b. Rail: Tamil Nadu has a well-developed rail network as part of Southern Railway, Headquartered at Chennai. Tamil Nadu has a total railway track length of 6,693 km and there are690 railway stations in the State.

d. Ports: Tamil Nadu has three major ports; one each at Chennai, Ennore, and Tuticorin, as well as one intermediate port in Nagapattinam, and 23 minor ports.

Chapter 12

II. Very Short Answer Questions:

21. If $62 = 34 + 4x$ what is x?

Solution :

$$62 = 34 + 4x$$
$$62 - 34 = 4x$$
$$28 = 4x$$
$$x = \frac{28^7}{4_1}$$
$$\therefore x = 7$$

23. Find the average cost function where

$TC = 60 + 10x + 15x^2.$ [BE

Solution :

$$TC = 60 + 10x + 15x^2$$

$$\boxed{\text{Formula} = \frac{TC}{x}}$$

$$\text{Average cost function} = \frac{60}{x} + \frac{10x}{x} + \frac{15x^2}{x}$$

$$= \boxed{\frac{60}{x} + 10 + 15x}$$

22. Given the demand function $q = 150 - 3p$, derive a function for MR.

Solution :

Demand function $q = 150 - 3p$, MR = ?

$$\frac{dq}{dp} = -3$$

$$\eta d = \frac{-p}{q}\frac{dq}{dp} = \frac{-p}{150-3p}(-3)$$

$$= \frac{3p}{150-3p}$$

$$MR = p\left[1-\frac{1}{\eta d}\right] = p\left[1-\frac{1}{\frac{3p}{150-3p}}\right]$$

$$= p\left[1-\frac{(150-3p)}{3p}\right]$$

$$= p\left[\frac{3p-150+3p}{3p}\right]$$

$$= p\left[\frac{6p-150}{3p}\right]$$

$$= \frac{6}{3}[p-25]$$

$$= 2[p-25]$$

$$\boxed{MR = 2p - 50}$$

24. The demand function is given by $x = 20 - 2p - p^2$ where p and x are the price and the quantity respectively. Find the elasticity of demand for $p = 2.5$ [Govt. MQP-2018]

Solution :

$$\eta d = \frac{p}{x}\frac{dx}{dp}$$

$$\frac{dx}{dp} = -2-2p$$

$$\eta d = \frac{-p}{20-2p-p^2}(-2-2p)$$

$$= \frac{2p(r+p)}{20-2p-p^2}$$

$$\boxed{\text{When } p = 2.5}$$

$$\eta d = \frac{2(2.5)(1+2.5)}{20-2(2.5)-(2.5)^2}$$

$$= \frac{5(3.5)}{20-5-6.25}$$

$$= \frac{17.5}{15-6.25}$$

$$\eta d = \frac{17.5}{8.75}$$

$$\boxed{\text{Ans.} = 2}$$

25. Suppose the price p and quantity q of a commodity are related by the equation $q = 30 - 4p - p^2$ find

(i) e_d at $p = 2$ (ii) MR

Solution :

(i)

$$\frac{dq}{dp} = (-4 - 2p)$$

$$\eta d = \frac{-p}{q}\left(\frac{dq}{dp}\right)$$

$$= \frac{-p}{30 - 4p - p^2}(-4 - 2p)$$

$$= \frac{4p + 2p^2}{30 - 4p - p^2}$$

Put $p = 2$,

$$= \frac{4(2) + 2(2)^2}{30 - 4(2)^2 - 4} = \frac{8 + 8}{30 - 8 - 4}$$

$$= \frac{16}{30 - 12} = \frac{\overset{8}{\cancel{16}}}{\underset{9}{\cancel{18}}} = \frac{8}{9}$$

(ii) MR = ?

$$MR = \frac{dq}{dp}(-4 - 2p)$$

$$R = pq$$

$$= p(30 - 4p - p^2)$$

$$= 30p - 4p^2 - p^3$$

$$MR = \frac{dR}{dp}$$

$$= 30(1) - 4(2p) - 3(p)^2$$

$$= 30 - 8p - 3p^2$$

$$MR = 30 - 8p - 3p^2$$

26. What is the formula for elasticity of supply if you know the supply function?   *[BEQ]*

Solution :

Elasticity of supply $= \dfrac{p}{q}\dfrac{dq}{dp}$

$Ps = X_0P_0 -$ integration of supply function within limited

$$\boxed{= X_0P_0 - \int_0^{x_0} g(x)\,dx}$$

27. What are the Main menus of MS Word?
- ❖ Home menu
- ❖ Insert
- ❖ Page Layout
- ❖ Reference
- ❖ Review
- ❖ View

III. Short Answer Questions:

28. Illustrate the uses of Mathematical Methodsm in Economics.

1. Mathematical Methods help to present the economic problems in a more precise form.
2. Mathematical Methods help to explain economic concepts.
3. Mathematical Methods help to use a large Number variables in economic analyses.
4. Mathematical Methods help to quantify the impact or effect of any economic activity implemented by Government or anybody.

29. Solve for x quantity demanded if $16x - 4 = 68 + 7x$

Solution :

$$16x - 4 = 68 + 7x$$
$$16x - 7x = 68 + 4$$
$$9x = 72$$
$$x = \frac{\cancel{72}}{\cancel{9}}$$
$$\boxed{\therefore x = 8}$$

30. A firm has the revenue function $R = 600q - 0.03q^2$ and the cost function is $C = 150q + 60{,}000$, where q is the number of units produced. Find AR, AC, MR and MC.   *[BEQ]*

Solution :

$$\boxed{MR = \text{Marginal Revenue} = \left(R\cdot\frac{1}{q}\right)}$$

$$R = 600q - 0.03q^2$$
$$R^1 = 600 - (0.03)\,2(q) = 600 - 0.06q$$

$$AR = \frac{R}{q}$$

$$= \frac{600q - 0.03q^2}{q}$$

$$= \frac{600\cancel{q}}{\cancel{q}} - \frac{0.03q^{\cancel{2}}}{\cancel{q}}$$

$$AR = 600 - 0.03q$$

$$\boxed{\text{Average cost (AC)} = \frac{\text{Total cost}}{\text{output}}}$$

$$= \frac{150q + 60000}{q}$$

$$AC = \frac{150\cancel{q}}{\cancel{q}} + \frac{60000}{q}$$

$$AC = 150 + \frac{60000}{q}$$

$$\boxed{\text{Marginal cost (MC)} = \frac{d}{dq}(C)}$$

$$= \frac{d}{dq}(150q + 60000)$$

$$MC = 150$$

31. Solve the following linear equations by using Cramer's rule.

$$x_1 - x_2 + x_3 = 2;$$
$$x_1 + x_2 - x_3 = 0;$$
$$-x_1 - x_2 - x_3 = -6$$

Solution :

$$x_1 - x_2 + x_3 = 2; \qquad (1+4-3)$$
$$x_1 + x_2 - x_2 = 0;$$
$$-x_1 - x_2 - x_3 = -6$$

$$\begin{bmatrix} 1 & -1 & 1 \\ 1 & 1 & -1 \\ -1 & -1 & -1 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} 2 \\ 0 \\ -6 \end{bmatrix}$$

$$AX = B$$

$$A = \begin{bmatrix} 1 & -1 & 1 \\ 1 & 1 & -1 \\ -1 & -1 & -1 \end{bmatrix}$$

$$\Delta = \begin{bmatrix} 1 & -1 & 1 \\ 1 & 1 & -1 \\ -1 & -1 & -1 \end{bmatrix}$$

$$= 1(-1-1) + 1(-1-1) + 1(-1+1)$$
$$= -2 - 2 + 0$$

$$\boxed{\therefore \Delta = -4}$$

32. If a firm faces the total cost function $TC = 5 + x^2$ where x is output, what is TC when x is 10?

Solution :

$$TC = 5 + (10)^2$$
$$= 5 + 100$$

$$\boxed{\therefore TC = 105}$$

33. If $TC = 2.5q^3 - 13q^2 + 50q + 12$ derive the M function and AC function.

Solution :

$$\boxed{\frac{dc}{dq} = M.C,} \qquad \boxed{A.C = \frac{\text{Total cost}}{\text{output}}}$$

$$\frac{dc}{dq} = 2.5(3)q^2 - (13 \times 2)q + 50$$

$$\boxed{M.C = 7.5q^2 - 26q + 50}$$

$$A.C = \frac{2.5q^3 - 13q^2 + 50q + 12}{q}$$

$$= \frac{2.5q^3}{q} - \frac{13q^2}{q} + \frac{50q}{q} + \frac{12}{q}$$

$$\boxed{\therefore A.C = 2.5q^2 - 13q + 50 + \frac{12}{q}}$$

34. What are the steps involved in executing a MS Excel sheet?

i) Plan the keystrokes needed to complete the tasks.

(ii) Click Tools.

(iii) Assign a Name for the Macro.

(iv) Assign a shortcut key for the Macro.

(v) Click Ok.

(vi) Perform the steps needed to create your report.

(vii) Click on the stop button on the Macro toolbar to stop recording and save the Macro.

35. A Research scholar researching the market for fresh cow milk assumes that $Qt = f(Pt, Y, A, N, Pc)$ where Qt is the quantity of milk demanded, Pt is the price of fresh cow milk, Y is average household income, A is advertising expenditure on processed pocket milk, N is population and Pc is the price of processed pocket milk .

(a) What does $Qt = f(Pt, Y, A, N, Pc)$ mean in words?

(b) Identify the independent variables.

(c) Make up a specific form for this function. (Use your knowledge of Economics to deduce whether the coefficients of the different independent variables should be positive or negative.)

a) i) Qt is the functions of Pt, Y, A, N, Pc.

ii) Other determinants of demand are,

❖ Pt - Price of fresh cow milk. Y - Average household Income.

❖ A - Advertising expenditure on processed pocket milk.

❖ N - Population.

❖ Pc - Price of processed pocket milk.

(b) i) 'Y' (Average household Income and population) and 'N' are independent variables.

ii) Pc is depending on Pt, A and N.

iii) 'A' is depending on 'N'.

(c) When price of fresh cow milk increases quantity of milk demanded decreases.

➢ When average household income increases and quantity of milk demanded is also increases.

36. Calculate the elasticity of demand for the demand schedule by using differential calculus method $P = 60 - 0.2Q$ where price is
(i) zero (ii) Rs. 20 (iii) Rs. 40.

Solution : *[Govt. MQP-2018; HY-201...]*

Elasticity of demand

$$e_d = \frac{q}{p}\frac{dp}{dq}$$

$$p = 60 - 0.2q$$

$$\frac{dp}{dq} = 0 - 0.2(1)$$

$$\frac{dp}{dq} = -0.2$$

(i)
$$q = 0$$
$$p = 60 - 0.2(0) = 60 - 0$$
$$e_d = \frac{0}{60} \times (-0.2)$$

$$\boxed{e_d = 0}$$

(ii)
$$q = 20$$
$$p = 60 - 0.2(20)$$
$$p = 60 - 4$$
$$p = 56$$
$$e_d = \frac{20}{56} \times (-0.2) = \frac{-4}{56}$$

$$\boxed{e_d = 0.071}$$

(iii)
$$q = 40$$
$$p = 60 - 0.2(40)$$
$$p = 60 - 8$$
$$p = 52$$
$$e_d = \frac{40}{52} \times -0.2 = \frac{8}{52}$$

$$\boxed{e_d = 0.153}$$

37. The demand and supply functions are $P_d = 1600 - x^2$ and $P_s = 2x^2 + 400$ respectively. Find the consumer's surplus and producer's Surplus at equilibrium point. *[BEQ]*

Solution :

$$P_d = 1600 - x^2$$
$$P_s = 2x^2 + 400$$
$$P_d = P_s$$
$$1600 - x^2 = 2x^2 + 400$$
$$1600 - x^2 - 2x^2 - 400 = 0$$
$$-3x^2 + 1200 = 0$$
$$+3x^2 = +1200$$
$$x^2 = \frac{1200^{400}}{3_1}$$
$$x = \pm\sqrt{400}$$

$$\boxed{x_0 = 20}$$

$$q = \frac{60}{0.2} \times \frac{10}{10} = \frac{600}{2} = 300$$
$$q = 300$$
$$\eta d = \frac{-p}{q} \cdot \frac{dq}{dp} = \frac{-0}{300} \times \frac{-1}{0.2}$$
$$= \frac{0}{60} = 0$$
$$\eta d = 0$$

When P = 20
$$0.2q = 60 - 20$$
$$0.2q = 40$$
$$q = \frac{40}{0.2} \times \frac{10}{10} = \frac{400}{2}$$
$$q = 200$$
$$\eta d = \frac{-p}{q} \cdot \frac{dq}{dp} = \frac{-20}{200} - \frac{1}{0.2}$$
$$= \frac{20}{40} = \frac{1}{2} = 0.5$$
$$\eta d = 0.5$$

When P = 40
$$0.2q = 60 - 40$$
$$0.2q = 20$$
$$q = \frac{20}{0.2} \times \frac{10}{10} = \frac{200}{2} = 100$$
$$q = 100$$
$$\eta d = \frac{-p}{q} \cdot \frac{dp}{dq} = \frac{-40}{100} - \frac{1}{0.2} = \frac{40}{20}$$
$$\eta d = 2$$

P	0	20	40
q	300	200	100
ηd	0	0.5	2

38. What are the ideas of information and communication technology used in economics?

Introduction :

(i) Information and communication Technology (ICT) is the infrastructure that enables computing faster and accurate.

(ii) The following tables gives an idea of range of technologies that fall under the category of ICT.

S.No	Information	Technologies
1	Creation	Personal Computers, Digital Camera, Scanner, Smart Phone
2	Processing	Calculator, PC, Smart Phone
3	Storage	CD, DVD, Pen Drive, Microchip, Cloud
4	Display	PC, TV, Projector, Smart Phone

Best of Luck