SECOND YEAR HIGHER SECONDARY EXAMINATION MARCH 2019

SUBJECT : MATHEMATICS (SCIENCE) **CODE. NO: SY 27**

Qn No	Sub Qns	Answer Key/Value Points	Score	Total
1	(a)	$f(x) = \sin x \qquad g(x) = x^2$		
		$(f\circ g)(x) = f(g(x))$	1/2	
		$= f(x^2)$		
		$= \sin(x^2)$	1/2	
	(b)	$(u\circ v)x = u(v(x)) = u\left(\frac{3+x}{2}\right)$		3
		$= 2\left(\frac{3+x}{2}\right) - 3 = x$	1	
		$(u\circ v) = I$		
		$(v\circ u)x = v(u(x))$		
		$= v(2x-3)$	1	
		$= \frac{3+2x-3}{2} = x$		
		$(v\circ u) = I$		
2	(a)	$x = 5 \qquad y = 8$	$\frac{1}{2}+\frac{1}{2}$	
	(b)	$A = \begin{bmatrix} 2 & 5 & 4 \\ 5 & 3 & 8 \\ 4 & 8 & 9 \end{bmatrix} \qquad A' = \begin{bmatrix} 2 & 5 & 4 \\ 5 & 3 & 8 \\ 4 & 8 & 9 \end{bmatrix}$	$\frac{1}{2}$	
		$AA' = \begin{bmatrix} 2 & 5 & 4 \\ 5 & 3 & 8 \\ 4 & 8 & 9 \end{bmatrix} \begin{bmatrix} 2 & 5 & 4 \\ 5 & 3 & 8 \\ 4 & 8 & 9 \end{bmatrix}$		3
		$= \begin{bmatrix} 45 & 57 & 84 \\ 57 & 98 & 116 \\ 84 & 116 & 161 \end{bmatrix}$; AA' is Symmetric	$\frac{1}{2}$	
		$A + A^t = \begin{bmatrix} 2 & 5 & 4 \\ 5 & 3 & 8 \\ 4 & 8 & 9 \end{bmatrix} + \begin{bmatrix} 2 & 5 & 4 \\ 5 & 3 & 8 \\ 4 & 8 & 9 \end{bmatrix}$	$\frac{1}{2}$	

NOTE: Consider all correct alternate methods.

(2/16)

		$A+A' = \begin{bmatrix} 4 & 10 & 8 \\ 10 & 6 & 16 \\ 8 & 16 & 18 \end{bmatrix}$, is symmetric Rmk (i) For any x, y and correct AA' and $A+A'$ give score 2 (ii) For $(A+A')' = A'+A$ $(AA')' = A'A = AA'$	$\frac{1}{2}$ 1	
3	(a) (b)	$y = x^2-2x+1$; $\frac{dy}{dx} = 2x-2$ slope $= 2x-2$ Since the tangent is $\parallel^{l}$ to $2x-y+9=0$ slopes are equal. $2x-y+9=0$ $\therefore y = 2x+9$ slope $= 2$ $\therefore 2x-2 = 2 \Rightarrow x = 2$ and $y = 1$ $\therefore$ point $(2,1)$ Eqn of tangent $y-y_1 = \left(\frac{dy}{dx}\right)(x-x_1)$ $y-1 = 2(x-2)$ $y-2x+3=0$. Rmk slope $m = \frac{-a}{b}$ — $\frac{1}{2}$	1 $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$	 3

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4	(a)	$f(x) = \frac{\sec^2 x}{\tan x}$ or $2\operatorname{cosec} 2x$	1	
	(b)	$\int \frac{1}{\sqrt{1-4x^2}}\,dx = \int \frac{1}{\sqrt{4\left(\frac{1}{4}-x^2\right)}}\,dx$	$\frac{1}{2}$	
		$= \frac{1}{2}\int \frac{1}{\sqrt{\left(\frac{1}{2}\right)^2 - x^2}}\,dx$	$\frac{1}{2}$	
		$= \frac{1}{2}\sin^{-1}\left(\frac{x}{1/2}\right) + C$	1	3
		$= \frac{1}{2}\sin^{-1} 2x + C$		
		Rmks: a) (i) $\int \frac{f'(x)}{f(x)}\,dx = \log\lvert f(x)\rvert$ (1/2)		
		(ii) $\frac{d}{dx}\log x = \frac{1}{x}$ (1/2)		
		b) (i) $\int \frac{1}{\sqrt{a^2-x^2}}\,dx = \sin^{-1}\frac{x}{a} + c$ — (1)		
		(ii) Direct answer give score (2).		
5	(a)	(iii) $\int_a^b y\,dx$	1	
	(b)	Curve $y = 3x$	1	
		Area $= \int_1^2 y\,dx$		
		$= \int_1^2 3x\,dx$	1	3
		$= 3\left(\frac{x^2}{2}\right)_1^2 = \frac{9}{2}$		
		Rmk: (i) $\int_1^2 y\,dx$, 1 Score		
		(ii) For any equation of line — 1/2 Score		

Qn No	Sub Qns	Answer Key/Value Points	Score	Total
6	(a)	(ii) 2 OR (IV) 3	1	
	(b)	$\sec^2 x \tan y \, dx + \sec^2 y \tan x \, dy = 0$		
		$\frac{\sec^2 x}{\tan x} dx + \frac{\sec^2 y}{\tan y} dy = 0$	1	3
		$\therefore \int \frac{\sec^2 x}{\tan x} dx + \int \frac{\sec^2 y}{\tan y} dy = 0$	$\frac{1}{2}$	
		ie $\log\lvert\tan x\rvert + \log\lvert\tan y\rvert = \log C$	$\frac{1}{2}$	
		$\tan x \tan y = C$.		
		Rmk Consider C instead of log C.		
7		For analysing the problem give Score 3		3
		Mini. $Z = 1000x + 800y$		
		Constraints $20x + 30y \geq 500$		
		$15x + 12y \geq 400$		
		$25x + 23y \geq 300$		
		$x, y \geq 0$.		
8	a)	Not One-One	$\frac{1}{2}$	
		Because different persons have same birthday	$\frac{1}{2}$	
	(b) (i)	$f(x) = \sin x$		
		$f(x_1) = f(x_2) \Rightarrow \sin x_1 = \sin x_2$		
		$\Rightarrow x_1 = x_2$	$\frac{1}{2}$	
		$\Rightarrow f$ is one-one		
		$g(x) = \cos x$		
		$g(x_1) = g(x_2) \Rightarrow \cos x_1 = \cos x_2$	$\frac{1}{2}$	
		$\Rightarrow x_1 = x_2$		
		$\Rightarrow g$ is one-one		

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	(ii)	$(f+g)(x) = \sin x + \cos x$		
		$(f+g)(x_1) = (f+g)(x_2)$		
		$\Rightarrow \sin x_1 + \cos x_1 = \sin x_2 + \cos x_2$	$\frac{1}{2}$	
		$\Rightarrow \sin x_1 - \sin x_2 = \cos x_2 - \cos x_1$		
		$\Rightarrow \cos\frac{x_1+x_2}{2} = \sin\frac{x_1+x_2}{2}$		
		$\Rightarrow x_1 = \frac{\pi}{2} - x_2$		4
		$\Rightarrow f+g$ is not one	$\frac{1}{2}$	
		Rmk $f+g$ is not one-one, give (1)		
	C.	(iii) 6	1	
9		$x = \tan\theta$	$\frac{1}{2}$	
		$A = \sin^{-1}\left(\frac{2\tan\theta}{1+\tan^2\theta}\right) = \sin^{-1}(\sin 2\theta) = 2\theta$	$\frac{1}{2}$	
		$B = \cos^{-1}\left(\frac{1-\tan^2\theta}{1+\tan^2\theta}\right) = \cos^{-1}(\cos 2\theta) = 2\theta$	$\frac{1}{2}$	
		$C = \tan^{-1}\left(\frac{2\tan\theta}{1-\tan^2\theta}\right) = \tan^{-1}(\tan 2\theta) = 2\theta$	$\frac{1}{2}$	4
		$3A - 4B + 2C = \frac{\pi}{3}$		
		$3\cdot 2\theta - 4\cdot 2\theta + 2\cdot 2\theta = \pi/3$	$\frac{1}{2}$	
		$2\theta = \pi/3$	$\frac{1}{2}$	
		$\therefore \tan^{-1} x = \pi/6 \quad x = \frac{1}{\sqrt{3}}$	1	
		Rmk (i) Give $\frac{1}{2}$ score for each formula of $2\tan^{-1} x$		
		(ii) For direct substitution and correct answer give score 4		

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10	a)	$f(x) = \begin{cases} x^2 & x<0 \\ 0 & x=0 \\ x & x>0 \end{cases}$	1	
	b)	$\lim_{x\to 0^+} f(x) = \lim_{x\to 0^+}(x) = 0$	$\frac{1}{2}$	
		$\lim_{x\to 0^-} f(x) = \lim_{x\to 0^-}(x^2) = 0$	$\frac{1}{2}$	4
		$f(0) = 0$		
		$f(x)$ is continuous at $x=0$	1	
	(c)	$f(x)$ is not differentiable at $x=0$	1	
		Rmk: a) For analysing the figure give 1 score b) For direct answer (Continuous) give 2 Score		
11	a)	$S = 2x^2 + 4xy$	$\frac{1}{2}$	
		$= 2x^2 + 4x\cdot\frac{V}{x^2}$ $\left(V = x^2y \;\therefore y = \frac{V}{x^2}\right)$	$\frac{1}{2}$	
		$= 2x^2 + \frac{4V}{x}$		
	(b)	$\frac{dS}{dx} = 4x - \frac{4V}{x^2}$	1	
		$\frac{dS}{dx} = 0$	$\frac{1}{2}$	4
		$\Rightarrow V = x^3$	$\frac{1}{2}$	
		$\Rightarrow x = V^{1/3}$		
		$\frac{d^2S}{dx^2} = 4 + \frac{8V}{x^3} = 4+8 = 12 > 0$	1	
		$\therefore$ S is minimum		

Qn No	Sub Qns	Answer Key/Value Points	Score	Total
		$y = \frac{V}{x^2} = \frac{x^3}{x^2} = x$ $\therefore$ Cuboid becomes Cube. Rmk Give 1 Score for $V = x^2 y$		
12.	a)	$A = 1$; $B = 1$	$\frac{1}{2}+\frac{1}{2}$	
	(b)	$\int \frac{2x+4}{x^2+3x+1}\,dx = \int \frac{2x+3}{x^2+3x+1}\,dx + \int \frac{1}{x^2+3x+1}\,dx$	1	
		$= \log\lvert x^2+3x+1\rvert + \int \frac{1}{x^2+3x+\frac{9}{4}-\frac{9}{4}+1}\,dx$	$\frac{1}{2}$	
		$= \log\lvert x^2+3x+1\rvert + \int \frac{1}{(x+\frac{3}{2})^2-(\frac{\sqrt5}{2})^2}$	$\frac{1}{2}$	4
		$= \log\lvert x^2+3x+1\rvert + \frac{1}{2\cdot\frac{\sqrt5}{2}} \log\left\lvert \frac{x+\frac{3}{2}-\frac{\sqrt5}{2}}{x+\frac{3}{2}+\frac{\sqrt5}{2}}\right\rvert$	1	
		$= \log\lvert x^2+3x+1\rvert + \frac{1}{\sqrt5} \log\left\lvert \frac{x+\frac{3-\sqrt5}{2}}{x+\frac{3+\sqrt5}{2}}\right\rvert$		
		Rmk: $\int \frac{1}{x^2-a^2}\,dx = \frac{1}{2a}\log\left\lvert\frac{x-a}{x+a}\right\rvert + C$ — give 1 Score		
13	a)	One	1	
	(b)	$IF = e^{\int P\,dx}$	$\frac{1}{2}$	
		$= e^{\int \sec^2 x\,dx}$		
		$= e^{\tan x}$	$\frac{1}{2}$	
	(c)	$y \cdot e^{\tan x} = \int \frac{\tan x}{\cos^2 x} \cdot e^{\tan x}\,dx$	1	

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		$u = \tan x$		
		$\therefore y e^{\tan x} = \int u e^{u}\, du$	$\frac{1}{2}$	4
		$= \tan x \cdot e^{\tan x} - e^{\tan x} + C$	$\frac{1}{2}$	
		Rmks: (i) $P = \frac{1}{\cos^2 x}$; $Q = \frac{\tan x}{\cos^2 x}$ $\frac{1}{2}$		
		(ii) $y \times IF = \int (Q \times IF)\, dx + C$ $\frac{1}{2}$		
14	a)	For analysing the problem give 1 Score	1	
		$\bar{AB} = 3i - 3j + k$		
		$\bar{AC} = -3i + j - k$		
	(b)	$\lvert\bar{AB}\rvert = \sqrt{19}$	$\frac{1}{2}$	
		$\lvert\bar{AC}\rvert = \sqrt{11}$		
		$\cos\theta = \left\lvert \frac{\bar{AB} \cdot \bar{AC}}{\lvert\bar{AB}\rvert \lvert\bar{AC}\rvert} \right\rvert$		
		$= \left\lvert \frac{-13}{\sqrt{19} \cdot \sqrt{11}} \right\rvert = \frac{13}{\sqrt{19} \cdot \sqrt{11}}$	$\frac{1}{2}$	
		$\theta = \cos^{-1}\left(\frac{13}{\sqrt{19} \cdot \sqrt{11}} \right)$		
	(c)	$\hat{n} = \frac{\bar{AB} \times \bar{AC}}{\lvert\bar{AB} \times \bar{AC}\rvert}$		
		$\bar{AB} \times \bar{AC} = \begin{vmatrix} i & j & k \\ 3 & -3 & 1 \\ -3 & 1 & -1 \end{vmatrix}$	$\frac{1}{2}$	
		$= 2i - 6k$	$\frac{1}{2}$	

Qn No	Sub Qns	Answer Key/Value Points	Score	Total
		$\lvert \overline{AB} \times \overline{AC} \rvert = \sqrt{40}$	$\frac{1}{2}$	4
		$\therefore$ Required vector $= 9 \frac{(2i - 6k)}{\sqrt{40}}$	$\frac{1}{2}$	
		Rmk (b) $\cos\theta \left\lvert \frac{\overline{AB} \cdot \overline{AC}}{\lvert\overline{AB}\rvert \cdot \lvert\overline{AC}\rvert} \right\rvert$ — give $\frac{1}{2}$ Score		
		(c) $\hat{n} = \frac{\overline{AB} \times \overline{AC}}{\lvert \overline{AB} \times \overline{AC} \rvert}$ — give $\frac{1}{2}$ Score		
15	a)	$\overline{a} \times \overline{b}$ or $\overline{b} \times \overline{c}$ or $\overline{a} \times \overline{c}$ or $\overline{b} \times \overline{a}$ or $\overline{c} \times \overline{b}$ or $\overline{c} \times \overline{a}$	1	
	(b)	$[\overline{a}\ \overline{b}\ \overline{c}] = 0$;	$\frac{1}{2}$	4
		$[\overline{a}+\overline{b}, \overline{b}+\overline{c}, \overline{c}+\overline{a}] = (\overline{a}+\overline{b}) \cdot [(\overline{b}+\overline{c}) \times (\overline{c}+\overline{a})]$	$\frac{1}{2}$	
		$= (\overline{a}+\overline{b}) \cdot [\overline{b}\times\overline{c} + \overline{b}\times\overline{a} + \overline{c}\times\overline{c} + \overline{c}\times\overline{a}]$	$\frac{1}{2}$	
		$= \overline{a} \cdot (\overline{b} \times \overline{c}) + \overline{b} \cdot (\overline{c} \times \overline{a})$	$\frac{1}{2}$	
		$= 2[\overline{a}\ \overline{b}\ \overline{c}]$	$\frac{1}{2}$	
		$= 0$	$\frac{1}{2}$	
		$\therefore \overline{a}+\overline{b}, \overline{b}+\overline{c}, \overline{c}+\overline{a}$ are coplanar		
		Rmk $[\overline{a}\ \overline{b}\ \overline{c}] = \overline{a} \cdot (\overline{b} \times \overline{c})$ — $\frac{1}{2}$ Score		
16.	(a)	1, 0, 0. OR $\cos 0, \cos 90, \cos 90$	1	
	(b)	$\cos^2\alpha + \cos^2\beta + \cos^2\gamma = 1$	1	
		$1 - \sin^2\alpha + 1 - \sin^2\beta + 1 - \sin^2\gamma = 1$	$\frac{1}{2}$	
		$\therefore \sin^2\alpha + \sin^2\beta + \sin^2\gamma = 2$	$\frac{1}{2}$	

c) $\alpha=\beta=\gamma$ OR $\cos\alpha=\cos\beta=\cos\gamma$ — $\frac{1}{2}$

$\cos^2\alpha+\cos^2\beta+\cos^2\gamma=1$

$\therefore 3\cos^2\alpha=1 \Rightarrow \cos\alpha=\frac{1}{\sqrt{3}}$ — $\frac{1}{2}$ — 4

$\therefore \cos\beta=\frac{1}{\sqrt{3}}$; $\cos\gamma=\frac{1}{\sqrt{3}}$

Rmk: $l^2+m^2+n^2=1$ — (1).

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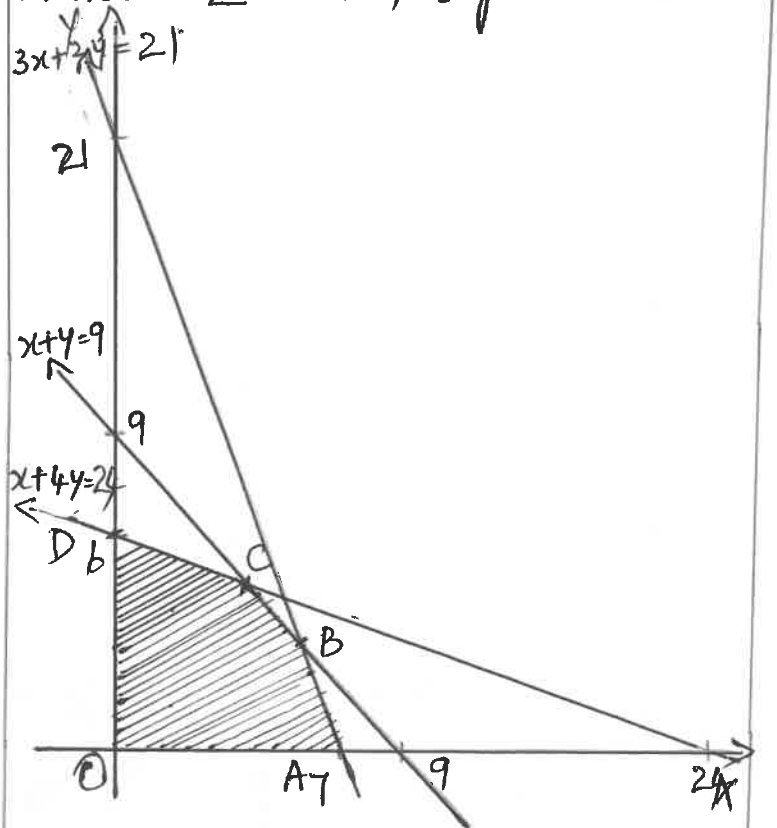
$x+4y\le 24$, $3x+y\le 21$, $x+y\le 9$, $x,y\ge 0$ — 1

Maxi: $Z=5x+8y$ — 1



$1\frac{1}{2}$ — 4

Vertices	O (0,0)	A (7,0)	B (6,3)	C (4,5)	D (0,6)
Z = 5x+8y	0	35	54	60	48

$\frac{1}{2}$

Maximum at (4,5); Z = 60

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18.		$A^2 = \begin{bmatrix}3 & 1\\ -1 & 2\end{bmatrix}\begin{bmatrix}3 & 1\\ -1 & 2\end{bmatrix} = \begin{bmatrix}8 & 5\\ -5 & 3\end{bmatrix}$	1	
		$5A = \begin{bmatrix}15 & 5\\ -5 & 10\end{bmatrix}$ $\quad 7I = \begin{bmatrix}7 & 0\\ 0 & 7\end{bmatrix}$	1	
		$A^2 - 5A + 7I = \begin{bmatrix}0 & 0\\ 0 & 0\end{bmatrix}$	1	
		$A^2 - 5A + 7I = 0$		
		$A^2 = 5A - 7I$		
		$= \begin{bmatrix}15 & 5\\ -5 & 10\end{bmatrix} - \begin{bmatrix}7 & 0\\ 0 & 7\end{bmatrix}$		
		$A^2 = \begin{bmatrix}8 & 5\\ -5 & 3\end{bmatrix}$	$\frac{1}{2}$	
		$A^4 = A^2 . A^2 = \begin{bmatrix}8 & 5\\ -5 & 3\end{bmatrix}\begin{bmatrix}8 & 5\\ -5 & 3\end{bmatrix}$		6
		$= \begin{bmatrix}39 & 55\\ -55 & -16\end{bmatrix}$	$\frac{1}{2}$	
		$A^2 - 5A + 7I = 0$		
		Multiply by A^{-1}		
		$A^{-1}(A^2 - 5A + 7I) = 0$	1	
		$A - 5I + 7A^{-1} = 0$		
		$7A^{-1} = 5I - A$		
		$7A^{-1} = \begin{bmatrix}5 & 0\\ 0 & 5\end{bmatrix} - \begin{bmatrix}3 & 1\\ -1 & 2\end{bmatrix}$	$\frac{1}{2}$	
		$A^{-1} = \frac{1}{7}\begin{bmatrix}2 & -1\\ 1 & 3\end{bmatrix}$	$\frac{1}{2}$	
		RMK: Finding $A^{-1} = \frac{Adj A}{\lvert A\rvert}$ give 1 score.		
19	(a)	$A^{-1} = \frac{Adj A}{\lvert A\rvert}$	1	
		$\lvert A\rvert = -1$	1	
		$Adj A = \begin{bmatrix}0 & -1 & 2\\ 2 & -9 & 23\\ 1 & -5 & 13\end{bmatrix}$	1	
		$A^{-1} = \begin{bmatrix}0 & 1 & -2\\ -2 & 9 & -23\\ -1 & 5 & -13\end{bmatrix}$		

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	(b)	$AX = B$		
		$\begin{bmatrix} 2 & -3 & 5 \\ 3 & 2 & -4 \\ 1 & 1 & -2 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 11 \\ -5 \\ -3 \end{bmatrix}$	1	
		$X = A^{-1}B$		
		$\begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 0 & 1 & -2 \\ -2 & 9 & -23 \\ -1 & 5 & -13 \end{bmatrix} \begin{bmatrix} 11 \\ -5 \\ -3 \end{bmatrix}$	1	6
		$= \begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix}$	1	
		RMK: (a) for 6 correct elements of Adj A give 1		
20	(a)	$\sin^2 x + \cos^2 y = 1$		
		$2\sin x \cos x + 2\cos y(-\sin y)\frac{dy}{dx} = 0$	1	
		$-\sin y \cos y \frac{dy}{dx} = -\sin x \cos x$		
		$\frac{dy}{dx} = \frac{\sin x \cos x}{\sin y \cos y}$	1	
		$= \frac{\sin 2x}{\sin 2y}$		
	(b)	$y = x^x$		
		$\log y = x \log x$	1	6
		$\frac{1}{y}\frac{dy}{dx} = x \cdot \frac{1}{x} + \log x \cdot 1$	$\frac{1}{2}$	
		$\frac{dy}{dx} = y[1 + \log x]$	$\frac{1}{2}$	
		$= x^x[1 + \log x]$		
	(c)	$x = a(t - \sin t)$ $y = a(1 + \cos t)$		

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		$\frac{dx}{dt} = a(1-\cos t)$	$\frac{1}{2}$	
		$\frac{dy}{dt} = -a\sin t$	$\frac{1}{2}$	
		$\frac{dy}{dx} = \frac{\frac{dy}{dt}}{\frac{dx}{dt}}$	$\frac{1}{2}$	
		$= \frac{-a\sin t}{a(1-\cos t)}$		
		$= \frac{-\sin t}{1-\cos t}$	$\frac{1}{2}$	
		$= -\cot t/2$		
		RMK :(a) Derivative of $\sin x$ and $\cos x$ (1/2)		
		(b) $\frac{d}{dx}(x^x) = x^x(1+\log x)$ – give score (2)		
21	(a)	$I = \int_0^{\pi/2} \frac{\sin x}{\sin x+\cos x}dx = \int_0^{\pi/2} \frac{\sin(\pi/2-x)}{\sin(\pi/2-x)+\cos(\pi/2-x)}dx$	1	
		$= \int_0^{\pi/2} \frac{\cos x}{\cos x+\sin x}dx$	1/2	
		$2I = \int_0^{\pi/2} 1\,dx$	1/2	
		$= [x]_0^{\pi/2} = \frac{\pi}{2}$	1/2	
		$I = \frac{\pi}{4}$	1/2	
	(b)	$\int_{-\pi/2}^{\pi/2} \sin^7 x\,dx = 0$	1	
		$\because \sin^7 x$ is an odd function.		
	(c)	$\int x\sin 3x\,dx = x\int \sin 3x\,dx - \int 1\left[\int \sin 3x\,dx\right]dx$	1	

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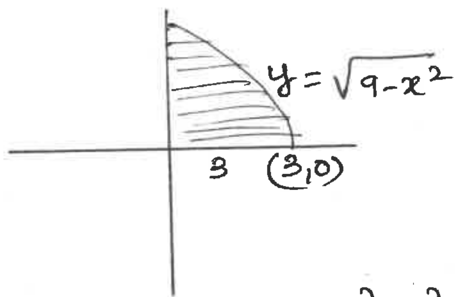
		$= x \cdot \frac{-\cos 3x}{3} - \int -\frac{\cos 3x}{3} dx$		
		$= -\frac{x \cos 3x}{3} + \frac{1}{3}\frac{\sin 3x}{3} + C$	1	6
		$= -\frac{x \cos 3x}{3} + \frac{\sin 3x}{9} + C.$		
		RMK (a) $\int_0^a f(x)dx = \int_0^a f(a-x)dx$ — ½ score.		
		(b) $f(-x) = -f(x)$, odd function (½)		
		$\int_{-a}^{a} f(x)dx = 0$, $f(x)$ is odd (½)		
		(c) Integration by parts formula (1)		
22	(a)	$\text{Area} = \int_a^b y\,dx$	$\frac{1}{2}$	
		$= 4\int_0^{\pi/2} \sin x\,dx$		
		$= 4 \times 1 = 4$	$\frac{1}{2}$	
	(b)	(i) 		6
		Equation of curve $x^2+y^2=9$	$\frac{1}{2}$	
		$y = \sqrt{9-x^2}$	$\frac{1}{2}$	
		$\text{Area} = \int_a^b y\,dx$	$\frac{1}{2}$	
		$= \int_0^3 \sqrt{9-x^2}\,dx$	$\frac{1}{2}$	
		$= \left[\frac{x}{2}\sqrt{9-x^2} + \frac{9}{2}\sin^{-1}\left(\frac{x}{3}\right)\right]_0^3$	1	

$= \frac{9}{2}\sin^{-1}(1) = \frac{9\pi}{4}$ sq. units — 1

Qn No	Sub Qns	Answer Key/Value Points	Score	Total
		(ii) Required Area $= 4 \times \frac{9\pi}{4}$ $= 9\pi$ sq. units	1	
		RMK : (b)(i) Correct figure ① score. (ii) Direct Answer ① score.		
23	(a)	$(3x-y+2z-4)+k(x+y+z-2)=0$	1	
		It passes through $(2,2,1)$ $(3\cdot 2-2+2\cdot 1-4)+k(2+2+1-2)=0$ $k = \frac{-2}{3}$	$\frac{1}{2}$	
		$(3x-y+2z-4)-\frac{2}{3}(x+y+z-2)=0$ $7x-5y+4z-8=0$	$\frac{1}{2}$	
	(b)	$\vec{r} = (-\vec{i}-\vec{j}-\vec{k})+\lambda(7\vec{i}-6\vec{j}+\vec{k})$	1	
		$\vec{r} = (3\vec{i}+5\vec{j}+7\vec{k})+\mu(\vec{i}-2\vec{j}+\vec{k})$	1	6
	(c)	$S.D = \left\lvert \frac{(\vec{a_2}-\vec{a_1})\cdot(\vec{b_1}\times\vec{b_2})}{\lvert\vec{b_1}\times\vec{b_2}\rvert} \right\rvert$	$\frac{1}{2}$	
		$\vec{a_2}-\vec{a_1} = 4\vec{i}+6\vec{j}+8\vec{k}$	$\frac{1}{2}$	
		$\vec{b_1}\times\vec{b_2} = \begin{vmatrix} \vec{i} & \vec{j} & \vec{k} \\ 7 & -6 & 1 \\ 1 & -2 & 1 \end{vmatrix} = -4\vec{i}-6\vec{j}-8\vec{k}$	$\frac{1}{2}$	
		$SD = \left\lvert \frac{-116}{\sqrt{116}} \right\rvert = \sqrt{116}$	½	
		~~RMK~~ :		

Qn No	Sub Qns	Answer Key/Value Points	Score	Total
24	(a)	E_1 - Event of choosing bag I		
		E_2 - Event of choosing bag II		
		A - Event of drawing a red ball.		
		$P(E_1) = P(E_2) = \frac{1}{2}$		
		$P(A\mid E_1) = \frac{4}{8} = \frac{1}{2}$		
		$P(A\mid E_2) = \frac{2}{8} = \frac{1}{4}$	1	
		$P(E_1\mid A) = \dfrac{P(E_1)\cdot P(A\mid E_1)}{P(E_1)\cdot P(A\mid E_1) + P(E_2)P(A\mid E_2)}$	1	
		$= \dfrac{\frac{1}{2}\times\frac{1}{2}}{\frac{1}{2}\times\frac{1}{2}+\frac{1}{2}\times\frac{1}{4}}$		6
		$= \frac{2}{3}$	1	
	(b) (i)	$\Sigma P_i = 1$	½	
		$K+3K+5K+7K+4K = 1$		
		$20K = 1$		
		$K = \frac{1}{20}$	½	
	(ii)	$\begin{array}{c\|c\|c\|c\|c\|c\|c} X & 0 & 1 & 2 & 3 & 4 & \\ \hline P(X) & \frac{1}{20} & \frac{3}{20} & \frac{5}{20} & \frac{7}{20} & \frac{4}{20} & \\ xP(x) & 0 & \frac{3}{20} & \frac{10}{20} & \frac{21}{20} & \frac{16}{20} & \frac{50}{20} \\ x^2P(x) & 0 & \frac{3}{20} & \frac{20}{20} & \frac{63}{20} & \frac{64}{20} & \frac{150}{20} \end{array}$		
		$\text{Mean} = \Sigma x P(x) = \frac{50}{20} = \frac{5}{2}$	1	
		$\text{Variance} = \Sigma x^2 P(x) - [\Sigma x P(x)]^2$	½	
		$= \frac{5}{4}$	½	

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