KENDRIYA VIDYALAYA SANGATHAN, RAIPUR REGION

FIRST PRE-BOARD EXAM (2025-26)

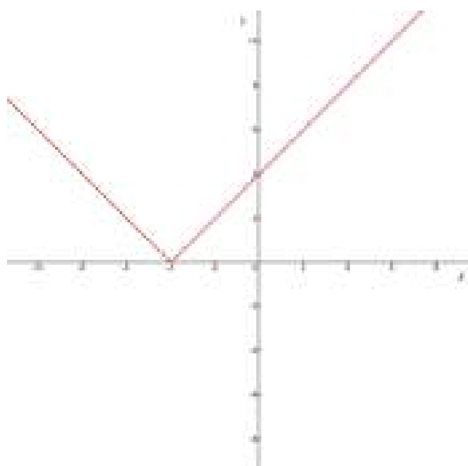
MARKING SCHEME

SUBJECT: MATHEMATICS

Q.NO.	ANSWER	TOTAL MARKS
1.	(A) $\begin{bmatrix} \frac{1}{4} & 0 & 0 \\ 0 & \frac{1}{5} & 0 \\ 0 & 0 & \frac{1}{6} \end{bmatrix}$	1
2.	(B) 1	1
3.	(A) $\overrightarrow{AB} + \overrightarrow{BC} + \overrightarrow{AC} = \vec{0}$	1
4.	(C) $\frac{\pi}{3}$	1
5.	(B) $\frac{1}{4}$	1
6.	(C) not defined	1
7.	(B) R is reflexive and transitive but not symmetric	1
8.	(D) 126	1
9.	(A) π	1
10.	(D) 2, 1	1
11.	(A) 0	1
12.	(C) $x + 2y \geq 76, 2x + y \leq 104, x, y \geq 0$	1
13.	(D) -1	1
14.	(A) $-\frac{1}{\log x} + c$	1
15.	(C) first order linear differential equation	1
16.	(B) ± 5	1
17.	(C) x^{-1}	1
18.	(C) z is maximum at (10, 50), minimum at (0, 0)	1
19.	(C) Assertion (A) is true, but Reason (R) is false	1
20.	(D) Assertion (A) is false, but Reason (R) is true	1
21.	Let $u(x) = sin^2 x$ and $v(x) = e^{\cos x}$ Then , $\frac{du}{dx} = 2\sin x \cos x$ ………………………. (1/2 M) and $\frac{dv}{dx} = -\sin x\, e^{\cos x}$…………………………………(1/2 M) Thus, $\frac{du}{dv} = \frac{\frac{du}{dx}}{\frac{dv}{dx}} = \frac{2\sin x \cos x}{-\sin x e^{\cos x}} = -\frac{2\cos x}{e^{\cos x}}$…………..(1 M) **OR** Let $y = \tan^{-1}\left(\frac{\sin x}{1 + \cos x}\right)$ $\Rightarrow y = \tan^{-1}\left(\frac{2\sin\frac{x}{2}\cos\frac{x}{2}}{2cos^2\frac{x}{2}}\right)$ ……………..(1/2 M)	2

	$\Rightarrow y = \tan^{-1}\left(\frac{\sin\frac{x}{2}}{\cos\frac{x}{2}}\right)$ $\Rightarrow y = \tan^{-1}\left(\tan\frac{x}{2}\right)$ ………..(1/2 M) $\Rightarrow y = \frac{x}{2}$ ……………………..(1/2 M) Hence, $\frac{dy}{dx} = \frac{1}{2}$………………..(1/2 M)	
22.	$\overrightarrow{AB} = (2-1)\vec{\imath} + (3-1)\vec{\jmath} + (5-2)\vec{k} = \vec{\imath} + 2\vec{\jmath} + 3\vec{k}$…………..(1/2 M) $\overrightarrow{AC} = (1-1)\vec{\imath} + (5-1)\vec{\jmath} + (5-2)\vec{k} = 4\vec{\jmath} + 3\vec{k}$………………(1/2 M) Area of triangle ABC $= \frac{1}{2}\left\|\overrightarrow{AB} \times \overrightarrow{AC}\right\| = \frac{1}{2}\begin{vmatrix} \hat{\imath} & \hat{\jmath} & \hat{k} \\ 1 & 2 & 3 \\ 0 & 4 & 3 \end{vmatrix} = \frac{1}{2}\left\|-6\hat{\imath} - 3\hat{\jmath} + 4\hat{k}\right\|$ $= \frac{1}{2}\sqrt{(-6)^2 + (-3)^2 + 4^2} = \frac{1}{2}\sqrt{61}$ sq. units……………………(1 M)	2
23.	$\cos^{-1}\left(-\frac{1}{\sqrt{2}}\right) + \tan^{-1}\left(\frac{1}{\sqrt{3}}\right) + \tan^{-1}\left[\sin\left(-\frac{\pi}{2}\right)\right]$ $= \left(\pi - \frac{\pi}{4}\right) + \frac{\pi}{6} + \tan^{-1}(-1)$ ……………….(1 M) $= \frac{3\pi}{4} + \frac{\pi}{6} - \frac{\pi}{4}$ ……………………………..(1/2 M) $= \frac{9\pi + 2\pi - 3\pi}{12}$ $= \frac{8\pi}{12}$ $= \frac{2\pi}{3}$ ……………………………………(1/2 M)	2
24.	$f(x) = e^x - e^{-x} + x - \tan^{-1} x$ $f'(x) = e^x + e^{-x} + 1 - \frac{1}{1+x^2}$ …………….(1 M) $= e^x + e^{-x} + \frac{1+x^2-1}{1+x^2}$ $= e^x + e^{-x} + \frac{x^2}{1+x^2} > 0 \ \forall\, x \in R$……………(1 M) Hence, f is strictly increasing in its domain.	2
25.	Let $\vec{a} = \hat{\imath} + \hat{\jmath} + \hat{k}$ and $\vec{b} = p\hat{\imath} + \hat{\jmath} - 2\hat{k}$. A/Q, $\frac{\vec{a}.\vec{b}}{\|\vec{b}\|} = \frac{1}{3}$………………………………………(1/2 M) $\Rightarrow \frac{(\hat{\imath} + \hat{\jmath} + \hat{k}).(p\hat{\imath} + \hat{\jmath} - 2\hat{k})}{\|p\hat{\imath} + \hat{\jmath} - 2\hat{k}\|} = \frac{1}{3}$ $\Rightarrow \frac{p-1}{\sqrt{p^2+5}} = \frac{1}{3}$………………………………(1/2 M) $\Rightarrow 4p^2 - 9p + 2 = 0$………………………(1/2 M)	2

	$\Rightarrow p = 2 \ or \ p = \frac{1}{4}$…………………………..(1/2 M) **OR** $\overrightarrow{DV} = -5\vec{i} + 4\vec{j} + 7\vec{k}$……………………..(1/2 M) $\overrightarrow{DA} = 5\vec{i} + 2\vec{j} + 4\vec{k}$……………………….(1/2 M) $\angle VDA = \cos^{-1}\left(\frac{\overrightarrow{DV}.\overrightarrow{DA}}{\lvert\overrightarrow{DV}\rvert\lvert\overrightarrow{DA}\rvert}\right)$ $= \cos^{-1}\left(\frac{-25+8+28}{\sqrt{25+16+49}\sqrt{25+4+16}}\right)$…………………….(1/2 M) $= \cos^{-1}\left(\frac{11}{\sqrt{90}\sqrt{45}}\right) = \cos^{-1}\left(\frac{11}{45\sqrt{2}}\right)$…………………………..(1/2 M)	
26.	We have, $f\ (x) = \ 2x^3 - \ 15x^2 \ + \ 36x \ + 1$ $\Rightarrow f'(x) = 6x^2 - 30x + 36$ ……………………..…..(1/2 M) Let $f'(x) = 0$ $\Rightarrow 6x^2 - 30x + 36 = 0$ $\Rightarrow 6(x-2)(x-3) = 0$ $\Rightarrow Either\ x = 3\ or\ x = 2$……………………………………..(1/2 M) Now, $f(1) = 2(1)^3 - \ 15(1)^2 \ + \ 36(1) \ + 1 = 24$ $f(2) = 2(2)^3 - \ 15(2)^2 \ + \ 36(2) \ + 1 = 29$ $f(3) = 2(3)^3 - \ 15(3)^2 \ + \ 36(3) \ + 1 = 28$ $f(5) = 2(5)^3 - \ 15(5)^2 \ + \ 36(5) \ + 1 = 56$…………………(1 M) Absolute maximum is 56………………..….(1/2 M) and Absolute minimum is 24………………(1/2 M)	3
27.	$x = \left(t + \frac{1}{t}\right)^a$ $\Rightarrow \frac{dx}{dt} = a\left(t + \frac{1}{t}\right)^{a-1}\left(1 - \frac{1}{t^2}\right)$ ……………………………(1 M) Also, $y = a^{t+\frac{1}{t}}$ $\Rightarrow \frac{dy}{dt} = a^{t+\frac{1}{t}}\left(1 - \frac{1}{t^2}\right)\log a$ ………………………………(1 M) Now, $\frac{dy}{dx} = \frac{\frac{dy}{dt}}{\frac{dx}{dt}} = \frac{a^{t+\frac{1}{t}}\left(1-\frac{1}{t^2}\right)\log a}{a\left(t+\frac{1}{t}\right)^{a-1}\left(1-\frac{1}{t^2}\right)} = \frac{a^{t+\frac{1}{t}}\log a}{a\left(t+\frac{1}{t}\right)^{a-1}}$…………..(1 M) **OR** Let $u = (\cos x)^x$ and $v = \cos^{-1}\sqrt{x}$………..(1/2 M) Then, $y = u + v$ $\Rightarrow \frac{dy}{dx} = \frac{du}{dx} + \frac{dv}{dx}$ …………………………..(1/2 M)	3

	Now, $u=(\cos x)^x$ $\Rightarrow \log u=\log(\cos x)^x$ $\Rightarrow \log u = x\log(\cos x)$ $\Rightarrow \frac{1}{u}\frac{du}{dx}=\log(\cos x)-x\tan x$ $\Rightarrow \frac{du}{dx}=(\cos x)^x\{\log(\cos x)-x\tan x\}$ ………………(1 M) Also, $v=\cos^{-1}\sqrt{x}$ $\Rightarrow \frac{dv}{dx}=-\frac{1}{2\sqrt{x-x^2}}$…………………………..(1/2 M) Now, $\frac{dy}{dx}=(\cos x)^x\{\log(\cos x)-x\tan x\}-\frac{1}{2\sqrt{x-x^2}}$…………..(1/2 M)	
28.	 ……………..(1 M) Reqd. Area $=\int_{-8}^{-4} y dx+\int_{-4}^{0} y dx$ ………………......(1/2 M) $=\int_{-8}^{-4}-(x+4)dx+\int_{-4}^{0}(x+4)dx$…………………(1/2 M) $=\left[-\frac{x^2}{2}-4x\right]_{-8}^{-4}+\left[\frac{x^2}{2}+4x\right]_{-4}^{0}$……………………...(1/2 M) $=\left\{\left[-\frac{(-4)^2}{2}-4(-4)\right]-\left[-\frac{(-8)^2}{2}-4(-8)\right]\right\}+\left[\frac{0^2}{2}+4(0)-\frac{(-4)^2}{2}-4(-4)\right]$ $=\{[-8+16]-[-32+32]\}+[0-8+16]$ $=16$ …………………………………………………(1/2 M)	3
29.	Let $\overrightarrow{a_1}=\hat{\imath}+2\hat{\jmath}+\hat{k}, \overrightarrow{b_1}=\hat{\imath}-\hat{\jmath}+\hat{k}$ $\overrightarrow{a_2}=2\hat{\imath}-\hat{\jmath}-\hat{k}, \overrightarrow{b_2}=2\hat{\imath}+\hat{\jmath}+2\hat{k}$ $\overrightarrow{b_1}\times\overrightarrow{b_2}=\begin{vmatrix}\hat{\imath} & \hat{\jmath} & \hat{k}\\ 1 & -1 & 1\\ 2 & 1 & 2\end{vmatrix}=-3\hat{\imath}+3\hat{k}$……………………(1 M) $\overrightarrow{a_2}-\overrightarrow{a_1}=\hat{\imath}-3\hat{\jmath}-2\hat{k}$…………………………………(1/2 M)	3

$(\overrightarrow{b_1} \times \overrightarrow{b_2}).(\overrightarrow{a_2} - \overrightarrow{a_1}) = -9$ ……………………………..(1/2 M)

Shortest Distance $= \left|\frac{(\overrightarrow{b_1} \times \overrightarrow{b_2}).(\overrightarrow{a_2} - \overrightarrow{a_1})}{|\overrightarrow{b_1} \times \overrightarrow{b_2}|}\right|$……………………..(1/2 M)

$= \left|\frac{-9}{\sqrt{18}}\right| = \frac{3}{\sqrt{2}} = \frac{3\sqrt{2}}{2}$ units………..……..(1/2 M)

OR

Let $\overrightarrow{b_1} = -3\hat{\imath} + 2\hat{\jmath} + 2\hat{k}$ and $\overrightarrow{b_2} = 3\hat{\imath} + \hat{\jmath} - 7\hat{k}$………………(1/2 M)

Now,

$\vec{b} = \overrightarrow{b_1} \times \overrightarrow{b_2} = \begin{vmatrix} \hat{\imath} & \hat{\jmath} & \hat{k} \\ -3 & 2 & 2 \\ 3 & 1 & -7 \end{vmatrix} = -16\hat{\imath} - 15\hat{\jmath} - 9\hat{k}$…………(1 M)

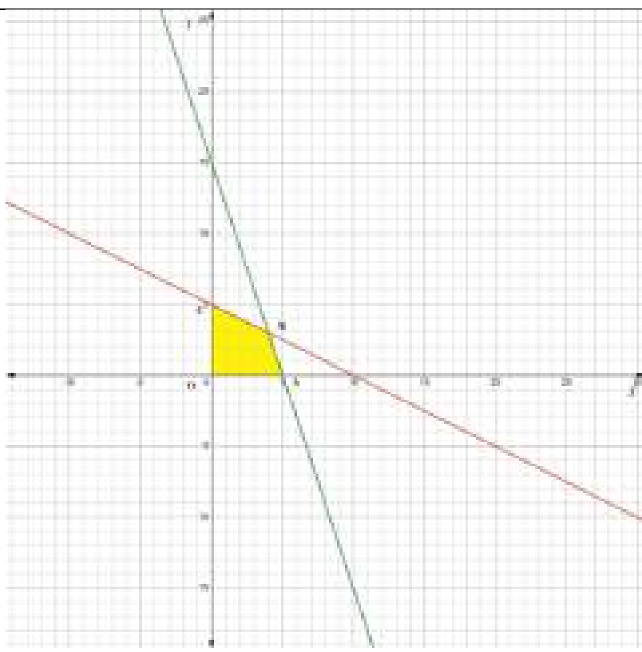
Let $\vec{a} = 3\hat{\imath} - 4\hat{\jmath} + 7\hat{k}$……………………………(1/2 M)

Therefore , required vector equation of the line is

$\vec{r} = \vec{a} + \lambda\vec{b}$

i.e. $\vec{r} = 3\hat{\imath} - 4\hat{\jmath} + 7\hat{k} + \lambda(-16\hat{\imath} - 15\hat{\jmath} - 9\hat{k})$……………(1 M)

30.



………………$(1\frac{1}{2}$ M)

Corner Points	Z= $3x + 2y$
O (0, 0)	0
A (5, 0)	15
B (4, 3)	18
C (0, 5)	10

Table: (1 M)

Reqd. Max Value is 18 obtained at point B (4, 3)……..(1/2 M)

3

31.	Let A and B be the set of students who read Hindi and English respectively. Then, P(A)= $\frac{60}{100} = 0.6$, $P(B) = \frac{40}{100} = 0.4$, $P(A \cap B) = \frac{20}{100} = 0.2$ (a) $P(A' \cap B') = P(A \cup B)' = 1 - P(A \cup B)$ $= 1 - \text{P(A)} - \text{P(B)} + P(A \cap B)$ $= 1 - 0.6 - 0.4 + 0.2 = 0.2$ …………………….(1 M) (b) $P(B\|A) = \frac{P(A \cap B)}{P(A)} = \frac{0.2}{0.6} = \frac{1}{3}$……..……………..(1 M) (c) $P(A\|B) = \frac{P(A \cap B)}{P(B)} = \frac{0.2}{0.4} = \frac{1}{2}$……………………(1 M) **OR** P(A)= $\frac{1}{2}$, $P(B) = \frac{1}{3}$ (i) P (the problem is solved) = $P(A \cup B)$ $= \text{P(A)} + \text{P(B)} - \text{P(A} \cap \text{B)}$ ……………………(1/2 M) $= \text{P(A)} + \text{P(B)} - \text{P(A)P(B)}$ $= \frac{1}{2} + \frac{1}{3} - \frac{1}{2}.\frac{1}{3}$ …………………………………(1/2 M) $= \frac{3+2-1}{6}$ $= \frac{4}{6}$ $= \frac{2}{3}$ …………………………………(1/2 M) (ii) P (exactly one of them solves the problem) = $P(A \cap B') + P(A' \cap B)$ $= P(A) - P(A \cap B) + P(B) - P(A \cap B)$ ……………(1/2 M) $= \text{P(A)} + \text{P(B)} - 2\,\text{P(A)P(B)}$ ……………………….(1/2 M) $= \frac{1}{2} + \frac{1}{3} - 2.\frac{1}{2}.\frac{1}{3}$ $= \frac{3+2-2}{6}$ $= \frac{3}{6}$ $= \frac{1}{2}$ ……………………………………………(1/2 M)	3
32.	Let $I = \int \left[\sqrt{\cot x} + \sqrt{\tan x}\right] dx$ $\Rightarrow I = \int \sqrt{\tan x}\left[\frac{\sqrt{\cot x}}{\sqrt{\tan x}} + 1\right] dx$ $\Rightarrow I = \int \sqrt{\tan x}\,[\cot x + 1] dx$ ………………..(1 M) Let $\sqrt{\tan x} = z$ $\Rightarrow \tan x = z^2$	

	$\Rightarrow sec^2x\, dx = 2zdz$ $\Rightarrow dx = \frac{2zdz}{sec^2x}$ $\Rightarrow dx = \frac{2zdz}{1+tan^2x}$ $\Rightarrow dx = \frac{2zdz}{1+z^4}$ ……………………………..(1 M) Now, $I = \int z\left[\frac{1}{z^2}+1\right]\frac{2zdz}{1+z^4}$ $\Rightarrow\ I = \int\left[\frac{1+z^2}{z^2}\right]\frac{2z^2dz}{1+z^4}$ $\Rightarrow\ I = 2\int\left[\frac{1+z^2}{1+z^4}\right]dz$ $\Rightarrow\ I = 2\int\left[\frac{\frac{1}{z^2}+1}{\frac{1}{z^2}+z^2}\right]dz$ $\Rightarrow\ I = 2\int\left[\frac{\frac{1}{z^2}+1}{2+\left(z-\frac{1}{z}\right)^2}\right]dz$ …………(1.5 M) Let $t = z - \frac{1}{z}$ $\Rightarrow dt = \left(1+\frac{1}{z^2}\right)dz$ ………..(1/ 2 M) Hence, $I = 2\int\frac{dt}{2+t^2}$ $\Rightarrow\ I = 2\int\frac{dt}{(\sqrt{2})^2+t^2}$ $\Rightarrow\ I = 2.\frac{1}{\sqrt{2}}\tan^{-1}\frac{t}{\sqrt{2}} + c$ $\Rightarrow\ I = \sqrt{2}\tan^{-1}\left(\frac{\sqrt{\tan x}-\sqrt{\cot x}}{\sqrt{2}}\right) + c$ ………..(1 M) **OR** Let $I = \int_0^{\frac{\pi}{4}}\frac{\sin x+\cos x}{9+16\sin 2x}dx$ $\Rightarrow I = \int_0^{\frac{\pi}{4}}\frac{\sin x+\cos x}{25-16+16\sin 2x}dx$ $\Rightarrow I = \int_0^{\frac{\pi}{4}}\frac{\sin x+\cos x}{25-16(1-\sin 2x)}dx$	

	$\Rightarrow I = \int_0^{\frac{\pi}{4}} \frac{\sin x+\cos x}{25-16(\sin^2 x+cos^2 x-2\sin x\cos x)}dx$ $\Rightarrow I = \frac{1}{16}\int_0^{\frac{\pi}{4}} \frac{\sin x+\cos x}{\frac{25}{16}-(\sin x-\cos x)^2}dx$ …………….(2 M) Let $\sin x - \cos x = t$ $\Rightarrow (\cos x + \sin x)dx = dt$ When $x = 0, t = \sin 0 - \cos 0 = 0 - 1 = -1$ When $x = \frac{\pi}{4}, t = \sin\frac{\pi}{4} - \cos\frac{\pi}{4} = \frac{1}{\sqrt{2}} - \frac{\pi}{4} = 0$……….(1 M) Then, $I = \frac{1}{16}\int_{-1}^{0} \frac{1}{\left(\frac{5}{4}\right)^2-(t)^2}dt$ $\Rightarrow I = \frac{1}{16}\left[\frac{1}{2.\frac{5}{4}}\log\left\|\frac{\frac{5}{4}+t}{\frac{5}{4}-t}\right\|\right]_{-1}^{0}$ $\Rightarrow I = \frac{1}{40}\left[\log\left\|\frac{5+4t}{5-4t}\right\|\right]_{-1}^{0}$ $\Rightarrow I = \frac{1}{40}\left[\log 1 - \log\frac{1}{9}\right]$ $\Rightarrow I = \frac{1}{40}\log 9$ ……………..(2 M)	
33.	$2ye^{\frac{x}{y}}dx + \left(y - 2xe^{\frac{x}{y}}\right)dy = 0$ $\Rightarrow \frac{dx}{dy} = \frac{2xe^{\frac{x}{y}}-y}{2ye^{\frac{x}{y}}}$ $\Rightarrow \frac{dx}{dy} = \frac{x}{y} - \frac{1}{2}e^{-\frac{x}{y}}$ ………(Eq. 1)……….(1/2 M) Let $F(x,y) = \frac{x}{y} - \frac{1}{2}e^{-\frac{x}{y}}$ Then $F(\lambda x, y\lambda) = \frac{\lambda x}{\lambda y} - \frac{1}{2}e^{-\frac{\lambda x}{\lambda y}} = \lambda^0\left(\frac{x}{y} - \frac{1}{2}e^{-\frac{x}{y}}\right)$………….(1/2 M)	

	Hence, the given differential equation is homogeneous differential equation. Let $\frac{x}{y} = v$ $\Rightarrow x = yv$ $\Rightarrow \frac{dx}{dy} = v + y\frac{dv}{dy}$ ………………….(1/2 M) Putting in Eq. 1, we get $v + y\frac{dv}{dy} = v - \frac{1}{2}e^{-v}$ $\Rightarrow\ y\frac{dv}{dy} = -\frac{1}{2}e^{-v}$ $\Rightarrow 2e^{v}dv\ = -\frac{dy}{y}$ $\Rightarrow 2e^{v}\ = -\log y + c$ $\Rightarrow 2e^{\frac{x}{y}}\ = -\log y + c$ ………………(2 M) Given , $x = 0, y = 1$, we get $2e^{0}\ = -\log 1 + c$ i.e. $c = 2$……………(1 M) Hence, the required particular solution is $2e^{\frac{x}{y}}\ = -\log y + 2$………..(1/2 M)	
34.	Let $\frac{x}{1} = \frac{y-2}{2} = \frac{z-3}{3} = \lambda$ $\Rightarrow x = \lambda, y = 2\lambda + 2, z = 3\lambda + 3$……………….(1/2 M) Then A$(\lambda,\ 2\lambda + 2,\ 3\lambda + 3)$ is a point on the given line. Let the coordinates of P' be (x_1, y_1, z_1). Since, A is the midpoint of the line segment PP', we get $\lambda = \frac{1+x_1}{2} \Rightarrow x_1 = 2\lambda - 1$ ……………………………..(1/2 M) $2\lambda + 2 = \frac{3+y_1}{2} \Rightarrow y_1 = 4\lambda + 1$ ………………………(1/2 M) $3\lambda + 3 = \frac{2+z_1}{2} \Rightarrow z_1 = 6\lambda + 4$ ………………………(1/2 M) Direction ratios of the line PP' are $(1 - x_1, 3 - y_1, 2 - z_1)$………(1/2 M) Since, the given line is perpendicular to PP'. Therefore, $1.(1 - x_1) + 2.(3 - y_1) + 3.(2 - z_1) = 0$……………(1/2 M) $\Rightarrow (2 - 2\lambda) + 2(2 - 4\lambda) + 3(-2 - 6\lambda) = 0$ $\Rightarrow \lambda = 0$ ……………………………………….....(1/2 M) Hence, $P'(x_1, y_1, z_1) \equiv (-1, 1, 4)$……………(1/2 M) Equation of PP' is	

	$\frac{x-1}{1-x_1} = \frac{y-3}{3-y_1} = \frac{z-2}{2-z_1}$ ……………………(1/2 M) i.e. $\frac{x-1}{2} = \frac{y-3}{2} = \frac{z-2}{-2}$……………………(1/2 M) **OR** Given, Equation of CD is $\frac{x-4}{1} = \frac{y+7}{-2} = \frac{z-8}{2}$ Let $\overrightarrow{a_1} = 4\hat{\imath} - 7\hat{\jmath} + 8\hat{k}$ and $\vec{b} = \hat{\imath} - 2\hat{\jmath} + 2\hat{k}$ Again, let $\overrightarrow{a_2} = -\hat{\imath} + 2\hat{\jmath} + \hat{k}$ $\overrightarrow{a_2} - \overrightarrow{a_1} = -5\hat{\imath} + 9\hat{\jmath} - 7\hat{k}$ …………………….(1 M) $\vec{b} \times (\overrightarrow{a_2} - \overrightarrow{a_1}) = \begin{vmatrix} \hat{\imath} & \hat{\jmath} & \hat{k} \\ 1 & -2 & 2 \\ -5 & 9 & -7 \end{vmatrix} = -4\hat{\imath} - 3\hat{\jmath} - \hat{k}$ ………..(1 M) Distance between AB and CD is $d = \left\| \frac{\vec{b} \times (\overrightarrow{a_2} - \overrightarrow{a_1})}{\|\vec{b}\|} \right\|$ $= \frac{\|-4\hat{\imath} - 3\hat{\jmath} - \hat{k}\|}{\|\hat{\imath} - 2\hat{\jmath} + 2\hat{k}\|}$ $= \frac{\sqrt{(-4)^2 + (-3)^2 + (-1)^2}}{\sqrt{1^2 + (-2)^2 + 2^2}}$ $= \frac{\sqrt{26}}{3}$ units………………..(2 M) Area of the parallelogram is $d.\|AB\| = \frac{\sqrt{26}}{3}.\|2\hat{\imath} - 4\hat{\jmath} + 4\hat{k}\|$ $= \frac{\sqrt{26}}{3}.6 = 2\sqrt{26}$ sq. units………………………………….…(1M)	
35.	$\begin{bmatrix} 1 & 2 & -3 \\ 3 & 2 & -2 \\ 2 & -1 & 1 \end{bmatrix} \begin{bmatrix} 0 & 1 & 2 \\ -7 & 7 & -7 \\ -7 & 5 & -4 \end{bmatrix} = \begin{bmatrix} 7 & 0 & 0 \\ 0 & 7 & 0 \\ 0 & 0 & 7 \end{bmatrix} = 7I$…(Eq. 1)…………….(2 M) The given system of equations can be written as $\begin{bmatrix} 1 & 2 & -3 \\ 3 & 2 & -2 \\ 2 & -1 & 1 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 6 \\ 3 \\ 2 \end{bmatrix}$ $\Rightarrow AX = B$ ……………………….(1/2 M) Where $A = \begin{bmatrix} 1 & 2 & -3 \\ 3 & 2 & -2 \\ 2 & -1 & 1 \end{bmatrix}, X = \begin{bmatrix} x \\ y \\ z \end{bmatrix}, B = \begin{bmatrix} 6 \\ 3 \\ 2 \end{bmatrix}$	

	$\Rightarrow X = A^{-1}B$ …………………………..(1/2 M) From Eq. 1, we have $A^{-1} = \frac{1}{7}\begin{bmatrix} 0 & 1 & 2 \\ -7 & 7 & -7 \\ -7 & 5 & -4 \end{bmatrix}$ …………………..(1/2 M) Then, $X = \frac{1}{7}\begin{bmatrix} 0 & 1 & 2 \\ -7 & 7 & -7 \\ -7 & 5 & -4 \end{bmatrix}\begin{bmatrix} 6 \\ 3 \\ 2 \end{bmatrix} = \frac{1}{7}\begin{bmatrix} 7 \\ -35 \\ -35 \end{bmatrix}$…………(1 M) $\Rightarrow \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 1 \\ -5 \\ -5 \end{bmatrix}$ Hence, $x = 1, y = -5, z = -5$……………….(1/2 M)	
36.	(i) P(the plane will not crash) = $P(E_2) = 1 - P(E_1) = 1 - 0.0000001 = 0.9999999$ (ii) P(A | E_1) + P(A | E_2) = $0.95 + 1 = 1.95$ (iii) (a) $P(A) = P(E_1)$P(A | E_1) + $P(E_2)$P(A | E_2) $= 0.0000001 \times 0.95 + 0.9999999 \times 1$ $= 0.000000095 + 0.9999999 = 0.999999995$ **OR** (iii) (b) P(E_2 | A)= $\frac{P(E_2)\text{P(A} \mid E_2)}{P(A)} = \frac{0.9999999}{0.999999995} = \frac{999999900}{999999995}$	
37.	(i) R_4 1 (ii) R_5 1 (iii) (a) R_1 and R_3 1+1 OR (iii) (b) Required pairs to be added to make the relation R_2 as an equivalence relation are: (1,1),(2,2),(3,3),(2,1),(3,1) and (2,3) 2m	
38.	(i) $F = \frac{(40)^2}{500} - \frac{(40)}{4} + 14 = \frac{1600}{500} - 10 + 14 = \frac{16}{5} + 4 = \frac{36}{5}$ (ii) $F = \frac{V^2}{500} - \frac{V}{4} + 14$ $\Rightarrow 1 = \frac{2V}{500}\frac{dV}{dF} - \frac{1}{4}\frac{dV}{dF}$ $\Rightarrow 1 = \left(\frac{2V-125}{500}\right)\frac{dV}{dF}$ $\Rightarrow \frac{dV}{dF} = \frac{500}{2V-125}$ (iii) (a) Let $\frac{dF}{dV} = 0$ $\Rightarrow \frac{2V-125}{500} = 0$ $\Rightarrow 2V = 125$	

	$\Rightarrow V = \frac{125}{2} = 62.5$ km/h Also, $\frac{d^2F}{dV^2} = \frac{1}{125} > 0$ Therefore, V is minimum at $V = 62.5$ km/h **OR** (iii) (b) Given, $\frac{dF}{dV} = -0.01$ $\Rightarrow \frac{2V-125}{500} = -\ 0.01$ $\Rightarrow 2V - 125 = -5$ $\Rightarrow 2V = 120$ $\Rightarrow V = 60$ km/hr Then, $F\ =\ \frac{(60)^2}{500} - \frac{60}{4}\ +\ 14$ $\Rightarrow F = \frac{3600}{500} - 15 + 14$ $\Rightarrow F = \frac{31}{5} = 6.2$ litre/100 km Therefore, Fuel consumption for 600 km is $\frac{6.2}{100} \times 600\ = 37.2$ litres	