SUMMER– 2019 EXAMINATION

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

Important Instructions to examiners:

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

Q. No.	Sub Q.N.	Answers	Marking Scheme
1.		**Attempt any FIVE of the following:**	**10**
	a)	Prove that $\frac{1}{\log_3 6}+\frac{1}{\log_8 6}+\frac{1}{\log_9 6}=3$	**02**
	Ans	$L.H.S=\frac{1}{\log_3 6}+\frac{1}{\log_8 6}+\frac{1}{\log_9 6}$	
		$=\frac{\log 3}{\log 6}+\frac{\log 8}{\log 6}+\frac{\log 9}{\log 6}$	½
		$=\frac{\log(3\times 8\times 9)}{\log 6}$	½
		$=\frac{\log 216}{\log 6}$	
		$=\frac{\log 6^3}{\log 6}$	½
		$=\frac{3\log 6}{\log 6}$	
		$=3=R.H.S$	½
		--	
	b)	Find x, if $\begin{vmatrix}4 & 3 & 9\\ 3 & -2 & 7\\ 11 & 4 & x\end{vmatrix}=0$	**02**

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Q. No.	Sub Q.N.	Answers	Marking Scheme
1.	b) Ans	$\begin{vmatrix} 4 & 3 & 9 \\ 3 & -2 & 7 \\ 11 & 4 & x \end{vmatrix} = 0$	
		$4(-2x-28)-3(3x-77)+9(12+22)=0$	½
		$\therefore -8x-112-9x+231+306=0$	½
		$\therefore -17x+425=0$	
		$\therefore x=25$	1
	c)	Without using calculator,find the value of $\cos(105^0)$	**02**
	Ans	$\cos(105^0)=\cos(60^0+45^0)$	½
		$=\cos 60^0\cos 45^0-\sin 60^0\sin 45^0$	½
		$=\left(\frac{1}{2}\right)\left(\frac{1}{\sqrt{2}}\right)-\left(\frac{\sqrt{3}}{2}\right)\left(\frac{1}{\sqrt{2}}\right)$	½
		$=\frac{1-\sqrt{3}}{2\sqrt{2}}$ or -0.2588	½
	d)	The area of a rectangular garden is 3000 m^2.Its sides are in the ratio 6:5.Find the perimeter of the garden	**02**
	Ans	$\because$ Sides are in the ratio 6:5	
		$\therefore$ length $=6x$,breadth $=5x$	
		Area $=(6x)(5x)$	½
		$3000=30x^2$	
		$\therefore x^2=100$	
		$\therefore\ x=10$	1
		$\therefore$ Length $=60\ m$, Breadth $=50\ m$	
		Perimeter $=2(\text{length}+\text{breadth})$	
		$=2(60+50)=220$	½
	e)	Find the area of ring between two concentric cicles whose circumferences are 75cm and 55 cm.	**02**
	Ans	Area of ring $=A(\text{larger circle})-A(\text{smaller circle})$	

Q. No.	Sub Q.N.	Answers	Marking Scheme
1.	e)	$\therefore$ Area of ring $= \pi r_1^2 - \pi r_2^2 = \pi\left(r_1^2 - r_2^2\right)$	½
		$\because 2\pi r_1 = 75$	
		$\therefore r_1 = \frac{75}{2\pi}$	½
		$\because 2\pi r_2 = 55$	
		$\therefore r_2 = \frac{55}{2\pi}$	½
		Area of ring $= \pi\left(r_1^2 - r_2^2\right)$	
		$= \pi\left(\left(\frac{75}{2\pi}\right)^2 - \left(\frac{55}{2\pi}\right)^2\right)$	
		$= 206.9$	½
	f)	Find the range and coefficient of range	**02**
		40, 52, 47, 28, 45, 36, 47, 50	
	Ans	Range = $L - S$	
		$=52-28$	
		$= 24$	1
		Coefficient of range $= \frac{L-S}{L+S}$	
		$= \frac{52-28}{52+28}$	
		$= 0.3$	1
	g)	The two sets of observations are given below:	**02**
		Set I Set II	
		$\bar{x} = 82.5$ $\bar{x} = 48.75$	
		$\sigma = 7.3$ $\sigma = 8.35$	
		Which of two sets is more consistent?	
	Ans	For Set I	
		$C.V = \frac{\sigma}{\bar{x}} \times 100$	

Q. No.	Sub Q. N.	Answers	Marking Scheme
1.	g)	$C.V.=\frac{7.3}{82.5}\times 100=8.848$	½
		For Set II	
		$C.V.=\frac{\sigma}{\bar{x}}\times 100$	
		$=\frac{8.35}{48.75}\times 100=17.128$	½
		$C.V.$ of Set I < $C.V.$ of Set II	
		$\therefore$ Set I is more consistent.	1
		--	
2.		**Attempt any THREE of the following :**	**12**
	a)	Solve the equations by Cramer's rule: $x+y+z=3, x-y+z=1, x+y-2z=0$	**04**
	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
		$D_x=\begin{vmatrix}3 & 1 & 1\\1 & -1 & 1\\0 & 1 & -2\end{vmatrix}=3(2-1)-1(-2-0)+1(1+0)=6$	
		$\therefore x=\frac{D_x}{D}=\frac{6}{6}=1$	1
		$D_y=\begin{vmatrix}1 & 3 & 1\\1 & 1 & 1\\1 & 0 & -2\end{vmatrix}=1(-2-0)-3(-2-1)+1(0-1)=6$	
		$\therefore y=\frac{D_y}{D}=\frac{6}{6}=1$	1
		$D_z=\begin{vmatrix}1 & 1 & 3\\1 & -1 & 1\\1 & 1 & 0\end{vmatrix}=1(0-1)-1(0-1)+3(1+1)=6$	
		$\therefore z=\frac{D_z}{D}=\frac{6}{6}=1$	1
		--	

Q. No.	Sub Q.N.	Answers	Marking Scheme
2.	b)	If $A=\begin{bmatrix}2&4&4\\4&2&4\\4&4&2\end{bmatrix}$, find A^2-8A.	**04**
	Ans	$A^2=AA=\begin{bmatrix}2&4&4\\4&2&4\\4&4&2\end{bmatrix}\begin{bmatrix}2&4&4\\4&2&4\\4&4&2\end{bmatrix}$	
		$A^2=\begin{bmatrix}4+16+16&8+8+16&8+16+8\\8+8+16&16+4+16&16+8+8\\8+16+8&16+8+8&16+16+4\end{bmatrix}$	1
		$A^2=\begin{bmatrix}36&32&32\\32&36&32\\32&32&36\end{bmatrix}$	1
		$8A=8\begin{bmatrix}2&4&4\\4&2&4\\4&4&2\end{bmatrix}=\begin{bmatrix}16&32&32\\32&16&32\\32&32&16\end{bmatrix}$	1
		$\therefore A^2-8A=\begin{bmatrix}36&32&32\\32&36&32\\32&32&36\end{bmatrix}-\begin{bmatrix}16&32&32\\32&16&32\\32&32&16\end{bmatrix}=\begin{bmatrix}20&0&0\\0&20&0\\0&0&20\end{bmatrix}$	1
		---	
	c)	Resolve into partial fractions $\dfrac{3x+2}{(x+1)(x^2-1)}$	**04**
	Ans	$\dfrac{3x+2}{(x+1)^2(x-1)}=\dfrac{A}{x+1}+\dfrac{B}{(x+1)^2}+\dfrac{C}{x-1}$	½
		$\therefore 3x+2=A(x-1)(x+1)+B(x-1)+C(x+1)^2$	
		Put $x=-1$	
		$\therefore -3+2=B(-1-1)$	
		$\boxed{B=\dfrac{1}{2}}$	1
		Put $x=1$	

Q. No.	Sub Q. N.	Answers	Marking Scheme
2.	c)	$\therefore 3+2=C(1+1)^2$	
		$\boxed{C=\frac{5}{4}}$	1
		Put $x=0, B=\frac{1}{2}, C=\frac{5}{4}$	
		$\therefore 2=A(0-1)(0+1)+\frac{1}{2}(0-1)+\frac{5}{4}(0+1)^2$	
		$\boxed{A=-\frac{5}{4}}$	1
		$\therefore \frac{3x+2}{(x+1)^2(x-1)}=\frac{-\frac{5}{4}}{x+1}+\frac{\frac{1}{2}}{(x+1)^2}+\frac{\frac{5}{4}}{x-1}$	½
		---	
	d)	A metal strip having sides $17\times7\times5$ cm is melted down and minted into coins each of diameter 1.4 cm and thickness 0.08 cm.Assuming no wastage,how many coins can be minted?	**04**
	Ans	Metal strip has dimensions $17\times7\times5$ cm	
		Volume of metal strip=17×7×5=595 cm^3	½
		Coin has diameter 1.4 cm $\therefore$ radius $= 0.7\ cm$	½
		Thickness of coin = 0.08 cm	
		Volume of one coin $=\pi r^2 h$	
		$=\pi(0.7)^2(0.08)$	
		$=0.123$	1
		Number of coin minted $=\frac{\text{Volume of metal strip}}{\text{Volume of one coin}}$	
		$=\frac{595}{0.123}$	
		$=4837.4\approx4837$	2

3.		**Attempt any THREE of the following:**	**12**
	a)	Prove that	
		$\tan 70^0-\tan 50^0-\tan 20^0=\tan 70^0\tan 50^0\tan 20^0$	**04**
	Ans	$\because\ 70^0-20^0=50^0$	

Q. No.	Sub Q.N.	Answers	Marking Scheme
3.	a)	$\tan\left(70^0-20^0\right)=\tan 50^0$	1
		$\frac{\tan 70^0-\tan 20^0}{1+\tan 70^0\tan 20^0}=\tan 50^0$	1
		$\tan 70^0-\tan 20^0=\tan 50^0\left(1+\tan 70^0\tan 20^0\right)$	½
		$\tan 70^0-\tan 20^0=\tan 50^0+\tan 50^0\tan 70^0\tan 20^0$	½
		$\tan 70^0-\tan 50^0-\tan 20^0=\tan 70^0\tan 50^0\tan 20^0$	1
		---	
	b)	Prove that $\frac{1+\sin\theta-\cos\theta}{1+\sin\theta+\cos\theta}=\tan\left(\frac{\theta}{2}\right)$	**04**
	Ans	$\frac{1+\sin\theta-\cos\theta}{1+\sin\theta+\cos\theta}$	
		$=\frac{1-\cos\theta+\sin\theta}{1+\cos\theta+\sin\theta}$	
		$=\frac{2\sin^2\frac{\theta}{2}+2\sin\frac{\theta}{2}\times\cos\frac{\theta}{2}}{2\cos^2\frac{\theta}{2}+2\sin\frac{\theta}{2}\times\cos\frac{\theta}{2}}$	2
		$=\frac{2\sin\frac{\theta}{2}\left(\sin\frac{\theta}{2}+\cos\frac{\theta}{2}\right)}{2\cos\frac{\theta}{2}\left(\sin\frac{\theta}{2}+\cos\frac{\theta}{2}\right)}$	1
		$=\tan\left(\frac{\theta}{2}\right)$	1
		---	
	c)	Prove that $\frac{\cos 2A+2\cos 4A+\cos 6A}{\cos A+2\cos 3A+\cos 5A}=\cos A-\sin A\tan 3A$	**04**
	Ans	$\frac{\cos 2A+2\cos 4A+\cos 6A}{\cos A+2\cos 3A+\cos 5A}=\frac{2\cos 4A+\cos 2A+\cos 6A}{2\cos 3A+\cos A++\cos 5A}$	
		$=\frac{2\cos 4A+2\cos\left(\frac{2A+6A}{2}\right)\cos\left(\frac{2A-6A}{2}\right)}{2\cos 3A+2\cos\left(\frac{A+5A}{2}\right)\cos\left(\frac{A-5A}{2}\right)}$	1

Q. No.	Sub Q.N.	Answers	Marking Scheme
3.			
	c)	$\frac{\cos 2A+2\cos 4A+\cos 6A}{\cos A+2\cos 3A+\cos 5A}=\frac{2\cos 4A+2.\cos 4A.\cos(-2A)}{2\cos 3A+2.\cos 3A.\cos(-2A)}$	½
		$=\frac{2\cos 4A(1+\cos(-2A))}{2\cos 3A(1+\cos(-2A))}$	½
		$=\frac{\cos 4A}{\cos 3A}$	½
		$=\frac{\cos(3A+A)}{\cos 3A}$	½
		$=\frac{\cos 3A\cos A-\sin 3A\sin A}{\cos 3A}$	
		$=\frac{\cos 3A\cos A}{\cos 3A}-\frac{\sin 3A\sin A}{\cos 3A}$	1
		$=\cos A-\tan 3A\sin A$	
		$=R.H.S$	
		---	
	d)	Prove that $\sin 20^0\ \sin 40^0\ \sin 60^0\ \sin 80^0=\frac{3}{16}$	**04**
	Ans	$\sin 20^0\ \sin 40^0\ \sin 60^0\ \sin 80^0$	
		$=\frac{\sqrt{3}}{2}\left[\sin 40^0\ \sin 80^0\right]\sin 20^0$	½
		$=\frac{\sqrt{3}}{4}\left[\cos 40^0-\cos 120^0\right]\sin 20^0$	½
		$=\frac{\sqrt{3}}{4}\left[\cos 40^0-\cos(180^0-60)\right]\sin 20^0$	½
		$=\frac{\sqrt{3}}{4}\left[\cos 40^0+\cos 60^0\right]\sin 20^0$	½
		$=\frac{\sqrt{3}}{4}\left[\cos 40^0+\frac{1}{2}\right]\sin 20^0$	½
		$=\frac{\sqrt{3}}{4}\left[\cos 40^0\sin 20^0+\frac{1}{2}\sin 20^0\right]$	½

Q. No.	Sub Q.N.	Answers	Marking Scheme
3.	d)	$= \frac{\sqrt{3}}{8}\left[\sin 60^0 + \sin\left(-20^0\right) + \sin 20^0\right]$	½
		$= \frac{\sqrt{3}}{8}\left[\sin 60^0 + \sin 20^0 - \sin 20^0\right]$	
		$= \frac{\sqrt{3}}{8}\frac{\sqrt{3}}{2} = \frac{3}{16}$	½

4.		**Attempt any THREE of the following:**	**12**
	a)	Find the adjoint of matrix $A = \begin{bmatrix} 2 & 5 & 3 \\ 3 & 1 & 2 \\ 1 & 2 & 1 \end{bmatrix}$	**04**
	Ans	$A = \begin{bmatrix} 2 & 5 & 3 \\ 3 & 1 & 2 \\ 1 & 2 & 1 \end{bmatrix}$	
		Matrix of minors $= \begin{bmatrix} \begin{vmatrix} 1 & 2 \\ 2 & 1 \end{vmatrix} & \begin{vmatrix} 3 & 2 \\ 1 & 1 \end{vmatrix} & \begin{vmatrix} 3 & 1 \\ 1 & 2 \end{vmatrix} \\ \begin{vmatrix} 5 & 3 \\ 2 & 1 \end{vmatrix} & \begin{vmatrix} 2 & 3 \\ 1 & 1 \end{vmatrix} & \begin{vmatrix} 2 & 5 \\ 1 & 2 \end{vmatrix} \\ \begin{vmatrix} 5 & 3 \\ 1 & 2 \end{vmatrix} & \begin{vmatrix} 2 & 3 \\ 3 & 2 \end{vmatrix} & \begin{vmatrix} 3 & 1 \\ 3 & 1 \end{vmatrix} \end{bmatrix}$	
		$= \begin{bmatrix} -3 & 1 & 5 \\ -1 & -1 & -1 \\ 7 & -5 & -13 \end{bmatrix}$	2
		Matrix of cofactors $= \begin{bmatrix} -3 & -1 & 5 \\ 1 & -1 & 1 \\ 7 & 5 & -13 \end{bmatrix}$	1
		$AdjA = \begin{bmatrix} -3 & 1 & 7 \\ -1 & -1 & 5 \\ 5 & 1 & -13 \end{bmatrix}$	1

Q. No.	Sub Q.N.	Answers	Marking Scheme
4.	b)	Resolve in to partial fractions $\frac{x^4}{x^3+1}$	**04**
	Ans	$x^3+1\overline{)x^4}\ (x$ x^4+x $-\ \ -$ $-x$	
		$\frac{x^4}{x^3+1}=x-\frac{x}{x^3+1}$	½
		$\frac{x}{x^3+1}=\frac{x}{(x+1)(x^2-x+1)}=\frac{A}{x+1}+\frac{Bx+C}{x^2-x+1}$	
		$\therefore x=(x^2-x+1)A+(x+1)(Bx+C)$	
		Put $x=-1$	
		$\therefore -1=3A$	
		$\therefore A=\frac{-1}{3}$	1
		Put $x=0$	
		$0=(1)A+(1)C$	
		$0=\frac{-1}{3}+C$	
		$\therefore C=\frac{1}{3}$	1
		Put $x=1$	
		$\therefore 1=(1)A+2(B+C)$	
		$\therefore 1=\frac{-1}{3}+2B+\frac{2}{3}$	
		$\therefore 1-\frac{1}{3}=2B$	
		$\therefore \frac{2}{3}=2B$	

Q. No.	Sub Q.N.	Answers	Marking Scheme
4.	b)	$\therefore B = \frac{1}{3}$	1
		$\therefore \frac{x}{(x+1)(x^2-x+1)} = \frac{\frac{-1}{3}}{x+1} + \frac{\frac{1}{3}x+\frac{1}{3}}{x^2-x+1}$	
		$\frac{x^4}{x^3+1} = x - \frac{\frac{-1}{3}}{x+1} + \frac{\frac{1}{3}x+\frac{1}{3}}{x^2-x+1}$	½
		---	
	c)	Prove that $\tan^{-1}(1)+\tan^{-1}(2)+\tan^{-1}(3)=\pi$	**04**
	Ans	$\tan^{-1}(1)+\tan^{-1}(2)+\tan^{-1}(3)$	
		$=\pi+\tan^{-1}\left(\frac{1+2}{1-(1)(2)}\right)+\tan^{-1}(3)$	1
		$=\pi+\tan^{-1}(-3)+\tan^{-1}(3)$	1
		$=\pi-\tan^{-1}(3)+\tan^{-1}(3)$	1
		$=\pi$	1
		---	
	d)	Prove that $\sin^{-1}\left(\frac{3}{5}\right)-\sin^{-1}\left(\frac{8}{17}\right)=\cos^{-1}\left(\frac{84}{85}\right)$	**04**
	Ans	Let $\sin^{-1}\left(\frac{3}{5}\right)=A$	
		$\therefore \sin A = \frac{3}{5}$	
		$\therefore \cos^2 A = 1-\sin^2 A$	
		$=1-\frac{9}{25}$	
		$=\frac{16}{25}$	
		$\therefore \cos A = \frac{4}{5}$	1

Q. No.	Sub Q.N.	Answers	Marking Scheme
4.		$\sin^{-1}\left(\frac{8}{17}\right)=B \quad \therefore \sin B=\frac{8}{17}$	
		$\therefore \cos^2 B=1-\sin^2 B$	
		$=1-\frac{64}{289}$	
		$=\frac{225}{289}$	
		$\therefore \cos B=\frac{15}{17}$	1
		$\therefore \cos(A-B)=\cos A\cos B+\sin A\sin B$	
		$=\frac{4}{5}\times\frac{15}{17}+\frac{3}{5}\times\frac{8}{17}$	
		$\therefore \cos(A-B)=\frac{84}{85}$	1
		$\therefore A-B=\cos^{-1}\left(\frac{84}{85}\right)$	
		$\sin^{-1}\left(\frac{3}{5}\right)-\sin^{-1}\left(\frac{8}{17}\right)=\cos^{-1}\left(\frac{84}{85}\right)$	1
		---	
	e)	Without using calculator,Prove that	**04**
		$\sin 420^0\cos 390^0+\cos(-300^0)\sin(-330^0)=1$	
	Ans	$\sin 420^0=\sin(90^0\times 4+60^0)$	
		$=\sin 60^0=\frac{\sqrt{3}}{2}$	½
		$\cos 390^0=\cos(90^0\times 4+30^0)$	½
		$=\cos 30^0=\frac{\sqrt{3}}{2}$	
		$\cos(-300^0)=\cos(300^0)$	½
		$=\cos(90^0\times 3+30^0)$	
		$=\sin 30^0=\frac{1}{2}$	½

Q. No.	Sub Q.N.	Answers	Marking Scheme
4.	e)	$\sin\left(-330^0\right) = -\sin\left(330^0\right)$	½
		$= -\sin\left(90^0 \times 3 + 60^0\right)$	
		$= -\left(-\cos 60^0\right) = \frac{1}{2}$	½
		$\sin 420^0 \cos 390^0 + \cos\left(-300^0\right)\sin\left(-330^0\right)$	
		$= \left(\frac{\sqrt{3}}{2}\right)\left(\frac{\sqrt{3}}{2}\right) + \left(\frac{1}{2}\right)\left(\frac{1}{2}\right)$	
		$= 1$	1

5.		**Attempt any TWO of the following:**	**12**
	a)	Attempt the following:	**06**
	i)	Find the acute angle between the lines $y = 5x + 6$ and $y = x$.	**03**
	Ans	For $y = 5x + 6 \ \therefore 5x - y + 6 = 0$	
		slope $m_1 = -\frac{a}{b} = -\frac{5}{-1} = 5$	1
		For $y = x \ \therefore x - y = 0$	
		slope $m_2 = -\frac{a}{b} = -\frac{1}{-1} = 1$	1
		$\therefore \tan\theta = \left\lvert\frac{m_1 - m_2}{1 + m_1 m_2}\right\rvert$	
		$= \left\lvert\frac{5-1}{1+5\times 1}\right\rvert$	
		$\therefore \tan\theta = \frac{2}{3}$	1
		$\therefore \theta = \tan^{-1}\left(\frac{2}{3}\right)$	
		---	
	ii)	Find the equation of the line passing through the point $(4,5)$ and perpendicular to the line $7x - 5y = 420$.	**03**

Q. No.	Sub Q.N.	Answers	Marking Scheme
5.	a)ii) Ans	Point $=(x_1, y_1)=(4,5)$ Slope of the line $7x-5y=420$ is, $m=-\frac{a}{b}=-\frac{7}{-5}=\frac{7}{5}$ $\therefore$ Slope of the required line is, $m_1=-\frac{1}{m}=\frac{-5}{7}$ $\therefore$ equation is, $y-y_1=m_1(x-x_1)$ $\therefore\ y-5=\frac{-5}{7}(x-4)$ $\therefore 5x+7y-55=0$	1 1 1
	b)	Attempt the following:	**06**
	i) Ans	Find the length of the perpendicular from the point $(2,3)$ on the line $4x-6y-3=0$. $p=\left\|\frac{ax_1+by_1+c}{\sqrt{a^2+b^2}}\right\|$ $=\left\|\frac{4(2)+(-6)(3)-3}{\sqrt{(4)^2+(-6)^2}}\right\|$ $=\left\|\frac{8-18-3}{\sqrt{52}}\right\|$ $=\frac{13}{\sqrt{52}}$ or 1.803	**03** 1 2
	ii) Ans	Find the equation of the line passing through $(1,7)$ and having slope 2 units. Point $=(x_1, y_1)=(1,7)$ & slope = 2 $\therefore$ Equation of line is, $y-y_1=m(x-x_1)$ $\therefore\ y-7=2(x-1)$ $\therefore 2x-y+5=0$	**03** 1 2

Q. No.	Sub Q.N.	Answers	Marking Scheme
5.	c)	Attempt the following:	**06**
	i)	*A* square grassy plot is of side 100 meters.It has a gravel path 10 meters wide all round it on the inside.Find the area of the path.	**03**
	Ans	Area of path = Area of grassy plot – Area of inner gravel path $=(100)^2-(80)^2$ $=3600$ *sq.m.*	3
	ii)	The volume of a sphere is $\frac{88}{21}$ cubic meters. Find its surface area.	**03**
	Ans	Volume of sphere $=\frac{4}{3}\pi r^3$	
		$\therefore \frac{4}{3}\pi r^3=\frac{88}{21}$	1
		$r^3=\frac{88}{21}\times\frac{3}{4}\times\frac{7}{22}$	
		$r^3=1$	1
		$r=1$	
		Surface area of sphere $=4\pi r^2$	
		$=4\pi(1)^2=4\pi$ sq.m.	1
6.		**Attempt any TWO of the following:**	**12**
	a)(i)	Find the mean deviation from mean of the following distribution:	**03**

C.I	0-10	10-20	20-30	30-40	40-50
f_i	5	8	15	16	6

6. a)(i) Ans

C.I.	f_i	x_i	$f_i x_i$	$d_i = \lvert x_i - \bar{x} \rvert$	$f_i d_i$
0-10	5	5	25	22	110
10-20	8	15	120	12	96
20-30	15	25	375	2	30
30-40	16	35	560	8	128
40-50	6	45	270	18	108
	$\sum f_i = 50$		$\sum f_i x_i = 1350$		$\sum f_i d_i = 472$

Marking Scheme: 1

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

$$\therefore \bar{x} = \frac{1350}{50}$$

$$\therefore \bar{x} = 27$$

Marking Scheme: 1

$$M.D = \frac{\sum f_i d_i}{f_i}$$

$$\therefore M.D = \frac{472}{50}$$

$$\therefore M.D. = 9.44$$

Marking Scheme: 1

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ii) Find range & coefficient of range for the following data:

Marking Scheme: **03**

C.I	10-19	20-29	30-39	40-49	50-59
f	15	25	13	17	10

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

6. ii)

C.I	9.5-19.5	19.5-29.5	29.5-39.5	39.5-49.5	49.5-59.5
f	15	25	13	17	10

Ans — 1

$\text{Range} = L - S$

$= 59.5 - 9.5$ — 1

$= 50$

$\text{Coefficient of range} = \frac{L-S}{L+S}$

$= \frac{59.5-9.5}{59.5+9.5}$

$= 0.725$ — 1

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b) Calculate standard deviation and co-efficient of variance of the following table: **06**

Marks below	5	10	15	20	25
No.of Students	6	16	28	38	46

Ans

Class	x_i	f_i	$f_i x_i$	$d_i = \frac{x_i - a}{h}$	$f_i d_i$	d_i^2	$f_i d_i^2$
0-5	2.5	6	15	-2	-12	4	24
5-10	7.5	10	75	-1	-10	1	10
10-15	12.5	12	150	0	0	0	0
15-20	17.5	10	175	1	10	1	10
20-25	22.5	8	180	2	16	4	32
		46	595		4		76

3

$\text{Mean } \bar{x} = \frac{\sum f_i x_i}{N} = \frac{595}{46} = 12.935$ — 1

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

Q. No.	Sub Q. N.	Answers	Marking Scheme
6.	b)	$S.D. = \sigma = \sqrt{\frac{76}{46} - \left(\frac{4}{46}\right)^2} \times 5$	
		$S.D. = \sigma = 6.412$	1
		Coefficient of variance $= \frac{\sigma}{\bar{x}} \times 100$	
		$= \frac{6.412}{12.935} \times 100$	
		$= 49.57$	1
		OR	

Class Interval	x_i	f_i	$f_i x_i$	x_i^2	$f_i x_i^2$
0-5	2.5	6	15	6.25	37.5
5-10	7.5	10	75	56.25	562.5
10-15	12.5	12	150	156.25	1875
15-20	17.5	10	175	306.25	3062.5
20-25	22.5	8	180	506.25	4050
		46	595		9587.5

3

Mean $\bar{x} = \frac{\sum f_i x_i}{N} = \frac{595}{46} = 12.935$ 1

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

$S.D. = \sigma = \sqrt{\frac{9587.5}{46} - \left(12.935\right)^2}$

Q. No.	Sub Q. N.	Answers	Marking Scheme
6.	b)	S.D. $= \sigma = 6.412$	1
		Coefficient of variance $= \frac{\sigma}{\bar{x}} \times 100$	
		$= \frac{6.412}{12.935} \times 100$	
		$= 49.57$	1
		---	
	c)	Solve the following equations by matrix inversion method : **06**	
		$x + y + z = 6$, $3x - y + 3z = 10$, $5x + 5y - 4z = 3$	
	Ans	Let $A = \begin{bmatrix} 1 & 1 & 1 \\ 3 & -1 & 3 \\ 5 & 5 & -4 \end{bmatrix}$, $B = \begin{bmatrix} 6 \\ 10 \\ 3 \end{bmatrix}$, $X = \begin{bmatrix} x \\ y \\ z \end{bmatrix}$	
		$\lvert A \rvert = \begin{vmatrix} 1 & 1 & 1 \\ 3 & -1 & 3 \\ 5 & 5 & -4 \end{vmatrix}$	
		$\lvert A \rvert = 1(4-15) - 1(-12-15) + 1(15+5)$	
		$\therefore \lvert A \rvert = 36 \neq 0$	1
		$\therefore A^{-1}$ exists	
		Matrix of minors $= \begin{bmatrix} \begin{vmatrix} -1 & 3 \\ 5 & -4 \end{vmatrix} & \begin{vmatrix} 3 & 3 \\ 5 & -4 \end{vmatrix} & \begin{vmatrix} 3 & -1 \\ 5 & 5 \end{vmatrix} \\ \begin{vmatrix} 1 & 1 \\ 5 & -4 \end{vmatrix} & \begin{vmatrix} 1 & 1 \\ 5 & -4 \end{vmatrix} & \begin{vmatrix} 1 & 1 \\ 5 & 5 \end{vmatrix} \\ \begin{vmatrix} 1 & 1 \\ -1 & 3 \end{vmatrix} & \begin{vmatrix} 1 & 1 \\ 3 & 3 \end{vmatrix} & \begin{vmatrix} 1 & 1 \\ 3 & -1 \end{vmatrix} \end{bmatrix}$	
		Matrix of minors $= \begin{bmatrix} -11 & -27 & 20 \\ -9 & -9 & 0 \\ 4 & 0 & -4 \end{bmatrix}$	1

Q. No.	Sub Q. N.	Answers	Marking Scheme
6.	c)	Matrix of cofactors $= \begin{bmatrix} -11 & 27 & 20 \\ 9 & -9 & 0 \\ 4 & 0 & -4 \end{bmatrix}$	½
		$\text{Adj.}A = \begin{bmatrix} -11 & 9 & 4 \\ 27 & -9 & 0 \\ 20 & 0 & -4 \end{bmatrix}$	½
		$A^{-1} = \frac{1}{\lvert A \rvert}\text{Adj.}A$	
		$A^{-1} = \frac{1}{36}\begin{bmatrix} -11 & 9 & 4 \\ 27 & -9 & 0 \\ 20 & 0 & -4 \end{bmatrix}$	1
		$\therefore X = A^{-1}B$	
		$\begin{bmatrix} x \\ y \\ z \end{bmatrix} = \frac{1}{36}\begin{bmatrix} -11 & 9 & 4 \\ 27 & -9 & 0 \\ 20 & 0 & -4 \end{bmatrix}\begin{bmatrix} 6 \\ 10 \\ 3 \end{bmatrix}$	
		$\begin{bmatrix} x \\ y \\ z \end{bmatrix} = \frac{1}{36}\begin{bmatrix} -66+90+12 \\ 162-90+0 \\ 120+0-12 \end{bmatrix}$	1
		$\begin{bmatrix} x \\ y \\ z \end{bmatrix} = \frac{1}{36}\begin{bmatrix} 36 \\ 72 \\ 108 \end{bmatrix} = \begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix}$	
		$\therefore \quad x = 1\,,\ y = 2\,,\ z = 3.$	1

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.
