Q1 $Q_D = 170 - 20P + 20P_b + 3P_c + 2Y$

$Q_S = 178 + 10P - 60P_h$

(a) $P_b = 8$, $P_c = 10$, $P_h = 1.3$,

$Y = 20{,}000\$ = 20$ (thousand dollars)

$= 20$ units

$\therefore$ Inserting these values in our above functions,

$\rightarrow Q_D = 170 - 20P + 20(8) + 3(10) + 2(20)$

$\therefore \boxed{Q_D = 400 - 20P} \Leftarrow$ Demand Curve equation

$\rightarrow$ Similarly, $Q_S = 178 + 10P - 60(1.3)$

$\therefore \boxed{Q_S = 100 + 10P} \Leftarrow$ Supply Curve Equation

$\rightarrow$ for equilibrium, $Q_D = Q_S$

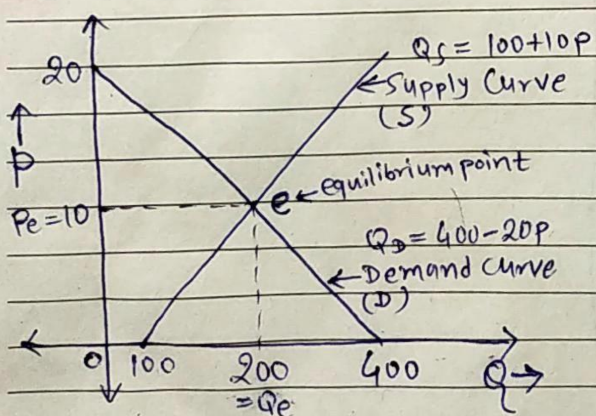
$\therefore 400 - 20P_e = 100 + 10P_e$

$\therefore 30P_e = 300 \quad \therefore \boxed{P_e = 10} \Leftarrow$ eq. price in dollars per kg.

$\therefore Q_e = 100 + 10(10)$

$\therefore \boxed{Q_e = 200}$ units $\Leftarrow$ eq. qty.

$\rightarrow$ Now, graphing the curves and showing above derived equilibrium price and quantity on graph :→

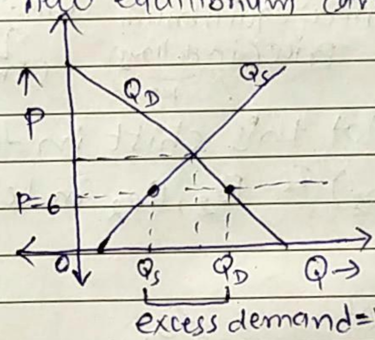


(b) now, suppose government imposes a price ceiling on the price of pork at $P = 12$ (dollars/kg)

→ Now, we know that this price is more than the equilibrium price

$\therefore$ new equilibrium price & qty. will remain same as we obtained previously, i.e. $\boxed{P_e = 10}$ and $\boxed{Q_e = 200}$

→ Now, if the government sets the price ceiling at $P = 6$ dollars/kg, new equilibrium can be graphed below:



→ As shown above in graph, with $P = 6$, $Q_D = 400 - 20P = 400 - 20(6)$

$= 280$

whereas, $Q_S = 100 + 10(6)$

$= 160$

$\therefore$ There will be now shortage of pork, with excess demand quantity $= Q_D - Q_S = 120$ units at price, $P = 6$ dollars/kg, at new equilibrium.

Document1

(c) → Here, we will see how the demand curve for processed pork would shift if the price of chicken P_c is increased by 50%. from \$10 to \$15.

$\therefore P_c = 15$ inserting in Q_D,

$\therefore Q_{D_2} = 170 - 20P + 20(8) + 3(15) + 2(20)$

$\therefore \boxed{Q_{D_2} = 415 - 20P}$

& $\boxed{Q_S = 100 + 10P}$

$\therefore$ at new equilibrium,

$Q_{D_2} = Q_S$

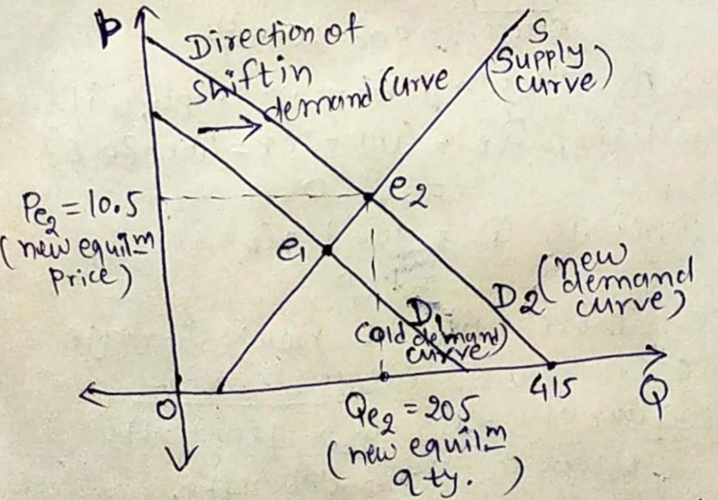
$\therefore 415 - 20P = 100 + 10P$

$\therefore 30P = 315$

$\therefore \boxed{P_{e_2} = 10.5}$ & $\boxed{Q_{e_2} = 205}$

↑new equilibrium price (in dollars/kg)   ↑new equil^m qty. (in units)

→ We can plot this shift in demand curve (Q_{D_2}) & P_{e_2}, Q_{e_2} in below graph,



→ So, as shown above, demand curve shifts rightward with this new price of $P_c = 15$.

(d) Here, we will solve, equil^m price and qty. in terms of P_b, P_c, P_h & Y.

At equilibrium,

$\therefore Q_D = Q_S$

$\therefore 170 - 20P + 20P_b + 3P_c + 2Y$

$= 178 + 10P - 60P_h$

$\therefore 30P = 20P_b + 3P_c + 60P_h + 2Y - 8$

$$\therefore \boxed{P_e = \frac{2P_b}{3} + \frac{P_c}{10} + 2P_h + \frac{Y}{15} - \frac{4}{15}}$$

and, $Q_e = 178 + 10P_e - 60P_h$

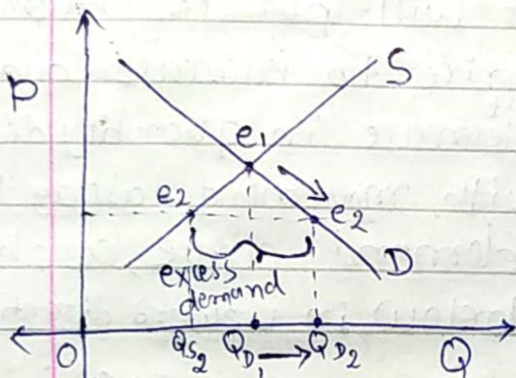
$= 178 + 10\left(\frac{2}{3}P_b + \frac{P_c}{10} + 2P_h + \frac{Y}{15} - \frac{4}{15}\right) - 60P_h$

$$\boxed{Q_e = \frac{526}{3} + \frac{20P_b}{3} + P_c - 40P_h + \frac{2Y}{3}}$$

→ So, above two are the required equations for the equilibrium price and quantity.

Q2 Effects of the given events on the demand for the Bordeaux wine :-

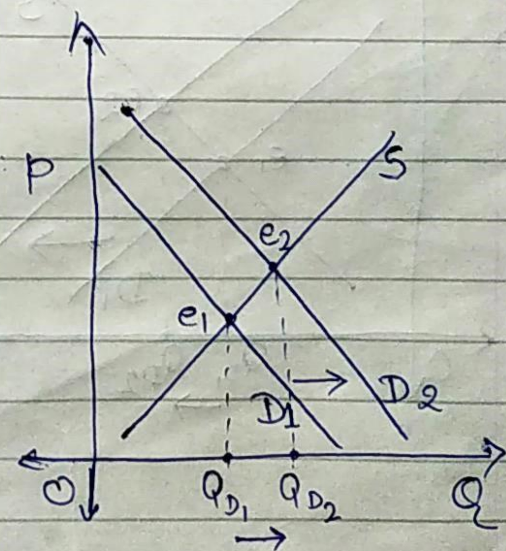
(a) Decrease in the price of Bordeaux wine :



As shown above, with the decrease in the price of Bordeaux wine, we ~~move~~ will have <u>downward movement along the demand curve</u> and demand for the Bordeaux wine will increase, and as a result there will be Bordeaux wine shortage or excess demand of Bordeaux wine.

(b) Here, we have a new study linking longevity with moderate amounts of wine consumption, so, with this change in external factor, we will have <u>shift in demand curve</u>.

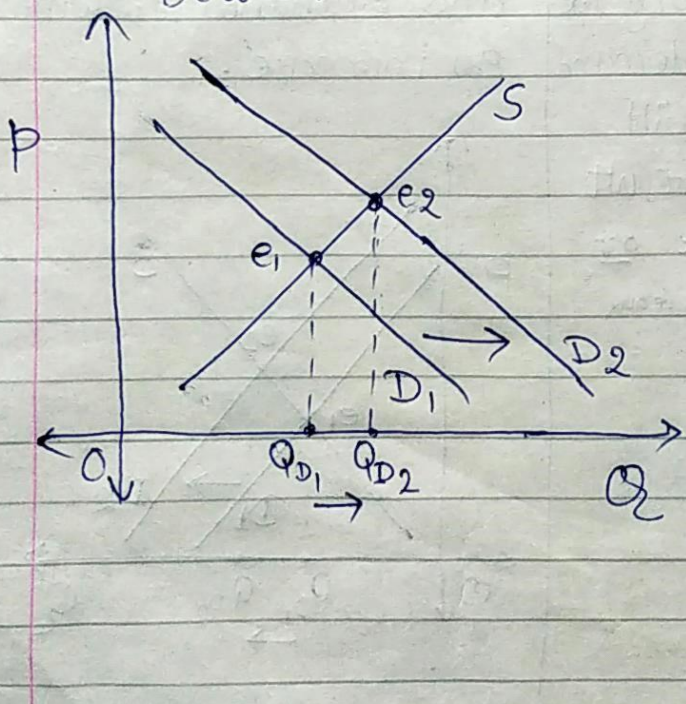
→ Moreover, as we understand that non-drinkers will also start demanding wine as a result of this new study, our demand curve will <u>shift rightwards</u>, as shown below, and demand for wine will ~~go~~ increase.



(c) An increase in the price of Toscana wine:

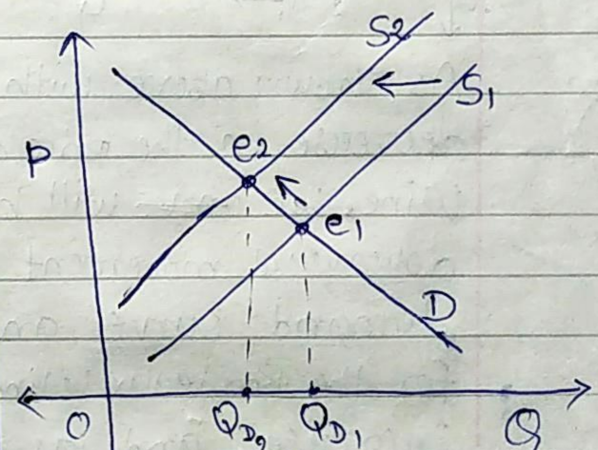
→ As Toscana wine would be a substitute good of Bordeaux wine and therefore with the increase in the price of Toscana wine, consumer will switch to Bordeaux wine.

→ Therefore, we will have shift in demand curve, in rightward direction, as demand for Bordeaux wine ~~in~~ is increasing, as shown below:-



(d) A severe drought in the Bordeaux region of France:

→ This will result in supply curve to shift in left and it will put pressure on equilim price to increase and as a result decrease in quantity demanded with movement along the demand curve, as shown below, in upward direction:



Q3 $Q_D = 10,000 - 100W$ | where, Q = qty. of workers employed
$Q_S = 2000 + 1900W$ | and W = Hourly wage.

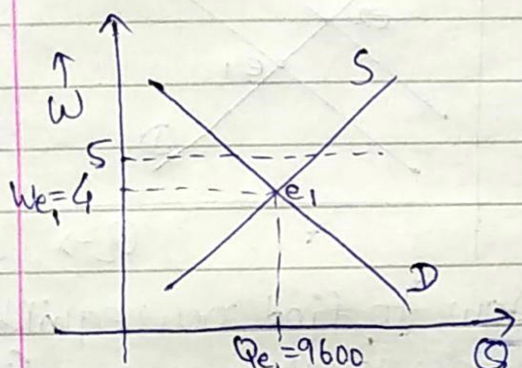
∴ for equilibrium, $Q_D = Q_S$

∴ $10000 - 100W = 2000 + 1900W$

∴ $\boxed{W_e = 4}$ and $Q_e = 10000 - 100(4)$

∴ $\boxed{Q_e = 9600}$

→ So, W_e & Q_e gives us the initial equilibrium wage and employment level.



→ now, with $w = 5$ \$/hr min^m^ allowable wage govt. policy,

$Q_D = 10000 - 100(5) = 9500$

and $Q_S = 2000 + 1900(5) = 11500$

∴ $Q_S - Q_D = 2000$

∴ There will be excess supply of 2000 workers or labors.

→ Also, new employment level $= Q_D = 9500$

& total payments to labor :

(1) earlier : $Q_e \times W_e = 9600 \times 4 = 38,400$

and (2) now : $Q_e \times W_e = 9500 \times 5 = 47,500$

∴ increase in total payments to labor $= 47,500 - 38400$

$= \boxed{9100 \$}$

Q4

Initial equilibrium price & qty

$P = 60 \ \$/\text{barrel}$,

$Q = 90 \ \frac{\text{million barrels}}{\text{day}}$,

$\eta = 1$ (= price elasticity of supply)

$\varepsilon = (-0.2)$ (= price elasticity of demand)

now, $Q_D = a - bP$

& $Q_S = g + hP$

where, $\eta = h \times \frac{P}{Q}$

$\therefore 1 = h \times \frac{60}{90}$ $\therefore \underline{h = 1.5}$

and, $\varepsilon = -b \times \frac{P}{Q}$

$\therefore -0.2 = -b \times \frac{60}{90}$

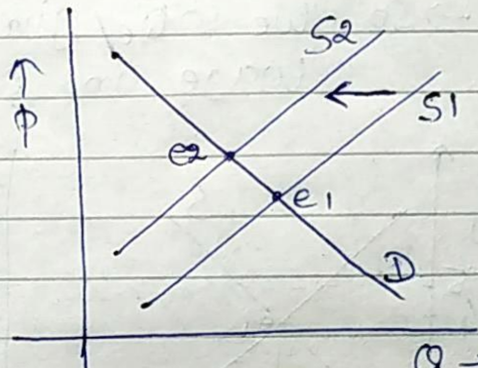
$\therefore \underline{b = 0.3}$

$\therefore Q_D = a - 0.3P$	$Q_S = g + 1.5P$
$\therefore 90 = a - 0.3(60)$	$\therefore 90 = g + 1.5(60)$
$\therefore \underline{a = 108}$	$\therefore \underline{g = 0}$
$\therefore \boxed{Q_D = 108 - 0.3P}$	$\boxed{Q_S = 1.5P}$

→ Now, as given in the questions with additional consumption of oil by government, new supply curve shifts to left by 2 million barrels,

$\therefore Q_{S_2} = 1.5P - 2$

∴ plotting these curves in graph:



Now, to find new equilibrium price & qty, we can solve this:

$Q_D = Q_{S2}$

$\therefore 108 - 0.3P_{e_2} = 1.5P_{e_2} - 2$

$\therefore P_{e_2} = 110/1.8$

$\therefore \boxed{P_{e2} = 61.11 \ \$/\text{barrel}}$

and, $Q_{e_2} = 1.5(61.11) - 2$

$\boxed{Q_{e2} = 89.66 \ \frac{\text{million barrel}}{\text{day}}}$

→ So, we can say that, due to given decision of government, there will be increase in market price & reduction in Quantity consumed, for oil product given in the question.

Q5 $Q^d = 1400 + 2Y - 70P$

$Q^s = -1000 + 80P$

With $Y = 300$

$Q^d = 2000 - 70P$

$Q^s = -1000 + 80P$

for initial equilibrium,

$Q^d = Q^s \therefore 2000 - 70P = -1000 + 80P$

$\therefore \boxed{P_{e_1} = 20}$ (\$/ball) $\therefore Q_{e_1} = 2000 - 70(20)$

$\therefore \boxed{Q_{e_1} = 600 \left(\frac{\text{ball}}{\text{month}}\right)}$

→ Now, with govt. tax of \$10/ball on seller,

$P_s = P_b - 10$

where, P_s = Price seller get.
P_b = Buyer Price

$\therefore Q^s = -1000 + 80P_s$

$= -1000 + 80(P_b - 10)$

and $Q^d = 2000 - 70P_b$

$\therefore$ at new equilibrium,

$Q^s = Q^d$

$\therefore -1000 + 80(P_b - 10) = 2000 - 70P_b$

$\therefore 150P_b = 3800$

$\therefore \boxed{P_b = 25.33}$ (Price in \$/ball)

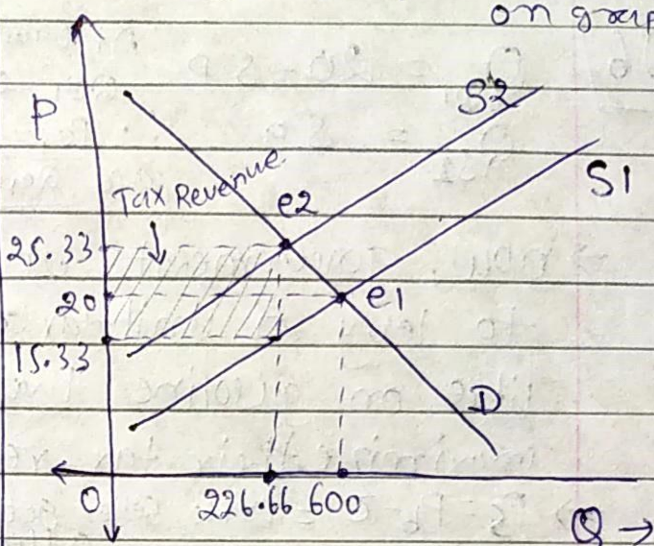
$\therefore P_s = 25.33 - 10$

$\boxed{P_s = 15.33}$ (\$/ball)

$\therefore Q_{e_2} = 2000 - 70(25.33)$

$\therefore \boxed{Q_{e_2} = 226.66}$ (balls/month)

→ plotting these equilibrium values on graph:-



$\therefore$ percent of Tax borne by consumers

$= \frac{\Delta P}{\Delta \tau} \times 100 = \frac{25.33 - 20}{10 - 0} \times 100$

$= (5.33/10) \times 100$

$= \boxed{53.33\%}$

And, Amount of tax revenue

$= Q_{e_2} \times \tau$

$= 226.66 \times 10$

$= \boxed{2266.6 \text{ (dollars/month)}}$

Q6 $Q_{D1} = 20 - 5P$

$Q_{S1} = 5P$

At Equilibrium, $Q_{D1} = Q_{S1} = Q_{e1}$

$\therefore \underline{P_{e1} = 2}$ and $\underline{Q_{e1} = 10}$

→ now, government wants to levy a unit-tax (τ) per litre on gasoline that would maximize their tax-revenue.

→ $P_s = P_b - \tau$ = Price seller get effectively after tax.

$\therefore Q_{D_2} = 20 - 5P_b$

$Q_{S_2} = 5P_s = 5(P_b - \tau)$

→ At equilibrium,

$Q_{D2} = Q_{S2} = Q_{e2}$

$\therefore 20 - 5P_b = 5(P_b - \tau)$

$\therefore \cancel{10}^{2} P_b = \cancel{20}^{4} + \cancel{5}\tau$

$\therefore \boxed{P_b = \frac{\tau + 4}{2}}$

→ Now,

$\therefore$ govt. tax Revenue $(R) = Q_{e2} \times \tau$

$= (20 - 5P_b)\tau$

$= \left[20 - 5\left(\frac{\tau+4}{2}\right)\right]\tau$

$= \left(\frac{20 - 5\tau}{2}\right)\tau$

$\therefore \boxed{R = 10\tau - \frac{5}{2}\tau^2}$

→ Now, we can say that revenue for given τ will be maximum when $(dR/d\tau = 0)$

→ By plugging above formula of R in $\frac{dR}{d\tau} = 0$, we have,

$\therefore \frac{d}{d\tau}\left(10\tau - \frac{5}{2}\tau^2\right) = 0$

$\therefore 10 - \frac{5}{\cancel{2}}(\cancel{2}\tau) = 0$

$\therefore \boxed{\tau = 2}$ (dollars/litre)

$\therefore$ We can say that, revenue maximizing unit tax $\tau = 2$ dollars/litre

And $\therefore P_{e2} = P_b = \frac{2+4}{2} = 3$ and $Q_{e2} = 5$

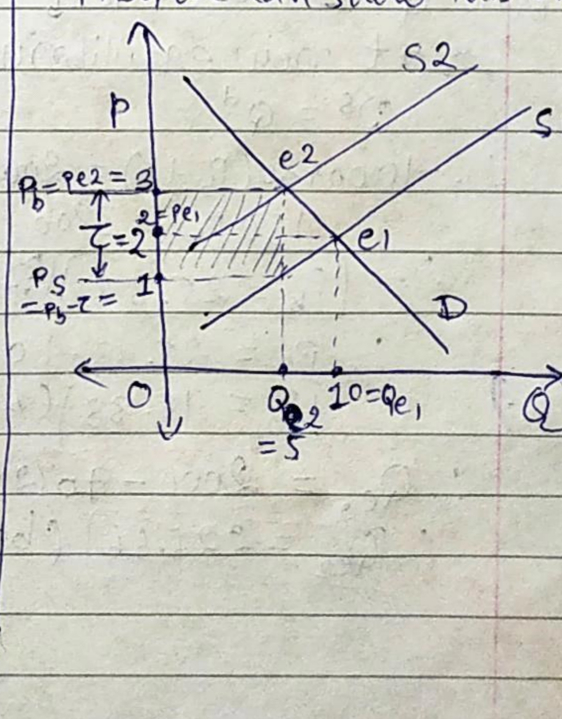
& tax revenue ⇒

$R = 10\tau - \frac{5}{2}\tau^2$

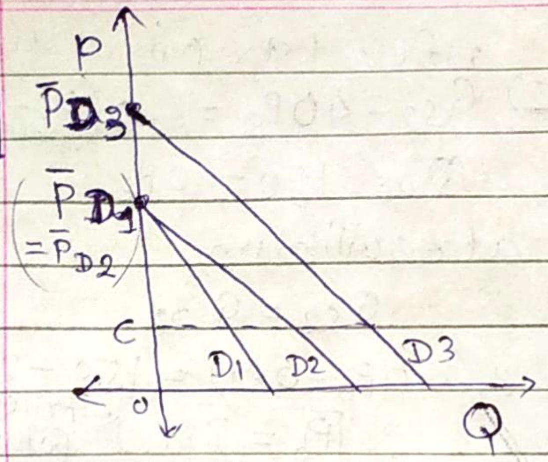
$= 10(2) - \frac{5}{2}(2)^2$

$\therefore \boxed{R = 10 \text{ million dollars}}$

→ Also, we can show this on graph:



Q7



$\boxed{Q_D = a - bP}$ —— (1)

where, $Q_D = 0 \Rightarrow 0 = a - bP$

$\therefore P = a/b = \bar{P}$

$\therefore \bar{P}$ = choke price = vertical intercept axis (of demand curve) —— (2)

(a) we have to prove here that, $\varepsilon = -\dfrac{P}{\bar{P} - P}$

for that, we have to go back to definition of ε,

$$\therefore \varepsilon = \frac{\Delta Q_D / Q_D}{\Delta P / P} = \frac{\Delta Q_D}{\Delta P} \times \frac{P}{Q_D}$$

now for point elasticity,

$$\varepsilon = \frac{dQ_D}{dP} \times \frac{P}{Q_D}$$

from eqn (1), $\dfrac{dQ_D}{dP} = \dfrac{d(a-bP)}{dP} = (-b)$

$$\therefore \varepsilon = \frac{-b \times P}{a - bP}$$

$\therefore$ by dividing and multiplying on right side of eqn with b,

we have,
$$\varepsilon = \frac{(-bP/b)}{\left(\frac{a-bP}{b}\right)} = \frac{-P}{\frac{a}{b} - P}$$

from eqn (2), $\dfrac{a}{b} = \bar{P}$,

$\therefore$ It is proved that, $\boxed{\varepsilon = -\dfrac{P}{\bar{P} - P}}$ —— (3)

(b) from graph, and eqn (2) we can say that,

$(\bar{P}_{D1} = \bar{P}_{D2}) < (\bar{P}_{D3})$ —— (4)

$\therefore$ from eqn (3), $\varepsilon = -\dfrac{P}{\bar{P} - P}$

If $P_{D1} = P_{D2} = P_{D3} = c$

$$\therefore \varepsilon_{D1} = \varepsilon_{D2} = -\frac{c}{\bar{P}_{D1} - c} = -\frac{c}{\bar{P}_{D2} - c}$$

and,
$$\varepsilon_{D3} = -\frac{c}{\bar{P}_{D3} - c}$$ —— (5)

$\therefore$ ~~Plug~~ using eqn (4) & eqn (5), we can say that, numerical value of

$\varepsilon_{D3} < (\varepsilon_{D1} = \varepsilon_{D2})$

(ignoring negative sign in ε)

$\therefore$ At a price c, elasticity of curves D1 & D2 is same and it is greater than D3 curve elasticity value.

MY NOTE BOOKS

Q8

$Q_s = 40P$ ① $\therefore$ slope $= h = 40$

$Q_d = 150 - 20P$ ② $\therefore$ slope $= (-b) = (-20)$

[unit of Q ⇒ million maple syrup bottles / year
for P ⇒ price / bottle.]

(a) for market equilibrium,

$Q_s = Q_d$

$\therefore 40P = 150 - 20P$

$\therefore 60P = 150 \quad \therefore \boxed{P_e = 2.5}$ (price unit / bottle)

and $Q_e = 40 \times 2.5$

$\therefore \boxed{Q_e = 100}$ (million bottle / yr)

Ans.: $\therefore$ Pe & Qe computed above is the market equilm price and qty. as asked in the question.

(b) at the equilibm price & qty,

(i) Price elasticity of demand $= \mathcal{E} = -b \times \frac{P}{Q}$

$= -20 \times \frac{2.5}{100}$ ($\because$ from eqn ②)

$\therefore \boxed{\mathcal{E} = -0.5}$

(ii) Price elasticity of supply $= \eta = h \times \frac{P}{Q} = 40 \times \frac{2.5}{100}$

($\because$ from eqn ①)

$\therefore \boxed{\eta = 1}$

After tax on bottle:→

(c) $Q_{S2} = 40P_s = 40(P_b - 0.9)$

$Q_{D2} = 150 - 20P_b$

at equilibrium,

$Q_{S2} = Q_{D2}$

$\therefore 40(P_b - 0.9) = 150 - 20P_b$

$\therefore \boxed{P_b = 3.1}$ ← (price / bottle) after tax.

$\therefore \boxed{Q_{e2} = 40(3.1 - 0.9) = 88}$ ← Qty after tax (million bottles / yr)

& $\boxed{P_s = P_b - 0.9 = 2.2}$

↑ supplier received price / bottle after tax.

(d) we are given that,

$\mathcal{E}_{(\text{long run})} > \mathcal{E}_{(\text{short run})}$

(considering numerical value)

now, tax incidence on consumers,

$$\boxed{\frac{\Delta P}{\Delta \tau} = \frac{\eta}{\eta - \mathcal{E}}}$$

(where, $\mathcal{E}$ will be with (-ve) value)

$\therefore$ if we consider that, η stays the same, then from above two eqns, we can say that,

$$\left(\frac{\Delta P}{\Delta \tau}\right)_{\text{long run}} < \left(\frac{\Delta P}{\Delta \tau}\right)_{\text{short run}}$$

$\therefore$ Tax incidence or tax burden on consumers in long run will be lesser compared to the short run.

$\boxed{Q9}$ log linear demand function,

$$\boxed{\ln Q = a - b(\ln P)}$$

where, $Q, a, b, P > 0$.

or $\boxed{Q = A P^{-b}}$

(a) → Now, we need to prove that, elasticity of demand, $\varepsilon = (-b)$.

→ for that, first we define,

$$\varepsilon = \frac{dQ}{dP} \times \frac{P}{Q} = \frac{d(AP^{-b})}{dP} \times \frac{P}{AP^{-b}}$$

$$= \frac{\cancel{A}(-bP^{-b-1})P}{\cancel{A}P^{-b}} = -bP^{-b-1+1+b}$$

$$= -bP^{0} = -b \times 1$$

$\therefore \boxed{\varepsilon = (-b)}$ is proved.

(b) Here, we are given with following demand function,

$$\ln Q = 9.01 - 0.68 \ln P + 0.75 \ln A - 1.31 \ln M$$

→ So, we can calculate the effect on the consumption of cereal of following cases:

⟨a⟩ 5% reduction in the price of cereal :→

→ As we proved in part-(a) above, price elasticity of demand, $\varepsilon_P = (-b) =$ coefficient of $\ln P$ in log linear demand function

$\therefore \varepsilon = -0.68$

$\therefore$ with 5% reduction in price, there will be $(0.68 \times 5) = \boxed{3.4\%}$ $\boxed{\text{increase}}$ in Qty. consumption of cereal.

⟨b.⟩ 4% increase in income :→

→ from our derivation in part-(a), we can say that income elasticity of demand, ε_M = co-efficient of $\ln M$ in function of $\ln Q$.

$= (-1.3)$

$\therefore$ with 4% increase in income, there will be $(1.3 \times 4) = \boxed{5.2\% \text{ decrease}}$ in the consumption Qty of cereal.

⟨c.⟩ 20% reduction in cereal Advertising :→

ε_A = Advertising elasticity of demand = co-efficient of $\ln A$ in the function of $\ln Q$

$= 0.75$

$\therefore$ with 20% reduction in advertising, there will be $(20 \times 0.75) = \boxed{15\% \text{ decrease}}$ in the Qty consumption of cereal.

(C)

→ As, derived in the subpart⟨b.⟩ of part(b),

ε_M = income elasticity of demand $= (-1.3) \Rightarrow (-ve)$

$\therefore$ As income increases, quantity demand of cereal decreases.

$\therefore$ we can say that cereal is an $\boxed{\text{inferior good.}}$