WINTER-18 EXAMINATION

Subject Name: Basic Mathematics **Model Answer** **Subject Code:** 22103

Important Instructions to Examiners:

1) The answers should be examined by key words and not as word-to-word as given in the model answer scheme.
2) The model answer and the answer written by candidate may vary but the examiner may try to assess the understanding level of the candidate.
3) The language errors such as grammatical, spelling errors should not be given more Importance (Not applicable for subject English and Communication Skills.
4) While assessing figures, examiner may give credit for principal components indicated in the figure. The figures drawn by candidate and model answer may vary. The examiner may give credit for any equivalent figure drawn.
5) Credits may be given step wise for numerical problems. In some cases, the assumed constant values may vary and there may be some difference in the candidate's answers and model answer.
6) In case of some questions credit may be given by judgement on part of examiner of relevant answer based on candidate's understanding.
7) For programming language papers, credit may be given to any other program based on equivalent concept.

Q. No.	Sub Q.N.	Answers	Marking Scheme
1.		Attempt **any five** of the following :	**10**
	a)	Evaluate $\log_3 81$	**02**
	Ans	$\log_3 81$	
		$= \log_3 (3)^4$	½
		$= 4\log_3 3$	½
		$= 4(1)$	½
		$= 4$	½
		OR	
		$\log_3 81$ OR	
		$= \frac{\log 81}{\log 3}$ Let $\log_3 81 = x$	½
		$= \frac{\log (3)^4}{\log 3}$ $3^x = 81$	½
		$= \frac{4\log 3}{\log 3}$ $3^x = 3^4$	½
		$= 4$ $x = 4$	½
		---	
	b)	Find the area of the triangle whose vertices are $(4,3)(1,4)$ and $(2,3)$.	**02**
	Ans	Let $(x_1, y_1) = (4,3), (x_2, y_2) = (1,4)$ and $(x_3, y_3) = (2,3)$	

Q. No.	Sub Q.N.	Answers	Marking Scheme
1.	b)	$A=\frac{1}{2}\begin{vmatrix} x_1 & y_1 & 1 \\ x_2 & y_2 & 1 \\ x_3 & y_3 & 1 \end{vmatrix}$	
		$=\frac{1}{2}\begin{vmatrix} 4 & 3 & 1 \\ 1 & 4 & 1 \\ 2 & 3 & 1 \end{vmatrix}$	1
		$=\frac{1}{2}\left[4(4-3)-3(1-2)+1(3-8)\right]$	
		$=1$	1
	c)	Find the value of $\sin(15^0)$ using compound angles	**02**
	Ans	$\sin(15^0)$	
		$=\sin(45^0-30^0)$	½
		$=\sin 45^0\cos 30^0-\cos 45^0\sin 30^0$	½
		$=\left(\frac{1}{\sqrt{2}}\right)\left(\frac{\sqrt{3}}{2}\right)-\left(\frac{1}{\sqrt{2}}\right)\left(\frac{1}{2}\right)$	½
		$=\frac{\sqrt{3}-1}{2\sqrt{2}}$ or 0.2588	½
		OR	
		$\sin(15^0)$	
		$=\sin(60^0-45^0)$	½
		$=\sin 60^0\cos 45^0-\cos 60^0\sin 45^0$	½
		$=\left(\frac{\sqrt{3}}{2}\right)\left(\frac{1}{\sqrt{2}}\right)-\left(\frac{1}{2}\right)\left(\frac{1}{\sqrt{2}}\right)$	½
		$=\frac{\sqrt{3}-1}{2\sqrt{2}}$ or 0.2588	½
	d)	Find the area of rhombus whose diagonals are 6 cm and 9 cm.	**02**
	Ans	Area of rhombus $=\frac{1}{2}(d_1\times d_2)$	
		$=\frac{1}{2}(6\times 9)$	1

Q. No.	Sub Q.N.	Answers	Marking Scheme
1.	d)	Area of rhombus = 27	1
	e) Ans	The length , breadth and height of a cuboid are 8 cm,11 cm and 15 cm respectively.Find the total surface area. Let $l=8$, $b=11$, $h=15$ Total surface Area of a cuboid $=2\left[lb+bh+hl\right]$ $=2\left[8\times11+11\times15+15\times8\right]$ $=746$	**02** 1 1
	f) Ans	Find the range of the data: 14 , 18 , 22 , 35 , 42 , 44 , 8 , 7 , 5 and 2 Range $= L-S$ $=44-2$ $=42$	**02** 1 1
	g) Ans	If mean is 34.5 and standard deviation is 5 find the coefficient of variance. Coefficient of variance $=\frac{\sigma}{\bar{x}}\times100$ $=\frac{5}{34.5}\times100$ $=14.493$	**02** 1 1
2.		Attempt **any three** of the following:	**12**
	a) Ans	If $A=\begin{bmatrix}0 & 1 & -1\\ 4 & -3 & 4\\ 3 & -3 & 4\end{bmatrix}$ prove that $A^2=I$ $A=\begin{bmatrix}0 & 1 & -1\\ 4 & -3 & 4\\ 3 & -3 & 4\end{bmatrix}$	**04**

WINTER – 18 EXAMINATION

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Q. No.	Sub Q. N.	Answers	Marking Scheme
2.	a)	$A^2 = AA$ $= \begin{bmatrix} 0 & 1 & -1 \\ 4 & -3 & 4 \\ 3 & -3 & 4 \end{bmatrix} \begin{bmatrix} 0 & 1 & -1 \\ 4 & -3 & 4 \\ 3 & -3 & 4 \end{bmatrix}$ $= \begin{bmatrix} 0+4-3 & 0-3+3 & 0+4-4 \\ 0-12+12 & 4+9-12 & -4-12+16 \\ 0-12+12 & 3+9-12 & -3-12+16 \end{bmatrix}$ $= \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$ $= I$ $\therefore A^2 = I$	2 2
	b)	Resolve into partial fractions: $\frac{x^2+23x}{(x+3)(x^2+1)}$	**04**
	Ans	$\frac{x^2+23x}{(x+3)(x^2+1)} = \frac{A}{x+3} + \frac{Bx+C}{x^2+1}$ $\therefore\ x^2+23x = (x^2+1)A + (x+3)(Bx+C)$ Put $x=-3$ $\therefore (-3)^2 + 23(-3) = ((-3)^2+1)A$ $\therefore -60 = 10A$ $\therefore\ A = -6$ Put $x=0$ $\therefore\ 0 = (1)A + (3)(0+C)$ $\therefore 0 = -6+3C$ $\therefore C = 2$ Put $x=1$ $\therefore 24 = 2(-6) + 4B + 4(2)$ $\therefore B = 7$ $\therefore \frac{x^2+23x}{(x+3)(x^2+1)} = \frac{-6}{x+3} + \frac{7x+2}{x^2+1}$	½ 1 1 1 ½

Q. No.	Sub Q.N.	Answers	Marking Scheme
2.	c)	Solve the following equations by Cramer's rule: $x+y+z=2$ $y+z=1$ $x+z=3$	**04**
	Ans	$D=\begin{vmatrix}1&1&1\\0&1&1\\1&0&1\end{vmatrix}$ $=1(1-0)-1(0-1)+1(0-1)=1$	1
		$D_x=\begin{vmatrix}2&1&1\\1&1&1\\3&0&1\end{vmatrix}$ $=2(1-0)-1(1-3)+1(0-3)=1$ $\therefore x=\frac{D_x}{D}=\frac{1}{1}=1$	1
		$D_y=\begin{vmatrix}1&2&1\\0&1&1\\1&3&1\end{vmatrix}$ $=1(1-3)-2(0-1)+1(0-1)=-1$ $\therefore y=\frac{D_y}{D}=\frac{-1}{1}=-1$	1
		$D_z=\begin{vmatrix}1&1&2\\0&1&1\\1&0&3\end{vmatrix}$ $=1(3-0)-1(0-1)+2(0-1)=2$ $\therefore z=\frac{D_z}{D}=\frac{2}{1}=2$	1
		---	

2. d) Find mean of the following data:

Class - Interval	0-10	10-20	20-30	30-40	40-50
Frequency	3	5	8	3	1

Ans

Class-Interval	x_i	f_i	$f_i x_i$
0-10	5	3	15
10-20	15	5	75
20-30	25	8	200
30-40	35	3	105
40-50	45	1	45
		20	440

Mean $\bar{x} = \dfrac{\sum f_i x_i}{N}$ — 2

$\therefore \bar{x} = \dfrac{440}{20}$ — 1

$\therefore \bar{x} = 22$ — 1

04

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3. Attempt **any three** of the following: **12**

a) If $\tan A = \dfrac{1}{2}, \tan B = \dfrac{1}{3}$, find the value of $\tan(A+B)$ **04**

Ans

$\tan(A+B) = \dfrac{\tan A + \tan B}{1 - \tan A \tan B}$

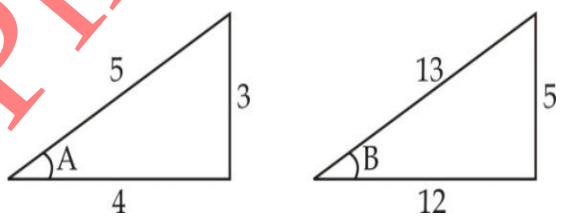
$= \dfrac{\frac{1}{2} + \frac{1}{3}}{1 - \left(\frac{1}{2}\right)\left(\frac{1}{3}\right)}$ — 2

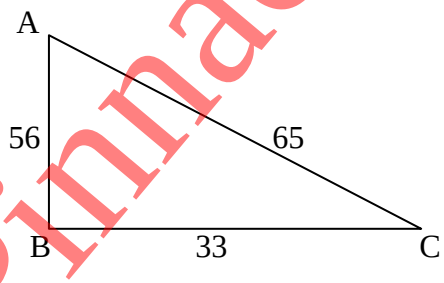
$= 1$ — 2

Q. No.	Sub Q.N.	Answers	Marking Scheme
3.	b)	Prove : $\tan\left(\frac{\pi}{4}+A\right)=\frac{\cos A+\sin A}{\cos A-\sin A}$	**04**
	Ans	$\tan\left(\frac{\pi}{4}+A\right)$	
		$=\frac{\tan\frac{\pi}{4}+\tan A}{1-\tan\frac{\pi}{4}\tan A}$	1
		$=\frac{1+\tan A}{1-\tan A}$	1
		$=\frac{1+\frac{\sin A}{\cos A}}{1-\frac{\sin A}{\cos A}}$	1
		$=\frac{\cos A+\sin A}{\cos A-\sin A}$	1
		OR	
		$\frac{\cos A+\sin A}{\cos A-\sin A}$	
		$=\frac{1+\frac{\sin A}{\cos A}}{1-\frac{\sin A}{\cos A}}$	1
		$=\frac{1+\tan A}{1-\tan A}$	1
		$=\frac{\tan\frac{\pi}{4}+\tan A}{1-\tan\frac{\pi}{4}\tan A}$	1
		$=\tan\left(\frac{\pi}{4}+A\right)$	1
		---	
	c)	Prove: $\frac{\sin 4A+\sin 5A+\sin 6A}{\cos 4A+\cos 5A+\cos 6A}=\tan 5A$	**04**

Q. No.	Sub Q.N.	Answers	Marking Scheme
3.	c) Ans	$\frac{\sin 4A+\sin 5A+\sin 6A}{\cos 4A+\cos 5A+\cos 6A}$	
		$=\frac{(\sin 4A+\sin 6A)+\sin 5A}{(\cos 4A+\cos 6A)+\cos 5A}$	
		$=\frac{2\sin\left(\frac{4A+6A}{2}\right)\cos\left(\frac{4A-6A}{2}\right)+\sin 5A}{2\cos\left(\frac{4A+6A}{2}\right)\cos\left(\frac{4A-6A}{2}\right)+\cos 5A}$	2
		$=\frac{2\sin 5A\cos(-A)+\sin 5A}{2\cos 5A\cos(-A)+\cos 5A}$	1
		$=\frac{\sin 5A[2\cos(-A)+1]}{\cos 5A[2\cos(-A)+1]}$	½
		$=\tan 5A$	½
		---	
	d)	Prove : $\cos^{-1}\left(\frac{4}{5}\right)+\cos^{-1}\left(\frac{12}{13}\right)=\cos^{-1}\left(\frac{33}{65}\right)$	**04**
	Ans	Let $\cos^{-1}\left(\frac{4}{5}\right)=A$	
		$\therefore \cos A=\frac{4}{5}$	
		$\therefore \sin^2 A=1-\cos^2 A$	
		$=1-\frac{16}{25}$	
		$=\frac{9}{25}$	
		$\therefore \sin A=\frac{3}{5}$	1
		$\cos^{-1}\left(\frac{12}{13}\right)=B$	
		$\therefore \cos B=\frac{12}{13}$	
		$\therefore \sin^2 B=1-\cos^2 B$	
		$\therefore \sin^2 B=1-\frac{144}{169}$	

Q. No.	Sub Q.N.	Answers	Marking Scheme
3.	d)	$\therefore \sin^2 B = \frac{25}{169}$	
		$\therefore \sin B = \frac{5}{13}$	1
		$\therefore \cos(A+B) = \cos A\cos B - \sin A\sin B$	
		$= \left(\frac{4}{5}\right)\left(\frac{12}{13}\right) - \left(\frac{3}{5}\right)\left(\frac{5}{13}\right)$	1
		$= \frac{48}{65} - \frac{15}{65}$	
		$\therefore \cos(A+B) = \frac{33}{65}$	
		$\therefore A+B = \cos^{-1}\left(\frac{33}{65}\right)$	½
		$\therefore \cos^{-1}\left(\frac{4}{5}\right) + \cos^{-1}\left(\frac{12}{13}\right) = \cos^{-1}\left(\frac{33}{65}\right)$	½
		OR	
		Let $\cos^{-1}\left(\frac{4}{5}\right) = A$	
		$\therefore \cos A = \frac{4}{5}$	
		$\therefore \tan A = \frac{3}{4}$	
		$A = \tan^{-1}\left(\frac{3}{4}\right)$	
		$\therefore \cos^{-1}\left(\frac{4}{5}\right) = \tan^{-1}\left(\frac{3}{4}\right)$	1
		$\cos^{-1}\left(\frac{12}{13}\right) = B$	
		$\therefore \cos B = \frac{12}{13}$	
		$\therefore \tan B = \frac{5}{12}$	



Q. No.	Sub Q.N.	Answers	Marking Scheme
3.	d)	$B = \tan^{-1}\left(\frac{5}{12}\right)$	
		$\therefore \cos^{-1}\left(\frac{12}{13}\right) = \tan^{-1}\left(\frac{5}{12}\right)$	1
		$L.H.S. = \tan^{-1}\left(\frac{3}{4}\right) + \tan^{-1}\left(\frac{5}{12}\right)$	
		$= \tan^{-1}\left(\frac{\frac{3}{4}+\frac{5}{12}}{1-\left(\frac{3}{4}\right)\left(\frac{5}{12}\right)}\right)$	½
		$= \tan^{-1}\left(\frac{56}{33}\right)$	½
		Let $\tan^{-1}\left(\frac{56}{33}\right) = C$ 	
		$\therefore \tan C = \frac{56}{33}$	
		$\therefore \cos C = \frac{33}{65}$	
		$\therefore C = \cos^{-1}\left(\frac{33}{65}\right)$	1
		$\therefore \cos^{-1}\left(\frac{4}{5}\right) + \cos^{-1}\left(\frac{12}{13}\right) = \cos^{-1}\left(\frac{33}{65}\right)$	

4.		Attempt **any three** of the following:	**12**
	a)	If $A = \begin{bmatrix} 2 & 4 & 4 \\ 4 & 2 & 4 \\ 4 & 4 & 2 \end{bmatrix}$ show that $A^2 - 8A$ is scalar matrix.	**04**
	Ans	$A^2 - 8A$	
		$= A.A - 8A$	

Q. No.	Sub Q.N.	Answers	Marking Scheme
4.	a)	$=\begin{bmatrix}2&4&4\\4&2&4\\4&4&2\end{bmatrix}\begin{bmatrix}2&4&4\\4&2&4\\4&4&2\end{bmatrix}-8\begin{bmatrix}2&4&4\\4&2&4\\4&4&2\end{bmatrix}$ $=\begin{bmatrix}36&32&32\\32&36&32\\32&32&36\end{bmatrix}-\begin{bmatrix}16&32&32\\32&16&32\\32&32&16\end{bmatrix}$ $=\begin{bmatrix}20&0&0\\0&20&0\\0&0&20\end{bmatrix}$ $\therefore A^2-8A$ is scalar matrix	2+1 1
	b)	Resolve into partial fraction: $\frac{3x-1}{(x-4)(x+1)(x-1)}$.	**04**
	Ans	$\frac{3x-1}{(x-4)(x+1)(x-1)}=\frac{A}{x-4}+\frac{B}{x+1}+\frac{C}{x-1}$	½
		$\therefore 3x-1=A(x+1)(x-1)+B(x-4)(x-1)+C(x-4)(x+1)$ Put $x=4$ $3(4)-1=A(4+1)(4-1)$ $\therefore 11=15A$ $\therefore A=\frac{11}{15}$	1
		Put $x=-1$ $3(-1)-1=B(-1-4)(-1-1)$ $\therefore -4=B(-5)(-2)$ $\therefore B=\frac{-2}{5}$	1
		Put $x=1$ $3(1)-1=C(1-4)(1+1)$ $\therefore 2=C(-3)(2)$ $\therefore C=\frac{-1}{3}$	1

Q. No.	Sub Q.N.	Answers	Marking Scheme
4.	b)	$\therefore \dfrac{3x-1}{(x-4)(x+1)(x-1)} = \dfrac{\frac{11}{15}}{x-4} + \dfrac{\frac{-2}{5}}{x+1} + \dfrac{\frac{-1}{3}}{x-1}$	½
		---	
	c)	Prove that $\cos 20^0.\cos 40^0.\cos 60^0.\cos 80^0 = \dfrac{1}{16}$	**04**
	Ans	$\cos 20^0 \cos 40^0 \cos 60^0 \cos 80^0 = \dfrac{1}{2}(2\cos 20°\cos 40°).\left(\dfrac{1}{2}\right)\cos 80°$	½
		$= \dfrac{1}{4}\left[\cos(20°+40°)+\cos(20°-40°)\right]\cos 80°$	½
		$= \dfrac{1}{4}\left[\cos(60°)+\cos(-20°)\right]\cos 80°$	½
		$= \dfrac{1}{4}\left[\dfrac{1}{2}\cos 80° + \cos 20°\cos 80°\right]$	
		$= \dfrac{1}{4}\left[\dfrac{1}{2}\cos 80° + \dfrac{1}{2}(2\cos 20°\cos 80°)\right]$	½
		$= \dfrac{1}{8}\left[\cos 80° + \cos(20°+80°) + \cos(20°-80°)\right]$	½
		$= \dfrac{1}{8}\left[\cos 80° + \cos(100°) + \cos(-60°)\right]$	
		$= \dfrac{1}{8}\left[\cos 80° + \cos(180-80°) + \dfrac{1}{2}\right]$	½
		$= \dfrac{1}{8}\left[\cos 80° - \cos(80°) + \dfrac{1}{2}\right]$	½
		$= \dfrac{1}{16}$	½
		---	
	d)	Prove: $\sin A.\sin(60-A).\sin(60+A) = \dfrac{1}{4}\sin 3A.$	**04**
	Ans	$L.H.S. = \sin A.\sin(60-A).\sin(60+A)$	
		$= \sin A(\sin 60\cos A - \cos 60\sin A)(\sin 60\cos A + \cos 60\sin A)$	½
		$= \sin A\ [\frac{\sqrt{3}}{2}\ cosA - \frac{1}{2}sinA\ ]\ [\frac{\sqrt{3}}{2}\cos A + \frac{1}{2}\ sinA]$	1

Q. No.	Sub Q.N.	Answers	Marking Scheme
4.	d)	$L.H.S. = sinA\left[\left(\frac{\sqrt{3}}{2}cosA\right)^2 - \left(\frac{1}{2}sinA\right)^2\right]$	½
		$= sinA\left[\frac{3}{4}cos^2A - \frac{1}{4}sin^2A\right]$	
		$= \frac{1}{4}\sin A\,[3\,cos^2A - sin^2A]$	½
		$= \frac{1}{4}\sin A\,[3\,(1 - sin^2A) - sin^2A]$	
		$= \frac{1}{4}\sin A\,[3 - 3sin^2A - sin^2A]$	½
		$= \frac{1}{4}\,[3\sin A - 3\sin^3 A - \sin^3 A]$	
		$= \frac{1}{4}\,[3\sin A - 4\sin^3 A]$	½
		$= \frac{1}{4}\,\sin 3A = R.H.S.$	½
	e)	Prove : $\tan^{-1}\left(\frac{1}{7}\right) + \tan^{-1}\left(\frac{1}{13}\right) = \cos^{-1}\left(\frac{9}{2}\right)$	**04**
	Ans	$L.H.S. = \tan^{-1}\left(\frac{1}{7}\right) + \tan^{-1}\left(\frac{1}{13}\right)$	
		$= \tan^{-1}\left[\frac{\frac{1}{7}+\frac{1}{13}}{1-\left(\frac{1}{7}\right)\left(\frac{1}{13}\right)}\right]$	2
		$= \tan^{-1}\left(\frac{2}{9}\right)$	1½
		$R.H.S. = \cot^{-1}\left(\frac{9}{2}\right)$	
		$\cot^{-1}\left(\frac{9}{2}\right) \neq \cos^{-1}\left(\frac{9}{2}\right)$	½
		$\therefore L.H.S. \neq R.H.S.$	
		Note: **"If Students attempted to solve the question Give appropriate marks."**	

Q. No.	Sub Q.N.	Answers	Marking Scheme
5.		Attempt **any two** of the following:	**12**
	a)	Attempt the following:	**06**
	(i)	Find the equation of straight line passes through the points $(-4,6)$ and $(8,-3)$.	**03**
	Ans	Let $(x_1, y_1) = (-4,6)$ and $(x_2, y_2) = (8,-3)$ Equation of line is, $\frac{y-y_1}{y_1-y_2} = \frac{x-x_1}{x_1-x_2}$ $\therefore \frac{y-6}{6+3} = \frac{x+4}{-4-8}$ $\therefore \frac{y-6}{9} = \frac{x+4}{-12}$	2
		$\therefore -12y+72 = 9x+36$ $\therefore 9x+12y-36 = 0$ *or* $3x+4y-12 = 0$	1
	(ii)	Find the equation of line passing through the point $(2,5)$ and through the intersection of the lines $x+y=0$ and $2x-y=9$.	**03**
	Ans	Let $(x_1, y_1) = (2,5)$ $x+y=0$ $2x-y=9$ --- $3x=9$ $x=3$ $\therefore y=-3$ $\therefore (x_2, y_2) = (3,-3)$	1
		Equation of line is, $\frac{y-y_1}{y_1-y_2} = \frac{x-x_1}{x_1-x_2}$ $\therefore \frac{y-5}{5+3} = \frac{x-2}{2-3}$	1

Q. No.	Sub Q.N.	Answers	Marking Scheme
5.	a)(ii)	$\therefore \frac{y-5}{8} = \frac{x-2}{-1}$ $\therefore -y+5 = 8x-16$ $\therefore 8x+y-21=0$	1
	b)	Attempt the following:	**06**
	(i)	Find the acute angle between the lines $3x+2y+4=0$ and $2x-3y-7=0$.	**03**
	Ans	For $3x+2y+4=0$,	
		slope $m_1 = \frac{-a}{b} = \frac{-3}{2}$	½
		For $2x-3y-7=0$,	
		slope $m_2 = \frac{-a}{b} = \frac{-2}{-3} = \frac{2}{3}$	½
		$\therefore \tan\theta = \left\lvert \frac{m_1-m_2}{1+m_1m_2} \right\rvert$	
		$= \left\lvert \frac{\frac{-3}{2}-\frac{2}{3}}{1+\left(\frac{-3}{2}\right)\left(\frac{2}{3}\right)} \right\rvert$	1
		$\therefore \tan\theta = \infty$	½
		$\therefore \theta = \tan^{-1}(\infty)$	
		$\therefore \theta = 90^0$ or $\frac{\pi}{2}$	½
		OR	
		Consider $m_1m_2 = \left(\frac{-3}{2}\right)\left(\frac{2}{3}\right)$	1
		$= -1$	1
		$\because m_1m_2 = -1$	
		$\therefore$ Lines are perpendicular	
		$\therefore \theta = 90^0$ or $\frac{\pi}{2}$	1

Q. No.	Sub Q.N.	Answers	Marking Scheme
5.	b)(ii)	Find the distance between lines $3x+2y=5$ and $6x+4y=6$	**03**
	Ans	$L_1: 3x+2y-5=0$ and $L_2: 6x+4y-6=0$	
		$\therefore L_1: 6x+4y-10=0$ and $L_2: 6x+4y-6=0$	
		$\therefore \ a=6 \ , \ b=4 \ , \ c_1=-10$ and $c_2=-6$	
		$d=\left\lvert\dfrac{c_2-c_1}{\sqrt{a^2+b^2}}\right\rvert$	
		$=\left\lvert\dfrac{-6+10}{\sqrt{6^2+4^2}}\right\rvert$	2
		$=\left\lvert\dfrac{4}{\sqrt{52}}\right\rvert$	1
		$=0.555$ or $\dfrac{2}{\sqrt{13}}$	
		---	
	c)	Attempt the following:	**06**
	(i)	A square grassy plot is of side 100 metre.It has a gravel path 10 metres wide all round it on the inside. Find the area of path.	**03**
	Ans	Area of path = Area of grassy plot – Area of inner square of grassy plot	
		$=(100)^2-(80)^2$	2
		$=3600$	1
		---	
	c)(ii)	The volume of cube is 1000 cm^3.Find its total surface area.	**03**
	Ans	Let side of cube $=l$	
		$\therefore$ volume of cube $=l^3=1000$	1
		$\therefore l=10$	
		Total surface area of cube $=6l^2$	
		$=6(10)^2$	1
		$=600$	1

6.		Attempt **any two** of the following:	**12**
	a)	Find mean, standard deviation and coefficient of variance of the following data:	

Q. No.	Sub Q.N.	Answers	Marking Scheme
6.	a)		**06**

Class-Interval	0-10	10-20	20-30	30-40	40-50
Frequency	3	5	8	3	1

Ans

Class Interval	x_i	f_i	$f_i x_i$	$d_i = \frac{x_i - a}{h}$	$f_i d_i$	d_i^2	$f_i d_i^2$
0-10	5	3	15	-2	-6	4	12
10-20	15	5	75	-1	-5	1	5
20-30	25	8	200	0	0	0	0
30-40	35	3	105	1	3	1	3
40-50	45	1	45	2	2	4	4
		20	440		-6		24

3

Mean $\bar{x} = \frac{\sum f_i x_i}{N}$

$\therefore \bar{x} = \frac{440}{20}$

$\therefore \bar{x} = 22$

1

$$S.D. = \sigma = \sqrt{\frac{\sum f_i d_i^2}{N} - \left(\frac{\sum f_i d_i}{N}\right)^2} \times h$$

$$= \sqrt{\frac{24}{20} - \left(\frac{-6}{20}\right)^2} \times 10$$

$$= 10.54$$

1

Coefficient of variance $= \frac{\sigma}{\bar{x}} \times 100$

$$= \frac{10.54}{22} \times 100$$

$$= 47.91$$

1

Q. No.	Sub Q. N.	Answers	Marking Scheme
6.	a)	**OR**	

Class Interval	x_i	f_i	$f_i x_i$	x_i^2	$f_i x_i^2$
0-10	5	3	15	25	75
10-20	15	5	75	225	1125
20-30	25	8	200	625	5000
30-40	35	3	105	1225	3675
40-50	45	1	45	2025	2025
		20	440		11900

3

Mean $\bar{x} = \dfrac{\sum f_i x_i}{N}$

$\therefore \bar{x} = \dfrac{440}{20}$

$\therefore \bar{x} = 22$

1

S.D. $\sigma = \sqrt{\dfrac{\sum f_i x_i^2}{N} - \left(\bar{x}\right)^2}$

$= \sqrt{\dfrac{11900}{20} - (22)^2}$

$\sigma = 10.54$

1

Coefficient of variance $= \dfrac{\sigma}{\bar{x}} \times 100$

$= \dfrac{10.54}{22} \times 100$

$= 47.91$

1

Q. No.	Sub Q. N.	Answers	Marking Scheme
6.	b)	Attempt the following:	**06**
	(i)	Find mean for the following data:	

Class-Interval	10-20	20-30	30-40	40-50	50-60	60-70
Frequency	4	6	10	18	9	3

03

Ans

Class	x_i	f_i	$f_i x_i$
10-20	15	4	60
20-30	25	6	150
30-40	35	10	350
40-50	45	18	810
50-60	55	9	495
60-70	65	3	195
		50	2060

2

Mean $\bar{x} = \dfrac{\sum f_i x_i}{N}$

$\therefore \bar{x} = \dfrac{2060}{50}$ ½

$\therefore \bar{x} = 41.2$ ½

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b)(ii) The two sets of observation are given below: **03**

Set-I	Set-II
$\bar{x} = 82.5$	$\bar{x} = 48.75$
$\sigma = 7.3$	$\sigma = 8.35$

Which of the two sets is more consistent?

Q. No.	Sub Q. N.	Answers	Marking Scheme
6.	b)(ii) Ans	Coefficient of variance $V = \frac{\sigma}{x} \times 100$ For set-I $V_1 = \frac{7.3}{82.5} \times 100$ $\therefore V_1 = 8.848$	1
		For set-II $V_2 = \frac{8.35}{48.75} \times 100$ $\therefore V_2 = 17.128$	1
		$\therefore V_1 < V_2$ $\therefore$ Set-I is more consistent.	1
	c)	Solve the following equations by matrix inversion method : $x + 3y + 2z = 6$, $3x - 2y + 5z = 5$, $2x - 3y + 6z = 7$.	**06**
	Ans	Let $A = \begin{bmatrix} 1 & 3 & 2 \\ 3 & -2 & 5 \\ 2 & -3 & 6 \end{bmatrix}$, $B = \begin{bmatrix} 6 \\ 5 \\ 7 \end{bmatrix}$, $X = \begin{bmatrix} x \\ y \\ z \end{bmatrix}$	
		$\lvert A \rvert = \begin{vmatrix} 1 & 3 & 2 \\ 3 & -2 & 5 \\ 2 & -3 & 6 \end{vmatrix}$	
		$\lvert A \rvert = 1(-12+15) - 3(18-10) + 2(-9+4)$	
		$\lvert A \rvert = -31$ $\therefore \lvert A \rvert \neq 0$	1
		$\therefore A^{-1}$ exists	

Q. No.	Sub Q. N.	Answers	Marking Scheme
6.	c)	$\text{Matrix of minors} = \begin{bmatrix} \begin{vmatrix} -2 & 5 \\ -3 & 6 \end{vmatrix} & \begin{vmatrix} 3 & 5 \\ 2 & 6 \end{vmatrix} & \begin{vmatrix} 3 & -2 \\ 2 & -3 \end{vmatrix} \\ \begin{vmatrix} 3 & 2 \\ -3 & 6 \end{vmatrix} & \begin{vmatrix} 1 & 2 \\ 2 & 6 \end{vmatrix} & \begin{vmatrix} 1 & 3 \\ 2 & -3 \end{vmatrix} \\ \begin{vmatrix} 3 & 2 \\ -2 & 5 \end{vmatrix} & \begin{vmatrix} 1 & 2 \\ 3 & 5 \end{vmatrix} & \begin{vmatrix} 1 & 3 \\ 3 & -2 \end{vmatrix} \end{bmatrix}$	
		$= \begin{bmatrix} 3 & 8 & -5 \\ 24 & 2 & -9 \\ 19 & -1 & -11 \end{bmatrix}$	1
		$\text{Matrix of cofactors} = \begin{bmatrix} 3 & -8 & -5 \\ -24 & 2 & 9 \\ 19 & 1 & -11 \end{bmatrix}$	1
		OR	
		$C_{11} = +\begin{vmatrix} -2 & 5 \\ -3 & 6 \end{vmatrix} = 3 \quad , \quad C_{12} = -\begin{vmatrix} 3 & 5 \\ 2 & 6 \end{vmatrix} = -8 \quad , \quad C_{13} = +\begin{vmatrix} 3 & -2 \\ 2 & -3 \end{vmatrix} = -5$	
		$C_{21} = -\begin{vmatrix} 3 & 2 \\ -3 & 6 \end{vmatrix} = -24 \quad , \quad C_{22} = +\begin{vmatrix} 1 & 2 \\ 2 & 6 \end{vmatrix} = 2 \quad , \quad C_{23} = -\begin{vmatrix} 1 & 3 \\ 2 & -3 \end{vmatrix} = 9$	
		$C_{31} = +\begin{vmatrix} 3 & 2 \\ -2 & 5 \end{vmatrix} = 19 \quad , \quad C_{32} = -\begin{vmatrix} 1 & 2 \\ 3 & 5 \end{vmatrix} = 1 \quad , \quad C_{33} = +\begin{vmatrix} 1 & 3 \\ 3 & -2 \end{vmatrix} = -11$	
		$\text{Matrix of cofactors} = \begin{bmatrix} 3 & -8 & -5 \\ -24 & 2 & 9 \\ 19 & 1 & -11 \end{bmatrix}$	2
		$Adj.A = \begin{bmatrix} 3 & -24 & 19 \\ -8 & 2 & 1 \\ -5 & 9 & -11 \end{bmatrix}$	½
		$A^{-1} = \frac{1}{\lvert A \rvert}\text{Adj.}A$	
		$= \frac{1}{-31}\begin{bmatrix} 3 & -24 & 19 \\ -8 & 2 & 1 \\ -5 & 9 & -11 \end{bmatrix}$	½

Q. No.	Sub Q. N.	Answers	Marking Scheme
6.	c)	$X = A^{-1}B$ $\begin{bmatrix} x \\ y \\ z \end{bmatrix} = \frac{1}{-31}\begin{bmatrix} 3 & -24 & 19 \\ -8 & 2 & 1 \\ -5 & 9 & -11 \end{bmatrix}\begin{bmatrix} 6 \\ 5 \\ 7 \end{bmatrix}$ $\begin{bmatrix} x \\ y \\ z \end{bmatrix} = \frac{1}{-31}\begin{bmatrix} 18-120+133 \\ -48+10+7 \\ -30+45-77 \end{bmatrix}$ $\begin{bmatrix} x \\ y \\ z \end{bmatrix} = \frac{1}{-31}\begin{bmatrix} 31 \\ -31 \\ -62 \end{bmatrix}$ $\begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} -1 \\ 1 \\ 2 \end{bmatrix}$ $\therefore \quad x = -1, \quad y = 1, \quad z = 2$ --- --- ***Important Note*** *In the solution of the question paper, wherever possible all the possible alternative methods of solution are given for the sake of convenience. Still student may follow a method other than the given herein. In such case, first see whether the method falls within the scope of the curriculum, and then only give appropriate marks in accordance with the scheme of marking.* --- ---	1 1