SUMMER – 2022 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.
8) As per the policy decision of Maharashtra State Government, teaching in English/Marathi and Bilingual (English + Marathi) medium is introduced at first year of AICTE diploma Programme from academic year 2021-2022. Hence if the students in first year (first and second semesters) write answers in Marathi or bilingual language (English +Marathi), the Examiner shall consider the same and assess the answer based on matching of concepts with model answer.

Q. No.	Sub Q. N.	Answer	Marking Scheme
1.		**Solve any <u>FIVE</u> of the following:**	10
	a)	Find value of $\log\left(\frac{2}{3}\right)+\log\left(\frac{4}{5}\right)-\log\left(\frac{8}{15}\right)$	**02**
	Ans	$\log\left(\frac{2}{3}\right)+\log\left(\frac{4}{5}\right)-\log\left(\frac{8}{15}\right)=\log\left(\frac{2}{3}\times\frac{4}{5}\right)-\log\left(\frac{8}{15}\right)$.	1
		$=\log\left(\frac{8}{15}\right)-\log\left(\frac{8}{15}\right)$	
		$=0$ *OR* $=\log\left(\frac{\frac{8}{15}}{\frac{8}{15}}\right)=\log(1)=0$	1
		--	
	b)	Show that the points $(8,1)$ $(3,-4)$ and $(2,-5)$ are collinear.	**02**
	Ans	Consider $\begin{vmatrix} x_1 & y_1 & 1 \\ x_2 & y_2 & 1 \\ x_3 & y_3 & 1 \end{vmatrix}$	

SUMMER – 2022 EXAMINATION

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

Q. No	Sub Q. N.	Answer	Marking Scheme
1.	b)	$= \begin{vmatrix} 8 & 1 & 1 \\ 3 & -4 & 1 \\ 2 & -5 & 1 \end{vmatrix}$	½
		$= 8(-4+5)-1(3-2)+1(-15+8)$	1
		$= 0$	
		$\therefore$ Points are collinear	½
	c)	Without using calculator find the value of $\sin(105^0)$	**02**
	Ans	$\sin(105^0)$	
		$= \sin(60^0 + 45^0)$	
		$= \sin 60^0 \cos 45^0 + \cos 60^0 \sin 45^0$	1
		$= \frac{\sqrt{3}}{2}\frac{1}{\sqrt{2}} + \frac{1}{2}\frac{1}{\sqrt{2}}$	½
		$= \frac{\sqrt{3}+1}{2\sqrt{2}}$ OR 0.9659	½
	d)	Find area of Rhombus where diagonals are of length 6 cm and 9 cm.	**02**
	Ans	Area of rhombus $= \frac{1}{2}(d_1 \times d_2)$	
		$= \frac{1}{2}(6 \times 9)$	1
		Area of rhombus $= 27$	1
	e)	Find surface area of cuboid whose dimensions are $8\text{cm} \times 11\text{cm} \times 15\text{cm}$	**02**
	Ans	Let $l = 8$, $b = 11$, $h = 15$	
		Total surface Area of a cuboid $= 2[lb + bh + hl]$	1
		$= 2[8 \times 11 + 11 \times 15 + 15 \times 8]$	
		$= 746$	1

SUMMER – 2022 EXAMINATION

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

Q. No.	Sub Q. N.	Answer	Marking Scheme
1.	f)	If coefficient of variance is 5 and mean is 60.Find standard deviation.	**02**
	Ans	Coefficient of variation $= \frac{S.D}{Mean} \times 100$	
		$\therefore 5 = \frac{S.D}{60} \times 100$	1
		$\therefore \frac{5 \times 60}{100} = S.D.$	
		$\therefore S.D. = 3$	1
	g)	Find range and coefficient of range for the data: 40, 52, 47, 28, 45, 36, 47, 50	**02**
	Ans	Range $= L - S$	
		$=52 - 28$	
		$= 24$	1
		Coefficient of range $= \frac{L-S}{L+S}$	
		$= \frac{52-28}{52+28}$	½
		$= 0.3$	½
	h)	Find surface area of sphere whose volume is $\frac{4\pi}{3}$ cm^3.	**02**
	Ans	Volume of sphere $= \frac{4}{3}\pi r^3$	
		$\therefore \frac{4\pi}{3} = \frac{4}{3}\pi r^3$	
		$1 = r^3$	
		$\therefore r = 1$	1
		Surface area of sphere $= 4\pi r^2$	
		$= 4\pi(1)^2$	

Q. No.	Sub Q. N.	Answer	Marking Scheme
		$= 4\pi$ OR $12.56\ \text{cm}^2$	1

2.		**Solve any THREE of the following :**	**12**
	a)	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
		$= \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$	1
		$= I$	
		$\therefore A^2 = I$	
		---	
	b)	Resolve following into partial fractions : $\dfrac{x+3}{(x-1)(x+1)(x+5)}$	**04**
	Ans	$\dfrac{x+3}{(x-1)(x+1)(x+5)} = \dfrac{A}{x-1} + \dfrac{B}{x+1} + \dfrac{C}{x+5}$	½
		$\therefore\ x+3 = A(x+1)(x+5) + B(x-1)(x+5) + C(x-1)(x+1)$	

SUMMER – 2022 EXAMINATION

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

Q. No.	Sub Q. N.	Answer	Marking Scheme
2.		Put $x=1$ $4=A(2)(6)$ $4=12A$ $\therefore A=\frac{1}{3}$	1
		Put $x=-1$ $-1+3=B(-2)(4)$ $2=-8B$ $\therefore B=-\frac{1}{4}$	1
		Put $x=-5$ $-5+3=C(-6)(-4)$ $-2=24C$ $\therefore C=\frac{-1}{12}$	1
		$\frac{x+3}{(x-1)(x+1)(x+5)} = \frac{\frac{1}{3}}{x-1}+\frac{-\frac{1}{4}}{x+1}+\frac{-\frac{1}{12}}{x+5}$	½
	c)	Following results are obtained as a result of experiment. Find V_1, V_2 and V_3 by using Cramer's Rule. $V_1+V_2+V_3=9;\ V_1-V_2+V_3=3;\ V_1+V_2-V_3=1$	**04**
	Ans	$D=\begin{vmatrix}1 & 1 & 1\\ 1 & -1 & 1\\ 1 & 1 & -1\end{vmatrix}=1(1-1)-1(-1-1)+1(1+1)=4$	1
		$D_{V_1}=\begin{vmatrix}9 & 1 & 1\\ 3 & -1 & 1\\ 1 & 1 & -1\end{vmatrix}=9(1-1)-1(-3-1)+1(3+1)=8$	
		$\therefore V_1=\frac{D_{V_1}}{D}=\frac{8}{4}=2$	1

Q. No.	Sub Q. N.	Answer	Marking Scheme
2.		$D_{V_2}=\begin{vmatrix}1 & 9 & 1\\ 1 & 3 & 1\\ 1 & 1 & -1\end{vmatrix}=1(-3-1)-9(-1-1)+1(1-3)=12$	
		$\therefore V_2=\frac{D_{V_2}}{D}=\frac{12}{4}=3$	1
		$D_{V_3}=\begin{vmatrix}1 & 1 & 9\\ 1 & -1 & 3\\ 1 & 1 & 1\end{vmatrix}=1(-1-3)-1(1-3)+9(1+1)=16$	
		$\therefore V_3=\frac{D_{V_3}}{D}=\frac{16}{4}=4$	1
	d)	Compute mean deviation for the mean of the data: 12, 6, 7, 3, 15, 10, 18, 5.	**04**
	Ans		

x_i	$d_i=x_i-\bar{x}$	$\lvert d_i\rvert$
3	-6.5	6.5
5	-4.5	4.5
6	-3.5	3.5
7	-2.5	2.5
10	0.5	0.5
12	2.5	2.5
15	5.5	5.5
18	8.5	8.5
$\sum x_i=76$		$\sum\lvert d_i\rvert=34$

2

where Mean $\bar{x}=\frac{\sum x_i}{N}=\frac{76}{8}$

$\bar{x}=9.5$ 1

$\therefore$ Mean deviation about mean $=\frac{\sum\lvert d_i\rvert}{N}$

$=\frac{34}{8}=4.25$ 1

Q. No.	Sub Q. N.	Answer	Marking Scheme
3.		**Solve any THREE of the following :**	**12**
	a)	Solve Without using calculator.	**04**
	Ans	$\sin 420^0 \cos 390^0 + \sin(-330^0)\cos(-300^0)$	
		$\sin 420^0 = \sin(90^0 \times 4 + 60^0)$	
		$= \sin 60^0 = \frac{\sqrt{3}}{2}$	½
		$\cos 390^0 = \cos(90^0 \times 4 + 30^0)$	½
		$= \cos 30^0 = \frac{\sqrt{3}}{2}$	½
		$\sin(-330^0) = -\sin(330^0)$	
		$= -\sin(90^0 \times 3 + 60^0)$	½
		$= -(-\cos 60^0) = \frac{1}{2}$	½
		$\cos(-300^0) = \cos(300^0)$	
		$= \cos(90^0 \times 3 + 30^0)$	
		$= \sin 30^0 = \frac{1}{2}$	½
		$\sin 420^0 \cos 390^0 + \cos(-300^0)\sin(-330^0)$	
		$= \left(\frac{\sqrt{3}}{2}\right)\left(\frac{\sqrt{3}}{2}\right) + \left(\frac{1}{2}\right)\left(\frac{1}{2}\right)$	
		$= 1$	1
		---	
	b)	Prove that $\frac{\sin 4\theta + \sin 2\theta}{1 + \cos 2\theta + \cos 4\theta} = \tan 2\theta$	**04**
	Ans	$LHS = \frac{\sin 4\theta + \sin 2\theta}{1 + \cos 4\theta + \cos 2\theta}$	
		$= \frac{2.\sin 2\theta.\cos 2\theta + \sin 2\theta}{2\cos^2 2\theta + \cos 2\theta}$	2

Q. No.	Sub Q. N.	Answer	Marking Scheme
3.		$= \dfrac{\sin 2\theta(2\cos 2\theta + 1)}{\cos 2\theta(2\cos 2\theta + 1)}$	1
		$= \tan 2\theta$	1
	c)	Prove: $\dfrac{\sin 4A + \sin 5A + \sin 6A}{\cos 4A + \cos 5A + \cos 6A} = \tan 5A$	**04**
	Ans	$\dfrac{\sin 4A + \sin 5A + \sin 6A}{\cos 4A + \cos 5A + \cos 6A}$	
		$= \dfrac{(\sin 4A + \sin 6A) + \sin 5A}{(\cos 4A + \cos 6A) + \cos 5A}$	
		$= \dfrac{2\sin\left(\dfrac{4A+6A}{2}\right)\cos\left(\dfrac{4A-6A}{2}\right) + \sin 5A}{2\cos\left(\dfrac{4A+6A}{2}\right)\cos\left(\dfrac{4A-6A}{2}\right) + \cos 5A}$	2
		$= \dfrac{2\sin 5A\cos(-A) + \sin 5A}{2\cos 5A\cos(-A) + \cos 5A}$	1
		$= \dfrac{\sin 5A[2\cos(-A) + 1]}{\cos 5A[2\cos(-A) + 1]}$	
		$= \tan 5A$	1
	d)	Prove : $\tan^{-1}\left(\dfrac{1}{8}\right) + \tan^{-1}\left(\dfrac{1}{5}\right) = \tan^{-1}\left(\dfrac{1}{3}\right)$	**04**
	Ans	$L.H.S = \tan^{-1}\left(\dfrac{1}{8}\right) + \tan^{-1}\left(\dfrac{1}{5}\right)$	
		$= \tan^{-1}\left(\dfrac{\frac{1}{8} + \frac{1}{5}}{1 - \left(\frac{1}{8}\right)\left(\frac{1}{5}\right)}\right)$	2

Q. No.	Sub Q. N.	Answer	Marking Scheme
		$= \tan^{-1}\left(\frac{1}{3}\right)$ $= R.H.S$	2

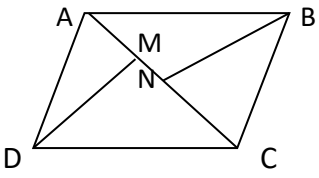
4.		**Solve any THREE of the following:**	**12**
	a)	Find x and y if $\left\{4\begin{bmatrix}1 & 2 & 0\\ 2 & -1 & 3\end{bmatrix}-2\begin{bmatrix}1 & 3 & -1\\ 2 & -3 & 4\end{bmatrix}\right\}\begin{bmatrix}2\\ 0\\ -1\end{bmatrix}=\begin{bmatrix}x\\ y\end{bmatrix}$	**04**
	Ans	$\left\{4\begin{bmatrix}1 & 2 & 0\\ 2 & -1 & 3\end{bmatrix}-2\begin{bmatrix}1 & 3 & -1\\ 2 & -3 & 4\end{bmatrix}\right\}\begin{bmatrix}2\\ 0\\ -1\end{bmatrix}=\begin{bmatrix}x\\ y\end{bmatrix}$	
		$\left\{\begin{bmatrix}4 & 8 & 0\\ 8 & -4 & 12\end{bmatrix}-\begin{bmatrix}2 & 6 & -2\\ 4 & -6 & 8\end{bmatrix}\right\}\begin{bmatrix}2\\ 0\\ -1\end{bmatrix}=\begin{bmatrix}x\\ y\end{bmatrix}$	1
		$\begin{bmatrix}2 & 2 & 2\\ 4 & 2 & 4\end{bmatrix}\begin{bmatrix}2\\ 0\\ -1\end{bmatrix}=\begin{bmatrix}x\\ y\end{bmatrix}$	1
		$\begin{bmatrix}4+0-2\\ 8+0-4\end{bmatrix}=\begin{bmatrix}x\\ y\end{bmatrix}$	1
		$\begin{bmatrix}2\\ 4\end{bmatrix}=\begin{bmatrix}x\\ y\end{bmatrix}$ $\therefore x=2, y=4$	1
		---	
	b)	Resolve into partial fractions: $\frac{3x-2}{(x+2)(x^2+4)}$	**04**
	Ans	$\frac{3x-2}{(x+2)(x^2+4)}=\frac{A}{x+2}+\frac{Bx+C}{x^2+4}$	½

Q. No.	Sub Q. N.	Answer	Marking Scheme
4.		$3x-2=(x^2+4)A+(x+2)(Bx+C)$	
		Put $x=-2$	
		$-8=8A$	1
		$A=-1$	
		Put $x=0$	
		$-2=4A+2C$	1
		$\therefore C=1$	
		Put $x=1$	
		$1=5A+(3)(B+C)$	
		$1=-5+3B+3C$	1
		$\therefore B=1$	
		$\frac{3x-2}{(x+2)(x^2+4)}=\frac{-1}{x-2}+\frac{(1)x+1}{x^2+1}$	
		$\frac{3x-2}{(x+2)(x^2+4)}=\frac{-1}{x-2}+\frac{x+1}{x^2+1}$	½
		---	
	c)	Prove that $\cos 20^0.\cos 40^0.\cos 80^0=\frac{1}{8}$	**04**
	Ans	$\cos 20^0\cos 40^0\cos 80^0=\frac{1}{2}(2\cos 20°\cos 40°).\cos 80°$	½
		$=\frac{1}{2}[\cos(20°+40°)+\cos(20°-40°)]\cos 80°$	½
	-	$=\frac{1}{2}[\cos(60°)+\cos(-20°)]\cos 80°$	½
		$=\frac{1}{2}\left[\frac{1}{2}\cos 80°+\cos 20°\cos 80°\right]$	½
		$=\frac{1}{4}[\cos 80°+2\cos 20°\cos 80°]$	
		$=\frac{1}{4}[\cos 80°+\cos(20°+80°)+\cos(20°-80°)]$	½

Q. No.	Sub Q. N.	Answer	Marking Scheme
4.		$= \frac{1}{4}\left[\cos 80° + \cos(180-80°) + \frac{1}{2}\right]$	½
		$= \frac{1}{4}\left[\cos 80° - \cos(80°) + \frac{1}{2}\right]$	½
		$= \frac{1}{8}$	½
	d)	If $\tan(x+y) = \frac{3}{4}$ and $\tan(x-y) = \frac{1}{3}$. Find $\tan 2x$	**04**
	Ans	$x+y+x-y = 2x$	
		$\tan(x+y+x-y) = \tan 2x$	1
		$\frac{\tan(x+y)+\tan(x-y)}{1-\tan(x+y)\tan(x-y)} = \tan 2x$	1
		$\frac{\frac{3}{4}+\frac{1}{3}}{1-\frac{3}{4}.\frac{1}{3}} = \tan 2x$	1
		$\therefore \tan 2x = \frac{13}{9}$	1
	e)	If $\sin A = \frac{1}{2}$ Find sin3A	**04**
	Ans	$\sin 3A = 3\sin A - 4\sin^3 A$	2
		$= 3\left(\frac{1}{2}\right) - 4\left(\frac{1}{2}\right)^3$	
		$= 1$	2
5		**Solve any <u>TWO</u> of the following:**	**12**
	a)	**Attempt the following:**	**06**
	i)	Find equation of line passing through points $(6,-4)$ and $(-3,8)$.	**03**

Q. No.	Sub Q. N.	Answer	Marking Scheme
5.	Ans	Equation of line is $\frac{y-y_1}{y_1-y_2}=\frac{x-x_1}{x_1-x_2}$ $\frac{y+4}{-4-8}=\frac{x-6}{6+3}$ $\frac{y+4}{-12}=\frac{x-6}{9}$ $12x+9y-36=0$	1 1 1
	ii)	Find the distance between the parallel lines $3x+2y-5=0$ and $3x+2y-6=0$ $3x+2y-5=0$ $a=3,\ b=2,\ c_1=-5$ For $3x+2y-6=0$ $a=3,\ b=2,\ c_2=-6$ $\therefore$ distance between two parallel lines is $=\left\|\frac{c_2-c_1}{\sqrt{a^2+b^2}}\right\|=\left\|\frac{-6+5}{\sqrt{3^2+(2)^2}}\right\|$ $=\left\|\frac{-1}{\sqrt{13}}\right\|$ $=\frac{1}{\sqrt{13}}$ OR 0.277	**03** 1 1 1
	b)	**Attempt the following:**	**06**
	i)	Find equation of line passing through the point $(2,0)$ and perpendicular to $x+y+3=0$.	**03**
	Ans	Point $=(x_1,y_1)=(2,0)$ Slope of the line $x+y+3=0$. is, $m=-\frac{a}{b}=-\frac{1}{1}=-1$	½

Q. No.	Sub Q. N.	Answer	Marking Scheme
5.		$\therefore$ Slope of the required line is,	
		$m_1 = -\frac{1}{m} = -\frac{1}{-1} = 1$	1
		$\therefore$ equation is,	
		$y - y_1 = m_1(x - x_1)$	
		$\therefore\ y - 0 = 1(x - 2)$	½
		$\therefore\ x - y - 2 = 0$	1
		---	
	ii)	Find the acute angle between the lines $3x - y + 4 = 0$ and $2x + y = 3$.	**03**
	Ans	For $3x - y + 4 = 0$	
		slope $m_1 = -\frac{a}{b} = -\frac{3}{-1} = 3$	½
		For $2x + y = 3$	
		slope $m_2 = -\frac{a}{b} = -\frac{2}{1} = -2$	½
		$\therefore \tan\theta = \left\lvert\frac{m_1 - m_2}{1 + m_1 m_2}\right\rvert$	
		$= \left\lvert\frac{3+2}{1+3\times(-2)}\right\rvert$	1
		$\therefore \tan\theta = 1$	
		$\therefore \theta = \tan^{-1}(1) = \frac{\pi}{4}$	1
		---	
	c)	**Attempt the following:**	**06**
	i)	Find the area of ring between two concentric circles whose circumference are 77cm and 55cm	**03**
	Ans	circumference of outer circle =77	
		$2\pi r_1 = 77$	
		$r_1 = \frac{77}{2\pi}$	½

Q. No.	Sub Q. N.	Answer	Marking Scheme
5.		circumference of inner circle $= 55$ $2\pi r_2 = 55$ $r_2 = \frac{55}{2\pi}$	½
		Area of outer circle $= \pi r_1^2$ $= \pi\left(\frac{77}{2\pi}\right)^2 = 471.81$	½
		Area of inner circle $= \pi r_2^2$ $= \pi\left(\frac{55}{2\pi}\right)^2 = 240.72$	½
		Area of ring = *Area* of outer circle – *Area* of inner circle $= 471.81 - 240.72$ $= 231.09$	1
	ii)	The area of piece of land in the form of a quadrilateral ABCD. The diagonal AC is 400m long off-set to B is 220m and off-set to D is 98m.Find the area.	**03**
	Ans		
		$A(\square ABCD) = A(\Delta ABC) + A(\Delta ADC)$ $= \frac{1}{2} \times AC \times BN + \frac{1}{2} \times AC \times DM$ $= \frac{1}{2} \times 400 \times 220 + \frac{1}{2} \times 400 \times 98$	2
		$= 63600$	1
6.		**Solve any TWO of the following:**	**12**
	a)	Find the mean and standard deviation and coefficient of variance of the following data:	**06**

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

6.

Class-Interval	0-10	10-20	20-30	30-40	40-50
Frequency	3	5	8	3	1

Class Interval	x_i	f_i	$f_i x_i$	$d_i = \frac{x_i - a}{h}$	$f_i d_i$	d_i^2	$f_i d_i^2$
0-10	5	3	15	-2	-6	4	12
10-20	15	5	75	-1	-5	1	5
20-30	25	8	200	0	0	0	0
30-40	35	3	105	1	3	1	3
40-50	45	1	45	2	2	4	4
		20	440		-6		24

2

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

$\therefore \bar{x} = \frac{440}{20}$

$\therefore \bar{x} = 22$

1

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

$$= \sqrt{\frac{24}{20} - \left(\frac{-6}{20}\right)^2} \times 10$$

1

$$= 10.54$$

1

Coefficient of variance $= \frac{\sigma}{\bar{x}} \times 100$

$$= \frac{10.54}{22} \times 100$$

$$= 47.91$$

1

Q. No.	Sub Q. N.	Answer	Marking Scheme
6.		**OR**	

Class Interval	x_i	f_i	$f_i x_i$	x_i^2	$f_i x_i^2$
0-10	5	3	15	25	75
10-20	15	5	75	225	1125
20-30	25	8	200	625	5000
30-40	35	3	105	1225	3675
40-50	45	1	45	2025	2025
		20	440		11900

2

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

$\therefore \bar{x} = \frac{440}{20}$

$\therefore \bar{x} = 22$

1

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

$= \sqrt{\frac{11900}{20} - \left(22\right)^2}$

1

$\sigma = 10.54$

1

Coefficient of variance $= \frac{\sigma}{\bar{x}} \times 100$

$= \frac{10.54}{22} \times 100$

$= 47.91$

1

---

b) Attempt the following: **06**

SUMMER – 2022 EXAMINATION

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

Q. No.	Sub Q. N.	Answer	Marking Scheme
6.	i)	Find range and coefficient of range for the following data:	**03**

Marks	10-19	20-29	30-39	40-49	50-59	60-69
No of students	6	10	16	14	8	4

C.I.	9.5-19.5	19.5-29.5	29.5-39.5	39.5-49.5	49.5-59.5	59.5-69.5
f_i	6	10	16	14	8	4

$\text{Range} = L - S = 69.5 - 9.5$ 1

$= 60$ 1

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

$= \frac{69.5-9.5}{69.5+9.5}$

$= \frac{60}{79}$ OR 0.759 1

---

ii) The two sets of observation are given below: **03**

Set-I	Set-II
$\bar{x} = 82.5$	$\bar{x} = 48.75$
$\sigma = 7.3$	$\sigma = 8.35$

Which of the two sets is more consistent?

Ans Coefficient of variance $V = \frac{\sigma}{\bar{x}} \times 100$

Q. No.	Sub Q. N.	Answer	Marking Scheme
6.	i)	For set-I $V_1 = \frac{7.3}{82.5} \times 100$ $\therefore V_1 = 8.848$ For set-II $V_2 = \frac{8.35}{48.75} \times 100$ $\therefore V_2 = 17.128$ $\therefore V_1 < V_2$ $\therefore$ Set-I is more consistent.	1 1 1
	c)	Using matrix inversion method , solve $x+y+z=3$; $x+2y+3z=4$; $x+4y+9z=6$	**06**
	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 Matrix of minors $= \begin{bmatrix} \begin{vmatrix} 2 & 3 \\ 4 & 9 \end{vmatrix} & \begin{vmatrix} 1 & 3 \\ 1 & 9 \end{vmatrix} & \begin{vmatrix} 1 & 2 \\ 1 & 4 \end{vmatrix} \\ \begin{vmatrix} 1 & 1 \\ 4 & 9 \end{vmatrix} & \begin{vmatrix} 1 & 1 \\ 1 & 9 \end{vmatrix} & \begin{vmatrix} 1 & 1 \\ 1 & 4 \end{vmatrix} \\ \begin{vmatrix} 1 & 1 \\ 2 & 3 \end{vmatrix} & \begin{vmatrix} 1 & 1 \\ 1 & 3 \end{vmatrix} & \begin{vmatrix} 1 & 1 \\ 1 & 2 \end{vmatrix} \end{bmatrix}$	1

Q. No.	Sub Q. N.	Answer	Marking Scheme
6.		$= \begin{bmatrix} 6 & 6 & 2 \\ 5 & 8 & 3 \\ 1 & 2 & 1 \end{bmatrix}$	1
		Matrix of cofactors $= \begin{bmatrix} 6 & -6 & 2 \\ -5 & 8 & -3 \\ 1 & -2 & 1 \end{bmatrix}$	1
		OR	
		$c_{11} = (-1)^{1+1}\begin{vmatrix} 2 & 3 \\ 4 & 9 \end{vmatrix} = 6,\ c_{12} = (-1)^{1+2}\begin{vmatrix} 1 & 3 \\ 1 & 9 \end{vmatrix} = -6,\ c_{13} = (-1)^{1+3}\begin{vmatrix} 1 & 2 \\ 1 & 4 \end{vmatrix} = 2,$	
		$c_{21} = (-1)^{2+1}\begin{vmatrix} 1 & 1 \\ 4 & 9 \end{vmatrix} = -5,\ c_{22} = (-1)^{2+2}\begin{vmatrix} 1 & 1 \\ 1 & 9 \end{vmatrix} = 8,\ c_{23} = (-1)^{2+3}\begin{vmatrix} 1 & 1 \\ 1 & 4 \end{vmatrix} = -3,$	
		$c_{31} = (-1)^{3+1}\begin{vmatrix} 1 & 1 \\ 2 & 3 \end{vmatrix} = 1,\ c_{32} = (-1)^{3+2}\begin{vmatrix} 1 & 1 \\ 1 & 3 \end{vmatrix} = -2,\ c_{33} = (-1)^{3+3}\begin{vmatrix} 1 & 1 \\ 1 & 2 \end{vmatrix} = 1,$	
		Matrix of cofactors $= \begin{bmatrix} 6 & -6 & 2 \\ -5 & 8 & -3 \\ 1 & -2 & 1 \end{bmatrix}$	2
		$\therefore AdjA = \begin{bmatrix} 6 & -5 & 1 \\ -6 & 8 & -2 \\ 2 & -3 & 1 \end{bmatrix}$	½
		$A^{-1} = \frac{1}{\lvert A \rvert}\text{Adj.}A = \frac{1}{2}\begin{bmatrix} 6 & -5 & 1 \\ -6 & 8 & -2 \\ 2 & -3 & 1 \end{bmatrix}$	½
		$X = A^{-1}B$	
		$\therefore \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \frac{1}{2}\begin{bmatrix} 6 & -5 & 1 \\ -6 & 8 & -2 \\ 2 & -3 & 1 \end{bmatrix}\begin{bmatrix} 3 \\ 4 \\ 6 \end{bmatrix}$	

Q. No.	Sub Q. N.	Answer	Marking Scheme
6.		$\therefore \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \frac{1}{2}\begin{bmatrix} 18-20+6 \\ -18+32-12 \\ 6-12+6 \end{bmatrix}$	1
		$\therefore \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \frac{1}{2}\begin{bmatrix} 4 \\ 2 \\ 0 \end{bmatrix}$	
		$\begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 2 \\ 1 \\ 0 \end{bmatrix}$	
		$\therefore \quad x=2\ ,\ \ y=1\ ,\ \ z=0$	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.	
