Applied Mathematics : Mock 1 - Set 1 (2023-2024)

Section A :-

1) c) $3^1 = 3 \pmod 7 \Rightarrow 3^2 = 2 \pmod 7 \Rightarrow 3^3 = (3\times 2) \pmod 7 \Rightarrow -1 \pmod 7$.

$(3^3)^{16} = (-1)^{16} \pmod 7 \Rightarrow 3^{48} \times 3^2 = 1 \times 3^2 \pmod 7 \Rightarrow 3^{50} = 2 \pmod 7 = \underline{\underline{2}}$

2) c) $\frac{x-3}{x+5} \times \frac{x+5}{x+5} > 0 \Rightarrow \frac{(x-3)(x+5)}{(x+5)^2} > 0 \Rightarrow (x-3)(x+5) > 0$

$\Rightarrow \underline{\underline{x < -5 \text{ or } x > 3}}$

3) b) Since $n = 26 \Rightarrow |t| = 3.07$ & $t_{25}(0.05) = 2.06$

i.e., $|t| > t_\alpha$ $\therefore$ Wheels produced by the Machine is <u>Inferior</u> Quality

4) c) Judgement Sampling

5) b)

$$\begin{array}{ccc} (c) & & (d) \\ ₹85/kg & & ₹100/kg \\ & ₹92/kg\ (m) & \\ 8 & & 7 \end{array}$$

$\frac{\text{quantity of cheaper}}{\text{quantity of dearer}} = \frac{d-m}{m-c} = \underline{\underline{\frac{8}{7}}}$

6) a) $P(X=r) = \frac{e^{-\lambda}\lambda^r}{r!} \Rightarrow P(X=2) = \frac{e^{-2}2^2}{2!} = \frac{e^{-2}\cancel{4}^{\,2}}{\cancel{2}} = 2e^{-2}$ or $\underline{\underline{\frac{2}{e^2}}}$

7) b) $1000 \pmod{24} \Rightarrow 1000 = 24\times 41 + 16 \Rightarrow 1000 \equiv 16 \pmod{24}$

$\therefore$ 1000 hours is equivalent to 16 hours $\therefore$ 7 pm + 16 hrs = <u>11.a.m</u>.

8) c) Rate of Return = $\frac{\text{Current Value of investment} - \text{Cost of investment}}{\text{Cost of investment}} \times 100$

$= \frac{216000 - 200000}{200000} \times 100 \Rightarrow 0.08 \times 100 \Rightarrow \underline{\underline{8\%}}$

9) b) $\int e^x (f(x) + f'(x))\,dx = e^x f(x) + c$ $\quad \therefore \int \underbrace{e^x\left(\log x + \frac{1}{x}\right)}_{e^x\,(f(x)+f'(x))} = e^x \log x + c$

10) a) Short term

11) b) Annual depreciation = $\frac{\text{Cost of an asset} - \text{Scrap value}}{\text{Useful life years}}$

$\Rightarrow 9000 = \frac{80000 - \text{Scrap value}}{8} \Rightarrow 72000 - 80000 = -\text{Scrap value}$

$\therefore$ Scrap Value = $\underline{\underline{₹8000}}$

12) c) $r_{eff} = \left(1+\frac{r}{m}\right)^m - 1 \Rightarrow \left(1+\frac{0.08}{2}\right)^2 - 1 \Rightarrow (1.04)^2 - 1 = 1.0816 - 1 = 0.0816$

$\therefore$ Effective rate of interest = $\underline{\underline{8.16\%}}$

13) c) $A = R\left(\frac{(1+i)^n - 1}{i}\right) \Rightarrow 50000 = R\left[\frac{(1.03)^{16}-1}{0.03}\right] \Rightarrow R = \frac{5000 \times 0.03}{0.6047}$

$\Rightarrow \underline{\underline{R = ₹2480.54}}$

14) b) $\frac{dx}{x} = -\frac{dy}{y} \Rightarrow \log x = -\log y + c \Rightarrow \log x + \log y = \log c$

$\Rightarrow \cancel{\log} xy = \cancel{\log} c \Rightarrow \underline{\underline{xy = C}}$

15) a) $\Sigma p_i = 1 \Rightarrow 0 + 2k + 2k + 3k + k^2 + 2k^2 + 7k^2 + 2k = 1 \Rightarrow 10k^2 - 9k - 1 = 0$

$\Rightarrow (k+1)(10k-1) = 0 \Rightarrow k = -1$ and $k = \frac{1}{10}$ $\therefore$ $\boxed{k = \frac{1}{10}}$

16) b) Secular trend

17) c) $Z = \frac{x-\mu}{\sigma} = \frac{20-12}{4} = \frac{8}{4} = \underline{\underline{2}}$

19) d) $R(x) = 200x - \frac{x^3}{3} \Rightarrow MR = 200 - x^2 \Rightarrow MR(10) = 200 - 100 = 100$ $\therefore$ A is False

$MR = \frac{d}{dx}(R)$ - True

20) a) $P(X \geq 2) = 1 - [P(0) + P(1)] = 1 - (q + 7p)q^6 \Rightarrow 1 - \left(\frac{3}{4} + \frac{7}{4}\right)\left(\frac{3}{4}\right)^6$

$\Rightarrow 1 - \frac{5}{2} \cdot \frac{3^6}{7^6} \Rightarrow 1 - \frac{3645}{8192} = \frac{4547}{8192}$ (A - True)

$P(X \geq 2)$ R - (True)

18) d)

Section - B

21) Given $R = ₹3120$, $i = \frac{6}{100} = 0.06$

$P = R + \frac{R}{i} = ₹\left(3120 + \frac{3120}{0.06}\right) = ₹(3120 + 52{,}000) = ₹55120$

22) a) $A = \begin{bmatrix} 2 & 1 & 0 \\ 3 & 1 & 2 \\ 0 & 4 & -1 \end{bmatrix}$ $|adj A| = |A|^{n-1} \Rightarrow (-15)^{3-1} = (-15)^2 = \underline{\underline{225}}$

$\therefore |A| = 2(-1-8) - 1(-3-0) = 2(-9) - 1(-3) = -18 + 3 = -15$

(or)

b) $AX = B \Rightarrow \begin{bmatrix} p & q \\ r & s \end{bmatrix}\begin{bmatrix} 3 & -4 \\ 1 & -1 \end{bmatrix} = \begin{bmatrix} 5 & 2 \\ -2 & 1 \end{bmatrix} \Rightarrow \begin{bmatrix} 3p+q & -4p-q \\ 3r+s & -4r-s \end{bmatrix} = \begin{bmatrix} 5 & 2 \\ -2 & 1 \end{bmatrix}$

$3p+q = 5$ and $-4p-q = 2$, Solve we get $p = -7$ and $q = 26$

$3r+s = -2$ and $-4r-s = 1$, Solve we get $r = 1$ and $s = -5$

$\therefore \quad A = \begin{bmatrix} -7 & 26 \\ 1 & -5 \end{bmatrix}$

23)

	No of Units	chemical A	Chemical B	Cost
Supplier S	x	4	2	₹10
Supplier T	y	1	1	₹4
		80(min)	(60 min)	

Min $Z = 10x + 4y$ (Objective function)

$4x + y \geq 80$ (Constraint on Chemical A)

$2x + y \geq 60$ (Constraint on chemical B)

$x \geq 0,\ y \geq 0$ (Non-negativetity constraints)

24) a) Given, $x = 4$ km/h, $y = 2$ km/h, $t = 10$ min or $\frac{10}{60}$ hr

Wkt, $d = \frac{t(x^2 - y^2)}{2y} \Rightarrow d = \frac{1}{6}\frac{(4^2 - 2^2)}{2\times 2} = \frac{16-4}{6\times 4} = \frac{12}{24} = \frac{1}{2} = 0.5$

Hence, the distance between two points is 0.5 km

(or)

b) Given :- A pipe can fill a tank in 5 hours (1^{st} pipe)
another pipe can empty it in 6 hours (2^{nd} pipe)

Part of tank filled by 1^{st} pipe in 1 hr $= \frac{1}{5}$

Part of tank emptied by 2^{nd} pipe in 1 hr $= \frac{1}{6}$

$\therefore$ Part of tank filled by both pipes $= \frac{1}{5} - \frac{1}{6} = \frac{1}{30}$

Hence, the tank will be filled completely in 30 hours.

25) $H_0 : \mu \geq 225.4$ $\quad n = 25 \quad \sigma = 21.3$

$H_a : \mu < 225.4$ $\quad \bar{x} = 237.6$

$$\therefore \ t = \frac{\bar{x} - \mu_0}{\frac{s}{\sqrt{n}}} = \frac{237.6 - 225.4}{\frac{21.3}{5}} = 2.86$$

CVA :-

$t \geq -t_\alpha$

$2.86 \geq -1.711$

$\therefore$ Do not reject H_0

Hence, the advertising campaign is successful.

Section - C

26) a) $\int_0^1 x^2 e^x \, dx$

$\int uv \, dx = u \int v \, dx - \int \left[\frac{du}{dx} \int v \, dx \right] dx$

$$= \left[x^2 . e^x \right]_0^1 - \int_0^1 2x e^x \, dx = (1.e^1 - 0) - 2\int_0^1 x e^x \, dx$$

$$= e - 2\left[(xe^x)_0^1 - \int_0^1 1 . e^x \, dx \right] \Rightarrow e - 2(e^1 - 0) + 2\int_0^1 e^x \, dx$$

$$= e - 2e + 2\left[e^x \right]_0^1 \Rightarrow -e + 2(e^1 - e^0) \Rightarrow -e + 2(e - 1) \Rightarrow e - 2$$

(or)

b) $\int \frac{x^3}{x^4 + 3x^2 + 2} \, dx$ $\quad$ Put $x^2 = t \Rightarrow 2x \, dx = dt \Rightarrow x \, dx = \frac{1}{2} dt$

$$\therefore \ = \frac{1}{2} \int \frac{t \, dt}{t^2 + 3t + 2} = \frac{1}{2} \int \frac{t}{(t+2)(t+1)} dt = \frac{A}{t+2} + \frac{B}{t+1}$$

$$\Rightarrow t = A(t+1) + B(t+2) \quad \therefore \ \boxed{A = 2} \ \& \ \boxed{B = -1}$$

$$= \frac{1}{2} \int \left[\frac{2}{t+2} - \frac{1}{t+1} \right] dt \Rightarrow \frac{1}{\cancel{2}} (\cancel{2} \log|t+2|) - \frac{1}{2} \log|t+1| + c$$

$$\Rightarrow \log|x^2 + 2| - \frac{1}{2} \log|x^2 + 1| + c$$

27) Number of pens and notebooks sold by both the shopkeepers are represented by sale matrix

$$S = \begin{array}{cc} P & NB \\ \left(\begin{array}{c} 5 \\ 6 \end{array} \right. & \left. \begin{array}{c} 7 \\ 4 \end{array} \right) \end{array} \begin{array}{l} \text{shopkeeper } P \\ \text{shopkeeper } Q \end{array}$$

Also, cost of a pen and a notebook

$$C = \begin{pmatrix} ₹12 \\ ₹27 \end{pmatrix} \begin{array}{l} \text{Pen} \\ \text{Notebook} \end{array}$$

$$\text{Amount received} = \begin{pmatrix} 5 & 7 \\ 6 & 4 \end{pmatrix} \begin{pmatrix} 12 \\ 27 \end{pmatrix} = \begin{pmatrix} 60+189 \\ 72+108 \end{pmatrix} = \begin{pmatrix} 249 \\ 180 \end{pmatrix}$$

Hence, shopkeeper P received ₹249 and shopkeeper Q received ₹180.

28) Let r be the radius of the spherical balloon @ any time t,

V be its Volume and s its Suface area

$V = \frac{4}{3}\pi r^3$ ⟶ ① & $S = 4\pi r^2$ Given :- $\frac{dV}{dt} = 3\,cm^3/sec$ ⟶ ②

① = ②

$3 = 4\pi r^2 \frac{dr}{dt} \Rightarrow \boxed{\frac{dr}{dt} = \frac{3}{4\pi r^2}}$ $\frac{ds}{dt} = 4\pi . 2r\frac{dr}{dt} = 8\pi r . \frac{3}{4\pi r^2}$

$\Rightarrow \frac{ds}{dt} = \frac{6}{r} \Rightarrow \left.\frac{dS}{dt}\right|_{r=2} = 3$

Hence, the suface area is increasing @ the rate $3\,cm^2/sec$ @ $r = 2cm$

29 a) $D(q) = 1000 - 0.4q^2$ $S(q) = 42q$ @ Equilibrium $D(q) = S(q)$

$1000 - 0.4q_0^2 = 42q_0 \Rightarrow 0.4q_0^2 + 42q_0 - 1000 = 0 \Rightarrow q^2 + 105q - 2500 = 0$

$\Rightarrow (q_0+125)(q_0-20) = 0 \Rightarrow q_0 = 20$ or -125 $\therefore \boxed{q_0 = 20} \Rightarrow \boxed{P_0 = 840}$

$PS = q_0P_0 - \int_0^{q_0} S(q)\,dq \Rightarrow 20 \times 840 - \int_0^{20} 42q\,dq = 16800 - 42\left[\frac{q^2}{2}\right]_0^{20}$

$PS = 16800 - 8400 = 8400$ units.

Hence, at equibrilum price, the producer's surplus is 8400 units

(or)

b) $D(q) = S(q)$ @ equilibrium $D(q) = \frac{20}{q+1}$, $S(q) = q+2$

$\Rightarrow \frac{20}{q_0+1} = q_0 + 2 \Rightarrow 20 = (q_0+1)(q_0+2) \Rightarrow q_0^2 + 3q_0 - 18 = 0$

$\Rightarrow (q_0+6)(q_0-3) \Rightarrow q_0 = -6$ and 3 $\therefore \boxed{q_0 = 3} \Rightarrow \boxed{P_0 = 5}$

$$\text{Consumer's Surplus} = \int_0^{q_0} D(q)\,dq - q_0 p_0 = \int_0^3 \frac{20}{q+1}\,dq - (3)(5)$$

$$= 20\log(q+1)\Big|_0^3 - 15 \Rightarrow 20\log 4 - 15 \Rightarrow 20(2\log 2) - 15$$

$$\Rightarrow 40\log 2 - 15 \Rightarrow 40(0.6932) - 15 = 12.73$$

Hence, at equilibrium price, the consumer's Surplus is 12.73

30) Given : Purchase = ₹40,00,000

Down payment = ₹x

Balance, $P = (₹40,00,000 - x)$

$r = 9\% \Rightarrow i = \frac{9}{1200}$; $n = 25 \times 12 = 300$

EMI = ₹30,000

$$EMI = \frac{P \times i}{1-(1+i)^{-n}} \Rightarrow 30{,}000 = \frac{(4000000 - x) \times 0.0075}{1-(1.0075)^{-300}}$$

$$30{,}000 = \frac{(4000000 - x) \times 0.0075}{1 - 0.1062} \Rightarrow \frac{26814}{0.0075} = 40{,}00{,}000 - x$$

$x = 40,00,000 - 3575200 \Rightarrow x = ₹4,24,800$

∴ The downpayment amount be ₹4,24,800

31) Given $P = ₹1,50,000$, $r = 9\%$ or 0.09, $n = 3$, $m = 4$ (quarterly)

$$\text{Sinking fund, } A = \frac{\left[\left[\left(1+\frac{r}{m}\right)\right]^{n\times m}\right] - 1}{\left(\frac{r}{m}\right)} \times P$$

$$\Rightarrow \frac{\left\{\left(1+\frac{0.09}{4}\right)\right\}^{12} - 1}{\left(\frac{0.09}{4}\right)} \times 1{,}50{,}000 =$$

$$\Rightarrow \frac{(1+0.0225)^{12} - 1}{0.0225} \times 150000$$

$\Rightarrow$ ₹2,040,000

or $R = ₹1,50,000$

$n = 12$

$i = \frac{9}{400} = 0.0225$

$$A = R\left[\frac{(1+i)^n - 1}{i}\right]$$

$$A = 150000\left[\frac{(1.0225)^{12} - 1}{0.0225}\right]$$

$$A = \frac{150000 \times 10000}{225} \times (0.3060)$$

A = ₹2,040000

Section-D

32) a) (i) Given mean $= \lambda = 3.2$

Let X be the number of bicycle riders which use the cycle track

Required Probability $= P(X \le 2) = P(X=0) + P(X=1) + P(X=2)$

$$P(X=r) = \frac{e^{-\lambda}\lambda^r}{r!} \Rightarrow \frac{e^{-3.2}(3.2)^0}{0!} + \frac{e^{-3.2}(3.2)^1}{1!} + \frac{e^{-3.2}(3.2)^2}{2!}$$

$$\Rightarrow e^{-3.2}[1+3.2+5.12] \Rightarrow 0.041 \times 9.32 \Rightarrow \underline{\underline{0.382}}$$

(ii) Required Probability $= P(X \ge 3) = 1 - P(X \le 2)$

$$= 1 - 0.382 \Rightarrow \underline{\underline{0.618}}$$

(or)

(b) Let X denote the amount which the man wins or loses

As the man throws a die atmost thrice and quits the game as and when he gets a number greater than 4, the sample space of the random experiment is $S = \{W, LW, LLW, LLL\}$

$\therefore \; X = \underbrace{5, 4, 3}_{\text{Profit}}, \underset{\downarrow \text{loss}}{-3}$

P(getting a number greater than 4) $= \frac{2}{6} = \frac{1}{3}$

P(not getting a number greater than 4) $= \frac{4}{6} = \frac{2}{3}$

$P(X=5) = \frac{1}{3}$

$P(X=4) = \frac{2}{3} \times \frac{1}{3} = \frac{2}{9}$

$P(X=3) = \frac{2}{3} \times \frac{2}{3} \times \frac{1}{3} = \frac{4}{27}$

$P(X=-3) = \frac{2}{3} \times \frac{2}{3} \times \frac{2}{3} = \frac{8}{27}$

$E(X) = \Sigma x_i p_i = \left(\frac{1}{3} \times 5\right) + \left(\frac{2}{9} \times 4\right) + \left(\frac{4}{27} \times 3\right) + \left(\frac{8}{27} \times -3\right)$

$= \frac{5}{3} + \frac{8}{9} + \frac{4}{9} - \frac{8}{9}$

$E(X) = \frac{19}{9}$

$\therefore$ The Expected amount he wins $= ₹\frac{19}{9}$ or $₹2\frac{1}{9}$

33)

Type	no of units	cost	Profit
A	x	₹360	₹100
B	y	₹120	₹50
	≤ 300 (atmost)	$\leq$ ₹72000 (atmost)	

Maximize $Z = 100x + 50y$

$360x + 120y \leq 72000$

$\Rightarrow 3x + y \leq 600$ (Constraint on investment)

$x + y \leq 300$ (constraint on capacity)

$y \leq x + 200$ (constraint on Type B)

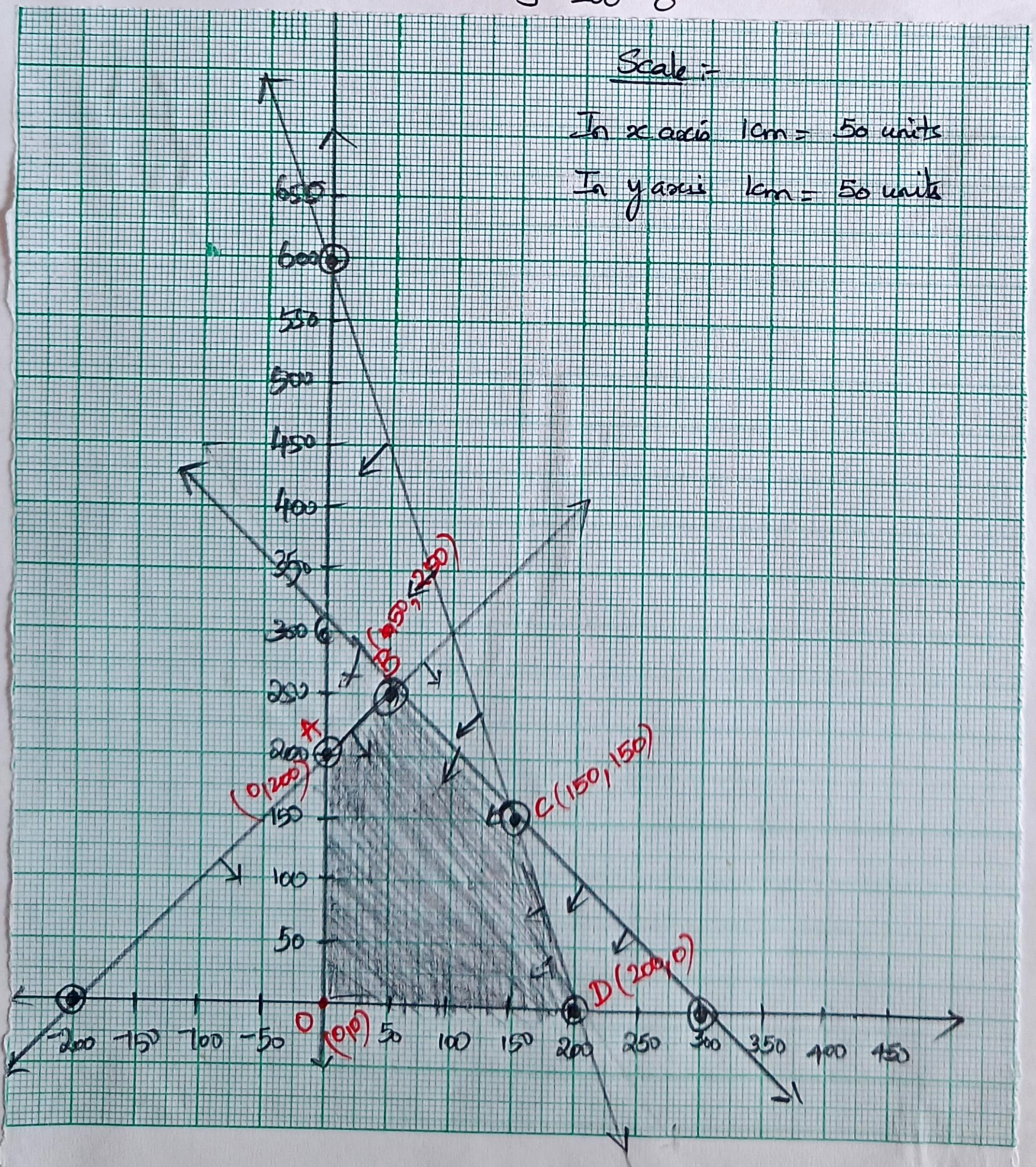
$x \geq 0,\ y \geq 0$ (Non-negativity Constraints)

$3x + y = 600$; $x + y = 300$; $x - y = -200$

x	0	200
y	600	0

x	0	300
y	300	0

x	0	-200
y	200	0



Corner points	$Z = 100x + 50y$
$(0,0)$	0
$(0, 200)$	10000
$(50, 250)$	17500
$(150, 150)$	22500 → Max
$(200, 0)$	20000

Hence, maximum profit = ₹22500 by manufacturing 150 cardigans of type A and 150 cardigans of type B.

34)

a) Let the two numbers be x and y

Given: $x+y=15 \Rightarrow \boxed{y = 15-x}$

To prove: $P = x^2y^3 \Rightarrow \boxed{P = x^2(15-x)^3}$

$$\frac{dP}{dx} = 2x(15-x)^3 + 3x^2(15-x)^2(-1)$$

$$\boxed{\frac{dP}{dx} = 2x(15-x)^3 - 3x^2(15-x)^2}$$

$$\frac{dP}{dx} = 0 \Rightarrow 2\cancel{x}(15-x)^{\cancel{3}} = 3x^{\cancel{2}}\cancel{(15-x)^2} \Rightarrow 30-2x = 3x \Rightarrow 30 = 5x$$

$$\Rightarrow \boxed{x = 6} \quad \therefore \boxed{y = 9}$$

$$\frac{d^2P}{dx^2} = 2(15-x)^3 - 6x(15-x)^2 - 6x(15-x)^2 + 6x^2(15-x)$$

@ $x = 6$

$$\Rightarrow 2(9)^3 - 12(6)(9)^2 + (6)\times 6^2(9)$$

$$= 1458 - 5832 + 1944$$

$$= 3402 - 5832$$

$\boxed{\frac{d^2P}{dx^2} = -2430 < 0}$, Thus P is maximum when $x = 6$ & $y = 9$

So, the required two parts into which 15 should be divided are 6 and 9.

(or)

b) Given, the demand function is $x = \frac{24-2p}{3}$

(i) Revenue function $R = px = p \times \frac{24-2p}{3} \Rightarrow R = 8p - \frac{2}{3}p^2$

(ii) To prove : R is Maximum

$$\frac{dR}{dp} = 8 - \frac{2}{3}(2p) = 8 - \frac{4}{3}p \qquad \therefore \boxed{\frac{dR}{dp} = 8 - \frac{4}{3}p}$$

$$\frac{dR}{dp} = 0 \Rightarrow 8 - \frac{4}{3}p = 0 \Rightarrow \overset{2}{\cancel{8}} = \frac{\cancel{4}}{3}p \Rightarrow \boxed{p = 6}$$

$$\frac{d^2R}{dp^2} = 0 - \frac{4}{3} \Rightarrow \boxed{\frac{d^2R}{dp^2} = -\frac{4}{3} < 0}$$

$\therefore$ The revenue is maximum when $p = 6$ i.e., the price per unit is ₹6.

The number of units demanded is given by $x = \frac{24 - 2\times 6}{3} = 4$

Hence, the revenue is maximum when 4 units are demanded and the price per unit is ₹6.

35) Let adaptable to new techniques be 'x'

Let careful and alert in difficult situations be 'y'

Let keeping calm in tense situations be 'z'

$$x + y + z = 9500$$

$$2x + 4y + 3z = 29{,}000$$

$$5x + 2y + 3z = 30{,}500$$

$$AX = B$$

$$\begin{bmatrix} 1 & 1 & 1 \\ 2 & 4 & 3 \\ 5 & 2 & 3 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 9500 \\ 29000 \\ 30500 \end{bmatrix}$$

$$|A| = 2(2-3) - 4(5-3) + 3(5-2) = -1$$

$|A| \neq 0$, hence A^{-1} exists

The system is consistent & has unique solution

$$X = A^{-1}B \quad \text{where} \quad A^{-1} = \frac{1}{|A|}\,\text{adj}\,A$$

$$\begin{array}{cccccccc}
4 & & 3 & & 2 & & 4 & \\
 & 6 & & 9 & & -16 & & \\
2 & & 3 & & 5 & & 2 & \\
 & -1 & & -2 & & 3 & & \\
1 & & 1 & & 1 & & 1 & \\
 & -1 & & -1 & & 2 & & \\
4 & & 3 & & 2 & & 4 &
\end{array}$$

$$\text{Cofactor of } A = \begin{bmatrix} 6 & 9 & -16 \\ -1 & -2 & 3 \\ -1 & -1 & 2 \end{bmatrix}$$

$$\text{adj}\,A = (\text{Cof } A)^T = \begin{bmatrix} 6 & -1 & -1 \\ 9 & -2 & -1 \\ -16 & 3 & 2 \end{bmatrix}$$

$$\therefore A^{-1} = \frac{1}{|A|}\,\text{adj}\,A$$

$$A^{-1} = \frac{1}{-1}\begin{bmatrix} 6 & -1 & -1 \\ 9 & -2 & -1 \\ -16 & 3 & 2 \end{bmatrix}$$

$$A^{-1} = \begin{bmatrix} -6 & 1 & 1 \\ -9 & 2 & 1 \\ 16 & -3 & -2 \end{bmatrix}$$

$$X = A^{-1}B$$

$$X = \begin{bmatrix} -6 & 1 & 1 \\ -9 & 2 & 1 \\ 16 & -3 & -2 \end{bmatrix}\begin{bmatrix} 9500 \\ 29000 \\ 30500 \end{bmatrix}$$

$$X = \begin{bmatrix} -57000 + 29000 + 30500 \\ -85500 + 58000 + 30500 \\ 152000 - 87000 - 61000 \end{bmatrix} \Rightarrow X = \begin{bmatrix} 2500 \\ 3000 \\ 4000 \end{bmatrix} \Rightarrow \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 2500 \\ 3000 \\ 4000 \end{bmatrix}$$

$$\therefore x = ₹\,2500$$

$$y = ₹\,3000$$

$$z = ₹\,4000$$

Section - E

36) i)

(c) ₹15 (d) ₹20

(m) ₹16.50

₹3.50 (d-m) ₹1.50 (m-c)

$\dfrac{\text{quantity of cheaper}}{\text{quantity of dearer}} = \dfrac{3.50}{1.50} = \dfrac{7}{3}$

$\therefore$ $\underline{\underline{7:3}}$

(ii)

(c) 930 (d) 1080

(m) 100

80 (d-m) 70 (m-c)

Required ratio $= \dfrac{d-m}{m-c} = \dfrac{80}{70} = \dfrac{8}{7}$

i.e., $\underline{\underline{8:7}}$

iii) Let quantity of pure milk be x litres. It is given that the mixture is sold @ a profit of 20% and the selling price of the mixture is ₹60/l.

$SP = CP\left(1 + \dfrac{\text{Profit}}{100}\right) \Rightarrow 60 = CP\left(1 + \dfrac{20}{100}\right) \Rightarrow CP = 60 \times \dfrac{5}{6} = ₹50$

₹60/l (Milk) ₹0/l (Water)

Mean price ₹50/l

50 10

thus, $\dfrac{\text{Quantity of pure milk}}{\text{Quantity of water}} = \dfrac{50}{10}$

$\dfrac{x}{5} = \dfrac{5}{1}$

$\boxed{x = 25}$

Hence, the amount of pure milk in the mixture is 25 litres.

(or)

SP of mixture = ₹110, profit 10 %.

$SP = CP\left(1 + \frac{\text{Profit}}{100}\right) \Rightarrow 110 = CP\left(1 + \frac{10}{100}\right) \Rightarrow 110 = CP\left(\frac{110}{100}\right) \Rightarrow \boxed{CP = ₹100}$

Let the C.P. of second liquid be ₹x

C.P. of first liquid be ₹$(x+20)$

Thus, CP of 1st liquid = ₹$(x+20)$, CP of Mixture = ₹100

₹ $(x+20)$ (CP of 1st liq) ₹x (CP of 2nd liq)

₹100

$(100-x)$ $(x-80)$

$\frac{\text{Quantity of 1st liquid}}{\text{Quantity of 2nd liquid}} = \frac{100-x}{x-80} = \frac{3}{2} \Rightarrow \boxed{x = 88}$

Hence, cost price of 2nd liquid is ₹88.

37) (i) $n = 6$, $P = \frac{1}{2}$ Let X denoted number of heads

(ii) $P(X=4) = {}^6C_4\left(\frac{1}{2}\right)^4\left(\frac{1}{2}\right)^2 = \frac{15}{64}$

(iii) $P(X \geq 4) = P(X=4) + P(X=5) + P(X=6)$

$= {}^6C_4\left(\frac{1}{2}\right)^4\left(\frac{1}{2}\right)^2 + {}^6C_5\left(\frac{1}{2}\right)^5\left(\frac{1}{2}\right)^1 + {}^6C_6\left(\frac{1}{2}\right)^6\left(\frac{1}{2}\right)^0$

$= (15+6+1)\left[\frac{1}{2^6}\right] = \frac{11}{32}$

(or)

If $n = 5$ and $P(X=0) = \frac{32}{343}$, then ${}^5C_0\, q^5 = \frac{32}{343} \Rightarrow q^5 = \left(\frac{2}{3}\right)^5 \Rightarrow \boxed{q = 5}$

$\therefore P = \frac{1}{3}$

$\therefore P(X=3) = {}^5C_3\, p^3 q^2 = 10 \times \left(\frac{1}{3}\right)^3\left(\frac{2}{3}\right)^2 = \frac{40}{243}$

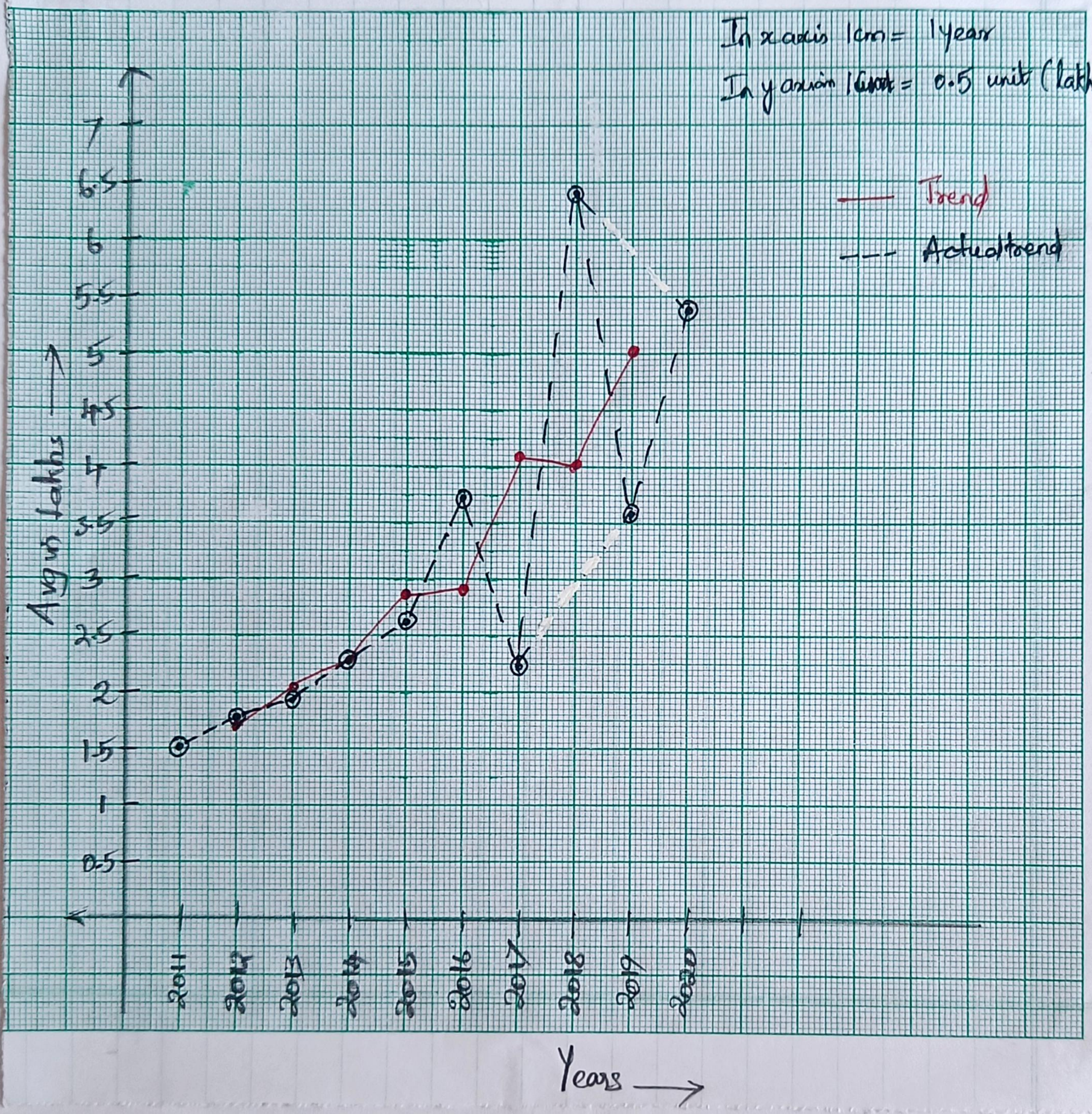
38)

Year	Avg (in lakh)	3yr moving	3yr moving average
2011	1.5	–	–
2012	1.8	5.2	1.733
2013	1.9	5.9	1.966
2014	2.2	6.7	2.233
2015	2.6	8.5	2.833
2016	3.7	8.5	2.833
2017	2.2	12.3	4.10
2018	6.4	12.2	4.066
2019	3.6	15.4	5.133
2020	5.4	–	–

(i) The trend value for the year 2012 = 1.733

(ii) The trend value for the year 2015 = 2.833

(iii) Graph (P.T.O)


In x axis 1cm = 1year
In y axis 1 = 0.5 unit (lakhs)
Trend
Actual trend
Avg in lakhs
7
6.5
6
5.5
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
Years