SUMMER – 17 EXAMINATION

Model Answer

Subject Code: 17104

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 answer 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		**Solve any TEN of the following:**	**20**
	a)	Find x, if $\begin{vmatrix} 1 & 1 & 1 \\ 3 & x & 3 \\ 1 & x & 2 \end{vmatrix} = 0$	**02**
	Ans	$\begin{vmatrix} 1 & 1 & 1 \\ 3 & x & 3 \\ 1 & x & 2 \end{vmatrix} = 0$	
		$\therefore 1(2\times x - x\times 3) - 1(3\times 2 - 1\times 3) + 1(3\times x - 1\times x) = 0$	1
		$\therefore -x - 3 + 2x = 0$	
		$\therefore x - 3 = 0$	
		$\therefore x = 3$	1
		---	
	b)	If $A = \begin{bmatrix} 2 & -1 \\ 4 & 3 \end{bmatrix}, B = \begin{bmatrix} 3 & -2 \\ -1 & 4 \end{bmatrix}$ Find the matrix 'X' Such that $2A + X = 3B$	**02**
	Ans	$\because 2A + X = 3B$	
		$\therefore X = 3B - 2A$	
		$= 3\begin{bmatrix} 3 & -2 \\ -1 & 4 \end{bmatrix} - 2\begin{bmatrix} 2 & -1 \\ 4 & 3 \end{bmatrix}$	
		$= \begin{bmatrix} 9 & -6 \\ -3 & 12 \end{bmatrix} - \begin{bmatrix} 4 & -2 \\ 8 & 6 \end{bmatrix}$	1

Q. No.	Sub Q. N.	Answer	Marking Scheme
1	b)	$\therefore X = \begin{bmatrix} 5 & -4 \\ -11 & 6 \end{bmatrix}$	1
	c)	If $A = \begin{bmatrix} 3 & 9 \\ -1 & -3 \end{bmatrix}$ Show that A^2 is null matrix	**02**
	Ans	$A^2 = A.A = \begin{bmatrix} 3 & 9 \\ -1 & -3 \end{bmatrix}\begin{bmatrix} 3 & 9 \\ -1 & -3 \end{bmatrix}$	½
		$= \begin{bmatrix} 9-9 & 27-27 \\ -3+3 & -9+9 \end{bmatrix}$	½
		$= \begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}$	½
		$\therefore A^2$ is null matrix	½
	d)	If $A = \begin{bmatrix} 2 & -1 & 3 \\ 4 & 1 & -3 \\ 0 & -1 & 1 \end{bmatrix}$ find $\left\vert A \right\vert$ and verify that matrix A is singular or non-singular matrix.	**02**
	Ans	$\left\vert A \right\vert = \begin{vmatrix} 2 & -1 & 3 \\ 4 & 1 & -3 \\ 0 & -1 & 1 \end{vmatrix}$	
		$=2(1-3)+1(4-0)+3(-4-0)$	1
		$= -4+4-12$	
		$= -12 \neq 0$	½
		$\therefore$ A is non-singular matrix	½
	e)	Resolve into partial fraction $\dfrac{x+4}{x(x+1)}$	**02**
	Ans	Let $\dfrac{x+4}{x(x+1)} = \dfrac{A}{x} + \dfrac{B}{x+1}$	½
		$\therefore x+4 = (x+1)A + xB$	
		Put $x = 0$	
		$\therefore 0+4 = A(0+1)+B(0)$	
		$\therefore A = 4$	½
		Put $x = -1$	
		$-1+4 = A(-1+1)+B(-1)$	

Q. No.	Sub Q. N.	Answer	Marking Scheme
1	e)	$\therefore B = -3$	½
		$\therefore \dfrac{x+4}{x(x+1)} = \dfrac{4}{x} + \dfrac{(-3)}{x+1}$	½
		OR	
		$\dfrac{x+4}{x(x+1)} = \dfrac{A}{x} + \dfrac{B}{x+1}$	½
		$\therefore x+4 = (x+1)A + xB$	
		$\therefore x+4 = x(A+B) + A$	
		$\therefore A+B = 1, A = 4$ and	½
		$B = -3$	½
		$\therefore \dfrac{x+4}{x(x+1)} = \dfrac{4}{x} + \dfrac{(-3)}{x+1}$	½
	f)	Prove that $\dfrac{1}{1-\cos A} + \dfrac{1}{1+\cos A} = 2\cos ec^2 A$	**02**
	Ans	$\dfrac{1}{1-\cos A} + \dfrac{1}{1+\cos A}$	
		$= \dfrac{(1+\cos A)+(1-\cos A)}{(1-\cos A)(1+\cos A)}$	½
		$= \dfrac{1+\cos A+1-\cos A}{1^2-\cos^2 A}$	½
		$= \dfrac{2}{\sin^2 A}$	½
		$= 2\text{cosec}^2 A$	½
	g)	Using compound angle formula, find $\cos(75)^0$	**02**
	Ans	$\cos(75)^0 = \cos(30^0+45^0)$	½
		$=\cos 30^0 . \cos 45^0 - \sin 30^0 . \sin 45^0$	½
		$= \dfrac{\sqrt{3}}{2} . \dfrac{1}{\sqrt{2}} - \dfrac{1}{2} . \dfrac{1}{\sqrt{2}}$	½
		$= \dfrac{\sqrt{3}-1}{2\sqrt{2}}$	½
		--	
	h)	If $\sin A = \dfrac{1}{2}$, find $\sin(3A)$.	**02**
	Ans	$\sin 3A = 3\sin A - 4\sin^3 A$	

Q. No.	Sub Q. N.	Answer	Marking Scheme
1	h)	$= 3\left(\frac{1}{2}\right) - 4\left(\frac{1}{2}\right)^3$	1
		$= 1$	1
		--	
	i)	Express as product form $\cos 4\theta + \cos 8\theta$	**02**
	Ans	$\cos 4\theta + \cos 8\theta$	
		$= 2\cos\left(\frac{4\theta + 8\theta}{2}\right).\cos\left(\frac{4\theta - 8\theta}{2}\right)$	1
		$= 2\cos(6\theta).\cos(-2\theta)$	1
		$= 2\cos(6\theta).\cos(2\theta)$	
	j)	If $\tan^{-1}(1) + \tan^{-1}(x) = 0$ then find $'x'$	**02**
	Ans	$\tan^{-1}(1) + \tan^{-1}(x) = 0$	
		$\therefore \frac{\pi}{4} + \tan^{-1}(x) = 0$	½
		$\therefore \tan^{-1}(x) = -\frac{\pi}{4}$	½
		$\therefore x = \tan\left(-\frac{\pi}{4}\right)$	½
		$\therefore x = -1$	½
		OR	
		$\tan^{-1}(1) + \tan^{-1}(x) = 0$	
		$\tan^{-1}\left(\frac{1+x}{1-x}\right) = 0$	½
		$\therefore \left(\frac{1+x}{1-x}\right) = \tan(0)$	½
		$\therefore \frac{1+x}{1-x} = 0$	½
		$\therefore 1 + x = 0$	
		$\therefore x = -1$	½
		--	
	k)	State the conditions of parallel and perpendicular lines, whose slopes are M_1 and M_2	**02**
	Ans	Condition for Parallel Lines, $M_1 = M_2$	1
		Condition for perpendicular lines, $M_1.M_2 = -1$	1

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1	l)	Find the range of the data:	**02**
		45,42,39,40,48,41,45,44	
	Ans	Range = Largest value – Smallest value	
		$= 48 - 39$	1
		$= 9$	1
		--	
2		**Solve any FOUR of the following:**	**16**
	a)	Solve the following equations using Cramers rule of determinants	**04**
		$x+y+z=3\ ,\ x-y+z=1\ ,\ x+y-2z=0$	
	Ans	$D = \begin{vmatrix} 1 & 1 & 1 \\ 1 & -1 & 1 \\ 1 & 1 & -2 \end{vmatrix}$	
		$=1(2-1)-1(-2-1)+1(1+1)$	
		$=6$	1
		$D_x = \begin{vmatrix} 3 & 1 & 1 \\ 1 & -1 & 1 \\ 0 & 1 & -2 \end{vmatrix}$	
		$=3(2-1)-1(-2-0)+1(1-0)$	½
		$=6$	
		$D_y = \begin{vmatrix} 1 & 3 & 1 \\ 1 & 1 & 1 \\ 1 & 0 & -2 \end{vmatrix}$	
		$=1(-2-0)-3(-2-1)+1(0-1)$	½
		$=6$	
		$D_z = \begin{vmatrix} 1 & 1 & 3 \\ 1 & -1 & 1 \\ 1 & 1 & 0 \end{vmatrix}$	½
		$=1(0-1)-1(0-1)+3(1+1)$	
		$=6$	
		$x = \frac{D_x}{D} = \frac{6}{6} = 1$	½
		$y = \frac{D_y}{D} = \frac{6}{6} = 1$	½
		$z = \frac{D_z}{D} = \frac{6}{6} = 1$	½

Q. No.	Sub Q. N.	Answer	Marking Scheme
2	b)	Find x, y, z if $\left\{\begin{bmatrix}1&3&2\\2&0&1\\3&1&2\end{bmatrix}+2\begin{bmatrix}3&0&2\\1&4&5\\2&1&0\end{bmatrix}\right\}\begin{bmatrix}1\\2\\3\end{bmatrix}=\begin{bmatrix}x\\y\\z\end{bmatrix}$	**04**
	Ans	$\left\{\begin{bmatrix}1&3&2\\2&0&1\\3&1&2\end{bmatrix}+2\begin{bmatrix}3&0&2\\1&4&5\\2&1&0\end{bmatrix}\right\}\begin{bmatrix}1\\2\\3\end{bmatrix}=\begin{bmatrix}x\\y\\z\end{bmatrix}$	
		$\therefore\left\{\begin{bmatrix}1&3&2\\2&0&1\\3&1&2\end{bmatrix}+\begin{bmatrix}6&0&4\\2&8&10\\4&2&0\end{bmatrix}\right\}\begin{bmatrix}1\\2\\3\end{bmatrix}=\begin{bmatrix}x\\y\\z\end{bmatrix}$	½
		$\therefore\left\{\begin{bmatrix}7&3&6\\4&8&11\\7&3&2\end{bmatrix}\right\}\begin{bmatrix}1\\2\\3\end{bmatrix}=\begin{bmatrix}x\\y\\z\end{bmatrix}$	1
		$\therefore\begin{bmatrix}7+6+18\\4+16+33\\7+6+6\end{bmatrix}=\begin{bmatrix}x\\y\\z\end{bmatrix}$	1½
		$\therefore\begin{bmatrix}31\\53\\19\end{bmatrix}=\begin{bmatrix}x\\y\\z\end{bmatrix}$	1
		$\therefore\ x=31\ ,\ y=53\ ,\ z=19$	
		--	
	c)	Express the matrix A as the sum of symmetric and skew-symmetric matrices, where $A=\begin{bmatrix}-1&7&1\\2&3&4\\5&0&5\end{bmatrix}$	**04**
	Ans	Consider $A+A^T=\begin{bmatrix}-1&7&1\\2&3&4\\5&0&5\end{bmatrix}+\begin{bmatrix}-1&2&5\\7&3&0\\1&4&5\end{bmatrix}$	
		$=\begin{bmatrix}-2&9&6\\9&6&4\\6&4&10\end{bmatrix}$	1
		and $A-A^T=\begin{bmatrix}-1&7&1\\2&3&4\\5&0&5\end{bmatrix}-\begin{bmatrix}-1&2&5\\7&3&0\\1&4&5\end{bmatrix}$	

Q. No.	Sub Q. N.	Answer	Marking Scheme
2	c)	$= \begin{bmatrix} 0 & 5 & -4 \\ -5 & 0 & 4 \\ 4 & -4 & 0 \end{bmatrix}$	1
		Consider $A = \frac{1}{2}\left(A + A^T\right) + \frac{1}{2}\left(A - A^T\right)$	½
		$\therefore A = \frac{1}{2}\begin{bmatrix} -2 & 9 & 6 \\ 9 & 6 & 4 \\ 6 & 4 & 10 \end{bmatrix} + \frac{1}{2}\begin{bmatrix} 0 & 5 & -4 \\ -5 & 0 & 4 \\ 4 & -4 & 0 \end{bmatrix}$	
		$\therefore A = \begin{bmatrix} -1 & \frac{9}{2} & 3 \\ \frac{9}{2} & 3 & 2 \\ 3 & 2 & 5 \end{bmatrix} + \begin{bmatrix} 0 & \frac{5}{2} & -2 \\ -\frac{5}{2} & 0 & 2 \\ 2 & -2 & 0 \end{bmatrix}$	1
		= symmetric matrix + skew-symmetric matrix	½
	d)	Find A^{-1} by adjoint method, If $A = \begin{bmatrix} 2 & -1 & 0 \\ 1 & 0 & 4 \\ 1 & -1 & 1 \end{bmatrix}$	**04**
	Ans	$A = \begin{bmatrix} 2 & -1 & 0 \\ 1 & 0 & 4 \\ 1 & -1 & 1 \end{bmatrix}$	
		$\therefore \lvert A \rvert = \begin{vmatrix} 2 & -1 & 0 \\ 1 & 0 & 4 \\ 1 & -1 & 1 \end{vmatrix}$	
		$= 2(0+4) + 1(1-4) + 0(-1-0)$	
		$= 5 \neq 0$	1
		$\therefore A^{-1}$ exists	

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2	d)	$\text{Matrix of minors} = \begin{bmatrix} \begin{vmatrix} 0 & 4 \\ -1 & 1 \end{vmatrix} & \begin{vmatrix} 1 & 4 \\ 1 & 1 \end{vmatrix} & \begin{vmatrix} 1 & 0 \\ 1 & -1 \end{vmatrix} \\ \begin{vmatrix} -1 & 0 \\ -1 & 1 \end{vmatrix} & \begin{vmatrix} 2 & 0 \\ 1 & 1 \end{vmatrix} & \begin{vmatrix} 2 & -1 \\ 1 & -1 \end{vmatrix} \\ \begin{vmatrix} -1 & 0 \\ 0 & 4 \end{vmatrix} & \begin{vmatrix} 2 & 0 \\ 1 & 4 \end{vmatrix} & \begin{vmatrix} 2 & -1 \\ 1 & 0 \end{vmatrix} \end{bmatrix}$	1
		$= \begin{bmatrix} 4 & -3 & -1 \\ -1 & 2 & -1 \\ -4 & 8 & 1 \end{bmatrix}$	
		$\text{Matrix of cofactors} = \begin{bmatrix} 4 & 3 & -1 \\ 1 & 2 & 1 \\ -4 & -8 & 1 \end{bmatrix}$	1
		$\text{Adj.}A = \begin{bmatrix} 4 & 1 & -4 \\ 3 & 2 & -8 \\ -1 & 1 & 1 \end{bmatrix}$	½
		$A^{-1} = \frac{1}{\|A\|}\text{Adj.}A$	
		$A^{-1} = \frac{1}{5}\begin{bmatrix} 4 & 1 & -4 \\ 3 & 2 & -8 \\ -1 & 1 & 1 \end{bmatrix}$	½
		--	
	e)	Resolve into partial fractions: $\frac{x^2+1}{(x+1)(x^2+4)}$	04
	Ans	Let $\frac{x^2+1}{(x+1)(x^2+4)} = \frac{A}{x+1} + \frac{Bx+C}{x^2+4}$	½
		$\therefore\ x^2+1 = (x^2+4)A + (x+1)(Bx+C)$	
		Put $x=-1$	
		$\therefore\ 2 = 5A$	
		$\therefore\ A = \frac{2}{5}$	1
		Put $x = 0$	
		$1 = 4A + (1)C$	
		$1 = 4\left(\frac{2}{5}\right) + C$	

Q. No.	Sub Q. N.	Answer	Marking Scheme
2	e)	$\therefore C = \frac{-3}{5}$	1
		Put $x = 1$	
		$2 = 5A + 2(B + C)$	
		$2 = 5\left(\frac{2}{5}\right) + 2B + 2\left(\frac{-3}{5}\right)$	
		$\frac{6}{5} = 2B$	
		$\therefore B = \frac{3}{5}$	1
		$\therefore \frac{x^2+1}{(x+1)(x^2+4)} = \frac{\frac{2}{5}}{x+1} + \frac{\frac{3}{5}x - \frac{3}{5}}{x^2+4}$	½
		--	
	f)	Resolve into partial fractions : $\frac{x^2+1}{x(x^2-1)}$	**04**
	Ans	$\frac{x^2+1}{x(x^2-1)} = \frac{x^2+1}{x(x-1)(x+1)}$	
		$\frac{x^2+1}{x(x-1)(x+1)} = \frac{A}{x} + \frac{B}{x-1} + \frac{C}{x+1}$	½
		$\therefore x^2 + 1 = A(x-1)(x+1) + Bx(x+1) + Cx(x-1)$	
		Put $x = 0$	
		$1 = A(-1)(1)$	
		$1 = -A$	
		$\therefore A = -1$	1
		Put $x = 1$	
		$1 + 1 = B(1)(1+1)$	
		$\therefore B = 1$	1
		Put $x = -1$	
		$1 + 1 = C(-1)(-2)$	
		$\therefore C = 1$	1
		$\therefore \frac{x^2+1}{x(x-1)(x+1)} = \frac{-1}{x} + \frac{1}{x-1} + \frac{1}{x+1}$	½

Q. No.	Sub Q. N.	Answer	Marking Scheme
3		**Solve any FOUR of the following:**	**16**
	a)	Using matrix inversion method, solve the equations : $x+y+z=3,\ x+2y+3z=4,\ x+4y+9z=6$	**04**
	Ans	$Let\ A=\begin{bmatrix}1&1&1\\1&2&3\\1&4&9\end{bmatrix}$	
		$\lvert A\rvert=\begin{vmatrix}1&1&1\\1&2&3\\1&4&9\end{vmatrix}$	
		$\lvert A\rvert=1(18-12)-1(9-3)+1(4-2)$ $\therefore \lvert A\rvert=2\neq 0$ $\therefore A^{-1}$ exists	½
		$\text{Matrix of minors}=\begin{bmatrix}\begin{vmatrix}2&3\\4&9\end{vmatrix}&\begin{vmatrix}1&3\\1&9\end{vmatrix}&\begin{vmatrix}1&2\\1&4\end{vmatrix}\\\begin{vmatrix}1&1\\4&9\end{vmatrix}&\begin{vmatrix}1&1\\1&9\end{vmatrix}&\begin{vmatrix}1&1\\1&4\end{vmatrix}\\\begin{vmatrix}1&1\\2&3\end{vmatrix}&\begin{vmatrix}1&1\\1&3\end{vmatrix}&\begin{vmatrix}1&1\\1&2\end{vmatrix}\end{bmatrix}$	½
		$=\begin{bmatrix}6&6&2\\5&8&3\\1&2&1\end{bmatrix}$	
		$\text{Matrix of cofactors}=\begin{bmatrix}6&-6&2\\-5&8&-3\\1&-2&1\end{bmatrix}$	½
		$AdjA=\begin{bmatrix}6&-5&1\\-6&8&-2\\2&-3&1\end{bmatrix}$	
		$A^{-1}=\frac{1}{\lvert A\rvert}\text{Adj}.A=\frac{1}{2}\begin{bmatrix}6&-5&1\\-6&8&-2\\2&-3&1\end{bmatrix}$	½
		$X=A^{-1}B$	
		$\therefore\begin{bmatrix}x\\y\\z\end{bmatrix}=\frac{1}{2}\begin{bmatrix}6&-5&1\\-6&8&-2\\2&-3&1\end{bmatrix}\begin{bmatrix}3\\4\\6\end{bmatrix}$	½

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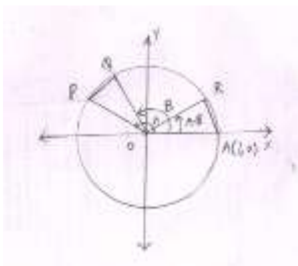
3	a)	$= \frac{1}{2}\begin{bmatrix} 18-20+6 \\ -18+32-12 \\ 6-12+6 \end{bmatrix}$	½
		$= \frac{1}{2}\begin{bmatrix} 4 \\ 2 \\ 0 \end{bmatrix}$	
		$\begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 2 \\ 1 \\ 0 \end{bmatrix}$	1
		$\therefore \quad x = 2\ ,\ \ y = 1\ ,\ \ z = 0$	
	b)	Resolve into partial fraction $\frac{x^2}{(x+1)(x+2)^2}$	**04**
	Ans	Let $\frac{x^2}{(x+1)(x+2)^2} = \frac{A}{x+1} + \frac{B}{x+2} + \frac{C}{(x+2)^2}$	½
		$x^2 = (x+2)^2 A + (x+1)(x+2)B + (x+1)C$	
		Put $x = -1$	
		$\therefore 1 = (1)A$	
		$\therefore A = 1$	1
		Put $x = -2$	
		$\therefore 4 = (-1)C$	
		$\therefore C = -4$	1
		Put $x = 0$	
		$\therefore 0 = 4A + 2B + C$	
		$\therefore 0 = 4 - 2B - 4$	
		$\therefore B = 0$	1
		$\therefore \frac{x^2}{(x+1)(x+2)^2} = \frac{1}{x+1} + \frac{0}{x+2} + \frac{(-4)}{(x+2)^2}$	½
		$\frac{x^2}{(x+1)(x+2)^2} = \frac{1}{x+1} - \frac{4}{(x+2)^2}$	
	c)	Resolve into partial fraction: $\frac{x^4}{x^3+1}$	**04**

Q. No.	Sub Q. N.	Answer	Marking Scheme
3	Ans	$x^3+1\overline{)x^4}$ quotient x $x^4 + x$ $- \quad -$ ---------- $-x$	
		$\therefore \dfrac{x^4}{x^3+1} = x - \dfrac{x}{x^3+1}$	1
		$\therefore \dfrac{x}{x^3+1} = \dfrac{x}{(x+1)(x^2-x+1)}$	
		$\dfrac{x}{(x+1)(x^2-x+1)} = \dfrac{A}{x+1} + \dfrac{Bx+C}{x^2-x+1}$	½
		$\therefore x = (x^2-x+1)A + (x+1)(Bx+C)$	
		Put $x=-1$ $-1 = 3A$ $A = -\dfrac{1}{3}$	½
		Put $x=0$ $0 = A + C$ $\therefore C = \dfrac{1}{3}$	½
		Put $x=1$ $1 = A + 2(B+C)$ $1 = -\dfrac{1}{3} + 2B + 2\left(\dfrac{1}{3}\right)$	
		$\therefore B = \dfrac{1}{3}$	½
		$\therefore \dfrac{x}{(x+1)(x^2-x+1)} = \dfrac{-\frac{1}{3}}{x+1} + \dfrac{\frac{1}{3}x+\frac{1}{3}}{x^2-x+1}$	½
		$\therefore \dfrac{x^4}{x^3+1} = x - \left(\dfrac{-\frac{1}{3}}{x+1} + \dfrac{\frac{1}{3}x+\frac{1}{3}}{x^2-x+1}\right)$	½
		--	

Q. No.	Sub Q. N.	Answer	Marking Scheme
3	d)	If $\tan\left(\frac{\alpha}{2}\right)=\frac{1}{\sqrt{3}}$ then find $\sin\alpha$	**04**
	Ans	$\tan\left(\frac{\alpha}{2}\right)=\frac{1}{\sqrt{3}}$	
		$\therefore \frac{\alpha}{2}=\tan^{-1}\left(\frac{1}{\sqrt{3}}\right)$	1
		$\therefore \frac{\alpha}{2}=\frac{\pi}{6}$ or 30^0	1
		$\therefore \alpha=\frac{\pi}{3}$ or 60^0	1
		$\therefore \sin\alpha=\sin 60^0=\frac{\sqrt{3}}{2}$	1
		---	
	e)	Show that : $\tan^{-1}(1)+\tan^{-1}(2)+\tan^{-1}(3)=\pi$	**04**
	Ans	$\tan^{-1}(1)+\tan^{-1}(2)+\tan^{-1}(3)$	
		$=\tan^{-1}\left(\frac{1+2}{1-1.2}\right)+\pi+\tan^{-1}(3)$	1
		$=\tan^{-1}(-3)+\pi+\tan^{-1}(3)$	1
		$=-\tan^{-1}(3)+\pi+\tan^{-1}(3)$	1
		$=\pi$	1
		OR	
		$\tan^{-1}(1)+\tan^{-1}(2)+\tan^{-1}(3)$	
		$=\frac{\pi}{4}+\pi+\tan^{-1}\left(\frac{2+3}{1-2.3}\right)$	1
		$=\frac{\pi}{4}+\pi+\tan^{-1}(-1)$	1
		$=\frac{\pi}{4}+\pi-\frac{\pi}{4}$	1
		$=\pi$	1
		---	
	f)	Show that : $\sin 20^0\ \sin 40^0\ \sin 60^0\ \sin 80^0=\frac{3}{16}$	**04**
	Ans	$\sin 20^0\sin 40^0\sin 60^0\sin 80^0$	
		$=\sin 20^0\sin 40^0\frac{\sqrt{3}}{2}\sin 80^0$	½

Q. No.	Sub Q. N.	Answer	Marking Scheme
3	f)	$= \frac{\sqrt{3}}{4}\left[2\sin 20^0 \sin 40^0\right]\sin 80^0$	
		$= \frac{\sqrt{3}}{4}\left[\cos\left(-20^0\right) - \cos 60^0\right]\sin 80^0$	1
		$= \frac{\sqrt{3}}{4}\left[\cos 20^0 - \frac{1}{2}\right]\sin 80^0$	
		$= \frac{\sqrt{3}}{4}\left[\cos 20^0 \sin 80^0 - \frac{1}{2}\sin 80^0\right]$	½
		$= \frac{\sqrt{3}}{4}\left[\frac{1}{2} 2\cos 20^0 \sin 80^0 - \frac{1}{2}\sin 80^0\right]$	1
		$= \frac{\sqrt{3}}{8}\left[\sin 100^0 - \sin\left(-60\right) - \sin 80^0\right]$	
		$= \frac{\sqrt{3}}{8}\left[\sin\left(2\times 90^0 - 80\right) + \frac{\sqrt{3}}{2} - \sin 80^0\right]$	
		$= \frac{\sqrt{3}}{8}\left[\sin 80^0 + \frac{\sqrt{3}}{2} - \sin 80^0\right]$	½
		$= \frac{3}{16}$	½
		--	
4		**Solve any <u>FOUR</u> of the following:**	**16**
	a)	Prove that : $\sin\left(A-B\right) = \sin A\cos B - \cos A\sin B$	**04**
	Ans		
		Consider a standard unit circle	
		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	½
		$P\left(\cos A, \sin A\right)$, $Q\left(\cos B, \sin B\right)$	

Q. No.	Sub Q. N.	Answer	Marking Scheme
4	a)	$R\left[\cos(A-B),\sin(A-B)\right]\ ,\ S(1,0)$	
		$\sqrt{(\cos A-\cos B)^2+(\sin A-\sin B)^2}=\sqrt{\left[\cos(A-B)-1\right]^2+\left[\sin(A-B)-0\right]^2}$	½
		$(\cos A-\cos B)^2+(\sin A-\sin B)^2=\left[\cos(A-B)-1\right]^2+\left[\sin(A-B)-0\right]^2$	
		$\therefore\ \cos^2A+\cos^2B-2\cos A\cos B+\sin^2A+\sin^2B-2\sin A\sin B=$ $\cos^2(A-B)+1-2\cos(A-B)+\sin^2(A-B)$	½
		$\therefore\ 1+1-2(\cos A\cos B+\sin A\sin B)=1+1-2\cos(A-B)$	½
		$\therefore\ \cos A\cos B+\sin A\sin B=\cos(A-B)$	1
		Replace A by $\left(\frac{\pi}{2}+A\right)$ in above equation	
		$\therefore\ \cos\left(\frac{\pi}{2}+A\right)\cos B+\sin\left(\frac{\pi}{2}+A\right)\sin B=\cos\left(\frac{\pi}{2}+A-B\right)$	½
		$\therefore\ -\sin A\cos B+\cos A\sin B=-\sin(A-B)$	
		$\therefore\ \sin(A-B)=\sin A\cos B-\cos A\sin B$	½
		--	
	b)	Prove that : $\dfrac{1-\tan2\theta.\tan\theta}{1+\tan2\theta.\tan\theta}=\dfrac{\cos3\theta}{\cos\theta}$	**04**
	Ans	$\dfrac{1-\tan2\theta.\tan\theta}{1+\tan2\theta.\tan\theta}$	
		$=\dfrac{1-\frac{\sin2\theta}{\cos2\theta}.\frac{\sin\theta}{\cos\theta}}{1+\frac{\sin2\theta}{\cos2\theta}.\frac{\sin\theta}{\cos\theta}}$	1
		$=\dfrac{\cos2\theta\cos\theta-\sin2\theta\sin\theta}{\cos2\theta\cos\theta+\sin2\theta\sin\theta}$	1
		$=\dfrac{\cos(2\theta+\theta)}{\cos(2\theta-\theta)}$	1
		$=\dfrac{\cos3\theta}{\cos\theta}$	1
		--	
	c)	Evaluate : $\tan\left[2\tan^{-1}\frac{1}{5}\right]$	**04**
	Ans	$\tan\left[2\tan^{-1}\frac{1}{5}\right]$	
		$=\tan\left[\tan^{-1}\frac{1}{5}+\tan^{-1}\frac{1}{5}\right]$	1

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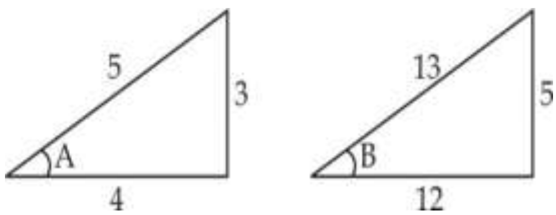
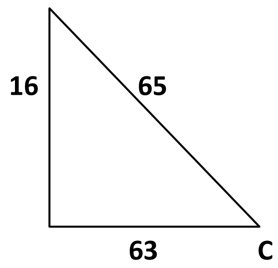
Q. No.	Sub Q. N.	Answer	Marking Scheme
4	c)	$= \tan\left[\tan^{-1}\left(\dfrac{\frac{1}{5}+\frac{1}{5}}{1-\frac{1}{5}.\frac{1}{5}}\right)\right]$	1
		$= \tan\left[\tan^{-1}\left(\dfrac{5}{12}\right)\right]$	1
		$= \dfrac{5}{12}$	1
		OR	
		Let $\tan^{-1}\dfrac{1}{5} = \theta \qquad \therefore \tan\theta = \dfrac{1}{5}$	1
		$\therefore \tan\left[2\tan^{-1}\dfrac{1}{5}\right] = \tan[2\theta]$	
		$= \dfrac{2\tan\theta}{1-\tan^2\theta}$	1
		$= \dfrac{2\left(\frac{1}{5}\right)}{1-\left(\frac{1}{5}\right)^2}$	1
		$= \dfrac{5}{12}$	1
	d)	Show that : $\sin 50^0 - \sin 70^0 + \sin 10^0 = 0$	**04**
	Ans	$\sin 50^0 - \sin 70^0 + \sin 10^0$	
		$= 2\cos\left(\dfrac{50^0+70^0}{2}\right)\sin\left(\dfrac{50^0-70^0}{2}\right)+\sin 10^0$	1
		$= 2\cos 60^0 \sin\left(-10^0\right)+\sin 10^0$	1
		$= 2\left(\dfrac{1}{2}\right)\sin\left(-10^0\right)+\sin 10^0$	1
		$= -\sin 10^0 + \sin 10^0$	½
		$= 0$	½
	e)	Prove that : $\tan A \tan(60-A)\tan(60+A) = \tan 3A$	**04**
	Ans	$\tan A \tan(60-A)\tan(60+A)$	
		$= \tan A\left(\dfrac{\tan 60 - \tan A}{1+\tan 60 \tan A}\right)\left(\dfrac{\tan 60 + \tan A}{1-\tan 60 \tan A}\right)$	1

Q. No.	Sub Q. N.	Answer	Marking Scheme
4	e)	$= \tan A\left(\dfrac{\sqrt{3}-\tan A}{1+\sqrt{3}\tan A}\right)\left(\dfrac{\sqrt{3}+\tan A}{1-\sqrt{3}\tan A}\right)$	1
		$= \tan A\left(\dfrac{3-\tan^2 A}{1-3\tan^2 A}\right)$	1
		$= \dfrac{3\tan A-\tan^3 A}{1-3\tan^2 A}$	½
		$= \tan 3A$	½
		OR	
		$\tan A\tan(60-A)\tan(60+A)$	
		$= \dfrac{\sin A\sin(60-A)\sin(60+A)}{\cos A\cos(60-A)\cos(60+A)}$	
		$= \dfrac{\sin A(\sin 60\cos A-\cos 60\sin A)(\sin 60\cos A+\cos 60\sin A)}{\cos A(\cos 60\cos A+\sin 60\sin A)(\cos 60\cos A-\sin 60\sin A)}$	1
		$= \dfrac{\sin A\left(\sin^2 60\cos^2 A-\cos^2 60\sin^2 A\right)}{\cos A\left(\cos^2 60\cos^2 A-\sin^2 60\sin^2 A\right)}$	
		$= \dfrac{\sin A\left(\left(\dfrac{\sqrt{3}}{2}\right)^2\cos^2 A-\left(\dfrac{1}{2}\right)^2\sin^2 A\right)}{\cos A\left(\left(\dfrac{1}{2}\right)^2\cos^2 A-\left(\dfrac{\sqrt{3}}{2}\right)^2\sin^2 A\right)}$	1
		$= \dfrac{\sin A\left(\dfrac{3}{4}\cos^2 A-\dfrac{1}{4}\sin^2 A\right)}{\cos A\left(\dfrac{1}{4}\cos^2 A-\dfrac{3}{4}\sin^2 A\right)}$	
		$= \dfrac{\sin A\left(3\cos^2 A-\sin^2 A\right)}{\cos A\left(\cos^2 A-3\sin^2 A\right)}$	½
		$= \dfrac{\sin A\left(3\left(1-\sin^2 A\right)-\sin^2 A\right)}{\cos A\left(\cos^2 A-3\left(1-\cos^2 A\right)\right)}$	½
		$= \dfrac{\sin A\left(3-3\sin^2 A-\sin^2 A\right)}{\cos A\left(\cos^2 A-3+3\cos^2 A\right)}$	
		$= \dfrac{3\sin A-4\sin^3 A}{4\cos^3 A-3\cos A}$	
		$= \dfrac{\sin 3A}{\cos 3A}$	½

Q. No.	Sub Q. N.	Answer	Marking Scheme
4	e)	$= \tan 3A$	½
	f)	Without using calculator find the value of $\sin 150^0 + \cos 300^0 - \tan 315^0 + \sec^2 3660^0$	04
	Ans	$\sin 150^0 = \sin(2 \times 90 - 30) = \sin 30 = \dfrac{1}{2}$	½
		$\cos 300^0 = \cos(4 \times 90 - 60) = \cos 60 = \dfrac{1}{2}$	½
		$\tan 315^0 = \tan(4 \times 90 - 45) = -\tan 45 = -1$	½
		$\sec 3660^0 = \sec(40 \times 90 + 60) = \sec 60 = 2$	½
		$\therefore \sin 150^0 + \cos 300^0 - \tan 315^0 + \sec^2 3660^0$	
		$= \dfrac{1}{2} + \dfrac{1}{2} - (-1) + (2)^2$	1
		$= 6$	1
5		**Solve any <u>FOUR</u> of the following:**	16
	a)	Prove that $\sin 3A = 3\sin A - 4\sin^3 A$	04
	Ans	$\sin 3A$	½
		$= \sin(2A + A)$	
		$= \sin 2A \cos A + \cos 2A \sin A$	1
		$= 2\sin A \cos A \cos A + (\cos^2 A - \sin^2 A)\sin A$	1
		$= 2\sin A \cos^2 A + (1 - \sin^2 A - \sin^2 A)\sin A$	½
		$= 2\sin A(1 - \sin^2 A) + (1 - 2\sin^2 A)\sin A$	½
		$= 2\sin A - 2\sin^3 A + \sin A - 2\sin^3 A$	
		$= 3\sin A - 4\sin^3 A$	½
	b)	Show that $\dfrac{\sin 4A + \sin 5A + \sin 6A}{\cos 4A + \cos 5A + \cos 6A} = \tan 5A$	04
	Ans	$\dfrac{\sin 4A + \sin 5A + \sin 6A}{\cos 4A + \cos 5A + \cos 6A}$	
		$= \dfrac{(\sin 4A + \sin 6A) + \sin 5A}{(\cos 4A + \cos 6A) + \cos 5A}$	
		$= \dfrac{2\sin\left(\dfrac{4A+6A}{2}\right)\cos\left(\dfrac{4A-6A}{2}\right) + \sin 5A}{2\cos\left(\dfrac{4A+6A}{2}\right)\cos\left(\dfrac{4A-6A}{2}\right) + \cos 5A}$	1

Q. No.	Sub Q. N.	Answer	Marking Scheme
5	b)	$= \dfrac{2\sin 5A\cos(-A)+\sin 5A}{2\cos 5A\cos(-A)+\cos 5A}$	1
		$= \dfrac{\sin 5A(2\cos(-A)+1)}{\cos 5A(2\cos(-A)+1)}$	1
		$= \tan 5A$	1
		--	
	c)	Show that $\cos^{-1}\left(\dfrac{4}{5}\right)-\cos^{-1}\left(\dfrac{12}{13}\right)=\cos^{-1}\left(\dfrac{63}{65}\right)$	**04**
	Ans	Let $\cos^{-1}\left(\dfrac{4}{5}\right)=A$	
		$\therefore \cos A=\dfrac{4}{5}$	
		$\therefore \sin^2 A=1-\cos^2 A$	
		$=1-\dfrac{16}{25}$	
		$=\dfrac{9}{25}$	
		$\therefore \sin A=\dfrac{3}{5}$	1
		$\cos^{-1}\left(\dfrac{12}{13}\right)=B$	
		$\therefore \cos B=\dfrac{12}{13}$	
		$\therefore \sin^2 B=1-\cos^2 B$	
		$=1-\dfrac{144}{169}$	
		$=\dfrac{25}{169}$	
		$\therefore \sin B=\dfrac{5}{13}$	1
		$\therefore \cos(A-B)=\cos A\cos B+\sin A\sin B$	

Q. No.	Sub Q. N.	Answer	Marking Scheme
5	c)	$= \frac{4}{5}\frac{12}{13} + \frac{3}{5}\frac{5}{13}$	
		$= \frac{48}{65} + \frac{15}{65}$	
		$\therefore \cos(A - B) = \frac{63}{65}$	1
		$\therefore A - B = \cos^{-1}\left(\frac{63}{65}\right)$	
		$\therefore \cos^{-1}\left(\frac{4}{5}\right) - \cos^{-1}\left(\frac{12}{13}\right) = \cos^{-1}\left(\frac{63}{65}\right)$	1
		OR	
		$\text{Let } \cos^{-1}\left(\frac{4}{5}\right) = A$	
		$\therefore \cos A = \frac{4}{5}$	
		$\therefore \tan A = \frac{3}{4}$ 	
		$A = \tan^{-1}\left(\frac{3}{4}\right)$	
		$\therefore \cos^{-1}\left(\frac{4}{5}\right) = \tan^{-1}\left(\frac{3}{4}\right)$	1
		$\cos^{-1}\left(\frac{12}{13}\right) = B$	
		$\therefore \cos B = \frac{12}{13}$	
		$\therefore \tan B = \frac{5}{12}$	
		$B = \tan^{-1}\left(\frac{5}{12}\right)$	
		$\therefore \cos^{-1}\left(\frac{12}{13}\right) = \tan^{-1}\left(\frac{5}{12}\right)$	1
		$L.H.S. = \tan^{-1}\left(\frac{3}{4}\right) - \tan^{-1}\left(\frac{5}{12}\right)$	
		$= \tan^{-1}\left(\frac{\frac{3}{4} - \frac{5}{12}}{1 + \frac{3}{4}\frac{5}{12}}\right)$	1

Q. No.	Sub Q. N.	Answer	Marking Scheme
5	c)	$= \tan^{-1}\left(\dfrac{\dfrac{36-20}{48}}{1+\dfrac{15}{48}}\right)$	
		$= \tan^{-1}\left(\dfrac{\dfrac{16}{48}}{\dfrac{48+15}{48}}\right)$	½
		$= \tan^{-1}\left(\dfrac{16}{63}\right)$	
		Let $\tan^{-1}\left(\dfrac{16}{63}\right) = C$	
		$\therefore \tan C = \dfrac{16}{63}$	
		$\therefore \cos C = \dfrac{63}{65}$ 	
		$\therefore C = \cos^{-1}\left(\dfrac{63}{65}\right)$	
		$\therefore R.H.S. = \cos^{-1}\left(\dfrac{63}{65}\right)$	½
		--	
	d)	Find 'p' if the lines $3x+4py+8=0$ and $3py-9x+10=0$ are perpendicular to each other	**04**
	Ans	$L_1 : 3x+4py+8=0$ and	
		$L_2 : -9x+3py+10=0$	
		$\therefore$ slope $= \dfrac{-a}{b}$	
		$m_1 = \dfrac{-3}{4p}$	1
		$m_2 = \dfrac{9}{3p}$	1
		lines are perpendicular	
		$\therefore m_1 m_2 = -1$	
		$\dfrac{-3}{4p}\,\dfrac{9}{3p} = -1$	1

Q. No.	Sub Q. N.	Answer	Marking Scheme
5	d)	$\therefore \frac{9}{4p^2}=1$ $\therefore \frac{9}{4}=p^2$ $\therefore p=\pm\frac{3}{2}$	 1
	e) Ans	Find the angle between the lines : $3x-y+4=0$ and $2x+y-3=0$ $L_1: 3x-y+4=0$ and $L_2: 2x+y-3=0$ $\therefore$ slope $=\frac{-a}{b}$ $\therefore m_1=\frac{-3}{-1}=3$ $\therefore m_2=\frac{-2}{1}=-2$ $\tan\theta=\left\|\frac{m_1-m_2}{1+m_1m_2}\right\|$ $\therefore \tan\theta=\left\|\frac{3+2}{1+3(-2)}\right\|$ $\therefore \tan\theta=\|-1\|$ $\therefore \tan\theta=1$ $\therefore \theta=\tan^{-1}(1)$ $\therefore \theta=45^0$ or $\frac{\pi}{4}$	**04** 1 1 1 1
	f) Ans	Find the equation of straight line passing through the point of intersection of lines $4x+3y=8$ and $x+y=1$ and parallel to the line $5x-7y=3$ $4x+3y=8$ $x+y=1$ ----------- $4x+3y=8$ $3x+3y=3$ $-$ --------- $x=5$	**04** 1

Q. No.	Sub Q. N.	Answer	Marking Scheme
5	f)	$\therefore\ y = -4$	1
		$\therefore$ Point of intersection is $(x, y) = (5, -4)$	
		line is parllel to the line $5x - 7y = 3$	
		$\therefore$ slope of required line $m = \dfrac{-a}{b} = \dfrac{5}{7}$	1
		$\therefore$ equation of line is	
		$y - y_1 = m(x - x_1)$	
		$\therefore\ y + 4 = \dfrac{5}{7}(x - 5)$	1
		$\therefore\ 7y + 28 = 5x - 25$	
		$\therefore\ 5x - 7y - 53 = 0$	
6		**Solve any <u>FOUR</u> of the following:**	**16**
	a)	Find the equation of straight line which is perpendicular bisector of the line joining the points $A(8,-1)$ and $B(6,3)$	**04**
	Ans	Let P be midpoint of AB	
		$\therefore\ P$ is $\left(\dfrac{8+6}{2}, \dfrac{-1+3}{2}\right)$	
		$i.e. P(7,1)$	1
		Slope of $AB, m_1 = \dfrac{3-(-1)}{6-8}$	
		$m_1 = -2$	1
		$\because$ required line is perpendicular to AB	
		$\therefore\ m_1 m_2 = -1$	
		$\therefore\ m_2 = \dfrac{1}{2}$	1
		$\therefore$ equation of required line is	
		$y - y_1 = m_2(x - x_1)$	
		$\therefore\ y - 1 = \dfrac{1}{2}(x - 7)$	1
		$\therefore\ x - 2y - 5 = 0$	
		--	
	b)	Find the equation of the line whose intercept on the X-axis is double that on the Y-axis and passing through the point $(4,1)$	**04**
	Ans	Let x-intercept $= a$	
		y-intercept $= b$	

Q. No.	Sub Q. N.	Answer	Marking Scheme
6	b)	from given $a = 2b$	½
		equation of line is	
		$\frac{x}{a}+\frac{y}{b}=1$	
		$\therefore \frac{x}{2b}+\frac{y}{b}=1$	1
		$\therefore x+2y=2b$	½
		at $(4,1)$	
		$6=2b$	1
		$\therefore b=3$	
		$\therefore$ equation of line is	
		$x+2y=6$	1
	c)	From the following data investigate which set is more consistent	**04**
	Ans	Let V_1 and V_2 be coefficient of variations for set I and set II respectively	
		$\therefore V_1=\frac{\sigma}{\bar{x}}\times 100$	
		$=\frac{5.9}{83.4}\times 100$	1½
		$=7.07$	
		$V_2=\frac{7.45}{51.85}\times 100$	1½
		$=14.36$	
		$\because V_1 < V_2$	
		$\therefore$ set I is more consistent	1
	d)	Find Range and coefficient of Range for the following data:	**04**

Table for 6 c):

Set	a.m.$=\bar{x}$	S.D.$=\sigma$
Set I	83.4	5.9
Set II	51.85	7.45

Table for 6 d):

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

Q. No.	Sub Q. N.	Answer	Marking Scheme
6	Ans	(table below)	

Marks	19.5-29.5	29.5-39.5	39.5-49.5	49.5-59.5	59.5-69.5	69.5-79.5	79.5-89.5	89.5-99.5
No. of Students	10	15	16	20	21	22	09	08

$\text{Range} = L - S = 99.5 - 19.5$

$= 80$ — **2**

$\text{Coefficient of Range} = \dfrac{L-S}{L+S}$

$= \dfrac{99.5-19.5}{99.5+19.5}$ — **2**

$= 0.672$

---

e) Find the mean deviation for the following data: — **04**

Marks	3	4	5	6	7	8
No. of Students	1	3	7	5	2	2

Ans

x_i	f_i	$f_i x_i$	$d_i = x_i - \bar{x}$	$\lvert d_i \rvert$	$f_i \lvert d_i \rvert$
3	1	3	-2.5	2.5	2.5
4	3	12	-1.5	1.5	4.5
5	7	35	-0.5	0.5	3.5
6	5	30	0.5	0.5	2.5
7	2	14	1.5	1.5	3
8	2	16	2.5	2.5	5
	20	110			21

2

$\text{Mean } \bar{x} = \dfrac{\sum f_i x_i}{N} = \dfrac{110}{20}$

Q. No.	Sub Q. N.	Answer	Marking Scheme
6	e)	$\bar{x} = 5.5$	1
		$M.D. = \dfrac{\sum f_i \lvert d_i \rvert}{\sum f_i}$	
		$= \dfrac{21}{20}$	
		$= 1.05$	1
	f)	Find the standard deviation for the following data :	04

Class Interval	0-5	5-10	10-15	15-20	20-25	25-30	30-35	35-40
Frequency	03	05	09	15	20	16	10	02

Ans

Class	x_i	f_i	$f_i x_i$	x_i^2	$f_i x_i^2$
0-5	2.5	3	7.5	6.25	18.75
5-10	7.5	5	37.5	56.25	281.25
10-15	12.5	9	112.5	156.25	1406.25
15-20	17.5	15	262.5	306.25	4593.75
20-25	22.5	20	450	506.25	10125
25-30	27.5	16	440	756.25	12100
30-35	32.5	10	325	1056.25	10562.5
35-40	37.5	2	75	1406.25	2812.5
		$\sum f_i = 80$	$\sum f_i x_i = 1710$		$\sum f_i x_i^2 = 41900$

(2 marks)

$$\text{Mean } \bar{x} = \frac{\sum f_i x_i}{N} = \frac{1710}{80}$$

$$\bar{x} = 21.375$$

(1 mark)

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Q. No.	Sub Q. N.	Answer	Marking Scheme
6	f)		

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

$$= \sqrt{\frac{41900}{80} - (21.375)^2}$$

$$\sigma = 8.177$$ 1

OR

Class	x_i	f_i	$d_i = \frac{x_i - a}{h}$	$f_i d_i$	d_i^2	$f_i d_i^2$
0-5	2.5	3	-4	-12	16	48
5-10	7.5	5	-3	-15	9	45
10-15	12.5	9	-2	-18	4	36
15-20	17.5	15	-1	-15	1	15
20-25	22.5	20	0	0	0	0
25-30	27.5	16	1	16	1	16
30-35	32.5	10	2	20	4	40
35-40	37.5	2	3	6	9	18
		$\sum f_i = 80$		$\sum f_i d_i = -18$		$\sum f_i d_i^2 = 218$

2

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

$$= \sqrt{\frac{218}{80} - \left(\frac{-18}{80}\right)^2} \times 5$$ 1

$$= 8.177$$ 1

Q. No.	Sub Q. N.	Answer	Marking Scheme
		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.* -- --	