

Class-XII

Mathematics(041)

ETB 14
1:2ETB 14
1:2
BOB
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Section - A

1. b b.p 4 ✓

2. b a.p 1 ✓

3. b c.p I - A ✓

4. b ~~a.p~~ I + c.p 1 ✓

5. b d.p 4 ✓

$$\begin{vmatrix} x & 3 & 4 \\ 1 & 2 & 1 \\ 1 & 4 & 1 \end{vmatrix} = x(2-4) - 3(1-1) + 4(4-2) \\
 = -2x + 8 = 0 \\
 2x = 8 \\
 \boxed{x = 4}$$

6. b c.p $2x^{2x} (1 + \log x)$

$$y = x^{2x} \rightarrow \log y = 2x \log x \quad \frac{1}{y} \frac{dy}{dx} = 2(\log x + x \frac{1}{x}) \\
 = 2x^{2x} (\log x + 1)$$

7.4 b.p $x = 1.5$

8.4 ~~b.p~~ d.p $-16x$

$$x = A \cos 4t + B \sin 4t$$

$$\frac{dx}{dt} = -4A \sin 4t + 4B \cos 4t$$

$$\frac{d^2x}{dt^2} = -16A \cos 4t - 16B \sin 4t$$

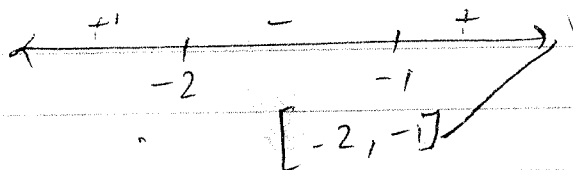
$$= -16(x)$$

9.4 b.p $(-2, -1)$

$$f'(x) = 6x^2 + 18x + 12 = 0$$

$$6(x^2 + 3x + 2) = 0$$

$$6(x+2)(x+1) = 0$$



$$x = A \cos 4t + B \sin 4t$$

$$\frac{dx}{dt} = -4A$$

$$x^2 + 3x + 2$$

$$x^2 + 2x + x + 2$$

$$(x+2)(x+1)$$

$$\int \frac{\sec^2 x}{1 + \tan^2 x} dx = \int \frac{\sec^2 x}{\sec^2 x} dx$$

$$\int \frac{1}{\cos x} dx = \int \frac{1}{\cos x} dx$$

$$\int \frac{1}{1 - \sin x} \cdot \frac{1 + \sin x}{1 + \sin x} dx$$

$$\int \frac{1 + \sin x}{\cos^2 x} dx$$

$$\int \sec^2 x + \int \sec x \tan x$$

$$= \tan x + \sec x + C$$

10.4 b.4 $\sec x + \tan x + C$

11.4 d.4 -2

12.4 b.4 3

$$3 \left(\frac{dy}{dx} \right)^2 \left(\frac{d^2y}{dx^2} \right)$$

13.4 b.4 $\frac{a_1}{b_1} = \frac{a_2}{b_2} = \frac{a_3}{b_3}$

14.4 c.4 7

15.4 a.4 $0, -\frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}$

16.4 d.4 90°

$$-(x-2) \cdot \frac{-(x-2)}{x-2}$$

$$- \int -1 dx$$

$$= \int 1 dx = [x]_{-1}^1$$

$$= [1 - (-1)]$$

$$= [1+1] = 2$$

$$\sqrt{36+4+9} = 7$$

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

$$\frac{x}{\frac{1}{6}} = \frac{y}{-1} = \frac{z}{-4}$$

$$= \frac{1}{2} \cdot \frac{1}{6} \cdot \frac{-1}{3} + \frac{4}{4}$$

$$= \frac{1}{12} - \frac{1}{3} + \frac{1}{4}$$

$$= \frac{1 - 4 + 3}{12} = \frac{0}{12} = 0$$

17.7 C.Y. ~~7~~
8 ✓

18.7 C.Y. 31
32 X

19.7 a.b Both are ~~true~~ and R is correct explanation of A

20.7 d.b A is false but R is true.

20.7 a.b Both ~~A & R~~ are ~~ca~~ and R is correct explanation of A

Section - B

21. $f(x) = \tan^{-1} x$

Domain = $R \setminus \{0\} \cup (-\infty, \infty)$, where, R = set of real numbers

Range = $\left(-\frac{\pi}{2}, \frac{\pi}{2}\right)$

22. $\lim_{x \rightarrow 0^-}$

o.k. LHL

$$\lim_{x \rightarrow 0^-} f(x) = \lim_{x \rightarrow 0^-} \frac{\sin^2 \lambda x}{x^2} = \lim_{h \rightarrow 0} \frac{\sin^2 \lambda(0-h)}{(0-h)^2}$$

$$= \lim_{h \rightarrow 0} \frac{\sin^2 \lambda h}{h^2} \times \frac{\lambda^2}{\lambda^2} = \lambda^2 \lim_{\lambda h \rightarrow 0} \left(\frac{\sin \lambda h}{\lambda h} \right)^2$$
$$= \lambda^2$$

RHL

$$\lim_{x \rightarrow 0^+} f(x) = \lim_{x \rightarrow 0^+} \frac{\sin^2 \lambda x}{x^2} = \lim_{h \rightarrow 0} \frac{\sin^2 \lambda(0+h)}{(0+h)^2}$$

$$= \lim_{h \rightarrow 0} \frac{\sin^2 \lambda h}{h^2} \times \frac{\lambda^2}{\lambda^2} = \lambda^2 \lim_{h \rightarrow 0} \left(\frac{\sin \lambda h}{\lambda h} \right)^2$$

$$= \lambda^2$$

Now,

Put $x=0$, in $f(x) = 1$

As, $f(x)$ is continuous at $x=0$
 $\Rightarrow$ LHL = RHL = $f(0)$

$$\Rightarrow \lambda^2 = 1$$

$$\Rightarrow \boxed{\lambda = \pm 1}$$

$$\text{ans } \lambda = \pm 1$$

23.7

$$\frac{2x}{8} + \frac{y}{8} = \frac{8}{8}$$

$$y = 2$$

$$y = 4$$

$$\frac{x}{4} + \frac{y}{8} = 1$$

Point of intersection

$$x = \frac{1}{2}(8 - y)$$

$$2x + 2 = 8$$

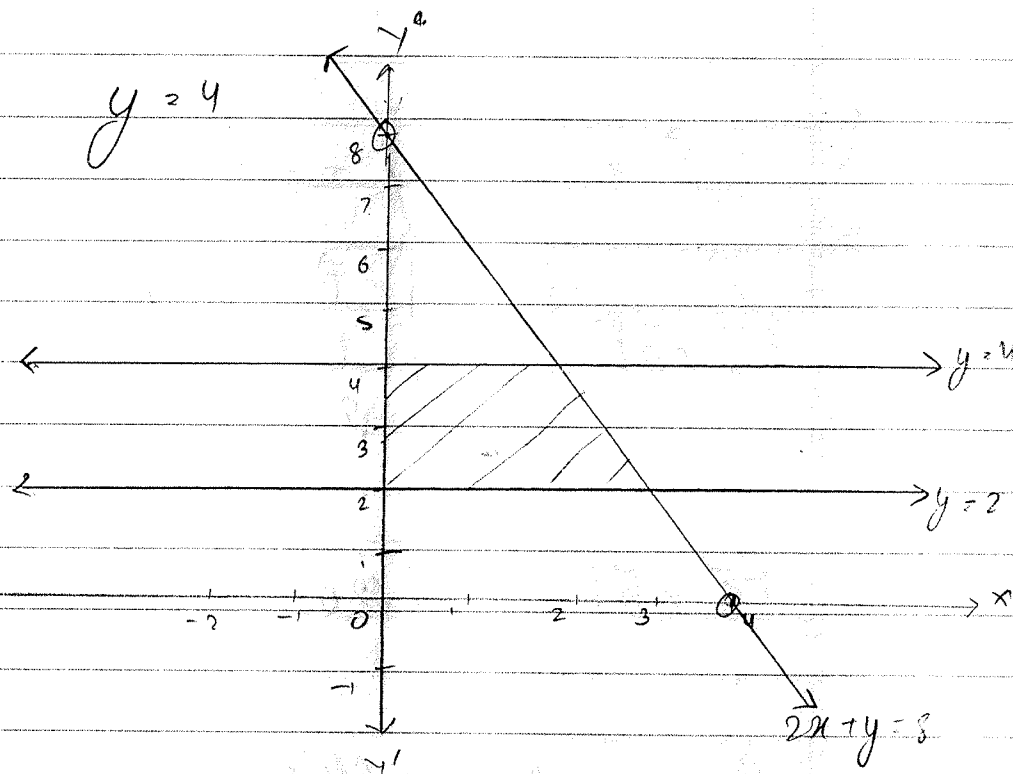
72-

Shaded
area

$$= \int_2^4 \frac{1}{2} (8 - y) dy$$

$$= \frac{1}{2} \left[8y - \frac{y^2}{2} \right]_2^4 = \frac{1}{2} \left[32 - 8 - (16 - 2) \right]$$

$$= \frac{1}{2} [24 - 14] = 5 \text{ sq units}$$

ans 5 sq. unit

24.4
D.P.

$$\vec{a} = \hat{i} - \hat{j} + 3\hat{k}$$

$$\vec{b} = 2\hat{i} - 7\hat{j} + \hat{k}$$

$$\vec{a} \times \vec{b} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 1 & -1 & 3 \\ 2 & -7 & 1 \end{vmatrix} = \hat{i}(-1+21) - \hat{j}(1-6) + \hat{k}(-7+2)$$

$$= 20\hat{i} + 5\hat{j} - 5\hat{k}$$

$$|\vec{a} \times \vec{b}| = \sqrt{(20)^2 + (5)^2 + (-5)^2} = \sqrt{400 + 25 + 25} = \sqrt{450}$$

$$= 15\sqrt{2}$$

Area of parallelogram = $|\vec{a} \times \vec{b}| = 15\sqrt{2}$ sq. units

25.4

$$A(1, 2, -1)$$

$$5x - 25 = 14 - 7y = 35z$$

$$\frac{x-5}{\left(\frac{1}{5}\right)} = \frac{y-2}{\left(\frac{-1}{7}\right)} = \frac{z}{\left(\frac{1}{35}\right)}$$

Required line is

$$\vec{r} = (\hat{i} + 2\hat{j} - \hat{k}) + \lambda \left(\frac{1}{5}\hat{i} - \frac{1}{7}\hat{j} + \frac{1}{35}\hat{k} \right)$$

$$\text{or } \vec{r} = (\hat{i} + 2\hat{j} - \hat{k}) + \lambda (7\hat{i} - 5\hat{j} + 1\hat{k})$$

Cartesian equation:

$$\frac{x-1}{7} = \frac{y-2}{-5} = \frac{z+1}{1}$$

Section - C

26th

$$A = \begin{bmatrix} 1 & 2 & 3 \\ 3 & -2 & 1 \\ 4 & 2 & 1 \end{bmatrix}$$

$$A^2 = \begin{bmatrix} 1 & 2 & 3 \\ 3 & -2 & 1 \\ 4 & 2 & 1 \end{bmatrix} \begin{bmatrix} 1 & 2 & 3 \\ 3 & -2 & 1 \\ 4 & 2 & 1 \end{bmatrix} = \begin{bmatrix} 1+6+12 & 2-4+6 & 3+2+3 \\ 3-6+4 & 6+4+2 & 9-2+1 \\ 4+6+4 & 8-4+2 & 12+2+1 \end{bmatrix}$$

$$A^2 = \begin{bmatrix} 19 & 4 & 8 \\ 1 & 12 & 8 \\ 14 & 6 & 15 \end{bmatrix}$$

$$A^3 = A^2 \times A$$

$$A^3 = \begin{bmatrix} 1 & 2 & 3 \\ 3 & -2 & 1 \\ 4 & 2 & 1 \end{bmatrix} \begin{bmatrix} 19 & 4 & 8 \\ 1 & 12 & 8 \\ 14 & 6 & 15 \end{bmatrix} = \begin{bmatrix} 19+2+42 & 4+24+18 & 8+16+45 \\ 57-2+14 & 12-24+6 & 24-16+15 \\ 76+2+14 & 12+24+6 & 32+16+15 \end{bmatrix}$$

$$A^3 = \begin{bmatrix} 63 & 46 & 69 \\ 69 & 0 & 23 \\ 92 & 54 & 63 \end{bmatrix}$$

$$A^3 = \begin{bmatrix} 63 & 46 & 69 \\ 69 & -6 & 23 \\ 92 & 46 & 63 \end{bmatrix}$$

LHS

$$= A^3 - 23A - 40I = \begin{bmatrix} 63 & 48 & 69 \\ 69 & 0 & 23 \\ 92 & 54 & 63 \end{bmatrix} - 23 \begin{bmatrix} 1 & 2 & 3 \\ 3 & -2 & 1 \\ 4 & 2 & 1 \end{bmatrix} - 40 \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

$$= \begin{bmatrix} 63 & 48 & 69 \\ 69 & 0 & 23 \\ 92 & 54 & 63 \end{bmatrix} - \begin{bmatrix} 23 & 46 & 69 \\ 69 & -46 & 23 \\ 92 & 46 & 23 \end{bmatrix}$$

LHS

$$= A^3 - 23A - 40I = \begin{bmatrix} 63 & 46 & 69 \\ 69 & -6 & 23 \\ 92 & 46 & 63 \end{bmatrix} - \begin{bmatrix} 23 & 46 & 69 \\ 69 & -46 & 23 \\ 92 & 46 & 23 \end{bmatrix} - \begin{bmatrix} 40 & 0 & 0 \\ 0 & 40 & 0 \\ 0 & 0 & 40 \end{bmatrix}$$

$$= \begin{bmatrix} 63 - 23 - 40 & 46 - 46 & 69 - 69 \\ 69 - 69 & -6 + 46 - 40 & 23 - 23 \\ 92 - 92 & 46 - 46 & 63 - 23 - 40 \end{bmatrix} = \begin{bmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix}$$

$$= 0 = RHS$$

Hence proved

27.4

Q.4

$$y = \tan x + \sec x$$

$$\frac{dy}{dx} = \sec^2 x + \sec x \tan x = \sec x (\sec x + \tan x)$$

$$\begin{aligned} \frac{d^2 y}{dx^2} &= \sec x \tan x (\sec x + \tan x) + \sec x (\sec x \tan x + \sec^2 x) \\ &= \sec^2 x \tan x + \sec x \tan^2 x + \sec^2 x \tan x + \sec^3 x \end{aligned}$$

27.6

Q.6

Let,

$$y = \sec^{-1} \left(\frac{1}{\sqrt{1-x^2}} \right)$$

$$\text{Let, } x = \sin \theta$$

$$y = \sec^{-1} \left(\frac{1}{\sqrt{1-\sin^2 \theta}} \right)$$

$$y = \sec^{-1} (\sec \theta)$$

$$t = \sin^{-1} (2x\sqrt{1-x^2})$$

$$\text{Let } x = \sin \theta$$

$$t = \sin^{-1} (2 \sin \theta \sqrt{1-\sin^2 \theta})$$

$$t = \sin^{-1} (\sin 2\theta)$$

$$y = \theta$$

$$y = \sin^{-1} x$$

$$\frac{dy}{dx} = \frac{1}{\sqrt{1-x^2}}$$

$$\frac{dy}{dt} = \frac{dy/dx}{dt/dx} = \frac{1}{\sqrt{1-x^2}} \cdot \frac{\sqrt{1-x^2}}{2} = \frac{1}{2}$$

$$t = 2\theta$$

$$t = 2 \sin^{-1} x$$

$$\frac{dt}{dx} = \frac{2}{\sqrt{1-x^2}}$$

ans $\frac{1}{2}$

28.10
Q.10

$$I = \int_0^{2\pi} \frac{1}{1 + e^{\sin x}} dx \quad \text{--- (1)}$$

$$I = \int_0^{2\pi} \frac{1}{1 + e^{\sin(2\pi-x)}} dx$$

$$\left\{ \because \int_0^a f(x) dx = \int_0^a f(a-x) dx \right\}$$

$$I = \int_0^{2\pi} \frac{1}{1 + e^{-8\sin x}} dx = \int_0^{2\pi} \frac{e^{8\sin x}}{1 + e^{8\sin x}} dx \quad \text{--- (I)}$$

(I) + (II)

$$2I = \int_0^{2\pi} \frac{1 + e^{8\sin x}}{1 + e^{8\sin x}} dx = \int_0^{2\pi} 1 dx$$

$$2I = [x]_0^{2\pi}$$

$$2I = 2\pi$$

$$I = \pi$$

ans π

29.4

$$y^2 \leq 2x$$

$$y^2 = 2x$$

$$y > x - 4$$

$$y = x - 4$$

$$x - y = 4$$

$$\frac{x}{4} + \frac{y}{-4} = 1$$

Point of intersection

$$y^2 = 2x$$

$$y = x - 4$$

$$x = y + 4$$

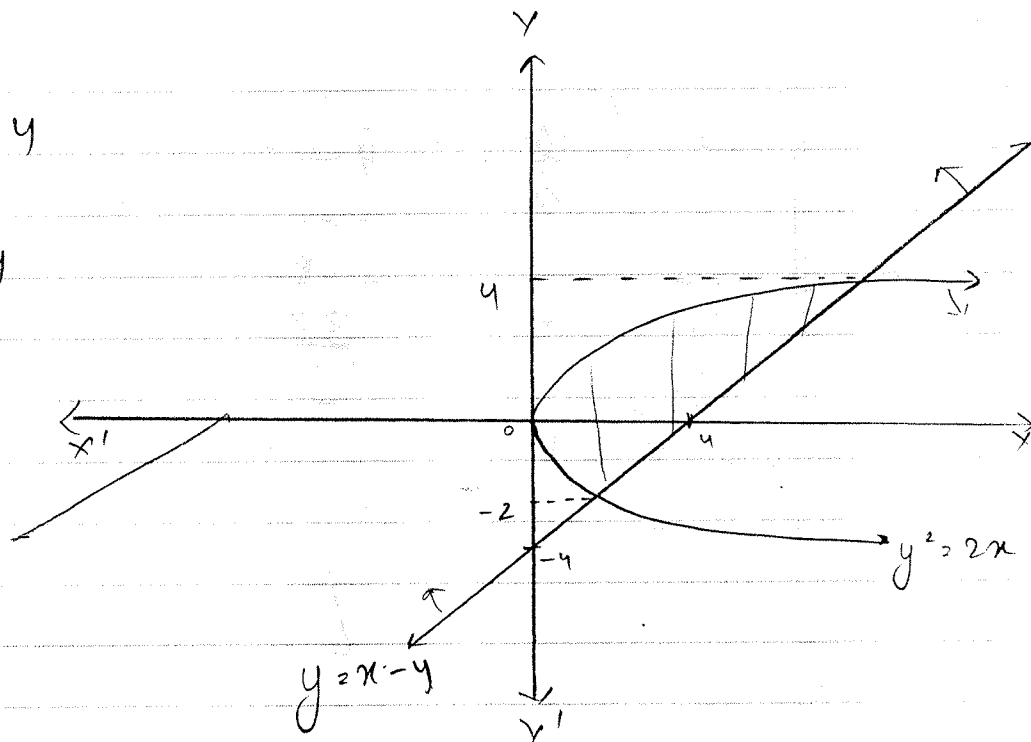
$$y^2 = 2(y + 4)$$

$$y^2 = 2y + 8 \Rightarrow y^2 - 2y - 8 = 0$$

$$(y - 4)(y + 2) = 0$$

$$y = -2, 4$$

$$\text{Required area} = \int_{-2}^4 (y + 4) dy - \int_{-2}^4 \frac{y^2}{2} dy$$



$$= \left[\frac{y^2}{2} - 4y - \frac{y^3}{6} \right]_{-2}^4$$

$$= \left[8 + 16 - \frac{32}{3} - \left(2 - 8 + \frac{4}{3} \right) \right]$$

$$= \left[24 - \frac{32}{3} + 6 - \frac{4}{3} \right] = \left[30 - \frac{36}{3} \right]$$

$$= \left[30 - 12 \right] = 18 \text{ sq unit}$$

ans 18 sq unit

30.4

b.p

Given, $|\vec{a}| = 3$ $|\vec{b}| = 4$ $|\vec{c}| = 2$

$$(\vec{a} + \vec{b} + \vec{c}) = \vec{0}$$

squaring,

$$(\vec{a} + \vec{b} + \vec{c})^2 = 0$$

$$\Rightarrow (\vec{a} + \vec{b} + \vec{c}) \cdot (\vec{a} + \vec{b} + \vec{c}) = 0$$

$$\Rightarrow \vec{a}^2 + \vec{b}^2 + \vec{c}^2 + \vec{a} \cdot \vec{b} + \vec{b} \cdot \vec{c} + \vec{a} \cdot \vec{c} + \vec{b} \cdot \vec{a} + \vec{c} \cdot \vec{b} + \vec{c} \cdot \vec{a} = 0$$

$$\vec{a}^2 + \vec{b}^2 + \vec{c}^2 + 2\vec{a} \cdot \vec{b} + 2\vec{b} \cdot \vec{c} + 2\vec{a} \cdot \vec{c} = 0$$

$$|\vec{a}|^2 + |\vec{b}|^2 + |\vec{c}|^2 + 2(\vec{a} \cdot \vec{b} + \vec{b} \cdot \vec{c} + \vec{c} \cdot \vec{a}) = 0$$

$$9 + 16 + 4 + 2(\vec{a} \cdot \vec{b} + \vec{b} \cdot \vec{c} + \vec{c} \cdot \vec{a}) = 0$$

$$2\mu = -29$$

$$\mu = \frac{-29}{2}$$

$$\text{ans } \frac{-29}{2}$$

31.4 Given lines are parallel lines

$$\vec{a}_1 = \hat{i} + 2\hat{j} - 4\hat{k}$$

$$\vec{b} = (2\hat{i} + 3\hat{j} + 6\hat{k})$$

$$\vec{a}_2 = 3\hat{i} + 3\hat{j} - 5\hat{k}$$

$$d = \frac{|(\vec{a}_2 - \vec{a}_1) \times \vec{b}|}{|\vec{b}|}$$

$$\vec{a}_2 - \vec{a}_1 = 2\hat{i} + \hat{j} - \hat{k}$$

$$|\vec{b}| = \sqrt{4 + 9 + 36} = 7$$

$$\begin{array}{r} 196 \\ 81 \\ 16 \\ \hline 7 \overline{) 293} \\ 28 \\ \hline 13 \end{array}$$

distance between lines,

$$d = \frac{|(\vec{a}_2 - \vec{a}_1) \times \vec{b}|}{|\vec{b}|}$$

$$\begin{aligned} (\vec{a}_2 - \vec{a}_1) \times \vec{b} &= \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 2 & 1 & -1 \\ 2 & 3 & 6 \end{vmatrix} \\ &= \hat{i}(6 + 3) - \hat{j}(12 + 2) + \hat{k}(6 - 2) \\ &= 9\hat{i} - 14\hat{j} + 4\hat{k} \end{aligned}$$

$$|(\vec{a}_2 - \vec{a}_1) \times \vec{b}| = \sqrt{81 + 196 + 16} = \sqrt{293}$$

$$d = \frac{\sqrt{293}}{7} \text{ unit}$$

Section - D

32.

b. Let numbers be x & y

ATQ,

$$x + y = 5$$

then, sum of cubes,
let,

$$\Rightarrow y = (5 - x)$$

$$C = x^3 + y^3$$

$$\text{minimize} \rightarrow C = x^3 + (5 - x)^3$$

$$\frac{dC}{dx} = 3x^2 + 3(5 - x)^2(-1)$$

$$= 3x^2 - 3(5 - x)^2$$

$$= 3x^2 - 3(25 + x^2 - 10x)$$

$$\frac{dC}{dx} = 3x^2 - 75 - 3x^2 + 30x$$

$$\frac{75 + 5}{30 \times 2}$$

$$\frac{dC}{dx} = 30x - 75$$

Put

$$\frac{dC}{dx} = 0$$

$$30x - 75 = 0$$

$$x = \frac{75}{30} = \frac{5}{2}$$

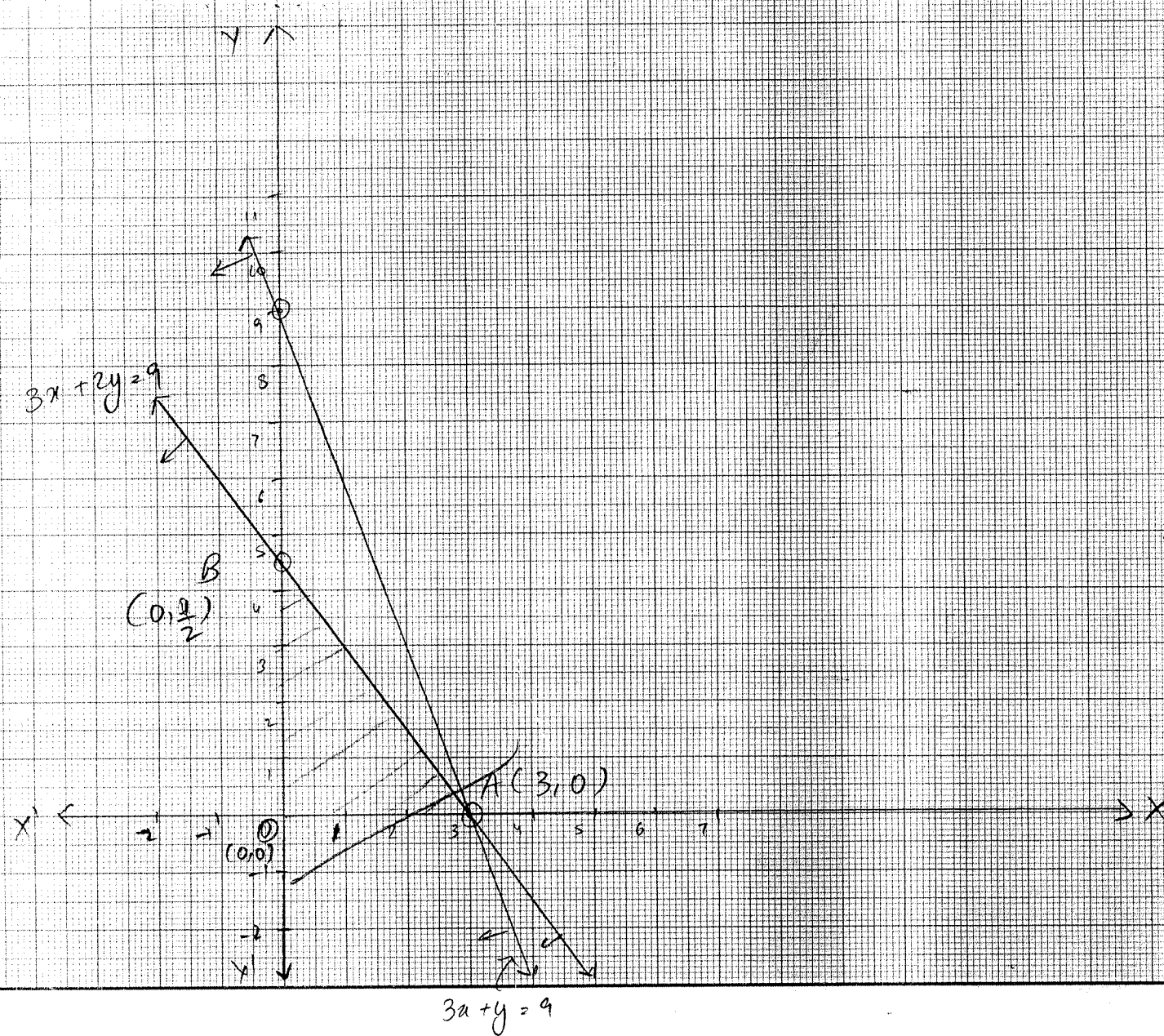
$$x = \frac{5}{2}$$

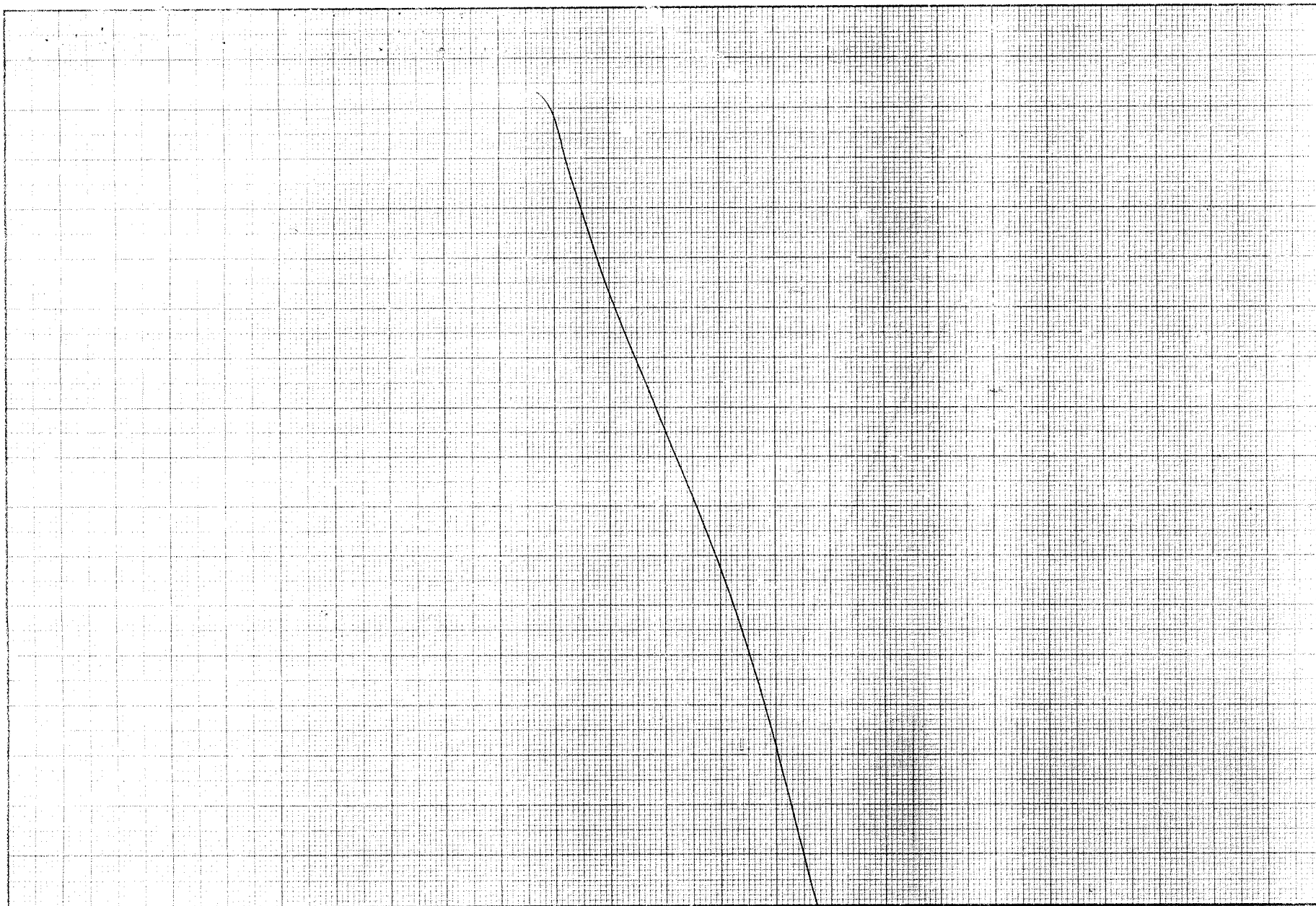
$$\frac{d^2C}{dx^2} = 30 > 0 \quad \frac{d^2C}{dx^2} \bigg|_{x = \frac{5}{2}} = 30 > 0$$

∴ Sum of cubes is least when $x = \frac{5}{2}$ & $y = \frac{5}{2}$

$$\therefore \text{Sum of squares} = x^2 + y^2 = \frac{25}{4} + \frac{25}{4} = \frac{25}{2}$$

$$\underline{\underline{\text{ans } \frac{25}{2}}}$$





33.7

$$I = \int_0^{\pi/2} \sin x \tan^{-1}(\sin x) dx = \int_0^{\pi/2} 2 \sin x \cos x \tan^{-1}(\sin x) dx$$

$$\text{let, } \sin x = t \quad \Rightarrow \quad dt = \cos x dx$$

$$I = 2 \int_0^1 t \tan^{-1}(t) dt$$

$$\text{let } I_1 = \int_0^1 t \tan^{-1} t dt$$

$$I_1 = \tan^{-1} t \cdot \frac{t^2}{2} - \frac{1}{2} \int \frac{t^2 + 1 - 1}{1 + t^2} dt = \frac{t^2}{2} \tan^{-1} t - \frac{1}{2} \left(1 - \frac{1}{1 + t^2} \right) dt$$

$$I_1 = \frac{t^2}{2} \tan^{-1} t - \frac{t}{2} + \frac{1}{2} \tan^{-1} t + C$$

$$I = 2 \left[\frac{t^2}{2} \tan^{-1} t - \frac{t}{2} + \frac{1}{2} \tan^{-1} t \right]_0^1$$

$$= 2 \left[\frac{1}{2} \tan^{-1}(1) - \frac{1}{2} + \frac{1}{2} \tan^{-1}(1) - \left(0 - 0 + \frac{1}{2} \tan^{-1}(0) \right) \right]$$

$$I = 2 \left(\frac{\pi}{8} - \frac{1}{2} + \frac{\pi}{8} \right) = 2 \left(\frac{\pi}{4} - \frac{1}{2} \right)$$

$$I = \frac{\pi}{2} - 1$$

$$\text{ans } \frac{\pi-2}{2} \quad \text{or} \quad \frac{1}{2}(\pi-2)$$

34.6

$$P = 70x + 40y$$

Subject to constraints

$$3x + 2y \leq 9$$

$$3x + y \leq 9$$

$$x \geq 0$$

$$y \geq 0$$

$$3x + 2y = 9$$

$$3x + y = 9$$

$$\frac{x}{3} + \frac{y}{\left(\frac{9}{2}\right)} = 1$$

$$\frac{x}{3} + \frac{y}{9} = 1$$

Corner points are $O(0,0)$, $A(3,0)$, $B(0, \frac{9}{2})$

Put $O(0,0)$ in $P = 70(0) + 40(0) = 0$

Put $A(3,0)$ in $P: P = 210 \leftarrow \text{Maximum}$

Put $B(0, \frac{9}{2})$ in $P: P = \cancel{180}$

$\therefore$ Maximum value of P is 210 at $\cancel{(3,0)}$

35% a.k. let,

E : He answered correctly

H_1 : He knows the answer

H_2 : He guesses the answer

$$P(H_1) = \frac{3}{5}$$

$$P(H_2) = \frac{2}{5}$$

$$P(E|H_1) = 1 \quad P(E|H_2) = \frac{1}{3}$$

From Bayes Theorem

$$P(H_1|E) = \frac{P(H_1) P(E|H_1)}{P(H_1) P(E|H_1) + P(H_2) P(E|H_2)}$$

$$P(H_1|E) = \frac{\frac{3 \times 1}{5}}{\frac{3 \times 1}{5} + \frac{2 \times 1}{3}} = \frac{3}{3 + \frac{2}{3}}$$

$$= \frac{3}{\frac{9+2}{3}}$$

$$P(H_1|E) = \frac{9}{11}$$

ans $\frac{9}{11}$

Section - E

Q. 1. Total possible relations from B to A = $2^{3 \times 2} = 2^6 = 64$

total functions from B to A = $2^3 = 8$

Ans

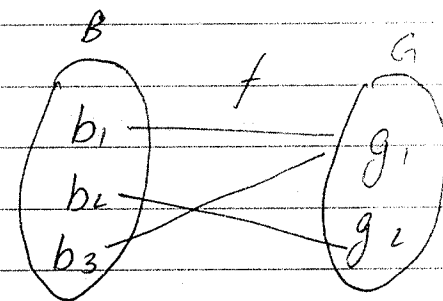
III → 2nd option

$$f = \{(b_1, g_1), (b_2, g_2), (b_3, g_1)\}$$

It is not bijective as

$$f(b_1) = g_1 \quad \& \quad f(b_3) = g_1$$

As $f(b_1) = f(b_3)$
through $b_1 \neq b_3$



∴ It is not one one as ~~for~~ b_1 & b_3 are related to same element g_1

As it is not one one, hence it is not bijective

37.4

1.4. At, cost of: 1 pen = ₹ x
 1 bag = ₹ y
 1 instrument box = ₹ z

then, ATO,

$$\begin{aligned} 3x + 5x + 3y + z &= 160 \\ 2x + y + 3z &= 190 \\ x + 2y + 4z &= 250 \end{aligned}$$

Given system of equations can be written as,

$$\underbrace{\begin{bmatrix} 5 & 3 & 1 \\ 2 & 1 & 3 \\ 1 & 2 & 4 \end{bmatrix}}_A \underbrace{\begin{bmatrix} x \\ y \\ z \end{bmatrix}}_X = \underbrace{\begin{bmatrix} 160 \\ 190 \\ 250 \end{bmatrix}}_B$$

$$A, \begin{bmatrix} 5 & 3 & 1 \\ 2 & 1 & 3 \\ 1 & 2 & 4 \end{bmatrix} \quad A X = B \quad X = \begin{bmatrix} x \\ y \\ z \end{bmatrix} \quad B = \begin{bmatrix} 160 \\ 190 \\ 250 \end{bmatrix}$$

ii-y

$$|A| = 5(4-6) - 3(8-3) + 1(4-1)$$

$$= -10 - 15 + 3$$

$$|A| = -22 \neq 0 \quad \therefore A^{-1} \text{ exists}$$

iii-y

$$A_{11} = -2$$

$$A_{21} = -10$$

$$A_{31} = 8$$

$$A_{12} = -5$$

$$A_{22} = 19$$

$$A_{32} = -13$$

$$A_{13} = 3$$

$$A_{23} = -7$$

$$A_{33} = -1$$

$$\text{adj}(A) = \begin{bmatrix} -2 & -5 & 3 \\ -10 & 19 & -7 \\ 8 & -13 & -1 \end{bmatrix}^T = \begin{bmatrix} -2 & -10 & 8 \\ -5 & 19 & -13 \\ 3 & -7 & -1 \end{bmatrix}$$

$$A^{-1} = \frac{1}{|A|} \text{adj}(A) = \frac{-1}{22} \begin{bmatrix} -2 & -10 & 8 \\ -5 & 19 & -13 \\ 3 & -7 & -1 \end{bmatrix}$$

$$A^{-1} = \frac{1}{22} \begin{bmatrix} 2 & 10 & -8 \\ 5 & -19 & 13 \\ -3 & 7 & 1 \end{bmatrix}$$

38.

I.

$$(x^2 - y^2) dx + 2xy dy = 0$$

$$2xy dy = -(x^2 - y^2) dx$$

$$\frac{dy}{dx} = \frac{-(x^2 - y^2)}{2xy} \quad \div \text{ Numerator \& Denominator by } x^2$$

$$\frac{dy}{dx} = \frac{-\left(1 - \left(\frac{y}{x}\right)^2\right)}{2\left(\frac{y}{x}\right)}$$

$$\frac{dy}{dx} = \frac{\left(\frac{y}{x}\right)^2 - 1}{2\left(\frac{y}{x}\right)} = g\left(\frac{y}{x}\right)$$

II. b

Let

$$v = \frac{y}{x}$$

⇒

$$y = xv$$

$$\frac{dy}{dx} = x \frac{dv}{dx} + v$$

⇒

$$v + x \frac{dv}{dx} = \frac{v^2 - 1}{2v}$$

$$x \frac{dv}{dx} = \frac{v^2 - 1}{2v} - v = \frac{v^2 - 1 - 2v^2}{2v}$$

$$x \frac{dv}{dx} = \frac{-1 - v^2}{2v} = -\frac{(v^2 + 1)}{2v}$$

$$\frac{2v}{v^2 + 1} dv = -\frac{1}{x} dx$$

Integrating both sides,

$$\log |v^2 + 1| = -\log |x| + \log |c|$$

$$\log |v^2 + 1| = \log \left| \frac{c}{x} \right|$$

$$V^2 + 1 = \frac{C}{\kappa}$$

$$\frac{y^2}{x^2} + 1 = \frac{C}{\kappa}$$

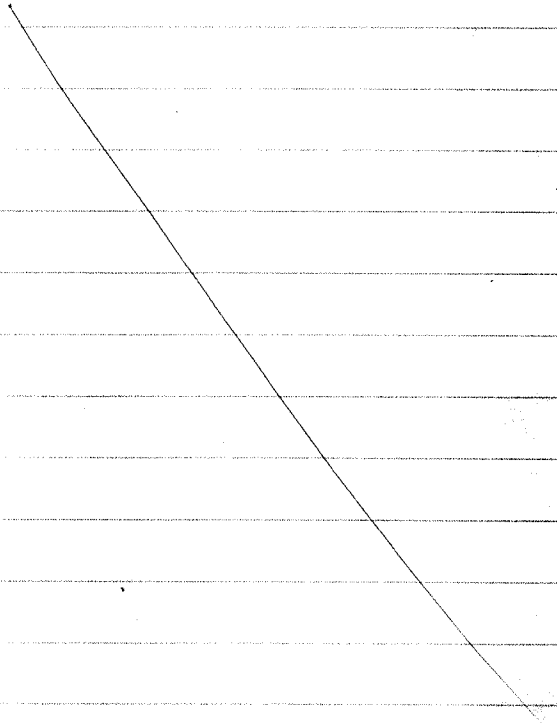
$$\frac{y^2}{x} + x = C$$

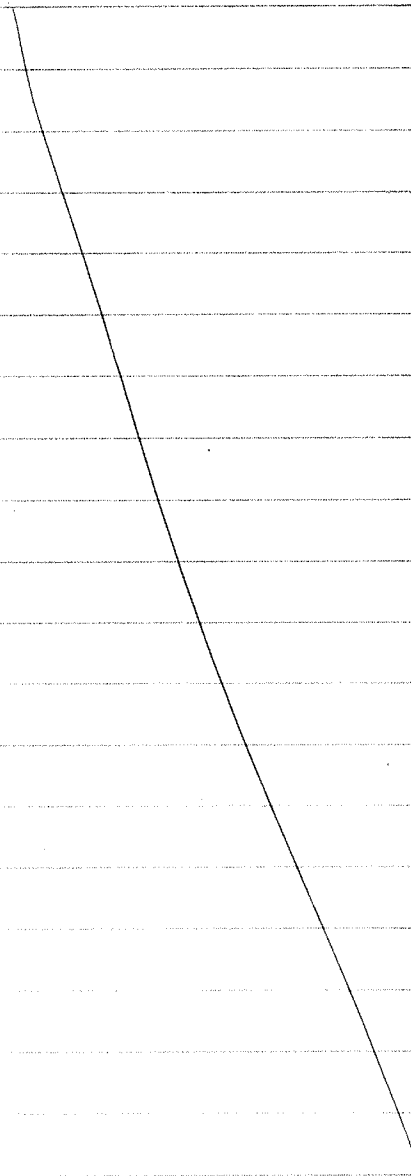
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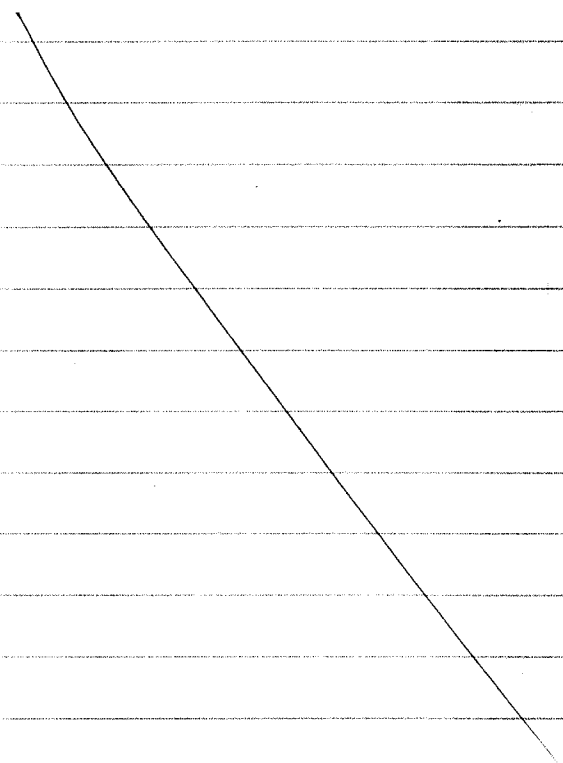
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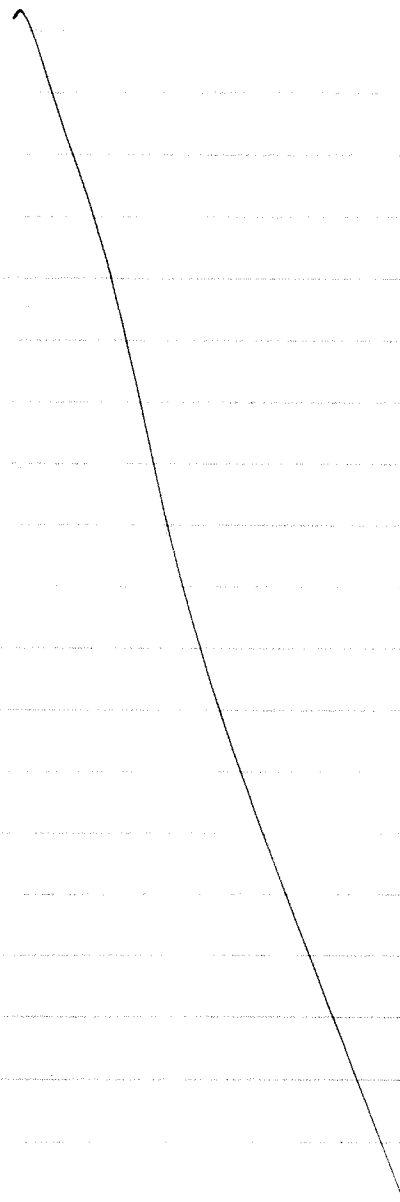
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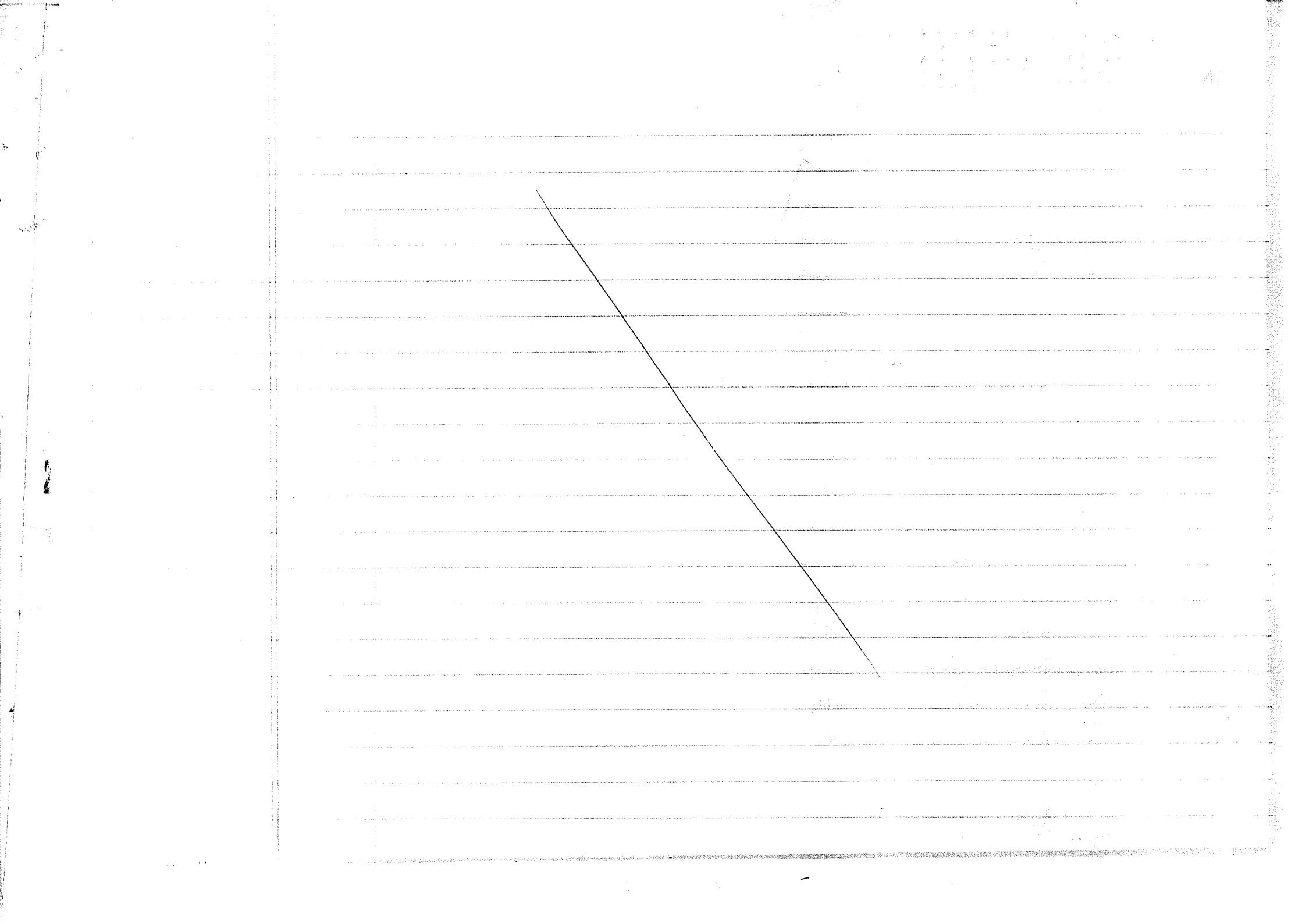
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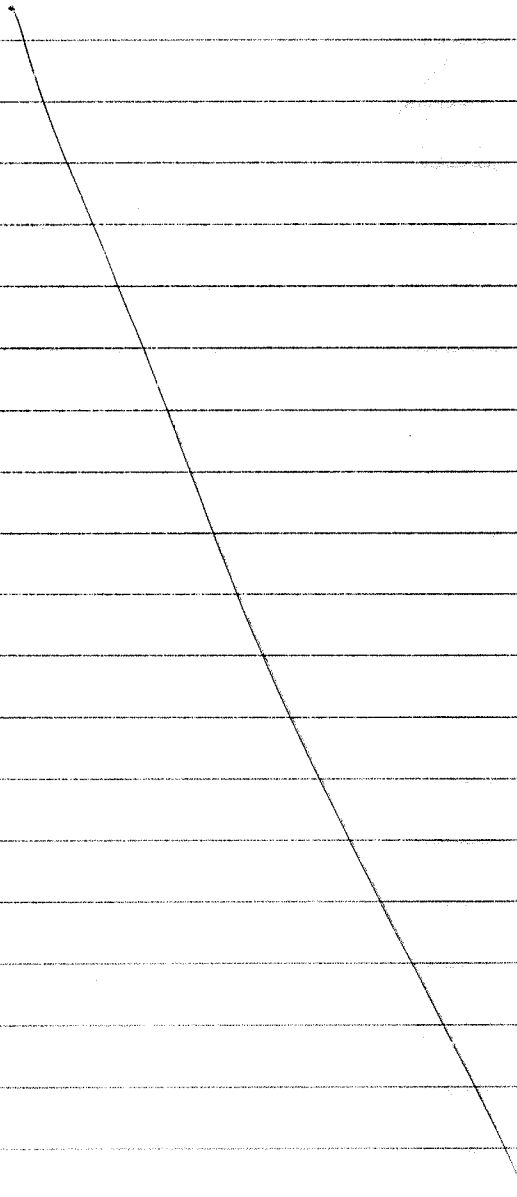


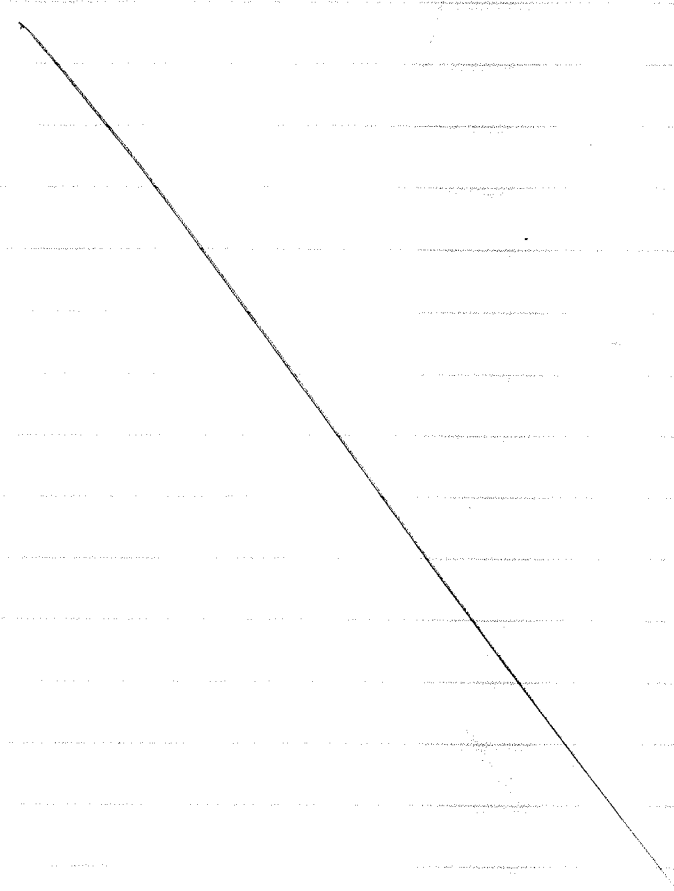




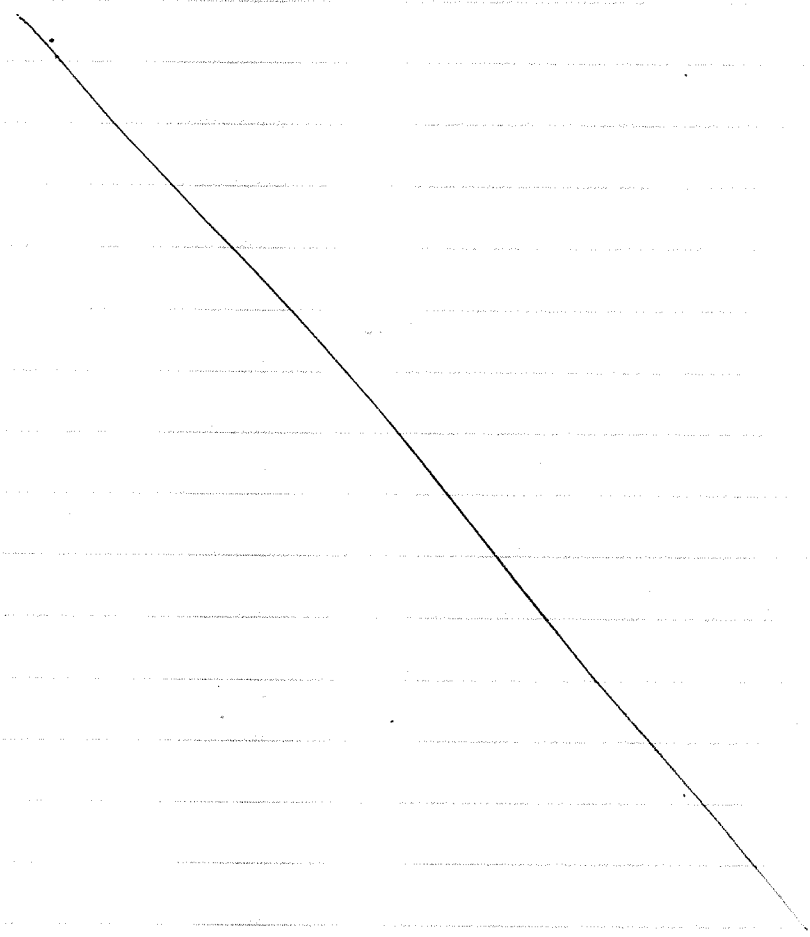








1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100



1

Rough

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

$$\frac{x}{\frac{1}{6}} = \frac{y}{-\frac{1}{4}} = \frac{z}{-\frac{1}{4}}$$

$$= \frac{1}{12} - \frac{1}{3} + \frac{1}{4} = \frac{1-4+3}{12} = 0$$

$$I = \int_1^8 \sqrt{10-(10-x)} = \int_2^8 \frac{\sqrt{x}}{\sqrt{10-x} + \sqrt{x}} dx$$

$$2I = \int_2^8 \frac{\sqrt{x} + \sqrt{10-x}}{\sqrt{x} + \sqrt{10-x}} dx = \int_2^8 1 dx = 8-2 = \frac{6}{2} = 3$$

$$\tan^{-1}(\sin x) - \frac{\cos 2x}{2}$$

$$+ \int \frac{\cos x \cdot \cos 2x}{1+\sin^2 x} dx$$

$$2 \sin x \cos x \tan^{-1} \sin x$$

$$2 \int_0^1 \frac{t \tan^{-1} t}{1+t^2} dt$$

$$\tan^{-1} t \left(\frac{1}{2} \right)$$

$$-\frac{1}{2} \int \frac{1+t^2}{1+t^2} dt$$

2023