Answers

1. Applications of Matrices and Determinants

Exercise 1.1

1.(i) $\rho(A)=2$ (ii) $\rho(A)=2$ (iii) $\rho(A)=1$ (iv) $\rho(A)=3$

(v) $\rho(A)=2$ (vi) $\rho(A)=2$ (vii) $\rho(A)=3$ (viii) $\rho(A)=2$

2. $\rho(AB)=2, \rho(BA)=2$ 3. $x=1, y=3, z=5$

4. $x=\frac{1}{11}(7-16k)$, $y=\frac{1}{11}(3+k)$, $z=k$ 5. $x=2,\ y=1,\ z=0,\ ,$ 6. $\lambda=\frac{-7}{2}$

7. $x=1000,\ y=2000,\ z=500$ 8. $x=1000,\ y=2200,\ z=1800$

Exercise 1.2

1.(i) $x=8\ ,\ y=-3$ (ii) $x=1,\ y=4$ (iii) $(x,\ y,\ z)=(2,\ -1,\ 0)$

(iv) $(x,\ y,\ z)=(1,\ 2,\ 3)$ (v) $(x,\ y,\ z)=\left(-1,\ \frac{1}{2},\frac{1}{3}\right)$

2. Cost per unit of labour is ₹10 Cost per unit of capital is ₹ 16

3. Amount invested at $4\frac{3}{4}\%$ is ₹7,300 Amount invested at $6\frac{1}{2}\%$ is ₹1,300

4. hourly charges for horse riding is ₹100 and AVT riding is ₹120

5. $(x,y,z)=(2,3,1)$

6. Amount invested at 2% is ₹250
   Amount invested at 3% is ₹4,000
   Amount invested at 6% is ₹4,250

Exercise 1.3

1. 36% 2.(i) 54% , 46% (ii) 50%

3. A=56.25%, B=43.75% 4. A=33%,B= 67%

Exercise 1.4

1	2	3	4	5	6	7	8	9	10	11	12	13
(d)	(b)	(a)	(c)	(d)	(b)	(b)	(b)	(a)	(c)	(c)	(b)	(c)
14	15	16	17	18	19	20	21	22	23	24	25	
(b)	(c)	(c)	(b)	(b)	(a)	(a)	(b)	(c)	(d)	(c)	(a)	

Miscellaneous problems

1. $\rho(A)=2$ 2. $\rho(A)=3$ 3. $\rho(A)=3$
4. The given system is inconsistent and has no solution. 5. $k = 8$.
6. The equations are inconsistent when k assumes any real value other than 0.
7. $x=1,\ y=2$ and $z=2$
8. Cost of wheat is ₹30/kg, Cost of sugar is ₹40/kg and Cost of rice is ₹50/kg.
9. The rates of commission for A,B and C are ₹2, ₹4 and ₹11 respectively
10. 39%

2. Integral Calculus – I

Exercise: 2.1

1. $\frac{2}{9}(3x+5)^{\frac{3}{2}}+c$ 2. $\frac{81x^5}{5}-\frac{16}{3x^3}-72x+c$ 3. $6x-\frac{13x^2}{2}-\frac{5x^3}{3}+c$
4. $\frac{2x^{\frac{9}{2}}}{9}-\frac{4x^{\frac{5}{2}}}{5}+2x^{\frac{3}{2}}+c$ 5. $\frac{(4x+7)^{\frac{3}{2}}}{3}-\frac{(4x+7)^{\frac{1}{2}}}{2}+c$
6. $\frac{1}{3}\left[(x+1)^{\frac{3}{2}}-(x-1)^{\frac{3}{2}}\right]+c$ 7. $b=\frac{13}{2}, c=-2, f(x)=\frac{x^2}{2}+\frac{13}{2}x-2$
8. $c=-20, f(x)=2x^4-x^2-20$

Exercise: 2.2

1. $x^2+\frac{1}{2}\log|x|-2x+c$ 2. $\frac{x^4}{4}+\frac{x^3}{3}+2\log|x-1|+c$
3. $\frac{x^3}{3}-x^2+4x-8\log|x+2|+c$ 4. $\frac{x^3}{3}-x^2+3x-4\log|x+5|+c$
5. $11\log|x-3|-8\log|x-2|+c$ 6. $\log|x+1|+3\log|x-3|+\frac{2}{(x+1)}+c$
7. $\log|x^3-x^2+5x-5|+c$ 8. $c=\frac{\pi}{4}, f(x)=\log|x|+\frac{\pi}{4}$

Exercise: 2.3

1. $\frac{a^x}{\log a}+a^a x-\frac{x^{n+1}}{n+1}+c$
2. $\frac{1}{a^x \log a}-\frac{1}{b^x \log b}+c$
3. $e^x+e^{2x}+\frac{e^{3x}}{3}+c$
4. $\frac{e^{2x}}{2}+\frac{e^{-4x}}{4}+c$
5. $\frac{e^{4x}}{4}+c$
6. $e^{\left(x+\frac{1}{x}\right)}+c$
7. $-\frac{1}{\log x}+c$
8. $c=1, f(x)=e^x+1$

Exercise: 2.4

1. $2\sin x+3\cos x+4\tan x+5\cot x+c$
2. $-\frac{3}{4}\cos x+\frac{1}{12}\cos 3x+c$
3. $\tan x+c$
4. $\tan x-\cot x+c$
5. $-[\sin x+\cos x]+c$

Exercise: 2.5

1. $-e^{-x}(x+1)+c$
2. $e^{3x}\left[\frac{x^3}{3}-\frac{x^2}{3}+\frac{2x}{9}-\frac{2}{27}\right]+c$
3. $x(\log x-1)+c$
4. $\frac{x^2}{2}\left[\log x-\frac{1}{2}\right]+c$
5. $\frac{x^{n+1}}{n+1}\left(\log x-\frac{1}{n+1}\right)+c$
6. $\frac{e^{x^2}}{2}\left(x^4-2x^2+2\right)+c$

Exercise: 2.6

1. $\log\left|x^2+5x-7\right|+c$
2. $\frac{1}{4}\log\left|x^4+1\right|+c$
3. $\frac{1}{2}\log\left|e^{2x}-2\right|+c$
4. $\frac{(\log x)^4}{4}+c$
5. $2\sqrt{3x^2+7x-1}+c$
6. $\frac{4}{3}\left(x^2+x+1\right)^{\frac{3}{2}}+c$
7. $\frac{1}{54}\left(1+x^9\right)^6+c$
8. $\frac{1}{e}\log\left|x^e+e^x\right|+c$
9. $\log\left|\log x\right|+c$
10. $\frac{1}{10}\log\left|\frac{x^2-2}{2x^2+1}\right|+c$
11. $xe^x\left[\log\left(xe^x\right)-1\right]+c$
12. $\log|x|-\frac{1}{2}\log\left|x^2+1\right|+c$
13. $\frac{e^x}{x^2}+c$
14. $\frac{e^x}{(x+1)^2}+c$
15. $\frac{e^{3x}}{9x}+c$

Exercise 2.7

1. $\frac{1}{24}\log\left|\frac{3+4x}{3-4x}\right|+c$
2. $\frac{1}{10}\log\left|\frac{9+x}{1-x}\right|+c$
3. $\frac{1}{6\sqrt{2}}\log\left|\frac{\sqrt{2}x-3}{\sqrt{2}x+3}\right|+c$
4. $\frac{1}{3}\log\left|\frac{x-2}{x+1}\right|+c$
5. $\log\left|\frac{x+1}{x+2}\right|+c$
6. $\frac{1}{10}\log\left|\frac{x-1}{x+4}\right|+c$
7. $\frac{1}{6}\log\left|\frac{e^x-3}{e^x+3}\right|+c$
8. $\frac{1}{3}\log\left|3x+\sqrt{9x^2-7}\right|+c$
9. $\log\left|(x+3)+\sqrt{x^2+6x+13}\right|+c$
10. $\log\left|\left(x-\frac{3}{2}\right)+\sqrt{x^2-3x+2}\right|+c$
11. $\frac{1}{4}\log\left|x^4+\sqrt{x^8-1}\right|+c$

12. $\frac{\left(x+\frac{1}{2}\right)}{2}\sqrt{1+x+x^2}+\frac{3}{8}\log\left|\left(x+\frac{1}{2}\right)+\sqrt{1+x+x^2}\right|+c$

13. $\frac{x}{2}\sqrt{x^2-2}-\log\left|x+\sqrt{x^2-2}\right|+c$ 14. $\frac{1}{4}\left[2x\sqrt{4x^2-5}-5\log\left|2x+\sqrt{4x^2-5}\right|\right]+c$

15. $\left(\frac{x+1}{2}\right)\sqrt{2x^2+4x+1}-\frac{\sqrt{2}}{4}\log\left|\sqrt{2}(x+1)+\sqrt{2x^2+4x+1}\right|+c$

16. $\frac{x^2}{2}-\frac{x}{2}\sqrt{x^2-1}+\frac{1}{2}\log\left|x+\sqrt{x^2-1}\right|+c$

Exercise 2.8

I:1. $\frac{1}{2}\left[e^2-1\right]$ 2. $\frac{1}{6}$ 3. $\frac{1}{2}\log\left[\frac{5}{2}\right]$ 4. $\log\left[\frac{1+e^3}{2}\right]$

5. $\frac{1}{2}\left[e-1\right]$ 6. $\frac{3}{8}$ 7. $\log\left[\frac{11}{5}\right]$ 8. 2 9. $\frac{1}{2}\left[2\log 2-1\right]$

II:1. 37 2. 4 3. 1 4. $c=4$

Exercise 2.9

1. 0 2. $\frac{\pi}{2}$ 3. 0 4. $\frac{\pi}{4}$ 5. 0 6. $\frac{16}{5}$

Exercise 2.10

1.(i) 6 (ii) $\frac{105\sqrt{\pi}}{16}$ (iii) $\frac{6!}{m^7}$ (iv) $\frac{3}{128}$ (v) $\left(2^6\right)5!$ 2. $\frac{1}{4}$

Exercise 2.11

1. $\frac{9}{2}$ 2. 4 3. 14 4. $\frac{1}{3}$

Exercise 2.12

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
(b)	(c)	(a)	(a)	(a)	(b)	(b)	(a)	(d)	(c)	(b)	(b)	(b)	(b)	(c)
16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
(d)	(c)	(c)	(b)	(a)	(b)	(b)	(c)	(a)	(a)	(a)	(b)	(d)	(b)	(c)

Miscellaneous problems

1. $\frac{2}{15}\left[(x+2)^{\frac{3}{2}}+(x+3)^{\frac{3}{2}}\right]+c$ 2. $\frac{1}{5}\log\left|\frac{2+x}{1-2x}\right|+c$ 3. $\frac{1}{4}\log\left|\frac{e^x+1}{e^x+5}\right|+c$

4. $\frac{x}{2}\sqrt{2x^2-3}-\frac{3\sqrt{2}}{4}\log\left|\sqrt{2}x+\sqrt{2x^2-3}\right|+c$

5. $\frac{(3x+2)}{6}\sqrt{9x^2+12x+3}-\frac{1}{6}\log\left|(3x+2)+\sqrt{9x^2+12x+3}\right|+c$

6. $\frac{1}{3}\left[(x+1)^3\log x-\frac{x^3}{3}-\frac{3x^2}{2}-3x-\log|x|\right]+c$

7. $x\log\left(x-\sqrt{x^2-1}\right)+\sqrt{x^2-1}+c$ 8. 0 9. $\frac{1}{4}\left[\frac{e^4-5}{e^2}\right]$ 10. $\frac{14}{15}$

3. Integral Calculus – II

Exercise 3.1

1. 5 sq.units 2. 2 sq.units 3. $\frac{8a^2}{3}sq.units$ 4. $\frac{3}{2}sq.units$

5. $\frac{17}{2}sq.units$ 6. $\frac{8}{3}sq.units$ 7. $\frac{32}{3}sq.units$

Exercise 3.2

1. ₹28,000 2. $y=\left(\frac{2x-1}{3x+2}\right)$ 3. $P=8-2x,\ R=8x-2x^2$

4. ₹4,419 5. ₹5,680

6. Total cost $=100x-5x^2+\frac{0.1x^3}{3}+500$, Average Cost $=100-5x+\frac{x^2}{30}+\frac{500}{x}$

7. Total Cost $=\frac{1500}{7}x^{\frac{7}{5}}$, Average Cost $=\frac{1500}{7}x^{\frac{2}{5}}$

8. Cost function $C=2\sqrt{ax+b}-2\sqrt{b}$ 9. ₹14,133.33

10. Total Revenue=₹5,95,000 11. Demand function $P=9-\frac{4x^2}{3}$

13. Demand function $P=20e^{-\frac{x}{10}}$ 14. Profit function $=13x-0.065x^2-120$

15. Revenue function $R=1500x-2x^2-x^3$, Average revenue function $P=1500-2x-x^2$

16. Revenue function $R=10x+\frac{3x^2}{2}-\frac{x^3}{3}$, Demand function $P=10+\frac{3x}{2}-\frac{x^2}{3}$

17. Total Cost $C=4000\sqrt{7x+4}+18000$, Average Cost $A.C=\frac{4000}{x}\sqrt{7x+4}+\frac{18000}{x}$

18. $C=\frac{x^2}{4}+5000$ 19. Revenue function $R=20x-\frac{5x^2}{2}+x^3$

20. Demand function $P=14-3x+3x^2$

Exercise 3.3

1. cs= 400 units
2. C.S=378 units
3. C.S=562.50 units
4. C.S=$\frac{1}{2}\left[1-\log_e 2\right]$ units
5. P.S=$\frac{25}{2}$units.
6. P.S=237.3 units
7. $C.S = 36\log\frac{3}{2} - 12\,units$
8. $\frac{32000}{3}$units
9. C.S=$\left(8\log 2-4\right)$units, P.S=$\frac{1}{4}$units
10. C.S=$\frac{1024}{3}$units, P.S=64 units
11. C.S=24 units, P.S=16 units

Exercise 3.4

1	2	3	4	5	6	7	8	9	10	11	12	13
(c)	(b)	(a)	(c)	(a)	(a)	(d)	(c)	(b)	(a)	(a)	(a)	(b)
14	15	16	17	18	19	20	21	22	23	24	25	
(c)	(c)	(b)	(a)	(b)	(a)	(c)	(a)	(c)	(a)	(b)	(c)	

Miscellaneous problems

1. ₹1,900
2. C= ₹3,125
4. $R = 6x - x^3 - \frac{x^4}{4}$, $p = 6 - x^2 - \frac{x^3}{4}$
5. Profit function is $10x - \frac{x^2}{40} - 100$.
6. $C.S = \frac{40}{9}$ units, $P.S = \frac{32}{9}$units.
7. 52,770 units
8. $P = 11 - \frac{x^3}{3}$
9. $\frac{76}{3}$ sq.units
10. $\frac{1}{5}\left[(2)^{\frac{5}{3}} - 1\right]$ sq.units

4. Differential Equations

Exercise 4.1

1.(i) (1 , 1) (ii) (3 , 1) (iii) (2 , 2) (iv) (3 , 1)
(v) (3 , 3) (vi) (2 , 1) (vii) (1 , 4).

2.(i) $y = x\frac{dy}{dx} + \frac{dy}{dx} - \left(\frac{dy}{dx}\right)^2$ (ii) $\left(\frac{dy}{dx}\right)^3 - 4xy\frac{dy}{dx} + 8y^2 = 0$ (iii) $y + x\frac{dy}{dx} = 0$

(iv) $x + y\frac{dy}{dx} = 0$
3. $r^2\left(\frac{d^2y}{dx^2}\right)^2 = \left[1+\left(\frac{dy}{dx}\right)^2\right]^3$
4. $y = x\frac{dy}{dx}$
5. $2a\frac{d^2y}{dx^2} + \left(\frac{dy}{dx}\right)^3 = 0$
6. $y^2 = x^2 + 2xy\frac{dy}{dx}$
7. $y = 2x\frac{dy}{dx} + y\left(\frac{dy}{dx}\right)^2$

Exercise 4.2

1.(i) $e^{-y} + ax + C = 0$ (ii) $\log x + \frac{x^2}{2} = \frac{y^2}{2} + \frac{y^3}{3} + C$
2. $\log x - x = \log y + C$
3.(i) $x = Cy$ (ii) $\log(1+y) = -e^x + C$
4. $(1+\sin x) = C(1+\cos y)$

5. $(x-1)(y+1)=C$ 6.(i) $\log y=\frac{-\cos 2x}{2}+C$ (ii) $\frac{e^{ax}}{a}=\frac{-e^{by}}{b}+C$

7. $(y-b)^2=(x-a)^2+b^2-a^2$

Exercise 4.3

1. $x=Ce^{\frac{y}{x}}$ 2. $x+y=Ke^{\frac{-2x}{x+y}}$ 3. $y+\sqrt{x^2+y^2}=x^2C$

4. $3y^2-4yx+3x^2=x^3C$ 5. $\left(xy-y^2\right)x=C$ 6. $y\sqrt{y^2-x^2}=2\sqrt{3}\,x^5$

7. $y=ce^{\frac{x^2}{2y^2}}$

Exercise 4.4

1. $\frac{y}{x}=x+C$ 2. $ye^{\sin x}=e^{\sin x}(\sin x-1)+C$ 3. $x^2y=\frac{x^6}{6}+C$

4. $y\left(1+x^3\right)=x+\frac{x^3}{3}+C$ 5. $xy=e^x\left(x^2-2x+2\right)+C$ 6. $y\sec x=\frac{1}{2}\left(x+\frac{\sin 2x}{2}\right)+C$

7. $y\sec^2 x=\sec x-2$ 8. $x^2e^x-2xe^x+2e^x+c$ 9. ₹ 2,22,550

Exercise 4.5

1. $y=Ae^{2x}+Be^{4x}$ 2. $y=(Ax+B)e^{2x}$ 3. $y=e^{-x}(A\cos\sqrt{2}\,x+B\sin\sqrt{2}\,x)$

4. $y=(Ax+B)e^{kx}$ 5. $y=\frac{e^{-3x}}{12}+\frac{e^{5x}}{20}$ 6. $y=Ae^{\frac{1}{2}x}+Be^{\frac{-3}{2}x}+\frac{e^{2x}}{21}$

7. $y=A\cos 4x+B\sin 4x$ 8. $y=e^x-\frac{3}{2}e^{2x}+\frac{e^{3x}}{2}$

9. $y=Ae^{-3x}+Be^{2x}+\frac{e^{3x}}{6}-\frac{x}{5}e^{-3x}$ 10. $y=(Ax+B)e^{5x}+2x^2e^{5x}+\frac{1}{5}$

11. $y=Ae^{\frac{-3}{2}x}+Be^{\frac{-5}{2}x}+xe^{-\frac{3}{2}x}$ 12. $y=Ae^{2x}+Be^{\frac{-7}{3}x}+xe^{2x}$

13. $P=Ae^{-4t}+Be^{2t}+2$

Exercise 4.6

1	2	3	4	5	6	7	8	9	10	11	12	13
(a)	(d)	(a)	(b)	(a)	(a)	(d)	(c)	(a)	(c)	(b)	(a)	(b)
14	15	16	17	18	19	20	21	22	23	24	25	
(c)	(d)	(a)	(d)	(a)	(b)	(d)	(a)	(a)	(d)	(c)	(a)	

Miscellaneous Problems

1. $p=Ae^{-4t}+Be^{2t}+3$ 2. $x^2\frac{d^2y}{dx^2}-2x\frac{dy}{dx}+2y=0$ 3. $e^x\left(x^2-2x+2\right)+\log y=c$

4. $x\left(1+\frac{3y^2}{x^2}\right)^{\frac{1}{3}}=c$ 5. $yx^2=\frac{x^6}{6}+c$ 6. $cm^2=2(m+6)$

7. $6y = \left(e^2 + e\right)e^x - \left(e^2 + e + 1\right)e^{2x} + e^{4x}$ 8. $ye^{\sin x} = 2e^{\sin x} + c$

9. $\log y = \frac{x^3}{3y^2} + c$ 10. $\log|1+y| = x + \frac{x^2}{2} + c$

5. Numerical Methods

Exercise 5.1

1. $\log\left(1 + \frac{h}{x}\right)$

2.

x	y	Δy	$\Delta^2 y$	$\Delta^3 y$	$\Delta^4 y$	$\Delta^5 y$
0	-1					
		1				
1	0		4			
		5		6		
2	5		10		0	
		15		6		0
3	20		16		0	
		31		6		
4	51		22			
		53				
5	104					

5. $\frac{-2}{(x+1)(x+2)(x+3)}$ 6. 31 7. 445 lakhs 8. 3 and 24

Exercise 5.2

1. 6.8 2. ₹2,900 3. $f\left(x\right) = 2x^3 - 7x^2 + 6x + 1$
4. 36.784 (lakhs) 5. 197 6. 15.45
7. 286.96 8. 27.992 9. 108.75 (Thousand tones)
10. 41 persons 11. 476.25 Lakhs 12. 53

Exercise 5.3

1	2	3	4	5	6	7	8	9	10	11	12	13	14
(a)	(c)	(a)	(c)	(d)	(a)	(c)	(c)	(c)	(c)	(a)	(c)	(b)	(b)

Miscellaneous Problems

3. $f\left(x\right) = x^2 - 3x + 1$ 4. 14.25, 23.5 5. 128.5
6. 189.79, 286.96 7. 5281, 6504
9. $y = \frac{2}{3}x^4 - 8x^3 + \frac{100}{3}x^2 - 56x + 31$ 10. $y = x^3 - 8x^2 + 19x - 12$

6. Random Variable and Mathematical Expectation

Exercise 6.1

1.

$P(X \le k)$	0.3	0.5	0.9	1

2. $$F_X(x)=\begin{cases}0 & for < 3\\ P_X(3)=0.3 & for\ 3\le x<5\\ P_X(3)+P_X(5)=0.5 & for\ 5\le x<8\\ P_X(3)+P_X(5)+P_X(8)=0.8 & for\ 8\le x<10\\ 1 & for\ x\ge 10\end{cases}$$

5.

$X = x_1$	0	1	2
$P(X = x_1)$	$\frac{1}{4}$	$\frac{1}{2}$	$\frac{1}{4}$

6. (i) 1/10, (ii) 81/100, 19/100, 8/10 (iii) 4

7. Hint: $\int_{-3}^{3} f(x)dx=\int_{-3}^{-1} f(x)dx+\int_{-1}^{1} f(x)dx+\int_{1}^{3} f(x)dx$

8. $(i)\,k=\frac{1}{16},(ii)\ f(x)=\frac{1}{4}(x-1)^3, 1<x\le 3$

9. $A=\frac{1}{5},(i)\frac{1}{e^2},(ii)\frac{e-1}{e},(iii)\frac{e-1}{e^2}$

10. $(a)yes, f(x)=\begin{cases}0, for\ x<0\\ \frac{1}{2}, for\ 0\le x<1\\ 0, for\ 1\le x<2\\ \frac{1}{4}, for\ 2\le x<4\\ 0\ , for\ x\ge 4\end{cases}$ $(b)(i)\frac{1}{4},(ii)\frac{3}{4},(iii)\frac{1}{4}$

Exercise 6.2

1. 3.5 2. 1.8 3. 0.78 4. $\frac{2}{3}$ 5. $\frac{3}{2}, \frac{3}{4}$ 6. ₹ 60

12. Expectation: ₹ 200; Variance: ₹ 21, 60,000; Standard Deviation: ₹ 1,469.69

13. 30 (or 30,000 miles) 14. Expectation: 1; Variance: 9 15. 20

Exercise 6.3

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
(c)	(d)	(b)	(c)	(b)	(c)	(d)	(d)	(d)	(d)	(d)	(a)	(c)	(c)	(a)
16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
(b)	(b)	(a)	(d)	(b)	(b)	(c)	(c)	(a)	(b)	(c)	(b)	(b)	(b)	(b)

Miscellaneous problems

1. (i) ½ (ii) ¼ (iii) ½ (iv) ¾

2. (a) (i) 13/24 (ii) 0 (b) X is NOT discrete since F is not a step function.

3. $\frac{1}{4}; \frac{1}{2}$ 4. (a) $\frac{1}{9}$ (b) $\frac{7}{9}$ 5. (i) $\frac{3}{5}, \frac{6}{5}$ (ii) $\frac{2}{25}$ 7. 1 9. $\frac{3}{4}, \frac{27}{80}$ 10. $\frac{1}{2}$

7. Probability distributions

Exercise: 7.1

6. (a) 0.059 (b) 0.2642 (c) 0.0133 (d) mean = 1 and variance = 0.95

7. (i) 0.01008 (ii) 0.000262 (iii) 0.09935 8. 0.375 9. 0.65536

10. (i) 0.3969 (ii) 0.45212 (iii) 0.9797 11. 5 or more trials 12. 0.7530

13. (i) 703 (ii) 516 (iii) 656 14. (i) 0.0634 (ii) 0.0634 (iii) 0.9729

15. 25/216 16. $\binom{25}{x}\left(\frac{1}{5}\right)^{x}\left(\frac{4}{5}\right)^{(25-x)}$ 17. $\frac{3}{4^{14}}$ 18. 0.2626 19. 0.8743

20. (i) $\frac{80}{243}$ (ii) $\frac{192}{243}$

Exercise: 7.2

6. 0.2352 7. 0.0025 8. (i) 0.2231 (ii) 0.1912

9.(i) 0.08208 (ii) 0.2138 (iii) 0.1089 10. (i) 2 days (ii) 91 days (iiii) 43 days

11. 0.0265 12. (i) 0.1353 (ii) 0.3235

Exercise: 7.3

5. (i) 67 (ii) 134 (iii) 1637 6 (i) mean = 60.48 (ii) standard deviation = 19.78

7. (i) 0.9772 (ii) 0.49865 8. (a) 46 (b) 46 (c) 342

9. 0.719 10. (i) 0.2420 (ii) 0.8413

Exercise 7.4

1	2	3	4	5	6	7	8	9	10	11	12	13	14
(b)	(c)	(c)	(c)	(c)	(a)	(b)	(a)	(c)	(d)	(a)	(a)	(d)	(b)
15	16	17	18	19	20	21	22	23	24	25	26	27	28
(d)	(b)	(d)	(d)	(d)	(d)	(a)	(a)	(b)	(b)	(a)	(c)	(d)	(d)

Miscellaneous problems

1. (i) 0.89131 (ii) 0.34173 2. 0.03295 3. 0.98981

4. 0.0067379 or 6.7379×10^{-3} 5. 80.33%

6. a) 0.4013 (b) 0.3413 7. a) 30.85% b) 37.20% c) 10.56%

8. a) 0.9938 (b) 0.9878 (c) 0.3944 9. 0.2119 10. 7

Exercise 8.1

17. 0.008 18. 0.9487 19. 0.2739 20. 0.025

Exercise 8.2

14. $|z| = 1.667$ 15. 1.2308 16. $|z| = 5$ 17. 3.536

Exercise 8.3

1	2	3	4	5	6	7	8	9	10
(a)	(b)	(a)	(b)	(b)	(a)	(c)	(b)	(c)	(a)
11	12	13	14	15	16	17	18	19	20
(a)	(a)	(a)	(d)	(b)	(b)	(a)	(c)	(a)	(c)

Miscellaneous problems

5. 0.015 6. (a) (66.86, 68.04) (b) (66.67,68.22) 7. $|z| = 2.67$

9. Applied Statistics

Exercise 9.1

13. Seasonal Indices

	I	II	III	IV
Total	18.6	20.8	18.8	20.8
Average	3.72	4.16	3.76	4.16
Seasonal indices	94.1772	105.3165	95.1899	105.3165

The Grand Average = 3.95

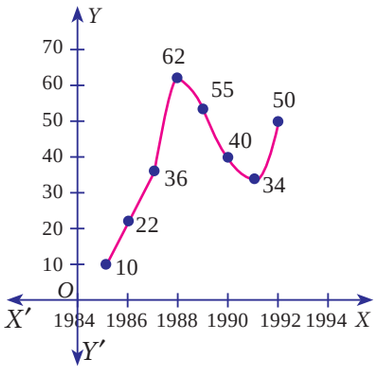
14. Three yearly moving average

Year	1987	1988	1989	1990	1991	1992
Three yearly moving total	46410	52010	63040	79470	94050	102450
Three yearly moving average	15470	17336.666	21013.333	26490	31350	34150

15. Five yearly moving average

Year	1981	1982	1983	1984	1985	1986	1987	1988
Four yearly moving total	619	617	624	621	615	619	613	606
Four yearly moving average	123.8	123.4	124.8	124.2	123	123.8	122.6	121.2

16. Free hand method



17. $a = 169.428$; $b = 3.285$; $Y = 169.428 + 3.285\,X$

18. $a = 54$; $b = 5.4$; $Y = 54 + 5.4\,X$

When $X = 2000$, $\hat{Y} = 54 + 5.4\,(2000\text{-}2002) = 43.2$

When $X = 2001$, $\hat{Y} = 54 + 5.4\,(2001\text{-}2002) = 48.6$

When $X = 2002$, $\hat{Y} = 54 + 5.4\,(2002\text{-}2002) = 54$

When $X = 2003$, $\hat{Y} = 54 + 5.4\,(2003\text{-}2002) = 59.4$

When $X = 2004$, $\hat{Y} = 54 + 5.4\,(2004\text{-}2002) = 64.8$

19. Semi- Average I = 276.666

Semi- Average II = 213.333

20. Monthly Indices

	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
Monthly Total	53	61	54	43	42	51	62	54	52	51	49	53
Monthly Average	17.7	20.3	18	14.3	14	17	20.7	18	17.3	17	16.3	17.7
Seasonal Indices	101.7	116.7	103.4	82.2	80.5	97.7	119.0	103.4	99.4	97.7	93.7	101.7

Grand Average = 17.4

21. Seasonal Indices

	I	II	III	IV
Total	372	358	362	364
Average	74.4	71.6	72.4	72.8
Seasonal indices	102.19	98.35	99.45	100

Grand Average = 72.8

22. $a = 48.8$; $b = 2$; $Y = 48.8 + 2X$

When $X = 1992$, $\hat{Y} = 48.8 + 2\ (1992\text{-}1994) = 44.8$

When $X = 1993$, $\hat{Y} = 48.8 + 2\ (1993\text{-}1994) = 46.8$

When $X = 1994$, $\hat{Y} = 48.8 + 2\ (1994\text{-}1994) = 48.8$

When $X = 1995$, $\hat{Y} = 48.8 + 2\ (1995\text{-}1994) = 50.8$

When $X = 1996$, $\hat{Y} = 48.8 + 2\ (1996\text{-}1994) = 52.8$

When $X = 1997$, $\hat{Y} = 48.8 + 2\ (1997\text{-}1994) = 54.8$

Exercise 9.2

14. Laspeyre's IN = 144.8 Paasche's IN = 144.4
15. Laspeyre's IN = 164.5 Paasche's IN = 162.4
16. Laspeyre's IN = 106.6 Paasche's IN = 106.8 Fisher's IN= 106.7
17. Fisher's IN = 138.5 TRT= 1 FRT = 1880/1560
18. Fisher's IN = 83.6
19. Fisher's IN = 122.314 TRT = 1
20. Cost of Living Index =2662.38
21. Cost of Living Index = 117.31
22. Cost of Living Index = 130.6192

Exercise 9.3

14. $\overline{\overline{X}} = 16.2$, UCL = 20.49, CL = 16.2, LCL = 11.91

    $\overline{R} = 7.4$, UCL = 15.65, CL = 7.4, LCL = 0
15. $\overline{\overline{X}} = 46.2$, UCL = 50.14, CL = 46.2, LCL = 42.26

    $\overline{R} = 6.8$, UCL = 14.38, CL = 6.8, LCL = 0
16. $\overline{\overline{X}} = 37.7$, UCL = 48.14, CL = 37.7, LCL = 27.26

    $\overline{R} = 18$, UCL = 38.07, CL = 18, LCL = 0
17. $\overline{\overline{X}} = 10.66$, UCL = 14.31, CL = 10.66, LCL = 7.006

    $\overline{R} = 6.3$, UCL = 13.32, CL = 6.3, LCL = 0
18. $\overline{\overline{X}} = 12.5$, UCL = 12.71, CL = 12.5, LCL = 12.28

	$\overline{R}$ = 0.37,	UCL = 0.78,	CL = 0.37,	LCL = 0
19.	$\overline{\overline{X}}$ = 30.1,	UCL = 44.75,	CL = 30.1,	LCL = 15.45
	$\overline{R}$ = 20.1,	UCL = 45.87,	CL = 20.1,	LCL = 0
20.	$\overline{\overline{X}}$ = 13.25,	UCL = 15.53,	CL = 13.25,	LCL = 10.97
	$\overline{R}$ = 3.12,	UCL = 7.12,	CL = 3.12,	LCL = 0
21.	$\overline{\overline{X}}$ = 41,	UCL = 43.31,	CL = 41.0,	LCL = 38.7
	$\overline{R}$ = 4,	UCL = 8.46,	CL = 4,	LCL = 0

Exercise 9.4

1	2	3	4	5	6	7	8	9	10	11	12	13
(d)	(b)	(d)	(d)	(c)	(a)	(c)	(b)	(b)	(b)	(a)	(d)	(c)
14	15	16	17	18	19	20	21	22	23	24	25	
(d)	(c)	(b)	(c)	(c)	(a)	(d)	(c)	(b)	(a)	(c)	(d)	

Miscellaneous problems

1. Three yearly moving Average
   148, 149.33, 152.33, 168.33, 253.33, 261.33, 281.67, 302.67, 327.
2. Four yearly moving Average
   708.75, 729.25, 748.25, 768.25, 784.5
3. Y = 55.975+ 0.825X
4. L= 49.9 P= 50.32 Fisher's = 50.09
5. Fisher =139.8
6. Consumer price index = 118.77
7. CLI = 126·10. The cost of living has increased upto 26.10% in 2011 as compared to 2010.
8. Control chart for Mean
   LCL = 47.56
   CL = 51.2
   UCL = 54.84
   Control chart for Range
   LCL = 0
   CL = 6.3
   UCL = 13.32
9. Control chart for Mean
   LCL = 1120.83
   CL = 1367.5
   UCL = 1614.17
   Control chart for Range
   LCL = 0
   CL = 427.5
   UCL = 904.16

10. Control chart for Mean
LCL = 4.774
CL = 4.982
UCL = 5.19

Control chart for Range
LCL = 0
CL = 0.36
UCL = 0.7614

10. Operations Research

Exercise 10.1

5. $x_{11}=16,\ x_{12}=3, x_{22}=15,\ x_{23}=22, x_{33}=9,\ x_{34}=25$
Total Cost = ₹ 580

6. $x_{11}=30,\ x_{21}=5, x_{22}=28,\ x_{23}=7,\ x_{33}=25,\ x_{34}=25$
Total Cost = ₹ 1,076

7. $x_{11}=15,\ x_{13}=10, x_{23}=35,\ x_{31}=15,\ x_{32}=25,$
Total Cost = ₹ 580

8. $x_{11}=1,\ x_{12}=5, x_{24}=1,\ x_{31}=6,\ x_{33}=3,\ x_{34}=1,$
Total Cost = ₹ 102

9. $x_{11}=10,\ x_{13}=20, x_{21}=20,\ x_{22}=20,\ x_{24}=10,\ x_{32}=20$
Total Cost = ₹ 370

10. $x_{11}=3,\ x_{12}=1, x_{22}=2,\ x_{23}=4,\ x_{24}=2,\ x_{34}=3, x_{35}=6$
Total Cost = ₹ 153

11. (i) $x_{11}=7,\ x_{21}=3, x_{22}=9,\ x_{32}=1,\ x_{33}=10,$
Total Cost = ₹ 94

(ii) $x_{13}=7,\ x_{21}=10, x_{23}=2,\ x_{32}=10,\ x_{33}=1,$
Total Cost = ₹ 61

(iii) $x_{11}=7,\ x_{21}=2, x_{23}=10,\ x_{31}=1,\ x_{32}=10,$
Total Cost = ₹ 40

12. $x_{11}=200, x_{21}=50, x_{22}=175, x_{23}=125, x_{32}=150, x_{33}=250$
Total Cost = ₹ 12,200

Exercise 10.2

4. 46 5. 280 6. 41 Hours 7. 37 8. 12

Exercise 10.3

1. (i) S_1 (ii) S_2 2. (a) Crop C (b) Crop B and Crop C
3. (i) Egg shampoo (ii) Egg Shampoo 4. (i) A_3 (ii) A_2 and A_3

Exercise 10.4

1	2	3	4	5	6	7	8	9	10	11	12	13	14
(a)	(a)	(c)	(c)	(a)	(a)	(c)	(c)	(d)	(b)	(d)	(b)	(d)	(d)

Miscellaneous Problems

1. $x_{11} = 5\ x_{21} = 2, x_{22} = 6,\ x_{32} = 3,\ x_{33} = 4, x_{43} = 14$
   Total Cost = ₹ 102

2. (a) $x_{12} = 10\ x_{13} = 20, x_{21} = 30,\ x_{22} = 20,\ x_{24} = 10\ , x_{32} = 20$

   (b) $x_{11} = 10\ x_{13} = 20, x_{21} = 20,\ x_{22} = 20,\ x_{24} = 10\ , x_{32} = 20$

   Total cost = ₹ 370

3. $x_{11} = 15\ x_{13} = 10, x_{23} = 35,\ x_{31} = 15,\ x_{32} = 25\ , x_{32} = 20$
   Total Cost = ₹ 560

4. $x_{12} = 1\ x_{12} = 5, x_{24} = 1,\ x_{31} = 6,\ x_{33} = 3\ , x_{34} = 1$
   Total Cost = ₹ 102

5. $A \rightarrow e,\ B \rightarrow c,\ C \rightarrow b,\ D \rightarrow a, E \rightarrow d$
   Minimum Distance =570 miles

6. $1 \rightarrow 11,\ 2 \rightarrow 8,\ 3 \rightarrow 7,\ 4 \rightarrow 9, 5 \rightarrow 10, 6 \rightarrow 12$
   Minimum distance =125 kms

7. (i) Debenture : 6000

   (ii) Stocks : 1000