ANSWER KEY

SECOND YEAR HIGHER SECONDARY EXAMINATION ......MARCH...... 2024

PART-I/II/III

SUBJECT: ....Mathematics (Commerce) 60........

CODE NO: ..SY..551 VERSION:.......

..60.. SCORES ...2... HOURS

Qn. No	Sub Qns	Answer Key/Value Points	Score	Total Score
1	(i)	$A=\begin{bmatrix}3&5&6\\1&-1&5\\2&3&-1\end{bmatrix}$ $A^T=\begin{bmatrix}3&1&2\\5&-1&3\\6&5&-1\end{bmatrix}$	1	3
		$A+A^T=\begin{bmatrix}6&6&8\\6&-2&8\\8&8&-2\end{bmatrix}$	$\frac{1}{2}$	
		$A-A^T=\begin{bmatrix}0&4&4\\-4&0&2\\-4&-2&0\end{bmatrix}$	$\frac{1}{2}$	
	(ii)	$A=\frac{1}{2}(A+A^T)+\frac{1}{2}(A-A^T)$	$\frac{1}{2}$	
		$=\frac{1}{2}\begin{bmatrix}6&6&8\\6&-2&8\\8&8&-2\end{bmatrix}+\frac{1}{2}\begin{bmatrix}0&4&4\\-4&0&2\\-4&-2&0\end{bmatrix}$	$\frac{1}{2}$	
2	(i)	For any related answer give ONE score	1	3
	(ii)	$x^2-36=36-36$		
		$x^2=36$	1	
		$x=\pm 6$	1	
3	(i)	$\frac{dy}{dx}=2\cos(2x+3)$	1	3
	(ii)	$\lim\limits_{x\to 5^-} f(x)=2x$ $=10$	$\frac{1}{2}$	
		$\lim\limits_{x\to 5^+} f(x)=k$ $=k$	$\frac{1}{2}$	
		Since $f(x)$ is continuous $k=10$	1	
4	(i)	(a) f is increasing in $[a,b]$	1	3
	(ii)	$f(x)=x^2-4x+6$		
		$f'(x)=2x-4$	1	
		$f'(x)=0 \Rightarrow x=2$	$\frac{1}{2}$	

Qn. No	Sub Qns	Answer Key/Value Points	Score	Total Score
		$f(x)$ is increasing in $[2,\infty)$	$\frac{1}{2}$	
5	(i)	$\int(\sin x+\cos x)\,dx = \int \sin x\,dx + \int \cos x\,dx$ $= -\cos x + \sin x + c$	$\frac{1}{2}$ $\frac{1}{2}$	3
	(ii)	$\int x e^x\,dx = x\int e^x dx - \int\left(1\times\int e^x dx\right)dx$ $= xe^x - e^x + c$	1 1	
6	(i)	One	1	3
	(ii)	$\frac{dy}{y} = \frac{dx}{x}$ Integrating, $\log y = \log x + \log c$ $y = cx$	1 1	
7		$X+Y = \begin{bmatrix}5 & 2\\0 & 9\end{bmatrix}$, $X-Y = \begin{bmatrix}3 & 6\\0 & -1\end{bmatrix}$ $2X = \begin{bmatrix}8 & 8\\0 & 8\end{bmatrix}$ $X = \begin{bmatrix}4 & 4\\0 & 4\end{bmatrix}$ $2Y = \begin{bmatrix}2 & -4\\0 & 10\end{bmatrix}$ $Y = \begin{bmatrix}1 & -2\\0 & 5\end{bmatrix}$	1 $\frac{1}{2}$ 1 $\frac{1}{2}$	3
8	(i)	(a) $P(A\cap B) = P(A)\cdot P(B)$	1	3
	(ii)	$P(A\cap B) = P(A)+P(B)-P(A\cup B)$ $= \frac{2}{7}+\frac{5}{7}-\frac{6}{7}$ $= \frac{1}{7}$ $P(A/B) = \frac{P(A\cap B)}{P(B)}$ $= \frac{\frac{1}{7}}{\frac{5}{7}}$ $= \frac{1}{5}$	$\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$	

Qn. No	Sub Qns	Answer Key/Value Points	Score	Total Score
9		For reflexive, $x \in R \Rightarrow x - x = 0$ is divisible by 2	$\frac{1}{2}$	
		$\therefore (x,x) \in S$, $\forall x \in R$, S is reflexive	$\frac{1}{2}$	
		$(x,y) \in S \Rightarrow x - y$ is divisible by 2	$\frac{1}{2}$	
		$\Rightarrow y - x$ is divisible by 2		
		$\Rightarrow (y,x) \in S$, S is symmetric	$\frac{1}{2}$	4
		$(x,y) \in S, (y,z) \in S$		
		$\Rightarrow x - y$ is divisible by 2	$\frac{1}{2}$	
		$y - z$ is divisible by 2		
		$\therefore x - z$ is divisible by 2, S is transitive	$\frac{1}{2}$	
		Hence S is an equivalance relation	1	
10		Area $= 4\int_0^2 y\,dx$	1	
		$y = \sqrt{\frac{9(4-x^2)}{4}}$	1	
		$= \frac{3}{2}\sqrt{4-x^2}$		
		Area $= 4\int_0^2 \frac{3}{2}\sqrt{4-x^2}\,dx$.		4
		$= 6\left[\frac{x}{2}\sqrt{4-x^2} + \frac{4}{2}\sin^{-1}\left(\frac{x}{2}\right)\right]_0^2$	1	
		$= 6 \times \frac{4}{2} \times \frac{\pi}{2}$	1	
		$= 6\pi$ units		
		Remark For direct answer using $A = \pi ab$ give ONE Score		
11	(I)	$\sin^{-1}\sin\left(\frac{\pi}{3}\right) = \frac{\pi}{3}$	1	
	(II)	LHS $= \sin^{-1}(3x - 4x^3)$ Put $x = \sin\theta$	1	
		$= \sin^{-1}(3\sin\theta - 4\sin^3\theta)$	$\frac{1}{2}$	4
		$= \sin^{-1}(\sin 3\theta)$	$\frac{1}{2}$	
		$= 3\theta$	$\frac{1}{2}$	
		$= 3\sin^{-1}x$	$\frac{1}{2}$	
12	(I)	$A^2 = \begin{bmatrix} 3 & -2 \\ 4 & -2 \end{bmatrix}\begin{bmatrix} 3 & -2 \\ 4 & -2 \end{bmatrix} = \begin{bmatrix} 1 & -2 \\ 4 & -4 \end{bmatrix}$	1	
		$KA - 2I = \begin{bmatrix} 3k & -2k \\ 4k & -2k \end{bmatrix} - \begin{bmatrix} 2 & 0 \\ 0 & 2 \end{bmatrix}$	1	

Qn. No	Sub Qns	Answer Key/Value Points	Score	Total Score
		$= \begin{bmatrix} 3k-2 & -2k \\ 4k & -2k-2 \end{bmatrix}$	1	4
		$\Rightarrow 3k-2=1,$ $k=1$	1	
13	(I)	$y=\sin^{-1}x \quad , \quad \frac{dy}{dx}=\frac{1}{\sqrt{1-x^2}}$	1	
	(II)	$y=x^3+3x^2+5x, \quad \frac{dy}{dx}=3x^2+6x+5$	2	4
		$\frac{d^2y}{dx^2}=6x+6$	1	
14	(I)	Local maximum at $(-2,0)$	1	
		Local minima at $(3,0)$	1	
	(II)	Increasing in $(-\infty,-2)\cup(3,\infty)$ or $(-\infty,-2]\cup[3,\infty)$	1	4
		decreasing in $(-2,3)$ or $[-2,3]$	1	
15	(I)	$\int \frac{2x+1}{x^2+x+2}\,dx$ Substitute $t=x^2+x+2$ -	1	
		$\int \frac{dt}{t} = \log\lvert t\rvert + C$ $= \log\lvert x^2+x+2\rvert + C$	1	4
	(II)	$\int_2^3 x^2\,dx = \left[\frac{x^3}{3}\right]_2^3$	1	
		$= \frac{27}{3}-\frac{8}{3} = \frac{19}{3}$	1	
16		$\vec{a_1}=\hat{i}+\hat{j}+\hat{k} \quad , \quad \vec{b_1}=2\hat{i}-\hat{j}+\hat{k}$	$\frac{1}{2}$	
		$\vec{a_2}=2\hat{i}-\hat{j}-\hat{k} \quad , \quad \vec{b_2}=3\hat{i}-5\hat{j}+2\hat{k}$	$\frac{1}{2}$	
		$\vec{a_2}-\vec{a_1}=\hat{i}-2\hat{j}-2\hat{k}$	$\frac{1}{2}$	4
		$\vec{b_1}\times\vec{b_2}=\begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 2 & -1 & 1 \\ 3 & -5 & 2 \end{vmatrix} = 3\hat{i}-\hat{j}-7\hat{k}$	1	
		$(\vec{a_2}-\vec{a_1})\cdot(\vec{b_1}\times\vec{b_2}) = 3+2+14=19$	$\frac{1}{2}$	
		$\lvert\vec{b_1}\times\vec{b_2}\rvert = \sqrt{9+1+49} = \sqrt{59}$	1	
		S.D. $= \frac{19}{\sqrt{59}}$		

Qn. No	Sub Qns	Answer Key/Value Points	Score	Total Score
17	(i)	$\lvert A\rvert = 3-4=-1$	1	
		$\text{adj } A = \begin{bmatrix} 3 & -2 \\ -2 & 1 \end{bmatrix}$	1	
		$A^{-1} = \frac{\text{adj } A}{\lvert A\rvert} = \begin{bmatrix} -3 & 2 \\ 2 & -1 \end{bmatrix}$	$\frac{1}{2}+\frac{1}{2}$	
	(ii)	$AX = B$		
		$\begin{bmatrix} 1 & 2 \\ 2 & 3 \end{bmatrix}\begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 2 \\ 3 \end{bmatrix}$	$\frac{1}{2}$	6
		$X = A^{-1}B$	$\frac{1}{2}$	
		$= \begin{bmatrix} -3 & 2 \\ 2 & -1 \end{bmatrix}\begin{bmatrix} 2 \\ 3 \end{bmatrix}$	1	
		$= \begin{bmatrix} 0 \\ 1 \end{bmatrix}$	1	
		$x=0,\ y=1$		
18	(i)	$\vec{a}\cdot\vec{b}=0$	$\frac{1}{2}$	
		$8\lambda-2-6=0$	$\frac{1}{2}$	
		$8\lambda=8$	1	
		$\lambda=1$		
	(ii)	$\vec{AB} = 0\hat{i}+\hat{j}+2\hat{k}$	1	
		$\vec{AC} = \hat{i}+2\hat{j}+0\hat{k}$	1	
	(iii)	$\text{Area} = \frac{1}{2}\lvert\vec{AB}\times\vec{AC}\rvert$	$\frac{1}{2}$	6
		$\vec{AB}\times\vec{AC} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 0 & 1 & 2 \\ 1 & 2 & 0 \end{vmatrix}$	1	
		$= -4\hat{i}+2\hat{j}-\hat{k}$		
		$\lvert\vec{AB}\times\vec{AC}\rvert = \sqrt{16+4+1} = \sqrt{21}$	$\frac{1}{2}$	
		$\text{Area} = \frac{1}{2}\sqrt{21}$		

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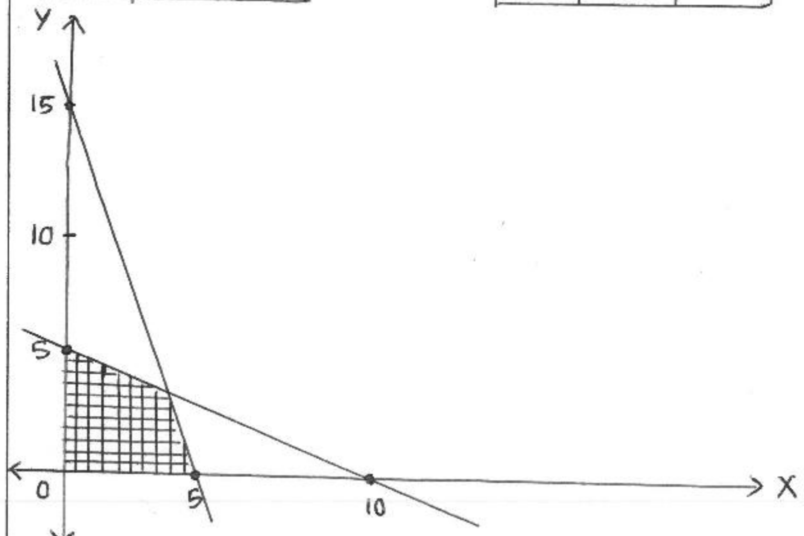
<tr><th>Qn. No</th><th>Sub Qns</th><th>Answer Key/Value Points</th><th>Score</th><th>Total Score</th></tr>
<tr><td>19</td><td></td><td>

$x + 2y = 10$

x	0	10
y	5	0

$3x + y = 15$

x	0	5
y	15	0



Solving $x+2y=10$, $3x+y=15 \Rightarrow x=4, y=3$

Corner points	Z
(0, 0)	0
(5, 0)	15
(0, 5)	10
(4, 3)	18 $\longrightarrow$ Maximum

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3

1

1</td><td>6</td></tr>
<tr><td>20</td><td></td><td>

Let E_1, E_2 be events corresponding to Bag 1, Bag 2 are chosen.

$$P(E_1) = P(E_2) = \frac{1}{2}$$

A: The drawn ball is red

$$P(A/E_1) = \frac{4}{8}, \quad P(A/E_2) = \frac{2}{8}$$

$$P(E_1/A) = \frac{P(E_1)\,P(A/E_1)}{P(E_1)\,P(A/E_1) + P(E_2)\,P(A/E_2)}$$

$$= \frac{\frac{1}{2} \times \frac{4}{8}}{\frac{1}{2} \times \frac{4}{8} + \frac{1}{2} \times \frac{2}{8}}$$

$$= \frac{2}{3}$$

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1

1

2

1</td><td>6</td></tr>
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Answer key verified and modified by

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