ANSWER KEY

II YEAR HIGHER SECONDARY EXAMINATION JULY 2022

PART-I/II/III

SUBJECT: MATHEMATICS (SCIENCE)

CODE NO: SAY 727 VERSION: P

60 SCORES 2 HOURS

Qn. No	Sub Qns	Answer Key/Value Points	Score	Total Score
	A	PART - I		
1.		d) $f: R \to R$, $f(x) = x^3$	1	1
2		b) $\pi/2$	1	1
3		40 (Remark : $2^3|A|$ - ½ score)	1	1
4		0.12 (Remark : $P(A \cap B) = P(A) \cdot P(B)$ ½ score)	1	1
5		a) ¼	1	1
6		$-\frac{1}{2}$ (Remark : slope $= \frac{dy}{dx}$, ½ score)	1	1
7		c) $\bar{a} \cdot \bar{b}$	1	1
8		$\bar{r} = (2j - k) + \lambda(2i + 3j + k)$ (Remark : $\bar{r} = \bar{a} + \lambda\bar{b}$ ½ score)	1	1
9		Order = 1	1	1
10	B	$\pi/6$ or 30° (Remark : $\sin^{-1}(1/2)$ ½ score)	1	1
11		c) 10	1	1
12		$n = 0$ (Remark : $l^2 + m^2 + n^2 = 1$, ½ score)	1	1
13		$e^{\sin x} \times \cos x$ (Remark ; for $e^{\sin x}$, ½ score)	1	1

Qn. No	Sub Qns	Answer Key/Value Points	Score	Total Score
		PART II		
14	A	$A^2 = A \times A$ (½) $= \begin{bmatrix} 1 & 3 \\ 2 & 0 \end{bmatrix} \times \begin{bmatrix} 1 & 3 \\ 2 & 0 \end{bmatrix} = \begin{bmatrix} 1+6 & 3+0 \\ 2+0 & 6+0 \end{bmatrix}$ (1) $= \begin{bmatrix} 7 & 3 \\ 2 & 6 \end{bmatrix}$ (½)		2
15		$\frac{dx}{dt} = 4\ cm/s$, $x = 20cm$ (½) $V = x^3$ (½) $\frac{dV}{dt} = 3x^2 \frac{dx}{dt}$ (½) $= 3 \times (20)^2 \times 4$ (½) $= 4800\ cm^3/s$		2
16		$f'(x) = 2x - 6$ (1) $f'(x) = 0 \Rightarrow x = 3$ (½) $\therefore$ Required interval is $[3, \infty)$ (½) (Remark : $f'(x) > 0 \Rightarrow x > 3$, 1 score)		2
17		$\frac{dy}{y^2} = 4x\,dx$ (1) $\int \frac{dy}{y^2} = \int 4x\,dx$ (½) $-\frac{1}{y} = 2x^2 + c$ (½)		2
18	B	$[\bar{a}\ \bar{b}\ \bar{c}] = \begin{vmatrix} 1 & -2 & 3 \\ -2 & 3 & -4 \\ 1 & -3 & 5 \end{vmatrix}$ (1) $= 1(15-12) + 2(-10+4) + 3(6-3)$ $= 3 - 12 + 9$ (½) $= 0$ (½) (Remark : $[\bar{a}, \bar{b}\ \bar{c}] = 0$ 1 Score)		2

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Qn. No	Sub Qns	Answer Key/Value Points	Score	Total Score
19		$\frac{dy}{dx} = 3\cos x + 4\sin x$ (1) $\frac{d^2y}{dx^2} = -3\sin x + 4\cos x$ (½) $= -y$ (½) $\therefore \frac{d^2y}{dx^2} + y = 0$		2
20		$\frac{dy}{dx} + \frac{2}{x}y = x$ $P = \frac{2}{x}$ (½) $IF = e^{\int P dx}$ (1) $= e^{\int \frac{2}{x} dx}$ $= e^{2\log x}$ (½) $= x^2$		2
21	A	PART III $A' = \begin{bmatrix} 2 & -1 & 1 \\ -1 & 3 & -2 \\ -4 & 4 & -3 \end{bmatrix}$ (1) $P = \frac{1}{2}(A+A') = \frac{1}{2}\begin{bmatrix} 4 & -2 & -3 \\ -2 & 6 & 2 \\ -3 & 2 & -6 \end{bmatrix}$ (1) $Q = \frac{1}{2}(A-A') = \frac{1}{2}\begin{bmatrix} 0 & 0 & -5 \\ 0 & 0 & 6 \\ 5 & -6 & 0 \end{bmatrix}$ (½) $A = P+Q$ (½)		3
22	a)	$(gof)(x) = g(f(x))$ (1) $= g(4x-1) = (4x-1)^2$ (1)	2	3
	b)	$(gof)(2) = (4\times 2 - 1)^2 = 49$ (1) Remark : $(fog)(x) = f(g(x))$ 1 score)	1	

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Qn. No	Sub Qns	Answer Key/Value Points	Score	Total Score
23		$P(E_1) = 1/2$, $P(E_2) = 1/2$ (½) $P(A/E_1) = 3/7$, $P(A/E_2) = 5/11$ (1) $P(E_2/A) = \frac{P(E_2) \times P(A/E_2)}{P(E_1) \times P(A/E_1) + P(E_2) \times P(A/E_2)}$ (1) $= \frac{\frac{1}{2} \times \frac{5}{11}}{\frac{1}{2} \times \frac{3}{7} + \frac{1}{2} \times \frac{5}{11}}$ (½) $= \frac{35}{68}$		3
24		$\bar{a} \times \bar{b} = \begin{vmatrix} i & j & k \\ 1 & -1 & 3 \\ 2 & -7 & 1 \end{vmatrix}$ (1) $= i(-1+21) - j(1-6) + k(-7+2)$ (½) $= 20i + 5j - 5k$ (½) Area of parallelogram $= \lvert \bar{a} \times \bar{b} \rvert$ (½) $= \sqrt{(20)^2 + (5)^2 + (-5)^2}$ $= \sqrt{450}$ (½) (Remark : Area $= \lvert \bar{a} \times \bar{b} \rvert$ 1 Score)		3
25	B	$A = IA$ $\begin{bmatrix} 1 & 1 \\ 2 & 3 \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} A$ (1) $\begin{bmatrix} 1 & 1 \\ 0 & 1 \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ -2 & 1 \end{bmatrix} A$, $R_2 \to R_2 - 2R_1$ (1) $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} = \begin{bmatrix} 3 & -1 \\ -2 & 1 \end{bmatrix} A$, $R_1 \to R_1 - R_2$ (1) $\therefore A^{-1} = \begin{bmatrix} 3 & -1 \\ -2 & 1 \end{bmatrix}$ (Remark : For direct answer 2 score)		3

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Qn. No	Sub Qns	Answer Key/Value Points	Score	Total Score
26	a)	$a*b = \frac{ab}{4} = \frac{ba}{4} = b*a$ (1)	2	3
	b)	$a*e = a$ (1)	1	
		$\frac{ae}{4} = a \Rightarrow e = 4$ (1)		
		(Remark : For $a*b = b*a$ $\frac{1}{2}$ Score)		
27		$f(x) = x^2$, $a = 0$, $b = 3$ (1)		3
		$\int_a^b f(x)dx = \lim_{h\to 0} h\left(f(a)+f(a+h)+\longrightarrow +f(a+(n-1)h)\right)$ (1)		
		$\int_0^3 x^2dx = \lim_{h\to 0} h\left(0+h^2+2^2h^2+\longrightarrow+(n-1)^2h^2\right)$ (½)		
		$= \lim_{h\to 0} h^3\left(1+2^2+\longrightarrow+(n-1)^2\right)$		
		$= \lim_{h\to 0} h^3\frac{(n(n-1)(2n-1))}{6}$		
		$= \frac{27}{6}\times 1\times 2$ (½)		
		$= 9$		
		(Remark : For direct answer 1 score)		
28	A a	PART IV		
		$\tan^{-1}\frac{2}{11}+\tan^{-1}\frac{7}{24} = \tan^{-1}\left(\frac{\frac{2}{11}+\frac{7}{24}}{1-\frac{2}{11}\times\frac{7}{24}}\right)$ (1)	2	
		$= \tan^{-1}\left(\frac{2\times 24+7\times 11}{11\times 24-2\times 7}\right)$ (½)		
		$= \tan^{-1}\left(\frac{125}{250}\right) = \tan^{-1}\left(\frac{1}{2}\right)$ (½)		
		(Remark : $\tan^{-1}x+\tan^{-1}y = \tan^{-1}\left(\frac{x+y}{1-xy}\right)$ 1 score)		

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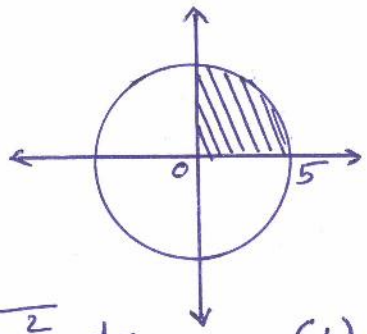
Qn. No	Sub Qns	Answer Key/Value Points	Score	Total Score
	b	$\sin^{-1}(\sin\frac{2\pi}{3}) = \sin^{-1}(\sin(\pi-\pi/3))$ (1) $= \sin^{-1}(\sin\pi/3) = \pi/3$ (1) (Remark : $\sin^{-1}(\sin x) = x$ 1 Score)	2	4
29		$x^2+y^2=25$ $y^2=25-x^2$ $y=\sqrt{25-x^2}$ (1)  Area $= 4\times\int_0^5 \sqrt{25-x^2}\,dx$ (1) $= 4\left[\frac{x}{2}\sqrt{25-x^2}+\frac{25}{2}\sin^{-1}\frac{x}{5}\right]_0^5$ (1) $= 4\left[\frac{25}{2}\sin^{-1}\frac{5}{5}\right]$ (½) $= 4\times\frac{25}{2}\sin^{-1}(1)$ (½) $= 4\times\frac{25}{2}\times\frac{\pi}{2}$ $= 25\pi$ (Remark : 1) For ~~fo~~igure 1 Score 2) Area $= \int_a^b y\,dx$ 1 Score 3) Formula $\int\sqrt{a^2-x^2}\,dx$ 1 Score)		4
30	a	$\lim_{x\to 2^-} f(x) = \lim_{x\to 2}(x^2+3) = 7$ (1) $\lim_{x\to 2^+} f(x) = \lim_{x\to 2}(x^3-3) = 5$ (1) LHL $\neq$ RHL $\therefore$ Limit doesnot exist Hence not continuous at $x=2$. (Remark: For writing not continuous ½ Score)	2	

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Qn. No	Sub Qns	Answer Key/Value Points	Score	Total Score
	b	$x = \sin 2t \Rightarrow \frac{dx}{dt} = 2\cos 2t$ (½) $y = \cos t \Rightarrow \frac{dy}{dt} = -\sin t$ (½) $\frac{dy}{dx} = \frac{dy/dt}{dx/dt}$ (½) $= \frac{-\sin t}{2\cos 2t}$ (½)	2	4
31		$\bar{a}_1 = i+2j+k$, $\bar{b}_1 = i-j+k$ (½) $\bar{a}_2 = 2i-j-k$, $\bar{b}_2 = 2i+j+2k$ (½) $\bar{a}_2 - \bar{a}_1 = i-3j-2k$ (½) $\bar{b}_1 \times \bar{b}_2 = \begin{vmatrix} i & j & k \\ 1 & -1 & 1 \\ 2 & 1 & 2 \end{vmatrix}$ (½) $= -3i+3k$ (½) $SD = \left\lvert \frac{(\bar{a}_2-\bar{a}_1)\cdot(\bar{b}_1\times\bar{b}_2)}{\lvert\bar{b}_1\times\bar{b}_2\rvert} \right\rvert$ (1) $= \left\lvert \frac{-3-6}{\sqrt{9+9}} \right\rvert = \frac{9}{3\sqrt{2}} = \frac{3}{\sqrt{2}}$ (½)		4
32	B (i)	$\sum p(x) = 1$ (1) $0+k+2k+2k+3k+k^2+2k^2+7k^2+k = 1$ (1) $\Rightarrow 10k^2+9k-1=0$ (½) $\Rightarrow k = 1/10$ (½)	3	4
	(ii)	$P(X<3) = P(0)+P(1)+P(2)$ (½) $= 0+\frac{1}{10}+\frac{2}{10} = \frac{3}{10}$ (½) $(0+k+2k = 3k = \frac{3}{10})$	1	

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Qn. No	Sub Qns	Answer Key/Value Points	Score	Total Score
33	a	$\bar{r} \cdot \hat{n} = d$ (1)		
		$\hat{n} = \frac{2i-2j+k}{3}$ (½)		
		$d = 2$	2	
		∴ Equation of the plane is		
		$\bar{r} \cdot \left(\frac{2i-2j+k}{3}\right) = 2$ (½)		
		$\bar{r} \cdot (2i-2j+k) = 6$		4
	b	$\bar{b} = 2i-3j+6k$, $\bar{n} = 2i-2j+k$ (½)		
		$\sin\theta = \left\lvert \frac{\bar{b} \cdot \bar{n}}{\lvert\bar{b}\rvert \lvert\bar{n}\rvert} \right\rvert$ (1)	2	
		$= \frac{4+6+6}{\sqrt{49} \times \sqrt{9}} = \frac{16}{7\times 3}$ (½)		
		$= \frac{16}{21}$		
		$\theta = \sin^{-1}\frac{16}{21}$		
34	A	PART V		
		$AX = B$		
		$A = \begin{bmatrix} 3 & -2 & 3 \\ 2 & 1 & -1 \\ 4 & -3 & 2 \end{bmatrix}$ $X = \begin{bmatrix} x \\ y \\ z \end{bmatrix}$ $B = \begin{bmatrix} 8 \\ 1 \\ 4 \end{bmatrix}$ (1)		
		$\lvert A\rvert = -17 \neq 0$ (1)		
		$\text{Adj } A = \begin{bmatrix} -1 & -5 & -1 \\ -8 & -6 & 9 \\ -10 & 1 & 7 \end{bmatrix}$ (2)		
		$A^{-1} = \frac{1}{\lvert A\rvert} \text{adj } A$ (½)		
		$= \frac{-1}{17}\begin{bmatrix} -1 & -5 & -1 \\ -8 & -6 & 9 \\ -10 & 1 & 7 \end{bmatrix}$ (½)		

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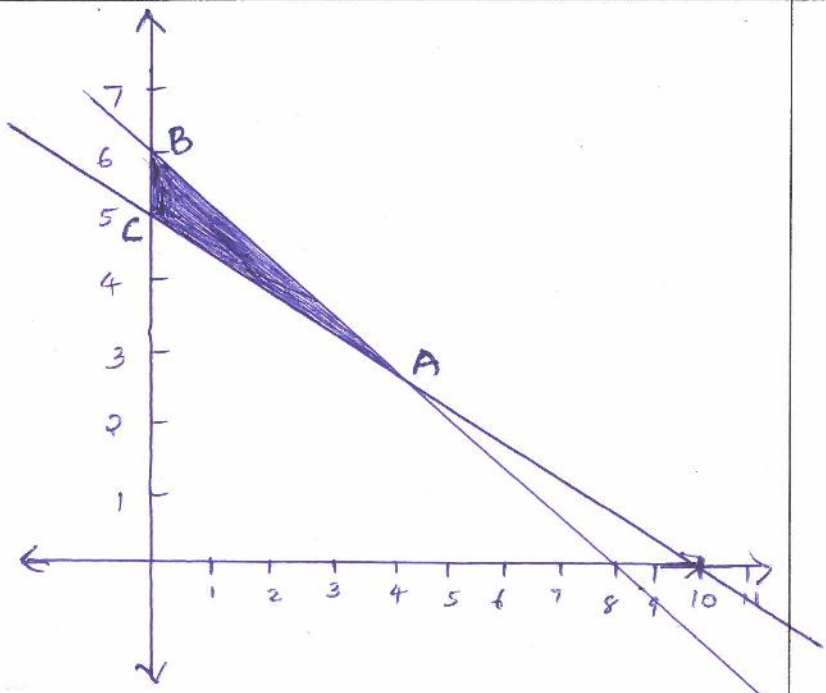
Qn. No	Sub Qns	Answer Key/Value Points	Score	Total Score
		$X = A^{-1}B$ (½) $= \frac{-1}{17}\begin{bmatrix} -1 & -5 & -1 \\ -8 & -6 & 9 \\ -10 & 1 & 7 \end{bmatrix}\begin{bmatrix} 8 \\ 1 \\ 4 \end{bmatrix}$ $\begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix}$ (½) $x=1,\ y=2,\ z=3$		6
35	a	$\int \frac{2x}{1+x^2}dx = \log\lvert 1+x^2\rvert + c$	1	
	b	$I = \int_0^a \frac{\sqrt{x}}{\sqrt{x}+\sqrt{a-x}}dx$ $I = \int_0^a \frac{\sqrt{a-x}}{\sqrt{a-x}+\sqrt{x}}dx$ (1) $2I = \int_0^a 1\,dx = (x)_0^a = a$ (½) (½) $I = \frac{a}{2}$ (Remark : $\int_0^a f(x)dx = \int_0^a f(a-x)dx$ 1 Score)	2	6
	c	$\int \frac{1}{x^2-6x+13}dx = \int \frac{1}{x^2-6x+3^2-3^2+13}dx$ (1) $= \int \frac{1}{(x-3)^2+2^2}dx$ (1) $= \frac{1}{2}\tan^{-1}\left(\frac{x-3}{2}\right)+c$ (1) (Remark : 1) For alternate method give full score 2) $\int \frac{1}{x^2+a^2}dx = \frac{1}{a}\tan^{-1}\left(\frac{x}{a}\right)+c$ 1 Score)	3	

Qn. No	Sub Qns	Answer Key/Value Points	Score	Total Score
36			4	6
		Corner points: A (4,3), B (0,6), C (0,5); Z = 200x + 500y: Z = 2300 – Minimum, Z = 3000, Z = 2500	2	
		Z = 2300 at x = 4 and y = 3		
		(Remark : 1) For x- and y axis 1 Score 2) For each line, 1 Score 3) For any other feasible region, give 3½ Score for the graph)		

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SCHEME FINARISATION PLUS ONE (SAY/IMP: July 2022)

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