Applied Mathematics - Mock 1 - Set 2 - Answer Keys 2023-2024

Section A

1) b) $(-6\times5)(\text{mod } 7) = -30(\text{mod } 7) = 5$

2) b) $-12x > 30 \Rightarrow \frac{-12x}{-12} < \frac{30}{-12} \Rightarrow x < \frac{-5}{2}$ i.e., $\{\ldots,-5,-4,-3\}$

3) b) Probability of not rejecting H_0 when H_0 is true

4) a) $\bar{x} - E = 100$, $\bar{x} + E = 300$, Solve $\bar{x} = 200$ and $E = 100$

5) d) $D = S\times T \Rightarrow X+Y = 30+6 = 36$ km/hr $\Rightarrow 24$ min $= \frac{24}{60}$ hrs

$\therefore D = 36\times\frac{24}{60} = 14.4$ km

6) c) $p = \frac{1}{4}$ $q = 1-p = \frac{3}{4}$ $\sigma = 3 = \sqrt{npq} \Rightarrow 9 = n\times\frac{1}{4}\times\frac{3}{4} \Rightarrow \boxed{n = 48}$

$\therefore \lambda = np = 48\times\frac{1}{4} = \underline{\underline{12}}$

7) b) 4

8) c) $P = \frac{R}{i}$

9) a) $\int x(5x^2-7)^6 dx = \frac{1}{10}\int(5x^2-7)^6 . 10x\, dx$ $\left\{ \int [f(x)]^n f'(x) dx = \frac{[f(x)]^{n+1}}{n+1} + c \right\}$

$\Rightarrow \frac{1}{10}\frac{(5x^2-7)^7}{7} + c = \frac{1}{70}(5x^2-7)^7 + c$

10) b) secular trend

11) d) Annual depreciation $= \frac{\text{Cost of an asset} - \text{Scrap Value}}{\text{Useful life}} = \frac{25000-8000}{6}$ ₹2833

12) c) $r_{eff} = \frac{10.25}{100} = 0.1025$ and $m = 2$

$r_{eff} = \left(1+\frac{r}{m}\right)^m - 1 \Rightarrow r_{eff} = \left(1+\frac{r}{2}\right)^2 - 1 \Rightarrow 0.1025 = \left(1+\frac{r}{2}\right)^2 - 1$

$\left(1+\frac{r}{2}\right)^2 = 1+0.1025 = 1.1025 \Rightarrow 1+\frac{r}{2} = \sqrt{1.1025} = 1.05$

$\Rightarrow \frac{r}{2} = 1.05-1 \Rightarrow \frac{r}{2} = 0.05 \Rightarrow r = 0.10 \Rightarrow \underline{\underline{10\%}}$

13) c) $CAGR = \left[\left(\frac{FV}{PV}\right)^{1/n} - 1\right] \times 100 \Rightarrow CAGR = \left[\left(\frac{14000}{10000}\right)^{1/2} - 1\right] \times 100$

$CAGR = \left(\frac{7}{5}\right)^{1/2} - 1 \Rightarrow (1.14)^{1/2} - 1 \Rightarrow 1.1832 - 1 \Rightarrow 0.1832 \times 100 \Rightarrow 18.32\%$

14) c) $x\frac{dy}{dx} - y = x^4 - 3x \Rightarrow I.F = e^{\int P dx} = e^{\int -\frac{1}{x} dx} = e^{-\log x} = e^{\log x^{-1}} = \underline{\underline{\frac{1}{x}}}$

$\frac{dy}{dx} - \frac{1}{x}\cdot y = x^3 - 3$

15) c) $Z = 3x + 2y$ @ $(0,2) = 4$

$(2,0) = 6 \longrightarrow$ Max

$(0,0) = 0$

16) c) Variance $= E(X^2) - [E(X)]^2 = 11 - (3)^2 = 11 - 9 = \underline{\underline{2}}$

17) d) All the given option are Correct

18) d) $Z = \frac{x-\mu}{\sigma} \Rightarrow 5 = \frac{x-12}{4} \Rightarrow x - 12 = 20 \Rightarrow \boxed{x = 32}$

19) a) Both the Assertion and Reason is true, and the reason is correct explanation for assertion

20)

Section B

21) Given $P = ₹40,000$; $r = 6\%$; $i = \frac{0.06}{2} = 0.03$, $P = \frac{R}{i}$ (payable @ end)

$40,000 = \frac{x}{0.03} \Rightarrow \boxed{x = ₹1200}$

22) a) $A = \begin{bmatrix} 3 & -2 \\ 4 & -2 \end{bmatrix} \Rightarrow A^2 = \begin{bmatrix} 1 & -2 \\ 4 & -4 \end{bmatrix} \Rightarrow A^2 = kA - 2I \Rightarrow \begin{bmatrix} 1 & -2 \\ 4 & -4 \end{bmatrix} = \begin{bmatrix} 3k-2 & -2k \\ 4k & -2k-2 \end{bmatrix}$

$\Rightarrow 3k - 2 = 1, \; -2k = -2, \; 4k = 4, \; -2k - 2 = -4 \Rightarrow \boxed{k = 1}$

(or)

b) $A' = -A$

$\begin{bmatrix} 0 & a-8 & -c+2 \\ -1 & 0 & 2 \\ 28 & 3b & 0 \end{bmatrix} = \begin{bmatrix} 0 & 1 & -28 \\ -a+8 & 0 & -3b \\ c-2 & -2 & 0 \end{bmatrix} \Rightarrow a - 8 = 1 \Rightarrow \boxed{a = 9}$

$3b = -2 \Rightarrow \boxed{b = \frac{-2}{3}}$

$-c + 2 = -28 \Rightarrow \boxed{c = 30}$

23)

Items	No. of Units	Cost	Profit
Wall hangings	x	₹300	₹50
Artificial plants	y	₹150	₹18
	≤ 80 (Space atmost)	$\leq$ ₹15000 (invest)	

Maximize $Z = 50x + 18y$

$x + y \leq 80$ (Constraint on space)

$300x + 150y \leq 15000$

$\Rightarrow 2x + y \leq 100$ (constraint on investment)

$x \geq 0, y \geq 0$ (non-negativity constraint)

24) a) $\frac{\text{Time taken upstream}}{\text{Time taken downstream}} = \frac{2}{1}$

Let x be the speed of the boat $= 15$ km/h

y " " " " stream $= y$ km/h

$\Rightarrow \frac{15+y}{15-y} = \frac{2}{1} \Rightarrow 15+y = 30-2y \Rightarrow 3y = 15 \Rightarrow \underline{y = 5 \text{ km/h}}$

(or)

b) A beats B by 1 km i.e., A travels 10 km & B travels 9 km

i.e., Speed of A : Speed of B = 10 : 9 = 100 : 90

Illy, B beats C by 1 km i.e., Speed of B : Speed of C = 10 : 9 = 90 : 81

$\therefore$ Speed of A : Speed of B : Speed of C = 100 : 90 : 81

$\Rightarrow$ A travels 100 m and C travels 81 m

$\Rightarrow$ A travels 10000 m and C travels 8100 m

$\Rightarrow$ A beats C by 1900 m.

25) Given :-

$H_0 : \mu = 0.50$ mm

$H_a : \mu \neq 0.50$ mm

$\mu = 0.50$ mm

$\bar{x} = 0.53$ mm

$n = 10$

$$t = \frac{\bar{x}-\mu}{\frac{s}{\sqrt{n-1}}} = \frac{0.50-0.50}{\frac{0.03}{3}} = 3 \qquad \boxed{t=3}$$

<u>CVA</u>:- $t \geq t_{\alpha/2} \Rightarrow 3 \geq 2.262$ $\therefore$ Reject H_0

Hence, we conclude that machine is not working properly.

<u>Section-C</u>

26) a) $\int \frac{x^2}{1-x^6}\,dx \Rightarrow \int \frac{x^2}{1-(x^3)^2}\,dx$ Let $x^3 = t \Rightarrow 3x^2 = \frac{dt}{dx} \Rightarrow dx = \frac{dt}{3x^2}$

$$\Rightarrow \int \frac{\cancel{x^2}}{1-(t)^2}\cdot\frac{dt}{3\cancel{x^2}} \Rightarrow \frac{1}{3}\int\frac{dt}{1-t^2} \qquad \left\{\because \int\frac{dx}{a^2-x^2} = \frac{1}{2a}\log\left|\frac{a+x}{a-x}\right| + c\right\}$$

$$= \frac{1}{3}\cdot\frac{1}{2}\log\left|\frac{1+t}{1-t}\right| + c \Rightarrow \frac{1}{6}\log\left|\frac{1+x^3}{1-x^3}\right| + c$$

(or)

b) $I = \int (x^2+1)\log x\,dx$ $\left\{\because \int uv\,dx = u\int v\,dx - \int\left[\frac{d}{dx}u\int v\,dx\right]dx\right\}$

$$I = \log x\int(x^2+1)dx - \int\left[\frac{d}{dx}\log x\int(x^2+1)\,dx\right]dx$$

$$I = \log x\left[\frac{x^3}{3}+x\right] - \int\left[\frac{x^3}{3}+1\right]dx = \left(\frac{x^3}{3}+x\right)\log x - \frac{x^3}{9} - x + c //$$

27) $A = \begin{bmatrix} 2 & 0 & 1 \\ 2 & 1 & 3 \\ 1 & -1 & 0 \end{bmatrix}$ $A^2 = \begin{bmatrix} 5 & -1 & 2 \\ 9 & -2 & 5 \\ 0 & -1 & -2 \end{bmatrix}$

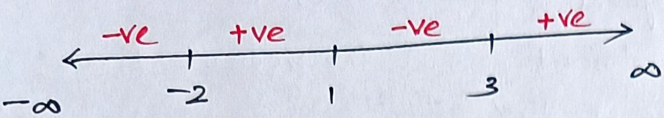
$$A^2 - 5A + 4I = \begin{bmatrix} 5 & -1 & 2 \\ 9 & -2 & 5 \\ 0 & -1 & -2 \end{bmatrix} - 5\begin{bmatrix} 2 & 0 & 1 \\ 2 & 1 & 3 \\ 1 & -1 & 0 \end{bmatrix} + 4\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix} = \begin{bmatrix} -1 & -1 & -3 \\ -1 & -3 & -10 \\ -5 & 4 & 2 \end{bmatrix}$$

$$X = -(A^2 - 5A + 4I) = X = -\begin{bmatrix} -1 & -1 & -3 \\ -1 & -3 & -10 \\ -5 & 4 & 2 \end{bmatrix} \Rightarrow X = \begin{bmatrix} 1 & 1 & 3 \\ 1 & 3 & 10 \\ +5 & -4 & -2 \end{bmatrix}$$

28) $f(x) = \frac{3}{10}x^4 - \frac{4}{5}x^3 - 3x^2 + \frac{36}{5}x + 11 \Rightarrow f'(x) = \frac{12}{10}x^3 - \frac{12}{5}x^2 - 6x + \frac{36}{5}$

$f'(x) \Rightarrow \frac{6}{5}(x-1)(x+2)(x+3)$

$f'(x) = 0 \Rightarrow \boxed{x = 1, -2, 3}$



$f(x)$ is strictly increasing in $(-2, 1) \cup (3, \infty)$ $\{\because f'(x) > 0$

$f(x)$ is strictly decreasing in $(-\infty, -2) \cup (1, 3)$ $\{\because f'(x) < 0$

29) (a) Given : $D(x) = p = x^2 - 6x + 16$ & $S(x) = p = \frac{1}{3}x^2 + \frac{4}{3}x + 4$

$x_0 = x$, $p_0 = p$ and $D(x) = S(x)$ @ equilibrium

$x_0^2 - 6x_0 + 16 = \frac{1}{3}x_0^2 + \frac{4}{3}x_0 + 4 \Rightarrow x_0^2 - 11x_0 + 18 = 0 \Rightarrow (x_0 - 2)(x_0 - 9) = 0$

Since $x < 7$, $\therefore \boxed{x_0 = 2} \Rightarrow \boxed{P_0 = 8}$

Consumer's Surplus $= \int_0^{x_0} D(x)\,dx - P_0 x_0 = \int_0^2 (x^2 - 6x + 16)\,dx - 8 \times 2$

$CS \Rightarrow \left[\frac{x^3}{3} - \frac{6x^2}{2} + \frac{16x}{2}\right]_0^2 - 16 \Rightarrow \boxed{CS = \frac{20}{3}}$

Hence, Consumer's surplus @ equilibrium is $\frac{20}{3}$ units

(or)

(b) Given: $MC = \frac{x}{\sqrt{x^2 + 400}}$, $C(x) = \int MC\,dx$

$\therefore C(x) = \int \frac{x}{\sqrt{x^2+400}}\,dx$ put $\sqrt{x^2 + 400} = t \Rightarrow x^2 + 400 = t^2 \Rightarrow 2x\,dx = 2t\,dt$

i.e., $x\,dx = t\,dt$)

$C(x) \Rightarrow \int \frac{\cancel{t}\,dt}{\cancel{t}} = \int dt = t + k \Rightarrow \boxed{C(x) = \sqrt{x^2 + 400} + k}$

Given fixed cost $= 1000$ i.e, when $x = 0$, $C(x) = 1000$

$\Rightarrow 1000 = \sqrt{0^2 + 400} + k \Rightarrow 1000 = 20 + k \Rightarrow \boxed{k = 980}$

$\therefore C(x) = \sqrt{x^2 + 400} + 980$

$\therefore$ Average cost $= \frac{C(x)}{x} = \frac{\sqrt{x^2 + 400}}{x} + \frac{980}{x}$

30) Cost of car purchased by Amrita = ₹ 12,50,000

Downpayment = ₹ 3,00,000

Balanced Amount = ₹ 9,50,000 = P

$r = 15\%$

i.e., $i = \frac{15}{1200} = 0.0125$; $n = 48$

$$EMI = \frac{Pi}{1-(1+i)^{-n}} = \frac{9,50,000 \times 0.0125}{1-(1+0.0125)^{-48}} = \frac{11875}{1-(1.0125)^{-48}}$$

$$EMI = \frac{11875}{1-0.5508565} = \frac{11875}{0.4491435} = ₹\ 26,439.2115$$

∴ EMI is approximately ₹ 26,439

31) $A = ₹\ 3,00,000 - ₹\ 30,000 = ₹\ 2,70,000$

$R = ?$

$n = 7$

$r = 5\%$ p.a. $\Rightarrow i = \frac{5}{100} = 0.05$

$$A = R\left[\frac{(1+i)^n - 1}{i}\right] \Rightarrow 270000 = R\left[\frac{(1+0.05)^7 - 1}{0.05}\right]$$

$$2700\cancel{00} \times \frac{5}{1\cancel{00}} = R\left[1.407-1\right] \Rightarrow 13500 = R\left[0.407\right]$$

$\boxed{R = ₹33169.53}$

∴ The annual deposit unto the sinking fund is ₹ 33169.53

Section D :-

32) a) Probability of defective bucket = 0.03

$n = 100$

$\lambda = np \Rightarrow \lambda = 100 \times 0.03 \Rightarrow \boxed{\lambda = 3}$

Let X = number of defective buckets in a sample of 100

$$P(X=r) = \frac{e^{-\lambda}\lambda^{r}}{r!}$$

(i) $P(\text{no defective buckets}) = P(X=0) = \frac{e^{-3}(3)^0}{0!} = e^{-3} = \underline{\underline{0.049}}$

(ii) $P(\text{atmost one defective buckets}) = P(X \le 1) = P(0) + P(1)$

$$= \frac{e^{-3}(3)^0}{0!} + \frac{e^{-3}(3)^1}{1!} = 0.049 + 0.147 = \underline{\underline{0.196}}$$

(or)

b) $p = 3q$ and $p+q=1$

Let p be probability of success.
q be probability of failure

$p = \frac{3}{4}$ $\quad q = \frac{1}{4}$

$\therefore$ $P(\text{atleast 3 successes}) = P(X \geq 3) = P(3) + P(4) + P(5)$

$$P(X \geq 3) = {}^5C_3\left(\frac{1}{4}\right)^2\left(\frac{3}{4}\right)^3 + {}^5C_4\left(\frac{1}{4}\right)^1\left(\frac{3}{4}\right)^4 + {}^5C_5\left(\frac{3}{4}\right)^5$$

$$= \frac{270}{1024} + \frac{405}{1024} + \frac{243}{1024} = \frac{918}{1024} = \frac{459}{512}$$

33.

Fertilisers	No. of units	Nitrogen	Phosphoric acid	costs
A	x	12%	5%	₹10/kg
B	y	4%	5%	₹8/kg
		$\geq$ 12kg (atleast)	$\geq$ 12kg (atleast)	

Minimize $Z = 10x + 8y$ (objective function)

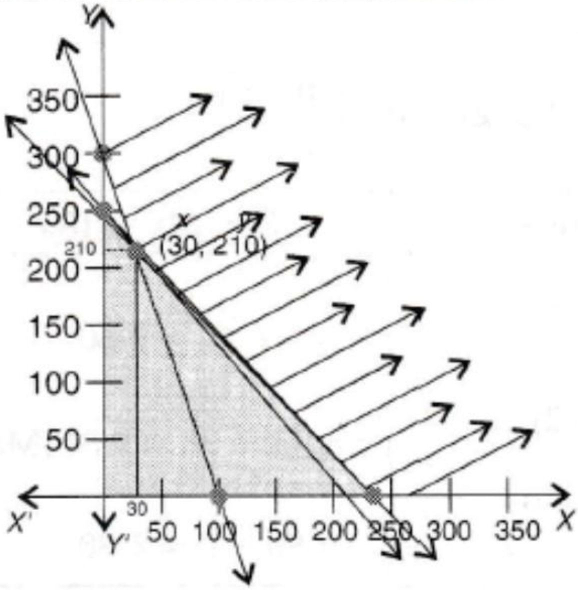
$\frac{12}{100}x + \frac{4}{100}y \geq 12$ i.e., $3x + y \geq 300$ (Nitrogen Constraint)

$\frac{5}{100}x + \frac{5}{100}y \geq 12$ i.e., $x + y \geq 240$ (Phosphoric acid Constraint)

$x \geq 0,\ y \geq 0$ (Non negativity constraint)

By Corner - point Method :

Corner Points	$Z = 10x + 8y$
(0, 300)	2,400
(240, 0)	2,400
(30, 210)	1,980 (Min)



Here cost is minimum at (30,210) and is ₹1,980. Since the region is unbounded, we have to draw

$10x+8y < 1980$

$\therefore$ L : $10x+8y = 1980$

Clearly open half plane has no common point with the feasible region is minimum value of ₹1,980.

Among the Values of Z, the least value is 1980.

We draw line $10x + 8y < 1980$, has no common points with the feasible region, therefore Z has minimum Value.

Minimum Value of Z is 1980 and it occurs @ (30, 210)

Hence, the minimum cost of the fertiliser is ₹1980 when he uses 30kg of fertiliser A and 210 kg of fertiliser B.

34) a) $C(x) = \frac{x^3}{3} - 7x^2 + 111x + 50$

demand function $x = 100 - p \Rightarrow p = 100 - x$

(i) $R(x) = xp = x(100 - x) = 100x - x^2$

(ii) $P(x) = R(x) - C(x) = (100x - x^2) - \left(\frac{x^3}{3} - 7x^2 + 111x + 50\right)$

$P(x) = -\frac{x^3}{3} + 6x^2 - 11x - 50$

(iii) P.T. P(x) is maximum

$P'(x) = -\cancel{3}.\frac{x^2}{\cancel{3}} + 12x - 11 \quad \therefore P'(x) = -x^2 + 12x - 11$

$P'(x) = 0 \Rightarrow -x^2 + 12x - 11 = 0 \Rightarrow x^2 - 12x + 11 = 0 \Rightarrow (x-1)(x-11) = 0$

$\therefore \boxed{x = 1, 11}$

$P''(x) = -2x + 12$

$P''(1) = -2(1) + 12 = 10 > 0$

$P''(11) = -2(11) + 12 = -10 < 0$

Hence, the profit maximising level is @ $x = 11$

iv) Putting $x = 11$ in $P(x)$ we get

$$P(11) = \frac{-(11)^3}{3} + 6\times(11)^2 - 11\times 11 - 50 = -\frac{1331}{3} + 726 - 121 - 50 = 111.33$$

Hence, the maximum profit = ₹111.33

(or)

(b) Let l, b, h be the length, breadth, depth

$$lbh = V \Rightarrow lb\times 3 = 75 \Rightarrow l\times b = 25$$

Let C be the cost,

$$C = 100(l\times b) + 50\times 2[h(b+l)]$$

$$= 100\left(l\times\frac{25}{l}\right) + 300\left(\frac{25}{l} + l\right) = 2500 + 300\left(\frac{25}{l} + l\right)$$

$$C = 2500 + 300\left(\frac{25}{l} + l\right)$$

$$\frac{dC}{dl} = 0 + 300\left(\frac{-25}{l^2} + 1\right) \Rightarrow \frac{dC}{dl} = 300\left(\frac{-25}{l^2} + 1\right)$$

$$\frac{dC}{dl} = 0 \Rightarrow 300\left(\frac{-25}{l^2} + 1\right) = 0 \Rightarrow \frac{-25}{l^2} = -1 \Rightarrow l^2 = 25 \Rightarrow \boxed{l = 5}$$

$$\frac{d^2C}{dl^2} = 300\left(\frac{50}{l^3}\right) \Rightarrow \left.\frac{d^2C}{dl^2}\right|_{l=5} = \overset{60}{\cancel{300}}\left(\frac{\overset{2}{\cancel{50}}}{\underset{5}{\cancel{125}}}\right) = 120 > 0$$

i.e., C is minimum, when $l = 5$, $b = 5$

Cost = $100(25) + 300(10) = 2500 + 3000$ = ₹5500

Hence, the minimum cost is ₹5,500

35) $A = \begin{bmatrix} 1 & -1 & 0 \\ 2 & 3 & 4 \\ 0 & 1 & 2 \end{bmatrix}$ $B = \begin{bmatrix} 2 & 2 & -4 \\ -4 & 2 & -4 \\ 2 & -1 & 5 \end{bmatrix}$

$$AB = \begin{bmatrix} 6 & 0 & 0 \\ 0 & 6 & 0 \\ 0 & 0 & 6 \end{bmatrix} \Rightarrow AB = 6I_3 \Rightarrow \boxed{\frac{B}{6} = A^{-1}}$$

$$A^{-1} = \frac{1}{6}\begin{bmatrix} 2 & 2 & -4 \\ -4 & 2 & -4 \\ 2 & -1 & 5 \end{bmatrix}$$

The given system of equations

$$x - y + 0z = 3$$
$$2x + 3y + 4z = 17$$
$$0x + y + 2z = 7$$

$AX = C$

$$\begin{bmatrix} 1 & -1 & 0 \\ 2 & 3 & 4 \\ 0 & 1 & 2 \end{bmatrix}\begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 3 \\ 17 \\ 7 \end{bmatrix}$$

$X = A^{-1}C$

$$X = \frac{1}{6}\begin{bmatrix} 2 & 2 & -4 \\ -4 & 2 & -4 \\ 2 & -1 & 5 \end{bmatrix}\begin{bmatrix} 3 \\ 17 \\ 7 \end{bmatrix} \Rightarrow X = \begin{bmatrix} 6+34-28 \\ -12+34-28 \\ 6-17+35 \end{bmatrix} = \frac{1}{6}\begin{bmatrix} 12 \\ -6 \\ 24 \end{bmatrix} = \begin{bmatrix} 2 \\ -1 \\ 4 \end{bmatrix}$$

$\therefore$ $x = 2,\ y = 1,\ z = 4$

Section E

36) (a) Pipe A and B together fill the tank in 6 hours (A+B)

Pipe B and C together fill the tank in 10 hours (B+C)

Pipe A and C together fill the tank in $7\frac{1}{2}$ hours or $\frac{15}{2}$ hours (A+C)

add all $2(A+B+C) = \dfrac{6 \times 10 \times \frac{15}{2}}{(6\times10) + (6\times\frac{15}{2}) + (10\times\frac{15}{2})} = \dfrac{450}{180} = \dfrac{5}{2}$ hrs

$\therefore$ (A+B+C) together will fill the tank in 5 hrs

(b) A will fill the tank in $[(A+B+C) - (B+C)] = \dfrac{10\times5}{10-5} = 10$ hrs

(ii) B will fill the tank in $\dfrac{\frac{15}{2}\times 5}{\frac{15}{2}-5} = 15$ hrs

(or)

C will fill the tank in $\dfrac{5\times 6}{6-5} = 30$ hrs

37)

(a) $\Sigma p_i = 1$

x	0	1	2	3	4
$P(x)$	$k(0)$	$k(1)$	$3k(2)$	$2k(5-3)$	$2k(5-4)$
	0	k	$6k$	$4k$	$2k$

$\Rightarrow k+6k+4k+2k=1 \Rightarrow 13k=1 \Rightarrow \boxed{k=\frac{1}{13}}$

(b) P(atleast 2 admissions) $= P(x\geq 2) = P(2)+P(3)+P(4)$

$= 6k+4k+2k = 12k$

$= 12\times\frac{1}{13} = \frac{12}{13}$

(ii) $\mu = \Sigma p_i x_i$

$\mu = 0\times 0 + \frac{1}{13}\times 1 + \frac{6}{13}\times 2 + \frac{4}{13}\times 3 + \frac{2}{13}\times 4 \Rightarrow \frac{1+12+12+8}{13} = \frac{33}{13}$

(or)

$\sigma^2 = \Sigma p_i x_i^2 - (\Sigma p_i x_i)^2$

$\sigma^2 = 0\times 0 + \frac{1}{13}\times 1 + \frac{6}{13}\times 4 + \frac{4}{13}\times 9 + \frac{2}{13}\times 16 - \left(\frac{33}{13}\right)^2$

$\sigma^2 = \frac{1+24+36+32}{13} - \left(\frac{33}{13}\right)^2$

$\sigma^2 = \frac{93}{13} - \left(\frac{33}{13}\right)^2 = \frac{1209-1089}{169} = \frac{120}{169}$

38) a)

Year (t)	Sales (₹ lakhs) (y)	$x = t_i - 2013$	x^2	xy	$y_t = a + bx$ Trend Values
2011	76	-2	4	-152	77.6
2012	80	-1	1	-80	95.6
2013	130	0	0	0	113.6
2014	144	1	1	144	131.6
2015	138	2	4	276	149.6
	568		10	188	

$\therefore \Sigma y = 568 \; ; \; \Sigma x^2 = 10, \; ; \; \Sigma xy = 188 \; , \; n = 5$

$$a = \frac{\Sigma y}{n} = \frac{568}{5} = 113.6$$

$$b = \frac{\Sigma xy}{\Sigma x^2} = \frac{188}{10} = 18.8$$

$$\therefore \; y_t = a + bx \Rightarrow \boxed{y_t = 113.6 + 18.8x}$$

$$y_{2018} = 113.6 + 18.8(5) = \underline{\underline{207.6}}$$

38) b)

Years	Sales (in lakhs)	3yr moving totals	3yr moving averages
2009	1.5	–	–
2010	1.8	5.2	1.73
2011	1.9	5.9	1.96
2012	2.2	6.7	2.23
2013	2.6	8.5	2.83
2014	3.7	8.5	2.83
2015	6.2	12.3	4.1
2016	6.4	12.2	4.06
2017	3.6	15.4	5.13
2018	5.4	–	–