SECOND YEAR HIGHER SECONDARY EXAMINATION MARCH 2018

SUBJECT : MATHEMATICS, COMMERCE CODE. NO: 9053

Qn No	Sub Qns	Answer Key/Value Points	Score	Total
1	a)	R_1 is reflexive ⟶ 1		
	b)	$R_2 = \{(1,1), (1,2), (1,3), (2,2), (2,3), (3,3)\}$ ⟶ (1) $(1,2), (2,3) \in R_2 \Rightarrow (1,3) \in R_2$ ⟶ (1) $\therefore R_2$ is transitive Remark : Concept of transitive give 1 score	2	3
2.		$\cos\theta = \frac{\vec{a}\cdot\vec{b}}{\lvert\vec{a}\rvert\lvert\vec{b}\rvert}$ ⟶ (1) $\vec{a}\cdot\vec{b} = 1-1+1 = 1$ ⟶ (1) $\lvert\vec{b}\rvert = \sqrt{3} = \lvert\vec{a}\rvert$ ⟶ $(\frac{1}{2})$ $\cos\theta = \frac{1}{3}$ ⟶ $(\frac{1}{2})$ $\theta = \cos^{-1}(\frac{1}{3})$		3
3	a)	$l^2+m^2+n^2 = 1$ or $\cos^2\alpha+\cos^2\beta+\cos^2\gamma = 1$ ⟶(1) $3l^2 = 1$ ⟶ $(\frac{1}{2})$ $l = \frac{1}{\sqrt{3}}$ ⟶ $(\frac{1}{2})$ Remark Concept of d.c.s give $\frac{1}{2}$ score	2	3

1/15

Qn No	Sub Qns	Answer Key/Value Points	Score	Total
	b	Direction angles : $0^\circ, 90^\circ, 90^\circ$ $\longrightarrow(\frac{1}{2})$ Direction cosines : $1, 0, 0$ $\longrightarrow(\frac{1}{2})$	1	
4	a)	$2A = \begin{bmatrix} 16 & 0 \\ 8 & 4 \\ 2 & 12 \end{bmatrix}$ $\longrightarrow$ (1) $2A+B = \begin{bmatrix} 17 & -1 \\ 8 & 5 \\ 3 & 12 \end{bmatrix}$ $\longrightarrow$ (1)	2	3
	b)	No $\longrightarrow(\frac{1}{2})$ For suitable reason (orders are different) $(\frac{1}{2})$	1	
5	a)	Area $\Delta = \frac{1}{2}\begin{vmatrix} 1 & 0 & 1 \\ 6 & 0 & 1 \\ 4 & 3 & 1 \end{vmatrix}$ $\longrightarrow$ (1) $= \frac{1}{2}(-3+18) = \frac{15}{2} \rightarrow (\frac{1}{2}+\frac{1}{2})$ Remark For formula, $\Delta = \frac{1}{2}\begin{vmatrix} x_1 & y_1 & 1 \\ x_2 & y_2 & 1 \\ x_3 & y_3 & 1 \end{vmatrix}$ give (1) Score	2	3
	b)	$\begin{vmatrix} \cos\theta & -\sin\theta \\ \sin\theta & \cos\theta \end{vmatrix} = \cos^2\theta + \sin^2\theta$ $\rightarrow$(1) $= 1$	1	

Qn No	Sub Qns	Answer Key/Value Points	Score	Total
6	a)	$\int (x - \frac{1}{x^2})\, dx$ ⟶ $(\frac{1}{2})$ $= \frac{x^2}{2} + \frac{1}{x} + c$ ⟶ $(\frac{1}{2})$	1	3
	b)	$I = \int \sin x\, dx - \int \text{cosec}^2 x\, dx$ ⟶ (1) $= -\cos x + \cot x + c$ ⟶ (1) Remark $\int \sin x\, dx = -\cos x$ or $\int \text{cosec}^2 x\, dx = -\cot x$ give (1) score	2	
7.		Area $= \int_1^4 y\, dx$ ⟶ (1) $= \int_1^4 \sqrt{x}\, dx$ ⟶ $(\frac{1}{2})$ $= \frac{2}{3}\left[x^{3/2}\right]_1^4$ ⟶ $(\frac{1}{2})$ $= \frac{2}{3}\left[4^{3/2} - 1^{3/2}\right]$ ⟶ $(\frac{1}{2})$ $= \frac{14}{3}$ ⟶ $(\frac{1}{2})$ Remark $\int_a^b f(x)\, dx$ or $\int_a^b y\, dx$ give 1 score		3

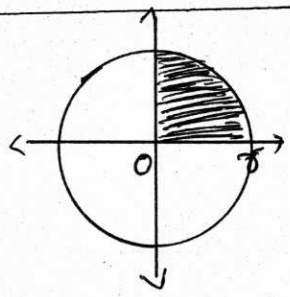
3/15

Qn No	Sub Qns	Answer Key/Value Points	Score	Total
8	a)	$fof(x) = \dfrac{2x\left(\frac{2x-1}{4}\right)-1}{4}$ $\longrightarrow \frac{1}{2}$	1	4
		$= \dfrac{2x-3}{8}$ $\longrightarrow \frac{1}{2}$		
		Remark		
		$fof(x) = f(f(x))$ give $(\frac{1}{2})$ score		
	b)	$fog = I$ / $gof = I$. $\longrightarrow (1)$	3	
		$f(g(x)) = x$. $\longrightarrow (\frac{1}{2})$		
		$f(y) = x$		
		$f\left(\frac{2y-1}{4}\right) = x$ $\longrightarrow (\frac{1}{2})$		
		$\therefore y = \frac{4x+1}{2}$		
		$g(x) = \frac{4x+1}{2}$ is the inverse of f $\longrightarrow (1)$		
		$\therefore$ f is invertible		
		Remark		
		1. For any other alternate method give full score		
		2. Concept of invertible functions give 1 score		

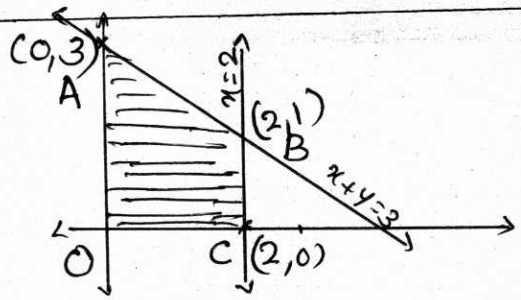
Qn No	Sub Qns	Answer Key/Value Points	Score	Total
9		$\begin{vmatrix} 1 & a & a^2 \\ 1 & b & b^2 \\ 1 & c & c^2 \end{vmatrix} = \begin{vmatrix} 1 & a & a^2 \\ 0 & b-a & b^2-a^2 \\ 0 & c-a & c^2-a^2 \end{vmatrix} \longrightarrow (1)$ $= \begin{vmatrix} b-a & b^2-a^2 \\ c-a & c^2-a^2 \end{vmatrix} \longrightarrow (1)$ $= (b-a)(c-a) \begin{vmatrix} 1 & b+a \\ 1 & c+a \end{vmatrix} \longrightarrow (1)$ $= (a-b)(b-c)(c-a) \longrightarrow (1)$ Remark 1. Answer through direct expansion give Full score 2. For direct expansion only give 1 score		4
10	a)	Let $x = \tan\theta \longrightarrow (\frac{1}{2})$ $\tan^{-1}\left(\frac{2x}{1-x^2}\right) = \tan^{-1}\left(\frac{2\tan\theta}{1-\tan^2\theta}\right) \longrightarrow (\frac{1}{2})$ $= \tan^{-1}(\tan 2\theta) \longrightarrow (\frac{1}{2})$ $= 2\theta \longrightarrow (\frac{1}{2})$ $= 2\tan^{-1}x$ Remark 1. $\tan^{-1}\left(\frac{2x}{1-x^2}\right) = 2\tan^{-1}x$ give 2 score 2. $\tan 2\theta = \frac{2\tan\theta}{1-\tan^2\theta}$ or $\tan^{-1}(\tan x) = x$ } give 1 score	2	4

Qn. No	Sub Qns	Answer Key/Value Points	Score	Total
	b)	LHS $= \tan^{-1}x + 2\tan^{-1}x = 3\tan^{-1}x$ $\longrightarrow (\frac{1}{2})$		
		RHS $= \tan^{-1}\left(\frac{3\tan\theta - \tan^3\theta}{1 - 3\tan^2\theta}\right) =$ $\longrightarrow (\frac{1}{2})$	2	
		$= \tan^{-1}(\tan 3\theta)$ $\longrightarrow (\frac{1}{2})$		
		$= 3\theta = 3\tan^{-1}x$ $\longrightarrow (\frac{1}{2})$		
		LHS = RHS		
		Remark 1. For any alternate method give full score 2. For ~~applying~~ $\tan^{-1}x + \tan^{-1}(y) = \tan^{-1}\left(\frac{x+y}{1-xy}\right)$ give (1) score		
11		$\sin x - \cos x$ is Continuous at $x \neq 0$ $\because -1$ is a constant $\therefore$ continuous (1) at $x = 0$ LHL $= -1$ RHL $= -1$ } $\longrightarrow$ (1) $f(0) = -1$ $\longrightarrow$ (1) $\therefore f$ is Continuous at $x = 0$ $\rightarrow$ (1) $\therefore f$ is Continuous on R Remark : Proving Cont. at $x=0$ only give full score 2. Concept of Cont. give 1 score		4

Qn. No	Sub Qns	Answer Key/Value Points	Score	Total
12	a)	$I = [\tan^{-1} x]_0^1 = \pi/4 \longrightarrow (\frac{1}{2} + \frac{1}{2})$	1	4
	b)	$\int_{-4}^{-2} -(x+2)\,dx + \int_{-2}^{4} (x+2)\,dx \longrightarrow (1)$	3	
		$= -\left(\frac{x^2}{2} + 2x\right)_{-4}^{-2} + \left(\frac{x^2}{2} + 2x\right)_{-2}^{4} \longrightarrow (1)$		
		$= 20 \longrightarrow (1)$		
		Remark 1) $\int_a^b f(x)\,dx = \int_a^c f(x)\,dx + \int_c^b f(x)\,dx \longrightarrow (1)$ 2) For process of integration give (1) score		
13		$\frac{dy}{dx} = \frac{y}{x} - \text{Cosec}\left(\frac{y}{x}\right) \longrightarrow (\frac{1}{2})$ Put $\frac{y}{x} = v$ or $y = vx \longrightarrow (1)$ $\frac{dy}{dx} = v + x\frac{dv}{dx} \longrightarrow (1)$ $\frac{dx}{x} = -\frac{dv}{\text{Cosec } v} \longrightarrow (\frac{1}{2})$ $\cos v = \log\lvert x\rvert + C \longrightarrow (1)$ $\cos\left(\frac{y}{x}\right) = \log\lvert x\rvert + C$		4

Qn. No	Sub Qns	Answer Key/Value Points	Score	Total
14		 $\longrightarrow$ (1)		
		Area = 4 · area of the shaded region		4
		$= 4\int_0^r \sqrt{r^2-x^2}\,dx$ $\longrightarrow$(1)		
		$= 4\left[\frac{x}{2}\sqrt{r^2-x^2} + \frac{r^2}{2}\sin^{-1}\frac{x}{r}\right]_0^r$ $\longrightarrow$(1)		
		$= 4\left[\frac{r^2}{2}\times\frac{\pi}{2} - 0\right] = \pi r^2$ $\longrightarrow$(1)		
		Remark 1) Area $= \int_a^b y\,dx$ give 1 score 2) For writing area $= \pi r^2$ give 1 score		
15	a)	$\frac{x-x_1}{a} = \frac{y-y_1}{b} = \frac{z-z_1}{c}$ $\longrightarrow$ (1)		
		$(x_1, y_1, z_1) = (-2, 4, -5)$ $a, b, c = 3, 5, 6$ $\longrightarrow$(1)	3	4
		$\frac{x+2}{3} = \frac{y-4}{5} = \frac{z+5}{6}$ $\longrightarrow$ (1)		
	b)	Yes, $\frac{3+3}{3} = \frac{14-4}{5} = \frac{4+8}{6}$ $\longrightarrow$(1)	1	
		Remark For writing 'yes' only give 1 score		

8/15

Qn. No	Sub Qns	Answer Key/Value Points	Score	Total
16	a)	 $\longrightarrow$ (2)	2	4
	b)	Corner points $\longrightarrow$ (1) A (0,3), B (2,1), C (2,0), O (0,0)	1	
	c)	Points | $Z = 2x+y$ A | 3 B | 5 $\longrightarrow$ max C | 4 O | 0 $\longrightarrow$ (1)	1	
		Remark 1. For drawing x and y axes give 1 Score 2. For any 3 correct corner points 1 Score		
17	a)	$m^2 + 3m^2 - m + m + m^2 + m^2 + m = 1$ $\longrightarrow$ (1) $6m^2 + m = 1$ $m = \frac{1}{3}$ $\longrightarrow$ (1)	2	4
	b	$P(x > 4) = P(5) + P(6) = \frac{4}{9}$ $\longrightarrow$ 1	1	
	c)	$P(1 < x < 4) = P(2) + P(3) = \frac{1}{3}$ $\longrightarrow$ 1	1	
		Remark For writing Sum of Probability = 1 1 Score		

Qn. No	Sub Qns	Answer Key/Value Points	Score	Total
18	a)	$A' = \begin{bmatrix} 4 & 0 & 1 \\ 1 & 3 & -2 \\ -2 & 2 & 3 \end{bmatrix}$ $\longrightarrow (1)$	1	
	b	$A + A' = \begin{bmatrix} 8 & 1 & 3 \\ 1 & 6 & 0 \\ 3 & 0 & 6 \end{bmatrix}$ $\longrightarrow (1)$	2	
		$A - A' = \begin{bmatrix} 0 & 1 & 1 \\ -1 & 0 & 4 \\ -1 & -4 & 0 \end{bmatrix}$ $\longrightarrow (1)$		6
	c)	$P = \frac{1}{2}(A + A') = \frac{1}{2}\begin{bmatrix} 8 & 1 & 3 \\ 1 & 6 & 0 \\ 3 & 0 & 6 \end{bmatrix}$ $\longrightarrow (1)$	3	
		$Q = \frac{1}{2}(A - A^T) = \frac{1}{2}\begin{bmatrix} 0 & 1 & 1 \\ -1 & 0 & 4 \\ -1 & -4 & 0 \end{bmatrix}$ $\longrightarrow (1)$		
		$A = P + Q$ $\longrightarrow$ (1)		
		Remark Concept of Symmetric and Skew Symmetric matrices (1) each		
19	a)	Cofactor $A = \begin{bmatrix} -1 & -4 & 10 \\ 5 & -4 & -2 \\ 3 & 12 & -6 \end{bmatrix}$ $\longrightarrow (2)$		
		$adj\ A = \begin{bmatrix} -1 & 5 & 3 \\ -4 & -4 & 12 \\ 10 & -2 & -6 \end{bmatrix}$ $\longrightarrow (\frac{1}{2})$		
		$\lvert A \rvert = 24$ $\longrightarrow$ $(\frac{1}{2})$		

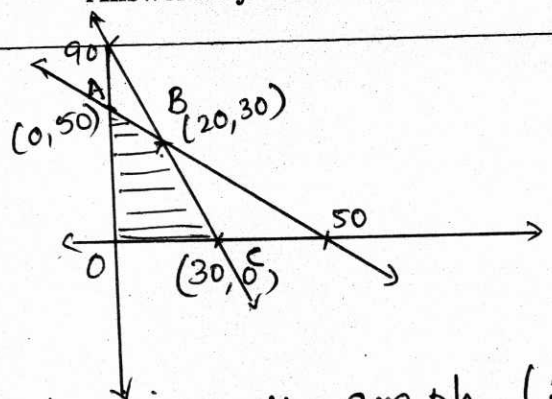
10/15

Qn. No	Sub Qns	Answer Key/Value Points	Score	Total
		$A^{-1} = \frac{1}{24}\begin{bmatrix} -1 & 5 & 3 \\ -4 & -4 & 12 \\ 10 & -2 & -6 \end{bmatrix} \longrightarrow (1)$	4	
		Remark 1. $A^{-1} = \frac{\text{adj } A}{\lvert A \rvert} \longrightarrow (1)$ 2. For Correct process for finding A^{-1} give 3 score		6
	b)	$AX = B$, $\begin{bmatrix} 2 & 1 & 3 \\ 4 & -1 & 0 \\ 2 & 2 & 1 \end{bmatrix}\begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 4 \\ -4 \\ 0 \end{bmatrix} \longrightarrow (\frac{1}{2})$		
		$X = A^{-1}B$ $= \frac{1}{24}\begin{bmatrix} -1 & 5 & 3 \\ -4 & -4 & 12 \\ 10 & -2 & -6 \end{bmatrix}\begin{bmatrix} 4 \\ -4 \\ 0 \end{bmatrix} \longrightarrow (1)$ $= \frac{1}{24}\begin{bmatrix} -24 \\ 0 \\ 48 \end{bmatrix} = \begin{bmatrix} -1 \\ 0 \\ 2 \end{bmatrix} \longrightarrow (\frac{1}{2})$	2	
		$x = -1,\ y = 0,\ z = 2$		
		Remark For finding x, y, z directly give 1 Score		

Qn. No	Sub Qns	Answer Key/Value Points	Score	Total
20	a)	$\frac{dy}{dx} = \frac{1}{1+x^2}$ ⟶ (1)	3	6
		$\frac{d^2y}{dx^2} = \frac{-2x}{(1+x^2)^2}$ ⟶ (1)		
		$\therefore (1+x^2)^2 \frac{d^2y}{dx^2} + 2x = 0$ ⟶ (1)		
	b)	Remark For alternate method give full score		
	b)	$\frac{dy}{dx} = \frac{x}{1+x^2} + \tan^{-1}x$ ⟶ (1)	3	
		$\frac{d^2y}{dx^2} = \frac{1+x^2-2x^2}{(1+x^2)^2} + \frac{1}{1+x^2}$ ⟶ (1)		
		$= \frac{2}{(1+x^2)^2}$ ⟶ (1)		
		Remark For product rule / quotient rule give 1 score		
21	a)	$C(x) = 8x^2 - 7x + 4$ $C'(x) = 16x - 7$ ⟶ (1) $C'(5) = 73$ $\Delta x = 0.001$ $\Delta y = C'(5) \times \Delta x = 0.073$ ⟶ (1)	3	

12/15

Qn. No	Sub Qns	Answer Key/Value Points	Score	Total
		$y+\Delta y \approx C(5)+\Delta y = 169.073$ $\longrightarrow$(1)		
		Remark Formula $f(x+\Delta x)=f(x)+f'(x).\Delta x$ or $\Delta y \approx \frac{dy}{dx}\Delta x$ give 1 score		6
	b	$C'(x)=0 \Rightarrow x=\frac{7}{16}$ $\longrightarrow$(1)		
		$C''(x)=16>0$ at $x=\frac{7}{16}$ $\longrightarrow$(1)	3	
		$\therefore$ C has a min. value at $x=\frac{7}{16}$ $\longrightarrow$(1)		
		Remark Concept of second der. test (1) score		
22	a)	$\vec{a}+\vec{b} = -i+j-k$ $\longrightarrow$(1) $\vec{a}-\vec{b} = 3i-5j+7k$ $\longrightarrow$(1)	2	
	b	$[\vec{a}, \vec{b}, \vec{c}] = \begin{vmatrix} 1 & -2 & 3 \\ -2 & 3 & -4 \\ 1 & -\lambda & 5 \end{vmatrix}$ $\longrightarrow$(1)	1	6
	c)	$[\vec{a}\ \vec{b}\ \vec{c}]=0$ $\longrightarrow$(1)		
		$\begin{vmatrix} 1 & -2 & 3 \\ -2 & 3 & -4 \\ 1 & -\lambda & 5 \end{vmatrix}=0$ $\longrightarrow$(1)	3	
		$\lambda=3$ $\longrightarrow$(1)		

Qn. No	Sub Qns	Answer Key/Value Points	Score	Total
23	a)		3	
		For drawing the graph (2½) For shading the region (½)		6
		Corner points | $Z = 3x+2y$ A (0, 50) | 100 B (20, 30) | 120 → max. C (30, 0) | 90 O (0, 0) | 0	3	
		∴ max. at $x=20$, $y=30$ value 120		
		Remark For each corner points give ½ score		
24	a	Yes → (1) $p = \frac{1}{6}$ $q = 5/6$ → $(\frac{1}{2}+\frac{1}{2})$	2	
	b)	$P(X=r) = {}^{7}C_{r}\left(\frac{5}{6}\right)^{7-r}\left(\frac{1}{6}\right)^{r}$ → (1) ~~(½)~~		6

Qn. No	Sub Qns	Answer Key/Value Points	Score	Total
		$P(X=2) = {}^7C_2 \left(\frac{5}{6}\right)^5 \left(\frac{1}{6}\right)^2 \rightarrow (1)$ $= 21 \times \frac{5^5}{6^7} \rightarrow (1)$ ii) $P(X=0) = {}^7C_0 \left(\frac{5}{6}\right)^7 \left(\frac{1}{6}\right)^0 \rightarrow (1\frac{1}{2})$ $= \left(\frac{5}{6}\right)^7 \rightarrow (\frac{1}{2})$ Remark For writing formula $P(X=r) = {}^nC_r\, q^{n-r}\, p^r$ give 1 score	4	

15/15

① S.K. Anilkumar

② MARIA DANIEL FERNANDEZ

3 HAREESH.S Hareesh

4. Molly Varghese Molly Varghese

5. B. Jayadev

6 Ajitha.C