CENTRAL KERALA SAHODAYA

MODEL EXAMINATION 2025-26

MATHEMATICS (041)

MARKING SCHEME – SET 1

Qn No.	Answer	Mark
	Section A	
1	a)) $y = \tan^{-1} x$	1
2	b) $-2\ or\ 10$	1
3	a) -2	1
4	c) $3I$	1
5	d) 4	1
6	c) $m \times n$	1
7	d) ± 1	1
8	d) $\sqrt{\pi}$	1
9	a) $k > 1$	1
10	d) $a = \frac{1}{3}, b = -1$	1
11	b) $\frac{\pi}{2} - 1$	1
12	c) $\frac{\pi}{3}$	1
13	c) $(-2,2)$	1
14	a)Orthogonal vectors	1
15	a)$aa' + cc' + 1 = 0$	1
16	c) Z is maximum at (40,15), minimum at (15,20)	1
17	b) $P(A' \cap B') = (1 - P(A))(1 - P(B)$	1
18	d)exists as the inequality $18x + 10y < 134$ does not have any point in common with the feasible region.	1
19	c) A is true but R is false	1
20	a)A and R are true and R is the correct explanation of A	1
	Section B	
21	$-\tan^{-1}\left(-\frac{1}{\sqrt{3}}\right) + \cot^{-1}\left(\frac{1}{\sqrt{3}}\right) + \tan^{-1}\left(\sin\left(-\frac{\pi}{2}\right)\right)$ $= \frac{\pi}{6} + \frac{\pi}{3} - \frac{\pi}{4}$ $= \frac{3\pi}{12}$ $= \frac{\pi}{4}$ OR $-1 \le \sqrt{x-1} \le 1$ $0 \le x - 1 \le 1$ $1 \le x \le 2$	 ½ ½ 1 ½ ½ 1

	$x \in [1,2]$	
22	Let $\vec{a} = 3\hat{\imath} - 2\hat{\jmath} + \hat{k}$ and $\vec{b} = 4\hat{\imath} + 3\hat{\jmath} - 2\hat{k}$ Vector $\vec{c}$ perpendicular to both $\vec{a} \& \vec{b} = \vec{a} \times \vec{b}$ $= \begin{bmatrix} \hat{\imath} & \hat{\jmath} & \hat{k} \\ 3 & -2 & 1 \\ 4 & 3 & -2 \end{bmatrix}$ $= \hat{\imath} + 10\hat{\jmath} + 17\hat{k}$ The unit vector $\hat{c}$in the direction of $\hat{c} = \frac{\hat{c}}{\lvert\hat{c}\rvert}$ $= \frac{\hat{\imath}+10\hat{\jmath}+17\hat{k}}{\sqrt{390}}$. Required vector = $5\hat{c} = 5(\frac{\hat{\imath}+10\hat{\jmath}+17\hat{k}}{\sqrt{390}})$	1 ½ ½
23	$y = (x + \sqrt{x^2 - 1})^2$ $\frac{dy}{dx} = 2\ (x + \sqrt{x^2 - 1})(1 + \frac{1}{2\sqrt{x^2-1}} 2x)$ $= 2\ (x + \sqrt{x^2 - 1})(\frac{\sqrt{x^2-1}+x}{\sqrt{x^2-1}})$ $= 2\frac{(x+\sqrt{x^2-1})^2}{\sqrt{x^2-1}}$ $= \frac{2y}{\sqrt{x^2-1}}$ $(x^2 - 1)(\frac{dy}{dx})^2 = 4y^2$ OR Let $u = \cos^{-1}(2x^2 - 1)$ $Let\ x = cos\theta$ Then $u = \cos^{-1}(2cos^2\theta - 1)$ $= \cos^{-1}(cos2\theta)$ $= 2\theta = 2\cos^{-1} x$ $\therefore \frac{du}{dx} = \frac{-2}{\sqrt{1 - x^2}}$ $Let\ \ v = \cos^{-1} x$ $\therefore \frac{dv}{dx} = -\frac{1}{\sqrt{1 - x^2}}$ $\therefore \frac{du}{dv} = \frac{du}{dx} \times \frac{dx}{du}$ $= 2$	½ ½ ½ ½ ½ ½ ½ ½

24	Given that the function is continuous everywhere. For the function to be continuous at $x = -\frac{\pi}{2}$, the left hand limit and right and limit must be equal. The left hand limit is , LHL = $\lim_{x\to -\frac{\pi}{2}^-} f(x) = \lim_{x\to -\frac{\pi}{2}} -2\, sinx$ $= 2$ The right hand limit is , RHL= $\lim_{x\to -\frac{\pi}{2}^+} f(x) = \lim_{x\to -\frac{\pi}{2}} A\, sinx + B$ $= -A + B$ $\therefore -A + B = 2$______(1) Continuity at $x = \frac{\pi}{2}$ LHL= $\lim_{x\to \frac{\pi}{2}^-} f(x) = \lim_{x\to \frac{\pi}{2}} A\, sinx + B$ $= A + B$ RHL = $\lim_{x\to \frac{\pi}{2}^+} f(x) = \lim_{x\to \frac{\pi}{2}} cosx$ = 0 $\therefore A + B = 0$_______(2) From (1) & (2), $A = -1, B = 1$	½ ½ ½ ½
25	$\int e^x (\frac{\sqrt{1 + sin2x}}{1 + cos2x} dx = \int e^x (\frac{\sqrt{\sin^2 x + \cos^2 x + 2sinxcosx}}{2\cos^2 x} dx.$ $= \int e^x (\frac{\sqrt{(sinx + cosx)^2}}{2\cos^2 x} dx.$ $= \int e^x (\frac{sinx + cosx}{2\cos^2 x} dx.$ $= \int e^x (\frac{1}{2} tanxsecx + \frac{1}{2} secx) dx.$ $= \frac{1}{2} \int e^x (secx + secxtanx) dx$ $= \frac{1}{2} e^x (secx) + c$	½ ½ ½ ½
	SECTION C	
26	Given that $\frac{dA}{dt} = 5mm^2 \& r = 8\ mm$ ie,$\frac{d}{dt}(4\pi r^2) = 5 \Rightarrow 4\pi \times 2r \frac{dr}{dt} = 5$ $\Rightarrow \frac{dr}{dt} = \frac{5}{8\pi r}$ $\therefore \frac{dr}{dt}(at\ r = 8) = \frac{5}{64\pi} mm/s$ Therefore $\frac{dv}{dt} = \frac{d}{dt}\left(\frac{4}{3}\pi r^3\right) = \frac{4}{3}\pi \times \frac{3r^2 dr}{dt}$ $= 20\ mm^3/s.$	½ ½ ½ ½ ½ ½
27	$\lvert x + 1\rvert = \begin{cases} x + 1, if\ x \geq -1 \\ -x - 1, if\ x < -1 \end{cases}$ $\int_{-4}^{2} \lvert x + 1\rvert dx = \int_{-4}^{-1} -(x + 1)dx + \int_{-1}^{2} (x + 1)dx$	1 ½

	$$= [-\frac{x^2}{2} - x]_{-4}^{-1} + [\frac{x^2}{2} + x]_{-1}^{2}$$ $$= 9$$ The value of the integral is **9**. The integral represents the **total area** between the graph of $y = \|x + 1\|$ and the x-axis on the interval $[-4,2]$.	½ 1
	.OR To find the points where the parabola $y = x^2$ *and the line* $y = x$ intersect, set the equations equal to each other and solve for x. $$\boldsymbol{x^2 = x} \Rightarrow x(x-1) = 0$$ $\Rightarrow x = 0$ *or* $x = 1$ ∴ The required area between the curves $y = x^2$ *and* $y = x$ *is* $$A = \int_0^1 x - x^2\, dx$$ $$= [\frac{x^2}{2} - \frac{x^3}{3}]_0^1$$ $$= \frac{1}{2} - \frac{1}{3}$$ $$= \frac{1}{6}\ sq.units$$	1 ½ ½ 1
28	E_1: *Female candidate* E_2: *Male candidate* A: *Candidate have distinction* $P(E_1) = \frac{2}{3}, P(E_2) = \frac{1}{3}$ $P\left(\frac{A}{E_1}\right) = 0.35, P\left(\frac{A}{E_2}\right) = 0.40$ $P(A) = P(E_1)P\left(\frac{A}{E_1}\right) + P(E_2)P(\frac{A}{E_2})$ $$= \frac{2}{3} \times 0.35 + \frac{1}{3} \times 0.40$$ $$= \frac{70 + 40}{300}$$ $$= \frac{11}{30}$$	½ ½ ½ ½ ½ ½
29	Given equation is $\frac{x+2}{3} = \frac{y+1}{2} = \frac{z-3}{2}$ Let $\frac{x+2}{3} = \frac{y+1}{2} = \frac{z-3}{2} = \boldsymbol{\lambda}$ Any point on the given line is of the form $x = 3\boldsymbol{\lambda} - 2, y = 2\boldsymbol{\lambda} - 1, z = 2\boldsymbol{\lambda} + \mathbf{3}$ Therefore the point Q on the line is Q($3\boldsymbol{\lambda} - 2, 2\boldsymbol{\lambda} - ,2\boldsymbol{\lambda} + \mathbf{3}$) According to the problem the distance between P and Q is 5 units. Then we have, $(3\lambda - 3)^2 + (2\lambda - 4)^2 + (2\lambda)^2 = 5^2$ $$17\lambda^2 - 34\lambda = 0 \Rightarrow \lambda = 0,2$$ Therefore the points are $(-2,-1,3)$ & $(4,3,7)$	½ ½ 1 1
	OR $$\vec{r} = (\hat{\imath} + \hat{\jmath} - \hat{k}) + \boldsymbol{\lambda}(2\hat{\imath} - 2\hat{\jmath} + \hat{k}), \hat{r} = (2\hat{\imath} - \hat{\jmath} - 3\hat{k}) + \mu(\hat{\imath} + 2\hat{\jmath} + 2\hat{k})$$ $$b_1 = (2\hat{\imath} - 2\hat{\jmath} + \hat{k}) \& b_2 = (\hat{\imath} + 2\hat{\jmath} + 2\hat{k})$$	½ ½

	The vector perpendicular to the given two lines is $b_1 \times b_2 = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 2 & -2 & 1 \\ 1 & 2 & 2 \end{vmatrix}$ $= -6\hat{i} - 3\hat{j} + 6\hat{k}$ Therefore vector equation of the required line is $\vec{r} = 2\hat{i} - \hat{j} + 3\hat{k} + \boldsymbol{\lambda}(2\hat{i} + \hat{j} - 2\hat{k})$	1 1

30

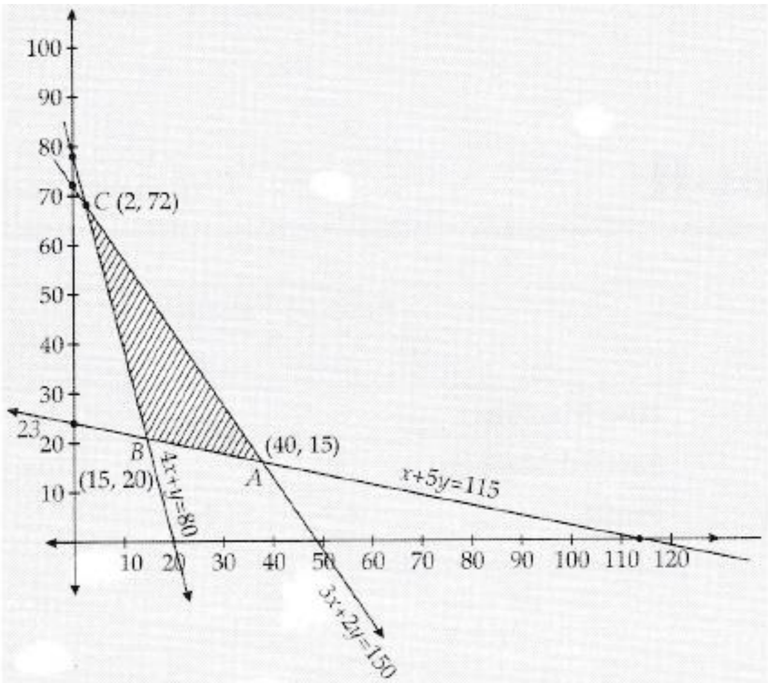
$Z = 6x + 3y$

$4x + y \geq 80$

$x + 5y \geq 115$

$3x + 2y \leq 150$

$x, y \geq 0$



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Corner Points	coordinates	Z = 6x + 3y
A	(15, 20)	150 Minimum
B	(2, 72)	228
C	(40, 15)	285

1

The minimum value of Z is 150 at (15,20)

31

Consider the given function $\sqrt{1 - x^2} + \sqrt{1 - y^2} = a(x - y)$

Let $x = \sin\theta$ and $y = sin\emptyset$

Then the given equation becomes, $\sqrt{1 - \sin^2\theta} + \sqrt{1 - \sin^2\emptyset} = a(sin\theta - sin\emptyset)$ ½

$\Rightarrow \sqrt{\cos^2\theta} + \sqrt{\cos^2\emptyset} = a(sin\theta - sin\emptyset)$ ½

$\therefore cos\theta + cos\emptyset = a(sin\theta - sin\emptyset)$

	$\Rightarrow 2\cos\frac{\theta+\emptyset}{2}\cos\frac{\theta-\emptyset}{2} = 2a\cos\frac{\theta+\emptyset}{2}\sin\frac{\theta-\emptyset}{2}$ $\Rightarrow \frac{\tan(\theta-\emptyset)}{2} = \frac{1}{a}$ $\Rightarrow \frac{\theta-\emptyset}{2} = \tan^{-1}(\frac{1}{a})$ $\Rightarrow \sin^{-1}x - \sin^{-1}y = 2\tan^{-1}\left(\frac{1}{a}\right)$ Differentiate both sides w.r.to x $\frac{1}{\sqrt{1-x^2}} - \frac{1}{\sqrt{1-y^2}} = 0$ $\Rightarrow \frac{1}{\sqrt{1-y^2}}\frac{dy}{dx} = \frac{1}{\sqrt{1-x^2}} \Rightarrow \frac{dy}{dx} = \frac{\sqrt{1-y^2}}{\sqrt{1-x^2}}$ **OR** $e^y(x+1) = 1$ Differentiate both sides w.r.t x $e^y\left(\frac{dy}{dx}\right) \times (x+1) + e^y = 0$ Dividing both sides by e^y, we get $(x+1)\frac{dy}{dx} + 1 = 0$__________(1) Differentiating again w.r.t x, $\frac{dy}{dx} + (x+1)\frac{d^2y}{dx^2} = 0$ $\Rightarrow (x+1)\frac{d^2y}{dx^2} = -\frac{dy}{dx}$ $\Rightarrow \frac{d^2y}{dx^2} = -\frac{1}{x+1}\frac{dy}{dx}$ $\Rightarrow \frac{d^2y}{dx^2} = (\frac{dy}{dx})^2$ (From(1))	½ ½ ½ ½ ½ ½ ½ ½ 1
	SECTION D	
32	$A = \begin{bmatrix} 1 & 2 & -3 \\ 2 & 0 & -3 \\ 1 & 2 & 0 \end{bmatrix}$ $\therefore \lvert A\rvert = -12 \neq 0$ Therefore A is invertible. $Adj\ A = \begin{bmatrix} 6 & -3 & 4 \\ -6 & 3 & 0 \\ -6 & -3 & -4 \end{bmatrix}^T$ $= \begin{bmatrix} 6 & -6 & 6 \\ -3 & 3 & -3 \\ 4 & 0 & -4 \end{bmatrix}$ $\therefore A^{-1} = -\frac{1}{12}\begin{bmatrix} 6 & -6 & 6 \\ -3 & 3 & -3 \\ 4 & 0 & -4 \end{bmatrix}$ The given equations are $x + 2y - 3z = 1$ $2x - 3z = 2$ $x + 2y = 3$ Which can be written in matrix form as	1 1 ½ ½

	$\begin{bmatrix}1 & 2 & -3\\2 & 0 & -3\\1 & 2 & 0\end{bmatrix}\begin{bmatrix}x\\y\\z\end{bmatrix}=\begin{bmatrix}1\\2\\3\end{bmatrix}$ $\begin{bmatrix}x\\y\\z\end{bmatrix}=\begin{bmatrix}1 & 2 & -3\\2 & 0 & -3\\1 & 2 & 0\end{bmatrix}^{-1}\begin{bmatrix}1\\2\\3\end{bmatrix}$ $\begin{bmatrix}x\\y\\z\end{bmatrix}=-\frac{1}{12}\begin{bmatrix}6 & -6 & 6\\-3 & 3 & -3\\4 & 0 & -4\end{bmatrix}\begin{bmatrix}1\\2\\3\end{bmatrix}$ $=\begin{bmatrix}2\\\frac{1}{2}\\\frac{2}{3}\end{bmatrix}$ $\therefore \boldsymbol{x=2, y=\frac{1}{2}, z=\frac{2}{3}}$	1 1
33	Let I= $\int_0^{\pi}\frac{4xsinx}{1+\cos^2 x}dx$________(1) Using the property that $\int_0^a f(x)dx=\int_0^a f(a-x)dx$ Therefore $I=\int_0^{\pi}\frac{4(\pi-x)\sin(\pi-x)}{1+\cos^2(\pi-x)}dx$ $I\ =\int_0^{\pi}\frac{4(\pi-x)\sin x}{1+\cos^2 x}dx$_________(2) $=\int_0^{\pi}\frac{4\pi\sin x}{1+\cos^2 x}dx-\int_0^{\pi}\frac{4xsinx}{1+\cos^2 x}dx$ $=\int_0^{\pi}\frac{4\pi\sin x}{1+\cos^2 x}dx-I$ $2I=\int_0^{\pi}\frac{4\pi\sin x}{1+\cos^2 x}dx$ $I=\frac{1}{2}\times 4\pi\int_0^{\pi}\frac{\sin x}{1+\cos^2 x}dx$ $Let\ cosx=t, sinxdx=-dt$ $If\ x=0, t=1\ and\ if\ x=\pi, t=-1$ So the integral becomes, $2\pi\int_1^{-1}\frac{-dt}{1+t^2}=2\pi\int_{-1}^{1}\frac{dt}{1+t^2}$ $=2\pi(\tan^{-1}t)_{-1}^{1}$ $=2\pi\times\frac{\pi}{2}=\pi^2.$ OR Let I= $\int\frac{1}{x[(logx)^2-3logx-4]}dx$ Let $logx=t, then\frac{1}{x}dx=dt$ Then $I=\int\frac{dt}{t^2-3t-4}$	½ 2 1 1 ½ 1 1

	$$= \int \frac{1}{(t-4)(t+1)}dt$$ Apply integration by partial fraction $\frac{1}{(t-4)(t+1)} = \frac{A}{t-4} + \frac{B}{t-1}$ To solve for A and B we get , $A = \frac{1}{5}$ & $B = -\frac{1}{5}$ $\therefore I = \int \frac{\frac{1}{5}}{t-4}dt + \int \frac{-\frac{1}{5}}{t-1}dt$ $= \frac{1}{5}\log(t-4) - \frac{1}{5}\log(t-1) + C$ $= \frac{1}{5}[\log(logx-4) - \log(logx-1)] + C$ $= \frac{1}{5}[log\left\|\frac{logx-4}{logx-1}\right\| + C$	1 1 2
34	The given differential equation is $(1+x^2)\frac{dy}{dx} + y = e^{\tan^{-1}x}$ The given linear equation can be converted into the form $$\frac{dy}{dx} + Py = Q$$ Divide the equation by $1+x^2, we\ get$ $\frac{dy}{dx} + \frac{y}{1+x^2} = \frac{e^{\tan^{-1}x}}{1+x^2}$, where $P(x) = \frac{1}{1+x^2}$, $Q(x) = \frac{e^{\tan^{-1}x}}{1+x^2}$ Integrating factor, IF=$e^{\int Pdx}$ $= e^{\int \frac{1}{1+x^2}dx}$ $= e^{\tan^{-1}x}$ Therefore solution is, $y(IF) = \int Q(x).(IF)dx + C$ $\therefore y.e^{\tan^{-1}x} = \int \frac{e^{\tan^{-1}x}}{1+x^2}.e^{\tan^{-1}x}\,dx$ $= \int \frac{e^{2\tan^{-1}x}}{1+x^2}dx$ Let $\tan^{-1}x = t, then\ \frac{1}{1+x^2} = dt$ $\therefore \int \frac{e^{2\tan^{-1}x}}{1+x^2}dx = \int e^{2t}dt = \frac{e^{2t}}{2} + c$ $\therefore y.e^{\tan^{-1}x} = \frac{1}{2}[e^{2\tan^{-1}x}] + c$ OR The given differential equation is $2xydy = (x^2+y^2)dx$.__________(1) To solve this homogeneous equation , rewrite the equation into the form $\frac{dy}{dx} = f(\frac{y}{x})$ Divide both sides of eq(1) by dx & $2xy$, we get $\frac{dy}{dx} = \frac{(x^2+y^2)}{2xy} \Rightarrow \frac{dy}{dx} = \frac{1+\left(\frac{y}{x}\right)^2}{2(\frac{x}{y})}$____________(2)	½ 1 1 1 1 ½ 1

	Let $y = vx$ *and differentiate both sides w.r.to x* $\frac{dy}{dx} = v + x\frac{dv}{dx}$________________(3) Equate (2) &(3) $v + x\frac{dv}{dx} = \frac{1+v^2}{2v} \Rightarrow x\frac{dv}{dx} = \frac{1+v^2}{2v} - v = \frac{1-v^2}{2v}$ $\frac{2v}{v^2-1}dv = -\frac{dx}{x}$ Integrate both sides, we get $\log(v^2-1) + logx = logC$ $\Rightarrow(v^2-1)x = C$ $\Rightarrow y^2 - x^2 = cx$	1 1 ½ 1 ½
35	Given L_1: *The line passing through* $(2,-1,1)$ *and parallel to* $\frac{x}{1} = \frac{y}{1} = \frac{z}{3}$ $L_2: \vec{r} = \hat{\imath} + (2\mu+1)\hat{\jmath} - (\mu+2)\hat{k}$ The standard form of given equations of lines are $L_1: \vec{r} = (2\hat{\imath} - \hat{\jmath} + \hat{k}) + \boldsymbol{\lambda}(\hat{\boldsymbol{\imath}} + \hat{\boldsymbol{\jmath}} + \mathbf{3}\hat{\boldsymbol{k}})$ $L_2: \vec{r} = (\hat{\imath} + \hat{\jmath} - 2\hat{k}) + \mu(2\,j - \hat{k})$ $a_1 = (2\hat{\imath} - \hat{\jmath} + \hat{k})$, $b_1 = (\hat{\boldsymbol{\imath}} + \hat{\boldsymbol{\jmath}} + \mathbf{3}\hat{\boldsymbol{k}})$ $a_2 = (\hat{\imath} + \hat{\jmath} - 2\hat{k})$, $b_2 = (2\,j - \hat{k})$ $b_1 \times b_2 = \begin{vmatrix} \hat{\imath} & \hat{\jmath} & \hat{k} \\ 1 & 1 & 3 \\ 0 & 2 & -1 \end{vmatrix}$ $= -7\hat{\imath} + \hat{\jmath} + 2\hat{k}$ $\|b_1 \times b_2\| = \|-7\hat{\imath} + \hat{\jmath} + 2\hat{k}\|$ $= \sqrt{(-7)^2 + 1^2 + 2^2}$ $= \sqrt{54}$ $a_2 - a_1 = (\hat{\imath} + \hat{\jmath} - 2\hat{k}) - (2\hat{\imath} - \hat{\jmath} + \hat{k})$ $= -\hat{\imath} + 2\hat{\jmath} - 3\hat{k}$ Shortest distance= $\left\| \frac{(b_1 \times b_2).(a_2 - a_1)}{\|b_1 \times b_2\|} \right\|$	 1 1 1 ½ ½ 1

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$$= \left|\frac{(-7\hat{\imath} + \hat{\jmath} + 2\hat{k}).(-\hat{\imath} + 2\hat{\jmath} - 3\hat{k})}{\sqrt{54}}\right|$$

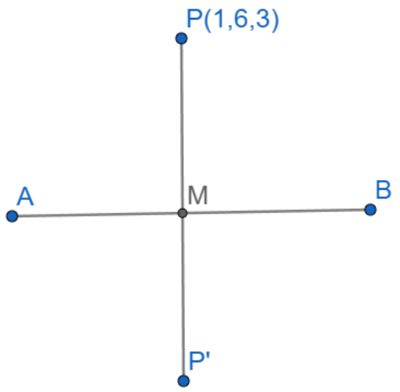
$= \frac{3}{\sqrt{54}}$ units

OR

Let $P(1,6,3)$be the given point.
Let M be the foot of the perpendicular from 'P' to the given line AB.
$\vec{r} = (\hat{\jmath} + 2\hat{k}) + \lambda(\hat{\imath} + 2\hat{\jmath} + 3\hat{k})$--------------(1)

$$\Rightarrow \frac{x-0}{1} = \frac{y-1}{2} = \frac{z-2}{3} = \lambda$$

Then the coordinates of M be $(\lambda, 2\lambda + 1, 3\lambda + 2)$, λ is a scalar.



The direction ratios of PM are :
$<\lambda - 1, 2\lambda + 1 - 6, 3\lambda + 2 - 3>$
Ie, $<\lambda - 1, 2\lambda - 5, 3\lambda - 1>$
And direction ratios of line (1) are <1,2,3>
Now, $PM \perp AB \Rightarrow (\lambda - 1).1 + (2\lambda - 5).2 + (3\lambda - 1).3 = 0$
$\Rightarrow \lambda - 1 + 4\lambda - 10 + 9\lambda - 3 = 0$
$\Rightarrow 14\lambda - 14 = 0$
$\Rightarrow \lambda = 1.$
$\therefore M\ is\ (1,3,5)$
Let $P'((\propto, \beta, \gamma)$ be the image of $P(1,6,3)$, then M is the midpoint of PP'.

$$\therefore \frac{\propto + 1}{2} = 1, \frac{\beta + 6}{2} = 3, \frac{\gamma + 3}{2} = 5 \Rightarrow \propto = 1, \beta = 0, \gamma = 7.$$

Hence the (1,0,7) is the image of $P(1,6,3)$ in given line.
Equation of line joining P & P' is, $\frac{x-1}{0} = \frac{y-6}{-6} = \frac{z-3}{4}$

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1
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$E_1: Event\ that\ a\ person\ has\ TB$

$E_2: Event\ that\ a\ person\ does\ not\ have\ TB$

$A: The\ person\ is\ diagnsed\ to\ have\ TB$

$$P(E_1) = 0.001 = \frac{1}{1000}$$

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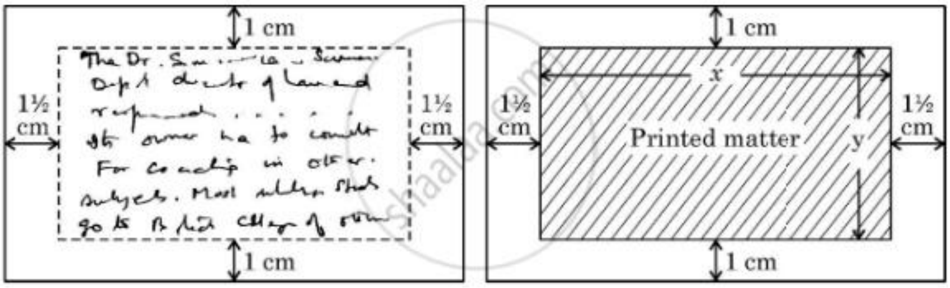
	$P(E_2) = 1 - 0.001 = 0.999 = \frac{999}{1000}$ $P\left(\frac{A}{E_1}\right) = 0.99 = \frac{99}{100}, P\left(\frac{A}{E_2}\right) = 0.001 = \frac{1}{1000}$ a) Number of persons out of 200,000 suffering from TB = $\frac{1}{1000} \times 200,000$ $= 200$ b) Required probability = $P\left(\frac{A}{E_1}\right) = \frac{99}{100}$ c) Required probability = $P\left(\frac{E_1}{A}\right) = \frac{P(E_1)P(\frac{A}{E_1})}{P(E_1)P\left(\frac{A}{E_1}\right)+P(E_2)P(\frac{A}{E_2})}$ $= \frac{\frac{1}{1000}\times\frac{99}{100}}{\frac{1}{1000}\times\frac{99}{100}+\frac{999}{1000}\times\frac{1}{1000}}$ $= \frac{110}{221}$ d) Required probability = $P\left(\frac{A}{E_2}\right) = 0.001$	1 1 1 ½ ½
37	 a) Let $A(x)$be the area of the visiting card then, As $xy = 24$ $A(x) = (x+3)(y+2)$ $= 2x + 3y + xy + 6$ $= 2x + 3\left(\frac{24}{x}\right) + x\left(\frac{24}{x}\right) + 6$ $= 2x + \frac{72}{x} + 30$ b) $A'(x) = 2 - \frac{72}{x^2}$ *and* $A''(x) = \frac{144}{x^3}$ Solving $A'(x) = 0 \Rightarrow 2 - \frac{72}{x^2} = 0$ $\Rightarrow x = 6$ $A''(6) = \frac{144}{6^3} > 0$ $\therefore$ *Area of the card is minimum at* $x = 6$ *and* $y = 4$ The dimension of the card with minimum area is length = 6 cm and breadth= 4 cm	2 2

38	Here $A = \{Nitya, Rohit\}, B = \{1,2,3,4,5,6\}$ a) Number of relations from A to B $= 2^{2\times 6} = 2^{12}$ b) Number of reflexive relations on B= $2^{6^2-6} = 2^{30}$ c) I) $R = \{(1,1),(1,2)(1,3),(1,4),(1,5),(1,6),(2,2),(2,4),(2,6),(3,3),(4,4),(5,5),(6,6)\}$ R is not an equivalence relation as $(1,2) \in R, but\ (2,1) \notin R$ OR II) $P = \{\}, P$ is a null relation. Since null relation is not reflexive, p is not an equivalence relation.	1 1 2 2