ECO TUT 4

Q.1] $P = 2000 - 50Q \Rightarrow Q = \frac{2000-P}{50} \Rightarrow \frac{\partial Q}{\partial P} = \frac{-1}{50}$

a) $E_p = \frac{\% \Delta Q}{\% \Delta P} = \frac{\partial Q}{\partial P} \times \frac{P}{Q}$ ← 500

Q a $\frac{2000-500}{50}$

$= \left(-\frac{1}{\cancel{50}}\right)\left(\frac{500}{\frac{1500}{\cancel{50}}}\right) = \boxed{-\frac{1}{3} = E_p}$ inelastic demand

b) $E_p = -1$ (unitary elastic) $P = ?$

$\cancel{-}1 = \left(\cancel{-}\frac{1}{\cancel{50}}\right)\left(\frac{P}{\frac{2000-P}{\cancel{50}}}\right)$

$2000 - P = P$

$\boxed{P = 1000}$

Q.2] a) Q_{sat} (in thousands) $= 152.5 - 0.9 P_{sat} + 1.05 P_{DSL} + 1.1 P_{cable}$

If $P_{cable} = P_{dsl} = \$30$

Q_{sat} (thous.) $= 217 - 0.9 P_{sat}$

For $P_{sat} = \$50$

$Q_{sat} = 172$ thousand

Revenue $= P \times Q = 50 \times 172{,}000$

$= 8.6$ million

This is less than 12 million.

b) If Price of Cable & DSL remain same

Revenue $= P_{sat} \times Q_{sat}$

$= P_{sat} \times (217 - 0.9 P_{sat})$

For Revenue $= 12,000,000$

or 12,000 thousands

$12,000 = 217 P_{sat} - 0.9 P_{sat}^2$

Solving Quadratic Eq^n

$P_{sat} = 155.20$ or 85.91

So, it is possible to make revenue of 12 million.

Q3]

$Q_d = 150 - 2P_x + 0.001 I + 1.5 P_y$

$Q_s = 60 + 4P_x - 2.5 W$

$W = 8.6$ $\quad I = 25,000$

$P_y = 5$

a) Apple Bonker is a substitute because if $P_y \uparrow$ then Q_x^d also $\uparrow$.

b) At Eq. $Q_x^s = Q_x^d$

$150 - 2P_x + (25000)(0.001)$
$+ 1.5(5) = 60 + 4P_x - 2.5(8.6)$

$\boxed{P_x = 24}$ $\quad \boxed{Q_x = 134.5}$

Expenditure $= P \times Q = 3228$

c) Effect of Price on Income ← calculate from eq^n

$$E_{PI} = \frac{\%\Delta I}{\%\Delta P} = \frac{\partial I}{\partial P} \times \frac{P}{Q} \quad \begin{matrix} \leftarrow 24-5=19 \\ \leftarrow 144.5 \end{matrix}$$

$$= \frac{2}{0.001} \qquad \frac{\Delta I}{\Delta P} = \frac{\partial I}{\partial P} = \frac{2}{0.001} = 2000$$

c) Expenditure' = 2745.5 = (24-5)(144.5)

new price ↑ new qty ↑

Fall = E - E' = 482.5

Q4] $x \rightarrow$ low grade steel

$Y \rightarrow$ High grade steel

$y = \frac{40-5x}{10-x} \rightarrow$ relation of qty

$P_y = 2P_x \rightarrow$ relation of price

Revenue = Revenue from X + Revenue from Y

→ to maximise Revenue :

we find critical points

$$R = P_x \times Q_x + P_y \times Q_y$$

$$R = P_x \times x + (2P_x)\left(\frac{40-5x}{10-x}\right)$$

$$= P_x\left[x + \frac{2(40-5x)}{10-x}\right]$$

$$\frac{\partial R}{\partial n} = P_n\left[1 + 2\left(\frac{(-5)(10-n) - (-1)(40-5n)}{(10-n)^2}\right)\right]$$

$$= P_n\left[1 + 2\left(\frac{-50 + \cancel{5n} + 40 - \cancel{5n}}{(10-n)^2}\right)\right]$$

$$\frac{\partial R}{\partial n} = 0 = P_n\left[1 + \frac{2(-10)}{(10-n)^2}\right]$$

$$1 + \frac{-20}{(10-n)^2} = 0$$

$$(10-n)^2 = 20$$

$$10 - n = \pm\sqrt{20}$$

$$n = 10 \pm \sqrt{20}$$

$$= 10 + \sqrt{20} \qquad 10 - \sqrt{20}$$

$$\underbrace{= 14.47 \qquad 5.52}_{\text{critical points}}$$

▷ Second Derivative Test

$$\frac{\partial^2 R}{\partial n^2} = P_n\left[-20 \times (-2)(10-n)^{-3}(-1)\right]$$

$$= P_n\left[\frac{-40}{(10-n)^3}\right]$$

for $n = 5.52$ $\frac{\partial^2 R}{\partial n^2} < 0$

So, $\boxed{n = 5.52}$ => <u>maxima</u>

Q5] a) $Q_A = 50 - P_A$ $\qquad E(Q_B) = E(Q_A) \times 6$

At $P = 10$

$Q = 50 - 10 = 40$

Q_B eqn satisfies (40, 10)

point of intersection

slope of $Q_A = Q_B$

$$E_a = -\frac{dQ_A}{dP} \times \frac{P_A}{Q_A} = -1 \times \frac{10}{40} = -\frac{1}{4}$$

$$E_b = 6 \times E_a = \underline{\underline{-\frac{3}{2}}}$$

b) $Q_B = a - 6P_B$ $\qquad \left[\text{slope} = E_b \times \frac{Q}{P}\right]$

which satisfies (40, 10)

$40 = a - 6 \times 10$

$a = 100$

$Q_B = 100 - 6P_B$

$= 100 - 48$

$= \underline{\underline{52}}$