New Satara Samuh Mumbai’s

New Satara College of Engineering and Management (Polytechnic) Korti,Pandharpur

Approved by AICTE & Affiliated MSBTE

MSBTE Institute code: l523, DTE Institute code: D-6725

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First Year
(Common to all Programs)

Scheme: I Semester: First

Name of Course: Basic Mathematics Course Code: 22103

MSBTE Question papers & Model Answers

- ✓ MSBTE Exam Winter-2017
- ✓ MSBTE Exam Summer-2018
- ✓ MSBTE Exam Winter-2018
- ✓ MSBTE Exam Summer-2019

22103

11718

3 Hours/70 Marks

Seat No. | | | | | | | | |

Instructions :
(1) All questions are compulsory.
(2) Answer each next main question on a new page.
(3) Illustrate your answers with neat sketches wherever necessary.
(4) Figures to the right indicate full marks.
(5) Assume suitable data, if necessary.
(6) Use of Non-programmable Electronic Pocket Calculator is permissible.

Marks

1. Attempt any five of the following : 10

a) Evaluate $\log_3 81$.

b) Show that the points (8, 1) (3, – 4) and (2, –5) are collinear using determinant.

c) Without using calculator find the value of sin(105°).

d) Find the area of a rhombus whose diagonals are of lengths 10 cm and 8.2 cm.

e) If the volume of a sphere is —— . Find its surface area.

f) Find the range and coefficient of range of the data :

50, 90, 120, 40, 180, 200, 80.

g) If the coefficient of variation of certain data is 5 and mean is 60. Find the standard deviation.

2. Attempt any three of the following : 12

a) If whether AB is singular or non-singular matrix ?

b) Resolve into partial fractions ______ .

c) Using Cramer's rule solve x – y – 2z = 1; 2x + 3y + 4z = 4; 3x – 2y – 6z = 5.

d) Compute the standard deviation for 15, 22, 27, 11, 9, 21, 14, 9.

Marks

3. Attempt any three of the following : 12

a) If tan (x + y) = / and tan (x – y) = / . Prove that tan 2x = / .

b) If A = 30°, verify that

i) sin 2A = 2 sin A cos A

ii) ______ .

c) Prove that cos 20 cos 40 cos 60 cos 80 = / .

d) Prove that / / / .

4. Attempt any three of the following : 12

a) If . Verify that $(AB)^T = B^T A^T$.

b) Resolve into partial fraction ______ .

c) Prove that sin (A + B) sin (A – B) = $\sin^2 A - \sin^2 B$.

d) If sin A = / find the value of sin 3A.

e) Prove that ______ .

5. Attempt any two of the following : 12

a) i) Find the equation of straight line passes through the points (3, 5) and (4, 6).

ii) Find the distance between the parallel lines 3x – y + 7 = 0 and 3x – y + 16 = 0.

b) i) Find the acute angle between the lines 2x + 3y + 5 = 0 and x – 2y – 4 = 0.

ii) Find the equation of the line through the point of intersection of lines, 4x + 3y = 8; and x + y = 1 and parallel to the line 5x – 7y = 3.

c) i) The area of a rectangular courtyard is 3000 sq.m. Its sides are in the ratio 6 : 5. Find the perimeter of courtyard.

ii) A circus tent is cylindrical to a height of 3m and conical above it. If its diameter is 105 m and slant height of cone is 5m, calculate the area of total canvas required.

Marks

6. Attempt any two : 12

a) Using matrix inversion method, solve x + y + z = 3; x + 2y + 3z = 4; x + 4y + 9z = 6.

b) Find mean, standard deviation and coefficient of variance of the following :

Class :	0 – 10	10 – 20	20 – 30	30 – 40	40 – 50
Frequency :	3	5	8	3	1

c) i) Calculate the range and coefficient of range for the following data :

Class :	21 – 25	26 – 30	31 – 35	36 – 40	41 – 45
Frequency :	4	16	38	12	10

ii) The two sets of observations are given below. Which of them is more consistent ?

Set I	Set II
¯ = 82.5	¯ = 48.75
= 7.3	=8.35

WINTER – 2017 EXAMINATION

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 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.		Attempt any **five** of the following:	**10**
	a)	Evaluate $\log_3 81$	**02**
	Ans	$\log_3 81$	
		$=\log_3 3^4$	½
		$=4\log_3 3$	½
		$=4(1)$	½
		$=4$	½
		OR	
		$\log_3 81$	
		$=\dfrac{\log 81}{\log 3}$	½
		$=\dfrac{\log 3^4}{\log 3}$	½
		$=\dfrac{4\log 3}{\log 3}$	½
		$=4$	½
		--	
	b)	Show that the points $(8,1)$ $(3,-4)$ and $(2,-5)$ are collinear using determinant.	**02**
	Ans	Consider $\begin{vmatrix} x_1 & y_1 & 1 \\ x_2 & y_2 & 1 \\ x_3 & y_3 & 1 \end{vmatrix}$	

Q. No.	Sub Q. N.	Answer	Marking Scheme
1.	b)	$=\begin{vmatrix} 8 & 1 & 1 \\ 3 & -4 & 1 \\ 2 & -5 & 1 \end{vmatrix}$	½
		$=8(-4+5)-1(3-2)+1(-15+8)$	½
		$=0$	½
		$\therefore$ Points are collinear	½
	c)	---	
	Ans	Without using calculator find the value of $\sin\left(105^0\right)$	**02**
		$\sin\left(105^0\right)$	
		$=\sin\left(60^0+45^0\right)$	½
		$=\sin 60^0 \cos 45^0+\cos 60^0 \sin 45^0$	½
		$=\frac{\sqrt{3}}{2}\frac{1}{\sqrt{2}}+\frac{1}{2}\frac{1}{\sqrt{2}}$	½
		$=\frac{\sqrt{3}+1}{2\sqrt{2}}$ OR 0.9659	½
		---	
	d)	Find area of rhombus whose diagonals are of length 10 cm and 8.2 cm	**02**
	Ans	Area of rhombus $=\frac{1}{2}\times d_1\times d_2$	
		$=\frac{1}{2}\times 10\times 8.2$	1
		$=41$ sq.cm	1
		---	
	e)	If the volume of a sphere is $\frac{4\pi}{3}$ cm^3.Find its surface area	**02**
	Ans	Volume of sphere $=\frac{4}{3}\pi r^3$	
		$\therefore \frac{4\pi}{3}=\frac{4}{3}\pi r^3$	½
		$1=r^3$	
		$\therefore r=1$	½
		Surface area of sphere $=4\pi r^2$	
		$=4\pi(1)^2$	½
		$=4\pi$ OR 12.56 cm^2	½

Q. No.	Sub Q. N.	Answer	Marking Scheme
1.	f)	Find the range and coefficient of range of the data: 50 , 90 , 120 , 40 , 180 , 200 , 80.	**02**
	Ans	Range $= L - S = 200 - 40$ $= 160$	1
		Coefficient of range $= \dfrac{L-S}{L+S}$ $= \dfrac{200-40}{200+40}$	½
		$= \dfrac{2}{3}$ OR 0.667	½
	g)	If the coefficient of variation of certain data is 5 and mean is 60.Find the standard deviation.	**02**
	Ans	Coefficient of variation $= \dfrac{S.D.}{Mean} \times 100$ $\therefore 5 = \dfrac{S.D.}{60} \times 100$	1
		$\therefore \dfrac{5 \times 60}{100} = S.D.$ $\therefore S.D. = 3$	1
2.		Attempt any **three** of the following:	**12**
	a)	If $A = \begin{bmatrix} 2 & 1 \\ 0 & 3 \end{bmatrix}, B = \begin{bmatrix} 1 & 2 \\ 3 & -2 \end{bmatrix}$ whether AB is singular or non-singular matrix?	**04**
	Ans	$AB = \begin{bmatrix} 2 & 1 \\ 0 & 3 \end{bmatrix} \begin{bmatrix} 1 & 2 \\ 3 & -2 \end{bmatrix}$ $\therefore AB = \begin{bmatrix} 2+3 & 4-2 \\ 0+9 & 0-6 \end{bmatrix}$	1
		$\therefore AB = \begin{bmatrix} 5 & 2 \\ 9 & -6 \end{bmatrix}$	1
		$\therefore \lvert AB \rvert = \begin{vmatrix} 5 & 2 \\ 9 & -6 \end{vmatrix} = -30 - 18 = -48$	1
		$\therefore \lvert AB \rvert \neq 0$	½
		$\therefore AB$ is non-singular matrix	½
	b)	Resolve into partial fractions : $\dfrac{x+3}{(x-1)(x+1)(x+5)}$	**04**

Q. No.	Sub Q. N.	Answer	Marking Scheme
2.	b) Ans	$\dfrac{x+3}{(x-1)(x+1)(x+5)} = \dfrac{A}{x-1}+\dfrac{B}{x+1}+\dfrac{C}{x+5}$	½
		$\therefore x+3 = A(x+1)(x+5)+B(x-1)(x+5)+C(x-1)(x+1)$	
		Put $x=1$	
		$4 = A(2)(6)$	
		$4 = 12A$	
		$\therefore A = \dfrac{1}{3}$	1
		Put $x=-1$	
		$-1+3 = B(-2)(4)$	
		$2 = -8B$	
		$\therefore B = -\dfrac{1}{4}$	1
		Put $x=-5$	
		$-5+3 = C(-6)(-4)$	
		$-2 = 24C$	
		$\therefore C = \dfrac{-1}{12}$	1
		$\dfrac{x+3}{(x-1)(x+1)(x+5)} = \dfrac{\frac{1}{3}}{x-1}+\dfrac{-\frac{1}{4}}{x+1}+\dfrac{-\frac{1}{12}}{x+5}$	½
		--	
	c)	Using Cramers rule solve $x-y-2z=1$; $2x+3y+4z=4$; $3x-2y-6z=5$	**04**
	Ans	$D = \begin{vmatrix} 1 & -1 & -2 \\ 2 & 3 & 4 \\ 3 & -2 & -6 \end{vmatrix}$	
		$=1(-18+8)+1(-12-12)-2(-4-9)$	1
		$=-8$	
		$D_x = \begin{vmatrix} 1 & -1 & -2 \\ 4 & 3 & 4 \\ 5 & -2 & -6 \end{vmatrix}$	
		$=1(-18+8)+1(-24-20)-2(-8-15)$	
		$=-8$	
		$\therefore x = \dfrac{D_x}{D} = \dfrac{-8}{-8} = 1$	1

Q. No.	Sub Q. N.	Answer	Marking Scheme
2.	c)	$D_y = \begin{vmatrix} 1 & 1 & -2 \\ 2 & 4 & 4 \\ 3 & 5 & -6 \end{vmatrix}$	
		$= 1(-24-20) - 1(-12-12) - 2(10-12)$	
		$= -16$	
		$\therefore y = \dfrac{D_y}{D} = \dfrac{-16}{-8} = 2$	1
		$D_z = \begin{vmatrix} 1 & -1 & 1 \\ 2 & 3 & 4 \\ 3 & -2 & 5 \end{vmatrix}$	
		$=1(15+8)+1(10-12)+1(-4-9)$	
		$D_z = 8$	
		$z = \dfrac{D_z}{D} = \dfrac{8}{-8} = -1$	1
	d)	Compute the standard deviation for 15 , 22 , 27 , 11 , 9 , 21 , 14 , 9.	**04**
	Ans	(see table below)	2
		Mean $\bar{x} = \dfrac{\sum x_i}{n}$	

x_i	$d_i = x_i - \bar{x}$	d_i^2
15	-1	1
22	6	36
27	11	121
11	-5	25
9	-7	49
21	5	25
14	-2	4
9	-7	49
$\sum x_i =$ 128		$\sum d_i^2 =$ 310

Q. No.	Sub Q. N.	Answer	Marking Scheme
2.	d)	Mean $\bar{x} = \frac{128}{8} = 16$	1
		Standard deviation $\sigma = \sqrt{\frac{\sum d_i^2}{n}}$ $= \sqrt{\frac{310}{8}}$ $= 6.22$	1
		OR	

x_i	x_i^2
15	225
22	484
27	729
11	121
9	81
21	441
14	196
9	81
$\sum x_i = 128$	$\sum x_i^2 = 2358$

(2 marks)

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

$\bar{x} = \frac{128}{8} = 16$ (1 mark)

Standard deviation $\sigma = \sqrt{\frac{\sum x_i^2}{N} - \left(\bar{x}\right)^2}$

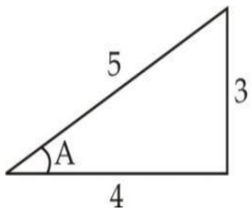
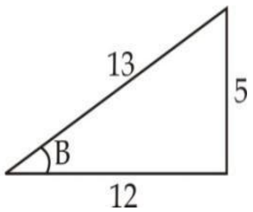
$= \sqrt{\frac{2358}{8} - (16)^2}$

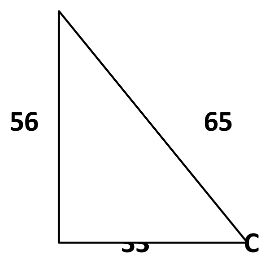
$= 6.22$ (1 mark)

Q. No.	Sub Q. N.	Answer	Marking Scheme
3.		Attempt any **three** of the following:	**12**
	a)	If $\tan(x+y)=3/4$ and $\tan(x-y)=8/15$. Prove that $\tan 2x = 77/36$	**04**
	Ans	Consider	
		$2x = x+y+x-y$	
		$\tan 2x = \tan(x+y+x-y)$	1
		$= \dfrac{\tan(x+y)+\tan(x-y)}{1-\tan(x+y)\tan(x-y)}$	1
		$= \dfrac{\frac{3}{4}+\frac{8}{15}}{1-\frac{3}{4}\frac{8}{15}}$	1
		$= \dfrac{77}{36}$	1
		$\therefore \tan 2x = 77/36$	
		OR	
		Let $x+y=A$	
		$x-y=B$	
		$\therefore \tan A = \dfrac{3}{4}$, $\tan B = \dfrac{8}{15}$	
		$\because 2x = A+B = x+y+x-y$	
		$\tan 2x = \tan(A+B)$	1
		$= \dfrac{\tan A+\tan B}{1-\tan A\tan B}$	1
		$= \dfrac{\frac{3}{4}+\frac{8}{15}}{1-\frac{3}{4}\frac{8}{15}}$	1
		$= \dfrac{77}{36}$	1
		$\therefore \tan 2x = 77/36$	
		--	
	b)	If $A=30^0$, verify that	**04**
		i) $\sin 2A = 2\sin A\cos A$	
		ii) $\cos 2A = \dfrac{1-\tan^2 A}{1+\tan^2 A}$	

Q. No.	Sub Q. N.	Answer	Marking Scheme
3.	b) Ans	$i) L.H.S. = \sin 2A$ $= \sin 2(30^0)$ $= \sin 60^0$ $= \frac{\sqrt{3}}{2}$	1
		$R.H.S. = 2\sin A\cos A$ $= 2\sin 30^0 \cos 30^0$ $= 2\left(\frac{1}{2}\right)\left(\frac{\sqrt{3}}{2}\right)$ $= \frac{\sqrt{3}}{2}$	1
		$\therefore \sin 2A = 2\sin A\cos A$ $ii) L.H.S. = \cos 2A = \cos 2\left(30^0\right)$ $= \cos 60^0$ $= \frac{1}{2}$	1
		$R.H.S. = \frac{1-\tan^2 A}{1+\tan^2 A}$ $= \frac{1-\tan^2 30^0}{1+\tan^2 30^0}$ $= \frac{1-\left(\frac{1}{\sqrt{3}}\right)^2}{1+\left(\frac{1}{\sqrt{3}}\right)^2}$ $= \frac{1}{2}$	1
		$\therefore \cos 2A = \frac{1-\tan^2 A}{1+\tan^2 A}$ --	
	c) Ans	Prove that $\cos 20 \cos 40 \cos 60 \cos 80 = \frac{1}{16}$	**04**
		$L.H.S. = \cos 20 \cos 40 \cos 60 \cos 80$ $= \cos 20 \cos 40 \frac{1}{2} \cos 80$	½
		$= \frac{1}{4}\left(2\cos 20 \cos 40\right)\cos 80$	½

Q. No.	Sub Q. N.	Answer	Marking Scheme
3.	c)	$\text{L.H.S.}=\frac{1}{4}(\cos 60+\cos 20)\cos 80$	1
		$=\frac{1}{4}\left(\frac{1}{2}+\cos 20\right)\cos 80$	
		$=\frac{1}{4}\left(\frac{1}{2}\cos 80+\cos 20\cos 80\right)$	
		$=\frac{1}{8}(\cos 80+2\cos 20\cos 80)$	
		$=\frac{1}{8}(\cos 80+\cos 100+\cos 60)$	½
		$=\frac{1}{8}\left(\cos 80+\cos 100+\frac{1}{2}\right)$	
		$=\frac{1}{8}\left(\cos 80+\cos(\pi-80)+\frac{1}{2}\right)$	½
		$=\frac{1}{8}\left(\cos 80-\cos 80+\frac{1}{2}\right)$	½
		$=\frac{1}{16}$	
		$=R.H.S.$	½
	d)	Prove that $\cos^{-1}\left(\frac{4}{5}\right)+\cos^{-1}\left(\frac{12}{13}\right)=\cos^{-1}\left(\frac{33}{65}\right)$	**04**
	Ans	Put $\cos^{-1}\left(\frac{4}{5}\right)=A$	
		$\because \cos A=\frac{4}{5}$	
		$\therefore \sin A=\sqrt{1-\cos^2 A}$	
		$=\sqrt{1-\frac{16}{25}}$	
		$=\frac{3}{5}$	1
		Put $\cos^{-1}\left(\frac{12}{13}\right)=B$	
		$\therefore \cos B=\frac{12}{13}$	
		$\therefore \sin B=\sqrt{1-\cos^2 B}$	
		$=\sqrt{1-\frac{144}{169}}$	

Q. No.	Sub Q. N.	Answer	Marking Scheme
3.	d)	$\therefore \sin B = \frac{5}{13}$	1
		Consider,	
		$\cos(A+B) = \cos A.\cos B - \sin A.\sin B$	
		$\cos(A+B) = \left(\frac{4}{5}\right)\left(\frac{12}{13}\right) - \left(\frac{3}{5}\right)\left(\frac{5}{13}\right)$	1
		$\therefore \cos(A+B) = \frac{33}{65}$	½
		$\therefore A+B = \cos^{-1}\left(\frac{33}{65}\right)$	½
		$\therefore \cos^{-1}\left(\frac{4}{5}\right) + \cos^{-1}\left(\frac{12}{13}\right) = \cos^{-1}\left(\frac{33}{65}\right)$	
		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
		Let $\cos^{-1}\left(\frac{12}{13}\right) = B$	
		$\therefore \cos B = \frac{12}{13}$	
		$\therefore \tan B = \frac{5}{12}$	
		$\therefore B = \tan^{-1}\left(\frac{5}{12}\right)$	
		$\cos^{-1}\left(\frac{12}{13}\right) = \tan^{-1}\left(\frac{5}{12}\right)$	1
		$L.H.S. = \cos^{-1}\left(4/5\right) + \cos^{-1}\left(12/13\right)$	

Q. No.	Sub Q. N.	Answer	Marking Scheme
3.	d)	$\text{L.H.S.} = \tan^{-1}\left(\frac{3}{4}\right) + \tan^{-1}\left(\frac{5}{12}\right)$	
		$= \tan^{-1}\left(\frac{\frac{3}{4}+\frac{5}{12}}{1-\frac{3}{4}\frac{5}{12}}\right)$	½
		$= \tan^{-1}\left(\frac{56}{33}\right)$	½
		Let $\tan^{-1}\left(\frac{56}{33}\right) = C$	
		$\therefore \tan C = \frac{56}{33}$	
		$\therefore \cos C = \frac{33}{65}$	
		$\therefore C = \cos^{-1}\left(\frac{33}{65}\right)$ 	
		$\therefore \tan^{-1}\left(\frac{56}{33}\right) = \cos^{-1}\left(\frac{33}{65}\right) = R.H.S.$	1
		--	
4.		Attempt any **three** of the following:	**12**
	a)	If $A = \begin{bmatrix} 2 & 5 & 6 \\ 0 & 1 & 2 \end{bmatrix}, B = \begin{bmatrix} 6 & 1 \\ 0 & 4 \\ 5 & 7 \end{bmatrix}$. Verify that $(AB)^T = B^T A^T$	**04**
	Ans	$AB = \begin{bmatrix} 2 & 5 & 6 \\ 0 & 1 & 2 \end{bmatrix} \begin{bmatrix} 6 & 1 \\ 0 & 4 \\ 5 & 7 \end{bmatrix}$	
		$AB = \begin{bmatrix} 12+0+30 & 2+20+42 \\ 0+0+10 & 0+4+14 \end{bmatrix}$	1
		$AB = \begin{bmatrix} 42 & 64 \\ 10 & 18 \end{bmatrix}$	½
		$(AB)^T = \begin{bmatrix} 42 & 10 \\ 64 & 18 \end{bmatrix}$	½
		$B^T A^T = \begin{bmatrix} 6 & 0 & 5 \\ 1 & 4 & 7 \end{bmatrix} \begin{bmatrix} 2 & 0 \\ 5 & 1 \\ 6 & 2 \end{bmatrix}$	½

WINTER – 2017 EXAMINATION
Model Answer Subject Code: 22103

Q. No.	Sub Q. N.	Answer	Marking Scheme
4.	a)	$B^T A^T = \begin{bmatrix} 12+0+30 & 0+0+10 \\ 2+20+42 & 0+4+14 \end{bmatrix}$	1
		$B^T A^T = \begin{bmatrix} 42 & 10 \\ 64 & 18 \end{bmatrix}$	½
		$\therefore (AB)^T = B^T A^T$	
		---	
	b)	Resolve into partial fraction $\frac{x^2-x+3}{(x-2)(x^2+1)}$	**04**
	Ans	$\frac{x^2-x+3}{(x-2)(x^2+1)} = \frac{A}{x-2} + \frac{Bx+C}{x^2+1}$	½
		$\therefore x^2-x+3 = (x^2+1)A + (x-2)(Bx+C)$	
		Put $x=2$	
		$5=5A$	
		$A=1$	1
		Put $x=0$	
		$3=A-2C$	
		$\therefore C=-1$	1
		Put $x=1$	
		$3=2A+(-1)(B+C)$	
		$3=2-B+1$	
		$\therefore B=0$	1
		$\frac{x^2-x+3}{(x-2)(x^2+1)} = \frac{1}{x-2} + \frac{(0)x-1}{x^2+1}$	½
		$\frac{x^2-x+3}{(x-2)(x^2+1)} = \frac{1}{x-2} - \frac{1}{x^2+1}$	
		---	
	c)	Prove that : $\sin(A+B)\sin(A-B) = \sin^2 A - \sin^2 B$	**04**
	Ans	$\sin(A+B)\sin(A-B)$	
		$= (\sin A\cos B + \cos A\sin B)(\sin A\cos B - \cos A\sin B)$	1
		$= \sin^2 A\cos^2 B - \cos^2 A\sin^2 B$	1
		$= \sin^2 A(1-\sin^2 B) - (1-\sin^2 A)\sin^2 B$	1
		$= \sin^2 A - \sin^2 A\sin^2 B - \sin^2 B + \sin^2 A\sin^2 B$	
		$= \sin^2 A - \sin^2 B$	1

Q. No.	Sub Q. N.	Answer	Marking Scheme
4.	d)	If sin A = $\frac{1}{2}$ find the value of sin3A.	**04**
	Ans	$\sin 3A = 3\sin A - 4\sin^3 A$	1
		$= 3\left(\frac{1}{2}\right) - 4\left(\frac{1}{2}\right)^3$	1
		$= 1$	2
	e)	Prove that $\frac{\sin 4A+\sin 5A+\sin 6A}{\cos 4A+\cos 5A+\cos 6A} = \tan 5A$	**04**
	Ans	$L.H.S. = \frac{\sin 4A+\sin 5A+\sin 6A}{\cos 4A+\cos 5A+\cos 6A}$	
		$= \frac{\sin 4A+\sin 6A+\sin 5A}{\cos 4A+\cos 6A+\cos 5A}$	
		$= \frac{2\sin\left(\frac{4A+6A}{2}\right)\cos\left(\frac{4A-6A}{2}\right)+\sin 5A}{2\cos\left(\frac{4A+6A}{2}\right)\cos\left(\frac{4A-6A}{2}\right)+\cos 5A}$	1
		$= \frac{2\sin 5A\cos(-A)+\sin 5A}{2\cos 5A\cos(-A)+\cos 5A}$	1
		$= \frac{\sin 5A(2\cos(-A)+1)}{\cos 5A(2\cos(-A)+1)}$	1
		$= \tan 5A$ $= R.H.S.$	1
5.		Attempt any **two** of the following:	**12**
	a) (i)	Find the equation of straight line passes through the points $(3,5)$ and $(4,6)$.	**03**
	Ans	Equation of line is $\frac{y-y_1}{y_1-y_2} = \frac{x-x_1}{x_1-x_2}$	
		$\frac{y-5}{5-6} = \frac{x-3}{3-4}$	2
		$\frac{y-5}{-1} = \frac{x-3}{-1}$ $x-y+2=0$	1
	(ii)	Find the distance between the parallel lines $3x-y+7=0$ and $3x-y+16=0$	**03**
	Ans	For $3x-y+7=0$	

Q. No.	Sub Q. N.	Answer	Marking Scheme
5.	a) (ii)	$a=3,\ b=-1,\ c_1=7$ For $3x-y+16=0$ $a=3,\ b=-1,\ c_2=16$ $\therefore$ distance between two parallel lines is $=\left\|\dfrac{c_2-c_1}{\sqrt{a^2+b^2}}\right\|=\left\|\dfrac{16-7}{\sqrt{3^2+(-1)^2}}\right\|$ $=\left\|\dfrac{9}{\sqrt{10}}\right\|$ $=\dfrac{9}{\sqrt{10}}$ OR 2.846	2 1
	b) (i) Ans	Find the acute angle between the lines $2x+3y+5=0$ and $x-2y-4=0$ For $2x+3y+5=0$ slope $m_1=-\dfrac{a}{b}=-\dfrac{2}{3}$ For $x-2y-4=0$, slope $m_2=-\dfrac{a}{b}=-\dfrac{1}{-2}=\dfrac{1}{2}$ $\therefore \tan\theta=\left\|\dfrac{m_1-m_2}{1+m_1m_2}\right\|$ $=\left\|\dfrac{-\frac{2}{3}-\frac{1}{2}}{1+\left(-\frac{2}{3}\right)\cdot\left(\frac{1}{2}\right)}\right\|$ $=\dfrac{7}{4}$ $\therefore \theta=\tan^{-1}\left(\dfrac{7}{4}\right)$ *OR* 60.26^0	**03** ½ ½ 1 1
	(ii) Ans	Find the equation of the line through the point of intersection of lines, $4x+3y=8$; and $x+y=1$ and parallel to the line $5x-7y=3$ $\because 4x+3y=8$ $x+y=1$ $\therefore\quad 4x+3y=8$ $-\ \ 4x+4y=4$	**03**

Q. No.	Sub Q. N.	Answer	Marking Scheme
5.	b) (ii)	$-y=4$	
		$y=-4$	
		$\therefore \quad x-4=1$	
		$\therefore x=5$	
		$\therefore$ Point of intersection $=(5,-4)$	1
		Slope of the line $5x-7y=3$ is,	
		$m=-\frac{a}{b}=-\frac{5}{-7}=\frac{5}{7}$	½
		$\therefore$ Slope of the required line is,	
		$m=\frac{5}{7}$	½
		$\therefore$ equation required line is,	
		$y-y_1=m(x-x_1)$	
		$\therefore y+4=\frac{5}{7}(x-5)$	½
		$\therefore 5x-7y-53=0$	½
		--	
	c) (i)	The area of a rectangular courtyard is 3000 sq.m. Its sides are in the ratio 6:5.Find the perimeter of courtyard.	**03**
	Ans	Area of rectangular courtyard is $=$ length $\times$ breadth	
		Given $l:b=6:5$	
		$i.e.\ \frac{l}{b}=\frac{6}{5}$	
		$\therefore l=\frac{6}{5}b$	
		$\because A=l\times b$	
		$3000=\frac{6}{5}b\times b$	
		$\frac{15000}{6}=b^2$	
		$2500=b^2$	1
		$\therefore b=50$	
		$\therefore l=\frac{6}{5}b=\frac{6}{5}\times 50$	1
		$\therefore l=60$	
		Perimeter of rectangular courtyard is $=2(l+b)$	
		$=2(60+50)$	
		$=220\ m.$	1

Q. No.	Sub Q. N.	Answer	Marking Scheme
5.	c) (i)	**OR** Sides are in the ratio $6:5$ Let x be the common multiple $\therefore$ Sides are $6x$ *and* $5x$ $\therefore A = 3000$ $\therefore 6x \times 5x = 3000$ $\therefore 30x^2 = 3000$ $\therefore x^2 = 100$ $\therefore x = 10$ $\therefore$ Sides are $6x = 60 = l$ *and* $5x = 50 = b$ Perimeter of rectangular courtyard is $= 2(l+b)$ $= 2(60+50)$ $= 220\ m.$	 1 1 1
	c) (ii)	A circus tent is cylindrical to height 3 m and conical above it . If its diameter is 105 m and slant height of cone is 5 m,calculate the area of total canvas required.	**03**
	Ans	Given $h = 3m$, $d = 105m$ $\therefore r = \frac{105}{2} = 52.5m$, $l = 5\ m$ curved surface area of cylinder $= 2\pi r$h $= 2 \times 3.14 \times 52.5 \times 3 = 989.1\ sq.m.$ curved surface area of cone $= \pi\, rl$ $= 3.14 \times 52.5 \times 5 = 824.25\ sq.m.$ $\therefore$ Area of total canvas required $= 989.1 + 824.25$ $= 1813.35\ sq.m.$	 1 1 1
6.		Attempt any **two:**	**12**
	a)	Using matrix inversion method , solve $x+y+z=3$; $x+2y+3z=4$; $x+4y+9z=6$	**06**
	Ans	Let $A = \begin{bmatrix} 1 & 1 & 1 \\ 1 & 2 & 3 \\ 1 & 4 & 9 \end{bmatrix}$ $\lvert A \rvert = \begin{vmatrix} 1 & 1 & 1 \\ 1 & 2 & 3 \\ 1 & 4 & 9 \end{vmatrix}$ $\lvert A \rvert = 1(18-12) - 1(9-3) + 1(4-2)$	

Q. No.	Sub Q. N.	Answer	Marking Scheme
6.	a)	$\therefore \lvert A\rvert = 2 \neq 0$	1
		$\therefore A^{-1}$ exists	
		Matrix of minors $= \begin{bmatrix} \begin{vmatrix} 2 & 3 \\ 4 & 9 \end{vmatrix} & \begin{vmatrix} 1 & 3 \\ 1 & 9 \end{vmatrix} & \begin{vmatrix} 1 & 2 \\ 1 & 4 \end{vmatrix} \\ \begin{vmatrix} 1 & 1 \\ 4 & 9 \end{vmatrix} & \begin{vmatrix} 1 & 1 \\ 1 & 9 \end{vmatrix} & \begin{vmatrix} 1 & 1 \\ 1 & 4 \end{vmatrix} \\ \begin{vmatrix} 1 & 1 \\ 2 & 3 \end{vmatrix} & \begin{vmatrix} 1 & 1 \\ 1 & 3 \end{vmatrix} & \begin{vmatrix} 1 & 1 \\ 1 & 2 \end{vmatrix} \end{bmatrix}$	
		$= \begin{bmatrix} 6 & 6 & 2 \\ 5 & 8 & 3 \\ 1 & 2 & 1 \end{bmatrix}$	1
		Matrix of cofactors $= \begin{bmatrix} 6 & -6 & 2 \\ -5 & 8 & -3 \\ 1 & -2 & 1 \end{bmatrix}$	½
		OR	
		$c_{11} = (-1)^{1+1}\begin{vmatrix} 2 & 3 \\ 4 & 9 \end{vmatrix} = 6,\ c_{12} = (-1)^{1+2}\begin{vmatrix} 1 & 3 \\ 1 & 9 \end{vmatrix} = -6,\ c_{13} = (-1)^{1+3}\begin{vmatrix} 1 & 2 \\ 1 & 4 \end{vmatrix} = 2,$	
		$c_{21} = (-1)^{2+1}\begin{vmatrix} 1 & 1 \\ 4 & 9 \end{vmatrix} = -5,\ c_{22} = (-1)^{2+2}\begin{vmatrix} 1 & 1 \\ 1 & 9 \end{vmatrix} = 8,\ c_{23} = (-1)^{2+3}\begin{vmatrix} 1 & 1 \\ 1 & 4 \end{vmatrix} = -3,$	1
		$c_{31} = (-1)^{3+1}\begin{vmatrix} 1 & 1 \\ 2 & 3 \end{vmatrix} = 1,\ c_{32} = (-1)^{3+2}\begin{vmatrix} 1 & 1 \\ 1 & 3 \end{vmatrix} = -2,\ c_{33} = (-1)^{3+3}\begin{vmatrix} 1 & 1 \\ 1 & 2 \end{vmatrix} = 1,$	
		Matrix of cofactors $= \begin{bmatrix} 6 & -6 & 2 \\ -5 & 8 & -3 \\ 1 & -2 & 1 \end{bmatrix}$	½
		$\therefore AdjA = \begin{bmatrix} 6 & -5 & 1 \\ -6 & 8 & -2 \\ 2 & -3 & 1 \end{bmatrix}$	½
		$A^{-1} = \frac{1}{\lvert A\rvert}\text{Adj}.A = \frac{1}{2}\begin{bmatrix} 6 & -5 & 1 \\ -6 & 8 & -2 \\ 2 & -3 & 1 \end{bmatrix}$	1
		$X = A^{-1}B$	
		$\therefore \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \frac{1}{2}\begin{bmatrix} 6 & -5 & 1 \\ -6 & 8 & -2 \\ 2 & -3 & 1 \end{bmatrix}\begin{bmatrix} 3 \\ 4 \\ 6 \end{bmatrix}$	

Q. No.	Sub Q. N.	Answer	Marking Scheme
6.	a)	$\therefore \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \frac{1}{2}\begin{bmatrix} 18-20+6 \\ -18+32-12 \\ 6-12+6 \end{bmatrix}$	1
		$\therefore \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \frac{1}{2}\begin{bmatrix} 4 \\ 2 \\ 0 \end{bmatrix}$	
		$\begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 2 \\ 1 \\ 0 \end{bmatrix}$	1
		$\therefore \; x=2 \;,\; y=1 \;,\; z=0$	
		--	
	b)	Find mean, standard deviation and coefficient of variance of the following:	**06**

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

Ans

C.I.	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
		N=20	$\sum f_i x_i =$ 440		$\sum f_i x_i^2 =$ 11900

(2)

Mean, $\bar{x} = \frac{\sum f_i x_i}{N} = \frac{440}{20} = 22$ (1)

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

$$S.D. = \sqrt{\frac{11900}{20} - (22)^2}$$ (1)

$S.D. = 10.54$ (1)

Q. No.	Sub Q. N.	Answer	Marking Scheme
6.	b)	Coefficient of variance $= \frac{S.D.}{Mean} \times 100$ $= \frac{10.54}{22} \times 100$ $= 47.91\%$	1
		OR	

Class	x_i	f_i	d_i	$f_i d_i$	d^2_i	$f_i d^2_i$
0-10	5	3	-2	-6	4	12
10-20	15	5	-1	-5	1	5
20-30	25	8	0	0	0	0
30-40	35	3	1	3	1	3
40-50	45	1	2	2	4	4
		N=20		-6		24

2

Mean, $\underline{x} = A + \left(\frac{\sum f_i d_i}{N}\right) \times h = 25 + \left(\frac{-6}{20}\right) \times 10 = 22$ 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 $= \frac{S.D.}{Mean} \times 100$

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

$= 47.91\%$ 1

OR

C.I.	x_i	f_i	$f_i x_i$	$\left(x_i - \bar{x}\right)^2$	$f_i\left(x_i - \bar{x}\right)^2$
0-10	5	3	15	289	867
10-20	15	5	75	49	245
20-30	25	8	200	9	72
30-40	35	3	105	169	507
40-50	45	1	45	529	529
		$\sum f_i = 20$	$\sum f_i x_i = 440$		$\sum f_i\left(x_i - \bar{x}\right)^2 = 2220$

2

Q. No.	Sub Q. N.	Answer	Marking Scheme
6.	b)	Mean, $\bar{x}=\frac{\sum f_i x_i}{N}=\frac{440}{20}=22$	1
		$S.D.=\sqrt{\frac{\sum f_i\left(x_i-\bar{x}\right)^2}{\sum f_i}}$	
		$S.D.=\sqrt{\frac{2220}{20}}$	1
		$S.D.=10.54$	1
		Coefficient of variance $=\frac{S.D.}{Mean}\times 100$ $=\frac{10.54}{22}\times 100$ $=47.91\%$	1
		--	
	c) (i)	Calculate the range and coefficient of range for the following data:	**03**
		Class: 21-25, 26-30, 31-35, 36-40, 41-45; Frequency: 4, 16, 38, 12, 10	
	Ans	C.I.: 20.5-25.5, 25.5-30.5, 30.5-35.5, 35.5-40.5, 40.5-45.5; f_i: 4, 16, 38, 12, 10	
		Range $=L-S=45.5-20.5$ $=25$	1
		Coefficient of range $=\frac{L-S}{L+S}$ $=\frac{45.5-20.5}{45.5+20.5}$	1
		$=\frac{25}{66}$ OR 0.379	1
		--	
	c) (ii)	The two sets of observations are given below. Which of them is more consistent?	**03**
		Set I: $\bar{x}=82.5$, $\sigma=7.3$; Set II: $\bar{x}=48.75$, $\sigma=8.35$	

Tables within c) (i):

Class:	21-25	26-30	31-35	36-40	41-45
Frequency:	4	16	38	12	10

C.I.	20.5-25.5	25.5-30.5	30.5-35.5	35.5-40.5	40.5-45.5
f_i	4	16	38	12	10

Q. No.	Sub Q. N.	Answer	Marking Scheme
6.	c) (ii)	Set-I Coefficient of variation $V_1 = \frac{S.D.}{Mean} \times 100$ $V_1 = \frac{7.3}{82.5} \times 100$ $V_1 = 8.848$ Set-II Coefficient of variation $V_2 = \frac{S.D.}{Mean} \times 100$ $V_2 = \frac{8.35}{48.75} \times 100$ $V_2 = 17.128$ $\because V_1 < V_2$ $\therefore$ Set I is more consistent	 1 1 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.

22103

21718

3 Hours / 70 Marks Seat No. | | | | | | | | |

Instructions : *(1)* ***All*** *questions are* ***compulsory****.*

(2) Answer ***each*** *next main question on a* ***new*** *page.*

(3) Illustrate your answers with ***neat*** *sketches* ***wherever*** *necessary.*

(4) Figures to the ***right*** *indicate* ***full*** *marks.*

(5) Use of Non-programmable Electronic Pocket Calculator is ***permissible****.*

(6) Mobile Phone, Pager and any other Electronic Communication devices are ***not*** *permissible in Examination Hall.*

Marks

1. Attempt **any five** of the following : **10**

a) Find the value of $\log\left(\frac{2}{3}\right)+\log\left(\frac{4}{5}\right)-\log\left(\frac{8}{15}\right)$.

b) Find the area of the triangle whose vertices are (3, 1), (–1, 3) and (–3, –2).

c) Without using calculator, find the value of sec (3660°).

d) The length of one side of the rectangle is twice the length of its adjacent side. If the perimeter of rectangle is 60 cms, find the area of the rectangle.

e) Find the surface area of a cuboid of dimensions 26 cms ; 20 cms and 12 cms.

f) Find range and coefficient of range for the data :

120, 50, 90, 100, 180, 200, 150, 40, 80.

g) If coefficient of variation of a distribution is 75% and standard deviation is 24, find its mean.

2. Attempt **any three** of the following : **12**

a) If $A=\begin{bmatrix}3 & -1\\ 2 & 4\end{bmatrix}$, $B=\begin{bmatrix}1 & 2\\ -3 & 0\end{bmatrix}$. Find X such that 2X + 3A – 4B = I.

b) Resolve into partial fractions : $\frac{x^2+1}{x(x^2-1)}$.

Marks

c) The voltage in an electric circuit are related by following equations :

$V_1 + V_2 + V_3 = 9$; $V_1 - V_2 + V_3 = 3$; $V_1 + V_2 - V_3 = 1$ find V_1, V_2 and V_3 by using Cramer's rule.

d) Calculate the mean deviation about the mean of the following data :

3, 6, 5, 7, 10, 12, 15, 18.

3. Attempt **any three** of the following : **12**

a) Without using calculator, find the value of

$\cos 570°. \sin 510° + \sin(-330°).\cos(-390°)$.

b) Prove that $\frac{\sin 4\theta + \sin 2\theta}{1 + \cos 2\theta + \cos 4\theta} = \tan 2\theta$.

c) Prove that $\frac{\sin 3A - \sin A}{\cos 3A + \cos A} = \tan A$.

d) Prove that $\tan^{-1}\frac{1}{4} + \tan^{-1}\frac{2}{9} = \cot^{-1} 2$.

4. Attempt **any three** of the following : **12**

a) Find x and y if

$$\left\{4 \cdot \begin{bmatrix} 1 & 2 & 0 \\ 2 & -1 & 3 \end{bmatrix} - 2 \cdot \begin{bmatrix} 1 & 3 & -1 \\ 2 & -3 & 4 \end{bmatrix}\right\} \begin{bmatrix} 2 \\ 0 \\ -1 \end{bmatrix} = \begin{bmatrix} x \\ y \end{bmatrix}.$$

b) Resolve into partial fractions $\frac{2x+1}{(x-1)\cdot(x^2+1)}$.

c) Prove that $\cos 20°.\cos 40°.\cos 60°.\cos 80° = \frac{1}{16}$.

d) If $\tan\frac{\theta}{2} = \frac{2}{3}$ find the value of $2\sin\theta + 3\cos\theta$.

e) If A and B are obtuse angles and $\sin A = \frac{5}{13}$ and $\cos B = \frac{-4}{5}$, then find $\sin(A + B)$.

Marks

5. Attempt **any two** of the following : **12**

a) Attempt the following :

i) Find the length of the perpendicular from the point (5, 4) on the straight line 2x + y = 34.

ii) Find the equation of the line passing through (3, –4) and having slope $\frac{3}{2}$.

b) Attempt the following :

i) Find the equation of line passing through the point (3, 4) and perpendicular to the line 2x – 4y + 5 = 0.

ii) Find the acute angle between the lines 3x – y = 4, and 2x + y = 3.

c) Attempt the following :

i) Find the capacity of a cylindrical water tank whose radius is 2.1 m and length is 5 m.

ii) External dimensions of a wooden cuboid are 30 cm × 25 cm × 20 cm. If the thickness of wood is 2 cm all round. Find the volume of the wood contained in the cuboid formed.

6. Attempt **any two** of the following : **12**

a) Calculate the mean, standard deviation and coefficient of variance of the following data :

Class interval	0 – 10	10 – 20	20 – 30	30 – 40	40 – 50
Frequency	03	05	08	03	01

b) Attempt the following :

i) Calculate the range and coefficient of range from the following data :

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

ii) The data of run scored by two batsmen A and B in five one day matches is given below :

Batsman	**Average run scored**	**S.D.**
A	44	5.1
B	54	6.31

State which batsman is more consistent ?

c) Solve the following equations by matrix inversion method :
x + 3y + 3z = 12; x + 4y + 4z = 15; x + 3y + 4z = 13.

SUMMER– 18 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)	Find the 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)	Find the area of the triangle whose vertices are $(3,1),(-1,3)$ and $(-3,-2)$.	**02**
	Ans	Let $(x_1,y_1)=(3,1),(x_2,y_2)=(-1,3)$ and $(x_3,y_3)=(-3,-2)$	
		$A=\frac{1}{2}\begin{vmatrix}x_1 & y_1 & 1\\ x_2 & y_2 & 1\\ x_3 & y_3 & 1\end{vmatrix}$	
		$=\frac{1}{2}\begin{vmatrix}3 & 1 & 1\\ -1 & 3 & 1\\ -3 & -2 & 1\end{vmatrix}$	1
		$=\frac{1}{2}\left[3(3+2)-1(-1+3)+1(2+9)\right]$	½

SUMMER – 18 EXAMINATION

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

Q. No.	Sub Q.N.	Answers	Marking Scheme
1.	b)	$A = 12$	½
	c)	Without using calculator,find the value of $\sec(3660^0)$	**02**
	Ans	$\sec(3660^0) = \sec(40\times 90^0 + 60^0)$ or $\sec\left(40\times\frac{\pi}{2} + 60^0\right)$	1
		$= \sec 60^0$	½
		$= 2$	½
	d)	The length of one side of the rectangle is twice the length of its adjacent side. If the perimeter of rectangle is 60 cms, find the area of the rectangle.	**02**
	Ans	Let adjacent side $= x$	
		$\therefore$ other side $= 2x$	½
		perimeter $= 2(x+2x) = 60$	
		$\therefore\ x = 10$	½
		$\therefore l =$ length $= 2x = 20$	
		$\therefore b =$ breadth $= x = 10$	
		Area $= l\times b$	
		$= 20\times 10 = 200$	1
	e)	Find the surface area of a cuboid of dimensions 26 cms ; 20 cms ans 12 cms.	**02**
	Ans	Let $l = 26, b = 20, h = 12$	
		Surface Area $= 2[lb + bh + hl]$	
		$= 2[26\times 20 + 20\times 12 + 12\times 26]$	1
		$= 2144$	1
	f)	Find range and coefficient of range for the data:	**02**
		120, 50, 90, 100, 180, 200, 150, 40, 80	
	Ans	Range $= L - S$	
		$= 200 - 40$	
		$= 160$	1
		coefficient of range $= \frac{L-S}{L+S}$	
		$= \frac{200-40}{200+40}$	½

SUMMER – 18 EXAMINATION

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

Q. No.	Sub Q.N.	Answers	Marking Scheme
1.	f)	coefficient of range $= 0.667$	½
		--	
	g)	If coefficient of variation of a distribution is 75% and standard deviation is 24, find its mean.	**02**
	Ans	coefficient of variation $= \dfrac{\sigma}{\bar{x}} \times 100$	
		$75 = \dfrac{24}{\bar{x}} \times 100$	½
		$\bar{x} = \dfrac{24 \times 100}{75}$	½
		$\bar{x} = 32$	1
		--	
2.		Attempt **any three** of the following **:**	**12**
	a)	If $A = \begin{bmatrix} 3 & -1 \\ 2 & 4 \end{bmatrix}, B = \begin{bmatrix} 1 & 2 \\ -3 & 0 \end{bmatrix}$. Find X such that $2X + 3A - 4B = I$.	**04**
	Ans	$2X + 3A - 4B = I$	
		$2X + 3\begin{bmatrix} 3 & -1 \\ 2 & 4 \end{bmatrix} - 4\begin{bmatrix} 1 & 2 \\ -3 & 0 \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$	
		$2X + \begin{bmatrix} 9 & -3 \\ 6 & 12 \end{bmatrix} - \begin{bmatrix} 4 & 8 \\ -12 & 0 \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$	1
		$2X + \begin{bmatrix} 5 & -11 \\ 18 & 12 \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$	1
		$2X = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} - \begin{bmatrix} 5 & -11 \\ 18 & 12 \end{bmatrix}$	1
		$2X = \begin{bmatrix} -4 & 11 \\ -18 & -11 \end{bmatrix}$	
		$\therefore X = \dfrac{1}{2}\begin{bmatrix} -4 & 11 \\ -18 & -11 \end{bmatrix}$ *OR* $X = \begin{bmatrix} -2 & \dfrac{11}{2} \\ -9 & \dfrac{-11}{2} \end{bmatrix}$	1
		--	

Q. No.	Sub Q. N.	Answers	Marking Scheme
2.	b)	Resolve into partial fractions $\dfrac{x^2+1}{x\left(x^2-1\right)}$	**04**
	Ans	$\dfrac{x^2+1}{x(x+1)(x-1)}=\dfrac{A}{x}+\dfrac{B}{x+1}+\dfrac{C}{x-1}$	½
		$\therefore x^2+1=A(x-1)(x+1)+B(x)(x-1)+C(x)(x+1)$	
		Put $x=0$	
		$\therefore 0+1=A(0-1)(0+1)$	1
		$\boxed{A=-1}$	
		Put $x=-1$	
		$\therefore (-1)^2+1=B(-1)(-1-1)$	1
		$\boxed{B=1}$	
		Put $x=1$	
		$\therefore 1^2+1=C(1)(1+1)$	1
		$\boxed{C=1}$	
		$\therefore \dfrac{x_2+1}{x(x+1)(x-1)}=\dfrac{-1}{x}+\dfrac{1}{x+1}+\dfrac{1}{x-1}$	½
	c)	The voltage in an electric circuit are related by following equations: $V_1+V_2+V_3=9;\ V_1-V_2+V_3=3;\ V_1+V_2-V_3=1$ find $V_1,\ V_2$ and V_3 by using Cramer's rule.	**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
		$D_{V_1}=\begin{vmatrix}9&1&1\\3&-1&1\\1&1&-1\end{vmatrix}=9(1-1)-1(-3-1)+1(3+1)=8$	
		$\therefore V_1=\dfrac{D_{V_1}}{D}=\dfrac{8}{4}=2$	1
		$D_{V_2}=\begin{vmatrix}1&9&1\\1&3&1\\1&1&-1\end{vmatrix}=1(-3-1)-9(-1-1)+1(1-3)=12$	

Q. No.	Sub Q.N.	Answers	Marking Scheme
2.	c)	$\therefore V_2 = \frac{D_{V_2}}{D} = \frac{12}{4} = 3$	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)	Calculate the mean deviation about the mean of the following data: 3, 6, 5, 7, 10, 12, 15, 18.	**04**
	Ans	(see table below)	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
3.		Attempt **any three** of the following **:**	**12**
	a)	Without using calculator find the value of $\cos 570^0 \sin 510^0 + \sin(-330^0)\cos(-390^0)$	**04**
	Ans	$\cos 570^0 = \cos(6 \times 90^0 + 30^0)$	

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
$\sum x_i = 76$		$\sum \lvert d_i \rvert = 34$

Q. No.	Sub Q. N.	Answers	Marking Scheme
3.	a)	$\cos 570^0 = -\cos 30^0 = -\frac{\sqrt{3}}{2}$	½
		$\sin 510^0 = \sin\left(6\times 90^0 - 30^0\right)$	
		$= \sin 30^0 = \frac{1}{2}$	½
		$\sin\left(-330^0\right) = -\sin\left(330^0\right)$	½
		$= -\sin\left(4\times 90^0 - 30^0\right) = -\left(-\sin 30^0\right) = \frac{1}{2}$	½
		$\cos\left(-390^0\right) = \cos 390^0$	½
		$= \cos\left(4\times 90^0 + 30^0\right) = \cos 30^0 = \frac{\sqrt{3}}{2}$	½
		$\therefore \cos 570^0 \sin 510^0 + \sin\left(-330^0\right)\cos\left(-390^0\right)$	
		$= \left(-\frac{\sqrt{3}}{2}\right)\left(\frac{1}{2}\right) + \left(\frac{1}{2}\right)\left(\frac{\sqrt{3}}{2}\right)$	
		$= 0$	1
		--	
	b)	Prove that $\frac{\sin 4\theta + \sin 2\theta}{1 + \cos 2\theta + \cos 4\theta} = \tan 2\theta$	**04**
	Ans	$\text{LHS} = \frac{\sin 4\theta + \sin 2\theta}{1 + \cos 4\theta + \cos 2\theta}$	
		$= \frac{2.\sin 2\theta.\cos 2\theta + \sin 2\theta}{2\cos^2 2\theta + \cos 2\theta}$	2
		$= \frac{\sin 2\theta\left(2\cos 2\theta + 1\right)}{\cos 2\theta\left(2\cos 2\theta + 1\right)}$	1
		$= \tan 2\theta$	1
		--	
	c)	Prove that $\frac{\sin 3A - \sin A}{\cos 3A + \cos A} = \tan A$	**04**
	Ans	$\text{LHS} = \frac{\sin 3A - \sin A}{\cos 3A + \cos A}$	

Q. No.	Sub Q.N.	Answers	Marking Scheme
3.	c)	$=\dfrac{2.\cos\left(\dfrac{3A+A}{2}\right).\sin\left(\dfrac{3A-A}{2}\right)}{2.\cos\left(\dfrac{3A+A}{2}\right).\cos\left(\dfrac{3A-A}{2}\right)}$	2
		$=\dfrac{2\cos 2A.\sin A}{2\cos 2A.\cos A}$	1
			1
		$=\tan A$	
		=RHS	
		--	
	d)	Prove that $\tan^{-1}\dfrac{1}{4}+\tan^{-1}\dfrac{2}{9}=\cot^{-1}2$	**04**
	Ans	$\tan^{-1}\dfrac{1}{4}+\tan^{-1}\dfrac{2}{9}$	
		$=\tan^{-1}\left[\dfrac{\frac{1}{4}+\frac{2}{9}}{1-\frac{1}{4}\times\frac{2}{9}}\right]$	2
		$=\tan^{-1}\left(\dfrac{1}{2}\right)$	1
		$=\cot^{-1}2$	1
		$\therefore\tan^{-1}\dfrac{1}{4}+\tan^{-1}\dfrac{2}{9}=\cot^{-1}2$	
		--	
4.		Attempt **any three** of the following **:**	**12**
	a)	Find x and y if	**04**

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

Q. No.	Sub Q.N.	Answers	Marking Scheme
4.	b)	$\therefore 1=\frac{3}{2}-C$ $\therefore C=\frac{1}{2}$	1
		Put $x=-1$, $\therefore\ 2(-1)+1=\left((-1)^2+1\right)A+(-1-1)\left(B(-1)+C\right)$ $\therefore -1=2A+2B-2C$ $\therefore -1=2\left(\frac{3}{2}\right)+2B-2\left(\frac{1}{2}\right)$ $\therefore -1=3+2B-1$ $\therefore B=-\frac{3}{2}$	1
		$\therefore \frac{2x+1}{(x-1)(x^2+1)}=\frac{\frac{3}{2}}{x-1}+\frac{-\frac{3}{2}x+\frac{1}{2}}{x^2+1}$ *OR* $\frac{2x+1}{(x-1)(x^2+1)}=\frac{1}{2}\left[\frac{3}{x-1}+\frac{-3x+1}{x^2+1}\right]$	½
		--	
	c)	Prove that $\cos 20^0.\cos 40^0.\cos 60^0.\cos 80^0=\frac{1}{16}$	**04**
	Ans	$\cos 20^0.\cos 40^0.\cos 60^0.\cos 80^0=\frac{1}{2}(2\cos 20°\cos 40°).\left(\frac{1}{2}\right)\cos 80°$	½
		$=\frac{1}{4}\left[\cos(20°+40°)+\cos(20°-40°)\right]\cos 80°$	½
		$=\frac{1}{4}\left[\cos(60°)+\cos(-20°)\right]\cos 80°$	½
		$=\frac{1}{4}\left[\frac{1}{2}\cos 80°+\cos 20°\cos 80°\right]$	
		$=\frac{1}{4}\left[\frac{1}{2}\cos 80°+\frac{1}{2}(2\cos 20°\cos 80°)\right]$	½
		$=\frac{1}{8}\left[\cos 80°+\cos(20°+80°)+\cos(20°-80°)\right]$	½
		$=\frac{1}{8}\left[\cos 80°+\cos(100°)+\cos(-60°)\right]$	

SUMMER – 18 EXAMINATION

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

Q. No.	Sub Q.N.	Answers	Marking Scheme
4.	c)	$\cos 20^0.\cos 40^0.\cos 60^0.\cos 80^0 = \frac{1}{8}\left[\cos 80° + \cos(180-80°) + \frac{1}{2}\right]$	½
		$= \frac{1}{8}\left[\cos 80° - \cos(80°) + \frac{1}{2}\right]$	½
		$= \frac{1}{16}$	½
	d)	If $\tan\frac{\theta}{2} = \frac{2}{3}$ find the value of $2\sin\theta + 3\cos\theta$.	**04**
	Ans	$2\sin\theta + 3\cos\theta$	
		$= 2\left(\frac{2\tan\frac{\theta}{2}}{1+\tan^2\frac{\theta}{2}}\right) + 3\left(\frac{1-\tan^2\frac{\theta}{2}}{1+\tan^2\frac{\theta}{2}}\right)$	2
		$= 2\left(\frac{2\times\frac{2}{3}}{1+\left(\frac{2}{3}\right)^2}\right) + 3\left(\frac{1-\left(\frac{2}{3}\right)^2}{1+\left(\frac{2}{3}\right)^2}\right)$	1
		$= 3$	1
	e)	If A and B are obtuse angles and $\sin A = \frac{5}{13}$ and $\cos B = -\frac{4}{5}$ then find $\sin(A+B)$.	**04**
	Ans	$\cos^2 A = 1 - \sin^2 A$	
		$= 1 - \left(\frac{5}{13}\right)^2$	
		$= 1 - \frac{25}{169} = \frac{144}{169}$	
		$\cos A = \pm\frac{12}{13}$	
		$\therefore \cos A = -\frac{12}{13}$ $(\because A$ is obtuse angle$)$	1
		$\sin^2 B = 1 - \cos^2 B$	
		$= 1 - \left(-\frac{4}{5}\right)^2$	

Q. No.	Sub Q.N.	Answers	Marking Scheme
4.	e)	$\sin^2 B = 1 - \frac{16}{25} = \frac{9}{25}$ $\sin B = \pm\frac{3}{5}$ $\therefore \sin B = \frac{3}{5} \quad (\because A \text{ is obtuse angle})$ $\therefore \sin(A+B) = \sin A.\cos B + \cos A.\sin B$ $= \left(\frac{5}{13}\right)\times\left(-\frac{4}{5}\right)+\left(-\frac{12}{13}\right)\times\left(\frac{3}{5}\right)$ $= -\frac{56}{65}$	 1 1 1
5.		Attempt **any two** of the following **:**	**12**
	a)	Attempt the following **:**	**06**
	i)	Find the length of the perpendicular from the point $(5,4)$ on the straigth line $2x+y=34$.	**03**
	Ans	$p = \left\lvert\frac{ax_1+by_1+c}{\sqrt{a^2+b^2}}\right\rvert$ $= \left\lvert\frac{2(5)+1(4)-34}{\sqrt{(2)^2+(1)^2}}\right\rvert$ $= \left\lvert\frac{10+4-34}{\sqrt{5}}\right\rvert$ $= \frac{20}{\sqrt{5}}$ OR 8.94	 2 1
	ii)	Find the equation of the line passing through $(3,-4)$ and having slope $\frac{3}{2}$.	**03**
	Ans	Point $=(x_1,y_1)=(3,-4)$ & slope $=\frac{3}{2}$ $\therefore$ equation of line is, $y-y_1=m(x-x_1)$	

Q. No.	Sub Q.N.	Answers	Marking Scheme
5.	a)ii)	$\therefore y-(-4)=\frac{3}{2}(x-3)$	1
		$\therefore 2(y+4)=3(x-3)$	1
		$\therefore 3x-2y-17=0$	1
		--	
	b)	Attempt the following:	**06**
	i)	Find the equation of line passing through $(3,4)$ and perpendicular to the line $2x-4y+5=0$.	**03**
	Ans	Point $=(x_1,y_1)=(3,4)$	
		Slope of the line $2x-4y+5=0$ is,	
		$m=-\frac{a}{b}=-\frac{2}{-4}=\frac{1}{2}$	1
		$\therefore$ Slope of the required line is,	
		$m'=-\frac{1}{m}=-2$	1
		$\therefore$ equation is,	
		$y-y_1=m'(x-x_1)$	
		$\therefore y-4=-2(x-3)$	
		$\therefore 2x+y-10=0$	1
		--	
	ii)	Find the acute angle between the lines $3x-y=4$ and $2x+y=3$.	**03**
	Ans	For $3x-y=4$,	
		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
		$\therefore \tan\theta=\left\|\frac{m_1-m_2}{1+m_1m_2}\right\|$	
		$=\left\|\frac{3-(-2)}{1+3\times(-2)}\right\|$	1
		$=1$	½

Q. No.	Sub Q.N.	Answers	Marking Scheme
5.	b) ii)	$\therefore \theta = \tan^{-1}(1)$ $\therefore \theta = \frac{\pi}{4}$ or 45^0	½
	c)	Attempt the following:	**06**
	i)	Find the capacity of a cylindrical water tank whose radius is 2.1m and length is 5m.	**03**
	Ans	Let $r = 2.1$ & $h = 5$ capacity of a cylindrical water tank = volume of cylinder $\therefore V = \pi r^2 h$ $= \frac{22}{7} \times (2.1)^2 \times 5$ $= 69.3$	 2 1
	ii)	External dimensions of a wooden cuboid are 30 cm× 25 cm× 20 cm. If the thickness of wood is 2 cm all round. Find the volume of the wood contained in the cuboid formed.	**03**
	Ans	External length of the cuboid = 30 cm External breadth of the cuboid = 25 cm External height of the cuboid = 20 cm External volume of the cuboid = $(30 \times 25 \times 20)\ cm^3$ $= 15000\ cm^3$ Internal volume of the cuboid = $(26 \times 21 \times 16)\ cm^3$ $= 8736\ cm^3$ Volume of wood = External Volume − Internal Volume $= 15000\ cm^3 - 8736\ cm^3$ $= 6264\ cm^3$	 1 1 1
6.		Attempt **any two** of the following **:**	**12**
	a)	Calculate the mean, standard deviation and co-efficient of variance of the following data:	**06**

Class Interval	0-10	10-20	20-30	30-40	40-50
Frequency	03	05	08	03	01

SUMMER – 18 EXAMINATION

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

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

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

3

Mean $\bar{x} = \frac{\sum f_i x_i}{N} = \frac{440}{20} = 22$ — 1

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

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

$$= 10.54$$ — 1

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

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

$$= 47.91$$ — 1

OR

Q. No.	Sub Q.N.	Answers	Marking Scheme
6.	a)		**06**

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

3

Mean $\bar{x} = \frac{\sum f_i x_i}{N} = \frac{440}{20} = 22$ 1

$$\text{S.D.}\sigma = \sqrt{\frac{\sum f_i x_i^2}{N} - (\bar{x})^2}$$
$$= \sqrt{\frac{11900}{20} - (22)^2}$$
$$\sigma = 10.54$$ 1

Coefficient of variance $= \frac{\sigma}{\bar{x}} \times 100$
$$= \frac{10.54}{22} \times 100$$
$$= 47.91$$ 1

---

b) Attempt the following: **06**

i) Calculate the range and coefficient of range from 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

Ans

Marks	9.5-19.5	19.5-29.5	29.5-39.5	39.5-49.5	49.5-59.5	59.5-69.5
No. of students	6	10	16	14	8	4

1

Q. No.	Sub Q.N.	Answers	Marking Scheme
6.	b)	Range $= L - S$	
		$= 69.5 - 9.5$	
		$= 60$	1
		Coefficient of range $= \frac{L-S}{L+S}$	
		$= \frac{69.5-9.5}{69.5+9.5}$	
		$= 0.76$	1
		--	
	ii)	The data of run scored by two batsmen A and B in five one day matches is given below :	**03**
		<table><tr><th>Batsman</th><th>Average run scored</th><th>S.D.</th></tr><tr><td>A</td><td>44</td><td>5.1</td></tr><tr><td>B</td><td>54</td><td>6.31</td></tr></table>	
		State which batsman is more consistent?	
	Ans	For Batsman A	
		$C.V = \frac{\sigma}{\bar{x}} \times 100$	
		$= \frac{5.1}{44} \times 100$	
		$= 11.59$	1
		For Batsman B	
		$C.V = \frac{\sigma}{\bar{x}} \times 100$	
		$= \frac{6.31}{54} \times 100$	
		$= 11.69$	1
		$C.V$ of A $<$ $C.V$ of B	
		$\therefore$ Batsman A is more consistent.	1
		--	

SUMMER – 18 EXAMINATION

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

Q. No.	Sub Q.N.	Answers	Marking Scheme
6.	c)	Solve the following equations by matrix inversion method :	**06**
		$x+3y+3z=12$, $x+4y+4z=15$, $x+3y+4z=13$	
	Ans	Let $A=\begin{bmatrix}1&3&3\\1&4&4\\1&3&4\end{bmatrix}$, $B=\begin{bmatrix}12\\15\\13\end{bmatrix}$, $X=\begin{bmatrix}x\\y\\z\end{bmatrix}$	
		$\lvert A\rvert=\begin{vmatrix}1&3&3\\1&4&4\\1&3&4\end{vmatrix}$	
		$\lvert A\rvert=1(16-12)-3(4-4)+3(3-4)$	
		$\lvert A\rvert=4-0-3$	
		$\therefore \lvert A\rvert=1\neq 0$	1
		$\therefore A^{-1}$ exists	
		Matrix of minors $=\begin{bmatrix}\begin{vmatrix}4&4\\3&4\end{vmatrix}&\begin{vmatrix}1&4\\1&4\end{vmatrix}&\begin{vmatrix}1&4\\1&3\end{vmatrix}\\\begin{vmatrix}3&3\\3&4\end{vmatrix}&\begin{vmatrix}1&3\\1&4\end{vmatrix}&\begin{vmatrix}1&3\\1&3\end{vmatrix}\\\begin{vmatrix}3&3\\4&4\end{vmatrix}&\begin{vmatrix}1&3\\1&4\end{vmatrix}&\begin{vmatrix}1&3\\1&4\end{vmatrix}\end{bmatrix}$	
		$=\begin{bmatrix}4&0&-1\\3&1&0\\0&1&1\end{bmatrix}$	1
		Matrix of cofactors $=\begin{bmatrix}4&0&-1\\-3&1&0\\0&-1&1\end{bmatrix}$	1
		OR	
		$C_{11}=+\begin{vmatrix}4&4\\3&4\end{vmatrix}=16-12=4,\ C_{12}=-\begin{vmatrix}1&4\\1&4\end{vmatrix}=-(4-4)=0$	
		$C_{13}=+\begin{vmatrix}1&4\\1&3\end{vmatrix}=3-4=-1,\ C_{21}=-\begin{vmatrix}3&3\\3&4\end{vmatrix}=-(12-9)=-3$	
		$C_{22}=+\begin{vmatrix}1&3\\1&4\end{vmatrix}=4-3=1,\ C_{23}=-\begin{vmatrix}1&3\\1&3\end{vmatrix}=-(3-3)=0$	

SUMMER – 18 EXAMINATION

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

Q. No.	Sub Q. N.	Answers	Marking Scheme
6.	c)	$C_{31}=+\begin{vmatrix}3&3\\4&4\end{vmatrix}=12-12=0,\ C_{32}=-\begin{vmatrix}1&3\\1&4\end{vmatrix}=-(4-3)=-1$	1
		$C_{33}=+\begin{vmatrix}1&3\\1&4\end{vmatrix}=4-3=1,$	
		Matrix of cofactors $=\begin{bmatrix}4&0&-1\\-3&1&0\\0&-1&1\end{bmatrix}$	1
		$\text{Adj}.A=\begin{bmatrix}4&-3&0\\0&1&-1\\-1&0&1\end{bmatrix}$	½
		$A^{-1}=\frac{1}{\lvert A\rvert}\text{Adj}.A$	
		$=\frac{1}{1}\begin{bmatrix}4&-3&0\\0&1&-1\\-1&0&1\end{bmatrix}$	½
		$\therefore X=A^{-1}B$	
		$\begin{bmatrix}x\\y\\z\end{bmatrix}=\begin{bmatrix}4&-3&0\\0&1&-1\\-1&0&1\end{bmatrix}\begin{bmatrix}12\\15\\13\end{bmatrix}$	
		$\begin{bmatrix}x\\y\\z\end{bmatrix}=\begin{bmatrix}48-45+0\\0+15-13\\-12+0+13\end{bmatrix}$	1
		$\begin{bmatrix}x\\y\\z\end{bmatrix}=\begin{bmatrix}3\\2\\1\end{bmatrix}$	1
		$\therefore\ x=3,\ y=2,\ z=1.$	
		--	

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.

22103

11819

3 Hours / 70 Marks

Seat No. | | | | | | | | |

Instructions : *(1) **All** questions are **compulsory**.*

*(2) Answer **each** next main question on a **new** page.*

*(3) Illustrate your answers with neat sketches **wherever** necessary.*

*(4) Figures to the **right** indicate **full** marks.*

*(5) Use of Non-programmable Electronic Pocket Calculator is **permissible**.*

*(6) Mobile Phone, Pager and any other Electronic Communication devices are **not** permissible in Examination Hall.*

Marks

1. Attempt **any five** of the following : **10**

a) Evaluate $\log_3^{81}$.

b) Find the area of the triangle whose vertices are (4, 3) (1, 4) and (2, 3).

c) Find the value of sin (15°) using compound angles.

d) Find the area of rhombus whose diagonals are 6 cm and 9 cm.

e) The length, breadth and height of a cuboid are 8 cm, 11 cm and 15 cm respectively. Find the total surface area.

f) Find the range of the data :

14, 18, 22, 35, 42, 44, 8, 7, 5 and 2.

g) If mean is 34.5 and standard deviation is 5 find the coefficient of variance.

Marks

2. Attempt **any three** of the following : **12**

a) If $A = \begin{bmatrix} 0 & 1 & -1 \\ 4 & -3 & 4 \\ 3 & -3 & 4 \end{bmatrix}$ prove that $A^2 = I$.

b) Resolve into partial fractions : $\dfrac{x^2 + 23x}{(x+3)(x^2+1)}$.

c) Solve the following equations by Cramer's rule :

$x + y + z = 2$

$y + z = 1$

$x + z = 3$

d) Find mean of the following data :

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

3. Attempt **any three** of the following : **12**

a) If $\tan A = \dfrac{1}{2}$, $\tan B = \dfrac{1}{3}$, find the value of tan (A + B).

b) Prove : $\tan\left(\dfrac{\pi}{4} + A\right) = \dfrac{\cos A + \sin A}{\cos A - \sin A}$.

c) Prove : $\dfrac{\sin 4A + \sin 5A + \sin 6A}{\cos 4A + \cos 5A + \cos 6A} = \tan 5A$.

d) Prove : $\cos^{-1}\left(\dfrac{4}{5}\right) + \cos^{-1}\left(\dfrac{12}{13}\right) = \cos^{-1}\left(\dfrac{33}{65}\right)$.

4. Attempt **any three** of the following : **12**

a) If $A = \begin{bmatrix} 2 & 4 & 4 \\ 4 & 2 & 4 \\ 4 & 4 & 2 \end{bmatrix}$ show that $A^2 - 8A$ is a scalar matrix.

Marks

b) Resolve into partial fraction : $\dfrac{3x-1}{(x-4)(x+1)(x-1)}$.

c) Prove that $\cos 20° \cos 40° \cos 60° \cos 80° = \dfrac{1}{16}$.

d) Prove : $\sin A \cdot \sin(60-A) \cdot \sin(60+A) = \dfrac{1}{4} \sin 3A$.

e) Prove : $\tan^{-1}\left(\dfrac{1}{7}\right) + \tan^{-1}\left(\dfrac{1}{13}\right) = \cos^{-1}\left(\dfrac{9}{2}\right)$.

5. Attempt **any two** of the following : **12**

a) Attempt the following :

i) Find the equation of straight line passes through the points (– 4, 6) and (8, – 3).

ii) Find the equation of line passing through the point (2, 5) and through the intersection of the lines x + y = 0 and 2x – y = 9.

b) Attempt the following :

i) Find the acute angle between the lines 3x + 2y + 4 = 0 and 2x – 3y – 7 = 0.

ii) Find the distance between the lines 3x + 2y = 5 and 6x + 4y = 6.

c) Attempt the following :

i) A square grassy plot is of side 100 metre. It has a gravel path 10 metres wide all round it on the inside. Find the area of path.

ii) The volume of cube is 1000 cm^3. Find its total surface area.

6. Attempt **any two** of the following : **12**

a) Find mean, standard deviation and coefficient of variance of the following data :

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

b) Attempt the following :

i) Find mean for the following data :

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

Marks

ii) The two sets of observation are given below :

Set – I	Set – II
$\overline{x} = 82.5$	$\overline{x} = 48.75$
$\sigma = 7.3$	$\sigma = 8.35$

Which of the two sets is more consistent ?

c) Solve the following equations by matrix inversion method :

$x + 3y + 2z = 6$

$3x - 2y + 5z = 5$

$2x - 3y + 6z = 7.$

WINTER-18 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)	Evaluate $\log_3 81$	**02**
	Ans	$\log_3 81$	
		$=\log_3 (3)^4$	½
		$=4\log_3 3$	½
		$=4(1)$	½
		$=4$	½
		OR	
		$\log_3 81$ OR	
		$=\dfrac{\log 81}{\log 3}$ Let $\log_3 81 = x$	½
		$=\dfrac{\log(3)^4}{\log 3}$ $3^x = 81$	½
		$=\dfrac{4\log 3}{\log 3}$ $3^x = 3^4$	½
		$=4$ $x=4$	½
		--	
	b)	Find the area of the triangle whose vertices are $(4,3)(1,4)$ and $(2,3)$.	**02**
	Ans	Let $(x_1,y_1)=(4,3),(x_2,y_2)=(1,4)$ and $(x_3,y_3)=(2,3)$	

Q. No.	Sub Q.N.	Answers	Marking Scheme
1.	b)	$A=\frac{1}{2}\begin{vmatrix} x_1 & y_1 & 1 \\ x_2 & y_2 & 1 \\ x_3 & y_3 & 1 \end{vmatrix}$	
		$=\frac{1}{2}\begin{vmatrix} 4 & 3 & 1 \\ 1 & 4 & 1 \\ 2 & 3 & 1 \end{vmatrix}$	1
		$=\frac{1}{2}\lfloor\lceil 4(4-3)-3(1-2)+1(3-8)\rceil\rfloor$	
		$=1$	1
	c)	Find the value of $\sin\left(15^0\right)$ using compound angles	**02**
	Ans	$\sin\left(15^0\right)$	
		$=\sin\left(45^0-30^0\right)$	½
		$=\sin 45^0 \cos 30^0 - \cos 45^0 \sin 30^0$	½
		$=\left(\frac{1}{\sqrt{2}}\right)\left(\frac{\sqrt{3}}{2}\right)-\left(\frac{1}{\sqrt{2}}\right)\left(\frac{1}{2}\right)$	½
		$=\frac{\sqrt{3}-1}{2\sqrt{2}}$ or 0.2588	½
		OR	
		$\sin\left(15^0\right)$	
		$=\sin\left(60^0-45^0\right)$	½
		$=\sin 60^0 \cos 45^0 - \cos 60^0 \sin 45^0$	½
		$=\left(\frac{\sqrt{3}}{2}\right)\left(\frac{1}{\sqrt{2}}\right)-\left(\frac{1}{2}\right)\left(\frac{1}{\sqrt{2}}\right)$	½
		$=\frac{\sqrt{3}-1}{2\sqrt{2}}$ or 0.2588	½
	d)	Find the area of rhombus whose diagonals are 6 cm and 9 cm.	**02**
	Ans	Area of rhombus $=\frac{1}{2}\left(d_1\times d_2\right)$	
		$=\frac{1}{2}\left(6\times 9\right)$	1

WINTER – 18 EXAMINATION

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

Q. No.	Sub Q.N.	Answers	Marking Scheme
1.	d)	Area of rhombus $= 27$	1
		--	
	e)	The length , breadth and height of a cuboid are 8 cm,11 cm and 15 cm respectively.Find the total surface area.	**02**
	Ans	Let $l = 8$, $b = 11$, $h = 15$	
		Total surface Area of a cuboid $= 2[lb + bh + hl]$	
		$= 2[8\times11+11\times15+15\times8]$	1
		$= 746$	1
		--	
	f)	Find the range of the data: 14 , 18 , 22 , 35 , 42 , 44 , 8 , 7 , 5 and 2	**02**
	Ans	Range = $L - S$	
		$= 44 - 2$	1
		$= 42$	1
		--	
	g)	If mean is 34.5 and standard deviation is 5 find the coefficient of variance.	**02**
	Ans	Coefficient of variance $= \frac{\sigma}{\bar{x}} \times 100$	
		$= \frac{5}{34.5} \times 100$	1
		$= 14.493$	1
		--	
2.		Attempt **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	$A = \begin{bmatrix} 0 & 1 & -1 \\ 4 & -3 & 4 \\ 3 & -3 & 4 \end{bmatrix}$	

WINTER – 18 EXAMINATION

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

Q. No.	Sub Q. N.	Answers	Marking Scheme
2.	a)	$A^2 = AA$	
		$=\begin{bmatrix} 0 & 1 & -1 \\ 4 & -3 & 4 \\ 3 & -3 & 4 \end{bmatrix}\begin{bmatrix} 0 & 1 & -1 \\ 4 & -3 & 4 \\ 3 & -3 & 4 \end{bmatrix}$	
		$=\begin{bmatrix} 0+4-3 & 0-3+3 & 0+4-4 \\ 0-12+12 & 4+9-12 & -4-12+16 \\ 0-12+12 & 3+9-12 & -3-12+16 \end{bmatrix}$	2
		$=\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$	2
		$= I$	
		$\therefore A^2 = I$	
		--	
	b)	Resolve into partial fractions: $\dfrac{x^2+23x}{(x+3)(x^2+1)}$	**04**
	Ans	$\dfrac{x^2+23x}{(x+3)(x^2+1)} = \dfrac{A}{x+3} + \dfrac{Bx+C}{x^2+1}$	½
		$\therefore x^2+23x = (x^2+1)A + (x+3)(Bx+C)$	
		Put $x=-3$	
		$\therefore (-3)^2 + 23(-3) = ((-3)^2+1)A$	
		$\therefore -60 = 10A$	1
		$\therefore A = -6$	
		Put $x=0$	
		$\therefore 0 = (1)A + (3)(0+C)$	
		$\therefore 0 = -6+3C$	1
		$\therefore C = 2$	
		Put $x=1$	
		$\therefore 24 = 2(-6)+4B+4(2)$	1
		$\therefore B = 7$	
		$\therefore \dfrac{x^2+23x}{(x+3)(x^2+1)} = \dfrac{-6}{x+3} + \dfrac{7x+2}{x^2+1}$	½

Q. No.	Sub Q.N.	Answers	Marking Scheme
2.	c)	Solve the following equations by Cramer's rule: $x+y+z=2$ $y+z=1$ $x+z=3$	**04**
	Ans	$D=\begin{vmatrix}1&1&1\\0&1&1\\1&0&1\end{vmatrix}$ $=1(1-0)-1(0-1)+1(0-1)=1$	1
		$D_x=\begin{vmatrix}2&1&1\\1&1&1\\3&0&1\end{vmatrix}$ $=2(1-0)-1(1-3)+1(0-3)=1$ $\therefore x=\dfrac{D_x}{D}=\dfrac{1}{1}=1$	1
		$D_y=\begin{vmatrix}1&2&1\\0&1&1\\1&3&1\end{vmatrix}$ $=1(1-3)-2(0-1)+1(0-1)=-1$ $\therefore y=\dfrac{D_y}{D}=\dfrac{-1}{1}=-1$	1
		$D_z=\begin{vmatrix}1&1&2\\0&1&1\\1&0&3\end{vmatrix}$ $=1(3-0)-1(0-1)+2(0-1)=2$ $\therefore z=\dfrac{D_z}{D}=\dfrac{2}{1}=2$	1
		--	

Q. No.	Sub Q. N.	Answers	Marking Scheme
2.	d)	Find mean of the following data:	**04**

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

Ans

Class-Interval	x_i	f_i	$f_i x_i$
0-10	5	3	15
10-20	15	5	75
20-30	25	8	200
30-40	35	3	105
40-50	45	1	45
		20	440

2

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

$\therefore \bar{x} = \dfrac{440}{20}$ 1

$\therefore \bar{x} = 22$ 1

---

3. Attempt **any three** of the following: **12**

a) If $\tan A = \frac{1}{2}, \tan B = \frac{1}{3}$, find the value of $\tan(A+B)$ **04**

Ans

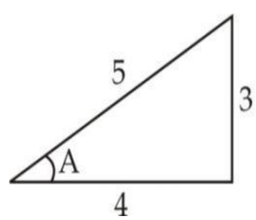
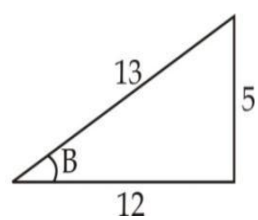
$$\tan(A+B) = \frac{\tan A + \tan B}{1 - \tan A \tan B}$$

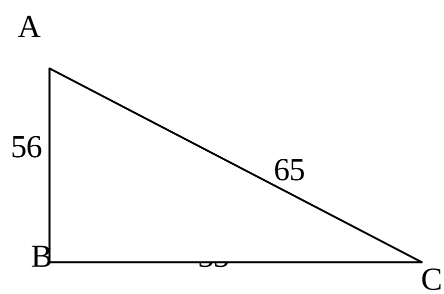
$$= \frac{\frac{1}{2} + \frac{1}{3}}{1 - \left(\frac{1}{2}\right)\left(\frac{1}{3}\right)}$$ 2

$$= 1$$ 2

Q. No.	Sub Q.N.	Answers	Marking Scheme
3.	b)	Prove : $\tan\left(\frac{\pi}{4}+A\right)=\frac{\cos A+\sin A}{\cos A-\sin A}$	**04**
	Ans	$\tan\left(\frac{\pi}{4}+A\right)$	
		$=\frac{\tan\frac{\pi}{4}+\tan A}{1-\tan\frac{\pi}{4}\tan A}$	1
		$=\frac{1+\tan A}{1-\tan A}$	1
		$=\frac{1+\frac{\sin A}{\cos A}}{1-\frac{\sin A}{\cos A}}$	1
		$=\frac{\cos A+\sin A}{\cos A-\sin A}$	1
		OR	
		$\frac{\cos A+\sin A}{\cos A-\sin A}$	
		$=\frac{1+\frac{\sin A}{\cos A}}{1-\frac{\sin A}{\cos A}}$	1
		$=\frac{1+\tan A}{1-\tan A}$	1
		$=\frac{\tan\frac{\pi}{4}+\tan A}{1-\tan\frac{\pi}{4}\tan A}$	1
		$=\tan\left(\frac{\pi}{4}+A\right)$	1
		--	
	c)	Prove: $\frac{\sin 4A+\sin 5A+\sin 6A}{\cos 4A+\cos 5A+\cos 6A}=\tan 5A$	**04**

Q. No.	Sub Q.N.	Answers	Marking Scheme
3.	c) Ans	$\frac{\sin 4A+\sin 5A+\sin 6A}{\cos 4A+\cos 5A+\cos 6A}$ $=\frac{(\sin 4A+\sin 6A)+\sin 5A}{(\cos 4A+\cos 6A)+\cos 5A}$ $=\frac{2\sin\left(\frac{4A+6A}{2}\right)\cos\left(\frac{4A-6A}{2}\right)+\sin 5A}{2\cos\left(\frac{4A+6A}{2}\right)\cos\left(\frac{4A-6A}{2}\right)+\cos 5A}$ $=\frac{2\sin 5A\cos(-A)+\sin 5A}{2\cos 5A\cos(-A)+\cos 5A}$ $=\frac{\sin 5A\left[2\cos(-A)+1\right]}{\cos 5A\left[2\cos(-A)+1\right]}$ $=\tan 5A$	 2 1 ½ ½
	d) Ans	Prove : $\cos^{-1}\left(\frac{4}{5}\right)+\cos^{-1}\left(\frac{12}{13}\right)=\cos^{-1}\left(\frac{33}{65}\right)$ Let $\cos^{-1}\left(\frac{4}{5}\right)=A$ $\therefore \cos A=\frac{4}{5}$ $\therefore \sin^2 A=1-\cos^2 A$ $=1-\frac{16}{25}$ $=\frac{9}{25}$ $\therefore \sin A=\frac{3}{5}$ $\cos^{-1}\left(\frac{12}{13}\right)=B$ $\therefore \cos B=\frac{12}{13}$ $\therefore \sin^2 B=1-\cos^2 B$ $\therefore \sin^2 B=1-\frac{144}{169}$	**04** 1

Q. No.	Sub Q.N.	Answers	Marking Scheme
3.	d)	$\therefore \sin^2 B = \frac{25}{169}$	
		$\therefore \sin B = \frac{5}{13}$	1
		$\therefore \cos(A+B) = \cos A \cos B - \sin A \sin B$	
		$= \left(\frac{4}{5}\right)\left(\frac{12}{13}\right) - \left(\frac{3}{5}\right)\left(\frac{5}{13}\right)$	1
		$= \frac{48}{65} - \frac{15}{65}$	
		$\therefore \cos(A+B) = \frac{33}{65}$	
		$\therefore A+B = \cos^{-1}\left(\frac{33}{65}\right)$	½
		$\therefore \cos^{-1}\left(\frac{4}{5}\right) + \cos^{-1}\left(\frac{12}{13}\right) = \cos^{-1}\left(\frac{33}{65}\right)$	½
		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
		$\cos^{-1}\left(\frac{12}{13}\right) = B$	
		$\therefore \cos B = \frac{12}{13}$	
		$\therefore \tan B = \frac{5}{12}$	

Q. No.	Sub Q.N.	Answers	Marking Scheme
3.	d)	$B=\tan^{-1}\left(\frac{5}{12}\right)$	
		$\therefore \cos^{-1}\left(\frac{12}{13}\right)=\tan^{-1}\left(\frac{5}{12}\right)$	1
		$L.H.S.=\tan^{-1}\left(\frac{3}{4}\right)+\tan^{-1}\left(\frac{5}{12}\right)$	
		$=\tan^{-1}\left(\frac{\frac{3}{4}+\frac{5}{12}}{1-\left(\frac{3}{4}\right)\left(\frac{5}{12}\right)}\right)$	½
		$=\tan^{-1}\left(\frac{56}{33}\right)$	½
		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
		$\therefore \cos^{-1}\left(\frac{4}{5}\right)+\cos^{-1}\left(\frac{12}{13}\right)=\cos^{-1}\left(\frac{33}{65}\right)$	
		--	
4.		Attempt **any three** of the following:	**12**
	a)	If $A=\begin{bmatrix}2&4&4\\4&2&4\\4&4&2\end{bmatrix}$ show that A^2-8A is scalar matrix.	**04**
	Ans	A^2-8A $=A.A-8A$	

WINTER – 18 EXAMINATION

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

Q. No.	Sub Q.N.	Answers	Marking Scheme
4.	a)	$=\begin{bmatrix}2&4&4\\4&2&4\\4&4&2\end{bmatrix}\begin{bmatrix}2&4&4\\4&2&4\\4&4&2\end{bmatrix}-8\begin{bmatrix}2&4&4\\4&2&4\\4&4&2\end{bmatrix}$	
		$=\begin{bmatrix}36&32&32\\32&36&32\\32&32&36\end{bmatrix}-\begin{bmatrix}16&32&32\\32&16&32\\32&32&16\end{bmatrix}$	2+1
		$=\begin{bmatrix}20&0&0\\0&20&0\\0&0&20\end{bmatrix}$	1
		$\therefore A^2-8A$ is scalar matrix	
	b)	Resolve into partial fraction: $\frac{3x-1}{(x-4)(x+1)(x-1)}$.	**04**
	Ans	$\frac{3x-1}{(x-4)(x+1)(x-1)}=\frac{A}{x-4}+\frac{B}{x+1}+\frac{C}{x-1}$	½
		$\therefore 3x-1=A(x+1)(x-1)+B(x-4)(x-1)+C(x-4)(x+1)$	
		Put $x=4$	
		$3(4)-1=A(4+1)(4-1)$	
		$\therefore 11=15A$	
		$\therefore A=\frac{11}{15}$	1
		Put $x=-1$	
		$3(-1)-1=B(-1-4)(-1-1)$	
		$\therefore -4=B(-5)(-2)$	
		$\therefore B=\frac{-2}{5}$	1
		Put $x=1$	
		$3(1)-1=C(1-4)(1+1)$	
		$\therefore 2=C(-3)(2)$	
		$\therefore C=\frac{-1}{3}$	1

Q. No.	Sub Q.N.	Answers	Marking Scheme
4.	b)	$\therefore \frac{3x-1}{(x-4)(x+1)(x-1)} = \frac{\frac{11}{15}}{x-4} + \frac{\frac{-2}{5}}{x+1} + \frac{\frac{-1}{3}}{x-1}$	½
		--	
	c)	Prove that $\cos 20^0 . \cos 40^0 . \cos 60^0 . \cos 80^0 = \frac{1}{16}$	**04**
	Ans	$\cos 20^0 \cos 40^0 \cos 60^0 \cos 80^0 = \frac{1}{2}(2\cos 20°\cos 40°).\left(\frac{1}{2}\right)\cos 80°$	½
		$= \frac{1}{4}\left[\left[\cos(20°+40°)+\cos(20°-40°)\right]\right]\cos 80°$	½
		$= \frac{1}{4}\left[\left[\cos(60°)+\cos(-20°)\right]\right]\cos 80°$	½
		$= \frac{1}{4}\left[\frac{1}{2}\cos 80° + \cos 20°\cos 80°\right]$	
		$= \frac{1}{4}\left[\frac{1}{2}\cos 80° + \frac{1}{2}(2\cos 20°\cos 80°)\right]$	½
		$= \frac{1}{8}\left[\left[\cos 80° + \cos(20°+80°) + \cos(20°-80°)\right]\right]$	½
		$= \frac{1}{8}\left[\left[\cos 80° + \cos(100°) + \cos(-60°)\right]\right]$	
		$= \frac{1}{8}\left[\cos 80° + \cos(180-80°) + \frac{1}{2}\right]$	½
		$= \frac{1}{8}\left[\cos 80° - \cos(80°) + \frac{1}{2}\right]$	½
		$= \frac{1}{16}$	½
		--	
	d)	Prove: $\sin A . \sin(60-A) . \sin(60+A) = \frac{1}{4}\sin 3A.$	**04**
	Ans	$L.H.S. = \sin A . \sin(60-A) . \sin(60+A)$	
		$= \sin A(\sin 60\cos A - \cos 60\sin A)(\sin 60\cos A + \cos 60\sin A)$	½
		$= \sin A\left[\frac{\sqrt{3}}{2}\cos A - \frac{1}{2}\sin A\right]\left[\frac{\sqrt{3}}{2}\cos A + \frac{1}{2}\sin A\right]$	1

Q. No.	Sub Q.N.	Answers	Marking Scheme
4.	d)	$L.H.S. = sinA\left[\left(\frac{\sqrt{3}}{2}cosA\right)^2 - \left(\frac{1}{2}sinA\right)^2\right]$	½
		$= sinA\left[\frac{3}{4}cos^2A - \frac{1}{4}sin^2A\right]$	
		$= \frac{1}{4}\sin A\,[3\,cos^2A - sin^2A]$	½
		$= \frac{1}{4}\sin A\,[3\,(1 - sin^2A) - sin^2A]$	
		$= \frac{1}{4}\sin A\,[3 - 3sin^2A - sin^2A]$	½
		$= \frac{1}{4}[3\sin A - 3\sin^3 A - \sin^3 A]$	
		$= \frac{1}{4}[3\sin A - 4\sin^3 A]$	½
		$= \frac{1}{4}\sin 3A$ =R.H.S.	½
		--	
	e)	Prove : $\tan^{-1}\left(\frac{1}{7}\right) + \tan^{-1}\left(\frac{1}{13}\right) = \cos^{-1}\left(\frac{9}{2}\right)$	**04**
	Ans	$L.H.S. = \tan^{-1}\left(\frac{1}{7}\right) + \tan^{-1}\left(\frac{1}{13}\right)$	
		$= \tan^{-1}\left[\frac{\frac{1}{7}+\frac{1}{13}}{1-\left(\frac{1}{7}\right)\left(\frac{1}{13}\right)}\right]$	2
		$= \tan^{-1}\left(\frac{2}{9}\right)$	1½
		$R.H.S. = \cot^{-1}\left(\frac{9}{2}\right)$	
		$\cot^{-1}\left(\frac{9}{2}\right) \neq \cos^{-1}\left(\frac{9}{2}\right)$	½
		$\therefore L.H.S. \neq R.H.S.$	
		Note: **"If Students attempted to solve the question Give appropriate marks."**	
		--	

WINTER – 18 EXAMINATION

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

Q. No.	Sub Q.N.	Answers	Marking Scheme
5.		Attempt **any two** of the following:	**12**
	a)	Attempt the following:	**06**
	(i)	Find the equation of straight line passes through the points $(-4,6)$ and $(8,-3)$.	**03**
	Ans	Let $(x_1,y_1)=(-4,6)$ and $(x_2,y_2)=(8,-3)$ Equation of line is, $\frac{y-y_1}{y_1-y_2}=\frac{x-x_1}{x_1-x_2}$ $\therefore \frac{y-6}{6+3}=\frac{x+4}{-4-8}$	2
		$\therefore \frac{y-6}{9}=\frac{x+4}{-12}$ $\therefore -12y+72=9x+36$ $\therefore 9x+12y-36=0$ *or* $3x+4y-12=0$	1
	(ii)	Find the equation of line passing through the point $(2,5)$ and through the intersection of the lines $x+y=0$ and $2x-y=9$.	**03**
	Ans	Let $(x_1,y_1)=(2,5)$ $x+y=0$ $2x-y=9$ __________ $3x=9$ $x=3$ $\therefore y=-3$ $\therefore (x_2,y_2)=(3,-3)$	1
		Equation of line is, $\frac{y-y_1}{y_1-y_2}=\frac{x-x_1}{x_1-x_2}$ $\therefore \frac{y-5}{5+3}=\frac{x-2}{2-3}$	1

Q. No.	Sub Q.N.	Answers	Marking Scheme
5.	a)(ii)	$\therefore \frac{y-5}{8}=\frac{x-2}{-1}$ $\therefore -y+5=8x-16$ $\therefore 8x+y-21=0$	1
	b)	Attempt the following:	**06**
	(i)	Find the acute angle between the lines $3x+2y+4=0$ and $2x-3y-7=0$.	**03**
	Ans	For $3x+2y+4=0$, slope $m_1=\frac{-a}{b}=\frac{-3}{2}$	½
		For $2x-3y-7=0$, slope $m_2=\frac{-a}{b}=\frac{-2}{-3}=\frac{2}{3}$	½
		$\therefore \tan\theta=\left\|\frac{m_1-m_2}{1+m_1m_2}\right\|$ $=\left\|\frac{\frac{-3}{2}-\frac{2}{3}}{1+\left(\frac{-3}{2}\right)\left(\frac{2}{3}\right)}\right\|$	1
		$\therefore \tan\theta=\infty$	½
		$\therefore \theta=\tan^{-1}(\infty)$ $\therefore \theta=90^0$ or $\frac{\pi}{2}$	½
		OR	
		Consider $m_1m_2=\left(\frac{-3}{2}\right)\left(\frac{2}{3}\right)$	1
		$=-1$	1
		$\because m_1m_2=-1$ $\therefore$ Lines are perpendicular $\therefore \theta=90^0$ or $\frac{\pi}{2}$	1

WINTER – 18 EXAMINATION

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

Q. No.	Sub Q.N.	Answers	Marking Scheme
5.	b)(ii)	Find the distance between lines $3x+2y=5$ and $6x+4y=6$	**03**
	Ans	$L_1: 3x+2y-5=0$ and $L_2: 6x+4y-6=0$	
		$\therefore L_1: 6x+4y-10=0$ and $L_2: 6x+4y-6=0$	
		$\therefore\ a=6\ ,\ b=4\ ,\ c_1=-10$ and $c_2=-6$	
		$d=\left\|\frac{c_2-c_1}{\sqrt{a^2+b^2}}\right\|$	
		$=\left\|\frac{-6+10}{\sqrt{6^2+4^2}}\right\|$	2
		$=\left\|\frac{4}{\sqrt{52}}\right\|$	1
		$=0.555$ or $\frac{2}{\sqrt{13}}$	
	c)	Attempt the following:	**06**
	(i)	A square grassy plot is of side 100 metre.It has a gravel path 10 metres wide all round it on the inside. Find the area of path.	**03**
	Ans	Area of path = Area of grassy plot – Area of inner square of grassy plot	
		$=(100)^2-(80)^2$	2
		$=3600$	1
	c)(ii)	The volume of cube is 1000 cm^3.Find its total surface area.	**03**
	Ans	Let side of cube $=l$	
		$\therefore$ volume of cube $=l^3=1000$	
		$\therefore l=10$	1
		Total surface area of cube $=6l^2$	
		$=6(10)^2$	1
		$=600$	1
6.		Attempt **any two** of the following:	**12**
	a)	Find mean, standard deviation and coefficient of variance of the following data:	

Q. No.	Sub Q.N.	Answers	Marking Scheme
6.	a)	See below	06

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

Ans

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

3

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

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

$$\therefore \bar{x} = 22$$

1

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

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

$$= 10.54$$

1

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

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

$$= 47.91$$

1

WINTER – 18 EXAMINATION

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

Q. No.	Sub Q. N.	Answers	Marking Scheme
6.	a)	**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

3

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

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

$\therefore \bar{x} = 22$ 1

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

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

$\sigma = 10.54$ 1

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

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

$= 47.91$ 1

Q. No.	Sub Q. N.	Answers	Marking Scheme
6.	b)	Attempt the following:	**06**
	(i)	Find mean for the following data:	**03**

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

Ans

Class	x_i	f_i	$f_i x_i$
10-20	15	4	60
20-30	25	6	150
30-40	35	10	350
40-50	45	18	810
50-60	55	9	495
60-70	65	3	195
		50	2060

2

Mean $\overline{x} = \dfrac{\sum f_i x_i}{N}$

$\therefore \overline{x} = \dfrac{2060}{50}$ ½

$\therefore \overline{x} = 41.2$ ½

---

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

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

Which of the two sets is more consistent?

Q. No.	Sub Q. N.	Answers	Marking Scheme
6.	b)(ii) Ans	Coefficient of variance $V = \frac{\sigma}{\bar{x}} \times 100$	
		For set-I	
		$V_1 = \frac{7.3}{82.5} \times 100$	
		$\therefore V_1 = 8.848$	1
		For set-II	
		$V_2 = \frac{8.35}{48.75} \times 100$	
		$\therefore V_2 = 17.128$	1
		$\therefore V_1 < V_2$	
		$\therefore$ Set-I is more consistent.	1
	c)	Solve the following equations by matrix inversion method :	**06**
		$x + 3y + 2z = 6$, $3x - 2y + 5z = 5$, $2x - 3y + 6z = 7$.	
	Ans	Let $A = \begin{bmatrix} 1 & 3 & 2 \\ 3 & -2 & 5 \\ 2 & -3 & 6 \end{bmatrix}$, $B = \begin{bmatrix} 6 \\ 5 \\ 7 \end{bmatrix}$, $X = \begin{bmatrix} x \\ y \\ z \end{bmatrix}$	
		$\|A\| = \begin{vmatrix} 1 & 3 & 2 \\ 3 & -2 & 5 \\ 2 & -3 & 6 \end{vmatrix}$	
		$\|A\| = 1(-12+15) - 3(18-10) + 2(-9+4)$	
		$\|A\| = -31$	1
		$\therefore \|A\| \neq 0$	
		$\therefore A^{-1}$ exists	

Q. No.	Sub Q. N.	Answers	Marking Scheme
6.	c)	$\text{Matrix of minors} = \begin{bmatrix} \begin{vmatrix} -2 & 5 \\ -3 & 6 \end{vmatrix} & \begin{vmatrix} 3 & 5 \\ 2 & 6 \end{vmatrix} & \begin{vmatrix} 3 & -2 \\ 2 & -3 \end{vmatrix} \\ \begin{vmatrix} 3 & 2 \\ -3 & 6 \end{vmatrix} & \begin{vmatrix} 1 & 2 \\ 2 & 6 \end{vmatrix} & \begin{vmatrix} 1 & 3 \\ 2 & -3 \end{vmatrix} \\ \begin{vmatrix} 3 & 2 \\ -2 & 5 \end{vmatrix} & \begin{vmatrix} 1 & 2 \\ 3 & 5 \end{vmatrix} & \begin{vmatrix} 1 & 3 \\ 3 & -2 \end{vmatrix} \end{bmatrix}$	
		$= \begin{bmatrix} 3 & 8 & -5 \\ 24 & 2 & -9 \\ 19 & -1 & -11 \end{bmatrix}$	1
		$\text{Matrix of cofactors} = \begin{bmatrix} 3 & -8 & -5 \\ -24 & 2 & 9 \\ 19 & 1 & -11 \end{bmatrix}$	1
		OR	
		$C_{11} = +\begin{vmatrix} -2 & 5 \\ -3 & 6 \end{vmatrix} = 3$, $C_{12} = -\begin{vmatrix} 3 & 5 \\ 2 & 6 \end{vmatrix} = -8$, $C_{13} = +\begin{vmatrix} 3 & -2 \\ 2 & -3 \end{vmatrix} = -5$	
		$C_{21} = -\begin{vmatrix} 3 & 2 \\ -3 & 6 \end{vmatrix} = -24$, $C_{22} = +\begin{vmatrix} 1 & 2 \\ 2 & 6 \end{vmatrix} = 2$, $C_{23} = -\begin{vmatrix} 1 & 3 \\ 2 & -3 \end{vmatrix} = 9$	
		$C_{31} = +\begin{vmatrix} 3 & 2 \\ -2 & 5 \end{vmatrix} = 19$, $C_{32} = -\begin{vmatrix} 1 & 2 \\ 3 & 5 \end{vmatrix} = 1$, $C_{33} = +\begin{vmatrix} 1 & 3 \\ 3 & -2 \end{vmatrix} = -11$	
		$\text{Matrix of cofactors} = \begin{bmatrix} 3 & -8 & -5 \\ -24 & 2 & 9 \\ 19 & 1 & -11 \end{bmatrix}$	2
		$Adj.A = \begin{bmatrix} 3 & -24 & 19 \\ -8 & 2 & 1 \\ -5 & 9 & -11 \end{bmatrix}$	½
		$A^{-1} = \frac{1}{\lvert A \rvert} \text{Adj}.A$	
		$= \frac{1}{-31} \begin{bmatrix} 3 & -24 & 19 \\ -8 & 2 & 1 \\ -5 & 9 & -11 \end{bmatrix}$	½

WINTER – 18 EXAMINATION

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

Q. No.	Sub Q. N.	Answers	Marking Scheme
6.	c)	$X = A^{-1}B$	
		$\begin{bmatrix} x \\ y \\ z \end{bmatrix} = \frac{1}{-31}\begin{bmatrix} 3 & -24 & 19 \\ -8 & 2 & 1 \\ -5 & 9 & -11 \end{bmatrix}\begin{bmatrix} 6 \\ 5 \\ 7 \end{bmatrix}$	
		$\begin{bmatrix} x \\ y \\ z \end{bmatrix} = \frac{1}{-31}\begin{bmatrix} 18-120+133 \\ -48+10+7 \\ -30+45-77 \end{bmatrix}$	1
		$\begin{bmatrix} x \\ y \\ z \end{bmatrix} = \frac{1}{-31}\begin{bmatrix} 31 \\ -31 \\ -62 \end{bmatrix}$	
		$\begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} -1 \\ 1 \\ 2 \end{bmatrix}$	1
		$\therefore\ x = -1,\ y = 1,\ z = 2$	
		--	
		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.	
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22103

21819

3 Hours / 70 Marks Seat No. | | | | | | | | |

Instructions : (1) All Questions are *compulsory*.

(2) Illustrate your answers with neat sketches wherever necessary.

(3) Figures to the right indicate full marks.

(4) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. Attempt any FIVE of the following : **10**

(a) Prove that $\frac{1}{\log_3 6} + \frac{1}{\log_8 6} + \frac{1}{\log_9 6} = 3$.

(b) Find x, if $\begin{vmatrix} 4 & 3 & 9 \\ 3 & -2 & 7 \\ 11 & 4 & x \end{vmatrix} = 0$.

(c) Without using calculator, find the value of $\cos(105^\circ)$.

(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.

(e) Find the area of ring between two concentric circles whose circumferences are 75 cm and 55 cm.

(f) Find the range and coefficient of range 40, 52, 47, 28, 45, 36, 47, 50.

(g) The two sets of observations are given below :

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 ?

2. Attempt any THREE of the following : **12**

(a) Solve the equations by Cramer's rule :

$x + y + z = 3,\ x - y + z = 1,\ x + y - 2z = 0$

(b) If $A = \begin{bmatrix} 2 & 4 & 4 \\ 4 & 2 & 4 \\ 4 & 4 & 2 \end{bmatrix}$, find $A^2 - 8A$.

(c) Resolve into partial fractions

$$\frac{3x + 2}{(x+1)(x^2 - 1)}$$

(d) A metal strip having sides 17 × 7× 5 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 ?

3. Attempt any THREE of the following : **12**

(a) Prove that

$$\tan 70^\circ - \tan 50^\circ - \tan 20^\circ = \tan 70^\circ \tan 50^\circ \tan 20^\circ .$$

(b) Prove that $\dfrac{1 + \sin\theta - \cos\theta}{1 + \sin\theta + \cos\theta} = \tan\left(\dfrac{\theta}{2}\right)$.

(c) Prove that $\dfrac{\cos 2A + 2\cos 4A + \cos 6A}{\cos A + 2\cos 3A + \cos 5A} = \cos A - \sin A \tan 3A$

(d) Prove that

$$\sin 20^\circ \sin 40^\circ \sin 60^\circ \sin 80^\circ = \frac{3}{16}$$

4. Attempt any THREE of the following : 12

(a) Find the adjoint of matrix

$$A = \begin{bmatrix} 2 & 5 & 3 \\ 3 & 1 & 2 \\ 1 & 2 & 1 \end{bmatrix}$$

(b) Resolve into partial fractions

$$\frac{x^4}{x^3+1}$$

(c) Prove that $\tan^{-1}(1) + \tan^{-1}(2) + \tan^{-1}(3) = \pi$.

(d) Prove that

$$\sin^{-1}\left(\frac{3}{5}\right) - \sin^{-1}\left(\frac{8}{17}\right) = \cos^{-1}\left(\frac{84}{85}\right)$$

(e) Without using calculator, prove that

$$\sin 420^\circ \cos 390^\circ + \cos(-300^\circ)\sin(-330^\circ) = 1$$

5. Attempt any TWO of the following : 12

(a) Attempt the following :

(i) Find the acute angle between the lines $y = 5x + 6$ and $y = x$.

(ii) Find the equation of the line passing through the point (4,5) and perpendicular to the line $7x - 5y = 420$.

(b) Attempt the following :

(i) Find the length of perpendicular from the point (2,3) on the line $4x - 6y - 3 = 0$.

(ii) Find the equation of the line passing through (1,7) and having slope 2 units.

(c) Attempt the following :

(i) A square grassy plot is of side 100 metres. It has a gravel path 10 meters wide all round it on the inside. Find the area of the path.

(ii) The volume of a sphere is $\frac{88}{21}$ cubic meters. Find its surface area.

6. Attempt any TWO of the following : **12**

(a) (i) Find the mean deviation from mean of the following distribution :

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

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

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

(b) Calculate standard deviation and coefficient of variance of the following table :

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

(c) Solve the following equations by using matrix inversion method :

$x + y + z = 6, 3x - y + 3z = 10, 5x + 5y - 4z = 3$

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	$L.H.S=\frac{1}{\log_3 6}+\frac{1}{\log_8 6}+\frac{1}{\log_9 6}$	
		$=\frac{\log 3}{\log 6}+\frac{\log 8}{\log 6}+\frac{1og9}{\log 6}$	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**

SUMMER– 2019 EXAMINATION

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

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
		$3000=30x^2$	
		$\therefore x^2=100$	
		$\therefore x=10$	
		$\therefore$ Length $=60\ m$, Breadth $=50\ m$	1
		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 $=A(\text{larger circle})-A(\text{smaller circle})$	

SUMMER– 2019 EXAMINATION

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

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: $\bar{x}=82.5$, $\sigma=7.3$ Set II: $\bar{x}=48.75$, $\sigma=8.35$	
		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)	$C.V.=\frac{7.3}{82.5}\times100=8.848$	½
		For Set II	
		$C.V.=\frac{\sigma}{\bar{x}}\times100$	
		$=\frac{8.35}{48.75}\times100=17.128$	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 $=\frac{\text{Volume of metal strip}}{\text{Volume of one coin}}$	
		$=\frac{595}{0.123}$	
		$=4837.4\approx 4837$	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
		$\dfrac{\tan 70^0 - \tan 20^0}{1+\tan 70^0 \tan 20^0} = \tan 50^0$	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 $\dfrac{1+\sin\theta - \cos\theta}{1+\sin\theta + \cos\theta} = \tan\left(\dfrac{\theta}{2}\right)$	**04**
	Ans	$\dfrac{1+\sin\theta - \cos\theta}{1+\sin\theta + \cos\theta}$	
		$= \dfrac{1-\cos\theta + \sin\theta}{1+\cos\theta + \sin\theta}$	
		$= \dfrac{2\sin^2\dfrac{\theta}{2} + 2\sin\dfrac{\theta}{2}\times\cos\dfrac{\theta}{2}}{2\cos^2\dfrac{\theta}{2} + 2\sin\dfrac{\theta}{2}\times\cos\dfrac{\theta}{2}}$	2
		$= \dfrac{2\sin\dfrac{\theta}{2}\left(\sin\dfrac{\theta}{2} + \cos\dfrac{\theta}{2}\right)}{2\cos\dfrac{\theta}{2}\left(\sin\dfrac{\theta}{2} + \cos\dfrac{\theta}{2}\right)}$	1
		$= \tan\left(\dfrac{\theta}{2}\right)$	1
		--	
	c)	Prove that $\dfrac{\cos 2A + 2\cos 4A + \cos 6A}{\cos A + 2\cos 3A + \cos 5A} = \cos A - \sin A \tan 3A$	**04**
	Ans	$\dfrac{\cos 2A + 2\cos 4A + \cos 6A}{\cos A + 2\cos 3A + \cos 5A} = \dfrac{2\cos 4A + \cos 2A + \cos 6A}{2\cos 3A + \cos A + + \cos 5A}$	
		$= \dfrac{2\cos 4A + 2\cos\left(\dfrac{2A+6A}{2}\right)\cos\left(\dfrac{2A-6A}{2}\right)}{2\cos 3A + 2\cos\left(\dfrac{A+5A}{2}\right)\cos\left(\dfrac{A-5A}{2}\right)}$	1

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

SUMMER – 2019 EXAMINATION

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

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 $=\begin{bmatrix}\begin{vmatrix}1 & 2\\ 2 & 1\end{vmatrix} & \begin{vmatrix}3 & 2\\ 1 & 1\end{vmatrix} & \begin{vmatrix}3 & 1\\ 1 & 2\end{vmatrix}\\ \begin{vmatrix}5 & 3\\ 2 & 1\end{vmatrix} & \begin{vmatrix}2 & 3\\ 1 & 1\end{vmatrix} & \begin{vmatrix}2 & 5\\ 1 & 2\end{vmatrix}\\ \begin{vmatrix}5 & 3\\ 1 & 2\end{vmatrix} & \begin{vmatrix}2 & 3\\ 3 & 2\end{vmatrix} & \begin{vmatrix}2 & 5\\ 3 & 1\end{vmatrix}\end{bmatrix}$	
		$=\begin{bmatrix}-3 & 1 & 5\\ -1 & -1 & -1\\ 7 & -5 & -13\end{bmatrix}$	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	$x^3+1\overline{)x^4}$ quotient x; x^4+x; $-\ -$; remainder $-x$	
		$\frac{x^4}{x^3+1} = x - \frac{x}{x^3+1}$	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**
		$\sin 420^0\cos 390^0+\cos\left(-300^0\right)\sin\left(-330^0\right)=1$	
	Ans	$\sin 420^0=\sin\left(90^0\times 4+60^0\right)$	
		$=\sin 60^0=\frac{\sqrt{3}}{2}$	½
		$\cos 390^0=\cos\left(90^0\times 4+30^0\right)$	
		$=\cos 30^0=\frac{\sqrt{3}}{2}$	½
		$\cos\left(-300^0\right)=\cos\left(300^0\right)$	½
		$=\cos\left(90^0\times 3+30^0\right)$	
		$=\sin 30^0=\frac{1}{2}$	½

SUMMER – 2019 EXAMINATION

Q. No.	Sub Q.N.	Answers	Marking Scheme
4.	e)	$\sin(-330^0) = -\sin(330^0)$	½
		$= -\sin(90^0 \times 3 + 60^0)$	½
		$= -(-\cos 60^0) = \frac{1}{2}$	
		$\sin 420^0 \cos 390^0 + \cos(-300^0)\sin(-330^0)$	
		$= \left(\frac{\sqrt{3}}{2}\right)\left(\frac{\sqrt{3}}{2}\right) + \left(\frac{1}{2}\right)\left(\frac{1}{2}\right)$	
		$= 1$	1
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
		$\therefore \tan\theta = \left\|\frac{m_1 - m_2}{1 + m_1 m_2}\right\|$	
		$= \left\|\frac{5-1}{1+5\times1}\right\|$	
		$\therefore \tan\theta = \frac{2}{3}$	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, $m=-\frac{a}{b}=-\frac{7}{-5}=\frac{7}{5}$	1
		$\therefore$ Slope of the required line is, $m_1=-\frac{1}{m}=\frac{-5}{7}$	1
		$\therefore$ equation is, $y-y_1=m_1(x-x_1)$ $\therefore y-5=\frac{-5}{7}(x-4)$ $\therefore 5x+7y-55=0$	1
	b)	Attempt the following:	**06**
	i) Ans	Find the length of the perpendicular from the point $(2,3)$ on the line $4x-6y-3=0$.	**03**
		$p=\left\|\frac{ax_1+by_1+c}{\sqrt{a^2+b^2}}\right\|$ $=\left\|\frac{4(2)+(-6)(3)-3}{\sqrt{(4)^2+(-6)^2}}\right\|$	1
		$=\left\|\frac{8-18-3}{\sqrt{52}}\right\|$ $=\frac{13}{\sqrt{52}}$ or 1.803	2
	ii) Ans	Find the equation of the line passing through $(1,7)$ and having slope 2 units.	**03**
		Point $=(x_1,y_1)=(1,7)$ & slope = 2 $\therefore$ Equation of line is, $y-y_1=m(x-x_1)$ $\therefore y-7=2(x-1)$	1
		$\therefore 2x-y+5=0$	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
		$r^3=\frac{88}{21}\times\frac{3}{4}\times\frac{7}{22}$ $r^3=1$ $r=1$	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

SUMMER – 2019 EXAMINATION

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

Q. No.	Sub Q.N.	Answers	Marking Scheme
6.	a)(i)		
	Ans		

C.I.	f_i	x_i	f_ix_i	$d_i = \|x_i - \overline{x}\|$	f_id_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
	$\sum f_i = 50$		$\sum f_ix_i = 1350$		$\sum f_id_i = 472$

1

$$Mean\ \overline{x} = \frac{\sum f_ix_i}{\sum f_i}$$

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

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

1

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

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

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

1

---

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

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

1

$\text{Range} = L - S$

$= 59.5 - 9.5$

$= 50$

1

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

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

$= 0.725$

1

---

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

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

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

SUMMER – 2019 EXAMINATION

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

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

SUMMER – 2019 EXAMINATION

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

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
		$\begin{bmatrix}x\\ y\\ z\end{bmatrix}=\frac{1}{36}\begin{bmatrix}36\\ 72\\ 108\end{bmatrix}=\begin{bmatrix}1\\ 2\\ 3\end{bmatrix}$	
		$\therefore\ x=1,\ y=2,\ z=3.$	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.	
		– –	

11920

3 Hours / 70 Marks

Seat No. | | | | | | | | |

Instructions : (1) All Questions are *compulsory*.

(2) Answer each next main Question on a new page.

(3) Illustrate your answers with neat sketches wherever necessary.

(4) Figures to the right indicate full marks.

(5) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. Attempt any FIVE of the following : **10**

(a) Find the value of x if $\log_3 (x + 6) = 2$.

(b) Find the area of triangle whose vertices are (–3, 1), (1, –3) and (2, 3).

(c) Without using calculator, find the value of $\cos(-765^\circ)$.

(d) Find the length of the longest pole that can be placed in a room 12 m long 9 m broad and 8 m high.

(e) Find the volume of the sphere whose surface area is 616 sq. m.

(f) If mean is 82 and standard deviation is 7, find the coefficient of variance.

(g) Find range and coefficient of range for the data :

3, 7, 11, 2, 16, 17, 22, 20, 19

2. Attempt any THREE of the following : 12

(a) If $A = \begin{bmatrix} -2 & 0 & 2 \\ 3 & 4 & 5 \end{bmatrix}$, $B = \begin{bmatrix} 2 & 1 \\ 3 & 5 \\ 0 & 2 \end{bmatrix}$ whether AB is singular or non-singular matrix.

(b) Resolve into partial fraction :

$$\frac{2x + 3}{x^2 - 2x - 3}$$

(c) The voltages in an circuit are related by the following equations :

$V_1 + V_2 + V_3 = 9$

$V_1 - V_2 + V_3 = 3$

$V_1 + V_2 - V_3 = 1$

Find V_1, V_2, V_3 by using Cramer's Rule.

(d) Compute standard deviation for the following data :

1, 2, 3, 4, 5, 6, 7

3. Attempt any THREE of the following : 12

(a) Simplify :

$$\frac{\cos^2(180^\circ - \theta)}{\sin(-\theta)} + \frac{\cos^2(270^\circ + \theta)}{\sin(180 + \theta)}$$

(b) Prove that :

$1 + \tan\theta \cdot \tan 2\theta = \sec 2\theta$.

(c) Prove that :

$$\frac{\sin 4A + \sin 5A + \sin 6A}{\cos 4A + \cos 5A + \cos 6A} = \tan 5A.$$

(d) Prove that :

$$\tan^{-1}\left(\frac{1}{2}\right) + \tan^{-1}\left(\frac{1}{3}\right) = \frac{\pi}{4}$$

4. Attempt any THREE of the following : **12**

(a) 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 $(AB)^T = B^T A^T$.

(b) Resolve in to partial fraction :

$$\frac{3x - 2}{(x + 2)(x^2 + 4)}$$

(c) Without using calculator, prove that

$$\cos 20^\circ \cdot \cos 40^\circ \cdot \cos 60^\circ \cdot \cos 80^\circ = \frac{1}{16}$$

(d) Prove that :

$$\tan A \cdot \tan (60 - A) \cdot \tan (60 + A^\circ) = \tan 3A$$

(e) If 3A and 3B are obtuse angles and $\sin A = \frac{12}{13}$, $\cos B = \frac{-4}{5}$,

find cos (A + B).

5. Attempt any TWO of the following : **12**

(a) Attempt the following :

(i) Find length of perpendicular from the point P (2, 5) on the line $2x + 3y - 6 = 0$.

(ii) Find the equation of line passing through (2, 3) and having slope 5 units.

(b) Attempt the following :

(i) Find the equation of the line passing through the point (2, 3) and perpendicular to the line $3x - 5y = 6$.

(ii) Find the acute angle between the lines $3x - y = 4$, $2x + y = 3$.

P.T.O.

(c) Attempt the following :

(i) A cylinder has hemispherical ends having radius 14 cm and height 50 cm. Find the total surface area.

(ii) A solid right circular cone of radius 2 m and height 27 m is melted and recasted into a sphere. Find the volume and surface area of the sphere.

6. Attempt any TWO of the following : **12**

(a) Find the mean, standard deviation and coefficient of variance of the following data :

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

(b) Attempt the following :

(i) From the following data, calculate range and coefficient of range :

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

(ii) The two set of observations are given below :

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 ?

(c) Solve the following equations by matrix inversion method :

$x + y + z = 3$

$3x - 2y + 3z = 4$

$5x + 5y + z = 11$

WINTER– 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 judgment on part of examiner of relevant answer based on candidate's understanding.
7) For programming language papers, credit may be given to any other program based on equivalent concept.

Q. No.	Sub Q.N.	Answers	Marking Scheme
1.		**Attempt any FIVE of the following:**	**10**
	a)	Find the value of x if $\log_3(x+6)=2$	**02**
	Ans	$\log_3(x+6)=2$	
		$\therefore x+6=3^2$	1
		$\therefore x+6=9$	
		$\therefore x=3$	1
		--	
	b)	Find the area of triangle whose vertices are $(-3,1),(1,-3)$ and $(2,3)$.	**02**
	Ans	Let $(x_1,y_1)=(-3,1),(x_2,y_2)=(1,-3)$ and $(x_3,y_3)=(2,3)$	
		$A=\frac{1}{2}\begin{vmatrix} x_1 & y_1 & 1 \\ x_2 & y_2 & 1 \\ x_3 & y_3 & 1 \end{vmatrix}$	
		$\therefore A=\frac{1}{2}\begin{vmatrix} -3 & 1 & 1 \\ 1 & -3 & 1 \\ 2 & 3 & 1 \end{vmatrix}$	1
		$\therefore A=\frac{1}{2}\left[-3(-3-3)-1(1-2)+1(3+6)\right]$	
		$\therefore A=14$	1
		--	
	c)	Without using calculator,find the value of $\cos(-765^0)$	**02**
	Ans	$\cos(-765^0)=\cos(765^0)$	½
		$=\cos(8\times90+45)$	

WINTER– 2019 EXAMINATION

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

Q. No.	Sub Q.N.	Answers	Marking Scheme
1.	c)	$\cos\left(-765^0\right) = \cos 45^0$	1
		$= \frac{1}{\sqrt{2}}$ or 0.707	½
	d)	Find the length of the longest pole that can be placed in a room 12 m long 9 m broad and 8 m high.	**02**
	Ans	Let $L = 12$ m, $B = 9\ m$, $H = 8\ m$	
		Longest pole = Length of diagonal	
		$= \sqrt{L^2 + B^2 + H^2}$	
		$= \sqrt{(12)^2 + (9)^2 + (8)^2}$	1
		$= 17\ m$	1
	e)	Find the volume of the sphere whose surface area is 616 sq.m.	**02**
	Ans	Surface area = 616	
		$4\pi r^2 = 616$	½
		$\therefore r^2 = \frac{616}{4\pi} = 49.02$	
		$\therefore r = 7.001$	½
		Volume $= \frac{4}{3}\pi r^3$	
		$= \frac{4}{3}\pi\,(7.001)^3$	½
		$= 1437.37$	½
	f)	If mean is 82 and standard deviation is 7, find the coefficient of variance .	**02**
	Ans	Coefficient of variation $= \frac{\sigma}{\bar{x}} \times 100$	
		Coefficient of variation $= \frac{7}{82} \times 100$	1
		$= 8.537$	1
	g)	Find range and coefficient of range for the data:	**02**
		3, 7,11,2,16,17,22,20,19	
	Ans	Range $= L - S$	
		$= 22 - 2$	½

Q. No.	Sub Q.N.	Answers	Marking Scheme
1.	g)	$\therefore$ Range = 20	½
		Coefficient of range $=\dfrac{L-S}{L+S}$	
		$=\dfrac{22-2}{22+2}$	½
		$=0.833$	½
2.		**Attempt any THREE of the following :**	**12**
	a)	If $A=\begin{bmatrix}-2 & 0 & 2\\ 3 & 4 & 5\end{bmatrix}, B=\begin{bmatrix}2 & 1\\ 3 & 5\\ 0 & 2\end{bmatrix}$ whether AB is singular or non singular matrix	**04**
	Ans	$AB=\begin{bmatrix}-2 & 0 & 2\\ 3 & 4 & 5\end{bmatrix}\begin{bmatrix}2 & 1\\ 3 & 5\\ 0 & 2\end{bmatrix}$	
		$=\begin{bmatrix}-4 & 2\\ 18 & 33\end{bmatrix}$	2
		Consider $\lvert AB\rvert=\begin{vmatrix}-4 & 2\\ 18 & 33\end{vmatrix}$	
		$=-132-36$	
		$=-168\neq 0$	1
		$\therefore$ AB is non singular matrix	1
	b)	Resolve into partial fraction: $\dfrac{2x+3}{x^2-2x-3}$	**04**
	Ans	$\dfrac{2x+3}{x^2-2x-3}=\dfrac{2x+3}{(x-3)(x+1)}$	
		$=\dfrac{A}{(x-3)}+\dfrac{B}{(x+1)}$	1
		$\therefore 2x+3=A(x+1)+B(x-3)$	
		Put $x=-1$	
		$\therefore -2+3=B(-1-3)$	
		$\therefore B=-\dfrac{1}{4}$	1

WINTER– 2019 EXAMINATION

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

Q. No.	Sub Q. N.	Answers	Marking Scheme
2.	b)	Put $x=3$ $\therefore 2(3)+3=A(3+1)$ $\therefore A=\frac{9}{4}$ $\frac{2x+3}{x^2-2x-3}=\frac{\frac{9}{4}}{(x-3)}+\frac{-\frac{1}{4}}{(x+1)}$	1 1
	c)	The voltages in an circuit are related by following equations: $V_1+V_2+V_3=9;\ V_1-V_2+V_3=3;\ V_1+V_2-V_3=1$. Find $V_1,\ V_2$ and V_3 by using Cramer's rule	**04**
	Ans	$D=\begin{vmatrix}1&1&1\\1&-1&1\\1&1&-1\end{vmatrix}=1(1-1)-1(-1-1)+1(1+1)=4$ $D_{V_1}=\begin{vmatrix}9&1&1\\3&-1&1\\1&1&-1\end{vmatrix}=9(1-1)-1(-3-1)+1(3+1)=8$ $\therefore V_1=\frac{D_{V_1}}{D}=\frac{8}{4}=2$ $D_{V_2}=\begin{vmatrix}1&9&1\\1&3&1\\1&1&-1\end{vmatrix}=1(-3-1)-9(-1-1)+1(1-3)=12$ $\therefore V_2=\frac{D_{V_2}}{D}=\frac{12}{4}=3$ $D_{V_3}=\begin{vmatrix}1&1&9\\1&-1&3\\1&1&1\end{vmatrix}=1(-1-3)-1(1-3)+9(1+1)=16$ $\therefore V_3=\frac{D_{V_3}}{D}=\frac{16}{4}=4$	1 1 1 1
	d)	Compute standard deviation for the following data: 1 , 2 , 3 , 4 , 5 , 6 , 7	**04**

WINTER– 2019 EXAMINATION

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

Q. No.	Sub Q.N.	Answers	Marking Scheme
2.	d)	<table><tr><td>x_i</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>$\sum x_i = 28$</td></tr><tr><td>x_i^2</td><td>1</td><td>4</td><td>9</td><td>16</td><td>25</td><td>36</td><td>49</td><td>$\sum x_i^2 = 140$</td></tr></table>	1
		Mean $\bar{x} = \frac{\sum x_i}{n} = \frac{28}{7} = 4$	1
		$S.D. = \sigma = \sqrt{\frac{\sum x_i^2}{n} - (\bar{x})^2}$	
		$\therefore \sigma = \sqrt{\frac{140}{7} - (4)^2}$	1
		$\therefore \sigma = 2$	1
3.		**Attempt any THREE of the following:**	**12**
	a)	Simplify: $\frac{\cos^2(180^0 - \theta)}{\sin(-\theta)} + \frac{\cos^2(270^0 + \theta)}{\sin(180 + \theta)}$	**04**
	Ans	$\cos^2(180^0 - \theta) = (-\cos\theta)^2 = \cos^2\theta$	½
		$\cos^2(270^0 + \theta) = \sin^2\theta$	½
		$\sin(-\theta) = -\sin\theta$	½
		$\sin(180 + \theta) = -\sin\theta$	½
		$\therefore \frac{\cos^2(180^0 - \theta)}{\sin(-\theta)} + \frac{\cos^2(270^0 + \theta)}{\sin(180 + \theta)}$	
		$= \frac{\cos_2\theta}{-\sin\theta} + \frac{\sin_2\theta}{-\sin\theta}$	½
		$= \frac{\cos_2\theta + \sin_2\theta}{-\sin\theta}$	½
		$= \frac{1}{-\sin\theta}$	½
		$= -\cos ec\theta$	½
	b)	Prove that : $1 + \tan\theta . \tan 2\theta = \sec 2\theta$	**04**

WINTER– 2019 EXAMINATION

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

Q. No.	Sub Q. N.	Answers	Marking Scheme
3.	b)	$1+\tan\theta.\tan 2\theta$	
	Ans	$=1+\dfrac{\sin\theta\ \sin 2\theta}{\cos\theta\ \cos 2\theta}$	
		$=\dfrac{\cos\theta\cos 2\theta+\sin\theta\sin 2\theta}{\cos\theta\cos 2\theta}$	½
		$=\dfrac{\cos(\theta-2\theta)}{\cos\theta\cos 2\theta}$	1
		$=\dfrac{\cos(-\theta)}{\cos\theta\cos 2\theta}$	½
		$=\dfrac{\cos\theta}{\cos\theta\cos 2\theta}$	
		$=\dfrac{1}{\cos 2\theta}$	1
		$=\sec 2\theta$	1
	c)	Prove that $\dfrac{\sin 4A+\sin 5A+\sin 6A}{\cos 4A+\cos 5A+\cos 6A}=\tan 5A$	**04**
	Ans	$\dfrac{\sin 4A+\sin 5A+\sin 6A}{\cos 4A+\cos 5A+\cos 6A}$	
		$=\dfrac{(\sin 4A+\sin 6A)+\sin 5A}{(\cos 4A+\cos 6A)+\cos 5A}$	
		$=\dfrac{2\sin\left(\frac{4A+6A}{2}\right)\cos\left(\frac{4A-6A}{2}\right)+\sin 5A}{2\cos\left(\frac{4A+6A}{2}\right)\cos\left(\frac{4A-6A}{2}\right)+\cos 5A}$	2
		$=\dfrac{2\sin 5A\cos(-A)+\sin 5A}{2\cos 5A\cos(-A)+\cos 5A}$	
		$=\dfrac{\sin 5A(2\cos(-A)+1)}{\cos 5A(2\cos(-A)+1)}$	1
		$=\tan 5A$	1
	d)	Prove that: $\tan^{-1}\left(\dfrac{1}{2}\right)+\tan^{-1}\left(\dfrac{1}{3}\right)=\dfrac{\pi}{4}$	**04**

WINTER– 2019 EXAMINATION

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

Q. No.	Sub Q.N.	Answers	Marking Scheme
3.	d)	$\tan^{-1}\left(\frac{1}{2}\right)+\tan^{-1}\left(\frac{1}{3}\right)$	
	Ans	$=\tan^{-1}\left(\frac{\frac{1}{2}+\frac{1}{3}}{1-\left(\frac{1}{2}\right)\left(\frac{1}{3}\right)}\right)$	2
		$=\tan^{-1}(1)$	1
		$=\frac{\pi}{4}$	1
4.		**Attempt any THREE of the following:**	**12**
	a)	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 $(AB)^T=B^TA^T$	**04**
	Ans	$AB=\begin{bmatrix}1 & 2 & -1\\ 3 & 0 & 2\\ 4 & 5 & 0\end{bmatrix}\begin{bmatrix}1 & 0 & 0\\ 2 & 1 & 0\\ 0 & 1 & 3\end{bmatrix}$	
		$AB=\begin{bmatrix}1+4-0 & 0+2-1 & 0+0-3\\ 3+0+0 & 0+0+2 & 0+0+6\\ 4+10+0 & 0+5+0 & 0+0+0\end{bmatrix}$	
		$AB=\begin{bmatrix}5 & 1 & -3\\ 3 & 2 & 6\\ 14 & 5 & 0\end{bmatrix}$	1
		$\therefore(AB)^T=\begin{bmatrix}5 & 3 & 14\\ 1 & 2 & 5\\ -3 & 6 & 0\end{bmatrix}$	½
		$B^TA^T=\begin{bmatrix}1 & 2 & 0\\ 0 & 1 & 1\\ 0 & 0 & 3\end{bmatrix}\begin{bmatrix}1 & 3 & 4\\ 2 & 0 & 5\\ -1 & 2 & 0\end{bmatrix}$	1
		$\therefore B^TA^T=\begin{bmatrix}1+4-0 & 3+0+0 & 4+10+0\\ 0+2-1 & 0+0+2 & 0+5+0\\ 0+0-3 & 0+0+6 & 0+0+0\end{bmatrix}$	

WINTER– 2019 EXAMINATION

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

Q. No.	Sub Q.N.	Answers	Marking Scheme
4.	a)	$\therefore B^T A^T = \begin{bmatrix} 5 & 3 & 14 \\ 1 & 2 & 5 \\ -3 & 6 & 0 \end{bmatrix}$	1
		$\therefore (AB)^T = B^T A^T$	½
	b)	Resolve in to partial fraction:	**04**
		$\frac{3x-2}{(x+2)(x^2+4)}$	
	Ans	$\frac{3x-2}{(x+2)(x^2+4)} = \frac{A}{x+2} + \frac{Bx+C}{x^2+4}$	½
		$\therefore 3x-2 = (x^2+4)A + (x+2)(Bx+C)$	
		Put $x=-2$	
		$\therefore 3(-2)-2 = ((-2)^2+4)A$	
		$\therefore -8 = 8A$	
		$\therefore A = -1$	1
		Put $x=0$	
		$\therefore -2 = 4A + 2C$	
		$\therefore -2 = 4(-1) + 2C$	
		$\therefore 2 = 2C$	
		$\therefore C = 1$	1
		Put $x=1$	
		$\therefore 3(1)-2 = ((1)^2+4)A + (1+2)(B(1)+C)$	
		$\therefore 1 = 5A + 3B + 3C$	
		$\therefore 1 = 5(-1) + 3B + 3(1)$	
		$\therefore 3 = 3B$	
		$\therefore B = 1$	1
		$\therefore \frac{3x-2}{(x+2)(x^2+4)} = \frac{-1}{x+2} + \frac{x+1}{x^2+4}$	½

Q. No.	Sub Q.N.	Answers	Marking Scheme
4.	c)	Without using calculator , prove that $\cos 20^0.\cos 40^0.\cos 60^0.\cos 80^0 = \frac{1}{16}$	**04**
	Ans	$\cos 20^0.\cos 40^0.\cos 60^0.\cos 80^0$	
		$=\frac{1}{2}(2\cos 20°\cos 40°).\left(\frac{1}{2}\right)\cos 80°$	½ ½
		$=\frac{1}{4}\left[\cos(20°+40°)+\cos(20°-40°)\right]\cos 80°$	
		$=\frac{1}{4}\left[\cos(60°)+\cos(-20°)\right]\cos 80°$	
		$=\frac{1}{4}\left[\frac{1}{2}\cos 80°+\cos 20°\cos 80°\right]$	½
		$=\frac{1}{4}\left[\frac{1}{2}\cos 80°+\frac{1}{2}(2\cos 20°\cos 80°)\right]$	½
		$=\frac{1}{8}\left[\cos 80°+\cos(20°+80°)+\cos(20°-80°)\right]$	½
		$=\frac{1}{8}\left[\cos 80°+\cos(100°)+\cos(-60°)\right]$	
		$=\frac{1}{8}\left[\cos 80°+\cos(180-80°)+\frac{1}{2}\right]$	½
		$=\frac{1}{8}\left[\cos 80°-\cos(80°)+\frac{1}{2}\right]$	½
		$=\frac{1}{16}$	½
	d)	Prove that:	
		$\tan A.\tan(60-A).\tan(60+A)=\tan 3A$	**04**
	Ans	$\tan A.\tan(60-A).\tan(60+A)$	
		$=\tan A.\frac{\tan 60-\tan A}{1+\tan 60\tan A}\frac{\tan 60+\tan A}{1-\tan 60\tan A}$	1
		$=\tan A.\left(\frac{\sqrt{3}-\tan A}{1+\sqrt{3}\tan A}\right)\left(\frac{\sqrt{3}+\tan A}{1-\sqrt{3}\tan A}\right)$	1
		$=\tan A.\left(\frac{3-\tan^2 A}{1-3\tan^2 A}\right)$	1

WINTER– 2019 EXAMINATION

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

Q. No.	Sub Q.N.	Answers	Marking Scheme
4.	d)	$=\left(\dfrac{3\tan A-\tan^3 A}{1-3\tan^2 A}\right)$	
		$=\tan 3A$	1
		--	
	e)	If $\angle A$ and $\angle B$ are obtuse angles and $\sin A=\dfrac{12}{13},\ \cos B=\dfrac{-4}{5}$, find $\cos(A+B)$	**04**
	Ans	$\sin A=\dfrac{12}{13},\ \cos B=\dfrac{-4}{5}$	
		$\cos^2 A=1-\sin^2 A$	
		$=1-\left(\dfrac{12}{13}\right)^2$	
		$=1-\dfrac{144}{169}=\dfrac{25}{169}$	
		$\cos A=\pm\dfrac{5}{13}$	
		$\therefore\cos A=-\dfrac{5}{13}$ $(\angle A$ is obtuse angle$)$	1
		$\sin^2 B=1-\cos^2 B$	
		$=1-\left(-\dfrac{4}{5}\right)^2$	
		$\sin^2 B=1-\dfrac{16}{25}=\dfrac{9}{25}$	
		$\sin B=\pm\dfrac{3}{5}$	
		$\therefore\sin B=\dfrac{3}{5}$ $(\angle B$ is obtuse angle$)$	1
		$\therefore\cos(A+B)=\cos A.\cos B-\sin A.\sin B$	
		$=\left(-\dfrac{5}{13}\right)\times\left(-\dfrac{4}{5}\right)-\left(\dfrac{12}{13}\right)\times\left(\dfrac{3}{5}\right)$	1
		$=-\dfrac{16}{65}$	1
		--	

WINTER– 2019 EXAMINATION

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

Q. No.	Sub Q.N.	Answers	Marking Scheme
5.		**Attempt any TWO of the following:**	**12**
	a)	Attempt the following:	**06**
	(i)	Find length of perpendicular from the point $P(2,5)$ on the line $2x+3y-6=0$	**03**
	Ans	$d=\left\|\frac{ax_1+by_1+c}{\sqrt{a^2+b^2}}\right\|$	
		$p=\left\|\frac{2(2)+3(5)-6}{\sqrt{(2)^2+(3)^2}}\right\|$	2
		$p=\frac{13}{\sqrt{13}}$ or $\sqrt{13}$ or 3.61	1
	a) ii)	Find the equation of the line passing through $(2,3)$ and having slope 5 units	**03**
	Ans	Point $(x_1,y_1)=(2,3)$ and slope $m=5$	
		Equation of line is,	
		$y-y_1=m(x-x_1)$	
		$\therefore y-3=5(x-2)$	1
		$\therefore y-3=5x-10$	1
		$\therefore 5x-y-7=0$	1
	b)	Attempt the following:	**06**
	i)	Find the equation of the line passing through the point $(2,3)$ and perpendicular to the line $3x-5y=6$	**03**
	Ans	Point $(x_1,y_1)=(2,3)$	
		Slope of the line $3x-5y-6=0$ is,	
		$m=-\frac{a}{b}=-\frac{3}{-5}=\frac{3}{5}$	½
		$\therefore$ Slope of the required line is,	
		$m'=-\frac{1}{m}=-\frac{5}{3}$	½

Q. No.	Sub Q.N.	Answers	Marking Scheme
5.	b)i) Ans	$\therefore$ equation is, $y - y_1 = m'(x - x_1)$ $\therefore y - 3 = -\frac{5}{3}(x-2)$ $\therefore 3y - 9 = -5x + 10$ $\therefore 5x + 3y - 19 = 0$	1 1
	b)ii) Ans	Find the acute angle between the lines $3x - y = 4$, $2x + y = 3$. For $3x - y = 4$ slope $m_1 = -\frac{a}{b} = -\frac{3}{-1} = 3$ *For* $2x + y = 3$ slope $m_2 = -\frac{a}{b} = -\frac{2}{1} = -2$ $\therefore \tan\theta = \left\|\frac{m_1 - m_2}{1 + m_1 m_2}\right\|$ $\therefore \tan\theta = \left\|\frac{3-(-2)}{1+3\times(-2)}\right\|$ $\therefore \tan\theta = 1$ $\therefore \theta = \tan^{-1}(1)$ $\therefore \theta = \frac{\pi}{4}$	**03** ½ ½ 1 1
	c)	Attempt the following:	**06**
	i) Ans	A cylinder has hemispherical ends having radius 14 cm and height 50 cm. Find the total surface area Given $r = 14$ cm and $h = 50$ cm Total surface area = Curved Surface area of Cylinder + Surface area of two hemisphere $\therefore A = 2\pi rh + 2(2\pi r^2) = 2\pi r(h + 2r)$ $= 2\pi(14)\left[50 + 2(14)\right]$ $= 2184\pi$ or 6861.24	**03** 2 1

Q. No.	Sub Q.N.	Answers	Marking Scheme
5.	c)(ii)	A solid right circular cone of radius 2 m and height 27 m melted and recasted into a sphere. Find the volume and surface area of the sphere.	**03**
	Ans	Volume of right circular cone $=\frac{1}{3}\pi r^2 h$	
		$=\frac{1}{3}\pi(2)^2(27)$	
		$=36\pi$ or 113.04	1
		Volume of sphere $=$ Volume of right circular cone $=36\pi$	
		Volume of sphere $=\frac{4}{3}\pi r^3$	
		$\therefore 36\pi=\frac{4}{3}\pi r^3$	
		$\therefore r^3=27$	1
		$\therefore r=3$	
		$\therefore$ Surface area of the sphere $=4\pi r^2$	
		$=4\pi(3)^2$	
		$=36\pi$ or 113.04	1
6.		**Attempt any TWO of the following :**	**12**
	a)	Find the mean, standard deviation and coefficient of variance of the following data:	**06**
	Ans	(tables below)	3

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

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	14	70	-2	-28	4	56
10-20	15	23	345	-1	-23	1	23
20-30	25	27	675	0	0	0	0
30-40	35	21	735	1	21	1	21
40-50	45	15	675	2	30	4	60
		100	2500		0		160

Q. No.	Sub Q.N.	Answers	Marking Scheme
6.	a)	Mean $\bar{x}=\frac{\sum f_i x_i}{N}=\frac{2500}{100}=25$	1
		$S.D.=\sigma=\sqrt{\frac{\sum f_i d_i^2}{N}-\left(\frac{\sum f_i d_i}{N}\right)^2}\times h$	
		$S.D.=\sigma=\sqrt{\frac{160}{100}-\left(\frac{0}{100}\right)^2}\times 10$	
		$=12.64$	1
		Coefficient of variance $V=\frac{\sigma}{\bar{x}}\times 100=\frac{12.64}{25}\times 100$	
		$=50.56$	1
		OR	

Class Interval	x_i	f_i	$f_i x_i$	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

(Marking scheme: 3)

Mean $\bar{x}=\frac{\sum f_i x_i}{N}=\frac{2500}{1000}=25$ — 1

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

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

$\sigma=12.64$ — 1

WINTER– 2019 EXAMINATION

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

Q. No.	Sub Q.N.	Answers	Marking Scheme
6.	a)	Coefficient of variance $=\frac{\sigma}{\bar{x}}\times 100$ $=\frac{12.64}{25}\times 100$ $=50.56$	1
	b)	Attempt the following:	**06**
	i)	Calculate the range and coefficient of range from 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

Ans

Marks	9.5-19.5	19.5-29.5	29.5-39.5	39.5-49.5	49.5-59.5	59.5-69.5
No. of students	6	10	16	14	8	4

1

$$\text{Range} = L - S = 69.5 - 9.5 = 60$$

1

$$\text{Coefficient of range} = \frac{L-S}{L+S} = \frac{69.5-9.5}{69.5+9.5} = 0.76$$

1

---

b)ii) The two set of observations are given below: **03**

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

Which of two set is more consistent?

Q. No.	Sub Q.N.	Answers	Marking Scheme
6.	b) ii) Ans	For Set I: Coefficient of variance $=\frac{\sigma}{\bar{x}}\times 100$ $=\frac{7.3}{82.5}\times 100$ $=8.848$	1
		For Set II: Coefficient of variance $=\frac{\sigma}{\bar{x}}\times 100$ $=\frac{8.35}{48.75}\times 100$ $=17.128$	1
		Set I is more consistent	1
	c)	Solve the following equations by matrix inversion method : $x+y+z=3$ $3x-2y+3z=4$ $5x+5y+z=11$	**06**
	Ans	Let $A=\begin{bmatrix}1 & 1 & 1\\ 3 & -2 & 3\\ 5 & 5 & 1\end{bmatrix}$, $B=\begin{bmatrix}3\\ 4\\ 11\end{bmatrix}$, $X=\begin{bmatrix}x\\ y\\ z\end{bmatrix}$ $\|A\|=\begin{vmatrix}1 & 1 & 1\\ 3 & -2 & 3\\ 5 & 5 & 1\end{vmatrix}$	
		$\|A\|=1(-2-15)-1(3-15)+1(15+10)$ $\therefore \|A\|=20\neq 0$ $\therefore A^{-1}$ exists	1
		Matrix of minors $=\begin{bmatrix}\begin{vmatrix}-2 & 3\\ 5 & 1\end{vmatrix} & \begin{vmatrix}3 & 3\\ 5 & 1\end{vmatrix} & \begin{vmatrix}3 & -2\\ 5 & 5\end{vmatrix}\\ \begin{vmatrix}1 & 1\\ 5 & 1\end{vmatrix} & \begin{vmatrix}1 & 1\\ 5 & 1\end{vmatrix} & \begin{vmatrix}1 & 1\\ 5 & 5\end{vmatrix}\\ \begin{vmatrix}1 & 1\\ -2 & 3\end{vmatrix} & \begin{vmatrix}1 & 1\\ 3 & 3\end{vmatrix} & \begin{vmatrix}1 & 1\\ 3 & -2\end{vmatrix}\end{bmatrix}$	

WINTER– 2019 EXAMINATION

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

Q. No.	Sub Q.N.	Answers	Marking Scheme
6.	c)	Matrix of minors $=\begin{bmatrix}-17 & -12 & 25\\ -4 & -4 & 0\\ 5 & 0 & -5\end{bmatrix}$	1
		Matrix of cofactors $=\begin{bmatrix}-17 & 12 & 25\\ 4 & -4 & 0\\ 5 & 0 & -5\end{bmatrix}$	1
		OR	
		$C_{11}=+\begin{vmatrix}-2 & 3\\ 5 & 1\end{vmatrix}=-2-15=-17,\ C_{12}=-\begin{vmatrix}3 & 3\\ 5 & 1\end{vmatrix}=-(3-15)=12\ ,\ C_{13}=+\begin{vmatrix}3 & -2\\ 5 & 5\end{vmatrix}=15+10=25$	
		$C_{21}=-\begin{vmatrix}1 & 1\\ 5 & 1\end{vmatrix}=-(1-5)=4\ ,\ C_{22}=+\begin{vmatrix}1 & 1\\ 5 & 1\end{vmatrix}=1-5=-4,\ C_{23}=-\begin{vmatrix}1 & 1\\ 5 & 5\end{vmatrix}=-(5-5)=0$	1
		$C_{31}=+\begin{vmatrix}1 & 1\\ -2 & 3\end{vmatrix}=3+2=5,\ C_{32}=-\begin{vmatrix}1 & 1\\ 3 & 3\end{vmatrix}=-(3-3)=0\ ,\ C_{33}=\begin{vmatrix}1 & 1\\ 3 & -2\end{vmatrix}=-2-3=-5$	
		Matrix of cofactors $=\begin{bmatrix}-17 & 12 & 25\\ 4 & -4 & 0\\ 5 & 0 & -5\end{bmatrix}$	1
		$\text{Adj}.A=\begin{bmatrix}-17 & 4 & 5\\ 12 & -4 & 0\\ 25 & 0 & -5\end{bmatrix}$	½
		$A^{-1}=\frac{1}{\lvert A\rvert}\text{Adj}.A$	
		$\therefore A^{-1}=\frac{1}{20}\begin{bmatrix}-17 & 4 & 5\\ 12 & -4 & 0\\ 25 & 0 & -5\end{bmatrix}$	1
		$\therefore X=A^{-1}B$	
		$\begin{bmatrix}x\\ y\\ z\end{bmatrix}=\frac{1}{20}\begin{bmatrix}-17 & 4 & 5\\ 12 & -4 & 0\\ 25 & 0 & -5\end{bmatrix}\begin{bmatrix}3\\ 4\\ 11\end{bmatrix}$	
		$\begin{bmatrix}x\\ y\\ z\end{bmatrix}=\frac{1}{20}\begin{bmatrix}-51+16+55\\ 36-16+0\\ 75+0-55\end{bmatrix}$	½

WINTER– 2019 EXAMINATION

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

Q. No.	Sub Q. N.	Answers	Marking Scheme
6.	c)	$\begin{bmatrix} x \\ y \\ z \end{bmatrix} = \frac{1}{20}\begin{bmatrix} 20 \\ 20 \\ 20 \end{bmatrix}$ $\therefore\ x=1,\ y=1,\ z=1$	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.* ----------	