ANSWER KEY

SECOND..... YEAR HIGHER SECONDARY EXAMINATION MARCH 2026

PART-I/II/III

SUBJECT: MATHEMATICS Sci 60

CODE NO: 54227 VERSION:.......

60 SCORES .... HOURS

Qn. No	Sub Qns	Answer Key/Value Points	Score	Total Score
1.	(i)	2×3	1	
	ii)	$PR = \begin{bmatrix}3 & -1 & 2\\ -2 & 1 & 4\end{bmatrix}\begin{bmatrix}3&0&0\\0&3&0\\0&0&3\end{bmatrix}$		
		$= \begin{bmatrix}9 & -3 & 6\\ -6 & 3 & 12\end{bmatrix}$	$\frac{1}{2}$	
		$3P = 3\begin{bmatrix}3 & -1 & 2\\ -2 & 1 & 4\end{bmatrix} = \begin{bmatrix}9 & -3 & 6\\ -6 & 3 & 12\end{bmatrix}$	$\frac{1}{2}$	3
	iii)	$3P+Q = \begin{bmatrix}9 & -3 & 6\\ -6 & 3 & 12\end{bmatrix} + \begin{bmatrix}4 & -2 & 1\\ -5 & 3 & 1\end{bmatrix}$	$\frac{1}{2}$	
		$= \begin{bmatrix}13 & -5 & 7\\ -11 & 6 & 13\end{bmatrix}$	$\frac{1}{2}$	
2.	(i)	$R = \{(1,1),(2,2),(3,3),(4,4)\}$	$\frac{1}{2}$	
		$(a,a)\in R\ \forall a\in A \therefore$ Reflexive.	$\frac{1}{2}$	
		$(a,b)\in R \Rightarrow (b,a)\in R \therefore$ symmetric	$\frac{1}{2}$	
		$(a,b)\in R, (b,c)\in R \Rightarrow (a,c)\in R$ $\therefore$ Transitive	$\frac{1}{2}$	3
		Hence R is Equalance Relation		
	ii)	Equalance classes are $\{1\}, \{2\}, \{3\}, \{4\}$	1	
	*	Remarks:- For $R=\{(1,1),(2,2),(3,3),(4,4)\}$ give 1 score.		

Qn. No	Sub Qns	Answer Key/Value Points	Score	Total Score
3.	(i)	$\int_0^{\pi} \sin x\, dx = -(\cos x)_0^{\pi}$	1	
		$= -(\cos\pi - \cos 0)$	$\frac{1}{2}$	
		$= -(-1-1) = 2$	$\frac{1}{2}$	
	ii)	Area $= 2\int_0^{\pi} \sin x\, dx$	$\frac{1}{2}$	3
		$= 2\times 2$ $= 4$	$\frac{1}{2}$	
		* Remarks:- For the fig:  $\frac{1}{2}$ Score For the formula Area $= \int_a^b y.dx$ - $\frac{1}{2}$ score.		
4.	(i)	$\vec{PQ} = \vec{OQ} - \vec{OP}$	$\frac{1}{2}$	
		$= (3-3)i + (6+1)j + (4-2)k$	$\frac{1}{2}$	
		$= 7j + 2k$		
	ii)	(b) λ	1	
	iii)	$\cos\theta = \left\| \frac{(3i+4j)\cdot(7j+2k)}{\sqrt{9+16}\cdot\sqrt{49+4}} \right\|$	$\frac{1}{2}$	3
		$= \frac{28}{5\sqrt{53}}$ $\therefore \theta = \cos^{-1}\left(\frac{28}{5\sqrt{53}}\right)$	$\frac{1}{2}$	
		* Remarks:- Formula For $\cos\theta$ give $\frac{1}{2}$ Score For Finding $\vec{a}\cdot\vec{b}$ or $\|\vec{a}\|\|\vec{b}\|$ give $\frac{1}{2}$ score.		
5.	(i)	$\cos^{-1}\left(-\frac{1}{2}\right) = \pi - \cos^{-1}\left(\frac{1}{2}\right)$	$\frac{1}{2}$	
		$= \pi - \frac{\pi}{3} = \frac{2\pi}{3}$	$\frac{1}{2}$	
	(ii)	$\tan^{-1}\left(\frac{\cos^2 x/2 - \sin^2 x/2}{\cos^2 x/2 + \sin^2 x/2 - 2\sin x/2 \cdot \cos x/2}\right)$	1	
		$= \tan^{-1}\left(\frac{\cos^2 x/2 - \sin^2 x/2}{(\cos x/2 - \sin x/2)^2}\right)$		
		$= \tan^{-1}\left(\frac{\cos x/2 + \sin x/2}{\cos x/2 - \sin x/2}\right)$	$\frac{1}{2}$	

Qn. No	Sub Qns	Answer Key/Value Points	Score	Total Score
		$= \tan^{-1}\left(\frac{1+\tan x/2}{1-\tan x/2}\right)$		3
		$= \tan^{-1}\left(\tan\left(\frac{\pi}{4}+\frac{x}{2}\right)\right)$	$\frac{1}{2}$	
		$= \frac{\pi}{4}+\frac{x}{2}$		
		* For Alternative Method give full score.		
6.	(i)	For $x<2 \Rightarrow f(x)=x^2$ a polynomial. So continuous	$\frac{1}{2}$	
		For $x>2 \Rightarrow f(x)=4$ is a constant fn: so continuous	$\frac{1}{2}$	
		Hence $f(x)$ is conti: in it's Domain	1	3
	ii)	$\frac{dy}{dx} = \frac{1}{2\sqrt{\sin(2x+1)}} \times \cos(2x+1) \times 2$	1	
		$= \frac{\cos(2x+1)}{\sqrt{\sin(2x+1)}}$		
7.	(i)	$f(2)=2$	$\frac{1}{2}$	
		$f(3)=3-1=2$	$\frac{1}{2}$	
		$\therefore f(x)$ is not one-one.		
		Let $y \in N$ For, $x \leq 2 \Rightarrow y=x \in N$	$\frac{1}{2}$	3
		For $x>2 \Rightarrow y=x-1$		
		$\therefore x=y+1 \in N$	$\frac{1}{2}$	
		$\therefore f$ is onto.	1	
		Remarks :- using Arrow diagram, showing not (1-1) give 1		
		definition for 1-1 - give ½ score.		
		definition for onto give -1- score.		
		For onto :- codomain = Range - 1 score		

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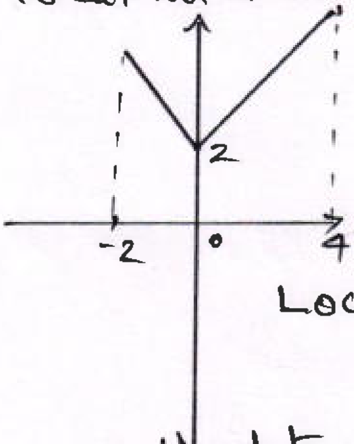
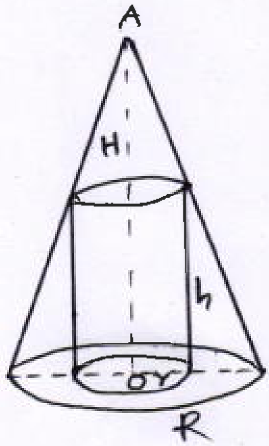
8.		$S=\{H1, H2, H3, H4, H5, H6, T1, T2, T3, T4, T5, T6\}$	$\frac{1}{2}$	
		$A=\{H1, H2, H3, H4, H5, H6\}$	$\frac{1}{2}$	
		$B=\{H3, T3\}$	$\frac{1}{2}$	
		$P(A)=\frac{6}{12}=\frac{1}{2}$ $\quad P(B)=\frac{2}{12}=\frac{1}{6}$	$\frac{1}{2}$	3
		$A\cap B=\{H3\}$ $\therefore P(A\cap B)=\frac{1}{12}$	$\frac{1}{2}$	
		$\therefore P(A)\cdot P(B)=\frac{1}{2}\times\frac{1}{6}=\frac{1}{12}$	$\frac{1}{2}$	
		Remarks:- For $P(A\cap B)=P(A)\cdot P(B)$ give 1 score		
9.	(i)	$C_{31}=(-3+2)=-1$ $\quad C_{32}=-(2-4)=2$ $C_{33}=-4+12=8$	1	
	ii)	(c) $\lvert A\rvert$	1	
	iii)	$A+A'=\begin{bmatrix}2&-3&1\\4&-2&1\\5&1&3\end{bmatrix}+\begin{bmatrix}2&4&5\\-3&-2&1\\1&1&3\end{bmatrix}$	1	4
		$=\begin{bmatrix}4&1&6\\1&-4&2\\6&2&6\end{bmatrix}$	1	
		Remarks:- Finding $A\cdot A'$ - give full score. writing A' only give 1 score.		
10.		$\frac{3x+1}{(x-1)(x^2+1)}=\frac{A}{x-1}+\frac{Bx+C}{x^2+1}$	1	
		$\therefore 3x+1=A(x^2+1)+(Bx+C)(x-1)$		
		put $x=1$ $4=2A$ $A=2$ put $x=0$ $1=A-C$ $\therefore C=1$ $0=A+B$ $B=-2$	1	

Qn. No	Sub Qns	Answer Key/Value Points	Score	Total Score
		$\therefore I = \int \frac{2}{x-1} \cdot dx + \int \frac{-2x+1}{x^2+1} \cdot dx$	$\frac{1}{2}$	
		$= 2\log\lvert x-1\rvert - \int \frac{2x}{x^2-1} dx + \int \frac{1}{x^2+1} dx$	$\frac{1}{2}$	4
		$= 2\log\lvert x-1\rvert - \log\lvert x^2+1\rvert + \tan^{-1}x + C$	1	
11.	(i)(a)	Decreasing in $(1,5)$	1	
	(b)	local maximum at $x=1$	$\frac{1}{2}$	
		local minimum at $x=5$	$\frac{1}{2}$	
	ii)			
		$f(-2) = \lvert -2\rvert + 2 = 4$	$\frac{1}{2}$	
		$f(4) = \lvert 4\rvert + 2 = 6$	$\frac{1}{2}$	4
		Local minimum at $x=0$ $f(0)=2$	$\frac{1}{2}$	
		$\therefore$ Absolute maximum is 6	$\frac{1}{2}$	
		$\therefore$ Absolute minimum is 2		
		Remarks:- i) For correct figure give 1 score. ii) $f'(x)<0$, then $f(x)$ is Decreasing give $\frac{1}{2}$ score.		
12.	(i)	$\frac{dx}{dt} = -4$, $\frac{dy}{dt} = 3$	$\frac{1}{2}$	
		$P = 2(x+y) \Rightarrow \frac{dP}{dt} = 2\left(\frac{dx}{dt} + \frac{dy}{dt}\right)$	$\frac{1}{2}$	
		$= 2(-4+3) = -2$ cm/s		

Qn. No	Sub Qns	Answer Key/Value Points	Score	Total Score
	ii)	$S = 2\pi r h$	$\frac{1}{2}$	
		$\frac{H}{R} = \frac{h}{R-r} \Rightarrow h = \frac{H}{R}(R-r)$	$\frac{1}{2}$	
		$\therefore S = 2\pi r \times \frac{H}{R}(R-r)$		
		$= \frac{2\pi H}{R}(Rr - r^2)$	$\frac{1}{2}$	
		$S' = \frac{2\pi H}{R}(R-2r)$		4
		$S' = 0 \Rightarrow r = \frac{R}{2}$	$\frac{1}{2}$	
		$S'' = \frac{2\pi H}{R}(-2) < 0$	$\frac{1}{2}$	
		$\therefore$ maximum at $r = \frac{R}{2}$	$\frac{1}{2}$	
				
		Remarks:- For figure give 1 score.		
13.	(i)	(a) 4	1	
	(ii)	$\text{Area} = \left\lvert \int_0^2 (x^2-2x)\,dx \right\rvert + \int_2^3 (x^2-2x)\,dx$	1	
		$= \left\lvert \left[\frac{x^3}{3} - x^2\right]_0^2 \right\rvert + \left[\frac{x^3}{3} - x^2\right]_2^3$	1	
		$= \left\lvert \frac{8}{3} - 4 \right\rvert + \frac{27}{3} - 9 - \frac{8}{3} + 4$	$\frac{1}{2}$	4
		$= \frac{4}{3} + 9 - 9 - \frac{8}{3} + 4$	$\frac{1}{2}$	
		$= \frac{8}{3}$		
		Remarks:- Find Area without using modulus give 2 Score only.		

Qn. No	Sub Qns	Answer Key/Value Points	Score	Total Score
14.	(i)	(d) 90°	1	
	(ii)	(a) Diagonal $= \vec{a}+\vec{b}$	$\frac{1}{2}$	
		$= 7\hat{i}+\hat{j}+8\hat{k}$	$\frac{1}{2}$	
		or		
		finding $\vec{a}-\vec{b}$ give full score.		
		Remark.		
		Any vector parallel to $\vec{a}+\vec{b}$ or $\vec{a}-\vec{b}$ give 1 score.		4
		(b) Area $= \lvert \vec{a}\times\vec{b} \rvert$	$\frac{1}{2}$	
		$\vec{a}\times\vec{b} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 3 & -1 & 2 \\ 4 & 2 & 6 \end{vmatrix} = -10\hat{i}-10\hat{j}+10\hat{k}$	$\frac{1}{2}+\frac{1}{2}$	
		Area $= \sqrt{10^2+10^2+10^2}$	$\frac{1}{2}$	
		$= 10\sqrt{3}$		
15.		$\vec{a_1} = -\hat{i}+\hat{j}+9\hat{k}$, $\vec{a_2} = 2\hat{i}-\hat{j}-\hat{k}$	$\frac{1}{2}$	
		$\vec{b_1} = 3\hat{i}+2\hat{j}+\hat{k}$, $\vec{b_2} = 2\hat{i}+\hat{j}+\hat{k}$	$\frac{1}{2}$	
		$S \cdot D = \left\lvert \dfrac{(\vec{a_2}-\vec{a_1})\cdot(\vec{b_1}\times\vec{b_2})}{\lvert \vec{b_1}\times\vec{b_2} \rvert} \right\rvert$	1	
		$\vec{a_2}-\vec{a_1} = 3\hat{i}-2\hat{j}-10\hat{k}$	$\frac{1}{2}$	
		$\vec{b_1}\times\vec{b_2} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 3 & 2 & 1 \\ 2 & 1 & 1 \end{vmatrix} = \hat{i}-\hat{j}-\hat{k}$	$\frac{1}{2}$	

Qn. No	Sub Qns	Answer Key/Value Points	Score	Total Score
		$\lvert\vec{b_1}\times\vec{b_2}\rvert = \sqrt{1+1+1} = \sqrt{3}$	$\frac{1}{2}$	
		$(\vec{a_2}-\vec{a_1})\cdot(\vec{b_1}\times\vec{b_2}) = 3+2+10 = 15$	$\frac{1}{2}$	4
		$S.D = \frac{15}{\sqrt{3}} = 5\sqrt{3}$		
		Remark. Using cartesian formula give full score.		
16		A : Construction job is completed on time		
		B : There will be strike		
		$P(B) = 0.65$, $P(B') = 1-0.65 = 0.35$	1	
		$P(A\mid B) = 0.32$, $P(A\mid B') = 0.8$	1	4
		$P(A) = P(B)\cdot P(A\mid B) + P(B')\cdot P(A\mid B')$	1	
		$= 0.65\times 0.32 + 0.35\times 0.8$	$\frac{1}{2}$	
		$= 0.488$	$\frac{1}{2}$	
17.		$A = \begin{bmatrix} 1 & 1 & 3 \\ 3 & 2 & -5 \\ 2 & 1 & 2 \end{bmatrix}$, $B = \begin{bmatrix} 16 \\ 6 \\ 10 \end{bmatrix}$, $X = \begin{bmatrix} x \\ y \\ z \end{bmatrix}$	1	
		$AX = B$, $X = A^{-1}B$	$\frac{1}{2}$	

Qn. No	Sub Qns	Answer Key/Value Points	Score	Total Score
		$\lvert A\rvert = -10 \neq 0$	1	
		$adj(A) = \begin{bmatrix} 9 & 1 & -11 \\ -16 & -4 & 14 \\ -1 & 1 & -1 \end{bmatrix}$	2	
		$A^{-1} = \frac{1}{\lvert A\rvert} adj(A)$	$\frac{1}{2}$	6
		$X = \frac{1}{-10}\begin{bmatrix} 9 & 1 & -11 \\ -16 & -4 & 14 \\ -1 & 1 & -1 \end{bmatrix}\begin{bmatrix} 16 \\ 6 \\ 10 \end{bmatrix}$	$\frac{1}{2}$	
		$= \begin{bmatrix} -4 \\ 14 \\ 2 \end{bmatrix}$	$\frac{1}{2}$	
18.	i)	$\frac{dy}{dx} = \frac{\frac{dy}{d\theta}}{\frac{dx}{d\theta}}$	$\frac{1}{2}$	
		$= \frac{a \times \cos\theta}{a(1-\cos\theta)} = \frac{\cos\theta}{1-\cos\theta}$	$\frac{1}{2}$	
	ii)	$e^y(x+1) = 1$		
		$\log e^y + \log(x+1) = \log 1$		
		$y + \log(x+1) = 0$	$\frac{1}{2}$	
		$y = -\log(x+1)$		
		$\frac{dy}{dx} = \frac{-1}{x+1}$	$\frac{1}{2}$	
		$\frac{d^2y}{dx^2} = \frac{1}{(x+1)^2}$	$\frac{1}{2}$	

Qn. No	Sub Qns	Answer Key/Value Points	Score	Total Score
		$\frac{d^2y}{dx^2} = \left(\frac{dy}{dx}\right)^2$	½	
		<u>Remark</u> Any other method give full score		
	iii)	$I = \int_0^{\pi} \frac{x}{1+\sin x}\,dx \quad \text{—} (1)$		
		$I = \int_0^{\pi} \frac{\pi - x}{1+\sin(\pi - x)}\,dx = \int_0^{\pi} \frac{\pi - x}{1+\sin x}\,dx \quad \text{—} (2)$	½	
		$2I = \pi \int_0^{\pi} \frac{1}{1+\sin x}\,dx$	½	6
		$= \pi \int_0^{\pi} \frac{1-\sin x}{1-\sin^2 x}\,dx$	½	
		$= \pi \int_0^{\pi} \left(\frac{1}{\cos^2 x} - \frac{\sin x}{\cos^2 x}\right) dx$	½	
		$= \pi \int_0^{\pi} (\sec^2 x - \sec x \tan x)\,dx$		
		$= \pi \left[\tan x - \sec x\right]_0^{\pi}$	½	
		$2I = \pi \times 2$		
		$I = \pi$	½	

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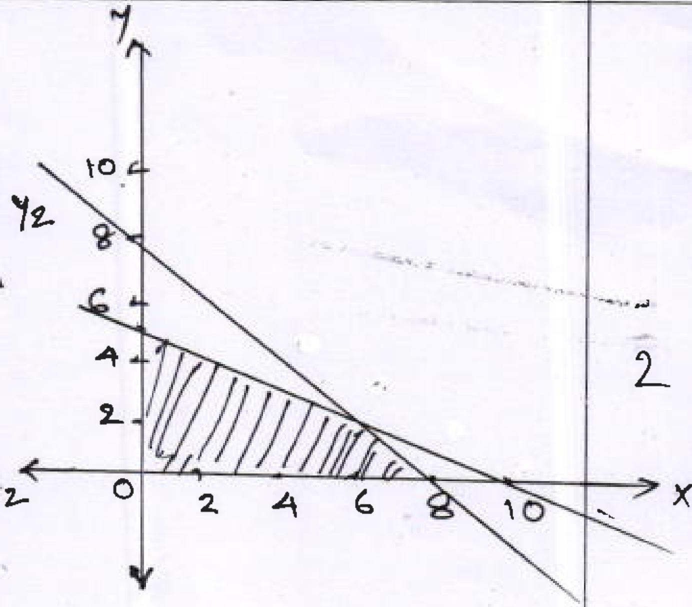
<tr><th>Qn. No</th><th>Sub Qns</th><th>Answer Key/Value Points</th><th>Score</th><th>Total Score</th></tr>
<tr><td>19.</td><td>i)</td><td>

$x+2y=10$

x	0	10
y	5	0

$x+y=8$

x	0	8
y	8	0



</td><td>2</td><td>6</td></tr>
<tr><td></td><td>ii)</td><td>

corner points

$(0,0),(8,0),(6,2),(0,5)$

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<tr><td></td><td>iii)</td><td>

Corner pt	$Z=2x+3y$
(0,0)	0
(8,0)	16
(6,2)	18
(0,5)	15

Max. value of $Z=18$ at $(6,2)$

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<tr><td>20.</td><td>i)</td><td>

$$\frac{dy}{dx}=xy$$

$$\frac{1}{y}dy=x\,dx$$

$$\int\frac{1}{y}dy=\int x\,dx$$

$$\log y=\frac{x^2}{2}+c$$

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1
1</td><td></td></tr>
<tr><td></td><td>ii)</td><td>

$$\frac{dy}{dx}=\frac{x}{y^2}$$

</td><td>½</td><td></td></tr>
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Qn. No	Sub Qns	Answer Key/Value Points	Score	Total Score
		$y^2 dy = x\,dx$	½	
		$\int y^2 dy = \int x\,dx$		
		$\frac{y^3}{3} = \frac{x^2}{2} + C$	1	
		Given $x=1,\ y=2$		6
		$\frac{8}{3} = \frac{1}{2} + C$		
		$C = \frac{13}{6}$	½	
		ie, $\frac{y^3}{3} = \frac{x^2}{2} + \frac{13}{6}$	½	
	*	Give full score for all correct alternate methods		

Qn. No	Sub Qns	Answer Key/Value Points	Score	Total Score
	1	RANJU. M. KUMAR 8156802805		
	2	SHAJI. A.G. 9446645117		
	3	LAL. E.V 9497894089		
	4.	DeepaRaj. R. 9496437320		
	5	Maria Manju 9447864983		
	6.	REJU THOMAS - 9446485892		
	7.	JAYADEV.B - 9400555339		
	8.	Bindhu Aravind - 944620257I		
	9	Aby Skariah 9562869701 7559959701		
	10.	Shareef Chaliy 9745284021.		