ANSWER KEY

Second YEAR HIGHER SECONDARY EXAMINATION March 2022

PART-~~I/II~~/III

SUBJECT: MATHEMATICS (SCIENCE) (H/I)

CODE NO: ~~XXXXX~~ 54 75 VERSION: Q

80 SCORES 2.30 HOURS

Qn. No	Sub Qns	Answer Key/Value Points	Score	Total Score
1		(b) 10		1
2		(a) Increasing in R		1
3		(c) $\int_a^b y\,dx$		1
4		(a) $\tan^{-1}y = \tan^{-1}x + C$		1
5		(a) $\sqrt{3}$		1
6		(b) 1		1
7		(c) $AB = BA = I$		1
8		(a) 0		1
9		(b) 1		1
10		(a) 4		1

Qn. No	Sub Qns	Answer Key/Value Points	Score	Total Score
11		$fog(x) = f(g(x))$	1	
		$= f(x^2)$	½	2
		$= \cos(x^2)$	1	
12		$\sin^{-1}\left(\frac{1}{2}\right) = \frac{\pi}{6}$		2
13		$f'(x) = 3$	½	
		$f'(x) = 3 > 0$	½	2
		$\therefore f$ is strictly increasing on R	1	
14		order = 1	1	
		degree = 1	1	2
15		$P(A\|B) = \frac{P(A \cap B)}{P(B)}$	1	
		$= \frac{0.32}{0.5} = \frac{16}{25}$	1	2

Qn. No	Sub Qns	Answer Key/Value Points	Score	Total Score
16		$\int_0^1 x\,dx = \left[\frac{x^2}{2}\right]_0^1$	1	
		$= \frac{1}{2} - 0$		2
		$= \frac{1}{2}$	1	
17		distance $= \left\lvert \frac{2 + 2\times 3 - 2\times -5 - 9}{\sqrt{1^2 + 2^2 + (-2)^2}} \right\rvert$	1	
		$= \left\lvert \frac{2+6+10-9}{\sqrt{1+4+4}} \right\rvert$		2
		$= \frac{9}{3} = 3$	1	
18		Since A and B are independent		
		$P(A \cap B) = P(A) \cdot P(B)$	1	2
		$= 0.3 \times 0.6 = 0.18$	1	
19		(a) $\sin^{-1}x + \cos^{-1}x = \frac{\pi}{2}$	1	
		(b) $\tan^{-1}x + \tan^{-1}y = \tan^{-1}\left(\frac{x+y}{1-xy}\right)$	1	4
		(c) $\sin^{-1}\left(\frac{1}{x}\right) = \operatorname{cosec}^{-1}x$	1	
		(d) $\tan^{-1}1 = \frac{\pi}{4}$	1	

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20		$\lim_{x\to 2^-} f(x) = \lim_{x\to 2^+} f(x) = f(2)$	1	
		$\lim_{x\to 2^-} kx^2 = \lim_{x\to 2^+} 3$	1	
		$4k = 3$	1	4
		$k = 3/4$	1	
21		$I = \int_0^{\pi/2} \frac{\sin x}{\sin x + \cos x}\, dx$ — ①		
		$I = \int_0^{\pi/2} \frac{\sin(\pi/2 - x)}{\sin(\pi/2 - x) + \cos(\pi/2 - x)}\, dx$	1	
		$= \int_0^{\pi/2} \frac{\cos x}{\cos x + \sin x}\, dx$ — ②	1	
		① + ② $\Rightarrow$		
		$2I = \int_0^{\pi/2} \frac{\sin x + \cos x}{\sin x + \cos x}\, dx$	1	4
		$= \int_0^{\pi/2} 1\, dx$		
		$= [x]_0^{\pi/2} = \pi/2$	1/2	
		$\therefore I = \pi/4$	1/2	

Qn. No	Sub Qns	Answer Key/Value Points	Score	Total Score
22	a	$\vec{a}+\vec{b} = 5\hat{i}+5\hat{j}+5\hat{k}$	2	2
	b	$\vec{a}\cdot\vec{b} = 2*3+3*2+2*3$	1	
		$= 6+6+6$		2
		$= 18$	1	
23		$\vec{a} = 5\hat{i}-2\hat{j}-4\hat{k}$	1	
		$\vec{b} = 3\hat{i}+2\hat{j}-8\hat{k}$	1	
		Vector eq: of the line is		
		$\vec{r} = \vec{a}+\lambda\vec{b}$	1	4
		$\vec{r} = 5\hat{i}-2\hat{j}-4\hat{k}+\lambda(3\hat{i}+2\hat{j}-8\hat{k})$	1	
24		$A=\begin{bmatrix}1&2\\2&3\end{bmatrix}$, $X=\begin{bmatrix}x\\y\end{bmatrix}$, $B=\begin{bmatrix}2\\3\end{bmatrix}$	3	
		$AX = B$		4
		$\begin{bmatrix}1&2\\2&3\end{bmatrix}\begin{bmatrix}x\\y\end{bmatrix}=\begin{bmatrix}2\\3\end{bmatrix}$	1	

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25		$\frac{1}{(x+1)(x+2)} = \frac{A}{x+1} + \frac{B}{x+2}$	1	
		$A = +1$	½	
		$B = -1$	½	4
		$\int \frac{1}{(x+1)(x+2)}\,dx = \int \frac{1\,dx}{x+1} - \int \frac{1\,dx}{x+2}$	1	
		$= \log\lvert x+1\rvert - \log\lvert x+2\rvert + c$	1	
26	a	$1 * 2 = 2$	2	
		$2 * 3 = 1$	2	4
	(b)	$(1*2)*3 = 2*3$	1	
		$= 1$	1	2

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27	(a)	$A+B = \begin{bmatrix} 1 & 2 \\ 5 & 3 \end{bmatrix} + \begin{bmatrix} 3 & 1 \\ 4 & 2 \end{bmatrix}$	1	
		$= \begin{bmatrix} 4 & 3 \\ 9 & 5 \end{bmatrix}$	1	2
	(b)	$2A = 2\begin{bmatrix} 1 & 2 \\ 5 & 3 \end{bmatrix}$	1	
		$= \begin{bmatrix} 2 & 4 \\ 10 & 6 \end{bmatrix}$	1	2
	(c)	$2A+B = \begin{bmatrix} 2 & 4 \\ 10 & 6 \end{bmatrix} + \begin{bmatrix} 3 & 1 \\ 4 & 2 \end{bmatrix}$	1	
		$= \begin{bmatrix} 5 & 5 \\ 14 & 8 \end{bmatrix}$	1	2
28	(a)	$\lvert A \rvert = \begin{vmatrix} 1 & 3 \\ 1 & 4 \end{vmatrix}$	1	
		$= 4-3 = 1$	2	3
	(b)	$\text{adj } A = \begin{bmatrix} 4 & -3 \\ -1 & 1 \end{bmatrix}$	3	3

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29		(a) $\frac{d}{dx}(2) = 0$	1	
		(b) $\frac{d}{dx}(x^1) = 1$	1	
		(c) $\frac{d}{dx}(x^2) = 2x$	1	
		(d) $\frac{d}{dx}(\sin x) = \cos x$	1	
		(e) $\frac{d}{dx}(\cos x) = -\sin x$	1	6
		(e) $\frac{d}{dx}(\sqrt{x}) = \frac{1}{2\sqrt{x}}$	1	
30		$\lvert A \rvert = \begin{vmatrix} 2 & 1 \\ 1 & 1 \end{vmatrix}$	1	
		$= 2 - 1 = 1$	1	
		$adj A = \begin{bmatrix} 1 & -1 \\ -1 & 2 \end{bmatrix}$	2	
		$A^{-1} = \frac{1}{\lvert A \rvert} adj A$	1	6
		$= \begin{bmatrix} 1 & -1 \\ -1 & 2 \end{bmatrix}$	1	

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31		$A = \begin{bmatrix} 2 & 5 \\ 3 & 2 \end{bmatrix}$, $X = \begin{bmatrix} x \\ y \end{bmatrix}$, $B = \begin{bmatrix} 1 \\ 7 \end{bmatrix}$	1	
		$\lvert A \rvert = \begin{vmatrix} 2 & 5 \\ 3 & 2 \end{vmatrix}$		
		$= 4 - 15$	1	
		$= -11$		
		$\text{adj } A = \begin{bmatrix} 2 & -5 \\ -3 & 2 \end{bmatrix}$	1	
		$A^{-1} = \frac{1}{\lvert A \rvert} \text{adj } A = -\frac{1}{11}\begin{bmatrix} 2 & -5 \\ -3 & 2 \end{bmatrix}$	1	
		$X = A^{-1}B$	½	6
		$= -\frac{1}{11}\begin{bmatrix} 2 & -5 \\ -3 & 2 \end{bmatrix}\begin{bmatrix} 1 \\ 7 \end{bmatrix}$	½	
		$= \frac{-1}{11}\begin{bmatrix} -33 \\ -3+14 \end{bmatrix}$	½	
		$= \frac{-1}{11}\begin{bmatrix} -33 \\ 11 \end{bmatrix} = \begin{bmatrix} 3 \\ -1 \end{bmatrix}$		
		$x = 3, y = -1$	½	

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32	(a)	$\vec{a} \times \vec{b} = \begin{vmatrix} i & j & k \\ 2 & 1 & 3 \\ 1 & 2 & 1 \end{vmatrix}$	1	
		$= i(1-6) - j(2-3) + k(4-1)$	2	4
		$= -5i + j + 3k$	1	
	(b)	$\lvert \vec{a} \times \vec{b} \rvert = \sqrt{(-5)^2 + 1^2 + 3^2}$	1	
		$= \sqrt{25 + 1 + 9}$	1	2
		$= \sqrt{35}$		
33	(a)	$A' = \begin{bmatrix} 3 & 1 \\ 1 & 5 \end{bmatrix}$	2	2
	(b)	$A + A' = \begin{bmatrix} 3 & 1 \\ 7 & 5 \end{bmatrix} + \begin{bmatrix} 3 & 7 \\ 1 & 5 \end{bmatrix}$	1	
		$= \begin{bmatrix} 6 & 8 \\ 8 & 10 \end{bmatrix}$	2	3

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	(c)	$A - A' = \begin{bmatrix} 3 & 1 \\ 7 & 5 \end{bmatrix} - \begin{bmatrix} 3 & 7 \\ 1 & 5 \end{bmatrix}$	1	3
		$= \begin{bmatrix} 0 & -6 \\ 6 & 0 \end{bmatrix}$.	2	
34	(a)	(i) $y = \sin(x^2)$		
		$\frac{dy}{dx} = \cos(x^2)\frac{d}{dx}(x^2)$	1	2
		$= \cos(x^2)\, 2x$	1	
		$= 2x\cos(x^2)$		
		(ii) $2x + 3y = \sin x$		
		Diff w.r.t x.		
		$2 + 3\frac{dy}{dx} = \cos x$	1	
		$3\frac{dy}{dx} = \cos x - 2$	½	2
		$\frac{dy}{dx} = \frac{\cos x - 2}{3}$	½	

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	(b)	$y = x^2 + x + 1$		
		$\frac{dy}{dx} = 2x + 1$	2	
		$\frac{d^2y}{dx^2} = 2$	2	4
35		$x + 2y = 10$	1	
		$3x + y = 15$	1	
		Corner points are (0,0), (5,0), (4,3), (0,5)	1	
		Maximum value of z is 18 at (4,3)	1	
			×4	8

x	0	10
y	5	0

x	0	5
y	15	0