

- 1 Suppose the demand curve is $Q(p) = p^\epsilon$, what is the elasticity of demand? If marginal cost is \$1 and $\epsilon = -2$, what is the profit-maximizing price?

$$\begin{aligned} \epsilon_{Q,P} &= \frac{\% \Delta Q}{\% \Delta P} = \frac{\Delta Q}{\Delta P} \times \frac{P}{Q} \\ Q &= p^{-2} \\ \frac{\Delta Q}{\Delta P} &= -2p^{-3} \\ \epsilon_{Q,P} &= \frac{\Delta Q}{\Delta P} \times \frac{P}{Q} \\ &= -2p^{-3} \times \frac{P}{p^{-2}} \\ &= -2p^{-3} \times p^2 \\ &= -2 \end{aligned}$$

$$\begin{aligned} \max \pi ; MR &= MC \\ \frac{1}{2} Q^{-\frac{1}{2}} &= 1 \\ Q^{-\frac{1}{2}} &= 2 \\ Q &= \frac{1}{4} \\ TR &= PQ \\ &= Q^{-\frac{1}{2}} \cdot Q \\ &= Q^{\frac{1}{2}} \\ MR &= \frac{1}{2} Q^{-\frac{1}{2}} \end{aligned}$$

substitute $Q = \frac{1}{4}$ into $Q = p^{-2}$; $p^{-2} = \frac{1}{4}$

$$p = 2$$

- 2 Suppose the demand curve for corn is $Q(p) = 10 - p$. Suppose that one firm owns all five units of corn in the world and has zero marginal cost. Does a monopoly sell less output than would be sold in a competitive market in which 100 firms each own 0.05 units?

$$\begin{aligned} TR &= Q(-Q + 10) \\ TR &= -Q^2 + 10Q \\ MR &= -2Q + 10 \\ MR &= MC ; -2Q + 10 = 0 \\ Q &= 5 \end{aligned}$$

\therefore Monopoly should sell at $Q = 5$

In the competitive market, total outputs are $100(0.05) = 5$

Both markets sell outputs at the same level which is 5 units.

8. Output is homogenous and the demand curve is

$$P = 448 - Q.$$

There are two firms with identical costs given by $C = q_i^2$ where q_i is the production of firm i . The marginal cost of firm i is $MC_i(q_i) = 2q_i$.

- (a) Find the Cournot equilibrium firm outputs.
(b) Find the Stackelberg equilibrium firm outputs.

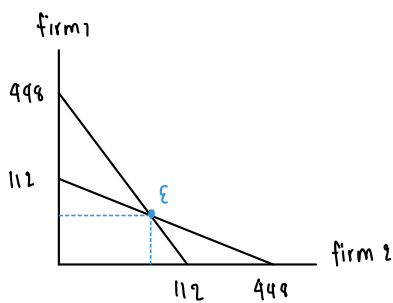
(a) Cournot equilibrium :

$$\begin{aligned} \text{Firm 1 ; } \pi_1 &= P \cdot q_1 - q_1^2 \\ &= (448 - q_1 - q_2) \cdot q_1 - q_1^2 \\ &= 448q_1 - q_1^2 - q_2q_1 - q_1^2 \\ \frac{\partial \pi_1}{\partial q_1} &= 448 - 2q_1 - q_2 - 2q_1 = 0 \\ &= -4q_1 + 448 = q_2 \end{aligned}$$

$$\begin{aligned} q_1 &= -\frac{1}{4}(-4q_1 + 448) + 448 \\ &= 16q_1 - 1792 + 448 \\ &= 89.6 \end{aligned}$$

$$\begin{aligned} \text{Firm 2 ; } \pi_2 &= P \cdot q_2 - q_2^2 \\ &= (448 - q_1 - q_2) \cdot q_2 - q_2^2 \\ &= 448q_2 - q_2^2 - q_1q_2 - q_2^2 \\ \frac{\partial \pi_2}{\partial q_2} &= 448 - 2q_2 - q_1 - 2q_2 = 0 \\ &= -4q_2 + 448 = q_1 \end{aligned}$$

$$q_2 = 89.6$$



(b) Stackelberg equilibrium (if firm 1 moves first) :

$$\begin{aligned}
 \text{Firm 2 : } \pi &= P \cdot q_2 - q_2^2 \\
 &= (448 - q_1 - q_2) q_2 - q_2^2 \\
 &= 448q_2 - q_2^2 - q_1q_2 - q_2^2 \\
 &= 448q_2 - 2q_2^2 - q_1q_2 \\
 \frac{\partial \pi}{\partial q_2} &= 448 - 4q_2 - q_1 = 0 \\
 q_2 &= 112 - \frac{1}{4}q_1
 \end{aligned}$$

$$\begin{aligned}
 \text{Firm 1 : } \pi &= P \cdot q_1 - q_1^2 \\
 &= (448 - q_1 - 112 + \frac{1}{4}q_1) q_1 - q_1^2 \\
 &= (336 - \frac{3}{4}q_1) q_1 - q_1^2 \\
 &= 336q_1 - \frac{3}{4}q_1^2 - q_1^2 \\
 &= 336q_1 - \frac{7}{4}q_1^2 \\
 \frac{\partial \pi}{\partial q_1} &= 336 - \frac{7}{2}q_1 = 0 \\
 q_1^* &= 96
 \end{aligned}$$

$$q_2^* = 112 - \frac{1}{4}(96) = 88$$

- (write about 0.5 page) Find 1 example of an industry that has a dominant firm. Describe what this industry is, which firm is the dominant firm, which firms are fringe firms (name the ones that you

L'Oréal, the world's largest cosmetics company, is the consumer goods industrial sector which is a category of stocks and companies that relate to items purchased by individuals and households rather than by manufacturers and industries. It makes and sells products that are intended for direct use by the buyers for their own use and enjoyment. Consumer goods can be broadly categorized as durable or nondurable, and the overall consumer goods sector can be broken down across many different industries. While some product types are considered luxury items. When the economy is growing, consumer demand grows and the sector will see an increased demand for higher-end products. When consumer demand shrinks, there is an increased relative demand for value products. Many companies rely heavily on advertising and brand differentiation. Performance depends heavily on consumer behavior. Developing new styles and marketing them to consumers is a priority.

The dominant firm is L'Oréal, a French personal care company found in 30 July 1909, developing activities in the field concentrating on hair color, skin care, sun protection, make-up, perfume, and hair care. The fringe firm is Soko Glam, it is the Korean skincare, beauty trends, and cosmetics, founded in 2012. It is considered one of the biggest providers of K-Beauty products in the US.