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SUMMER– 2019 EXAMINATION

Subject Name: Basic Mathematics

Model Answer

Subject Code:

22103

Important Instructions to examiners:

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

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



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1.	b)	$\begin{vmatrix} 4 & 3 & 9 \\ 3 & -2 & 7 \\ 11 & 4 & x \end{vmatrix} = 0$ $4(-2x-28) - 3(3x-77) + 9(12+22) = 0$ $\therefore -8x - 112 - 9x + 231 + 306 = 0$ $\therefore -17x + 425 = 0$ $\therefore x = 25$	<p>½</p> <p>½</p> <p>1</p>
	c)	Without using calculator, find the value of $\cos(105^\circ)$	02
	Ans	$\cos(105^\circ) = \cos(60^\circ + 45^\circ)$ $= \cos 60^\circ \cos 45^\circ - \sin 60^\circ \sin 45^\circ$ $= \left(\frac{1}{2}\right)\left(\frac{1}{\sqrt{2}}\right) - \left(\frac{\sqrt{3}}{2}\right)\left(\frac{1}{\sqrt{2}}\right)$ $= \frac{1-\sqrt{3}}{2\sqrt{2}} \text{ or } -0.2588$	<p>½</p> <p>½</p> <p>½</p>
	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	\therefore Sides are in the ratio 6:5 \therefore length = $6x$, breadth = $5x$ Area = $(6x)(5x)$ $3000 = 30x^2$ $\therefore x^2 = 100$ $\therefore x = 10$ \therefore Length = 60 m , Breadth = 50 m Perimeter = $2(\text{length} + \text{breadth})$ $= 2(60 + 50) = 220$	<p>½</p> <p>1</p> <p>½</p>
e)	Find the area of ring between two concentric circles whose circumferences are 75cm and 55 cm.	02	
Ans	Area of ring = $A(\text{larger circle}) - A(\text{smaller circle})$		



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1.	e)	$\therefore \text{Area of ring} = \pi r_1^2 - \pi r_2^2 = \pi (r_1^2 - r_2^2)$ $\therefore 2\pi r_1 = 75$ $\therefore r_1 = \frac{75}{2\pi}$ $\therefore 2\pi r_2 = 55$ $\therefore r_2 = \frac{55}{2\pi}$ $\text{Area of ring} = \pi (r_1^2 - r_2^2)$ $= \pi \left(\left(\frac{75}{2\pi} \right)^2 - \left(\frac{55}{2\pi} \right)^2 \right)$ $= 206.9$	<p>½</p> <p>½</p> <p>½</p> <p>½</p>					
	f)	<p>Find the range and coefficient of range</p> <p>40, 52, 47, 28, 45, 36, 47, 50</p> <p>Ans Range = $L - S$</p> $= 52 - 28$ $= 24$ <p>Coefficient of range = $\frac{L - S}{L + S}$</p> $= \frac{52 - 28}{52 + 28}$ $= 0.3$	<p>02</p> <p>1</p> <p>1</p>					
	g)	<p>The two sets of observations are given below:</p> <table style="width: 100%; border: none;"> <tr> <td style="text-align: center;">Set I</td> <td style="text-align: center;">Set II</td> </tr> <tr> <td style="text-align: center;">$\bar{x} = 82.5$</td> <td style="text-align: center;">$\bar{x} = 48.75$</td> </tr> <tr> <td style="text-align: center;">$\sigma = 7.3$</td> <td style="text-align: center;">$\sigma = 8.35$</td> </tr> </table> <p>Which of two sets is more consistent?</p> <p>Ans For Set I</p> $C.V = \frac{\sigma}{x} \times 100$	Set I	Set II	$\bar{x} = 82.5$	$\bar{x} = 48.75$	$\sigma = 7.3$	$\sigma = 8.35$
Set I	Set II							
$\bar{x} = 82.5$	$\bar{x} = 48.75$							
$\sigma = 7.3$	$\sigma = 8.35$							



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1.	g)	$C.V. = \frac{7.3}{82.5} \times 100 = 8.848$ <p>For Set II</p> $C.V. = \frac{\sigma}{x} \times 100$ $= \frac{8.35}{48.75} \times 100 = 17.128$ <p>$C.V.$ of Set I < $C.V.$ of Set II \therefore Set I is more consistent.</p> <p>-----</p>	<p>½</p> <p>½</p> <p>1</p>
2.		<p>Attempt any THREE of the following :</p> <p>a) Solve the equations by Cramer's rule: $x + y + z = 3, x - y + z = 1, x + y - 2z = 0$</p> <p>Ans</p> $D = \begin{vmatrix} 1 & 1 & 1 \\ 1 & -1 & 1 \\ 1 & 1 & -2 \end{vmatrix} = 1(2-1) - 1(-2-1) + 1(1+1) = 6$ $D_x = \begin{vmatrix} 3 & 1 & 1 \\ 1 & -1 & 1 \\ 0 & 1 & -2 \end{vmatrix} = 3(2-1) - 1(-2-0) + 1(1+0) = 6$ $\therefore x = \frac{D_x}{D} = \frac{6}{6} = 1$ $D_y = \begin{vmatrix} 1 & 3 & 1 \\ 1 & 1 & 1 \\ 1 & 0 & -2 \end{vmatrix} = 1(-2-0) - 3(-2-1) + 1(0-1) = 6$ $\therefore y = \frac{D_y}{D} = \frac{6}{6} = 1$ $D_z = \begin{vmatrix} 1 & 1 & 3 \\ 1 & -1 & 1 \\ 1 & 1 & 0 \end{vmatrix} = 1(0-1) - 1(0-1) + 3(1+1) = 6$ $\therefore z = \frac{D_z}{D} = \frac{6}{6} = 1$ <p>-----</p>	<p>12</p> <p>04</p> <p>1</p> <p>1</p> <p>1</p>



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2.	b)	<p>If $A = \begin{bmatrix} 2 & 4 & 4 \\ 4 & 2 & 4 \\ 4 & 4 & 2 \end{bmatrix}$, find $A^2 - 8A$.</p> <p>Ans $A^2 = AA = \begin{bmatrix} 2 & 4 & 4 \\ 4 & 2 & 4 \\ 4 & 4 & 2 \end{bmatrix} \begin{bmatrix} 2 & 4 & 4 \\ 4 & 2 & 4 \\ 4 & 4 & 2 \end{bmatrix}$</p> $A^2 = \begin{bmatrix} 4+16+16 & 8+8+16 & 8+16+8 \\ 8+8+16 & 16+4+16 & 16+8+8 \\ 8+16+8 & 16+8+8 & 16+16+4 \end{bmatrix}$ $A^2 = \begin{bmatrix} 36 & 32 & 32 \\ 32 & 36 & 32 \\ 32 & 32 & 36 \end{bmatrix}$ $8A = 8 \begin{bmatrix} 2 & 4 & 4 \\ 4 & 2 & 4 \\ 4 & 4 & 2 \end{bmatrix} = \begin{bmatrix} 16 & 32 & 32 \\ 32 & 16 & 32 \\ 32 & 32 & 16 \end{bmatrix}$ $\therefore A^2 - 8A = \begin{bmatrix} 36 & 32 & 32 \\ 32 & 36 & 32 \\ 32 & 32 & 36 \end{bmatrix} - \begin{bmatrix} 16 & 32 & 32 \\ 32 & 16 & 32 \\ 32 & 32 & 16 \end{bmatrix} = \begin{bmatrix} 20 & 0 & 0 \\ 0 & 20 & 0 \\ 0 & 0 & 20 \end{bmatrix}$	<p>04</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p>
	c)	<p>Resolve into partial fractions $\frac{3x+2}{(x+1)(x^2-1)}$</p> <p>Ans $\frac{3x+2}{(x+1)^2(x-1)} = \frac{A}{x+1} + \frac{B}{(x+1)^2} + \frac{C}{x-1}$</p> $\therefore 3x+2 = A(x-1)(x+1) + B(x-1) + C(x+1)^2$ <p>Put $x = -1$</p> $\therefore -3+2 = B(-1-1)$ $\boxed{B = \frac{1}{2}}$ <p>Put $x = 1$</p>	<p>04</p> <p>½</p> <p>1</p>



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2.	c)	$\therefore 3 + 2 = C(1+1)^2$ $\boxed{C = \frac{5}{4}}$ <p>Put $x = 0, B = \frac{1}{2}, C = \frac{5}{4}$</p> $\therefore 2 = A(0-1)(0+1) + \frac{1}{2}(0-1) + \frac{5}{4}(0+1)^2$ $\boxed{A = -\frac{5}{4}}$ $\therefore \frac{3x+2}{(x+1)^2(x-1)} = \frac{-\frac{5}{4}}{x+1} + \frac{\frac{1}{2}}{(x+1)^2} + \frac{\frac{5}{4}}{x-1}$ <hr/> <p>d) A metal strip having sides $17 \times 7 \times 5$ 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?</p> <p>Ans Metal strip has dimensions $17 \times 7 \times 5$ cm Volume of metal strip = $17 \times 7 \times 5 = 595$ cm³ Coin has diameter 1.4 cm \therefore radius = 0.7 cm Thickness of coin = 0.08 cm Volume of one coin = $\pi r^2 h$ $= \pi (0.7)^2 (0.08)$ $= 0.123$ Number of coin minted = $\frac{\text{Volume of metal strip}}{\text{Volume of one coin}}$ $= \frac{595}{0.123}$ $= 4837.4 \approx 4837$</p> <hr/>	<p>1</p> <p>1</p> <p>$\frac{1}{2}$</p> <p>04</p> <p>$\frac{1}{2}$</p> <p>$\frac{1}{2}$</p> <p>1</p> <p>2</p> <p>12</p> <p>04</p>
3.	a)	<p>Attempt any THREE of the following:</p> <p>Prove that</p> $\tan 70^\circ - \tan 50^\circ - \tan 20^\circ = \tan 70^\circ \tan 50^\circ \tan 20^\circ$	<p>12</p> <p>04</p>
	Ans	$\therefore 70^\circ - 20^\circ = 50^\circ$	



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3.	a)	$\tan(70^\circ - 20^\circ) = \tan 50^\circ$ $\frac{\tan 70^\circ - \tan 20^\circ}{1 + \tan 70^\circ \tan 20^\circ} = \tan 50^\circ$ $\tan 70^\circ - \tan 20^\circ = \tan 50^\circ (1 + \tan 70^\circ \tan 20^\circ)$ $\tan 70^\circ - \tan 20^\circ = \tan 50^\circ + \tan 50^\circ \tan 70^\circ \tan 20^\circ$ $\tan 70^\circ - \tan 50^\circ - \tan 20^\circ = \tan 70^\circ \tan 50^\circ \tan 20^\circ$	<p>1</p> <p>1</p> <p>½</p> <p>½</p> <p>1</p>
	b)	<p>Prove that $\frac{1 + \sin \theta - \cos \theta}{1 + \sin \theta + \cos \theta} = \tan\left(\frac{\theta}{2}\right)$</p>	04
	Ans	$\frac{1 + \sin \theta - \cos \theta}{1 + \sin \theta + \cos \theta}$ $= \frac{1 - \cos \theta + \sin \theta}{1 + \cos \theta + \sin \theta}$ $= \frac{2 \sin^2 \frac{\theta}{2} + 2 \sin \frac{\theta}{2} \times \cos \frac{\theta}{2}}{2 \cos^2 \frac{\theta}{2} + 2 \sin \frac{\theta}{2} \times \cos \frac{\theta}{2}}$ $= \frac{2 \sin \frac{\theta}{2} \left(\sin \frac{\theta}{2} + \cos \frac{\theta}{2} \right)}{2 \cos \frac{\theta}{2} \left(\sin \frac{\theta}{2} + \cos \frac{\theta}{2} \right)}$ $= \tan\left(\frac{\theta}{2}\right)$	<p>2</p> <p>1</p> <p>1</p>
c)	<p>Prove that $\frac{\cos 2A + 2 \cos 4A + \cos 6A}{\cos A + 2 \cos 3A + \cos 5A} = \cos A - \sin A \tan 3A$</p>	04	
Ans	$\frac{\cos 2A + 2 \cos 4A + \cos 6A}{\cos A + 2 \cos 3A + \cos 5A} = \frac{2 \cos 4A + \cos 2A + \cos 6A}{2 \cos 3A + \cos A + \cos 5A}$ $= \frac{2 \cos 4A + 2 \cos\left(\frac{2A+6A}{2}\right) \cos\left(\frac{2A-6A}{2}\right)}{2 \cos 3A + 2 \cos\left(\frac{A+5A}{2}\right) \cos\left(\frac{A-5A}{2}\right)}$	1	



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3.	c)	$\frac{\cos 2A + 2 \cos 4A + \cos 6A}{\cos A + 2 \cos 3A + \cos 5A} = \frac{2 \cos 4A + 2 \cdot \cos 4A \cdot \cos(-2A)}{2 \cos 3A + 2 \cdot \cos 3A \cdot \cos(-2A)}$ $= \frac{2 \cos 4A(1 + \cos(-2A))}{2 \cos 3A(1 + \cos(-2A))}$ $= \frac{\cos 4A}{\cos 3A}$ $= \frac{\cos(3A + A)}{\cos 3A}$ $= \frac{\cos 3A \cos A - \sin 3A \sin A}{\cos 3A}$ $= \frac{\cos 3A \cos A}{\cos 3A} - \frac{\sin 3A \sin A}{\cos 3A}$ $= \cos A - \tan 3A \sin A$ $= R.H.S$	<p>½</p> <p>½</p> <p>½</p> <p>½</p> <p>1</p>
	d)	<p>Prove that $\sin 20^\circ \sin 40^\circ \sin 60^\circ \sin 80^\circ = \frac{3}{16}$</p>	04
	Ans	$\sin 20^\circ \sin 40^\circ \sin 60^\circ \sin 80^\circ$ $= \frac{\sqrt{3}}{2} [\sin 40^\circ \sin 80^\circ] \sin 20^\circ$ $= \frac{\sqrt{3}}{4} [\cos 40^\circ - \cos 120^\circ] \sin 20^\circ$ $= \frac{\sqrt{3}}{4} [\cos 40^\circ - \cos(180^\circ - 60^\circ)] \sin 20^\circ$ $= \frac{\sqrt{3}}{4} [\cos 40^\circ + \cos 60^\circ] \sin 20^\circ$ $= \frac{\sqrt{3}}{4} \left[\cos 40^\circ + \frac{1}{2} \right] \sin 20^\circ$ $= \frac{\sqrt{3}}{4} \left[\cos 40^\circ \sin 20^\circ + \frac{1}{2} \sin 20^\circ \right]$	<p>½</p> <p>½</p> <p>½</p> <p>½</p> <p>½</p> <p>½</p>



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3.	d)	$= \frac{\sqrt{3}}{8} [\sin 60^\circ + \sin(-20^\circ) + \sin 20^\circ]$ $= \frac{\sqrt{3}}{8} [\sin 60^\circ + \sin 20^\circ - \sin 20^\circ]$ $= \frac{\sqrt{3}}{8} \frac{\sqrt{3}}{2} = \frac{3}{16}$	<p>½</p> <p>½</p>
4.		<p>Attempt any THREE of the following:</p> <p>a) Find the adjoint of matrix $A = \begin{bmatrix} 2 & 5 & 3 \\ 3 & 1 & 2 \\ 1 & 2 & 1 \end{bmatrix}$</p> <p>Ans $A = \begin{bmatrix} 2 & 5 & 3 \\ 3 & 1 & 2 \\ 1 & 2 & 1 \end{bmatrix}$</p> <p>Matrix of minors = $\begin{bmatrix} \begin{vmatrix} 1 & 2 \\ 2 & 1 \end{vmatrix} & \begin{vmatrix} 3 & 2 \\ 1 & 1 \end{vmatrix} & \begin{vmatrix} 3 & 1 \\ 1 & 2 \end{vmatrix} \\ \begin{vmatrix} 5 & 3 \\ 2 & 1 \end{vmatrix} & \begin{vmatrix} 2 & 3 \\ 1 & 1 \end{vmatrix} & \begin{vmatrix} 2 & 5 \\ 1 & 2 \end{vmatrix} \\ \begin{vmatrix} 5 & 3 \\ 1 & 2 \end{vmatrix} & \begin{vmatrix} 2 & 3 \\ 3 & 2 \end{vmatrix} & \begin{vmatrix} 2 & 5 \\ 3 & 1 \end{vmatrix} \end{bmatrix}$</p> <p>= $\begin{bmatrix} -3 & 1 & 5 \\ -1 & -1 & -1 \\ 7 & -5 & -13 \end{bmatrix}$</p> <p>Matrix of cofactors = $\begin{bmatrix} -3 & -1 & 5 \\ 1 & -1 & 1 \\ 7 & 5 & -13 \end{bmatrix}$</p> <p>$AdjA = \begin{bmatrix} -3 & 1 & 7 \\ -1 & -1 & 5 \\ 5 & 1 & -13 \end{bmatrix}$</p>	<p>12</p> <p>04</p> <p>2</p> <p>1</p> <p>1</p>



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4.	b)	Resolve in to partial fractions $\frac{x^4}{x^3+1}$	04
	Ans	$\begin{array}{r} x^4 \\ x^3+1 \overline{) x^4} \\ \underline{x^4 + x} \\ - \quad - \\ \hline -x \end{array}$ $\frac{x^4}{x^3+1} = x - \frac{x}{x^3+1}$ $\frac{x}{x^3+1} = \frac{x}{(x+1)(x^2-x+1)} = \frac{A}{x+1} + \frac{Bx+C}{x^2-x+1}$ $\therefore x = (x^2-x+1)A + (x+1)(Bx+C)$ <p>Put $x = -1$</p> $\therefore -1 = 3A$ $\therefore A = \frac{-1}{3}$ <p>Put $x = 0$</p> $0 = (1)A + (1)C$ $0 = \frac{-1}{3} + C$ $\therefore C = \frac{1}{3}$ <p>Put $x = 1$</p> $\therefore 1 = (1)A + 2(B+C)$ $\therefore 1 = \frac{-1}{3} + 2B + \frac{2}{3}$ $\therefore 1 - \frac{1}{3} = 2B$ $\therefore \frac{2}{3} = 2B$	<p>$\frac{1}{2}$</p> <p>1</p> <p>1</p>



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4.		$\sin^{-1}\left(\frac{8}{17}\right) = B \quad \therefore \sin B = \frac{8}{17}$ $\therefore \cos^2 B = 1 - \sin^2 B$ $= 1 - \frac{64}{289}$ $= \frac{225}{289}$ $\therefore \cos B = \frac{15}{17}$ $\therefore \cos(A - B) = \cos A \cos B + \sin A \sin B$ $= \frac{4}{5} \times \frac{15}{17} + \frac{3}{5} \times \frac{8}{17}$ $\therefore \cos(A - B) = \frac{84}{85}$ $\therefore A - B = \cos^{-1}\left(\frac{84}{85}\right)$ $\sin^{-1}\left(\frac{3}{5}\right) - \sin^{-1}\left(\frac{8}{17}\right) = \cos^{-1}\left(\frac{84}{85}\right)$	<p>1</p> <p>1</p> <p>1</p>
	e)	<p>Without using calculator, Prove that</p> $\sin 420^\circ \cos 390^\circ + \cos(-300^\circ) \sin(-330^\circ) = 1$	04
	Ans	$\sin 420^\circ = \sin(90^\circ \times 4 + 60^\circ)$ $= \sin 60^\circ = \frac{\sqrt{3}}{2}$ $\cos 390^\circ = \cos(90^\circ \times 4 + 30^\circ)$ $= \cos 30^\circ = \frac{\sqrt{3}}{2}$ $\cos(-300^\circ) = \cos(300^\circ)$ $= \cos(90^\circ \times 3 + 30^\circ)$ $= \sin 30^\circ = \frac{1}{2}$	<p>½</p> <p>½</p> <p>½</p> <p>½</p>



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4.	e)	$\sin(-330^\circ) = -\sin(330^\circ)$ $= -\sin(90^\circ \times 3 + 60^\circ)$ $= -(-\cos 60^\circ) = \frac{1}{2}$ $\sin 420^\circ \cos 390^\circ + \cos(-300^\circ) \sin(-330^\circ)$ $= \left(\frac{\sqrt{3}}{2}\right)\left(\frac{\sqrt{3}}{2}\right) + \left(\frac{1}{2}\right)\left(\frac{1}{2}\right)$ $= 1$	<p>½</p> <p>½</p> <p>1</p>
5.		<p>Attempt any TWO of the following:</p> <p>a) Attempt the following:</p> <p>i) Find the acute angle between the lines $y = 5x + 6$ and $y = x$.</p> <p>Ans For $y = 5x + 6 \therefore 5x - y + 6 = 0$</p> <p>slope $m_1 = -\frac{a}{b} = -\frac{5}{-1} = 5$</p> <p>For $y = x \therefore x - y = 0$</p> <p>slope $m_2 = -\frac{a}{b} = -\frac{1}{-1} = 1$</p> $\therefore \tan \theta = \frac{ m_1 - m_2 }{ 1 + m_1 m_2 }$ $= \frac{ 5 - 1 }{ 1 + 5 \times 1 }$ $\therefore \tan \theta = \frac{2}{3}$ $\therefore \theta = \tan^{-1}\left(\frac{2}{3}\right)$	<p>12</p> <p>06</p> <p>03</p> <p>1</p> <p>1</p> <p>1</p>
	ii)	<p>Find the equation of the line passing through the point (4,5) and perpendicular to the line</p> $7x - 5y = 420.$	03



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5.	a)ii)	Point = $(x_1, y_1) = (4, 5)$	
	Ans	Slope of the line $7x - 5y = 420$ is, $m = -\frac{a}{b} = -\frac{7}{-5} = \frac{7}{5}$ \therefore Slope of the required line is, $m_1 = -\frac{1}{m} = -\frac{5}{7}$ \therefore equation is, $y - y_1 = m_1(x - x_1)$ $\therefore y - 5 = -\frac{5}{7}(x - 4)$ $\therefore 5x + 7y - 55 = 0$	1 1 1
	b)	Attempt the following:	
	i)	Find the length of the perpendicular from the point $(2, 3)$ on the line $4x - 6y - 3 = 0$.	06
	Ans	$p = \frac{ ax_1 + by_1 + c }{\sqrt{a^2 + b^2}}$ $= \frac{ 4(2) + (-6)(3) - 3 }{\sqrt{(4)^2 + (-6)^2}}$ $= \frac{ 8 - 18 - 3 }{\sqrt{52}}$ $= \frac{13}{\sqrt{52}} \quad \text{or} \quad 1.803$	03 1 2
	ii)	Find the equation of the line passing through $(1, 7)$ and having slope 2 units.	03
	Ans	Point = $(x_1, y_1) = (1, 7)$ & slope = 2 \therefore Equation of line is, $y - y_1 = m(x - x_1)$ $\therefore y - 7 = 2(x - 1)$ $\therefore 2x - y + 5 = 0$	1 2



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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	<p>Area of path = Area of grassy plot – Area of inner gravel path</p> $= (100)^2 - (80)^2$ $= 3600 \text{ sq.m.}$	3												
	ii)	The volume of a sphere is $\frac{88}{21}$ cubic meters. Find its surface area.	03												
	Ans	<p>Volume of sphere = $\frac{4}{3}\pi r^3$</p> $\therefore \frac{4}{3}\pi r^3 = \frac{88}{21}$ $r^3 = \frac{88}{21} \times \frac{3}{4} \times \frac{7}{22}$ $r^3 = 1$ $r = 1$ <p>Surface area of sphere = $4\pi r^2$</p> $= 4\pi(1)^2 = 4\pi \text{ sq.m.}$	1 1 1												
6.		Attempt any TWO of the following:	12												
	a)(i)	Find the mean deviation from mean of the following distribution:	03												
		<table border="1" style="margin-left: auto; margin-right: auto;"> <tbody> <tr> <td>C.I</td> <td>0-10</td> <td>10-20</td> <td>20-30</td> <td>30-40</td> <td>40-50</td> </tr> <tr> <td>f_i</td> <td>5</td> <td>8</td> <td>15</td> <td>16</td> <td>6</td> </tr> </tbody> </table>	C.I	0-10	10-20	20-30	30-40	40-50	f_i	5	8	15	16	6	
C.I	0-10	10-20	20-30	30-40	40-50										
f_i	5	8	15	16	6										



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6.	a)(i)																																											
	Ans	<table border="1"> <thead> <tr> <th>C.I.</th> <th>f_i</th> <th>x_i</th> <th>$f_i x_i$</th> <th>$d_i = x_i - \bar{x}$</th> <th>$f_i d_i$</th> </tr> </thead> <tbody> <tr> <td>0-10</td> <td>5</td> <td>5</td> <td>25</td> <td>22</td> <td>110</td> </tr> <tr> <td>10-20</td> <td>8</td> <td>15</td> <td>120</td> <td>12</td> <td>96</td> </tr> <tr> <td>20-30</td> <td>15</td> <td>25</td> <td>375</td> <td>2</td> <td>30</td> </tr> <tr> <td>30-40</td> <td>16</td> <td>35</td> <td>560</td> <td>8</td> <td>128</td> </tr> <tr> <td>40-50</td> <td>6</td> <td>45</td> <td>270</td> <td>18</td> <td>108</td> </tr> <tr> <td></td> <td>$\sum f_i = 50$</td> <td></td> <td>$\sum f_i x_i = 1350$</td> <td></td> <td>$\sum f_i d_i = 472$</td> </tr> </tbody> </table> <p>Mean $\bar{x} = \frac{\sum f_i x_i}{\sum f_i}$</p> <p>$\therefore \bar{x} = \frac{1350}{50}$</p> <p>$\therefore \bar{x} = 27$</p> <p>$M.D = \frac{\sum f_i d_i}{f_i}$</p> <p>$\therefore M.D = \frac{472}{50}$</p> <p>$\therefore M.D. = 9.44$</p>	C.I.	f_i	x_i	$f_i x_i$	$d_i = x_i - \bar{x} $	$f_i d_i$	0-10	5	5	25	22	110	10-20	8	15	120	12	96	20-30	15	25	375	2	30	30-40	16	35	560	8	128	40-50	6	45	270	18	108		$\sum f_i = 50$		$\sum f_i x_i = 1350$		$\sum f_i d_i = 472$
C.I.	f_i	x_i	$f_i x_i$	$d_i = x_i - \bar{x} $	$f_i d_i$																																							
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	ii)	Find range & coefficient of range for the following data:																																										
		<table border="1"> <thead> <tr> <th>C.I</th> <th>10-19</th> <th>20-29</th> <th>30-39</th> <th>40-49</th> <th>50-59</th> </tr> </thead> <tbody> <tr> <th>f</th> <td>15</td> <td>25</td> <td>13</td> <td>17</td> <td>10</td> </tr> </tbody> </table>	C.I	10-19	20-29	30-39	40-49	50-59	f	15	25	13	17	10	03																													
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6.	ii)	<table border="1"> <tr> <td>C.I</td> <td>9.5-19.5</td> <td>19.5-29.5</td> <td>29.5-39.5</td> <td>39.5-49.5</td> <td>49.5-59.5</td> </tr> <tr> <td>f</td> <td>15</td> <td>25</td> <td>13</td> <td>17</td> <td>10</td> </tr> </table>	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																																												
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	Ans	<p>Range = L – S = 59.5 – 9.5 = 50</p> <p>Coefficient of range = $\frac{L-S}{L+S}$ = $\frac{59.5-9.5}{59.5+9.5}$ = 0.725</p>	1																																																								
	b)	<p>Calculate standard deviation and co-efficient of variance of the following table:</p> <table border="1"> <tr> <td>Marks below</td> <td>5</td> <td>10</td> <td>15</td> <td>20</td> <td>25</td> </tr> <tr> <td>No.of Students</td> <td>6</td> <td>16</td> <td>28</td> <td>38</td> <td>46</td> </tr> </table>	Marks below	5	10	15	20	25	No.of Students	6	16	28	38	46	06																																												
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	Ans	<table border="1"> <thead> <tr> <th>Class</th> <th>x_i</th> <th>f_i</th> <th>$f_i x_i$</th> <th>$d_i = \frac{x_i - a}{h}$</th> <th>$f_i d_i$</th> <th>d_i^2</th> <th>$f_i d_i^2$</th> </tr> </thead> <tbody> <tr> <td>0-5</td> <td>2.5</td> <td>6</td> <td>15</td> <td>-2</td> <td>-12</td> <td>4</td> <td>24</td> </tr> <tr> <td>5-10</td> <td>7.5</td> <td>10</td> <td>75</td> <td>-1</td> <td>-10</td> <td>1</td> <td>10</td> </tr> <tr> <td>10-15</td> <td>12.5</td> <td>12</td> <td>150</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> </tr> <tr> <td>15-20</td> <td>17.5</td> <td>10</td> <td>175</td> <td>1</td> <td>10</td> <td>1</td> <td>10</td> </tr> <tr> <td>20-25</td> <td>22.5</td> <td>8</td> <td>180</td> <td>2</td> <td>16</td> <td>4</td> <td>32</td> </tr> <tr> <td></td> <td></td> <td>46</td> <td>595</td> <td></td> <td>4</td> <td></td> <td>76</td> </tr> </tbody> </table>	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
Class	x_i	f_i	$f_i x_i$	$d_i = \frac{x_i - a}{h}$	$f_i d_i$	d_i^2	$f_i d_i^2$																																																				
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		<p>Mean $\bar{x} = \frac{\sum f_i x_i}{N} = \frac{595}{46} = 12.935$</p> <p>S.D. = $\sigma = \sqrt{\frac{\sum f_i d_i^2}{N} - \left(\frac{\sum f_i d_i}{N}\right)^2} \times h$</p>	1																																																								



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6.	b)	<p> $S.D. = \sigma = \sqrt{\frac{76}{46} - \left(\frac{4}{46}\right)^2} \times 5$ </p> <p> $S.D. = \sigma = 6.412$ </p> <p> Coefficient of variance = $\frac{\sigma}{x} \times 100$ $= \frac{6.412}{12.935} \times 100$ $= 49.57$ </p> <p style="text-align: center;"><u>OR</u></p> <table border="1" data-bbox="386 1054 1263 1522"> <thead> <tr> <th>Class Interval</th> <th>x_i</th> <th>f_i</th> <th>$f_i x_i$</th> <th>x_i^2</th> <th>$f_i x_i^2$</th> </tr> </thead> <tbody> <tr> <td>0-5</td> <td>2.5</td> <td>6</td> <td>15</td> <td>6.25</td> <td>37.5</td> </tr> <tr> <td>5-10</td> <td>7.5</td> <td>10</td> <td>75</td> <td>56.25</td> <td>562.5</td> </tr> <tr> <td>10-15</td> <td>12.5</td> <td>12</td> <td>150</td> <td>156.25</td> <td>1875</td> </tr> <tr> <td>15-20</td> <td>17.5</td> <td>10</td> <td>175</td> <td>306.25</td> <td>3062.5</td> </tr> <tr> <td>20-25</td> <td>22.5</td> <td>8</td> <td>180</td> <td>506.25</td> <td>4050</td> </tr> <tr> <td></td> <td></td> <td>46</td> <td>595</td> <td></td> <td>9587.5</td> </tr> </tbody> </table> <p> Mean $\bar{x} = \frac{\sum f_i x_i}{N} = \frac{595}{46} = 12.935$ </p> <p> $S.D. = \sigma = \sqrt{\frac{\sum f_i x_i^2}{N} - (\bar{x})^2}$ </p> <p> $S.D. = \sigma = \sqrt{\frac{9587.5}{46} - (12.935)^2}$ </p>	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	<p style="text-align: center;">1</p> <p style="text-align: center;">1</p> <p style="text-align: center;">3</p> <p style="text-align: center;">1</p>
Class Interval	x_i	f_i	$f_i x_i$	x_i^2	$f_i x_i^2$																																								
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6.	b)	<p>S.D. = $\sigma = 6.412$</p> <p>Coefficient of variance = $\frac{\sigma}{x} \times 100$</p> $= \frac{6.412}{12.935} \times 100$ $= 49.57$	1
	c)	<p>Solve the following equations by matrix inversion method :</p> <p>$x + y + z = 6$, $3x - y + 3z = 10$, $5x + 5y - 4z = 3$</p> <p>Ans Let $A = \begin{bmatrix} 1 & 1 & 1 \\ 3 & -1 & 3 \\ 5 & 5 & -4 \end{bmatrix}$, $B = \begin{bmatrix} 6 \\ 10 \\ 3 \end{bmatrix}$, $X = \begin{bmatrix} x \\ y \\ z \end{bmatrix}$</p> $ A = \begin{vmatrix} 1 & 1 & 1 \\ 3 & -1 & 3 \\ 5 & 5 & -4 \end{vmatrix}$ $ A = 1(4 - 15) - 1(-12 - 15) + 1(15 + 5)$ $\therefore A = 36 \neq 0$ <p>$\therefore A^{-1}$ exists</p> <p>Matrix of minors = $\begin{bmatrix} \begin{vmatrix} -1 & 3 \\ 5 & -4 \end{vmatrix} & \begin{vmatrix} 3 & 3 \\ 5 & -4 \end{vmatrix} & \begin{vmatrix} 3 & -1 \\ 5 & 5 \end{vmatrix} \\ \begin{vmatrix} 1 & 1 \\ 5 & -4 \end{vmatrix} & \begin{vmatrix} 1 & 1 \\ 5 & -4 \end{vmatrix} & \begin{vmatrix} 1 & 1 \\ 5 & 5 \end{vmatrix} \\ \begin{vmatrix} 1 & 1 \\ -1 & 3 \end{vmatrix} & \begin{vmatrix} 1 & 1 \\ 3 & 3 \end{vmatrix} & \begin{vmatrix} 1 & 1 \\ 3 & -1 \end{vmatrix} \end{bmatrix}$</p> <p>Matrix of minors = $\begin{bmatrix} -11 & -27 & 20 \\ -9 & -9 & 0 \\ 4 & 0 & -4 \end{bmatrix}$</p>	06
			1
			1



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6.	c)	$\text{Matrix of cofactors} = \begin{bmatrix} -11 & 27 & 20 \\ 9 & -9 & 0 \\ 4 & 0 & -4 \end{bmatrix}$ $\text{Adj.}A = \begin{bmatrix} -11 & 9 & 4 \\ 27 & -9 & 0 \\ 20 & 0 & -4 \end{bmatrix}$ $A^{-1} = \frac{1}{ A } \text{Adj.}A$ $A^{-1} = \frac{1}{36} \begin{bmatrix} -11 & 9 & 4 \\ 27 & -9 & 0 \\ 20 & 0 & -4 \end{bmatrix}$ $\therefore X = A^{-1}B$ $\begin{bmatrix} x \\ y \\ z \end{bmatrix} = \frac{1}{36} \begin{bmatrix} -11 & 9 & 4 \\ 27 & -9 & 0 \\ 20 & 0 & -4 \end{bmatrix} \begin{bmatrix} 6 \\ 10 \\ 3 \end{bmatrix}$ $\begin{bmatrix} x \\ y \\ z \end{bmatrix} = \frac{1}{36} \begin{bmatrix} -66+90+12 \\ 162-90+0 \\ 120+0-12 \end{bmatrix}$ $\begin{bmatrix} x \\ y \\ z \end{bmatrix} = \frac{1}{36} \begin{bmatrix} 36 \\ 72 \\ 108 \end{bmatrix} = \begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix}$ $\therefore x=1, y=2, z=3.$	<p>½</p> <p>½</p> <p>1</p> <p>1</p> <p>1</p>
		<p><u>Important Note</u></p> <p><i>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.</i></p>	