

केंद्रीय विद्यालय संगठन, अहमदाबाद संभाग
KENDRIYA VIDYALAYA SANGATHAN, AHMEDABAD REGION
 प्रथम प्री-बोर्ड परीक्षा 2025 - 26
PRE BOARD-I 2025-26

SUBJECT: MATHEMATICS (041)
CLASS: XI

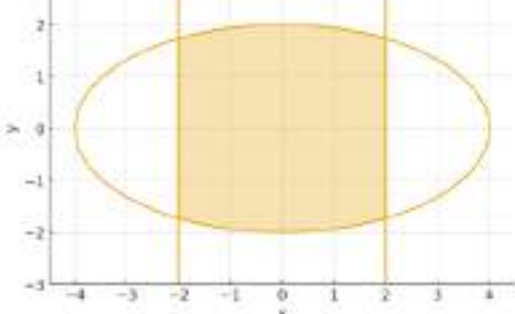
SET-1 (B)
ANSWER KEY

M.M.: 80
TIME: 3 HOURS

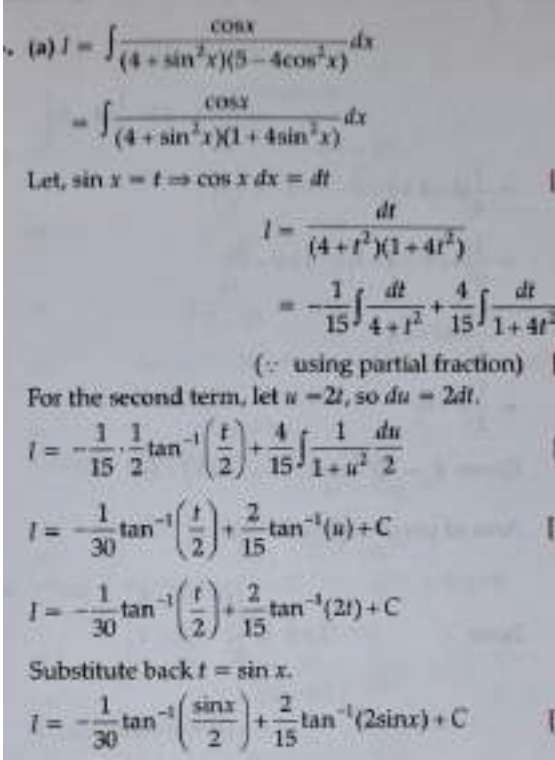
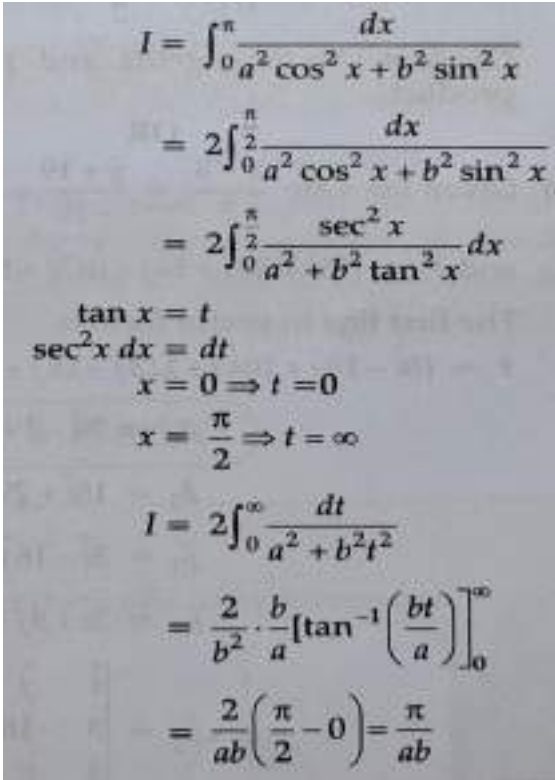
SECTION A

1	(b) 0	1
2	(c) (3,3)	1
3	(d) $q=3p$	1
4	(c) 12	1
5	(c) $\frac{\pi}{3}$	1
6	(c) $\frac{2}{3}$	1
7	(b) 64	1
8	(d) $R - \{4\}$	1
9	(d) a scalar matrix	1
10	(b) =1	1
11	(a) 8	1
12	(c) $-2\sqrt{\pi}$	1
13	(b) 2	1
14	(d) $(2, \infty)$	1
15	(b) $\tan (xe^x) + C$	1
16	(b) $\vec{a} \perp \vec{b}$	1
17	(d) (4,0)	1
18	(c) $\frac{\pi}{3}$	1
19	(d) Assertion(A) is false but reason(R) is true	1
20	(c) Assertion (A) is true but reason(R) is false.	1

	SECTION B	
21	Substitute $x = \tan(\theta)$ $\sin^{-1}\left(\frac{\tan \theta}{\sec \theta}\right) =$ $\sin^{-1}(\sin \theta) = \theta$ $= \tan^{-1} x$ OR $-1 \leq -x^2 \leq 1$ $(i) x^2 \geq -1$ This is true for all real numbers, as the square of any real number is non-negative. $(ii) -1 \leq -x^2$ $1 \geq x^2,$ $-1 \leq x \leq 1$ The domain of the function is $[-1, 1]$	1 1 0.5 0.5 1
22	Taking log both side $\log x = \frac{y}{x}$ Differentiate both side w.r.t. x $\frac{1}{x} = \frac{y-x\frac{dy}{dx}}{y^2}$ $\frac{dy}{dx} = \frac{xy-y^2}{x^2} = \frac{y(x-y)}{x^2} =$ Substitute $y = \frac{x}{\log x}$ $\frac{dy}{dx} = \frac{x-y}{x \log x}$	1 1
23	$u = 2^{\cos^2 x}, v = \cos^2 x$ $\frac{du}{dx} = 2^{\cos^2 x}(\log 2)(-2 \cos x \sin x), \frac{dv}{dx} = (-2 \cos x \sin x)$ $\frac{du}{dv} = \frac{\frac{du}{dx}}{\frac{dv}{dx}} = 2^{\cos^2 x}(\log 2)$	1 1
24	Put $\sqrt{x} = t, dx = 2t dt$ $\int_0^{\frac{\pi}{2}} \sin t dt$ $= 2[-\cos t]_0^{\frac{\pi}{2}} = 2(0 - 1) = -2$ OR Put $1 + 2x = t^2, x = \frac{t^2-1}{2}$ $2dx = 2t dt, dx = t dt$ $= \int \frac{t^2-1}{2} t t dt = \frac{1}{2} \int t^4 - t^2 dt$ $= \frac{1}{2} \left(\frac{t^5}{5} - \frac{t^3}{3} \right) + c$ $\frac{1}{2} \left(\frac{(1+2x)^{5/2}}{5} - \frac{(1+2x)^{3/2}}{3} \right) + c$	1 1 1 1

	$\frac{d^2y}{dx^2} = \frac{\sec^3\theta \tan\theta}{a^2}$ $\frac{d^2y}{dx^2} \text{ at } \theta = \frac{\pi}{4} = \frac{2\sqrt{2}}{a^2}$ OR $y = (\tan^{-1}x)^2$ Differentiate w.r.t x $\frac{dy}{dx} = \frac{2\tan^{-1}x}{1+x^2}$ $(1+x^2)\frac{dy}{dx} = 2\tan^{-1}x$ Again differentiate w.r.t x $(x^2+1)y_2 + 2xy_1 = \frac{2}{1+x^2}$ $(x^2+1)^2y_2 + 2x(x^2+1)y_1 = 2$	0.5 0.5 1 0.5 1 0.5
29	 Area = $4 \int_0^2 y dx = 4 \int_0^2 \frac{1}{2} \sqrt{4^2 - x^2} dx$ $= 2 \left[\frac{x}{2} \sqrt{4^2 - x^2} + 8 \sin^{-1} \left(\frac{x}{4} \right) \right]_0^2$ $2 \left[\sqrt{12} + \frac{8\pi}{6} \right] = 4\sqrt{3} + \frac{8\pi}{3}$ Type equation here. OR Required area $A = \int_0^4 x(4-x) dx + \left \int_4^5 x(4-x) dx \right$ $A = \left[2x^2 - \frac{x^3}{3} \right]_0^4 + \left \left[2x^2 - \frac{x^3}{3} \right]_4^5 \right $ $= 32/3 + 7/3 = 13 \text{ sq. units.}$	1 1 1 1 1 1
30	That the dr^o of given lines are not proportional so, they are not parallel lines. $(a_2 - a_1) = \hat{j} - 4\hat{k}$ $(b_1 \times b_2) = 2\hat{i} - 4\hat{j} - 3\hat{k}$ Consider $(a_2 - a_1) \cdot (b_1 \times b_2) = 8 \neq 0$ Hence line will not intersect. So the lines are skew. Shortest distance = $\left \frac{(a_2 - a_1) \cdot (b_1 \times b_2)}{ b_1 \times b_2 } \right = \frac{8}{\sqrt{4+16+9}} = \frac{8}{\sqrt{29}} \text{ units}$ OR Let the wicket keeper divides the line segment in ratio k:1 $\vec{W} = \frac{k \cdot \vec{F} + 1 \cdot \vec{B}}{k+1}$ $6\hat{i} + 12\hat{j} = \left(\frac{12k+2}{k+1} \right) \hat{i} + \left(\frac{18k+8}{k+1} \right) \hat{j}$	1/2 1/2 1/2 1/2 1 1 1

	On comparing the components, we get $6 = \left(\frac{12k+2}{k+1}\right), \quad k = \frac{2}{3}$	1
31	E = the first die showed an even number. F = the sum of the numbers on the dice is 9 = {(6,3), (3,6), (5,4), (4,5)} $E \cap F = \{(6,3), (4,5)\}$ $n(S) = 36, n(E) = 18, n(F) = 4, n(E \cap F) = 2$ $P\left(\frac{E}{F}\right) = \frac{P(E \cap F)}{P(F)} = \frac{2/36}{4/36} = \frac{1}{2}$ Type equation here.	1 1 1
	SECTION D	
32	Solution The given differential equation can be written as $\frac{dx}{dy} + \frac{x}{1+y^2} = \frac{\tan^{-1}y}{1+y^2} \quad \dots (1)$ Now (1) is a linear differential equation of the form $\frac{dx}{dy} + P_1 x = Q_1$, where, $P_1 = \frac{1}{1+y^2}$ and $Q_1 = \frac{\tan^{-1}y}{1+y^2}$. Therefore, $I.F = e^{\int \frac{1}{1+y^2} dy} = e^{\tan^{-1}y}$ Thus, the solution of the given differential equation is $x e^{\tan^{-1}y} = \int \left(\frac{\tan^{-1}y}{1+y^2} \right) e^{\tan^{-1}y} dy + C \quad \dots (2)$ Let $I = \int \left(\frac{\tan^{-1}y}{1+y^2} \right) e^{\tan^{-1}y} dy$ Substituting $\tan^{-1}y = t$ so that $\left(\frac{1}{1+y^2} \right) dy = dt$, we get $I = \int t e^t dt = t e^t - \int 1 \cdot e^t dt = t e^t - e^t = e^t (t - 1)$ or $I = e^{\tan^{-1}y} (\tan^{-1}y - 1)$ Substituting the value of I in equation (2), we get $x \cdot e^{\tan^{-1}y} = e^{\tan^{-1}y} (\tan^{-1}y - 1) + C$ or $x = (\tan^{-1}y - 1) + C e^{-\tan^{-1}y}$ which is the general solution of the given differential equation.	1 1 1 1 1
33	$(kA) \left(\frac{1}{k} A^{-1} \right) = k \frac{1}{k} (A A^{-1}) = I$ $(kA)^{-1} = \frac{1}{k} A^{-1}$. Hence calculate $(3A)^{-1} = \frac{1}{3} A^{-1}$, $A = \begin{bmatrix} 2 & -1 & 1 \\ -1 & 2 & -1 \\ 1 & -1 & 2 \end{bmatrix}$ $\det(A) = 4 \neq 0, A^{-1}$ exist $\text{adj}A = \begin{bmatrix} 3 & 1 & -1 \\ 1 & 3 & 1 \\ -1 & 1 & 3 \end{bmatrix}$	1 1/2 1/2 2

	$A^{-1} = \frac{1}{4} \begin{bmatrix} 3 & 1 & -1 \\ 1 & 3 & 1 \\ -1 & 1 & 3 \end{bmatrix}$ $(3A)^{-1} = \frac{1}{3} A^{-1} = \frac{1}{12} \begin{bmatrix} 3 & 1 & -1 \\ 1 & 3 & 1 \\ -1 & 1 & 3 \end{bmatrix}$	$\frac{1}{2}$ $\frac{1}{2}$
34	 OR 	1 1 1 1 1.5 1 1 1+0.5

35	$\frac{x}{1} = \frac{y-1}{2} = \frac{z-2}{3}$ Any arbitrary point on line is $M(\lambda, 2\lambda+1, 3\lambda+2)$ Dir's of AM are $\langle \lambda-1, 2\lambda-5, 3\lambda-1 \rangle$ AM perpendicular to line 1 $\lambda = 1$ $\therefore M(1, 3, 5)$ is the foot of perpendicular of the point A to the given line. Let the image of point A in the line be $A'(\alpha, \beta, \gamma)$ Since M is the mid point of AA', $M\left(\frac{1+\alpha}{2}, \frac{6+\beta}{2}, \frac{3+\gamma}{2}\right) = M(1, 3, 5)$ $A'(1, 0, 7)$ Also, Equation of AA' is $\frac{x-1}{0} = \frac{y-6}{-6} = \frac{z-3}{4}$ OR line $\frac{x+5}{1} = \frac{y+3}{4} = \frac{z-6}{-9}$, any random point on the line will be given by $P(\lambda-5, 4\lambda-3, -9\lambda+6)$ Since $PQ=7$ $\sqrt{(\lambda-7)^2 + (4\lambda-7)^2 + (-9\lambda+7)^2} = 7$ $\lambda = 1$ $P(-4, 1, -3)$ The Equation of line PQ is $\frac{x+4}{6} = \frac{y-1}{3} = \frac{z+3}{2}$ or $\frac{x-2}{6} = \frac{y-4}{3} = \frac{z+1}{2}$	1 1 1 1 1 1 1 1 1 1 1
	CASE STUDY	
36	(i) No. of possible relation from S to J = $2^{12} = 4096$ ($n(S \times J) = 12$) (ii) Condition: $S \leq J$ (hear, $4 > 3$) It is impossible to assign all speakers to distinct judges. one-one functions can be there from set S to set J=0 (iii) Given function from S to J as $f = \{(S_1, J_1), (S_2, J_2), (S_3, J_2), (S_4, J_3)\}$ S_2 and S_3 are both assigned to $J_2 \rightarrow$ not injective All judges $J = \{J_1, J_2, J_3\}$ are assigned $\rightarrow$ Surjective Since f is not bijective OR relation $R_1 = \{(S_1, S_2), (S_2, S_4)\}$ Add reflexive relation pairs $(S_1, S_1), (S_2, S_2), (S_3, S_3), (S_4, S_4)$ Keep (S_1, S_2) but excluded (S_2, S_1), Final relation $R_1 = \{(S_1, S_1), (S_2, S_2), (S_3, S_3), (S_4, S_4), (S_1, S_2), (S_2, S_4)\}$	1 1 1 1 1 2

37	(i) Capacity=area×depth = $x^2h = 250$ $Cost (C) = 500x^2 + 4000h^2$ $C = 500\left(\frac{250}{h}\right) + 4000h^2$ (ii) $\frac{dC}{dh} = -\frac{125000}{h^2} + 8000h$ $\frac{dC}{dh} = 0, h = \frac{5}{2}m$ or 2.5 m (iii) $\left(\frac{d^2C}{dh^2}\right)_{h=2.5} > 0$ Cost is minimum when h=2.5 m Minimum cost = $C = \frac{125000}{\frac{5}{2}} + 4000\left(\frac{5}{2}\right)^2 = \text{Rs } 75,000$ OR h=2.5 m when $\frac{dC}{dh} = 0$ For value of h less than 5/2 and closed o 5/2, $\frac{dC}{dh} < 0$ For value of h less more than 5/2 and closed o 5/2, $\frac{dC}{dh} > 0$ By first derivative test , C is minimum at h=5/2 Now $x^2 = \frac{250}{h}, x = 10 m, \text{ also, } x = 4h$	1 1 1 1 1 1
38	Let E_1=customer avails loan on fixed rate E_2=customer avails loan on floating rate E_3=customer avails loan on variable rate A= Person defaults on the loan $P(E_1) = \frac{1}{10}, P(E_2) = \frac{2}{10}, P(E_3) = \frac{7}{10},$ $P(A/E_1) = \frac{15}{100}, P(A/E_2) = \frac{3}{100}, P(A/E_3) = \frac{1}{100},$ (i) $P(A) = P(E_1)P(A/E_1) + P(E_2)P(A/E_2) + P(E_3)P(A/E_3) = 9/500$ (ii) $P\left(\frac{E_3}{A}\right) = \frac{P(E_3)P(A/E_3)}{P(E_1)P(A/E_1) + P(E_2)P(A/E_2) + P(E_3)P(A/E_3)} = 7/18$	1+1 1+1