ANSWER KEY

SECOND YEAR HIGHER SECONDARY SAY/IMPVT EXAMINATION

JUNE 2023

SUBJECT : MATHEMATICS (COMMERCE) CODE. NO: S-2251

60 SCORES 2.15 HOURS

Qn No	Sub Qns	Answer Key/Value Points	Score	Total
1	(a)	$A = \begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix}$	1	
		$= \begin{bmatrix} 2 & \frac{9}{2} \\ \frac{9}{2} & 8 \end{bmatrix}$	1	3
	(b)	$x = 1, \quad y = 4$	1	
2	(a)	2×3	1	
	(b)	$AB = \begin{bmatrix} 2\times3+3\times0 & 2\times2+3\times5 & 2\times1+3\times6 \\ 1\times3+4\times0 & 1\times2+4\times5 & 1\times1+4\times6 \end{bmatrix}$	1	3
		$= \begin{bmatrix} 6 & 19 & 20 \\ 3 & 22 & 25 \end{bmatrix}$	1	
3		$2 - 20 = 2x^2 - 24$	1	
		$6 = 2x^2$	1	
		$x^2 = 3$	½	3
		$x = \pm\sqrt{3}$	½	
4		LHL = RHL at $x = 2$	1	
		$\lim_{x\to2} kx^2 = \lim_{x\to2} 3$	1	
		$4k = 3$	½	3
		$k = \frac{3}{4}$	½	
5		Area, $A = \pi r^2$	1	
		$\frac{dA}{dr} = 2\pi r$	1	3
		$= 6\pi \ cm^2/sec$	1	

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6		Put $1+x^2=t$, $2x\,dx=dt$ When $x=0$, $t=1$ when $x=1$, $t=2$ $=\frac{1}{2}\int_1^2 \frac{dt}{t} = \frac{1}{2}\left[\log t\right]_1^2$ $=\frac{1}{2}\left[\log 2-\log 1\right]$ $=\frac{1}{2}\log 2 = \log\sqrt{2}$	1 ½ 1 ½	3
7	(a) (b)	$\vec{a}\cdot\vec{b}=0$ Projection of $\vec{a}$ on $\vec{b}$ $=\frac{\vec{a}\cdot\vec{b}}{\lvert\vec{b}\rvert}$ $=\frac{2+6+2}{\sqrt{1+4+1}}$ $=\frac{10}{\sqrt{6}}$ Remark: $\vec{a}\cdot\vec{b}=10$ give 1 Score	1 1 1	3
8		Sample space, $S=\{(B,B),(G_1,G_1),(B,G_1),(G_1,B)\}$ E: both the children are Boys $=\{(B,B)\}$ F: at least one is a boy $=\{(B,B),(G_1,B),(B,G_1)\}$ $E\cap F=\{(B,B)\}$ $P(F)=\frac{3}{4}$, $P(E\cap F)=\frac{1}{4}$ $P(E/F)=\frac{P(E\cap F)}{P(F)}=\frac{1}{3}$ Remark:1 $S=\{(B,B),(B,G),(G,B),(G,G)\}$ give One Score Remark 2: $P(E/F)=\frac{P(E\cap F)}{P(F)}$ give one score	1 ½+½ ½+½	3
9	(a) (b)	Since $(1,1),(2,2),(3,3)\in R$, R is reflexive $(2,1)\in R$, but $(1,2)\notin R$, R is not symmetric Since different elements in A are mapped to different elements in B, f is One–One Remark: Concept of One-one, give One Score Remark(a): $(a,a)\in R$, all $a\in A$, R is reflexive → give 1 score	1 1 2	4

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10	(a)	$\cot^{-1}\left(\frac{-1}{\sqrt{3}}\right) = \pi - \cot^{-1}\left(\frac{1}{\sqrt{3}}\right)$	1	
		$= \pi - \frac{\pi}{3}$		
		$= 2\frac{\pi}{3}$	1	
	(b)	$x = \sin\theta$, then $\theta = \sin^{-1}x$	½	4
		$\sin^{-1}\left(2x\sqrt{1-x^2}\right) = \sin^{-1}(2\sin\theta\cos\theta)$	½	
		$= \sin^{-1}(\sin 2\theta)$	½	
		$= 2\theta = 2\sin^{-1}x$	½	
11	(a)	$A+B = \begin{bmatrix} 3 & 4 & 2 \\ 4 & 1 & 3 \end{bmatrix}$	1	
	(b)	$A' = \begin{bmatrix} 4 & 3 \\ 2 & -1 \\ 1 & 0 \end{bmatrix}$ $\quad B' = \begin{bmatrix} -1 & 1 \\ 2 & 2 \\ 1 & 3 \end{bmatrix}$	½+½	4
	(c)	$(A+B)' = \begin{bmatrix} 3 & 4 \\ 4 & 1 \\ 2 & 3 \end{bmatrix}$, $A'+B' = \begin{bmatrix} 3 & 4 \\ 4 & 1 \\ 2 & 3 \end{bmatrix}$	1+1	
		$(A+B)' = A'+B'$		
12		Let x and $24-x$ be the numbers	1	
		$f(x) = x(24-x) = 24x - x^2$	½	
		$f'(x) = 24 - 2x$	½	
		$f'(x) = 0 \Rightarrow x = 12$	½	4
		$f''(x) = -2 < 0$	1	
		$\therefore$ f is maximum at $x = 12$	½	
		numbers are 12 and 12		
13	(a)	$\int \frac{dx}{x^2-16} = \int \frac{dx}{x^2-4^2}$	1	
		$= \frac{1}{8}\log\left\lvert\frac{x-4}{x+4}\right\rvert + c$	1	
		Remark $\int \frac{dx}{x^2-a^2} = \frac{1}{2a}\log\left\lvert\frac{x-a}{x+a}\right\rvert + c$ give 1 score		4
	(b)	$\int (2x^2+e^x)\,dx = 2\int x^2\,dx + \int e^x\,dx$	1	
		$= 2\frac{x^3}{3} + e^x + c$	1	

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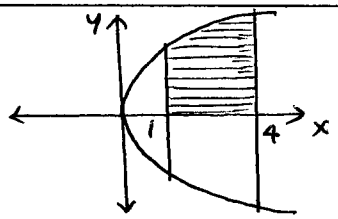
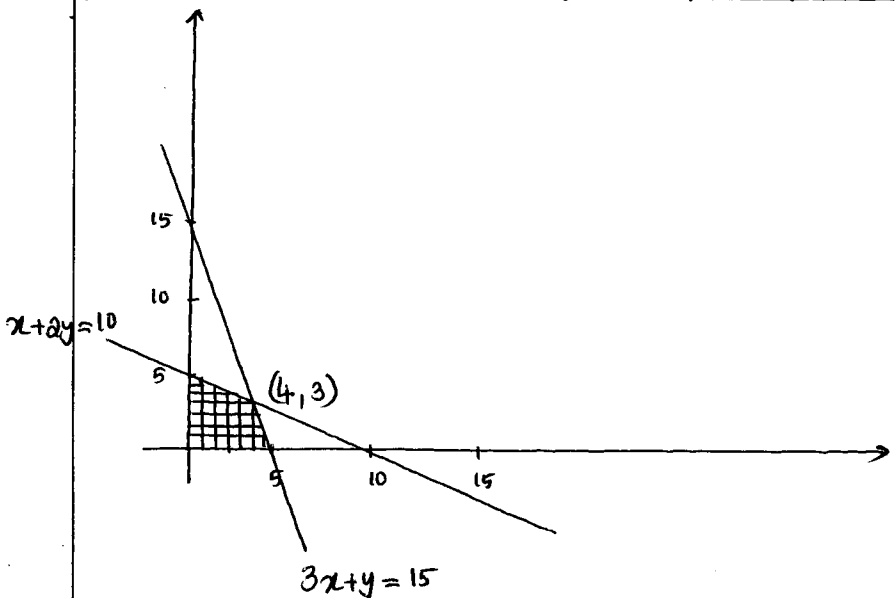
14		$\text{Area} = \int_1^4 \sqrt{x}\,dx$ 	2	4
		$= \left[\frac{x^{\frac{3}{2}}}{\frac{3}{2}}\right]_1^4$	1	
		$= \frac{2}{3}\left[8-1\right] = \frac{14}{3}$ Sq. units	1	
		Remark $\text{Area} = \int_a^b y\,dx$ give 1 score		
15	(a)	(ii) 2	1	4
	(b)	$\frac{dy}{1+y^2} = (1+x^2)\,dx$	1	
		$\int \frac{dy}{1+y^2} = \int (1+x^2)\,dx$	1	
		$\tan^{-1}y = x + \frac{x^3}{3} + C$	1	
16	(a)	direction cosines are $\frac{a}{\sqrt{a^2+b^2+c^2}}, \frac{b}{\sqrt{a^2+b^2+c^2}}, \frac{c}{\sqrt{a^2+b^2+c^2}}$	1	4
		$\frac{2}{\sqrt{4+1+4}}, \frac{-1}{\sqrt{4+1+4}}, \frac{-2}{\sqrt{4+1+4}}$	1	
		$\frac{2}{3}, \frac{-1}{3}, \frac{-2}{3}$		
	(b)	$\vec{a} = 5\hat{i}+2\hat{j}+4\hat{k}$, $\vec{b} = 3\hat{i}+2\hat{j}+8\hat{k}$	½	
		Vector equation of the line is $\vec{r} = \vec{a} + \lambda\vec{b}$	1	
		$= (5\hat{i}+2\hat{j}+4\hat{k}) + \lambda(3\hat{i}+2\hat{j}+8\hat{k})$	½	
17		System can be expressed in the form $AX = B$		6
		$A = \begin{bmatrix} 3 & -2 & 3 \\ 2 & 1 & -1 \\ 4 & -3 & 2 \end{bmatrix}$, $X = \begin{bmatrix} x \\ y \\ z \end{bmatrix}$, $B = \begin{bmatrix} 8 \\ 1 \\ 4 \end{bmatrix}$	1	
		$\lvert A\rvert = 3(2-3)+2(4+4)+3(-6-4)$	1	
		$= -17 \neq 0$		
		$\text{adj } A = \begin{bmatrix} -1 & -5 & -1 \\ -8 & -6 & 9 \\ -10 & 1 & 7 \end{bmatrix}$	2	
		$A^{-1} = \frac{\text{adj } A}{\lvert A\rvert} = \frac{-1}{17}\begin{bmatrix} -1 & -5 & -1 \\ -8 & -6 & 9 \\ -10 & 1 & 7 \end{bmatrix}$	1	

Qn. No	Sub Qns	Answer Key/Value Points	Score	Total Score
		$X = A^{-1}B = \begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix}$	1	
18	(a)	$\frac{dy}{dx} = \frac{d}{dx}(\tan(2x+3)) = \sec^2(2x+3)\frac{d}{dx}(2x+3)$	1	
		$= \sec^2(2x+3).2$	1	
		Remark: $\frac{dy}{dx} = \sec^2(2x+3)$ give 1 score		
	(b)	$2\frac{d}{dx}(x) + 3\frac{d}{dx}(y) = \frac{d}{dx}(\sin x)$	½	
		$2 + 3\frac{dy}{dx} = \cos x$	1	6
		$\frac{dy}{dx} = \frac{\cos x - 2}{3}$	½	
	(c)	$\frac{dx}{dt} = 2at$	½	
		$\frac{dy}{dt} = 2a$	½	
		$\frac{dy}{dx} = \frac{dy/dt}{dx/dt}$	½	
		$= \frac{1}{t}$	½	
19		$x+2y=10$ | x | 0 | 10 | | y | 5 | 0 | $3x+y=15$ | x | 0 | 5 | | y | 15 | 0 |	1	
			3	6

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Corner points	$Z = 3x + 2y$	
$(0, 5)$	10	
$(5, 0)$	15	
$(4, 3)$	18	← Maximum
$(0, 0)$	0	

Maximum $Z = 18$ at $(4, 3)$ — 1

Remark : Drawing X, Y axis give 1 score — 1

Remark : For correct graph and incorrect feasible region give $3\frac{1}{2}$ score

20	(a)	(i) $P(A \cap B) = P(A) \cdot P(B)$	½	
		$= 0.3 \times 0.4 = 0.12$	½	
		(ii) $P(A \cup B) = P(A) + P(B) - P(A \cap B)$	½	
		$= 0.3 + 0.4 - 0.12 = 0.58$	½	
	(b)	E_1 : event of choosing first bag		
		E_2 : event of choosing second bag		
		$P(E_1) = P(E_2) = \frac{1}{2}$	1	6
		A : event of drawing red ball		
		$P(A/E_1) = \frac{4}{8} = \frac{1}{2}$, $P(A/E_2) = \frac{2}{8} = \frac{1}{4}$	1	
		$P(E_1/A) = \frac{P(E_1)\,P(A/E_1)}{P(E_1)\,P(A/E_1) + P(E_2)\,P(A/E_2)}$	1	
		$= \frac{\frac{1}{2} \times \frac{4}{8}}{\frac{1}{2} \times \frac{4}{8} + \frac{1}{2} \times \frac{2}{8}}$	1	
		$= \frac{2}{3}$		
		For alternate methods give full score		

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Qn. No	Sub Qns	Answer Key/Value Points	Score	Total Score
	1.	Subhash. K.K 9496418185		
	2.	MANOJKUMAR. P 9447236288		
	3.	J. John Victor 9446171748		
	4.	Jiji Maraki 9809564586		
	5.	V.R. Jayakumar 9446850319		