WINTER– 2017 EXAMINATION Subject Code: 17104

Model Answer

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.	Answer	Marking Scheme
1.		**Attempt any TEN of the following:**	**20**
	a)	Find the value of 'P' if $\begin{vmatrix} P & 4 & -4 \\ 3 & -2 & 1 \\ -2 & -4 & 1 \end{vmatrix} = 0$	**02**
	Ans	$\begin{vmatrix} P & 4 & -4 \\ 3 & -2 & 1 \\ -2 & -4 & 1 \end{vmatrix} = 0$	
		$P(-2+4)-4(3+2)-4(-12-4)=0$	1
		$2P-20+64=0$	
		$\therefore P=-22$	1
		--	
	b)	If $A=\begin{bmatrix} 1 & -2 \\ 4 & 3 \end{bmatrix}$ find matrix X such that $A+2X=\begin{bmatrix} 3 & 6 \\ 0 & 1 \end{bmatrix}$	**02**
	Ans	$A+2X=\begin{bmatrix} 3 & 6 \\ 0 & 1 \end{bmatrix}$	
		$\therefore 2X=\begin{bmatrix} 3 & 6 \\ 0 & 1 \end{bmatrix}-A$	
		$\therefore 2X=\begin{bmatrix} 3 & 6 \\ 0 & 1 \end{bmatrix}-\begin{bmatrix} 1 & -2 \\ 4 & 3 \end{bmatrix}$	1

Q. No.	Sub Q. N.	Answer	Marking Scheme
1.	b)	$\therefore 2X = \begin{bmatrix} 2 & 8 \\ -4 & -2 \end{bmatrix}$	
		$\therefore X = \frac{1}{2}\begin{bmatrix} 2 & 8 \\ -4 & -2 \end{bmatrix}$	1
		$\therefore X = \begin{bmatrix} 1 & 4 \\ -2 & -1 \end{bmatrix}$	
		--	
	c)	If $A = \begin{bmatrix} 2 & 5 & 6 \\ 0 & 1 & 2 \end{bmatrix}$ and $B = \begin{bmatrix} 6 & 1 \\ 0 & 4 \\ 5 & 7 \end{bmatrix}$ find $(AB)^T$	**02**
	Ans	$AB = \begin{bmatrix} 2 & 5 & 6 \\ 0 & 1 & 2 \end{bmatrix}\begin{bmatrix} 6 & 1 \\ 0 & 4 \\ 5 & 7 \end{bmatrix}$	
		$AB = \begin{bmatrix} 12+0+30 & 2+20+42 \\ 0+0+10 & 0+4+14 \end{bmatrix} = \begin{bmatrix} 42 & 64 \\ 10 & 18 \end{bmatrix}$	1
		$\therefore (AB)^T = \begin{bmatrix} 42 & 10 \\ 64 & 18 \end{bmatrix}$	1
		--	
	d)	If $A = \begin{bmatrix} 2 & 4 \\ -1 & -2 \end{bmatrix}$ show that A^2 is a null matrix.	**02**
	Ans	$A^2 = A.A$	
		$= \begin{bmatrix} 2 & 4 \\ -1 & -2 \end{bmatrix}.\begin{bmatrix} 2 & 4 \\ -1 & -2 \end{bmatrix}$	
		$= \begin{bmatrix} 4-4 & 8-8 \\ -2+2 & -4+4 \end{bmatrix}$	1
		$= \begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}$	
		$\therefore A^2$ is a null matrix.	1
	e)	Resolve into partial fraction $\frac{1}{x^2+x}$	**02**
	Ans	Let	
		$\therefore \frac{1}{x(x+1)} = \frac{A}{x} + \frac{B}{x+1}$	½

Q. No.	Sub Q. N.	Answer	Marking Scheme
1.	e)	$1=(x+1)A+xB$	
		Put $x=0$	
		$\therefore A=1$	½
		Put $x=-1$	
		$\therefore B=-1$	½
		$\therefore \frac{1}{x(x+1)}=\frac{1}{x}+\frac{-1}{x+1}$	½
	f)	Prove that $\frac{\sin 2\theta}{\sin\theta}-\frac{\cos 2\theta}{\cos\theta}=\sec\theta$	**02**
	Ans	Consider $\frac{\sin 2\theta}{\sin\theta}-\frac{\cos 2\theta}{\cos\theta}$	
		$=\frac{\sin 2\theta.\cos\theta-\cos 2\theta.\sin\theta}{\sin\theta.\cos\theta}$	½
		$=\frac{\sin(2\theta-\theta)}{\sin\theta.\cos\theta}$	½
		$=\frac{\sin(\theta)}{\sin\theta.\cos\theta}$	½
		$=\frac{1}{\cos\theta}$	
		$=\sec\theta$	½
	g)	Evaluate: $2\cos 75^0.\cos 15^0$	**02**
	Ans	$2\cos 75^0.\cos 15^0$	
		$=\cos(75^0+15^0)+\cos(75^0-15^0)$	½
		$=\cos 90^0+\cos 60^0$	½
		$=0+\frac{1}{2}$	
		$=\frac{1}{2}$ or 0.5	1
	h)	Find principal value of $\cos^{-1}\left(-\frac{1}{2}\right)$	**02**
	Ans	$\cos^{-1}\left(-\frac{1}{2}\right)=\pi-\cos^{-1}\left(\frac{1}{2}\right)$	1

Q. No.	Sub Q. N.	Answer	Marking Scheme
1.	h)	$=\pi-\dfrac{\pi}{3}$ or 180^0-60^0	½
		$=\dfrac{2\pi}{3}$ or 120^0	½
		OR	
		Let $\cos^{-1}\left(-\dfrac{1}{2}\right)=\theta$	
		$\therefore -\dfrac{1}{2}=\cos\theta$	½
		But $-\dfrac{1}{2}=-\cos 60$	½
		$\because \cos(180-60)=-\cos 60$	½
		$\therefore -\dfrac{1}{2}=\cos(180-60)$	
		$-\dfrac{1}{2}=\cos(120)=\cos\theta$	
		$\therefore \theta=120$	½
		--	
	i)	Without using calculator find the value of $\sin\left(\dfrac{\pi}{12}\right)^c$	**02**
	Ans	$\sin\left(\dfrac{\pi}{12}\right)=\sin\left(15^0\right)=\sin\left(45^0-30^0\right)$ OR $\sin\left(\dfrac{\pi}{12}\right)=\sin\left(\dfrac{\pi}{4}-\dfrac{\pi}{6}\right)$	½
		$=\sin 45^0.\cos 30^0-\cos 45^0.\sin 30^0$ OR $\sin\dfrac{\pi}{4}.\cos\dfrac{\pi}{4}-\cos\dfrac{\pi}{4}.\sin\dfrac{\pi}{4}$	½
		$=\dfrac{1}{\sqrt{2}}.\dfrac{\sqrt{3}}{2}-\dfrac{1}{\sqrt{2}}.\dfrac{1}{2}$	
		$=\dfrac{\sqrt{3}-1}{2\sqrt{2}}$	1
		--	
	j)	If $\tan\left(\dfrac{A}{2}\right)=\dfrac{1}{\sqrt{3}}$ find $\sin A$	**02**
	Ans	$\tan\left(\dfrac{A}{2}\right)=\dfrac{1}{\sqrt{3}}$	
		$\therefore \dfrac{A}{2}=\tan^{-1}\left(\dfrac{1}{\sqrt{3}}\right)$	½

Q. No.	Sub Q. N.	Answer	Marking Scheme
1.	j)	$\frac{A}{2}=30^0$	½
		$\therefore A=60^0$	½
		$\therefore \sin A=\sin\left(60^0\right)=\frac{\sqrt{3}}{2}$	½
		--	
	k)	Find the slope and X-intercept of the line $\frac{x}{2}-\frac{y}{3}=\frac{1}{4}$	**02**
	Ans	$\frac{x}{2}-\frac{y}{3}-\frac{1}{4}=0$	
		Slope $=-\frac{a}{b}=-\frac{1/2}{-1/3}=\frac{3}{2}$	1
		X-intercept $=-\frac{c}{a}=-\frac{-1/4}{1/2}=\frac{1}{2}$ OR put $y=0$ $\therefore x=\frac{1}{2}$	1
		OR	
		$\frac{x}{2}-\frac{y}{3}-\frac{1}{4}=0$	
		$6x-4y-3=0$	
		Slope $=-\frac{a}{b}=-\frac{6}{-4}=\frac{3}{2}$	1
		X-intercept $=-\frac{c}{a}=-\frac{-3}{6}=\frac{1}{2}$	1
		--	
	l)	Find the range and coefficient of range of the data : $5,25,65,55,35,45,15$	**02**
	Ans	Range $=$ Largest value $-$ Smallest value $=L-S$	
		$=65-5$	
		$=60$	1
		Coefficient of range $=\frac{L-S}{L+S}=\frac{60}{70}=0.857$	1
		--	
2.		**Attempt any FOUR of the following** :	**16**
	a)	Solve the following equations by using Cramer's rule :	**04**
		$3x+3y-z=11$ $\quad 2x-y+2z=9$ $\quad 4x+3y+2z=25$	

WINTER – 2017 EXAMINATION

Model Answer Subject Code: 17104

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2.	a) Ans	$D=\begin{vmatrix}3 & 3 & -1\\ 2 & -1 & 2\\ 4 & 3 & 2\end{vmatrix}$	
		$=3(-2-6)-3(4-8)-1(6+4)$	
		$=-22$	1
		$D_x=\begin{vmatrix}11 & 3 & -1\\ 9 & -1 & 2\\ 25 & 3 & 2\end{vmatrix}$	
		$=11(-2-6)-3(18-50)-1(27+25)$	
		$=-44$	
		$\therefore x=\dfrac{D_x}{D}=\dfrac{-44}{-22}=2$	1
		$D_y=\begin{vmatrix}3 & 11 & -1\\ 2 & 9 & 2\\ 4 & 25 & 2\end{vmatrix}$	
		$=3(18-50)-11(4-8)-1(50-36)$	
		$=-66$	
		$\therefore y=\dfrac{D_y}{D}=\dfrac{-66}{-22}=3$	1
		$D_z=\begin{vmatrix}3 & 3 & 11\\ 2 & -1 & 9\\ 4 & 3 & 25\end{vmatrix}$	
		$=3(-25-27)-3(50-36)+11(6+4)$	
		$=-88$	
		$\therefore z=\dfrac{D_z}{D}=\dfrac{-88}{-22}=4$	1
		---	
	b)	If $A=\begin{bmatrix}1 & 3 & 2\\ 3 & 0 & 1\\ 3 & 1 & 2\end{bmatrix}, B=\begin{bmatrix}3 & 0 & 2\\ 1 & 4 & 5\\ 2 & 1 & 0\end{bmatrix}, C=\begin{bmatrix}1\\ 2\\ 3\end{bmatrix}, X=\begin{bmatrix}x\\ y\\ z\end{bmatrix}$ such that $(A+2B)C=X$ find x,y,z	**04**
	Ans	$\left(\begin{bmatrix}1 & 3 & 2\\ 3 & 0 & 1\\ 3 & 1 & 2\end{bmatrix}+2\begin{bmatrix}3 & 0 & 2\\ 1 & 4 & 5\\ 2 & 1 & 0\end{bmatrix}\right)\begin{bmatrix}1\\ 2\\ 3\end{bmatrix}=\begin{bmatrix}x\\ y\\ z\end{bmatrix}$	

Q. No.	Sub Q. N.	Answer	Marking Scheme
2.	b)	$\left(\begin{bmatrix}1&3&2\\3&0&1\\3&1&2\end{bmatrix}+\begin{bmatrix}6&0&4\\2&8&10\\4&2&0\end{bmatrix}\right)\begin{bmatrix}1\\2\\3\end{bmatrix}=\begin{bmatrix}x\\y\\z\end{bmatrix}$	1
		$\left(\begin{bmatrix}7&3&6\\5&8&11\\7&3&2\end{bmatrix}\right)\begin{bmatrix}1\\2\\3\end{bmatrix}=\begin{bmatrix}x\\y\\z\end{bmatrix}$	1
		$=\begin{bmatrix}7+6+18\\5+16+33\\7+6+6\end{bmatrix}=\begin{bmatrix}31\\54\\19\end{bmatrix}=\begin{bmatrix}x\\y\\z\end{bmatrix}$	2
		by equating $x=31, y=54, z=19$	
		--	
	c)	If $A=\begin{bmatrix}1&2&-2\\-1&3&0\\0&-2&1\end{bmatrix}$ find A^{-1} by adjoint method.	**04**
	Ans	$\lvert A\rvert=\begin{vmatrix}1&2&-2\\-1&3&0\\0&-2&1\end{vmatrix}=1(3+0)-2(-1-0)-2(2-0)=1\neq 0 \therefore A^{-1}$ exists	1
		Matrix of minors $=\begin{bmatrix}\begin{vmatrix}3&0\\-2&1\end{vmatrix}&\begin{vmatrix}-1&0\\0&1\end{vmatrix}&\begin{vmatrix}-1&3\\0&-2\end{vmatrix}\\\begin{vmatrix}2&-2\\-2&1\end{vmatrix}&\begin{vmatrix}1&-2\\0&1\end{vmatrix}&\begin{vmatrix}1&2\\0&-2\end{vmatrix}\\\begin{vmatrix}2&-2\\3&0\end{vmatrix}&\begin{vmatrix}1&-2\\-1&0\end{vmatrix}&\begin{vmatrix}1&2\\-1&3\end{vmatrix}\end{bmatrix}=\begin{bmatrix}3&-1&2\\-2&1&-2\\6&-2&5\end{bmatrix}$	1
		Matrix of cofactors $=\begin{bmatrix}3&1&2\\2&1&2\\6&2&5\end{bmatrix}$	1
		OR	
		$c_{11}=(-1)^{1+1}\begin{vmatrix}3&0\\-2&1\end{vmatrix}=3,\quad c_{12}=(-1)^{1+2}\begin{vmatrix}-1&0\\0&1\end{vmatrix}=1,\quad c_{13}=(-1)^{1+3}\begin{vmatrix}-1&3\\0&-2\end{vmatrix}=2,$ $c_{21}=(-1)^{2+1}\begin{vmatrix}2&-2\\-2&1\end{vmatrix}=2,\quad c_{22}=(-1)^{2+2}\begin{vmatrix}1&-2\\0&1\end{vmatrix}=1,\quad c_{23}=(-1)^{2+3}\begin{vmatrix}1&2\\0&-2\end{vmatrix}=2,$ $c_{31}=(-1)^{3+1}\begin{vmatrix}2&-2\\3&0\end{vmatrix}=6,\quad c_{32}=(-1)^{3+2}\begin{vmatrix}1&-2\\-1&0\end{vmatrix}=2,\quad c_{33}=(-1)^{3+3}\begin{vmatrix}1&2\\-1&3\end{vmatrix}=5$	2

Q. No.	Sub Q. N.	Answer	Marking Scheme
2.	c)	$\text{Adj}.A=\begin{bmatrix}3&2&6\\1&1&2\\2&2&5\end{bmatrix}$	½
		$A^{-1}=\frac{1}{\lvert A\rvert}.adj.A=\frac{1}{1}\begin{bmatrix}3&2&6\\1&1&2\\2&2&5\end{bmatrix}=\begin{bmatrix}3&2&6\\1&1&2\\2&2&5\end{bmatrix}$	½
		---	
	d)	If $A=\begin{bmatrix}3&1&-1\\3&1&2\end{bmatrix},B=\begin{bmatrix}1&1\\2&0\\3&-1\end{bmatrix},C=\begin{bmatrix}1\\3\end{bmatrix}$	**04**
		Verify that $A(BC)=(AB)C$	
	Ans	L.H.S = $A(BC)=\begin{bmatrix}3&1&-1\\3&1&2\end{bmatrix}\left\{\begin{bmatrix}1&1\\2&0\\3&-1\end{bmatrix}.\begin{bmatrix}1\\3\end{bmatrix}\right\}$	
		$A(BC)=\begin{bmatrix}3&1&-1\\3&1&2\end{bmatrix}\begin{bmatrix}1+3\\2+0\\3-3\end{bmatrix}$	
		$A(BC)=\begin{bmatrix}3&1&-1\\3&1&2\end{bmatrix}\begin{bmatrix}4\\2\\0\end{bmatrix}$	1
		$A(BC)=\begin{bmatrix}12+2-0\\12+2+0\end{bmatrix}$	
		$A(BC)=\begin{bmatrix}14\\14\end{bmatrix}$	1
		R.H.S = $(AB)C=\left\{\begin{bmatrix}3&1&-1\\3&1&2\end{bmatrix}.\begin{bmatrix}1&1\\2&0\\3&-1\end{bmatrix}\right\}\begin{bmatrix}1\\3\end{bmatrix}$	
		$(AB)C=\begin{bmatrix}3+2-3&3+0+1\\3+2+6&3+0-2\end{bmatrix}.\begin{bmatrix}1\\3\end{bmatrix}$	
		$(AB)C=\begin{bmatrix}2&4\\11&1\end{bmatrix}.\begin{bmatrix}1\\3\end{bmatrix}$	1
		$(AB)C=\begin{bmatrix}2+12\\11+3\end{bmatrix}$	

WINTER – 2017 EXAMINATION

Model Answer Subject Code: 17104

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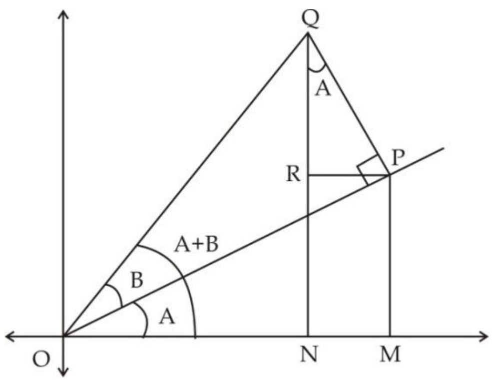
2.	d)	$(AB)C=\begin{bmatrix}14\\14\end{bmatrix}$	1
		$\therefore A(BC)=(AB)C$	
		--	
	e)	Resolve into partial fraction: $\dfrac{x+3}{(x^2-1)(x+5)}$	**04**
	Ans	Let $\dfrac{x+3}{(x-1)(x+1)(x+5)}=\dfrac{A}{x-1}+\dfrac{B}{x+1}+\dfrac{C}{x+5}$	½
		$x+3=A(x+1)(x+5)+B(x-1)(x+5)+C(x-1)(x+1)$	
		Put $x=1$	
		$1+3=A(1+1)(1+5)$	
		$4=A(12)$	
		$\therefore A=\dfrac{1}{3}$	1
		Put $x=-1$	
		$-1+3=B(-1-1)(-1+5)$	
		$2=B(-8)$	
		$\therefore B=-\dfrac{1}{4}$	1
		Put $x=-5$	
		$-5+3=C(-5-1)(-5+1)$	
		$-2=C(24)$	
		$\therefore C=-\dfrac{1}{12}$	1
		$\therefore \dfrac{x+3}{(x-1)(x+1)(x+5)}=\dfrac{\frac{1}{3}}{x-1}+\dfrac{-\frac{1}{4}}{x+1}+\dfrac{-\frac{1}{12}}{x+5}$	½
		--	
	f)	Resolve into partial fraction $\dfrac{e^x}{e^{2x}+4e^x+3}$	**04**
	Ans	Put $e^x=m$	½
		$\therefore \dfrac{m}{m^2+4m+3}=\dfrac{m}{(m+1)(m+3)}$	
		$\therefore \dfrac{m}{(m+1)(m+3)}=\dfrac{A}{m+1}+\dfrac{B}{m+3}$	½

Q. No.	Sub Q. N.	Answer	Marking Scheme
2.	f)	$\therefore m=(m+3)A+(m+1)B$ Put $m=-1$ $\therefore -1=A(-1+3)$ $\therefore A=-\frac{1}{2}$ Put $m=-3$ $\therefore -3=B(-3+1)$ $\therefore B=\frac{3}{2}$ $\therefore \frac{m}{(m+1)(m+3)}=\frac{-\frac{1}{2}}{m+1}+\frac{\frac{3}{2}}{m+3}$ $\therefore \frac{e^x}{(e^x+1)(e^x+3)}=\frac{-\frac{1}{2}}{e^x+1}+\frac{\frac{3}{2}}{e^x+3}$	 1 1 ½ ½
3.	a) Ans	**Attempt any FOUR of the following**: Solve the simultaneous equations by using matrix inversion method: $2x+3y-z=-3, 5x+y+3z=10, 4x+3y-2z=-3$ Let $A=\begin{bmatrix}2&3&-1\\5&1&3\\4&3&-2\end{bmatrix}, X=\begin{bmatrix}x\\y\\z\end{bmatrix}$ and $B=\begin{bmatrix}-3\\10\\-3\end{bmatrix}$ Consider, $\lvert A\rvert=\begin{vmatrix}2&3&-1\\5&1&3\\4&3&-2\end{vmatrix}$ $=2(-2-9)-3(-10-12)-1(15-4)$ $=33\neq 0 \therefore A^{-1}$exists Matrix of minors $=\begin{bmatrix}\begin{vmatrix}1&3\\3&-2\end{vmatrix}&\begin{vmatrix}5&3\\4&-2\end{vmatrix}&\begin{vmatrix}5&1\\4&3\end{vmatrix}\\\begin{vmatrix}3&-1\\3&-2\end{vmatrix}&\begin{vmatrix}2&-1\\4&-2\end{vmatrix}&\begin{vmatrix}2&3\\4&3\end{vmatrix}\\\begin{vmatrix}3&-1\\1&3\end{vmatrix}&\begin{vmatrix}2&-1\\5&3\end{vmatrix}&\begin{vmatrix}2&3\\5&1\end{vmatrix}\end{bmatrix}=\begin{bmatrix}-11&-22&11\\-3&0&-6\\10&11&-13\end{bmatrix}$	**16** **04** ½ 1

Q. No.	Sub Q. N.	Answer	Marking Scheme
3	a)	Matrix of cofactors $=\begin{bmatrix}-11 & 22 & 11\\ 3 & 0 & 6\\ 10 & -11 & -13\end{bmatrix}$	½
		OR	
		$c_{11}=(-1)^{1+1}\begin{vmatrix}1 & 3\\ 3 & -2\end{vmatrix}=-11,\ c_{12}=(-1)^{1+2}\begin{vmatrix}5 & 3\\ 4 & -2\end{vmatrix}=22,\ c_{13}=(-1)^{1+3}\begin{vmatrix}5 & 1\\ 4 & 3\end{vmatrix}=11,$	
		$c_{21}=(-1)^{2+1}\begin{vmatrix}3 & -1\\ 3 & -2\end{vmatrix}=3,\quad c_{22}=(-1)^{2+2}\begin{vmatrix}2 & -1\\ 4 & -2\end{vmatrix}=0,\quad c_{23}=(-1)^{2+3}\begin{vmatrix}2 & 3\\ 4 & 3\end{vmatrix}=6,$	1½
		$c_{31}=(-1)^{3+1}\begin{vmatrix}3 & -1\\ 1 & 3\end{vmatrix}=10,\quad c_{32}=(-1)^{3+2}\begin{vmatrix}2 & -1\\ 5 & 3\end{vmatrix}=-11,\ c_{33}=(-1)^{3+3}\begin{vmatrix}2 & 3\\ 5 & 1\end{vmatrix}=-13$	
		$AdjA=\begin{bmatrix}-11 & 3 & 10\\ 22 & 0 & -11\\ 11 & 6 & -13\end{bmatrix}$	
		$A^{-1}=\frac{1}{\lvert A\rvert}.adj.A\ =\frac{1}{33}\begin{bmatrix}-11 & 3 & 10\\ 22 & 0 & -11\\ 11 & 6 & -13\end{bmatrix}$	1
		$X=A^{-1}B$	
		$=\frac{1}{33}\begin{bmatrix}-11 & 3 & 10\\ 22 & 0 & -11\\ 11 & 6 & -13\end{bmatrix}\begin{bmatrix}-3\\ 10\\ -3\end{bmatrix}$	
		$=\frac{1}{33}\begin{bmatrix}33+30-30\\ -66+0+33\\ -33+60+39\end{bmatrix}=\frac{1}{33}\begin{bmatrix}33\\ -33\\ 66\end{bmatrix}$	
		$\therefore\begin{bmatrix}x\\ y\\ z\end{bmatrix}=\begin{bmatrix}1\\ -1\\ 2\end{bmatrix}$	1
		--	
	b)	Resolve into partial fractions: $\frac{x^3+x}{x^2-9}$	**04**
	Ans	$x^2-9\overline{)x^3+x}\ \ (x$ x^3-9x $-\quad +$ $\overline{\quad 10x}$	

Q. No.	Sub Q. N.	Answer	Marking Scheme
3.	b)	$\therefore \dfrac{x^3+x}{x^2-9}=x+\dfrac{10x}{x^2-9}$ ---------(1)	1
		Consider, $\dfrac{10x}{x^2-9}=\dfrac{10x}{(x+3)(x-3)}$	
		$\therefore \dfrac{10x}{(x+3)(x-3)}=\dfrac{A}{x+3}+\dfrac{B}{x-3}$	
		$10x=(x-3)A+(x+3)B$	
		Put $x=-3$	
		$-30=-6A$	
		$\therefore A=5$	1
		Put $x=3$	
		$\therefore B=5$	1
		$\therefore \dfrac{10x}{(x+3)(x-3)}=\dfrac{5}{x+3}+\dfrac{5}{x-3}$	½
		From $(1)\Rightarrow \dfrac{x^3+x}{x^2-9}=x+\dfrac{5}{x+3}+\dfrac{5}{x-3}$	½
		--	
	c)	Resolve into partial fractions $\dfrac{x^2-2x+3}{x^3+x}$	**04**
	Ans	$\dfrac{x^2-2x+3}{x^3+x}=\dfrac{x^2-2x+3}{x(x^2+1)}$	
		$\therefore \dfrac{x^2-2x+3}{x(x^2+1)}=\dfrac{A}{x}+\dfrac{Bx+C}{x^2+1}$	½
		$\therefore x^2-2x+3=(x^2+1)A+(x)(Bx+C)$	
		Put $x=0$	
		$\therefore 3=(1)A$	
		$\therefore A=3$	1
		Put $x=1$	
		$2=(2)A+(1)(B+C)$	
		$2=6+B+C$	
		$B+C=-4$ -----------(1)	
		Put $x=-1$	
		$6=(2)A+(-1)(-B+C)$	
		$6=6+B-C$	

Q. No.	Sub Q. N.	Answer	Marking Scheme
3.	c)	$B-C=0$ -----------(2)	
		Solving eq^{n}s (1) and (2)	
		$B=-2$ and $C=-2$	1+1
		$\therefore \dfrac{x^2-2x+3}{x\left(x^2+1\right)}=\dfrac{3}{x}+\dfrac{-2x-2}{x^2+1}$	½
		--	
	d)	Prove that $\dfrac{\cos 3A\sin 9A-\sin A\cos 5A}{\cos A\cos 5A-\sin 3A\sin 9A}=\tan 8A$	**04**
	Ans	$L.H.S.=\dfrac{\cos 3A\sin 9A-\sin A\cos 5A}{\cos A\cos 5A-\sin 3A\sin 9A}$	
		$=\dfrac{2\cos 3A\sin 9A-2\sin A\cos 5A}{2\cos A\cos 5A-2\sin 3A\sin 9A}$	
		$=\dfrac{\left[\sin(3A+9A)-\sin(3A-9A)\right]-\left[\sin(A+5A)+\sin(A-5A)\right]}{\left[\cos(A+5A)+\cos(A-5A)\right]-\left[\cos(3A-9A)-\cos(3A+9A)\right]}$	1
		$=\dfrac{\left[\sin(12A)-\sin(-6A)\right]-\left[\sin(6A)+\sin(-4A)\right]}{\left[\cos(6A)+\cos(-4A)\right]-\left[\cos(-6A)-\cos(12A)\right]}$	
		$=\dfrac{\left[\sin(12A)+\sin(6A)\right]-\left[\sin(6A)-\sin(4A)\right]}{\left[\cos(6A)+\cos(4A)\right]-\left[\cos(6A)-\cos(12A)\right]}$	½
		$=\dfrac{\sin(12A)+\sin(6A)-\sin(6A)+\sin(4A)}{\cos(6A)+\cos(4A)-\cos(6A)+\cos(12A)}$	
		$=\dfrac{\sin(12A)+\sin(4A)}{\cos(4A)+\cos(12A)}$	½
		$=\dfrac{2\sin\left(\frac{12A+4A}{2}\right).\cos\left(\frac{12A-4A}{2}\right)}{2\cos\left(\frac{4A+12A}{2}\right).\cos\left(\frac{4A-12A}{2}\right)}$	1
		$=\dfrac{2\sin(8A).\cos(4A)}{2\cos(8A).\cos(-4A)}$	
		$=\dfrac{\sin(8A).\cos(4A)}{\cos(8A).\cos(4A)}$	½
		$=\tan 8A=R.H.S.$	½
		--	
	e)	Prove that $\sin(A+B)=\sin A\cos B+\cos A\sin B$	**04**

Q. No.	Sub Q. N.	Answer	Marking Scheme
3.	e) Ans		1

Right Angled Triangle	Acute Angle	Trigonometric Ratios
Δ OMP	∠MOP = A	$\sin A = \frac{PM}{OP}, \quad \cos A = \frac{OM}{OP}$
Δ OPQ	∠POQ = B	$\sin B = \frac{PQ}{OQ}, \quad \cos B = \frac{OP}{OQ}$
Δ PRQ	∠PQR = A	$\sin A = \frac{PR}{PQ}, \quad \cos A = \frac{QR}{PQ}$
Δ ONQ	∠NOQ = A+B	$\sin(A+B) = \frac{QN}{OQ}, \quad \cos(A+B) = \frac{ON}{OQ}$

1

$$\therefore \sin(A+B) = \frac{QN}{OQ}$$

$$= \frac{QR+RN}{OQ}$$ ½

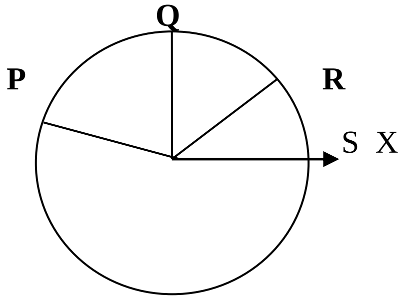
$$= \frac{QR+PM}{OQ}$$

$$= \frac{QR}{OQ} + \frac{PM}{OQ}$$ ½

$$= \frac{QR}{PQ} \times \frac{PQ}{OQ} + \frac{PM}{OP} \times \frac{OP}{OQ}$$

$$= \cos A \sin B + \sin A \cos B.$$

$$= \sin A \cos B + \cos A \sin B$$ 1

Q. No.	Sub Q. N.	Answer	Marking Scheme
3.	e)	**OR**	
		 	
		Consider a standard unit circle	1
		Let P,Q,R,S be points such that	
		$\angle XOP = A$, $\angle XOQ = B$, $\angle XOR = A - B$	
		From fig.	
		$\angle POQ = A - B$	
		$\therefore \angle POQ = \angle XOR$	
		$\therefore$ Chord $PQ =$ Chord RS	
		$\text{P}(\cos A, \sin A)$, $\text{Q}(\cos B, \sin B)$	
		$R[\cos(A-B), \sin(A-B)]$, $\text{S}(1,0)$	½
		$\because PQ = RS$	
		$\sqrt{(\cos A - \cos B)^2 + (\sin A - \sin B)^2} = \sqrt{[\cos(A-B)-1]^2 + [\sin(A-B)-0]^2}$	
		$(\cos A - \cos B)^2 + (\sin A - \sin B)^2 = [\cos(A-B)-1]^2 + [\sin(A-B)-0]^2$	1
		$\therefore \cos^2 A + \cos^2 B - 2\cos A \cos B + \sin^2 A + \sin^2 B - 2\sin A \sin B =$	
		$\cos^2(A-B) + 1 - 2\cos(A-B) + \sin^2(A-B)$	
		$\therefore 1 + 1 - 2(\cos A \cos B + \sin A \sin B) = 1 + 1 - 2\cos(A-B)$	
		$\therefore \cos A \cos B + \sin A \sin B = \cos(A-B)$	½
		Consider $\sin(A+B) = \cos\left(\frac{\pi}{2} - (A+B)\right)$	½
		$= \cos\left(\left(\frac{\pi}{2} - A\right) - B\right)$	
		$= \cos\left(\frac{\pi}{2} - A\right)\cos B + \sin\left(\frac{\pi}{2} - A\right)\sin B$	
		$= \sin A \cos B + \cos A \sin B$	½
		--	
	f)	Prove that $\cot^{-1}\left(\frac{6}{5}\right) + \tan^{-1}\left(\frac{1}{11}\right) = \sec^{-1}\left(\sqrt{2}\right)$	**04**
	Ans	Let $\cot^{-1}\left(\frac{6}{5}\right) = \tan^{-1}\left(\frac{5}{6}\right)$	
		$L.H.S. = \cot^{-1}\left(\frac{6}{5}\right) + \tan^{-1}\left(\frac{1}{11}\right)$	

Q. No.	Sub Q. N.	Answer	Marking Scheme
3.	f)	$= \tan^{-1}\left(\frac{5}{6}\right)+\tan^{-1}\left(\frac{1}{11}\right)$	½
		$= \tan^{-1}\left(\frac{\frac{5}{6}+\frac{1}{11}}{1-\frac{5}{6}\frac{1}{11}}\right)$	1
		$= \tan^{-1}\left(\frac{\frac{55+6}{66}}{\frac{66-5}{66}}\right)$	
		$= \tan^{-1}(1)$	1
		$= \frac{\pi}{4} = R.H.S.$	½
		$\therefore R.H.S = \sec^{-1}\left(\sqrt{2}\right) = \frac{\pi}{4}$	1
		--	
4.		**Attempt any FOUR of the following**:	**16**
	a)	Without using calculator find the value of	
		$\sin\left(150^0\right)+\cos\left(300^0\right)-\tan\left(315^0\right)+\sec^2\left(3660^0\right)$	**04**
	Ans	$\sin\left(150^0\right)=\sin\left(2\times 90-30\right)=\sin 30=\frac{1}{2}$	½
		$\cos\left(300^0\right)=\cos\left(4\times 90-60\right)=\cos 60=\frac{1}{2}$	½
		$\tan\left(315^0\right)=\tan\left(4\times 90-45\right)=-\tan 45=-1$	½
		$\sec^2\left(3660^0\right)=\left[\sec\left(3660^0\right)\right]^2=\left[\sec\left(40\times 90+60\right)\right]^2=\left[\sec\left(60\right)\right]^2=\left[2\right]^2=4$	1
		$\therefore \sin\left(150^0\right)+\cos\left(300^0\right)-\tan\left(315^0\right)+\sec^2\left(3660^0\right)$	
		$=\frac{1}{2}+\frac{1}{2}-(-1)+4$	1
		$=6$	½
		--	
	b)	In any $\Delta ABC, A+B+C=\pi$ prove that	
		$\sin 2A+\sin 2B-\sin 2C=4\cos A\cos B\sin C$	**04**
	Ans	$A+B+C=\pi$	
		$A+B=\pi-C$	
		$\therefore \sin\left(A+B\right)=\sin\left(\pi-C\right)=\sin C$	½

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Model Answer Subject Code: 17104

Q. No.	Sub Q. N.	Answer	Marking Scheme
4.	b) Ans	$\therefore \cos(A+B)=\cos(\pi-C)=-\cos C$	½
		$L.H.S.=\sin 2A+\sin 2B-\sin 2C$	
		$=2\sin\left(\frac{2A+2B}{2}\right)\cos\left(\frac{2A-2B}{2}\right)-\sin 2C$	
		$=2\sin(A+B)\cos(A-B)-\sin 2C$	1
		$=2\sin C\cos(A-B)-\sin 2C$	
		$=2\sin C\cos(A-B)-2\sin C\cos C$	½
		$=2\sin C\left[\cos(A-B)-\cos C\right]$	
		$=2\sin C\left[\cos(A-B)+\cos(A+B)\right]$	
		$=2\sin C\left[2\cos\left(\frac{A-B+A+B}{2}\right)\cos\left(\frac{A-B-A-B}{2}\right)\right]$	1
		$=2\sin C\,2\cos(A)\cos(-B)$	
		$=4\sin C\cos A\cos B=R.H.S.$	½
		---	
	c)	Show that $\sin 20^0\sin 40^0\sin 60^0\sin 80^0=\frac{3}{16}$	**04**
	Ans	$L.H.S.=\sin 20^0\sin 40^0\sin 60^0\sin 80^0$	
		$=\sin 20^0\sin 40^0\frac{\sqrt{3}}{2}\sin 80^0$	½
		$=\frac{\sqrt{3}}{4}[2\sin 20^0\sin 40^0]\sin 80^0$	
		$=\frac{\sqrt{3}}{4}\left(\cos\left(-20^0\right)-\cos 60^0\right)\sin 80^0$	1
		$=\frac{\sqrt{3}}{4}\left(\cos 20^0\sin 80^0-\cos 60^0\sin 80^0\right)$	
		$=\frac{\sqrt{3}}{8}\left(2\cos 20^0\sin 80^0-2\frac{1}{2}\sin 80^0\right)$	½
		$=\frac{\sqrt{3}}{8}\left(\sin 100^0+\sin 60^0-\sin 80^0\right)$	1
		$=\frac{\sqrt{3}}{8}\left(\sin(2\times 90-80)+\frac{\sqrt{3}}{2}-\sin 80^0\right)$	½
		$=\frac{\sqrt{3}}{8}\left(\sin 80^0+\frac{\sqrt{3}}{2}-\sin 80^0\right)$	
		$=\frac{3}{16}=R.H.S.$	½

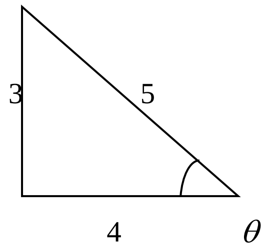
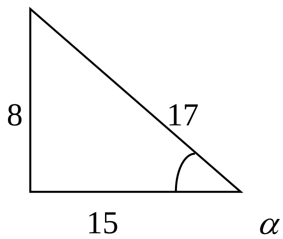
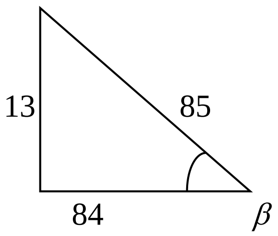
WINTER – 2017 EXAMINATION

Model Answer Subject Code: 17104

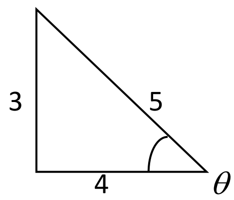
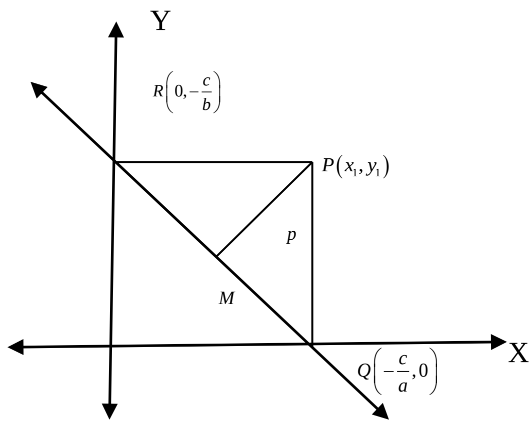
Q. No.	Sub Q. N.	Answer	Marking Scheme
4.	d)	If $x>0, y>0$ and $xy<1$ then prove that	**04**
		$\tan^{-1}x+\tan^{-1}y=\tan^{-1}\left(\frac{x+y}{1-xy}\right)$	
	Ans	Let $\tan^{-1}x=A$ and $\tan^{-1}y=B \therefore x=\tan A$ and $y=\tan B$	1
		$\tan(A+B)=\frac{\tan A+\tan B}{1-\tan A\tan B}$	1
		$A+B=\tan^{-1}\left(\frac{\tan A+\tan B}{1-\tan A\tan B}\right)$	1
		$\therefore \tan^{-1}x+\tan^{-1}y=\tan^{-1}\left(\frac{x+y}{1-xy}\right)$	1
		OR	
		Let $\tan^{-1}x=A$ and $\tan^{-1}y=B \therefore x=\tan A$ and $y=\tan B$	1
		$R.H.S.=\tan^{-1}\left(\frac{x+y}{1-xy}\right)$	
		$=\tan^{-1}\left(\frac{\tan A+\tan B}{1-\tan A\tan B}\right)$	1
		$=\tan^{-1}\left(\tan(A+B)\right)$	1
		$=A+B=\tan^{-1}x+\tan^{-1}y$	1
		$=L.H.S.$	
		--	
	e)	Prove that $\frac{\sec 8A-1}{\sec 4A-1}=\frac{\cot 2A}{\cot 8A}$	**04**
	Ans	$L.H.S.=\frac{\sec 8A-1}{\sec 4A-1}=\frac{\frac{1}{\cos 8A}-1}{\frac{1}{\cos 4A}-1}$	1
		$=\frac{(1-\cos 8A)\cos 4A}{(1-\cos 4A)\cos 8A}$	1
		$=\frac{2\sin^2 4A\cos 4A}{2\sin^2 2A\cos 8A}$	
		$=\frac{\sin 4A\sin 4A\cos 4A}{\sin 2A\sin 2A\cos 8A}$	
		$=\frac{2\sin 2A\cos 2A\sin 4A\cos 4A}{\sin 2A\sin 2A\cos 8A}$	1
		$=\frac{\cos 2A\sin 8A}{\sin 2A\cos 8A}$	
		$=\cot 2A\times\tan 8A$	

WINTER – 2017 EXAMINATION

Model Answer Subject Code: 17104

Q. No.	Sub Q. N.	Answer	Marking Scheme
4	e)	$=\dfrac{\cot 2A}{\cot 8A}$	1
	f)	Prove that: $\sin^{-1}\left(\frac{3}{5}\right)-\sin^{-1}\left(\frac{8}{17}\right)=\cos^{-1}\left(\frac{84}{85}\right)$	**04**
	Ans.	Put $\theta=\sin^{-1}\left(\frac{3}{5}\right)$ $\quad\therefore \sin\theta=\frac{3}{5}$	
		 	
		$\therefore \tan\theta=\frac{3}{4}$ $\quad\therefore \theta=\tan^{-1}\left(\frac{3}{4}\right)$	
		$\therefore \sin^{-1}\left(\frac{3}{5}\right)=\tan^{-1}\left(\frac{3}{4}\right)$	1
		Put $\sin^{-1}\left(\frac{8}{17}\right)=\alpha$ $\quad\therefore \sin\alpha=\frac{8}{17}$	
		 	
		$\therefore \tan\alpha=\frac{8}{15}$ $\quad\therefore \alpha=\tan^{-1}\left(\frac{8}{15}\right)$	
		$\therefore \sin^{-1}\left(\frac{8}{17}\right)=\tan^{-1}\left(\frac{8}{15}\right)$	1
		Put $\cos^{-1}\left(\frac{84}{85}\right)=\beta$ $\quad\therefore \cos\beta=\frac{84}{85}$	
		 	
		$\therefore \tan\beta=\frac{13}{84}$ $\quad\therefore \beta=\tan^{-1}\left(\frac{13}{84}\right)$	
		$\therefore \cos^{-1}\left(\frac{84}{85}\right)=\tan^{-1}\left(\frac{13}{84}\right)$	1
		$\therefore L.H.S.=\sin^{-1}\left(\frac{3}{5}\right)-\sin^{-1}\left(\frac{8}{17}\right)$	
		$\tan^{-1}\left(\frac{3}{4}\right)-\tan^{-1}\left(\frac{8}{15}\right)$	
		$=\tan^{-1}\left(\dfrac{\frac{3}{4}-\frac{8}{15}}{1+\frac{3}{4}\frac{8}{15}}\right)$	½
		$=\tan^{-1}\left(\frac{13}{84}\right)$	½
		$=\cos^{-1}\left(\frac{84}{85}\right)=R.H.S$	

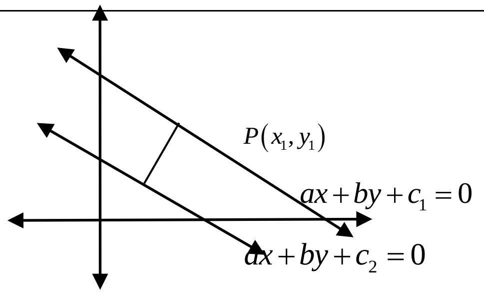
Q. No.	Sub Q. N.	Answer	Marking Scheme
5.		**Attempt any FOUR of the following** :	**16**
	a)	$\sin\alpha=\frac{12}{13},\cos\beta=\frac{3}{5}$, then , $\frac{\pi}{2}<\alpha<\pi$ and $0<\beta<\frac{\pi}{2}$ find $\cos(\alpha+\beta)$.	**04**
	Ans	$\because \cos^2\alpha=1-\sin^2\alpha$	
		$=1-\frac{144}{169}=\frac{25}{169}$	
		$\therefore \cos\alpha=\pm\frac{5}{13}$	
		$\therefore \cos\alpha=-\frac{5}{13}$ as $\frac{\pi}{2}<\alpha<\pi$	1
		$\cos\beta=\frac{3}{5}$	
		$\therefore \sin^2\beta=1-\cos^2\beta$	
		$=1-\frac{9}{25}=\frac{16}{25}$	
		$\therefore \sin\beta=\pm\frac{4}{5}$	
		$\therefore \sin\beta=\frac{4}{5}$ as $0<\beta<\frac{\pi}{2}$	1
		$\cos(\alpha+\beta)=\cos\alpha\cos\beta-\sin\alpha\sin\beta=\left(-\frac{5}{13}\cdot\frac{3}{5}\right)-\left(\frac{12}{13}\cdot\frac{4}{5}\right)$	1
		$=\frac{-63}{65}$	1
	b)	Show that $\cos59^0+\sin59^0=\sqrt{2}\cos14^0$	**04**
	Ans	L.H.S. $=\cos59^0+\sin59^0$	
		$=\cos59^0+\cos31^0$ $\left[\because \sin59^0=\cos\left(90^0-59^0\right)=\cos31^0\right]$	1
		$=2\cos\left(\frac{59^0+31^0}{2}\right)\cdot\cos\left(\frac{59^0-31^0}{2}\right)$	1
		$=2\cos45^0\cdot\cos14^0$	½
		$=2\left(\frac{1}{\sqrt{2}}\right)\cdot\cos14^0$	1
		$=\sqrt{2}\cos14^0$	½
		$=R.H.S.$	
	c)	Prove that $\cos^{-1}\left(\frac{4}{5}\right)+\tan^{-1}\left(\frac{3}{5}\right)=\tan^{-1}\left(\frac{27}{11}\right)$	**04**

Q. No.	Sub Q. N.	Answer	Marking Scheme
5.	c) Ans	Let $\cos^{-1}\left(\frac{4}{5}\right)=\theta$  $\therefore \cos\theta=\frac{4}{5}$ $\therefore \tan\theta=\frac{3}{4}$ $\therefore \theta=\tan^{-1}\left(\frac{3}{4}\right)$ $\therefore \cos^{-1}\left(\frac{4}{5}\right)=\tan^{-1}\left(\frac{3}{4}\right)$	1
		$\therefore L.H.S.=\cos^{-1}\left(\frac{4}{5}\right)+\tan^{-1}\left(\frac{3}{5}\right)$ $=\tan^{-1}\left(\frac{3}{4}\right)+\tan^{-1}\left(\frac{3}{5}\right)$ $=\tan^{-1}\left(\frac{\frac{3}{4}+\frac{3}{5}}{1-\frac{3}{4}\frac{3}{5}}\right)$	1
		$=\tan^{-1}\left(\frac{\frac{15+12}{20}}{1-\frac{9}{20}}\right)=\tan^{-1}\left(\frac{27}{11}\right)=R.H.S.$	2
	d)	If p is the length of perpendicular from a point $p(x_1,y_1)$ to the line $ax+by+c=0$ then prove that P = $\left\lvert\frac{ax_1+by_1+c}{\sqrt{a^2+b^2}}\right\rvert$	**04**
	Ans		1
		Let Q$\left(\frac{-c}{a},0\right)$ and R$\left(0,\frac{-c}{b}\right)$	

Q. No.	Sub Q. N.	Answer	Marking Scheme
5.	d)	$A(\Delta PQR)=\frac{1}{2}\begin{vmatrix} x_1 & y_1 & 1 \\ \frac{-c}{a} & 0 & 1 \\ 0 & \frac{-c}{b} & 1 \end{vmatrix}=\frac{1}{2}\left[x_1\left(0+\frac{c}{b}\right)-y_1\left(\frac{-c}{a}-0\right)+1\left(\frac{c^2}{ab}\right)\right]$	
		$=\frac{1}{2}\left[\frac{x_1c}{b}+\frac{y_1c}{a}+\frac{c^2}{ab}\right]=\frac{1}{2}\left[\frac{c}{ab}(ax_1+by_1+c)\right]$	1
		$\because d(QR)=\sqrt{\left(\frac{-c}{a}-0\right)^2+\left(0-\frac{-c}{b}\right)^2}$	
		$=\sqrt{\left(\frac{c^2}{a^2}\right)+\left(\frac{c^2}{b^2}\right)}$	
		$=\frac{c}{ab}\sqrt{a^2+b^2}$	
		$A(\Delta PQR)=\frac{1}{2}\times d(QR)\times PM$	
		$=\frac{1}{2}\times\frac{c}{ab}\sqrt{a^2+b^2}\times PM$	1
		$\therefore \frac{1}{2}\frac{c}{ab}(ax_1+by_1+c)=\frac{1}{2}\frac{c}{ab}\sqrt{a^2+b^2}\times PM$	1
		$\therefore PM=\left\lvert\frac{ax_1+by_1+c}{\sqrt{a^2+b^2}}\right\rvert$	
		--	
	e)	Find the equation of line passing through $(-1,1)$ and making an angle $\frac{\pi}{4}$ with the line $2x+3y=6$	**04**
	Ans	The slope of the given line $2x+3y=6$ is	
		$m_1=\frac{-2}{3}$	½
		Let the slope of the required line be 'm'	
		$\therefore\ \tan\theta=\left\lvert\frac{m_1-m_2}{1+m_1m_2}\right\rvert$	
		putting $\theta=45^0$, $m_1=\frac{-2}{3}$, $m_2=m$	

Q. No.	Sub Q. N.	Answer	Marking Scheme
5.	e)	$\therefore\ \tan 45^0 = \left\| \dfrac{\frac{-2}{3} - m}{1 + \left(\frac{-2}{3}\right)m} \right\|$	½
		$\therefore 1 = \left\| \dfrac{-2-3m}{3-2m} \right\|$	
		$\therefore \dfrac{-2-3m}{3-2m} = \pm 1$	
		$\therefore \dfrac{-2-3m}{3-2m} = 1$ or $\dfrac{-2-3m}{3-2m} = -1$	
		$\therefore -2-3m = 3-2m$ or $-2-3m = -3+2m$	
		$\therefore m = -5$ or $m = \dfrac{1}{5}$	1
		Hence the equation of lines, in slope-point form is	
		(i) for $m = -5$	
		$y - y_1 = m(x - x_1)$	
		$\therefore y - 1 = -5(x+1)$	
		$\therefore 5x + y + 4 = 0$	1
		(ii) for $m = \dfrac{1}{5}$	
		$y - y_1 = m(x - x_1)$	
		$\therefore y - 1 = \dfrac{1}{5}(x+1)$	
		$\therefore x - 5y + 6 = 0$	1
		--	
	f)	Find the co-ordinate of the foot of perpendicular drawn from $(3,4)$ to the straight line $4x - 2y + 9 = 0$.	**04**
	Ans	The slope of the given line $4x - 2y + 9 = 0$ is	
		$m_1 = \dfrac{-4}{-2} = 2$	½
		For perpendicular lines , $m_1 m_2 = -1$	
		$\therefore m_2 = \dfrac{-1}{2}$	½
		Equation of perpendicular is	
		$(y - y_1) = m(x - x_1)$	
		$\therefore y - 4 = \dfrac{-1}{2}(x - 3)$	

Q. No.	Sub Q. N.	Answer	Marking Scheme
5.	f)	$\therefore x+2y-11=0$	1
		Foot of the perpendicular = Point of intersection of two lines	
		$\therefore$ Solving the equations	
		$4x-2y=-9$	
		$x+2y=11$	
		$\therefore 4x-2y=-9$	
		$+\ \ x+2y=11$	
		______________	
		$5x=2$	
		$\therefore x=\dfrac{2}{5}$ and $y=\dfrac{53}{10}$	1+1
		$\left(x_1,y_1\right)=\left(\dfrac{2}{5},\dfrac{53}{10}\right)$	
		--	
6.		**Attempt any FOUR of the following**:	**16**
	a)	Show that the points $(6,1),(-1,8),(3,-2)$ are the vertices of right angled triangle by using slopes.	**04**
	Ans	Let $\text{A}(6,1),\ \text{B}(-1,8),\ \text{C}(3,-2)$ are the vertices of the ΔABC,	
		Slope of side AB $=m_1=\dfrac{y_2-y_1}{x_2-x_1}=\dfrac{8-1}{-1-6}=-1$	1
		Slope of side BC $=m_2=\dfrac{-2-8}{3+1}=\dfrac{-5}{2}$	1
		Slope of side AC $=m_3=\dfrac{-2-1}{3-6}=1$	1
		We observe that $m_1\times m_3=-1$	½
		$\therefore$ side $AB\perp$ side AC	
		$\therefore\Delta\text{ABC}$ is right angled triangle at vertex A.	½
		--	
	b)	Show that distance between two parallel lines $ax+by+4=0$ and $ax+by+c_2=0$ is $d=\left\|\dfrac{c_2-c_1}{\sqrt{a^2+b^2}}\right\|$	**04**
	Ans	Considering equations as $ax+by+c_1=0$ *and* $ax+by+c_2=0$	
		$L_1: ax+by+c_1=0$	
		$L_2: ax+by+c_2=0$	
		Let $\text{P}\left(x_1,y_1\right)$ be any point on the line L_1	
		$\therefore ax_1+by_1+c_1=0$	

Q. No.	Sub Q. N.	Answer	Marking Scheme
6.	b)		1
		$\therefore ax_1 + by_1 = -c_1$	1
		PM is perpendicular on the line L_2	
		$\therefore PM = \left\lvert \frac{ax_1 + by_1 + c_2}{\sqrt{a^2 + b^2}} \right\rvert$	1
		$\therefore PM = \left\lvert \frac{-c_1 + c_2}{\sqrt{a^2 + b^2}} \right\rvert = \left\lvert \frac{c_2 - c_1}{\sqrt{a^2 + b^2}} \right\rvert$	1
		Note: If student has attempted to solve this question reward appropriate marks.	
	c)	Following are the marks obtained by two students A and B	**04**

Marks obtained by A	44	80	76	48	52	72	68	56	60	64
Marks obtained by B	48	75	54	60	63	69	72	51	57	56

which of the two students is more consistent?

Ans

For Student A:

x_i	x_i^2
44	1936
80	6400
76	5776
48	2304
52	2704
72	5184
68	4624
56	3136
60	3600
64	4096
620	**39760**

Mean $\bar{x} = \frac{\sum x_i}{N} = \frac{620}{10} = 62$ ½

S.D.$=\sigma = \sqrt{\frac{\sum x_i^2}{N} - \left(\bar{x}\right)^2} = \sqrt{\frac{39760}{10} - (62)^2} = 11.49$ 1

Coefficient of Variance $= \frac{S.D.}{\bar{x}} \times 100 = \frac{11.49}{62} \times 100 = 18.53$ ½

Q. No.	Sub Q. N.	Answer	Marking Scheme
6.	c) Ans.	**For Student B:**	

x_i	x_i^2
48	2304
75	5625
54	2916
60	3600
63	3969
69	4761
72	5184
51	2601
57	3249
56	3136
605	**37345**

Mean $\bar{x} = \frac{\sum x_i}{N} = \frac{605}{10}$

$\bar{x} = 60.5$ ½

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

$= \sqrt{\frac{37345}{10} - (60.5)^2}$

$\sigma = 8.62$ ½

Coefficient of Variance $= \frac{S.D.}{\bar{x}} \times 100$

$= \frac{8.62}{60.5} \times 100$

$= 14.25$ ½

$\therefore CV(B) < CV(A)$

$\therefore$ Student B is more consistent. ½

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d) Calculate standard deviation of the following frequency distribution: **04**

Class Interval	0-10	10-20	20-30	30-40	40-50
Frequency	14	23	27	21	15

Q. No.	Sub Q. N.	Answer	Marking Scheme
6.	d)		
	Ans		

Class	x_i	f_i	$f_i x_i$	$x^2{}_i$	$f_i x^2{}_i$
0-10	5	14	70	25	350
10-20	15	23	345	225	5175
20-30	25	27	675	625	16875
30-40	35	21	735	1225	25725
40-50	45	15	675	2025	30375
		100	2500		78500

2

$$\text{Mean } \bar{x} = \frac{\sum f_i x_i}{N} = \frac{2500}{100} = 25$$

1

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

$$= \sqrt{\frac{78500}{100} - (25)^2}$$

$$\sigma = 12.65$$

1

OR

Class	x_i	f_i	d_i	$f_i d_i$	$d^2{}_i$	$f_i d^2{}_i$
0-10	5	14	-2	-28	4	56
10-20	15	23	-1	-23	1	23
20-30	25	27	0	0	0	0
30-40	35	21	1	21	1	21
40-50	45	15	2	30	4	60
		100		00		160

2

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

$$= \sqrt{\frac{160}{100} - \left(\frac{0}{100}\right)^2} \times 10$$

$$= 12.65$$

2

----

e) Find the mean deviation from the median of the following data. **04**

Weight of wood logs	10-20	20-30	30-40	40-50	50-60	60-70
Number of logs	4	6	10	18	9	3

Q. No.	Sub Q. N.	Answer	Marking Scheme
6.	e) Ans		

Class	x_i	f_i	$c.f.$	$\lvert x_i - M\rvert$	$f_i\lvert x_i - M\rvert$
10-20	15	4	4	27.78	111.12
20-30	25	6	10	17.78	106.68
30-40	35	10	20	7.78	77.8
40-50	45	18	38	2.22	39.96
50-60	55	9	47	12.22	109.98
60-70	65	3	50	22.22	66.66
		50			512.2

2

$$M = Median = L + \left(\frac{\frac{N}{2} - cf}{f}\right) \times h$$

$$= 40 + \left(\frac{25-20}{18}\right) \times 10 \qquad \because \text{Median class } 40-50$$

1

$$= 42.78$$

$$M.D. = \frac{\sum f_i \lvert x_i - M\rvert}{N}$$

$$= \frac{512.2}{50}$$

1

$$= 10.24$$

---

f) Find the coefficent of variance of the following data:

04

Expenditure	5	10	15	20	25
No.of students	6	16	28	38	46

Ans.

x_i	f_i	$f_i x_i$	x^2_i	$f_i x^2_i$
5	6	30	25	150
10	16	160	100	1600
15	28	420	225	6300
20	38	760	400	15200
25	46	1150	625	28750
	134	2520		52000

2

<table>
<tr><th>Q. No.</th><th>Sub Q. N.</th><th>Answer</th><th>Marking Scheme</th></tr>
<tr><td>6</td><td>f)</td><td>
Mean $\bar{x} = \frac{\sum f_i x_i}{N} = \frac{2520}{134} = 18.81$
S.D. $\sigma = \sqrt{\frac{\sum f_i x_i^2}{N} - \left(\bar{x}\right)^2}$
$= \sqrt{\frac{52000}{134} - (18.81)^2}$
$\sigma = 5.85$
Coefficient of Variance $= \frac{S.D.}{\bar{x}} \times 100$
$= \frac{5.85}{18.81} \times 100$
$= 31.10$

<u>Important Note</u>
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.
</td><td>½

1

½</td></tr>
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