

Homework 1

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$$\begin{aligned} \textcircled{1} \quad Q_{cp} &= p^\epsilon \\ \frac{\partial Q}{\partial p} &= \epsilon p^{\epsilon-1} \\ \frac{\partial Q}{\partial p} \cdot \frac{p}{Q} &= \epsilon p^{\epsilon-1} \cdot \frac{p}{p^\epsilon} \\ &= \epsilon p^{\epsilon-1} \cdot p^{1-\epsilon} \\ &= \epsilon \\ \text{elasticity} &= \epsilon \end{aligned}$$

$$\begin{aligned} TR &= Q^{\frac{1}{\epsilon}} + 1 & MR &= \left(\frac{1}{\epsilon} + 1\right) Q^{\frac{1}{\epsilon}-2} \quad \epsilon = -2 \\ \text{find } MC &= MR \\ 1 &= \left(\frac{1}{\epsilon} + 1\right) Q^{\frac{1}{\epsilon}} \\ Q^{\frac{1}{\epsilon}} &= \frac{1}{\frac{1}{\epsilon} + 1} \\ Q^{\frac{1}{-2}} &= \frac{1}{\frac{1}{-2} + 1} \\ Q^{\frac{1}{-2}} &= \frac{1}{\frac{1}{2}} \\ Q^{\frac{1}{-2}} &= 2 \\ Q &= \frac{1}{4} \\ \frac{\partial Q}{\partial p} \cdot \frac{p}{Q} &= \epsilon \cdot \frac{Q^{\frac{1}{\epsilon}}}{Q} \\ &= -2 \cdot \frac{2}{\frac{1}{4}} \\ &= -16 \end{aligned}$$

$$\begin{aligned} \textcircled{2} \quad Q &: 10 - p \quad \rightarrow \quad p : 10 - Q \\ TR &= 10Q - Q^2 & MR &= 10 - 2Q & MC &= 0 \\ \text{find } MR &= MC \\ 10 - 2Q &= 0 \\ 2Q &= 10 \\ Q &= 5 \end{aligned}$$

Total output from competitive firms = $100 \times 0.05 = 5$

$\therefore$ No, monopoly sell the same amount of output as in the competitive market.

$$(3) \quad P = 498 - Q \longrightarrow Q = 498 - P \quad C = Q_i^2 \quad MC_i(Q_i) = 2Q_i$$

(a) Cournot model

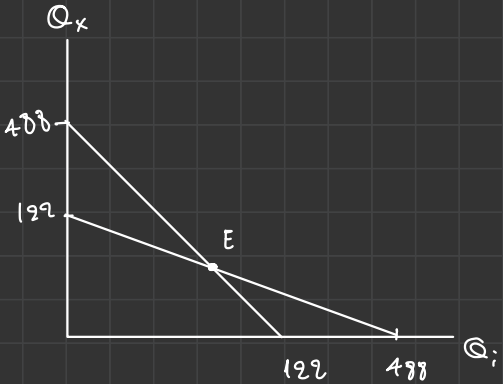
$$\begin{aligned} \pi &= P(Q)Q - C(Q) \\ &= (498 - Q_i - Q_x)Q_i - Q_i^2 \\ &= 498Q_i - Q_i^2 - Q_xQ_i - Q_i^2 \\ &= 498Q_i - Q_xQ_i - 2Q_i^2 \end{aligned}$$

$$\frac{\partial \pi}{\partial Q_i} = 498 - Q_x - 4Q_i = 0$$

$$4Q_i = 498 - Q_x$$

$$Q_i = 122 - \frac{1}{4}Q_x$$

$$Q_x = 498 - 4Q_i$$



(since, they are identical firms)

$$\therefore Q_i = 122 - \frac{1}{4}Q_x$$

$$Q_x = 122 - \frac{1}{4}Q_i$$

$$Q_i = 122 - \frac{1}{4}(122 - \frac{1}{4}Q_i)$$

$$Q_i = 122 - 28 + \frac{1}{16}Q_i$$

$$\frac{15}{16}Q_i = 84$$

$$Q_i = 89.6$$

$$Q_x = 84.6$$

(b) if firms 1 get the first move

$$\begin{aligned} \text{firm 2: } \pi &= P(Q_1, Q_2)Q_2 - C_2(Q_2) \\ &= (448 - Q_1 - Q_2)Q_2 - Q_2^2 \\ &= 448Q_2 - Q_2^2 - Q_1Q_2 - Q_2^2 \\ &= 448Q_2 - 2Q_2^2 - Q_1Q_2 \end{aligned}$$

$$\frac{\partial \pi}{\partial Q_2} = 448 - 4Q_2 - Q_1 = 0$$

$$Q_2 = 112 - \frac{1}{4}Q_1$$

firm 1:

$$\begin{aligned} \pi &= P(Q_1, Q_2)Q_1 - C_1(Q_1) \\ &= (336 - \frac{3}{4}Q_1)Q_1 - Q_1^2 \\ &= 336Q_1 - \frac{3}{4}Q_1^2 - Q_1^2 \\ &= 336Q_1 - \frac{7}{4}Q_1^2 \end{aligned}$$

$$\frac{\partial \pi}{\partial Q_1} = 336 - \frac{7}{2}Q_1 = 0$$

$$Q_1^* = 96$$

$$Q_2^* = 88$$

④

Dominant firms is the idea that when one big firm (Dominant) and many smaller firms (fringes). There are several factors that make firms dominant such as more efficient (lower cost), enter earlier (become more effective and have more time to grow) for example the US steel industry; There are many small fringe firms follow the main dominant firm or the market leader (Price Leadership).