SUMMER– 18 EXAMINATION

Subject Name: Basic Mathematics **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 answers and model answer.
6) In case of some questions credit may be given by judgement on part of examiner of relevant answer based on candidate's understanding.
7) For programming language papers, credit may be given to any other program based on equivalent concept.

Q. No.	Sub Q.N.	Answers	Marking Scheme
1.		**Attempt any TEN of the following:**	**20**
	a)	Find x, if $\begin{vmatrix} x & 0 & 0 \\ 3 & -2 & 1 \\ -2 & -4 & 1 \end{vmatrix} = 0$	**02**
	Ans	$\begin{vmatrix} x & 0 & 0 \\ 3 & -2 & 1 \\ -2 & -4 & 1 \end{vmatrix} = 0$	
		$\therefore\ x(-2+4)=0$	1
		$\therefore\ 2x=0$	
		$\therefore\ x=0$	1
		--	
	b)	If $A=\begin{bmatrix} 1 & 2 \\ -3 & 4 \end{bmatrix}$, $B=\begin{bmatrix} 4 & 5 \\ 1 & -3 \end{bmatrix}$, find $2A+B$.	**02**
	Ans	$2A+B=2\begin{bmatrix} 1 & 2 \\ -3 & 4 \end{bmatrix}+\begin{bmatrix} 4 & 5 \\ 1 & -3 \end{bmatrix}$	
		$=\begin{bmatrix} 2 & 4 \\ -6 & 8 \end{bmatrix}+\begin{bmatrix} 4 & 5 \\ 1 & -3 \end{bmatrix}$	1
		$=\begin{bmatrix} 6 & 9 \\ -5 & 5 \end{bmatrix}$	1
		--	

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Q. No.	Sub Q.N.	Answers	Marking Scheme
1.	c)	If $A=\begin{bmatrix}2 & 4\\-1 & -2\end{bmatrix}$ show that A^2 is null matrix.	**02**
	Ans	$A^2=AA=\begin{bmatrix}2 & 4\\-1 & -2\end{bmatrix}\begin{bmatrix}2 & 4\\-1 & -2\end{bmatrix}$	½
		$=\begin{bmatrix}4-4 & 8-8\\-2+2 & -4+4\end{bmatrix}$	1
		$=\begin{bmatrix}0 & 0\\0 & 0\end{bmatrix}$	½
		$\therefore A^2$ is null matrix	
	d)	If $A=\begin{bmatrix}3 & -5\\2 & 0\end{bmatrix}$, $B=\begin{bmatrix}1 & -2\\3 & 2\end{bmatrix}$ verify that $AB\neq BA$	**02**
	Ans	$AB=\begin{bmatrix}3 & -5\\2 & 0\end{bmatrix}\begin{bmatrix}1 & -2\\3 & 2\end{bmatrix}$	
		$=\begin{bmatrix}3-15 & -6-10\\2+0 & -4+0\end{bmatrix}$	
		$=\begin{bmatrix}-12 & -16\\2 & -4\end{bmatrix}$	1
		$BA=\begin{bmatrix}1 & -2\\3 & 2\end{bmatrix}\begin{bmatrix}3 & -5\\2 & 0\end{bmatrix}$	
		$=\begin{bmatrix}3-4 & -5+0\\9+4 & -15+0\end{bmatrix}$	
		$=\begin{bmatrix}-1 & -5\\13 & -15\end{bmatrix}$	1
		$AB\neq BA$	
	e)	Resolve into partial fraction $\dfrac{x+4}{x(x+1)}$	**02**
	Ans	$\dfrac{x+4}{x(x+1)}=\dfrac{A}{x}+\dfrac{B}{x+1}$	½
		$\therefore x+4=A(x+1)+B(x)$	

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1.	e)	Put $x=0$ $\boxed{A=4}$	½
		Put $x=-1$ $\boxed{B=-3}$	½
		$\therefore \dfrac{x+4}{x(x+1)}=\dfrac{4}{x}+\dfrac{-3}{x+1}$	½
	f)	Define Allied angle.	**02**
	Ans	If the sum or difference of the measures of two angles is either zero or is an integral multiple of 90^0,i.e , $n.\dfrac{\pi}{2}$ where $n\in I$, called as Allied angles.	02
	g)	Prove that $\sin 2\theta = 2\sin\theta\cos\theta$	**02**
	Ans	$\sin 2\theta=\sin(\theta+\theta)$	½
		$=\sin\theta\cos\theta+\cos\theta\sin\theta$	1
		$=2\sin\theta\cos\theta$	½
	h)	If $\sin 80^0+\sin 50^0=2\sin\alpha\cos\beta$, find α , β	**02**
	Ans	$\sin 80^0+\sin 50^0=2\sin\alpha\cos\beta$	
		$\sin(\alpha+\beta)+\sin(\alpha-\beta)=2\sin\alpha\cos\beta$	
		$\therefore \alpha+\beta=80^0$ & $\alpha-\beta=50^0$	1
		$\therefore \alpha=65^0$ & $\beta=15^0$	1
		OR	
		$\sin 80^0+\sin 50^0=2\sin\alpha\cos\beta$	
		$2\sin\left(\dfrac{80+50}{2}\right)\cos\left(\dfrac{80-50}{2}\right)=2\sin\alpha\cos\beta$	½
		$2\sin 65\cos 15=2\sin\alpha\cos\beta$	½
		$\therefore \alpha=65^0$ & $\beta=15^0$	1
	i)	Prove that $\sin^{-1}(-x)=-\sin^{-1}x$	**02**
	Ans	Let $\sin^{-1}(-x)=\theta$	
		$\therefore -x=\sin\theta$	½
		$\therefore x=-\sin\theta$	
		$\therefore x=\sin(-\theta)$	½

Q. No.	Sub Q. N.	Answers	Marking Scheme
1.	i)	$-\theta = \sin^{-1} x$	½
		$\theta = -\sin^{-1} x$	½
		$\sin^{-1}(-x) = -\sin^{-1} x$	
		OR	
		$\sin(-\theta) = -\sin\theta \quad ----(1)$	½
		put $\sin\theta = x$	
		$\therefore \theta = \sin^{-1} x$	½
		$(1) \Rightarrow$	
		$\sin(-\sin^{-1} x) = -x$	½
		$-\sin^{-1} x = \sin^{-1}(-x)$	½
		$\therefore \sin^{-1}(-x) = -\sin^{-1} x$	
	j)	Evaluate $2\cos 75^0 . \cos 15^0$ without using calculator.	**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
		$= 0 + \frac{1}{2}$	
		$= \frac{1}{2}$	1
	k)	Prove that the lines $3x - 2y + 6 = 0$ and $2x + 3y - 1 = 0$ are perpendicular to each other.	**02**
	Ans	$L_1 : 3x - 2y + 6 = 0$	
		$L_2 : 2x + 3y - 1 = 0$	

Q. No.	Sub Q.N.	Answers	Marking Scheme
1.	k)		
		$m_1 = \frac{-3}{-2} = \frac{3}{2}$	½
		$m_2 = \frac{-2}{3}$	½
		consider $m_1.m_2 = \frac{3}{2}.\frac{-2}{3} = -1$	½
		$\therefore$ Lines are perpendicular to each other.	½
	l)	Find the coefficient of range of the following distribution. 120,100,130,50,150	**02**
	Ans	coefficient of range $= \frac{L-S}{L+S}$	
		$= \frac{150-50}{150+50}$	1
		$= \frac{100}{200} = \frac{1}{2}$ or 0.5	1
2.		**Attempt any FOUR of the following :**	**16**
	a)	Solve the following equations by using Cramer's rule	**04**
		$3x + y + z = 4,\ \ 2x - 3y + z = 7,\ \ x + y + 3z = 6$	
	Ans	$D = \begin{vmatrix} 3 & 1 & 1 \\ 2 & -3 & 1 \\ 1 & 1 & 3 \end{vmatrix} = 3(-9-1) - 1(6-1) + 1(2+3) = -30$	1
		$D_x = \begin{vmatrix} 4 & 1 & 1 \\ 7 & -3 & 1 \\ 6 & 1 & 3 \end{vmatrix} = 4(-9-1) - 1(21-6) + 1(7+18) = -30$	
		$\therefore x = \frac{D_x}{D} = \frac{-30}{-30} = 1$	1
		$D_y = \begin{vmatrix} 3 & 4 & 1 \\ 2 & 7 & 1 \\ 1 & 6 & 3 \end{vmatrix} = 3(21-6) - 4(6-1) + 1(12-7) = 30$	
		$\therefore y = \frac{D_y}{D} = \frac{30}{-30} = -1$	1

Q. No.	Sub Q. N.	Answers	Marking Scheme
2.	a)	$D_z=\begin{vmatrix}3&1&4\\2&-3&7\\1&1&6\end{vmatrix}=3(-18-7)-1(12-7)+4(2+3)=-60$	
		$\therefore z=\frac{D_z}{D}=\frac{-60}{-30}=2$	1
	b)	If $A=\begin{bmatrix}1&2&-1\\3&0&2\\4&5&0\end{bmatrix}$, $B=\begin{bmatrix}1&0&0\\2&1&0\\0&1&3\end{bmatrix}$ verify that $(AB)^T=B^TA^T$	**04**
	Ans	$AB=\begin{bmatrix}1&2&-1\\3&0&2\\4&5&0\end{bmatrix}\begin{bmatrix}1&0&0\\2&1&0\\0&1&3\end{bmatrix}$	
		$=\begin{bmatrix}1+4+0&0+2-1&0+0-3\\3+0+0&0+0+2&0+0+6\\4+10+0&0+5+0&0+0+0\end{bmatrix}$	
		$AB=\begin{bmatrix}5&1&-3\\3&2&6\\14&5&0\end{bmatrix}$	1
		$(AB)^T=\begin{bmatrix}5&3&14\\1&2&5\\-3&6&0\end{bmatrix}$	1
		$B^TA^T=\begin{bmatrix}1&2&0\\0&1&1\\0&0&3\end{bmatrix}\begin{bmatrix}1&3&4\\2&0&5\\-1&2&0\end{bmatrix}$	1
		$=\begin{bmatrix}1+4+0&3+0+0&4+10+0\\0+2-1&0+0+2&0+5+0\\0+0-3&0+0+6&0+0+0\end{bmatrix}$	
		$=\begin{bmatrix}5&3&14\\1&2&5\\-3&6&0\end{bmatrix}$	1
		$(AB)^T=B^TA^T$	

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2.	c)	If A = $\begin{bmatrix} 0 & 1 & -1 \\ 4 & -3 & 4 \\ 3 & -3 & 4 \end{bmatrix}$ prove that $A^2 = I$	**04**
	Ans	$A = \begin{bmatrix} 0 & 1 & -1 \\ 4 & -3 & 4 \\ 3 & -3 & 4 \end{bmatrix}$	
		$A^2 = AA = \begin{bmatrix} 0 & 1 & -1 \\ 4 & -3 & 4 \\ 3 & -3 & 4 \end{bmatrix}\begin{bmatrix} 0 & 1 & -1 \\ 4 & -3 & 4 \\ 3 & -3 & 4 \end{bmatrix}$	1
		$= \begin{bmatrix} 0+4-3 & 0-3+3 & 0+4-4 \\ 0-12+12 & 4+9-12 & -4-12+16 \\ 0-12+12 & 3+9-12 & -3-12+16 \end{bmatrix}$	2
		$= \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix} = I$	1
		--	
	d)	If A = $\begin{bmatrix} 2 & 4 & 4 \\ 4 & 2 & 4 \\ 4 & 4 & 2 \end{bmatrix}$, show that $A^2 - 8A$ is a scalar matrix	**04**
	Ans	$A = \begin{bmatrix} 2 & 4 & 4 \\ 4 & 2 & 4 \\ 4 & 4 & 2 \end{bmatrix}$	
		$A^2 = AA = \begin{bmatrix} 2 & 4 & 4 \\ 4 & 2 & 4 \\ 4 & 4 & 2 \end{bmatrix}\begin{bmatrix} 2 & 4 & 4 \\ 4 & 2 & 4 \\ 4 & 4 & 2 \end{bmatrix}$	
		$= \begin{bmatrix} 4+16+16 & 8+8+16 & 8+16+8 \\ 8+8+16 & 16+4+16 & 16+8+8 \\ 8+16+8 & 16+8+8 & 16+16+4 \end{bmatrix}$	1
		$= \begin{bmatrix} 36 & 32 & 32 \\ 32 & 36 & 32 \\ 32 & 32 & 36 \end{bmatrix}$	1

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

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Q. No.	Sub Q.N.	Answers	Marking Scheme
2.	e)	$\therefore \frac{2x-3}{(x^2-1)(x+1)} = \frac{\frac{-1}{4}}{x-1} + \frac{\frac{1}{4}}{(x+1)} + \frac{\frac{5}{2}}{(x+1)^2}$	½
	f)	Resolve into partial fraction $\frac{3x-1}{(x-4)(2x+1)(x-1)}$	**04**
	Ans	Let $\frac{3x-1}{(x-4)(2x+1)(x-1)} = \frac{A}{x-4} + \frac{B}{2x+1} + \frac{C}{x-1}$	½
		$\therefore 3x-1 = A(2x+1)(x-1) + B(x-4)(x-1) + C(x-4)(2x+1)$	
		Put $x=4$ $3(4)-1 = A(2(4)+1)(4-1)$ $11 = A(9)(3)$ $11 = A(27)$ $\therefore A = \frac{11}{27}$	1
		Put $x = \frac{-1}{2}$ $3\left(\frac{-1}{2}\right)-1 = B\left(\frac{-1}{2}-4\right)\left(\frac{-1}{2}-1\right)$ $\frac{-5}{2} = B\left(\frac{-9}{2}\right)\left(\frac{-3}{2}\right)$ $\frac{-5}{2} = B\left(\frac{27}{4}\right)$ $\therefore B = \frac{-10}{27}$	1
		Put $x=1$ $3(1)-1 = C(1-4)(2(1)+1)$ $2 = C(-3)(3)$ $\therefore C = \frac{-2}{9}$	1

Q. No.	Sub Q. N.	Answers	Marking Scheme
2.	f)	$\therefore \frac{3x-1}{(x-4)(2x+1)(x-1)}=\frac{\frac{11}{27}}{x-4}+\frac{\frac{-10}{27}}{2x+1}+\frac{\frac{-2}{9}}{x-1}$	½
3.		**Attempt any <u>FOUR</u> of the following :**	**16**
	a)	Using matrix inversion method, solve the following equations. $3x+y+2z=3\ ,\ 2x-3y-z=-3\ ,\ x+2y+z=4$	**04**
	Ans	Let $A=\begin{bmatrix}3&1&2\\2&-3&-1\\1&2&1\end{bmatrix}$	
		$\|A\|=3(-3+2)-1(2+1)+2(4+3)$ $\therefore \|A\|=8$	½
		$A=\begin{bmatrix}3&1&2\\2&-3&-1\\1&2&1\end{bmatrix}$	
		Matrix of minors $=\begin{bmatrix}\begin{vmatrix}-3&-1\\2&1\end{vmatrix}&\begin{vmatrix}2&-1\\1&1\end{vmatrix}&\begin{vmatrix}2&-3\\1&2\end{vmatrix}\\\begin{vmatrix}1&2\\2&1\end{vmatrix}&\begin{vmatrix}3&2\\1&1\end{vmatrix}&\begin{vmatrix}3&1\\1&2\end{vmatrix}\\\begin{vmatrix}1&2\\-3&-1\end{vmatrix}&\begin{vmatrix}3&2\\2&-1\end{vmatrix}&\begin{vmatrix}3&1\\2&-3\end{vmatrix}\end{bmatrix}$	
		$=\begin{bmatrix}-1&3&7\\-3&1&5\\5&-7&-11\end{bmatrix}$	½
		Matrix of cofactors $=\begin{bmatrix}-1&-3&7\\3&1&-5\\5&7&-11\end{bmatrix}$	½
		OR	
		$C_{11}=+\begin{vmatrix}-3&-1\\2&1\end{vmatrix}=-3+2=-1,\ C_{12}=-\begin{vmatrix}2&-1\\1&1\end{vmatrix}=-(2+1)=-3$	

Q. No.	Sub Q.N.	Answers	Marking Scheme
3.	a)	$C_{13}=+\begin{vmatrix}2&-3\\1&2\end{vmatrix}=4+3=7,\ C_{21}=-\begin{vmatrix}1&2\\2&1\end{vmatrix}=-(1-4)=3$	
		$C_{22}=+\begin{vmatrix}3&2\\1&1\end{vmatrix}=3-2=1,\ C_{23}=-\begin{vmatrix}3&1\\1&2\end{vmatrix}=-(6-1)=-5$	
		$C_{31}=+\begin{vmatrix}1&2\\-3&-1\end{vmatrix}=(-1+6)=5,\ C_{32}=-\begin{vmatrix}3&2\\2&-1\end{vmatrix}=-(-3-4)=7$	
		$C_{33}=+\begin{vmatrix}3&1\\2&-3\end{vmatrix}=-9-2=-11,$	
		$\text{Matrix of cofactors}=\begin{bmatrix}-1&-3&7\\3&1&-5\\5&7&-11\end{bmatrix}$	1
		$\text{Adj}.A=\begin{bmatrix}-1&3&5\\-3&1&7\\7&-5&-11\end{bmatrix}$	½
		$A^{-1}=\frac{1}{\lvert A\rvert}\text{Adj}.A$	
		$\therefore A^{-1}=\frac{1}{8}\begin{bmatrix}-1&3&5\\-3&1&7\\7&-5&-11\end{bmatrix}$	½
		$X=A^{-1}B$	
		$\therefore\begin{bmatrix}x\\y\\z\end{bmatrix}=\frac{1}{8}\begin{bmatrix}-1&3&5\\-3&1&7\\7&-5&-11\end{bmatrix}\begin{bmatrix}3\\-3\\4\end{bmatrix}$	½
		$\therefore\begin{bmatrix}x\\y\\z\end{bmatrix}=\frac{1}{8}\begin{bmatrix}-3-9+20\\-9-3+28\\21+15-44\end{bmatrix}$	
		$\therefore\begin{bmatrix}x\\y\\z\end{bmatrix}=\frac{1}{8}\begin{bmatrix}8\\16\\-8\end{bmatrix}$	½

Q. No.	Sub Q.N.	Answers	Marking Scheme
3.	a)	$\therefore \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 1 \\ 2 \\ -1 \end{bmatrix}$	½
		$\therefore\ x=1,\ y=2,\ z=-1$	
		--	
	b)	Resolve into partial fraction : $\dfrac{x-2}{x^3+1}$	**04**
	Ans	$\dfrac{x-2}{x^3+1}=\dfrac{x-2}{(x+1)(x^2-x+1)}$	
		$\therefore \dfrac{x-2}{(x+1)(x^2-x+1)}=\dfrac{A}{x+1}+\dfrac{Bx+C}{x^2-x+1}$	½
		$\therefore x-2=A(x^2-x+1)+(Bx+C)(x+1)$	
		Put $x=-1$	
		$\therefore -3=3A$	
		$\therefore A=-1$	1
		Put $x=0$	
		$-2=(1)A+(1)C$	
		$-2=(1)(-1)+C$	
		$\therefore C=-1$	1
		Put $x=1$	
		$\therefore 1-2=(1)A+2(B+C)$	
		$\therefore -1=A+2B+2C$	
		$\therefore -1=-1+2B-2$	
		$\therefore -1+3=2B$	
		$\therefore 2=2B$	
		$\therefore B=1$	1
		$\therefore \dfrac{x-2}{(x+1)(x^2-x+1)}=\dfrac{-1}{x+1}+\dfrac{x-1}{x^2-x+1}$	½
		--	
	c)	Resolve into partial fraction : $\dfrac{x^4}{x^2-1}$	**04**

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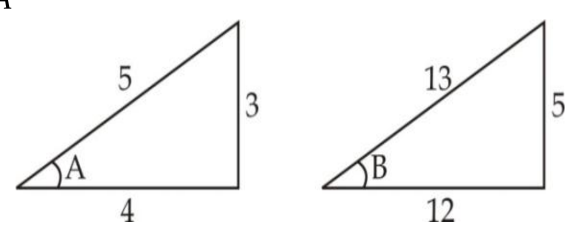
3.	c) Ans	$x^2-1\overline{)\,x^4\,}\,(x^2+1$	
		x^4-x^2	1
		$-\quad+$	
		x^2	
		x^2-1	
		$-\quad+$	
		1	
		$\therefore \dfrac{x^4}{x^2-1}=\left(x^2+1\right)+\dfrac{1}{x^2-1}$	½
		Let $\dfrac{1}{x^2-1}=\dfrac{1}{(x+1)(x-1)}=\dfrac{A}{x+1}+\dfrac{B}{x-1}$	½
		$\therefore\quad 1=A(x-1)+B(x+1)$	
		put $x=-1$	
		$\therefore\quad 1=A(-1-1)$	
		$\therefore A=-\dfrac{1}{2}$	½
		put $x=1$	
		$\therefore\quad 1=B(1+1)$	
		$\therefore B=\dfrac{1}{2}$	½
		$\dfrac{1}{x^2-1}=\dfrac{\frac{-1}{2}}{x+1}+\dfrac{\frac{1}{2}}{x-1}=\dfrac{1}{2}\left(\dfrac{1}{x-1}-\dfrac{1}{x+1}\right)$	½
		$\therefore \dfrac{x^4}{x^2-1}=\left(x^2+1\right)+\dfrac{1}{2}\left(\dfrac{1}{x-1}-\dfrac{1}{x+1}\right)$	½
	d)	Prove that $\sin(A+B).\sin(A-B)=\cos^2 B-\cos^2 A$	**04**
	Ans	$\text{LHS}=\sin(A+B).\sin(A-B)$	
		$=(\sin A.\cos B+\cos A.\sin B)(\sin A.\cos B-\cos A.\sin B)$	1
		$=(\sin A.\cos B)^2-(\cos A.\sin B)^2$	1
		$=\sin^2\text{A}\cos^2 B-\cos^2 A\sin^2 B$	

Q. No.	Sub Q.N.	Answers	Marking Scheme
3.	d)	$\text{LHS}=\left(1-\cos^2 A\right)\cos^2 B-\cos^2 A\left(1-\cos^2 B\right)$	1
		$=\cos^2 B-\cos^2 B.\cos^2 A-\cos^2 A+\cos^2 B.\cos^2 A$	
		$=\cos^2 B-\cos^2 A$	1
		$=\text{RHS}$	
	e)	Prove that $\tan 70^0-\tan 50^0-\tan 20^0=\tan 70^0.\tan 50^0.\tan 20^0$	**04**
	Ans	consider $\tan 70^0=\tan\left(50^0+20^0\right)$	½
		$\tan 70^0=\dfrac{\tan 50^0+\tan 20^0}{1-\tan 50^0.\tan 20^0}$	1
		$\tan 70^0\left(1-\tan 50^0.\tan 20^0\right)=\tan 50^0+\tan 20^0$	1
		$\tan 70^0-\tan 70^0.\tan 50^0.\tan 20^0=\tan 50^0+\tan 20^0$	½
		$\tan 70^0-\tan 50^0-\tan 20^0=\tan 70^0.\tan 50^0.\tan 20^0$	1
	f)	Prove that $\tan^{-1}\left(\dfrac{1}{7}\right)+\tan^{-1}\left(\dfrac{1}{13}\right)=\cot^{-1}\left(\dfrac{9}{2}\right)$	**04**
	Ans	$\text{LHS}=\tan^{-1}\left(\dfrac{1}{7}\right)+\tan^{-1}\left(\dfrac{1}{13}\right)$	
		$=\tan^{-1}\left(\dfrac{\frac{1}{7}+\frac{1}{13}}{1-\frac{1}{7}\cdot\frac{1}{13}}\right)$	1
		$=\tan^{-1}\left(\dfrac{20}{90}\right)$	
		$=\tan^{-1}\left(\dfrac{2}{9}\right)$	2
		$=\cot^{-1}\left(\dfrac{9}{2}\right)=\text{RHS}$	1
4.		**Attempt any FOUR of the following:**	**16**
	a)	Prove that $\cos 2A=2\cos^2 A-1$	**04**
	Ans	$\text{LHS}=\cos 2A$	
		$=\cos\left(A+A\right)$	½

Q. No.	Sub Q.N.	Answers	Marking Scheme
4.	a)	$\text{LHS} = \cos A \cdot \cos A - \sin A \cdot \sin A$	1
		$= \cos^2 A - \sin^2 A$	½
		$= \cos^2 A - \left(1 - \cos^2 A\right)$	1
		$= 2\cos^2 A - 1 = \text{RHS}$	1
		--	
	b)	If $\tan(x+y) = \frac{3}{4}$ and $\tan(x-y) = \frac{8}{15}$, show that $\tan 2x = \frac{77}{36}$	**04**
	Ans	$\text{LHS} = \tan 2x$	
		$= \tan\left[(x+y) + (x-y)\right]$	1
		$= \dfrac{\tan(x+y) + \tan(x-y)}{1 - \tan(x+y)\tan(x-y)}$	1
		$= \dfrac{\frac{3}{4} + \frac{8}{15}}{1 - \frac{3}{4} \times \frac{8}{15}}$	1
		$= \dfrac{77}{36}$	1
		$= \text{RHS}$	
		--	
	c)	In any ΔABC, prove that $\tan A + \tan B + \tan C = \tan A.\tan B.\tan C$	**04**
	Ans	In any ΔABC	
		$A + B + C = 180^0$ or π	
		$\therefore A + B = 180^0 - C$	1
		$\therefore \tan(A+B) = \tan\left(180^0 - C\right)$	½
		$\therefore \dfrac{\tan A + \tan B}{1 - \tan A.\tan B} = -\tan C$	1
		$\therefore \tan A + \tan B = -\tan C\left(1 - \tan A.\tan B\right)$	
		$\therefore \tan A + \tan B = -\tan C + \tan A.\tan B.\tan C$	½
		$\therefore \tan A + \tan B + \tan C = \tan A.\tan B.\tan C$	1
		--	

Q. No.	Sub Q.N.	Answers	Marking Scheme
4.	d)	Prove that $\frac{\cos 2A+2\cos 4A+\cos 6A}{\cos A+2\cos 3A+\cos 5A}=\cos A-\tan 3A.\sin A$	**04**
	Ans	$\text{LHS}=\frac{\cos 2A+2\cos 4A+\cos 6A}{\cos A+2\cos 3A+\cos 5A}$	
		$=\frac{\cos 2A+\cos 6A+2\cos 4A}{\cos A+\cos 5A+2\cos 3A}$	
		$=\frac{2.\cos\left(\frac{2A+6A}{2}\right).\cos\left(\frac{2A-6A}{2}\right)+2\cos 4A}{2.\cos\left(\frac{A+5A}{2}\right).\cos\left(\frac{A-5A}{2}\right)+2\cos 3A}$	1
		$=\frac{2\cos 4A.\cos(-2A)+2\cos 4A}{2\cos 3A.\cos(-2A)+2\cos 3A}$	½
		$=\frac{2\cos 4A\left[\cos(-2A)+1\right]}{2\cos 3A\left[\cos(-2A)+1\right]}$	
		$=\frac{\cos(3A+A)}{\cos 3A}$	1
		$=\frac{\cos 3A.\cos A}{\cos 3A}-\frac{\sin 3A.\sin A}{\cos 3A}$	1
		$=\cos A-\tan 3A.\sin A=$ RHS	½
		--	
	e)	Prove that $\cos^{-1}\left(\frac{4}{5}\right)+\cos^{-1}\left(\frac{12}{13}\right)=\cos^{-1}\left(\frac{33}{65}\right)$ (without using calculator.)	**04**
	Ans	Let $\cos^{-1}\left(\frac{4}{5}\right)=A$	
		$\therefore \cos A=\frac{4}{5}$	
		$\therefore \sin^2 A=1-\cos^2 A$	
		$=1-\frac{16}{25}$	
		$=\frac{9}{25}$	
		$\therefore \sin A=\frac{3}{5}$	1

Q. No.	Sub Q.N.	Answers	Marking Scheme
4.	e)	$\cos^{-1}\left(\frac{12}{13}\right)=B$	
		$\therefore \cos B=\frac{12}{13}$	
		$\therefore \sin^2 B=1-\cos^2 B$	
		$=1-\frac{144}{169}$	
		$=\frac{25}{169}$	
		$\therefore \sin B=\frac{5}{13}$	1
		$\therefore \cos(A+B)=\cos A\cos B-\sin A\sin B$	
		$=\frac{4}{5}\frac{12}{13}-\frac{3}{5}\frac{5}{13}$	1
		$=\frac{48}{65}-\frac{15}{65}$	
		$\therefore \cos(A+B)=\frac{33}{65}$	
		$\therefore A+B=\cos^{-1}\left(\frac{33}{65}\right)$	1
		$\therefore \cos^{-1}\left(\frac{4}{5}\right)+\cos^{-1}\left(\frac{12}{13}\right)=\cos^{-1}\left(\frac{33}{65}\right)$	
		OR	
		Let $\cos^{-1}\left(\frac{4}{5}\right)=A$	
		$\therefore \cos A=\frac{4}{5}$	
			
		$\therefore \tan A=\frac{3}{4}$	
		$A=\tan^{-1}\left(\frac{3}{4}\right)$	
		$\therefore \cos^{-1}\left(\frac{4}{5}\right)=\tan^{-1}\left(\frac{3}{4}\right)$	1

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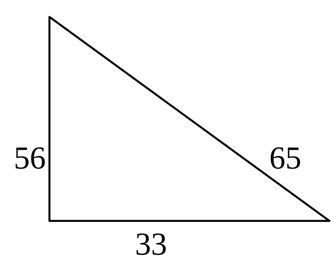
Q. No.	Sub Q. N.	Answers	Marking Scheme
4.	e)	$\cos^{-1}\left(\frac{12}{13}\right)=B$	
		$\therefore \cos B=\frac{12}{13}$	
		$\therefore \tan B=\frac{5}{12}$	
		$B=\tan^{-1}\left(\frac{5}{12}\right)$	
		$\therefore \cos^{-1}\left(\frac{12}{13}\right)=\tan^{-1}\left(\frac{5}{12}\right)$	1
		$L.H.S.=\tan^{-1}\left(\frac{3}{4}\right)+\tan^{-1}\left(\frac{5}{12}\right)$	
		$=\tan^{-1}\left(\frac{\frac{3}{4}+\frac{5}{12}}{1-\frac{3}{4}\frac{5}{12}}\right)$	
		$=\tan^{-1}\left(\frac{56}{33}\right)$	1
		Let $\tan^{-1}\left(\frac{56}{33}\right)=C$ 	
		$\therefore \tan C=\frac{56}{33}$	
		$\therefore \cos C=\frac{33}{65}$	
		$\therefore C=\cos^{-1}\left(\frac{33}{65}\right)$	1
		$\therefore \cos^{-1}\left(\frac{4}{5}\right)+\cos^{-1}\left(\frac{12}{13}\right)=\cos^{-1}\left(\frac{33}{65}\right)$	
		--	
	f)	Prove that $\tan^{-1}\left(\frac{1}{2}\right)+\tan^{-1}\left(\frac{1}{3}\right)=\frac{\pi}{4}$	**04**
	Ans	$LHS=\tan^{-1}\left(\frac{1}{2}\right)+\tan^{-1}\left(\frac{1}{3}\right)$	

Q. No.	Sub Q. N.	Answers	Marking Scheme
4.	f)	$=\tan^{-1}\left[\dfrac{\frac{1}{2}+\frac{1}{3}}{1-\frac{1}{2}\times\frac{1}{3}}\right]$	1
		$=\tan^{-1}\left[\dfrac{\frac{5}{6}}{1-\frac{1}{6}}\right]$	
		$=\tan^{-1}(1)$	2
		$=\dfrac{\pi}{4}$	1
5.		**Attempt any <u>FOUR</u> of the following:**	**16**
	a)	Prove that $\sin C+\sin D=2\sin\left(\dfrac{C+D}{2}\right)\cos\left(\dfrac{C-D}{2}\right)$	**04**
	Ans	We know that,	
		$\sin(A+B)+\sin(A-B)=2\sin A\cos B------(1)$	1
		Put $A+B=C$ $A-B=D$	
		$\therefore A=\dfrac{C+D}{2}$ and	1
		$B=\dfrac{C-D}{2}$	1
		$\therefore(1)\Rightarrow$	
		$\therefore\sin C+\sin D=2\sin\left(\dfrac{C+D}{2}\right)\cos\left(\dfrac{C-D}{2}\right)$	1
	b)	Prove that $\dfrac{\sin x-\sin 5x+\sin 9x-\sin 13x}{\cos x-\cos 5x-\cos 9x+\cos 13x}=\cot 4x$	**04**
	Ans	$LHS=\dfrac{\sin x-\sin 5x+\sin 9x-\sin 13x}{\cos x-\cos 5x-\cos 9x+\cos 13x}$	

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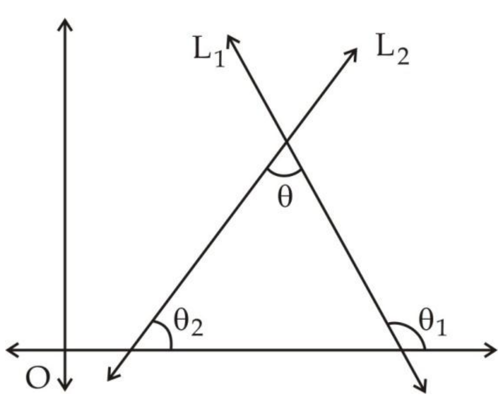
Q. No.	Sub Q. N.	Answers	Marking Scheme
5.	b)	$\text{LHS}=\dfrac{(\sin x+\sin 9x)-(\sin 5x+\sin 13x)}{(\cos x-\cos 9x)-(\cos 5x-\cos 13x)}$	
		$=\dfrac{2.\sin\left(\frac{x+9x}{2}\right).\cos\left(\frac{x-9x}{2}\right)-2.\sin\left(\frac{5x+13x}{2}\right).\cos\left(\frac{5x-13x}{2}\right)}{2.\sin\left(\frac{x+9x}{2}\right).\sin\left(\frac{9x-x}{2}\right)-2.\sin\left(\frac{5x+13x}{2}\right).\sin\left(\frac{13x-5x}{2}\right)}$	1
		$=\dfrac{\sin 5x.\cos(-4x)-\sin 9x.\cos(-4x)}{\sin 5x.\sin 4x-\sin 9x.\sin 4x}$	1
		$=\dfrac{\cos(-4x)[\sin 5x-\sin 9x]}{\sin 4\text{x}[\sin 5x-\sin 9x]}$	1
		$=\dfrac{\cos 4x}{\sin 4x}$	
		$=\cot 4x=\text{RHS}$	1
	c)	Prove that $\tan^{-1}(x)+\tan^{-1}(y)=\tan^{-1}\left(\dfrac{x+y}{1-xy}\right)$ if $x>0,\ \text{y}>0$ and $xy<1.$	**04**
	Ans	Let $\tan^{-1}x=A$ & $\tan^{-1}y=B$ $\therefore\ x=\tan A$ $\therefore\ y=\tan B$	1
		Consider $\tan(A+B)=\dfrac{\tan A+\tan B}{1-\tan A\tan B}$	
		$=\dfrac{x+y}{1-xy}$	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
	d)	Find the distance between two parallel line $3x-y+7=0$ and $3x-y+16=0$	**04**
	Ans	$L_1:3x-y+7=0$ & $L_2:3x-y+16=0$ $\therefore\ c_1=7$ & $c_2=16$	

Q. No.	Sub Q. N.	Answers	Marking Scheme
5.	d)	$p=\left\|\frac{c_2-c_1}{\sqrt{a^2+b^2}}\right\|$ OR $p=\left\|\frac{c_1-c_2}{\sqrt{a^2+b^2}}\right\|$	
		$=\left\|\frac{16-7}{\sqrt{3^2+(-1)^2}}\right\|$ $=\left\|\frac{7-16}{\sqrt{3^2+(-1)^2}}\right\|$	2
		$=\left\|\frac{9}{\sqrt{10}}\right\|$ $=\left\|\frac{-9}{\sqrt{10}}\right\|$	
		$=\frac{9}{\sqrt{10}}$ OR 2.846	2
	e)	Find the acute angle between the lines $3x-4y=420$ and $4x+3y=420$	**04**
	Ans	For $3x-4y=420$	
		slope $m_1=-\frac{a}{b}=-\frac{3}{-4}=\frac{3}{4}$	1
		For $4x+3y=420$	
		slope $m_2=-\frac{a}{b}=-\frac{4}{3}$	1
		$\tan\theta=\left\|\frac{m_1-m_2}{1+m_1m_2}\right\|$	
		$=\left\|\frac{\frac{3}{4}-\left(\frac{4}{-3}\right)}{1+\frac{3}{4}\times\left(\frac{4}{-3}\right)}\right\|$	1
		$=\infty$	1
		$\therefore\ \theta=\tan^{-1}(\infty)$	
		$\therefore\ \theta=\frac{\pi}{2}$ or 90^0	
	f)	Find the equation of a line passing through $(2,5)$ and the point of intersection of $x+y=0$ and $2x-y=9$.	**04**
	Ans	$x+y=0$, $2x-y=9$	

Q. No.	Sub Q. N.	Answers	Marking Scheme
5.	f)	$\therefore \quad x+y=0$ $\underline{2x-y=9}$ $\therefore \quad 3x=9$	
		$\Rightarrow x=3 \qquad \therefore\ y=-3$	1
		$\therefore$ point of intersection $=(3,-3)=(x_1,y_1)$	1
		and given point $=(2,5)=(x_2,y_2)$ $\therefore$ Equation of line is $\dfrac{y-y_1}{y_2-y_1}=\dfrac{x-x_1}{x_2-x_1}$	
		$\therefore \dfrac{y-(-3)}{5-(-3)}=\dfrac{x-3}{2-3}$	1
		$\therefore \dfrac{y+3}{8}=\dfrac{x-3}{-1}$ $\therefore -1(y+3)=8(x-3)$ $\therefore -y-3=8x-24$	
		$\therefore \quad 8x+y=21$	1
		--	
6.		**Attempt any <u>FOUR</u> of the following:**	**16**
	a)	If m_1 and m_2 are the slope of two lines then prove that angle between two lines is $\theta=\tan^{-1}\left\|\dfrac{m_1-m_2}{1+m_1m_2}\right\|$	**04**
	Ans		1
		Let θ_1 = Angle of inclination of L_1 θ_2 = Angle of inclination of L_2	

Q. No.	Sub Q. N.	Answers	Marking Scheme
6.	a)	$\therefore$ Slope of L_1 is $m_1 = \tan\theta_1$ Slope of L_2 is $m_2 = \tan\theta_2$	½
		$\therefore$ from figure	
		$\theta = \theta_1 - \theta_2$	
		$\therefore \tan\theta = \tan(\theta_1 - \theta_2)$	½
		$= \dfrac{\tan(\theta_1) - \tan(\theta_2)}{1 + \tan(\theta_1)\tan(\theta_2)}$	1
		$= \dfrac{m_1 - m_2}{1 + m_1 \cdot m_2}$	
		$\because \theta$ is acute	
		$\therefore \tan\theta = \left\lvert \dfrac{m_1 - m_2}{1 + m_1 \cdot m_2} \right\rvert$	½
		$\therefore \theta = \tan^{-1}\left\lvert \dfrac{m_1 - m_2}{1 + m_1 \cdot m_2} \right\rvert$	½
	b)	Find the equation of a line passing through the poing of intersection of lines $x - 2y - 5 = 0$ and $x + 3y = 10$ and parallel to the line $3x + 4y = 0$.	**04**
	Ans	$x - 2y = 5 \quad \times \ 3$ $x + 3y = 10 \quad \times \ 2$	
		$\therefore \quad 3x - 6y = 15$ $+ \ 2x + 6y = 20$ $5x = 35$ $x = 7$	1
		$\therefore \quad 7 - 2y = 5$ $\therefore -2y = -2$ $\therefore y = 1$	1
		$\therefore$ Point of intersection $= (7, 1)$	

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Q. No.	Sub Q. N.	Answers	Marking Scheme
6.	b)	Slope of the line $3x+4y=0$ is,	
		$m_1 = -\frac{a}{b} = -\frac{3}{4}$	½
		$\therefore$ Slope of the required line is,	
		$m = m_1 = -\frac{3}{4}$	½
		$\therefore$ equation of line is ,	
		$y - y_1 = m(x - x_1)$	
		$\therefore y - 1 = -\frac{3}{4}(x-7)$	½
		$\therefore 3x + 4y - 25 = 0$	½
		--	
	c)	The runs scored by two batsman A and B in 5 one day matches are are given below.	

A	48	50	39	46	37
B	50	52	60	55	53

Who is more consistent? Why? **04**

Ans

For Batsman A

x_i	$d_i = x_i - \bar{x}$	d_i^2
48	4	16
50	6	36
39	-5	25
46	2	4
37	-7	49
$\sum x_i = 220$		$\sum d_i^2 = 130$

½

$$\therefore \quad Mean, \bar{x} = \frac{\sum x_i}{N} = \frac{220}{5} = 44$$

$$\therefore \quad S.D. = \sqrt{\frac{\sum d_i^2}{N}} = \sqrt{\frac{130}{5}} = 5.099$$ OR ½

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Q. No.	Sub Q. N.	Answers	Marking Scheme
6.	c)	For Batsman A	

x_i	x_i^2
48	2304
50	2500
39	1521
46	2116
37	1369
$\sum x_i = 220$	$\sum x_i^2 = 9810$

½

$$\therefore \quad Mean, \bar{x} = \frac{\sum x_i}{N} = \frac{220}{5} = 44$$

$$\therefore \quad S.D. = \sqrt{\frac{\sum x_i^2}{N} - \left(\bar{x}\right)^2} = \sqrt{\frac{9810}{5} - 44^2} = 5.099$$

½

For Batsman B

x_i	$d_i = x_i - \bar{x}$	d_i^2
50	-4	16
52	-2	4
60	6	36
55	1	1
53	-1	1
$\sum x_i = 270$		$\sum d_i^2 = 58$

½

$$\therefore \quad Mean, \bar{x} = \frac{\sum x_i}{N} = \frac{270}{5} = 54$$

$$\therefore \quad S.D. = \sqrt{\frac{\sum d_i^2}{N}} = \sqrt{\frac{58}{5}} = 3.406$$

½

OR

For Batsman B

Q. No.	Sub Q. N.	Answers	Marking Scheme
6.	c)		

x_i	x_i^2
50	2500
52	2704
60	3600
55	3025
53	2809
$\sum x_i = 270$	$\sum x_i^2 = 14638$

½

$\therefore \quad Mean, \bar{x} = \frac{\sum x_i}{N} = \frac{270}{5} = 54$

$\therefore \quad S.D. = \sqrt{\frac{\sum x_i^2}{N} - \left(\bar{x}\right)^2} = \sqrt{\frac{14638}{5} - 54^2} = 3.406$ ½

For Batsman A

$\text{C.}V.\left(A\right) = \frac{\sigma}{\bar{x}} \times 100$

$= \frac{5.099}{44} \times 100$

$=11.589\%$ ½

For Batsman B

$C.V.\left(B\right) = \frac{\sigma}{\bar{x}} \times 100$

$= \frac{3.406}{54} \times 100$

$=6.307\%$ ½

$C.V.\left(B\right) < \text{C.}V.\left(A\right)$

$\therefore$ Batsman B is more consistent. 1

---

d) Calculate mean and standard deviation of the following frequency distribution. **04**

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

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

Class	x_i	f_i	$x_i f_i$	x_i^2	$f_i x_i^2$
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

Mean $\bar{x} = \frac{\sum f_i x_i}{N} = \frac{2500}{100} = 25$ 1

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

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

$$\sigma = 12.649$$ 1

OR

Class	x_i	f_i	d_i	$f_i d_i$	d_i^2	$f_i d_i^2$
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

Mean $= \bar{x} = A + h\left(\frac{\sum f_i d_i}{N}\right) = 25 + 10 \times \left(\frac{0}{100}\right) = 25$ 1

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

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

$$= 12.649$$ 1

Q. No.	Sub Q. N.	Answers	Marking Scheme

6. e) Find the mean deviation from mean of the following distribution.

Marks	0-10	10-20	20-30	30-40	40-50
No. of students	5	8	15	16	06

04

Ans

Marks	x_i	f_i	$f_i x_i$	$x_i - \bar{x}$	$\lvert x_i - \bar{x}\rvert$	$f_i \lvert x_i - \bar{x}\rvert$
0-10	5	5	25	-22	22	110
10-20	15	8	120	-12	12	96
20-30	25	15	375	-2	2	30
30-40	35	16	560	8	8	128
40-50	45	06	270	18	18	108
		50	1350			472

2

$$\text{Mean} = \frac{\sum f_i x_i}{\sum f_i}$$

$$= \frac{1350}{50}$$

$$= 27$$

1

$$\text{M.D.} = \frac{\sum f_i \lvert x_i - \bar{x}\rvert}{\sum f_i}$$

$$= \frac{472}{50}$$

$$= 9.44$$

1

---

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

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

04

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Q. No.	Sub Q. N.	Answers	Marking Scheme
6.	f) Ans		

Class	x_i	f_i	$f_i x_i$	x_i^2	$f_i x_i^2$
10-20	15	4	60	225	900
20-30	25	6	150	625	3750
30-40	35	10	350	1225	12250
40-50	45	18	810	2025	36450
50-60	55	9	495	3025	27225
60-70	65	3	195	4225	12675
		50	2060		93250

2

$$\text{mean } \bar{x} = \frac{\sum f_i x_i}{N} = \frac{2060}{50}$$

$$\bar{x} = 41.2$$

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

$$= \sqrt{\frac{93250}{50} - (41.2)^2}$$

$$= \sqrt{1865 - 1697.44}$$

$$= \sqrt{167.56}$$

$$\sigma = 12.94$$

1

$$\text{Variance} = \sigma^2 = (12.94)^2 = 167.44$$

½

$$\text{C.V.} = \frac{\text{S.D.}}{\text{Mean}} \times 100$$

$$= \frac{12.94}{41.2} \times 100 = 31.41$$

½

OR

Q. No.	Sub Q. N.	Answers	Marking Scheme
6.	f)	(table below)	2

Class	x_i	f_i	d_i	$f_i d_i$	d_i^2	$f_i d_i^2$
10-20	15	4	-2	-8	4	16
20-30	25	6	-1	-6	1	6
30-40	35	10	0	0	0	0
40-50	45	18	1	18	1	18
50-60	55	9	2	18	4	36
60-70	65	3	3	9	9	27
		50		31		103

$$\text{Mean} = \bar{x} = A + h\left(\frac{\sum f_i d_i}{N}\right) = 35 + 10 \times \left(\frac{31}{50}\right) = 41.2$$

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

$$= \sqrt{\frac{103}{50} - \left(\frac{31}{50}\right)^2} \times 10$$

$$= 12.94$$ — 1

$$\text{Variance} = \sigma^2 = (12.94)^2 = 167.44$$ — ½

$$\text{C.V.} = \frac{\text{S.D.}}{\text{Mean}} \times 100 = \frac{12.94}{41.2} \times 100 = 31.41$$ — ½

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.