COMMON PRE-BOARD EXAMINATION

MATHEMATICS - Code No. 041

Class: XII (2025-26) -SET - 3

Time Allowed: 3 hours **ANSWER KEY** **Maximum Marks: 80**

NO	SECTION A	MARKS

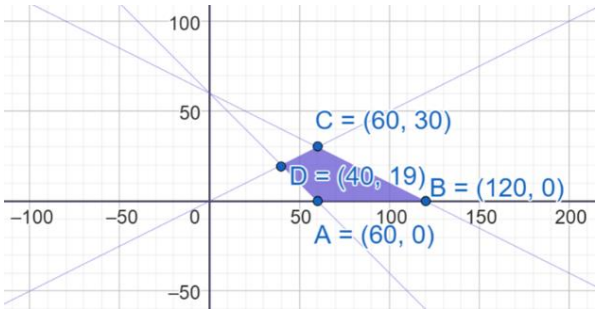
1	(c) 12 cm^2/sec	1
2	(c) $-\cos x + C$	1
3	(c) $(-\infty, 0) \cup (0, \infty)$	1
4	(a) $e^x \log \sin x$ + C	1
5	(a) $\frac{-2}{3}$	1
6	(d) $\|A\| \in [2, 4]$	1
7	(a) $\sqrt{507}$	1
8	(c) $\sec^2 y \tan y$	1
9	(d) $\left[0, \frac{2}{3}\right]$	1
10	(c) not defined	1

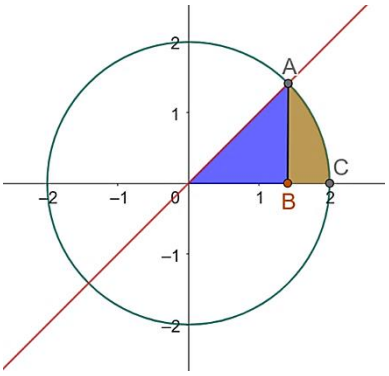
11	(a) Skew symmetric matrix	1
12	(c) 1/8	1
13	(d) 40	1
14	(c) -4	1
15	(b) 3	1
16	(b) The open half plane not containing origin.	1
17	(b) (0, 8)	1
18	(b) $\sec x$	1
19	(c) A is true and R is false.	1
20	(d) A is false but R is true.	1

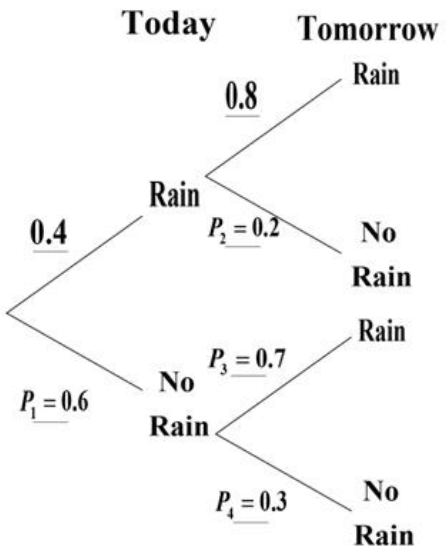
	SECTION B	
21	$\|\vec{a}\| = \frac{1}{2}$, $\|\vec{b}\| = \frac{4}{\sqrt{3}}$, $\left\|\vec{a} \times \vec{b}\right\| = \frac{1}{\sqrt{3}}$ $\left\|\vec{a} \times \vec{b}\right\| = \frac{1}{\sqrt{3}} \Rightarrow \|\vec{a}\|\|\vec{b}\|\sin\theta = \frac{1}{\sqrt{3}} \Rightarrow \sin\theta = \frac{1}{2}$ $\Rightarrow \cos\theta = \sqrt{1 - \frac{1}{4}} = = \pm\frac{\sqrt{3}}{2}$ $\left\|\vec{a}.\vec{b}\right\| = \|\vec{a}\|\left\|\vec{b}\right\|\|\cos\theta\| = \frac{1}{2} \times \frac{4}{\sqrt{3}} \times \frac{\sqrt{3}}{2} = 1$	1 0.5 0.5

22	A) $\int \frac{2^{x+1}-5^{x-1}}{10^x}$ dx	
	$\frac{2^{x+1}}{10^x} = 2.5^{-x}$; $\frac{5^{x-1}}{10^x} = \frac{1}{5}.2^{-x}$	0.5
	$\int \left(2.5^{-x} - \frac{1}{5}.2^{-x}\right) dx = (-2).\frac{5^{-x}}{\log 5} - (-1).\frac{1}{5}.\frac{2^{-x}}{\log 2} + C$	1
	$= -\frac{2}{5^x.\log 5} + \frac{1}{5.2^x.\log 2} + C$	0.5
	OR	
	B) $y = \sin x$, $[0,2\pi]$	
	Required Area = $\int_0^{\pi} \sin x \, dx + \left|\int_{\pi}^{2\pi} \sin x \right| dx$	0.5
	$= (-\cos x)_0^{\pi} + \left|(-\cos x)_{\pi}^{2\pi}\right|$	0.5
	$= -(\cos\pi - \cos 0) + \left|-(\cos 2\pi - \cos\pi)\right|$	0.5
	$= -(-1-1) + \left|-(1+1)\right| = 2 + 2 = 4 \text{sq. unit}$	0.5
23	$y = 5e^{7x} + 6e^{-7x}$	
	$\frac{dy}{dx} = 35e^{7x} - 42e^{-7x}$	0.5
	$\frac{d^2y}{dx^2} = 35.7e^{7x} - 42.(-7)e^{-7x} = 49(5e^{7x} + 6e^{-7x}) = 49y$	1
	$\frac{d^2y}{dx^2} = 49y$	0.5
24	$f(0) = 3$	0.5
	LHL = $\lim_{x\to 0^-} \frac{kx}{-x} = -k$	0.5
	RHL = $\lim_{x\to 0^+} 3 = 3$	0.5
	Since f is continuous at x = 0,	
	LHL = RHL = f(0) $\Rightarrow -k = 3 \Rightarrow k = -3$	0.5
25	A) $3\sin^{-1}\left(\frac{1}{\sqrt{2}}\right) + 2\cos^{-1}\left(\frac{\sqrt{3}}{2}\right) + \cos^{-1}(0)$	
	$\Rightarrow 3\times \pi/4 + 2\times \pi/6 + \pi/2$	1.5
	$\Rightarrow \frac{19\pi}{12}$	0.5
	OR	
	B) $\tan^{-1}\left(\frac{\cos x}{1-\sin x}\right), -\frac{3\pi}{2} < x < \frac{\pi}{2}$	
	$\Rightarrow \frac{\cos x}{1-\sin x} = \frac{\cos^2\frac{x}{2} - \sin^2\frac{x}{2}}{\sin^2\frac{x}{2} + \cos^2\frac{x}{2} - 2\sin\frac{x}{2}.\cos\frac{x}{2}} = \frac{\cos\frac{x}{2} + \sin\frac{x}{2}}{\cos\frac{x}{2} - \sin\frac{x}{2}} = \frac{1+\tan\frac{x}{2}}{1-\tan\frac{x}{2}}$	1
	$= \tan\left(\frac{\pi}{4} + \frac{x}{2}\right)$	0.5

	$\tan^{-1}\left(\tan\left(\frac{\pi}{4}+\frac{x}{2}\right)\right)=\frac{\pi}{4}+\frac{x}{2}$	0.5
	SECTION C	
26	A) $5x-25=14-7y=35z \Rightarrow \frac{x-5}{1/5}=\frac{y-2}{-1/7}=\frac{z-0}{1/35}$	0.5
	$\Rightarrow \frac{x-5}{7}=\frac{y-2}{-5}=\frac{z-0}{1}$ .....(1)	0.5
	$\vec{a}=\hat{\imath}+2\hat{\jmath}-\hat{k}$, $\vec{b}=7\hat{\imath}-5\hat{\jmath}+\hat{k}$	
	Required Vector equation:	
	$\vec{r}=\vec{a}+\lambda\overrightarrow{b}\Rightarrow\vec{r}=\left(\hat{\imath}+2\hat{\jmath}-\hat{k}\right)+\lambda\left(7\hat{\imath}-5\hat{\jmath}+\hat{k}\right)$	1
	Required Cartesian equation:	
	$\frac{x-1}{7}=\frac{y-2}{-5}=\frac{z+1}{1}$	1
	OR	
	B) $\overrightarrow{a_1}=\hat{\imath}+\hat{\jmath}$, $\overrightarrow{b_1}=2\hat{\imath}-\hat{\jmath}+\hat{k}$	
	$\overrightarrow{a_2}=2\hat{\imath}+\hat{\jmath}-\hat{k}$, $\overrightarrow{b_2}=3\hat{\imath}-5\hat{\jmath}+2\hat{k}$	
	$\overrightarrow{a_2}-\overrightarrow{a_1}=\hat{\imath}-\hat{k}$	0.5
	$\overrightarrow{b_1}\times\overrightarrow{b_2}=\begin{vmatrix}\hat{\imath} & \hat{\jmath} & \hat{k}\\ 2 & -1 & 1\\ 3 & -5 & 2\end{vmatrix}=3\hat{\imath}-\hat{\jmath}-7\hat{k}$	1
	$\left\lvert\overrightarrow{b_1}\times\overrightarrow{b_2}\right\rvert=\sqrt{9+1+49}=\sqrt{59}$	0.5
	$(\overrightarrow{a_2}-\overrightarrow{a_1}).\left(\overrightarrow{b_1}\times\overrightarrow{b_2}\right)=10$	0.5
	$d=\left\lvert\frac{(\overrightarrow{a_2}-\overrightarrow{a_1}).(\overrightarrow{b_1}\times\overrightarrow{b_2})}{\lvert\overrightarrow{b_1}\times\overrightarrow{b_2}\rvert}\right\rvert=\frac{10}{\sqrt{59}}$	0.5
27	$f(x)=\sin^2x-\cos x$, $x\in[0,\pi]$	
	$f'(x)=2\sin x.\cos x+\sin x$	1
	$f'(x)=0\Rightarrow 2\sin x.\cos x+\sin x=0\Rightarrow \sin x(2\cos x+1)=0$	
	$\sin x=0\Rightarrow x=0,\pi$	1
	$\cos x=-1/2\Rightarrow x=2\pi/3$	
	$f(0)=-1$, $f(2\pi/3)=5/4$, $f(\pi)=1$	
	Absolute maximum = 5/4 at $x=2\pi/3$	0.5

	Absolute minimum = -1 at $x = 0$	0.5
28	Minimize: $z = 5x + 10y$ $x + 2y \leq 120$ ….(1) $x + y \geq 60$ .....(2) $x - 2y \geq 0$…..(3) $x, y \geq 0$ A = (60,0) , B = (120, 0)  Solving (1) & (3) ⇒ C = (60,30) Solving (2) & (3) ⇒ D = (40,20) A = (60,0) ⇒ Z = 300 B = (120, 0) ⇒ Z = 600 C = (60,30) ⇒ Z = 600 D = (40,20 ⇒ Z = 400 Minimum Value = 300, when x = 60 & y = 0	Graph-1.5 1 0.5
29	$A)\ x = \cos t(3 - 2\cos^2 t) \Rightarrow x = \cos 3t \Rightarrow \frac{dx}{dt} = -3\sin 3t$ $y = \sin t(3 - 2\sin^2 t) \Rightarrow y = \sin 3t \Rightarrow \frac{dy}{dt} = 3\cos 3t$ $\frac{dy}{dx} = \frac{dy/dt}{dx/dt} = \frac{3\cos 3t}{-3\sin 3t} = -\cot 3t$ $t = \frac{\pi}{4} \Rightarrow \frac{dy}{dx} = -cot\frac{3\pi}{4} = -(-1) = 1$ **OR** B) $y = (\sin x)^x + \sin^{-1}\sqrt{x}$; $u = (\sin x)^x$; $v = \sin^{-1}\sqrt{x}$ $u = (\sin x)^x \Rightarrow \log u = x\log(\sin x)$ $\frac{du}{dx} = (\sin x)^x(\log(\sin x) + x\cot x)$ $v = \sin^{-1}\sqrt{x} \Rightarrow \frac{dv}{dx} = \frac{1}{\sqrt{1-x}} \times \frac{1}{2\sqrt{x}} = \frac{1}{2\sqrt{x-x^2}}$ $\frac{dy}{dx} = (\sin x)^x(\log(\sin x) + x\cot x) + \frac{1}{2\sqrt{x-x^2}}$	1 1 0.5 0.5 0.5 1 1 0.5

30	A) $I = \int \frac{\mathrm{dx}}{\sqrt{\sin^3 x\cos(x-a)}} = \int \frac{dx}{\sqrt{\sin^3 x(\cos x.\cos a+\sin x.\sin a)}}$	0.5
	$\int \frac{dx}{\sin^2 x\sqrt{\cot x.\cos a+\sin a}} = \int \frac{\mathrm{cosec}^2 x.dx}{\sqrt{\cot x.\cos a+\sin a}}$	1
	Put, $t = \cot x.\cos a + \sin a \Rightarrow \frac{dt}{dx} = -\mathrm{cosec}^2 x.\cos a$	0.5
	$\frac{-dt}{\cos a} = \mathrm{cosec}^2 x dx$	
	$I = \frac{-1}{\cos a}\int \frac{dt}{\sqrt{t}} = -\frac{1}{\cos a} \times 2\sqrt{t} \Rightarrow I = -\frac{2\sqrt{\cot x.\cos a+\sin a}}{\cos a} + C$	1
	B) **OR**	
	$x^2 + y^2 = 4, x = \sqrt{3}y$	
	$x^2 + y^2 = 4 \Rightarrow y = \sqrt{4 - x^2}$	0.5
	$\Rightarrow x = \pm\sqrt{3}$	
		
	Required area of the shaded region =	
	$\int_0^{\sqrt{3}} \frac{x}{\sqrt{3}} dx + \int_{\sqrt{3}}^{2} \sqrt{4 - x^2}\, dx$	1
	$= \frac{\sqrt{3}}{2} + \left(\frac{x}{2}\sqrt{4 - x^2} + \frac{4}{2} sin^1 \frac{x}{2}\right)_{\sqrt{3}}^{2}$	1
	$= \frac{\sqrt{3}}{2} + (0 + 2sin^{-1}1) - \left(\frac{\sqrt{3}}{2} \times 1 + 2sin^{-1}\frac{\sqrt{3}}{2}\right) = \pi - \frac{2\pi}{3} = \frac{\pi}{3}$	0.5
31	Since the event of raining today and not raining today are complementary events so if the probability that it rains today is 0.4 then the probability that it does not rain today is 1 - 0.4 = 0.6 $\Rightarrow P_1 = 0.6$	0.5
	If it rains today, the probability that it will rain tomorrow is 0.8 then the probability that it will not rain tomorrow is $1 - 0.8 = 0.2$.	0.5
	If it does not rain today, the probability that it will rain tomorrow is 0.7 then the probability that it will not rain tomorrow is $1 - 0.7 = 0.3$.	0.5

	 $P_1 \times P_4 - P_2 \times P_3 = 0.6 \times 0.3 - 0.2 \times 0.7 = 0.04$ Let E_1 and E_2 be the events that it will rain today and it will not rain today respectively. $P(E_1) = 0.4$, $P(E_2) = 0.6$ A be the event that it will rain tomorrow. $P(A / E_1) = 0.8$, $P(A / E_2) = 0.7$ $P(A) = P(E_1)\, P(A / E_1) + P(E_2)\, P(A / E_2) = 0.4 \times 0.8 + 0.6 \times 0.7 = 0.74$	0.5 0.5 0.5
	SECTION D	
32	A) $(x\,dy - y\,dx)y \sin\left(\frac{y}{x}\right) = (y\,dx + x\,dy)x \cos\left(\frac{y}{x}\right)$ $\frac{dy}{dx} = \frac{y^2\sin(y/x) + xy\cos(y/x)}{xy\sin(y/x) - x^2\cos(y/x)}$ This is a homogeneous differential equation. Put $y = vx$ $\Rightarrow \frac{dy}{dx} = v + x\frac{dv}{dx}$ $v + x\frac{dv}{dx} = \frac{v^2\sin v + v\cos v}{v\sin v - \cos v} \Rightarrow x\frac{dv}{dx} = \frac{2v\cos v}{v\sin v - \cos v}$ $\Rightarrow \int \frac{v\sin v - \cos v}{2v\cos v}\, dv = \int \frac{dx}{x}$ $\Rightarrow \frac{1}{2}\int \tan v\, dv - \frac{1}{2}\int \frac{1}{v}\, dv = \int \frac{dx}{x}$ $\Rightarrow \frac{1}{2}(\log\lvert sec v\rvert - \log\lvert v\rvert) = \log\lvert x\rvert + \log C_1$ $\Rightarrow \log\left\lvert\frac{sec v}{v}\right\rvert = \log\lvert 2x^2 C_1\rvert \Rightarrow \frac{sec v}{v} = 2x^2 C_1$	1 0.5 1 0.5 0.5 0.5 0.5 0.5

	$\Rightarrow \frac{\sec(y/x)}{y/x} = Cx^2 \Rightarrow \sec(y/x) = Cxy$ **OR**	
	B) $\frac{dy}{dx} + \frac{y^2+y+1}{x^2+x+1} = 0 \Rightarrow \frac{dy}{dx} = -\frac{(y^2+y+1)}{x^2+x+1}$	0.5 0.5
	$\Rightarrow \frac{dy}{y^2+y+1} = -\frac{dx}{x^2+x+1}$	
	$\Rightarrow \frac{dy}{\left(y+\frac{1}{2}\right)^2+\frac{3}{4}} = -\frac{dx}{\left(x+\frac{1}{2}\right)^2+\frac{3}{4}}$	0.5
	$\Rightarrow \int \frac{dy}{\left(y+\frac{1}{2}\right)^2+\left(\frac{\sqrt{3}}{2}\right)^2} = -\int \frac{dx}{\left(x+\frac{1}{2}\right)^2+\left(\frac{\sqrt{3}}{2}\right)^2}$	1
	$\Rightarrow \frac{2}{\sqrt{3}}\tan^{-1}\left(\frac{y+\frac{1}{2}}{\frac{\sqrt{3}}{2}}\right) + \frac{2}{\sqrt{3}}\tan^{-1}\left(\frac{x+\frac{1}{2}}{\frac{\sqrt{3}}{2}}\right) = C$	
	$\Rightarrow \tan^{-1}\left(\frac{2y+1}{\sqrt{3}}\right) + \tan^{-1}\left(\frac{2x+1}{\sqrt{3}}\right) = \frac{\sqrt{3}}{2}C$	
	$\Rightarrow \tan^{-1}\left(\frac{\frac{2y+1}{\sqrt{3}}+\frac{2x+1}{\sqrt{3}}}{1-\frac{2y+1}{\sqrt{3}}.\frac{2x+1}{\sqrt{3}}}\right) = \frac{\sqrt{3}}{2}C \Rightarrow \frac{\frac{2y+1}{\sqrt{3}}+\frac{2x+1}{\sqrt{3}}}{1-\frac{2y+1}{\sqrt{3}}.\frac{2x+1}{\sqrt{3}}} = \tan\left(\frac{\sqrt{3}}{2}C\right)$	1
	$\Rightarrow \frac{3/\sqrt{3}\,(2y+2x+2)}{3-4xy-2y-2x-1} = \tan\left(\frac{\sqrt{3}}{2}C\right)$	0.5
	$\frac{(y+x+1)}{(1-x-y-2xy)} = \frac{\sqrt{3}}{3}\tan\left(\frac{\sqrt{3}}{2}C\right)$	0.5
	$\Rightarrow \frac{(y+x+1)}{(1-x-y-2xy)} = A$, where $A = \frac{\sqrt{3}}{3}\tan\left(\frac{\sqrt{3}}{2}C\right)$	0.5
	$\Rightarrow y+x+1 = A(1-x-y-2xy)$	
33	A) $I = \int_0^{\pi} \frac{x\sin x}{1+\cos^2 x}\,dx$…….(1)	
	$I = \int_0^{\pi} \frac{(\pi-x)\sin(\pi-x)}{1+\cos^2(\pi-x)}\,dx$	0.5
	$= \int_0^{\pi} \frac{(\pi-x)\sin x}{1+\cos^2 x}\,dx$…….(2)	0.5
	(1) + (2) ⇒	
	$2I = \int_0^{\pi} \frac{\pi\sin x}{1+\cos^2 x}$	1
	Put $t = \cos x \Rightarrow dt = -\sin x\,dx$	0.5

	$x = 0 \Rightarrow t = 1; x = \pi \Rightarrow t = -1$	1
	$2I = \int_{-1}^{1} \frac{\pi dx}{1+t^2} \Rightarrow 2I = \pi(tan^{-1}t)_{-1}^{1}$	0.5
	$= \pi(\tan^{-1}(1) - \tan^{-1}(-1))$	1
	$2I = \pi\left(\frac{\pi}{4} + \frac{\pi}{4}\right) = \frac{\pi^2}{2} \Rightarrow I = \frac{\pi^2}{4}$	
	OR	
	B) $I = \int_{\pi/6}^{\pi/3} \frac{\sin x + \cos x}{\sqrt{\sin 2x}}$ dx	0.5
	Put $t = \sin x - \cos x \Rightarrow dt = (\cos x + \sin x)dx$	1
	And $\sin 2x = 1 - (\sin x - \cos x)^2$	0.5
	$x = \frac{\pi}{6} \Rightarrow t = \frac{1-\sqrt{3}}{2}; x = \frac{\pi}{3} \Rightarrow t = \frac{\sqrt{3}-1}{2}$	1
	$I = \int_{-(\sqrt{3}-1)/2}^{(\sqrt{3}-1)/2} \frac{dt}{\sqrt{1-t^2}}$	
	$\Rightarrow I = 2 \int_{0}^{(\sqrt{3}-1)/2} \frac{dt}{\sqrt{1-t^2}} = 2(\sin^{-1}t)_{0}^{(\sqrt{3}-1)/2}$	1
	$\Rightarrow I = 2\left(\sin^{-1}\left((\sqrt{3}-1)/2\right) - 0\right) = 2\sin^{-1}\left(\frac{(\sqrt{3}-1)}{2}\right)$	1
34	A = $\begin{bmatrix} 1 & -1 & 0 \\ 2 & 3 & 4 \\ 0 & 1 & 2 \end{bmatrix}$, B = $\begin{bmatrix} 2 & 2 & -4 \\ -4 & 2 & -4 \\ 2 & -1 & 5 \end{bmatrix}$	
	BA = $\begin{bmatrix} 2 & 2 & -4 \\ -4 & 2 & -4 \\ 2 & -1 & 5 \end{bmatrix} \times \begin{bmatrix} 1 & -1 & 0 \\ 2 & 3 & 4 \\ 0 & 1 & 2 \end{bmatrix} = \begin{bmatrix} 6 & 0 & 0 \\ 0 & 6 & 0 \\ 0 & 0 & 6 \end{bmatrix} = 6I$	1
	$\Rightarrow A^{-1} = \frac{B}{6}$	
	Given that	0.5
	$x - y = 3$, $2x + 3y + 4z = 17$, $y + 2z = 7$.	
	$A = \begin{bmatrix} 1 & -1 & 0 \\ 2 & 3 & 4 \\ 0 & 1 & 2 \end{bmatrix}, X = \begin{bmatrix} x \\ y \\ z \end{bmatrix}, D = \begin{bmatrix} 3 \\ 17 \\ 7 \end{bmatrix}$	1
	$A.X = D \Rightarrow X = A^{-1}.D$	
	$X = \frac{1}{6}\begin{bmatrix} 2 & 2 & -4 \\ -4 & 2 & -4 \\ 2 & -1 & 5 \end{bmatrix}\begin{bmatrix} 3 \\ 17 \\ 7 \end{bmatrix} = \frac{1}{6}\begin{bmatrix} 12 \\ -6 \\ 24 \end{bmatrix} = \begin{bmatrix} 2 \\ -1 \\ 4 \end{bmatrix}$	1
	$x = 2; y = -1; z = 4$	1.5

35	$\overrightarrow{r_1} = (8\hat{\imath} - 19\hat{\jmath} + 10\hat{k}) + \lambda(3\hat{\imath} - 16\hat{\jmath} + 7\hat{k}) \Rightarrow \overrightarrow{b_1} = 3\hat{\imath} - 16\hat{\jmath} + 7\hat{k}$ $\overrightarrow{r_2} = (15\hat{\imath} + 29\hat{\jmath} + 5\hat{k}) + \mu(3\hat{\imath} + 8\hat{\jmath} - 5\hat{k}) \Rightarrow \overrightarrow{b_2} = 3\hat{\imath} + 8\hat{\jmath} - 5\hat{k}$ $\vec{a} = \hat{\imath} + 2\hat{\jmath} - 4\hat{k}$ Required vector equation of the line : $\vec{r} = \vec{a} + \lambda\vec{b}$ $\vec{b}$ is the perpendicular vector to both $\overrightarrow{b_1}$ & $\overrightarrow{b_2}$ $\Rightarrow \vec{b} = \overrightarrow{b_1} \times \overrightarrow{b_2}$ $\overrightarrow{b_1} \times \overrightarrow{b_2} = \begin{vmatrix} \hat{\imath} & \hat{\jmath} & \hat{k} \\ 3 & -16 & 7 \\ 3 & 8 & -5 \end{vmatrix} = 24\hat{\imath} + 36\hat{\jmath} + 72\hat{k}$ Required equation of the line in vector form: $\vec{r} = (\hat{\imath} + 2\hat{\jmath} - 4\hat{k}) + \lambda(24\hat{\imath} + 36\hat{\jmath} + 72\hat{k})$ $\Rightarrow \vec{r} = (\hat{\imath} + 2\hat{\jmath} - 4\hat{k}) + \lambda(2\hat{\imath} + 3\hat{\jmath} + 6\hat{k})$ Required equation of the line in cartesian form: $\frac{x-1}{24} = \frac{y-2}{36} = \frac{z+4}{72} \Rightarrow \frac{x-1}{2} = \frac{y-2}{3} = \frac{z+4}{6}$	0.5 0.5 0.5 0.5 1 1 1
	SECTION E	
36	(a) $f_1(x) = x^2 + 1$ is not one-one, because $f(1) = f(-1) = 2$, even though $1 \neq -1$. Hence, different elements of domain give the same image. (b) For $f_2(x) = 4x^2 - 3$, the range is $[-3, \infty)$. Hence, if the function is onto, Codomain $Y = [-3, \infty)$. (c) For $f_3(x) = 2x - 5$: One-one: If $f(x_1) = f(x_2)$, then $2x_1 - 5 = 2x_2 - 5 \Rightarrow x_1 = x_2$. Hence, it is one-one. Onto: For any $y \in \mathbb{R}$, there exists $x = \frac{y+5}{2} \in \mathbb{R}$. Hence, it is onto. Therefore, $f_3(x) = 2x - 5$ is bijective. **OR** (c) For $f_1(x) = x^2 + 1$: • Range: $[1, \infty)$	0.5 0.5 0.5 0.5 1 1 1

	• Codomain: $\mathbb{R}$ Since not every real number is an image (e.g., 0 not in range), $f_1(x)$ is not onto when codomain is $\mathbb{R}$.	1
37	(a) Area, $A(x) = (10 + x)\sqrt{100 - x^2}$ (b) $A'(x) = \frac{-2x^2-10x+100}{\sqrt{100-x^2}}$ (c) Put $A'(x) = 0$ we get $x = 5$ $A''(x) = \frac{\sqrt{100-x^2}(-4x-10) - (-2x^2-10x+100)\frac{(-2x)}{2\sqrt{100-x^2}}}{100-x^2}$ $= \frac{2x^3-300x-1000}{(100-x^2)^{\frac{3}{2}}}$ (on simplification) $A''(5) = \frac{2(5)^3-300(5)-1000}{(100-(5)^2)^{\frac{3}{2}}} = \frac{-2250}{75\sqrt{75}} = \frac{-30}{\sqrt{75}} < 0$ thus, area of trapezium is maximum at $x = 5$ **OR** (c) Maximum area of trapezium $A(5) = (5 + 10)\sqrt{100 - (5)^2} = 15\sqrt{75} = 75\sqrt{3}$ cm^2	1 1 1 1 1+1
38	(a) Required Probability = $P(D/A)P(A) + P(D/B)P(B) + P(D/C)P(C) = 0.047$ (b) The probability = 1−probability that the form has a mistake and is processed by Ram $=1 - (30/47) = 17/47$	1+1 1+1

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