Que. No.	Sub. Que.	Model Answers	Marks	Total Marks

Important Instructions to the 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 the candidate and those in the 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 the model answer.
6) In case of some questions credit may be given by judgment 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.

Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
1)		**Attempt any TEN of the following:**		
	a)	Find the value of $\begin{vmatrix} 2 & 3 & 5 \\ 1 & 4 & 2 \\ 3 & 1 & 6 \end{vmatrix}$		
	Ans.	$\begin{vmatrix} 2 & 3 & 5 \\ 1 & 4 & 2 \\ 3 & 1 & 6 \end{vmatrix} = 2(24-2)-3(6-6)+5(1-12)$	1	
		$=-11$	1	**2**
	b)	If $A=\begin{bmatrix} 3 & -1 \\ 2 & 4 \end{bmatrix}$, find the matrix B such that $2A+3B=0$		
	Ans.	$2A=2\begin{bmatrix} 3 & -1 \\ 2 & 4 \end{bmatrix}=\begin{bmatrix} 6 & -2 \\ 4 & 8 \end{bmatrix}$	1	
		$\therefore 3B=-2A=\begin{bmatrix} -6 & 2 \\ -4 & -8 \end{bmatrix}$	½	
		$\therefore B=\frac{1}{3}\begin{bmatrix} -6 & 2 \\ -4 & -8 \end{bmatrix}$	½	**2**
		OR		
		$2A+3B=0$		
		$\therefore 3B=-2A$		
		$=-2\begin{bmatrix} 3 & -1 \\ 2 & 4 \end{bmatrix}$	½	
		$=\begin{bmatrix} -6 & 2 \\ -4 & -8 \end{bmatrix}$	1	
		$\therefore B=\frac{1}{3}\begin{bmatrix} -6 & 2 \\ -4 & -8 \end{bmatrix}$	½	**2**
	c)	Find the value of a and b, if $\begin{bmatrix} a-4b & 5 \\ 6 & -a+b \end{bmatrix}=\begin{bmatrix} 11 & 5 \\ 6 & -5 \end{bmatrix}$		
	Ans.	$\begin{bmatrix} a-4b & 5 \\ 6 & -a+b \end{bmatrix}=\begin{bmatrix} 11 & 5 \\ 6 & -5 \end{bmatrix}$		
		$\therefore a-4b=11$	½	
		$-a+b=-5$	½	
		$\therefore -3b=6$		
		$\therefore \boxed{b=-2}$	½	
		$\therefore \boxed{a=3}$	½	**2**

Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
1)	d)	Find the adjoint of matrix $\begin{bmatrix} 4 & -6 \\ 1 & 7 \end{bmatrix}$		
	Ans.	$Let \;\; A=\begin{bmatrix} 4 & -6 \\ 1 & 7 \end{bmatrix}$		
		$\therefore C(A)=\begin{bmatrix} 7 & -1 \\ 6 & 4 \end{bmatrix}$	1	
		$\therefore adj(A)=\begin{bmatrix} 7 & 6 \\ -1 & 4 \end{bmatrix}$	1	**2**
		OR		
		$Let \;\; A=\begin{bmatrix} 4 & -6 \\ 1 & 7 \end{bmatrix}$		
		$\therefore A_{11}=7 \qquad A_{12}=-1$ $A_{21}=6 \qquad A_{22}=4$	½	
		$\therefore C(A)=\begin{bmatrix} 7 & -1 \\ 6 & 4 \end{bmatrix}$	½	
		$\therefore adj(A)=\begin{bmatrix} 7 & 6 \\ -1 & 4 \end{bmatrix}$	1	**2**
		--		
	e)	Resolve into partial fractions: $\dfrac{x}{x^2-x-2}$		
	Ans.	$\dfrac{x}{x^2-x-2}=\dfrac{x}{(x-2)(x+1)}=\dfrac{A}{x-2}+\dfrac{B}{x+1}$		
		$\therefore \boxed{x=(x+1)A+(x-2)B}$		
		$Put \;\; x-2=0 \quad i.e., \;\; x=2$		
		$\therefore 2=(2+1)A+0$		
		$\therefore 2=3A$		
		$\therefore \boxed{\dfrac{2}{3}=A}$	1	
		$Put \;\; x+1=0 \quad i.e., \;\; x=-1$		
		$\therefore -1=0+(-1-2)B$		
		$\therefore -1=-3B$		
		$\therefore \boxed{\dfrac{1}{3}=B}$	½	
		$\therefore \boxed{\dfrac{x}{x^2-x-2}=\dfrac{\frac{2}{3}}{x-2}+\dfrac{\frac{1}{3}}{x+1}}$	½	**2**

Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
1)		**OR**		
		$\frac{x}{x^2-x-2}=\frac{x}{(x+1)(x-2)}=\frac{A}{x+1}+\frac{B}{x-2}$		
		$\therefore \boxed{x=(x-2)A+(x+1)B}$		
		$\therefore \boxed{\frac{1}{3}=A}$	1	
		$\therefore \boxed{\frac{2}{3}=B}$	½	
		$\therefore \boxed{\frac{x}{x^2-x-2}=\frac{\frac{1}{3}}{x+1}+\frac{\frac{2}{3}}{x-2}}$	½	**2**
		Note for partial fraction problems: The problems of partial fractions could also be solved by the method of "equating equal power coefficients". This method is also applicable. Give appropriate marks in accordance with the scheme of marking in the later problems as the solution by this method is not discussed. For the sake of convenience, the solution of the above problem with the help of this method is illustrated hereunder.		
		$\frac{x}{x^2-x-2}=\frac{x}{(x-2)(x+1)}=\frac{A}{x-2}+\frac{B}{x+1}$		
		$\therefore x=(x+1)A+(x-2)B$		
		$\therefore x=xA+A+xB-2B$		
		$\therefore 1\cdot x+0=x(A+B)+(A-2B)$		
		$\therefore A+B=1$		
		$A-2B=0$		
		$\therefore 2A+2B=2$		
		$A-2B=0$		
		$\therefore 3A=2$		
		$\therefore \boxed{A=\frac{2}{3}}$	1	
		$\therefore B=1-A=1-\frac{2}{3}$		
		$\therefore \boxed{B=\frac{1}{3}}$	½	
		$\therefore \boxed{\frac{x}{x^2-x-2}=\frac{\frac{2}{3}}{x-2}+\frac{\frac{1}{3}}{x+1}}$	½	**2**

Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
1)	f)	Show that $\tan\left(\frac{\pi}{4}-\theta\right)=\frac{1-\tan\theta}{1+\tan\theta}$		
	Ans.	$\tan\left(\frac{\pi}{4}-\theta\right)=\frac{\tan\left(\frac{\pi}{4}\right)-\tan\theta}{1+\tan\left(\frac{\pi}{4}\right)\tan\theta}$	1	
		$=\frac{1-\tan\theta}{1+\tan\theta}$	1	**2**
		--		
	g)	Prove that $\cos 2A=2\cos^2 A-1$		
	Ans.	$\cos 2A=\cos(A+A)$		
		$=\cos A\cos A-\sin A\sin A$	½	
		$=\cos^2 A-\sin^2 A$	½	
		$=\cos^2 A-(1-\cos^2 A)$	½	
		$=\cos^2 A-1+\cos^2 A$		
		$=2\cos^2 A-1$	½	**2**
		OR		
		$\cos 2A=\cos^2 A-\sin^2 A$	1	
		$=\cos^2 A-(1-\cos^2 A)$	½	
		$=2\cos^2 A-1$	½	**2**
		--		
	h)	If $\sin A=0.4$, find the value of $\sin 3A$.		
	Ans.	$\sin 3A=3\sin A-4\sin^3 A$	1	
		$=3(0.4)-4(0.4)^3$	½	
		$=0.944$ ...(*)	½	**2**
		Note (*): Due to the use of advance scientific calculator, writing directly the step (*) is allowed. No marks to be deducted.		
		OR		
		Given that $\sin A=0.4$.		
		$\therefore A=\sin^{-1}(0.4)=23.578^{o}$	1	
		$\therefore \sin 3A=\sin(3\times 23.578^{o})$	½	
		$=0.944$	½	**2**

Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
1)	i)	Prove that $\frac{\cos 3\theta}{\cos\theta}+\frac{\sin 3\theta}{\sin\theta}=4\cos 2\theta$		
	Ans.	$\frac{\cos 3\theta}{\cos\theta}+\frac{\sin 3\theta}{\sin\theta}=\frac{\sin\theta\cos 3\theta+\cos\theta\sin 3\theta}{\cos\theta\sin\theta}$	½	
		$=\frac{\sin(\theta+3\theta)}{\cos\theta\sin\theta}$		
		$=\frac{\sin 4\theta}{\cos\theta\sin\theta}$	½	
		$=\frac{\sin 2(2\theta)}{\cos\theta\sin\theta}$		
		$=\frac{2\sin 2\theta\cos 2\theta}{\cos\theta\sin\theta}$	½	
		$=\frac{2\cdot 2\sin\theta\cos\theta\cdot\cos 2\theta}{\cos\theta\sin\theta}$		
		$=4\cos 2\theta$	½	**2**
		OR		
		$\frac{\cos 3\theta}{\cos\theta}+\frac{\sin 3\theta}{\sin\theta}=\frac{4\cos^3\theta-3\cos\theta}{\cos\theta}+\frac{3\sin\theta-4\sin^3\theta}{\sin\theta}$	½	
		$=4\cos^2\theta-3+3-4\sin^2\theta$	½	
		$=4\cos^2\theta-4\sin^2\theta$	½	
		$=4\left(\cos^2\theta-\sin^2\theta\right)$		
		$=4\cos 2\theta$	½	**2**
		---		
	j)	Evaluate without using calculator $\frac{\tan 66^o+\tan 69^o}{1-\tan 66^o\tan 69^o}$		
	Ans.	$\frac{\tan 66^o+\tan 69^o}{1-\tan 66^o\tan 69^o}=\tan\left(66^o+69^o\right)$	½	
		$=\tan 135^o$		
		$=\tan\left(90^o+45^o\right)$ *OR* $\tan\left(180^o-45^o\right)$	½	
		$=-\cot 45^o$ *OR* $-\tan\left(45^o\right)$	½	
		$=-1$	½	**2**

Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
1)	k)	Find the slope and y-intercept of the line $\frac{x}{4}-\frac{y}{3}=2$		
	Ans.	$\frac{x}{4}-\frac{y}{3}-2=0$		
		$\therefore a=\frac{1}{4}$ $b=-\frac{1}{3}$ $c=-2$		
		$\therefore slope\ \ m=-\frac{a}{b}=-\frac{1/4}{-1/3}=\frac{3}{4}\ \ or\ \ 0.75$	1	
		$y-\text{int}=-\frac{c}{b}=-\frac{-2}{-1/3}=-6$	1	**2**
		OR		
		$\frac{x}{4}-\frac{y}{3}=2$		
		$\therefore 3x-4y-24=0$		
		$\therefore a=3$ $b=-4$ $c=-24$		
		$\therefore slope\ \ m=-\frac{a}{b}=-\frac{3}{-4}=\frac{3}{4}\ \ or\ \ 0.75$	1	
		$y-\text{int}=-\frac{c}{b}=-\frac{-24}{-4}=-6$	1	**2**
		OR		
		$\frac{x}{4}-\frac{y}{3}=2$		
		$\therefore y=\frac{3}{4}x-6$		
		$\therefore slope\ \ m=\frac{3}{4}\ \ or\ \ 0.75$	1	
		$y-\text{int}=-6$	1	**2**
		---		
	l)	Find the range of the following: 2, 3, 1, 10, 6, 31, 17, 20, 24		
	Ans.	$L=31$ $S=1$		
		$\therefore Range=L-S$		
		$=31-1$	1	
		$=30$	1	**2**

Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
2)		**Attempt any FOUR of the following:**		
	a)	Solve the equations for y and z $\frac{x}{4}-\frac{y}{3}+\frac{z}{2}=5,\quad \frac{x}{3}+\frac{y}{2}-\frac{z}{5}=11,\quad \frac{x}{7}-\frac{y}{9}+\frac{z}{6}=-2$ by using Cramer's rule.		
	Ans.	$\frac{x}{4}-\frac{y}{3}+\frac{z}{2}=5$ $\frac{x}{3}+\frac{y}{2}-\frac{z}{5}=11$ $\frac{x}{7}-\frac{y}{9}+\frac{z}{6}=-2$		
		$\therefore D=\begin{vmatrix}\frac{1}{4} & -\frac{1}{3} & \frac{1}{2}\\ \frac{1}{3} & \frac{1}{2} & -\frac{1}{5}\\ \frac{1}{7} & -\frac{1}{9} & \frac{1}{6}\end{vmatrix}=\frac{1}{4}\left(\frac{1}{12}-\frac{1}{45}\right)+\frac{1}{3}\left(\frac{1}{18}+\frac{1}{35}\right)+\frac{1}{2}\left(-\frac{1}{27}-\frac{1}{14}\right)$ $=-\frac{11}{1008}\quad or\quad -0.0109$	1	
		$D_y=\begin{vmatrix}\frac{1}{4} & 5 & \frac{1}{2}\\ \frac{1}{3} & 11 & -\frac{1}{5}\\ \frac{1}{7} & -2 & \frac{1}{6}\end{vmatrix}=\frac{1}{4}\left(\frac{11}{6}-\frac{2}{5}\right)-5\left(\frac{1}{18}+\frac{1}{35}\right)+\frac{1}{2}\left(-\frac{2}{3}-\frac{11}{7}\right)$ $=-\frac{2977}{2520}\quad or\quad -1.181$	1	
		$D_z=\begin{vmatrix}\frac{1}{4} & -\frac{1}{3} & 5\\ \frac{1}{3} & \frac{1}{2} & 11\\ \frac{1}{7} & -\frac{1}{9} & -2\end{vmatrix}=\frac{1}{4}\left(-1+\frac{11}{9}\right)+\frac{1}{3}\left(-\frac{2}{3}-\frac{11}{7}\right)+5\left(-\frac{1}{27}-\frac{1}{14}\right)$ $=-\frac{233}{189}\quad or\quad -1.233$	1	
		$\therefore y=\frac{D_y}{D}=\frac{-1.181}{-0.0109}=108.254$	½	
		$z=\frac{D_z}{D}=\frac{-1.233}{-0.0109}=112.970$	½	**4**
		(Please refer note on the next page)		

Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
2)		**Note:** As the use of the advance scientific calculator is permissible, calculating directly the values of fractional quantities e.g., $\frac{1}{4}\left(\frac{1}{12}-\frac{1}{45}\right)+\frac{1}{3}\left(\frac{1}{18}+\frac{1}{35}\right)+\frac{1}{2}\left(-\frac{1}{27}-\frac{1}{14}\right)$ is allowed. The same is also applicable in the next alternative method. No marks to be deducted for such direct calculations.		
		OR		
		$3x-4y+6z=60$ $10x+15y-6z=330$ $18x-14y+21z=-252$		
		$\therefore D=\begin{vmatrix}3 & -4 & 6\\10 & 15 & -6\\18 & -14 & 21\end{vmatrix}=3(315-84)+4(210+108)+6(-140-270)$ $=-495$	1	
		$D_y=\begin{vmatrix}3 & 60 & 6\\10 & 330 & -6\\18 & -252 & 21\end{vmatrix}=3(6930-1512)-60(210+108)+6(-2520-5940)$ $=-53586$	1	
		$D_z=\begin{vmatrix}3 & -4 & 60\\10 & 15 & 330\\18 & -14 & -252\end{vmatrix}=3(-3780+4620)+4(-2520-5940)+60(-140-270)$ $=-55920$	1	
		$\therefore y=\frac{D_y}{D}=\frac{-53586}{-495}=108.255$	½	
		$z=\frac{D_z}{D}=\frac{-55920}{-495}=112.970$	½	**4**
	b)	If $A=\begin{bmatrix}2 & -1 & 1\\-2 & 3 & -2\\-4 & 4 & -3\end{bmatrix}$, find A^2.		
	Ans.	$A^2=A\cdot A=\begin{bmatrix}2 & -1 & 1\\-2 & 3 & -2\\-4 & 4 & -3\end{bmatrix}\begin{bmatrix}2 & -1 & 1\\-2 & 3 & -2\\-4 & 4 & -3\end{bmatrix}$		
		$=\begin{bmatrix}4+2-4 & -2-3+4 & 2+2-3\\-4-6+8 & 2+9-8 & -2-6+6\\-8-8+12 & 4+12-12 & -4-8+9\end{bmatrix}$	2	
		$=\begin{bmatrix}2 & -1 & 1\\-2 & 3 & -2\\-4 & 4 & -3\end{bmatrix}$ (Please check note on next page)	2	**4**

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2)		**Note: In the answer matrix of A², if 1 to 3 elements are wrong either in sign or value, deduct ½ marks; if 4 to 6 elements are wrong, you may deduct 1 mark; other deduct all 2 marks.**		
	c)	If $A=\begin{bmatrix}1 & 2\\-2 & 3\end{bmatrix}$, $B=\begin{bmatrix}2 & 1\\2 & 3\end{bmatrix}$, $C=\begin{bmatrix}-3 & 1\\2 & 0\end{bmatrix}$, verify that $A(B+C)=AB+AC$.		
	Ans.	$B+C=\begin{bmatrix}2 & 1\\2 & 3\end{bmatrix}+\begin{bmatrix}-3 & 1\\2 & 0\end{bmatrix}$		
		$=\begin{bmatrix}-1 & 2\\4 & 3\end{bmatrix}$	1	
		$\therefore A(B+C)=\begin{bmatrix}1 & 2\\-2 & 3\end{bmatrix}\begin{bmatrix}-1 & 2\\4 & 3\end{bmatrix}$		
		$=\begin{bmatrix}-1+8 & 2+6\\2+12 & -4+9\end{bmatrix}$		
		$=\begin{bmatrix}7 & 8\\14 & 5\end{bmatrix}$	1	
		$AB=\begin{bmatrix}1 & 2\\-2 & 3\end{bmatrix}\begin{bmatrix}2 & 1\\2 & 3\end{bmatrix}$		
		$=\begin{bmatrix}2+4 & 1+6\\-4+6 & -2+9\end{bmatrix}$		
		$=\begin{bmatrix}6 & 7\\2 & 7\end{bmatrix}$	½	
		$AC=\begin{bmatrix}1 & 2\\-2 & 3\end{bmatrix}\begin{bmatrix}-3 & 1\\2 & 0\end{bmatrix}$		
		$=\begin{bmatrix}-3+4 & 1+0\\6+6 & -2+0\end{bmatrix}$		
		$=\begin{bmatrix}1 & 1\\12 & -2\end{bmatrix}$	½	
		$\therefore AB+AC=\begin{bmatrix}6 & 7\\2 & 7\end{bmatrix}+\begin{bmatrix}1 & 1\\12 & -2\end{bmatrix}$		
		$=\begin{bmatrix}7 & 8\\14 & 5\end{bmatrix}$	½	
		$\therefore A(B+C)=AB+AC$	½	**4**

Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
2)	d)	If $A=\begin{bmatrix}1 & -2 & 3\\ 2 & 3 & -1\\ -3 & 1 & 2\end{bmatrix}$, find $A^2-3A+9I$, where I is the unit matrix		
	Ans.	$A^2=A\cdot A=\begin{bmatrix}1 & -2 & 3\\ 2 & 3 & -1\\ -3 & 1 & 2\end{bmatrix}\begin{bmatrix}1 & -2 & 3\\ 2 & 3 & -1\\ -3 & 1 & 2\end{bmatrix}$		
		$=\begin{bmatrix}1-4-9 & -2-6+3 & 3+2+6\\ 2+6+3 & -4+9-1 & 6-3-2\\ -3+2-6 & 6+3+2 & -9-1+4\end{bmatrix}$	1	
		$=\begin{bmatrix}-12 & -5 & 11\\ 11 & 4 & 1\\ -7 & 11 & -6\end{bmatrix}$	1	
		$3A=3\begin{bmatrix}1 & -2 & 3\\ 2 & 3 & -1\\ -3 & 1 & 2\end{bmatrix}=\begin{bmatrix}3 & -6 & 9\\ 6 & 9 & -3\\ -9 & 3 & 6\end{bmatrix}$	½	
		$9I=9\begin{bmatrix}1 & 0 & 0\\ 0 & 1 & 0\\ 0 & 0 & 1\end{bmatrix}=\begin{bmatrix}9 & 0 & 0\\ 0 & 9 & 0\\ 0 & 0 & 9\end{bmatrix}$	½	
		$\therefore A^2-3A+9I=\begin{bmatrix}-12 & -5 & 11\\ 11 & 4 & 1\\ -7 & 11 & -6\end{bmatrix}-\begin{bmatrix}3 & -6 & 9\\ 6 & 9 & -3\\ -9 & 3 & 6\end{bmatrix}+\begin{bmatrix}9 & 0 & 0\\ 0 & 9 & 0\\ 0 & 0 & 9\end{bmatrix}$		
		$=\begin{bmatrix}-12-3+9 & -5+6+0 & 11-9+0\\ 11-6+0 & 4-9+9 & 1+3+0\\ -7+9+0 & 11-3+0 & -6-6+9\end{bmatrix}$		
		$=\begin{bmatrix}-6 & 1 & 2\\ 5 & 4 & 4\\ 2 & 8 & -3\end{bmatrix}$	1	**4**
		Note: The above problem could also be solved by taking all the terms simultaneously as follows:		
		$A^2-3A+9I$		
		$=\begin{bmatrix}1 & -2 & 3\\ 2 & 3 & -1\\ -3 & 1 & 2\end{bmatrix}\begin{bmatrix}1 & -2 & 3\\ 2 & 3 & -1\\ -3 & 1 & 2\end{bmatrix}-3\begin{bmatrix}1 & -2 & 3\\ 2 & 3 & -1\\ -3 & 1 & 2\end{bmatrix}+9\begin{bmatrix}1 & 0 & 0\\ 0 & 1 & 0\\ 0 & 0 & 1\end{bmatrix}$		

<table>
<tr><th>Que. No.</th><th>Sub. Que.</th><th>Model Answers</th><th>Marks</th><th>Total Marks</th></tr>
<tr><td>2)</td><td></td><td>$=\begin{bmatrix}1-4-9 & -2-6+3 & 3+2+6\\ 2+6+3 & -4+9-1 & 6-3-2\\ -3+2-6 & 6+3+2 & -9-1+4\end{bmatrix}-\begin{bmatrix}3 & -6 & 9\\ 6 & 9 & -3\\ -9 & 3 & 6\end{bmatrix}+\begin{bmatrix}9 & 0 & 0\\ 0 & 9 & 0\\ 0 & 0 & 9\end{bmatrix}$</td><td>1+½+½</td><td></td></tr>
<tr><td></td><td></td><td>$=\begin{bmatrix}-12 & -5 & 11\\ 11 & 4 & 1\\ -7 & 11 & -6\end{bmatrix}-\begin{bmatrix}3 & -6 & 9\\ 6 & 9 & -3\\ -9 & 3 & 6\end{bmatrix}+\begin{bmatrix}9 & 0 & 0\\ 0 & 9 & 0\\ 0 & 0 & 9\end{bmatrix}$</td><td>1</td><td></td></tr>
<tr><td></td><td></td><td>$=\begin{bmatrix}-12-3+9 & -5+6+0 & 11-9+0\\ 11-6+0 & 4-9+9 & 1+3+0\\ -7+9+0 & 11-3+0 & -6-6+9\end{bmatrix}$</td><td></td><td></td></tr>
<tr><td></td><td></td><td>$=\begin{bmatrix}-6 & 1 & 2\\ 5 & 4 & 4\\ 2 & 8 & -3\end{bmatrix}$
--</td><td>1</td><td>4</td></tr>
<tr><td></td><td>e)</td><td>Resolve into partial fractions: $\dfrac{x^2+1}{2x^4+5x^2+2}$</td><td></td><td></td></tr>
<tr><td></td><td>Ans.</td><td>$\dfrac{x^2+1}{2x^4+5x^2+2}$ $\qquad (Put\ \ x^2=y)$
$=\dfrac{y+1}{2y^2+5y+2}$</td><td>1</td><td></td></tr>
<tr><td></td><td></td><td>$=\dfrac{y+1}{(2y+1)(y+2)}=\dfrac{A}{2y+1}+\dfrac{B}{y+2}$
$\therefore \boxed{y+1=(y+2)A+(2y+1)B}$
$Put\ \ 2y+1=0 \quad or \quad y=-\dfrac{1}{2}$
$\therefore -\dfrac{1}{2}+1=\left(-\dfrac{1}{2}+2\right)A+0$
$\therefore \dfrac{1}{2}=\dfrac{3}{2}A$
$\therefore \boxed{\dfrac{1}{3}=A}$</td><td>1</td><td></td></tr>
<tr><td></td><td></td><td>$Put\ \ y+2=0 \quad or \quad y=-2$
$\therefore -2+1=0+(-4+1)B$
$\therefore -1=-3B$
$\therefore \boxed{\dfrac{1}{3}=B}$</td><td>1</td><td></td></tr>
</table>

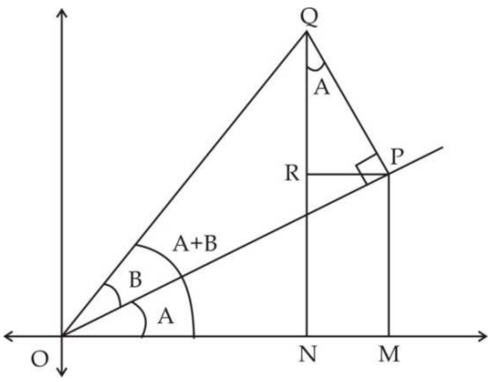
Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
2)		$\therefore \dfrac{y+1}{2y^2+5y+2}=\dfrac{\frac{1}{3}}{2y+1}+\dfrac{\frac{1}{3}}{y+2}$	½	
		$\therefore \boxed{\dfrac{x^2+1}{2x^4+5x^2+2}=\dfrac{\frac{1}{3}}{2x^2+1}+\dfrac{\frac{1}{3}}{x^2+2}}$	½	**4**
		--		
	f)	Resolve into partial fractions: $\dfrac{x^3+x}{x^2-9}$		
	Ans.	$\dfrac{x^3+x}{x^2-9}=x+\dfrac{10x}{x^2-9}$	1	
		$\therefore \dfrac{10x}{x^2-9}=\dfrac{10x}{(x-3)(x+3)}=\dfrac{A}{x-3}+\dfrac{B}{x+3}$		
		$\therefore \boxed{10x=(x+3)A+(x-3)B}$		
		$Put\ \ x-3=0\ \ i.e.,\ x=3$		
		$\therefore 30=6A+0$		
		$\therefore \boxed{5=A}$	1	
		$Put\ \ x+3=0\ \ i.e.,\ x=-3$		
		$\therefore -30=0-6B$		
		$\therefore \boxed{5=B}$	1	
		$\therefore \dfrac{10x}{x^2-9}=\dfrac{5}{x-3}+\dfrac{5}{x+3}$	½	
		$\therefore \boxed{\dfrac{x^3+x}{x^2-9}=x+\dfrac{5}{x-3}+\dfrac{5}{x+3}}$	½	**4**
		--		
3)		**Attempt any FOUR of the following:**		
	a)	Solve the equations $x+2y+3z=1,\ \ 2x+3y+2z=2,\ \ 3x+2y+4z=1$ by using matrix inversion method.		
	Ans.	$x+2y+3z=1$ $2x+3y+2z=2$ $3x+2y+4z=1$		

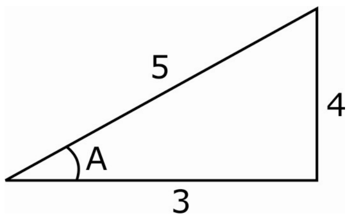
Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
3)		$A=\begin{bmatrix}1&2&3\\2&3&2\\3&2&4\end{bmatrix}\quad X=\begin{bmatrix}x\\y\\z\end{bmatrix}\quad K=\begin{bmatrix}1\\2\\1\end{bmatrix}$		
		$\therefore \lvert A\rvert=1(12-4)-2(8-6)+3(2-9)=-11$	1	
		$C(A)=\begin{bmatrix}\begin{vmatrix}3&2\\2&4\end{vmatrix}&-\begin{vmatrix}2&2\\3&4\end{vmatrix}&\begin{vmatrix}2&3\\3&2\end{vmatrix}\\-\begin{vmatrix}2&3\\2&4\end{vmatrix}&\begin{vmatrix}1&3\\3&4\end{vmatrix}&-\begin{vmatrix}1&2\\3&2\end{vmatrix}\\\begin{vmatrix}2&3\\3&2\end{vmatrix}&-\begin{vmatrix}1&3\\2&2\end{vmatrix}&\begin{vmatrix}1&2\\2&3\end{vmatrix}\end{bmatrix}$	1	
		$=\begin{bmatrix}8&-2&-5\\-2&-5&4\\-5&4&-1\end{bmatrix}$	½	
		OR	OR	
		The minor matrix of A is		
		$M(A)=\begin{bmatrix}\begin{vmatrix}3&2\\2&4\end{vmatrix}&\begin{vmatrix}2&2\\3&4\end{vmatrix}&\begin{vmatrix}2&3\\3&2\end{vmatrix}\\\begin{vmatrix}2&3\\2&4\end{vmatrix}&\begin{vmatrix}1&3\\3&4\end{vmatrix}&\begin{vmatrix}1&2\\3&2\end{vmatrix}\\\begin{vmatrix}2&3\\3&2\end{vmatrix}&\begin{vmatrix}1&3\\2&2\end{vmatrix}&\begin{vmatrix}1&2\\2&3\end{vmatrix}\end{bmatrix}$	½	
		$=\begin{bmatrix}8&2&-5\\2&-5&-4\\-5&-4&-1\end{bmatrix}$	½	
		$\therefore$ the matix of cofactors is,		
		$\therefore C(A)=\begin{bmatrix}8&-2&-5\\-2&-5&4\\-5&4&-1\end{bmatrix}$	½	
		OR	OR	
		The minors of matrix A are		
		$A_{11}=\begin{vmatrix}3&2\\2&4\end{vmatrix}=8\quad A_{12}=-\begin{vmatrix}2&2\\3&4\end{vmatrix}=-2\quad A_{13}=\begin{vmatrix}2&3\\3&2\end{vmatrix}=-5$		
		$A_{21}=-\begin{vmatrix}2&3\\2&4\end{vmatrix}=-2\quad A_{22}=\begin{vmatrix}1&3\\3&4\end{vmatrix}=-5\quad A_{23}=-\begin{vmatrix}1&2\\3&2\end{vmatrix}=4$	1	
		$A_{31}=\begin{vmatrix}2&3\\3&2\end{vmatrix}=-5\quad A_{32}=-\begin{vmatrix}1&3\\2&2\end{vmatrix}=4\quad A_{33}=\begin{vmatrix}1&2\\2&3\end{vmatrix}=-1$		

Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
3)		$\therefore$ the matix of cofactors is,		
		$\therefore C(A)=\begin{bmatrix} 8 & -2 & -5 \\ -2 & -5 & 4 \\ -5 & 4 & -1 \end{bmatrix}$	½	
		$\therefore adj(A)=\begin{bmatrix} 8 & -2 & -5 \\ -2 & -5 & 4 \\ -5 & 4 & -1 \end{bmatrix}$		
		$\therefore A^{-1}=\frac{1}{-11}\begin{bmatrix} 8 & -2 & -5 \\ -2 & -5 & 4 \\ -5 & 4 & -1 \end{bmatrix}$	½	
		$\therefore X = A^{-1}K=\frac{1}{-11}\begin{bmatrix} 8 & -2 & -5 \\ -2 & -5 & 4 \\ -5 & 4 & -1 \end{bmatrix}\begin{bmatrix} 1 \\ 2 \\ 1 \end{bmatrix}$		
		$=\frac{1}{-11}\begin{bmatrix} -1 \\ -8 \\ 2 \end{bmatrix}$		
		$=\begin{bmatrix} \frac{1}{11} \\ \frac{8}{11} \\ -\frac{2}{11} \end{bmatrix}$	½	
		$\therefore x=\frac{1}{11} \qquad y=\frac{8}{11} \qquad z=-\frac{2}{11}$	½	**4**
		---		
	b)	Resolve into partial fractions: $\frac{x^2+23x}{(x-3)(x^2+1)}$		
	Ans.	$\frac{x^2+23x}{(x-3)(x^2+1)}=\frac{A}{x-3}+\frac{Bx+C}{x^2+1}$		
		$\therefore x^2+23x=(x-3)(x^2+1)\left[\frac{A}{x-3}+\frac{Bx+C}{x^2+1}\right]$		
		$\therefore \boxed{x^2+23x=(x^2+1)A+(x-3)(Bx+C)}$		

Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
3)		$Put\ x=3$ $\therefore (3)^2+23(3)=\left((3)^2+1\right)A+0$ $\therefore 78=10A$ $\therefore \boxed{\frac{39}{5}=A}$	1	
		$Put\ x=0$ $\therefore 0^2+23(0)=\left(0^2+1\right)A+(0-3)(0+C)$ $\therefore 0=A-3C$ $\therefore 0=\frac{39}{5}-3C$ $\therefore 3C=\frac{39}{5}$ $\therefore \boxed{C=\frac{13}{5}}$	1	
		$Put\ x=1$ $\therefore 1^2+23(1)=\left(1^2+1\right)A+(1-3)(B+C)$ $\therefore 24=2A-2B-2C$ $\therefore 24=2\left(\frac{39}{5}\right)-2B-2\left(\frac{13}{5}\right)$ $\therefore 2B=2\left(\frac{39}{5}\right)-2\left(\frac{13}{5}\right)-24$ $\therefore 2B=-\frac{68}{5}$ $\therefore \boxed{B=-\frac{34}{5}}$	1	
		$\therefore \boxed{\frac{x^2+23x}{(x-3)\left(x^2+1\right)}=\frac{\frac{39}{5}}{x-3}+\frac{-\frac{34}{5}x+\frac{13}{5}}{x^2+1}}$	1	**4**
		Note for Partial Fraction Methods: The above Q. 2 (e) & (f) problems of partial fractions could be solved by the method of “equating equal power coefficients” also. This method, illustrated in the solution of Q. 1 (e), is also applicable. Give appropriate marks in accordance with the scheme of marking. As this method is very tedious and complicated, hardly someone use this method in such cases. So such solution methods for partial fraction problems are not illustrated herein.		

Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
3)	c)	Resolve into partial fractions: $\frac{e^x+1}{2e^{2x}+7e^x+5}$		
	Ans.	$\frac{e^x+1}{2e^{2x}+7e^x+5}$ $\left(Put\ \ e^x=y\right)$		
		$=\frac{y+1}{2y^2+7y+5}$	1	
		$=\frac{y+1}{(2y+5)(y+1)}$	1	
		$=\frac{1}{2y+5}$	1	
		$=\frac{1}{2e^x+5}$	1	
		OR		**4**
		$\frac{e^x+1}{2e^{2x}+7e^x+5}$ $\left(Put\ \ e^x=y\right)$		
		$=\frac{y+1}{2y^2+7y+5}$	1	
		$=\frac{y+1}{(2y+5)(y+1)}=\frac{A}{2y+5}+\frac{B}{y+1}$		
		$\therefore \boxed{y+1=(y+1)A+(2y+5)B}$		
		$Put\ \ 2y+5=0 \qquad \therefore y=-\frac{5}{2}$		
		$\therefore -\frac{5}{2}+1=\left(-\frac{5}{2}+1\right)A+0$		
		$\therefore -\frac{3}{2}=-\frac{3}{2}A$		
		$\therefore \boxed{1=A}$	1	
		$Put\ \ y+1=0 \qquad \therefore y=-1$		
		$\therefore -1+1=0+(-2+5)B$		
		$\therefore 0=3B$		
		$\therefore \boxed{0=B}$	1	
		$\therefore \frac{y+1}{2y^2+7y+5}=\frac{1}{2y+5}+\frac{0}{y+1}$	½	
		$\therefore \boxed{\frac{e^x+1}{2e^{2x}+7e^x+5}=\frac{1}{2e^x+5}}$	½	**4**

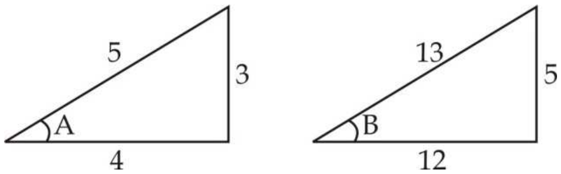
Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
3)	d)	Prove that $\sin(A+B)=\sin A.\cos B+\cos A.\sin B$		
	Ans.		1	
		$\sin(A+B)=\dfrac{QN}{OQ}$		
		$=\dfrac{QR+RN}{OQ}$	1	
		$=\dfrac{QR+PM}{OQ}$		
		$=\dfrac{QR}{OQ}+\dfrac{PM}{OQ}$		
		$=\dfrac{QR}{PQ}\times\dfrac{PQ}{OQ}+\dfrac{PM}{OP}\times\dfrac{OP}{OQ}$	1	
		$=\cos A.\sin B+\sin A.\cos B$	1	**4**
		Note: The above is proved by different ways in several books. Consider all these proof but check whether the method is falling within the scope of curriculum and give appropriate marks in accordance with the scheme of marking. In accordance with the Teacher's Manual published by MSBTE, the result is treated as Fundamental Result which is not proved by the help of any another result. If the above result is proved by students using any another result, suppose using cos (A+B), then this result i.e., cos (A+B) must have been proved first.		
		--		
	e)	Prove that $2\cot^{-1}(3)+\cos ec^{-1}\left(\dfrac{5}{4}\right)=\dfrac{\pi}{2}$		
	Ans.	$2\cot^{-1}(3)=2\tan^{-1}\left(\dfrac{1}{3}\right)$ $=\tan^{-1}\left(\dfrac{2\cdot\frac{1}{3}}{1-\left(\frac{1}{3}\right)^2}\right)$ $=\tan^{-1}\left(\dfrac{3}{4}\right)$	1+1	

Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
3)				
		OR	OR	
		$2\cot^{-1}(3)=\tan^{-1}\left(\frac{1}{3}\right)+\tan^{-1}\left(\frac{1}{3}\right)$		
		$=\tan^{-1}\left(\frac{\frac{1}{3}+\frac{1}{3}}{1-\left(\frac{1}{3}\right)\left(\frac{1}{3}\right)}\right)$	1	
		$=\tan^{-1}\left(\frac{3}{4}\right)$	1	
		$Let\quad A=\cos ec^{-1}\left(\frac{5}{4}\right)$		
		$\therefore \cos ecA=\frac{5}{4}$		
				
		$\therefore 2\cot^{-1}(3)+\cos ec^{-1}\left(\frac{5}{4}\right)=\tan^{-1}\left(\frac{3}{4}\right)+\tan^{-1}\left(\frac{4}{3}\right)$		
		$=\tan^{-1}\left(\frac{\frac{3}{4}+\frac{4}{3}}{1-\left(\frac{3}{4}\right)\left(\frac{4}{3}\right)}\right)$	1	
		$=\tan^{-1}(\infty)$		
		$=\frac{\pi}{2}$	1	
		OR	OR	
		$\therefore 2\cot^{-1}(3)+\cos ec^{-1}\left(\frac{5}{4}\right)=\tan^{-1}\left(\frac{3}{4}\right)+\cot^{-1}\left(\frac{3}{4}\right)$	1	
		$=\frac{\pi}{2}$	1	**4**
		Note that the result $\tan^{-1}(x)+\cot^{-1}(x)=\frac{\pi}{2}$ **can be used directly**		

Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
3)	f)	Prove that $\tan^{-1}(1)+\tan^{-1}(2)+\tan^{-1}(3)=\pi$		
	Ans.	$\tan^{-1}(1)+\tan^{-1}(2)+\tan^{-1}(3)=\frac{\pi}{4}+\tan^{-1}(2)+\tan^{-1}(3)$	1	
		$=\frac{\pi}{4}+\pi+\tan^{-1}\left(\frac{2+3}{1-2\cdot 3}\right)$	1	
		$=\frac{\pi}{4}+\pi+\tan^{-1}(-1)$	1	
		$=\frac{\pi}{4}+\pi-\frac{\pi}{4}$	½	
		$=\pi$	½	**4**
		OR		
		$\tan^{-1}(1)+\tan^{-1}(2)+\tan^{-1}(3)=\pi+\tan^{-1}\left(\frac{1+2}{1-1\cdot 2}\right)+\tan^{-1}(3)$	1	
		$=\pi+\tan^{-1}(-3)+\tan^{-1}(3)$	1	
		$=\pi-\tan^{-1}(3)+\tan^{-1}(3)$	1	
		$=\pi$	1	**4**
		OR		
		$\tan^{-1}(1)+\tan^{-1}(2)+\tan^{-1}(3)=\tan^{-1}(1)+\pi+\tan^{-1}\left(\frac{2+3}{1-2\cdot 3}\right)$	1	
		$=\tan^{-1}(1)+\pi+\tan^{-1}(-1)$	1	
		$=\tan^{-1}(1)+\pi-\tan^{-1}(1)$	1	
		$=\pi$	1	**4**
		--		
4)		**Attempt any FOUR of the following.**		
	a)	Without using the calculator, find the value of $\frac{4}{3\tan^2 30^o}+3\sin^2 120^o-\cos ec^2 30^o-\frac{3}{4\cot^2 120^o}+\cos^2 270^o$		
	Ans.	$\tan^2 30^o=\left(\frac{1}{\sqrt{3}}\right)^2=\frac{1}{3}$	½	
		$\sin 120^o=\sin(90^o+30^o)=\cos 30^o=\frac{\sqrt{3}}{2}$	½	

Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
4)		$\therefore \sin^2 120^o = \frac{3}{4}$	½	
		$\cos ec 30^o = 2$		
		$\therefore \cos ec^2 30^o = 4$	½	
		$\cot 120^o = \cot(90^o + 30^o)$ $= -\tan 30^o$ $= -\frac{1}{\sqrt{3}}$		
		$\therefore \cot^2 120^o = \frac{1}{3}$	½	
		$\cos 270^o = \cos(3\times 90^o + 0)$ $= \sin 0$ $= 0$		
		$\therefore \cos^2 270^o = 0$	½	
		But given that $\frac{4}{3\tan^2 30^o} + 3\sin^2 120^o - \cos ec^2 30^o - \frac{3}{4\cot^2 120^o} + \cos^2 270^o$		
		$= \frac{4}{3\left(\frac{1}{3}\right)} + 3\left(\frac{3}{4}\right) - 4 - \frac{3}{4\left(\frac{1}{3}\right)} + 0$	½	
		$= \frac{9}{2}$ *or* 4.5	½	**4**
		--		
	b)	Prove that $\frac{\cos 3A + 2\cos 5A + \cos 7A}{\cos A + 2\cos 3A + \cos 5A} = \cos 2A - \sin 2A \tan 3A$		
	Ans.	$\frac{\cos 3A + 2\cos 5A + \cos 7A}{\cos A + 2\cos 3A + \cos 5A} = \frac{\cos 3A + \cos 7A + 2\cos 5A}{\cos A + \cos 5A + 2\cos 3A}$		
		$= \frac{2\cos 5A \cos(-2A) + 2\cos 5A}{2\cos 3A \cos(-2A) + 2\cos 3A}$	1	
		$= \frac{\cos 5A[2\cos(-2A) + 2]}{\cos 3A[2\cos(-2A) + 2]}$	1	
		$= \frac{\cos 5A}{\cos 3A}$	½	
		$= \frac{\cos(2A + 3A)}{\cos 3A}$		

Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
4)		$=\dfrac{\cos 2A\cos 3A-\sin 2A\sin 3A}{\cos 3A}$	1	
		$=\cos 2A-\sin 2A\tan 3A$	½	**4**
		--		
	c)	Prove that (in ΔABC), $\tan A+\tan B+\tan C=\tan A\tan B\tan C$		
	Ans.	*We have,* $A+B+C=180^{o}$ *or* π		
		$\therefore A+B=180^{o}-C$		
		$\therefore \tan(A+B)=\tan(180^{o}-C)$	1	
		$\therefore \dfrac{\tan A+\tan B}{1-\tan A\tan B}=-\tan C$	1	
		$\therefore \tan A+\tan B=-\tan C[1-\tan A\tan B]$		
		$\therefore \tan A+\tan B=-\tan C+\tan A\tan B\tan C$	1	
		$\therefore \tan A+\tan B+\tan C=\tan A\tan B\tan C$	1	**4**
		--		
	d)	Prove that $\tan 3\theta=\dfrac{3\tan\theta-\tan^{3}\theta}{1-3\tan^{2}\theta}$		
	Ans.	$\tan 3\theta=\tan(\theta+2\theta)$		
		$=\dfrac{\tan\theta+\tan 2\theta}{1-\tan\theta\tan 2\theta}$	1	
		$=\dfrac{\tan\theta+\dfrac{2\tan\theta}{1-\tan^{2}\theta}}{1-\tan\theta\left(\dfrac{2\tan\theta}{1-\tan^{2}\theta}\right)}$	1	
		$=\dfrac{\dfrac{\tan\theta(1-\tan^{2}\theta)+2\tan\theta}{1-\tan^{2}\theta}}{\dfrac{1-\tan^{2}\theta-\tan\theta(2\tan\theta)}{1-\tan^{2}\theta}}$		
		$=\dfrac{\tan\theta-\tan^{3}\theta+2\tan\theta}{1-\tan^{2}\theta-2\tan^{2}\theta}$	1	
		$=\dfrac{3\tan\theta-\tan^{3}\theta}{1-3\tan^{2}\theta}$	1	**4**
		--		

Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
4)	e)	Prove that $\cos^{-1}\left(\frac{4}{5}\right)+\cos^{-1}\left(\frac{12}{13}\right)=\cos^{-1}\left(\frac{33}{65}\right)$		
	Ans.	$A=\cos^{-1}\left(\frac{4}{5}\right)$ $\quad B=\cos^{-1}\left(\frac{12}{13}\right)$		
		$\therefore \cos A=\frac{4}{5}$ $\quad \cos B=\frac{12}{13}$		
				
		$\cos(A+B)=\cos A\cos B-\sin A\sin B$	1	
		$=\frac{4}{5}\times\frac{12}{13}-\frac{3}{5}\times\frac{5}{13}$	1	
		$=\frac{33}{65}$	1	
		$\therefore A+B=\cos^{-1}\left(\frac{33}{65}\right)$	½	
		$\therefore \cos^{-1}\left(\frac{4}{5}\right)+\cos^{-1}\left(\frac{12}{13}\right)=\cos^{-1}\left(\frac{33}{65}\right)$	½	**4**
		---		
	f)	If $\tan x=\frac{5}{6},\ \tan y=\frac{1}{11}$, show that $x+y=\frac{\pi}{4}$		
	Ans.	$\tan x=\frac{5}{6},\ \tan y=\frac{1}{11}$		
		$\therefore x=\tan^{-1}\left(\frac{5}{6}\right),\ y=\tan^{-1}\left(\frac{1}{11}\right)$		
		$\therefore x+y=\tan^{-1}\left(\frac{5}{6}\right)+\tan^{-1}\left(\frac{1}{11}\right)$	1	
		$=\tan^{-1}\left(\frac{\frac{5}{6}+\frac{1}{11}}{1-\left(\frac{5}{6}\right)\left(\frac{1}{11}\right)}\right)$	1	
		$=\tan^{-1}(1)$	1	
		$=\frac{\pi}{4}$	1	**4**

Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
4)		**OR**		
		$\tan x = \frac{5}{6},\ \tan y = \frac{1}{11}$		
		$\therefore \tan(x+y) = \frac{\tan x + \tan y}{1 - \tan x \tan y}$	1	
		$= \frac{\frac{5}{6} + \frac{1}{11}}{1 - \left(\frac{5}{6}\right)\left(\frac{1}{11}\right)}$	1	
		$= 1$	1	
		$\therefore x + y = \tan^{-1}(1) = \frac{\pi}{4}$	1	**4**
		--		
5)		**Attempt any FOUR of the following.**		
	a)	Without using calculator prove that $\cos 20^\circ \cos 40^\circ \cos 60^\circ \cos 80^\circ = \frac{1}{16}$		
	Ans.	$\cos 20^\circ \cos 40^\circ \cos 60^\circ \cos 80^\circ = \cos 20^\circ \cos 40^\circ \left(\frac{1}{2}\right) \cos 80^\circ$	½	
		$= \frac{1}{2} \cdot \frac{1}{2}(2\cos 20^\circ \cos 40^\circ)\cos 80^\circ$		
		$= \frac{1}{4}(\cos 60^\circ + \cos 20^\circ)\cos 80^\circ$	½	
		$= \frac{1}{4}\left(\frac{1}{2} + \cos 20^\circ\right)\cos 80^\circ$	½	
		$= \frac{1}{4}\left(\frac{1}{2}\cos 80^\circ + \cos 80^\circ \cos 20^\circ\right)$		
		$= \frac{1}{4}\left(\frac{1}{2}\cos 80^\circ + \frac{1}{2} \cdot 2\cos 80^\circ \cos 20^\circ\right)$		
		$= \frac{1}{4} \cdot \frac{1}{2}\left[\cos 80^\circ + (\cos 100^\circ + \cos 60^\circ)\right]$	½	
		$= \frac{1}{8}\left[\cos 80^\circ + \cos 100^\circ + \frac{1}{2}\right]$	½	
		$= \frac{1}{8}\left[2\cos 90^\circ \cos(-10^\circ) + \frac{1}{2}\right]$	½	
		$= \frac{1}{8}\left[0 + \frac{1}{2}\right]$	½	
		$= \frac{1}{16}$	½	**4**

Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
5)		**Note** The above problem may also be solved by making various combinations of cosine ratios. Consequently the solutions vary in accordance with the combinations. Please give the appropriate marks in accordance with the scheme of marking. For the sake of convenience one of the solutions is illustrated hereunder.		
		$\cos 20^\circ \cos 40^\circ \cos 60^\circ \cos 80^\circ = \cos 20^\circ \cos 40^\circ \left(\frac{1}{2}\right) \cos 80^\circ$	½	
		$= \frac{1}{2} \cdot \frac{1}{2} \left(2\cos 40^\circ \cos 80^\circ\right) \cos 20^\circ$		
		$= \frac{1}{4} \left(\cos 120^\circ + \cos 40^\circ\right) \cos 20^\circ$	½	
		$= \frac{1}{4} \left(\cos\left(90^\circ + 30^\circ\right) + \cos 40^\circ\right) \cos 20^\circ$		
		$= \frac{1}{4} \left(-\sin 30^\circ + \cos 40^\circ\right) \cos 20^\circ$	½	
		$= \frac{1}{4} \left(-\frac{1}{2} + \cos 40^\circ\right) \cos 20^\circ$	½	
		$= \frac{1}{4} \left(-\frac{1}{2} \cos 20^\circ + \cos 20^\circ \cos 40^\circ\right)$		
		$= \frac{1}{4} \left(-\frac{1}{2} \cos 20^\circ + \frac{1}{2} \cdot 2\cos 20^\circ \cos 40^\circ\right)$		
		$= \frac{1}{4} \cdot \frac{1}{2} \left[-\cos 20^\circ + \cos 60^\circ + \cos\left(-20^\circ\right)\right]$	½	
		$= \frac{1}{8} \left[-\cos 20^\circ + \frac{1}{2} + \cos 20^\circ\right]$	½	
		$= \frac{1}{8} \left[\frac{1}{2}\right]$	½	
		$= \frac{1}{16}$	½	**4**
		--		

Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
5)	b)	Prove that $\dfrac{\sin 4x+\sin 5x+\sin 6x}{\cos 4x+\cos 5x+\cos 6x}=\tan 5x$		
	Ans.	$\dfrac{\sin 4x+\sin 5x+\sin 6x}{\cos 4x+\cos 5x+\cos 6x}=\dfrac{\sin 4x+\sin 6x+\sin 5x}{\cos 4x+\cos 6x+\cos 5x}$		
		$=\dfrac{2\sin 5x\cos(-x)+\sin 5x}{2\cos 5x\cos(-x)+\cos 5x}$	1+1	
		$=\dfrac{\sin 5x\left[2\cos(-x)+1\right]}{\cos 5x\left[2\cos(-x)+1\right]}$	1	
		$=\tan 5x$	1	**4**
		--		
	c)	Prove that $\tan^{-1}x+\tan^{-1}y=\tan^{-1}\left(\dfrac{x+y}{1-xy}\right),\quad x>0,\quad y>0,\quad xy<1$		
	Ans.	$Put\ \ \tan^{-1}x=A\quad and\quad \tan^{-1}y=B$		
		$\therefore\ \ x=\tan A\quad and\quad y=\tan B$		
		$\therefore \tan(A+B)=\dfrac{\tan A+\tan B}{1-\tan A\tan B}$	1	
		$=\dfrac{x+y}{1-xy}$	1	
		$\therefore A+B=\tan^{-1}\left(\dfrac{x+y}{1-xy}\right)$	1	
		$\therefore \tan^{-1}x+\tan^{-1}y=\tan^{-1}\left(\dfrac{x+y}{1-xy}\right)$	1	**4**
		--		
	d)	Find the equation of a straight line passing through (2, 5) and the point of intersection of the lines $x+y=0,\ \ 2x-y=9$.		
	Ans.	$x+y=0$		
		$\underline{2x-y=9}$		
		$\therefore\ \ 3x=9$		
		$\therefore x=3$	1	
		$y=-3$	1	
		$\therefore \text{Point of intersection}=(3,\ -3)$		

Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
5)		$\therefore equation\, is,$ $\frac{y-y_1}{y_2-y_1}=\frac{x-x_1}{x_2-x_1}$ $\therefore \frac{y-5}{-3-5}=\frac{x-2}{3-2}$ $\therefore 8x+y-21=0$	 1 1	
		OR	OR	
		$\therefore$ Point of intersection $=(3,-3)$ $\therefore Slope\, m=\frac{y_2-y_1}{x_2-x_1}=\frac{-3-5}{3-2}=-8$ $\therefore equation\, is,$ $y-y_1=m(x-x_1)$ $\therefore y-5=-8(x-2)$ $\therefore 8x+y-21=0$	 1 ½ ½	 **4**
	e)	Find the equation of the straight line passing through (-3, 10) and sum of their intercepts is 8.		
	Ans.	$Let\ x-\text{int}=a \qquad y-\text{int}=b$ $\therefore a+b=8$ $\therefore equation\ is$ $\frac{x}{a}+\frac{y}{b}=1 \quad or \quad \frac{x}{a}+\frac{y}{8-a}=1$ $\therefore bx+ay=ab$ $\therefore (8-a)x+ay=a(8-a)$ But passing through $(-3,\ 10)$ $\therefore -3(8-a)+10a=a(8-a)$ $\therefore -24+3a+10a=8a-a^2$ $\therefore a^2+5a-24=0$ $\therefore a=3,\ -8$ $\therefore \frac{x}{3}+\frac{y}{5}=1 \quad or \quad \frac{x}{-8}+\frac{y}{16}=1$	 1 1 ½+½ ½+½	 **4**

Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
5)	f)	Find the acute angle between the lines $2x+3y=13,\quad 2x-5y+7=0$		
	Ans.	$For\ \ 2x+3y=13,$		
		$slope\ \ m_1=-\frac{a}{b}=-\frac{2}{3}$	1	
		$For\ \ 2x-5y+7=0,$		
		$slope\ \ m_1=-\frac{a}{b}=-\frac{2}{-5}=\frac{2}{5}$	1	
		$\therefore \tan\theta=\left\|\frac{m_1-m_2}{1+m_1\cdot m_2}\right\|$		
		$=\left\|\frac{-\frac{2}{3}-\frac{2}{5}}{1+\left(-\frac{2}{3}\right)\cdot\left(\frac{2}{5}\right)}\right\|$	1	
		$=\frac{16}{11}\quad or\quad 1.455$	½	
		$\therefore \theta=\tan^{-1}\left(\frac{16}{11}\right)\quad or\quad \tan^{-1}(1.455)$	½	**4**
		--		
6)		**Attempt any FOUR of the following.**		
	a)	Find the equation of straight line passing through (5, 6) and making an angle 150° with x-axis.		
	Ans.	$Given\ \ \theta=150^\circ$		
		$\therefore slope\ \ m=\tan\theta=\tan 150^\circ$	1	
		$=-\frac{1}{\sqrt{3}}$	1	
		$\therefore equation\ is$		
		$y-y_1=m(x-x_1)$		
		$\therefore y-6=-\frac{1}{\sqrt{3}}(x-5)$	1	
		$\therefore \sqrt{3}y-6\sqrt{3}=-x+5$		
		$\therefore x+\sqrt{3}y-6\sqrt{3}-5=0$	1	**4**

<table>
<tr><th>Que. No.</th><th>Sub. Que.</th><th>Model Answers</th><th>Marks</th><th>Total Marks</th></tr>
<tr><td>6)</td><td></td><td>OR
$\therefore$ equation is
$y-y_1=\tan\theta\left(x-x_1\right)$
$\therefore y-6=\tan 150^{o}\left(x-5\right)$
$\therefore y-6=-\frac{1}{\sqrt{3}}\left(x-5\right)$
$\therefore \sqrt{3}y-6\sqrt{3}=-x+5$
$\therefore x+\sqrt{3}y-6\sqrt{3}-5=0$</td><td>

1
2

1</td><td>

4</td></tr>
<tr><td></td><td>b)

Ans.</td><td>If the length of perpendicular from (5, 4) on the straight line $2x+y+k=0$ is $4\sqrt{5}$ units. Find the value of k.
$p=\left|\frac{ax_1+by_1+c}{\sqrt{a^2+b^2}}\right|$
$\therefore 4\sqrt{5}=\left|\frac{2\left(5\right)+4+k}{\sqrt{2^2+1^2}}\right|$
$\therefore 4\sqrt{5}=\left|\frac{14+k}{\sqrt{5}}\right|$
$\therefore 4\sqrt{5}\cdot\sqrt{5}=\left|14+k\right|$
$\therefore 20=\left|14+k\right|$
$\therefore 20=14+k \quad or \quad -20=14+k$
$\therefore \boxed{6=k} \quad or \quad \boxed{-34=k}$</td><td>

1

1
½ + ½
½ + ½</td><td>

4</td></tr>
<tr><td></td><td>c)</td><td>The scores of two batsmen A and B in ten innings during a certain season are as under:
<table><tr><td>A</td><td>32</td><td>28</td><td>47</td><td>63</td><td>71</td><td>39</td><td>10</td><td>60</td><td>96</td><td>14</td></tr><tr><td>B</td><td>19</td><td>31</td><td>48</td><td>53</td><td>67</td><td>90</td><td>10</td><td>62</td><td>40</td><td>80</td></tr></table>Find which of the two batsmen is more consisting in scoring (use coefficient of variance).</td><td></td><td></td></tr>
</table>

Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
6)				

For Batsman A:

x_i	x_i^2
32	1024
28	784
47	2209
63	3969
71	5041
39	1521
10	100
60	3600
96	9216
14	196
460	**27660**

$$\bar{x} = \frac{460}{10} = 46$$ ½

$$\sigma = \sqrt{\frac{27660}{10} - \left(\frac{460}{10}\right)^2} = 25.495$$ ½

$$CV(A) = \frac{25.495}{46} \times 100 = 55.424$$ ½

For Batsman B:

x_i	x_i^2
19	361
31	961
48	2304
53	2809
67	4489
90	8100
10	100
62	3844
40	1600
80	6400
500	**30968**

$$\bar{x} = \frac{500}{10} = 50$$ ½

$$\sigma = \sqrt{\frac{30968}{10} - \left(\frac{500}{10}\right)^2} = 24.429$$ ½

$$CV(B) = \frac{24.429}{50} \times 100 = 48.858$$ ½

Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
6)		$\therefore CV(B) < CV(A)$	½	
		$\therefore$ B is more consistent.	½	**4**
		--		
	d)	Find the range and the coefficient of range for the following:		
		(table below)		
	Ans.	$L = 99 \quad S = 20$		
		$Difference\ between\ two\ sets = D = 1$		
		$\therefore Range = L - S + D$		
		$= 99 - 20 + 1$	1	
		$= 80$	1	
		$Coeff.\ of\ \ Range = \dfrac{L - S + D}{L + S}$		
		$= \dfrac{99 - 20 + 1}{99 + 20}$	1	
		$= \dfrac{80}{119} \quad or \quad 0.672$	1	**4**
		OR		
		(table below)		
		$L = 99.5 \qquad S = 19.5$		
		$\therefore Range = L - S$		
		$= 99.5 - 19.5$	1	
		$= 80$	1	
		$Coeff.\ of\ \ Range = \dfrac{L - S}{L + S}$		
		$= \dfrac{99.5 - 19.5}{99.5 + 19.5}$	1	
		$= \dfrac{80}{119} \quad or \quad 0.672$	1	**4**

Marks	20-29	30-39	40-49	50-59	60-69	70-79	80-89	90-99
No. of Students	10	15	16	20	21	22	09	08

Class	Cont. Class
20-29	19.5-29.5
30-39	29.5-39.5
40-49	39.5-49.5
50-59	49.5-59.5
60-69	59.5-69.5
70-79	69.5-79.5
80-89	79.5-89.5
90-99	89.5-99.5

Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
6)	e)	Calculate the mean deviation for the following data:		

Class intervals	40-59	60-79	80-99	100-119	120-139
No. of families	50	300	500	200	60

Ans.

Class	xi	f_i	$f_i x_i$	$D_i = \left\|x_i - \bar{x}\right\|$	$f_i D_i$
40-59	49.5	50	2475	38.559	1927.95
60-79	69.5	300	20850	18.559	5567.7
80-99	89.5	500	44750	1.441	720.5
100-119	109.5	200	21900	21.441	4288.2
120-139	129.5	60	7770	41.441	2486.46
		1110	**97745**		**14990.81**

1+1

$$\bar{x} = \frac{\sum f_i x_i}{N} = \frac{97745}{1110} = 88.059$$

1

$$M.D. = \frac{\sum f_i D_i}{N}$$

$$= \frac{14990.81}{1110}$$

½

$$= 13.505$$

½

4

----

f) Find the variance and coefficient of variance for the following distribution:

Class Intervals	20-25	25-30	30-35	35-40	40-45	45-50	50-55	55-60	60-65
Frequency	25	30	50	90	75	60	35	25	15

Ans.

Class	xi	f_i	$f_i x_i$	x_i^2	$f_i x_i^2$
20-25	22.5	25	562.5	506.25	12656.3
25-30	27.5	30	825	756.25	22687.5
30-35	32.5	50	1625	1056.25	52812.5
35-40	37.5	90	3375	1406.25	126563
40-45	42.5	75	3187.5	1806.25	135469
45-50	47.5	60	2850	2256.25	135375
50-55	52.5	35	1837.5	2756.25	96468.8
55-60	57.5	25	1437.5	3306.25	82656.3
60-65	62.5	15	937.5	3906.25	58593.8
		405	**16637.5**		**723281**

1

Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
6)		$\bar{x}=\frac{\sum f_i x_i}{N}=\frac{16637.5}{405}=41.08$	1	
		$S.D.=\sqrt{\frac{\sum f_i x_i^2}{N}-\left(\frac{\sum f_i x_i}{N}\right)^2}$		
		$=\sqrt{\frac{723281}{405}-\left(\frac{16637.5}{405}\right)^2}$		
		$=9.914$	½	
		$\therefore Variance=(S.D.)^2$		
		$=9.914^2$		
		$=98.287$	½	
		$Coeff.\ of\ Variance=\frac{S.D.}{\bar{x}}\times 100$		
		$=\frac{9.914}{41.08}\times 100$		
		$=24.133$	1	
		OR	OR	
		$\therefore Variance=\frac{\sum f_i x_i^2}{N}-\left(\frac{\sum f_i x_i}{N}\right)^2$		
		$=\frac{723281}{405}-\left(\frac{16637.5}{405}\right)^2$		
		$=98.287$	1	
		$Coeff.\ of\ Variance=\frac{\sqrt{\text{variance}}}{\bar{x}}\times 100$		
		$=\frac{\sqrt{98.287}}{41.08}\times 100$		
		$=24.133$	1	**4**
		OR		

Class	xi	f_i	d_i	$f_i d_i$	d_i^2	$f_i d_i^2$
20-25	22.5	25	-4	-100	16	400
25-30	27.5	30	-3	-90	9	270
30-35	32.5	50	-2	-100	4	200
35-40	37.5	90	-1	-90	1	90
40-45	42.5	75	0	0	0	0
45-50	47.5	60	1	60	1	60
50-55	52.5	35	2	70	4	140
55-60	57.5	25	3	75	9	225
60-65	62.5	15	4	60	16	240
		405		**-115**		**1625**

1

Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
6)		$A=42.5, \quad h=5, \quad d_i=\frac{x_i-A}{h}$ $\therefore \bar{x}=A+\frac{\sum f_i d_i}{N}\times h$ $=42.5+\frac{-115}{405}\times 5$ $=41.08$	1	
		$S.D.=h\times\sqrt{\frac{\sum f_i d_i^2}{N}-\left(\frac{\sum f_i d_i}{N}\right)^2}$ $=5\times\sqrt{\frac{1625}{405}-\left(\frac{-115}{405}\right)^2}$ $=9.914$	½	
		$\therefore Variance=(S.D.)^2$ $=9.914^2$ $=98.287$	½	
		$Coeff.\ of\ Variance=\frac{S.D.}{\bar{x}}\times 100$ $=\frac{9.914}{41.08}\times 100$ $=24.133$	1	
		OR	OR	
		$\therefore Variance=h^2\left[\frac{\sum f_i d_i^2}{N}-\left(\frac{\sum f_i d_i}{N}\right)^2\right]$ $=5^2\left[\frac{1625}{405}-\left(\frac{-115}{405}\right)^2\right]$ $=98.287$	1	
		$Coeff.\ of\ Variance=\frac{\sqrt{\text{variance}}}{\bar{x}}\times 100$ $=\frac{\sqrt{98.287}}{41.08}\times 100$ $=24.133$	1	**4**

		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.		