Intro Microeconomics | Vignette E5

November 8, 2022

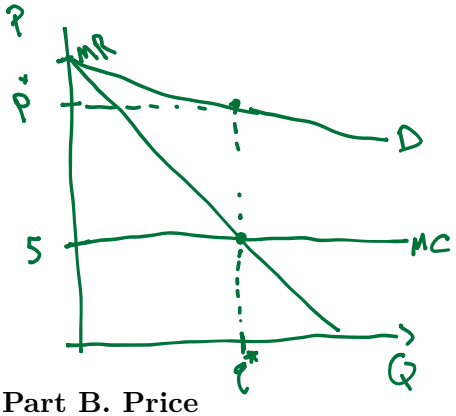
Unicorn Horn

The Apothecary is the only seller of unicorn horn in the area. Unicorn horn is an important ingredient in making potions, and everyone who needs the substance must buy it at the Apothecary. Demand for unicorn horn is given by the equation $P = 50 - Q$, where prices are given in terms of galleons and quantity is given in terms of stones. The marginal cost of producing unicorn horn is a constant 5 galleons per stone, and there are no fixed costs.

Part A. Quantity

$MC = 5$

Suppose the Apothecary sells unicorn horn to anyone for the same price. Knowing that the marginal revenue generated by each unit sold is $MR = 50 - 2Q$, calculate the Apothecary's profit maximizing quantity of unicorn horn.



$MR = MC$

$50 - 2Q = 5$

$45 = 2Q$

$\boxed{Q^* = \frac{45}{2}}$ PROFIT MAXIMIZING QUATITY

Part B. Price

What is the Apothecary's profit maximizing price?

$P = 50 - \left(\frac{45}{2}\right) = \frac{100 - 45}{2}$

$\boxed{P^* = \frac{55}{2}}$ PROFIT MAX PRICE

Part C. Profit

What is the Apothecary's maximum profit?

MC when constant, & no FC

$ATC = \frac{TC}{q} = \frac{MC \cdot q}{q} = MC$

$\Pi = (P - ATC)\,q$?

$= \left(\frac{55}{2} - \frac{10}{2}\right)\frac{45}{2}$

$\Pi^* = \left(\frac{45}{2}\right)^2$

Two Identical Firms: A, B $\quad MC_A = 5$, $MC_B = 5$

PART D, Duopoly → Game Theory

D: $P = 50 - Q$ ← Buyers Don't Care Who Sells: Homogeneous Good

$Q = q_A + q_B$ ← Market quantity is the sum of all sellers' quantity.

↳ $P = 50 - q_A - q_B$ ← Strategic Interaction!

FIRM'S PROBLEM → q_A

$MC_A = MR_A$

$5 = 50 - 2q_A - q_B$

$2q_A = 45 - q_B$

BR_A $\quad q_A^* = \frac{45}{2} - \frac{1}{2}q_B$

$TR_A = (50 - q_A - q_B)\cdot q_A$

$MR_A = 50 - 2q_A - q_B$

$MR_B = 50 - 2q_B - q_A$

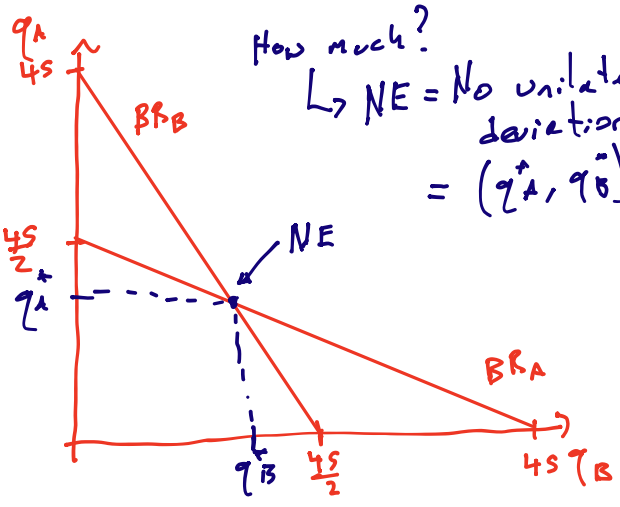
FIRM B → q_B

$MC_B = MR_B$

$5 = 50 - 2q_B - q_A$

TRICK! → In a symmetric game the solution is symmetric!

BR_B $\quad q_B^* = \frac{45}{2} - \frac{1}{2}q_A$



$q_A^* = \frac{45}{2} - \frac{1}{2}\left(\frac{45}{2} - \frac{1}{2}q_A^*\right) = \frac{2\cdot 45}{2\cdot 2} - \frac{45}{4} + \frac{1}{4}q_A^*$

$\left(1 - \frac{1}{4}\right)q_A^* = \frac{45}{4} \Rightarrow \frac{3}{4}q_A^* = \frac{45}{4} \Rightarrow$ $\boxed{q_A^* = \frac{45}{3}}$ $\quad \boxed{q_B^* = \frac{45}{3}}$

→ $P = D(\,)$ ← constant MC, NO FC = MC

→ $\Pi_A = (P - ATC)\,q_A$