrow q_o = \frac{180 - q_n}{2} \Rightarrow R_o(q_n) = \frac{180 - q_n}{2} \text{ if } q_n \leq 180$$

$$= 0 \text{ if } q_n > 180 \quad \ldots (1)$$

$$\pi_N = \left[65 - \frac{q_o + q_n}{3}\right] q_n - 10 q_n$$

$$\frac{\partial \pi_N}{\partial q_n} = 0 \Rightarrow q_n = \frac{165 - q_o}{2} \Rightarrow R_n(q_o) = \frac{165 - q_o}{2} \text{ if } q_o \leq 165$$

$$= 0 \text{ if } q_o > 165 \quad . (2)$$

Solving (1) & (2)

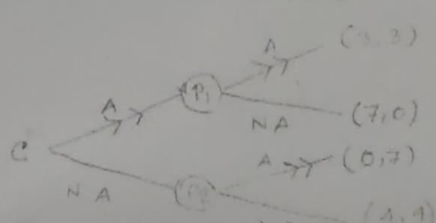
$$q_o^* = 65 \; ; \; q_n^* = 50 \; ; \; p^* = 80/3$$

6. Coke and Pepsi are the two dominant firms in the cola industry. The market size is \$8 billion. Each firm can choose whether to advertise. Advertising costs \$1 billion for each firm that chooses it. If one firm advertises and the other doesn't, then the former captures the whole market. If both firms advertise, they split the market 50:50 and pay for the advertising. If neither advertises, they split the market 50:50 but without the expense of advertising. What will be the outcome when the two firms move simultaneously? Draw the game tree for this game (assume that it is played sequentially), with Coke moving first and Pepsi following. What will be the outcome? (2+2+1)

Pepsi

Coke	A	NA
A	3, 3	7, 0
NA	0, 7	4, 4

$\Rightarrow$ NE : (A, A)



$\Rightarrow$ SPE : (A, A)