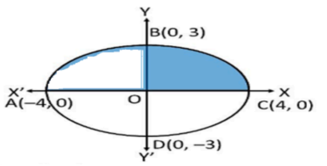
MARKING SCHEME SET 1 Code: KVS(DR)/2025/GP
KENDRIYA VIDYALAYA SANGATHAN, DELHI REGION
Pre-Board-I Examination-2025-26

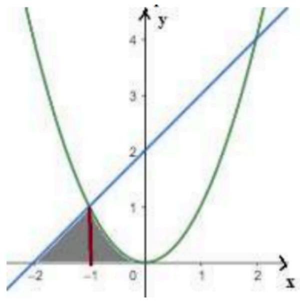
Class- XII **Subject: Mathematics (041)**

Time: 3 Hours **Maximum Marks: 80**

SECTION: A (Solution of MCQs of 1 Mark each)

Q.N.	ANS/HINT/SOLUTION WITH EXPECTED STEPS	MARKS AS PER STEPS
1.	B	1
2.	A	1
3.	C	1
4.	B	1
5.	C	1
6.	B	1
7.	C	1
8.	A	1
9.	C	1
10.	D	1
11.	C	1
12.	D	1
13.	A	1
14.	A	1
15.	D	1
16.	A	1
17.	B	1
18.	C	1
19.	C	1
20.	D	1
21.	Three points (or position vectors) are collinear if the vectors between them are proportional. Let A=(k,-10,3), B=(1,-1,3), C=(3,5,3). Consider vectors AB and AC: AB = B - A = (1-k, 9, 0) AC = C - A = (3-k, 15, 0) For AB and AC to be collinear, AB = λ AC for some scalar λ. Compare components: Since z-components are 0, they match. From y-component: 9 = λ·15 => λ = 9/15 = 3/5. From x-component: 1 - k = λ(3 - k) = (3/5)(3 - k) So 1 - k = (9/5) - (3k/5) Multiply by 5: 5 - 5k = 9 - 3k => bring terms: -5k +3k = 9 -5 => -2k =4 => k = -2. Answer: k = -2. **OR** Compute sum S = (2+λ)i + (4+2)j + (-5+3)k = (2+λ,6,-2). Unit vector along S = S/|S|. Dot product with (1,1,1) gives ((2+λ)+6+(-2)) / |S| = (λ+6)/|S| = 1.	1 1 1

	So |S| = λ+6. Square both sides: (2+λ)^2 + 6^2 + (-2)^2 = (λ+6)^2. => λ=1	 1
22.	dy/dx = -cot θ/2 y_2 =1/4 $\text{cosec}^{4\,\theta/2}$ at $\frac{\theta}{2}$, $y_2 = 4$	1 1
23.	(i) One–one (injective): correct proof of one one . (ii) Onto (surjective) : f is not onto as codomain not equal to range OR (i) Reflexive? Here (1,1),(2,2),(3,3)∈R So R is reflexive. (ii) Symmetric? We have (1,2)∈R but (2,1)∉R Therefore R is not symmetric. (iii) Transitive? (1,2)∈R and (2,3)∈R but (1,3)∉R. Hence R is not transitive. Conclusion: R is reflexive but neither symmetric nor transitive.	1 1 ½ ½ ½ ½
24.	LHL = -1 at x = 0 RHL = 1 at x = 0 Therefore f(x) is discontinuous at x = 0	½ ½ 1
25.	Correct fig and shaded region of required area Area = 2 square unit	1 1
26.	S = {(H,H), (H,T), (T,1), (T,2), (T,3), (T,4), (T,5), (T,6)} the probabilities assigned to the 8 elementary events Probability of each Event Correct answer OR The probability of speaking the truth is given as P(T)=3/5 The probability of lying is $P(L)=1-P(T)=1-3/5=2/5$ The probability of reporting a number greater than P(R)=P(R|A) · P(A)+P(R|A′) · P(A′) P(R)=(3/5) · (1/3)+(2/5) · (2/3)=3/15+4/15=7/15 P(A|R)=(3/5) · (1/3) / (7/15) = (3/ 15) / (7/15) P(A|R)=3/7	½ 1 1 1/2 1 1 1
27.	CORRECT FIG Corner points (2,0) (8,0) (4,12) (2,13) Max z = 200 at (4,12)	1 1 1
28.	Dr's of first line = <3,-16,7> Dr's of second line = <3,8,-5> Dr's of required line = <2,3,6> Required equation of line is $\frac{x-1}{2} = \frac{y-2}{3} = \frac{z+4}{6}$	½ ½ 1 1
29.	Correct fig. Equation of ellipse $\frac{x^2}{16} + \frac{y^2}{9} = 1$ 	1

	$y = \pm\frac{3}{4}\sqrt{16 - x^2}$ Area of Ellipse= $4\int_0^4 y dx$=$4\int_0^4 \frac{3}{4}\sqrt{16 - x^2}dx$ $=3\int_0^4 \sqrt{16 - x^2}dx$ $= 3\left[\frac{x}{2}\sqrt{16 - x^2} + \frac{16}{2}\frac{x}{4}\right]_0^4$ $= 3\times\frac{8\pi}{2}$ $= 12\pi$ square units **OR** x coordinates of point of intersection are (– 1, 2) Required area= $\int_{-2}^{-1} y_1 dx + \int_{-1}^{0} y_2 dx$ $= \int_{-2}^{-1}(x + 2)dx + \int_{-1}^{0} x^2 dx$ $=\left[\frac{x^2}{2} + 2x\right]_{-2}^{-1} + \left[\frac{x^3}{3}\right]_{-1}^{0}$ $=\left(-\frac{3}{2} - (-2)\right) + \left(0 - (-\frac{1}{3})\right)$ $=\frac{1}{2} + \frac{1}{3} = \frac{5}{6}$ square units  	1 1 1 1 1
30.	$F'(x) = 6(x^2+3x+2)$ Critical point : x=-1,-2 F(x) is decreasing function in interval (-2,-1) **OR** $F'(x) = 4-x$ Critical point : x=4 F(-2)= -10, f(4) = 8, f(9/2) = 63/8 Absolute max value = 8, absolute min value = -10	1 1 1 1 1 1
31.	$y = \sin(m\sin^{-1}x) \quad \Rightarrow \frac{dy}{dx} = \cos(m\sin^{-1}x).\frac{m}{\sqrt{1-x^2}}$ $\Rightarrow \sqrt{1-x^2}\frac{dy}{dx} = m\cos(m\sin^{-1}x)$ Again diff.w.r.t.x, $\sqrt{1-x^2}\frac{d^2y}{dx^2} + \frac{dy}{dx}\left(\frac{-2x}{\sqrt{1-x^2}}\right) = -m\sin(m\sin^{-1}x).\frac{m}{\sqrt{1-x^2}}$ $\Rightarrow (1-x^2)\frac{d^2y}{dx^2} - x\frac{dy}{dx} = -m^2\sin(m\sin^{-1}x) = -m^2y$ $\Rightarrow (1-x^2)\frac{d^2y}{dx^2} - x\frac{dy}{dx} + m^2y = 0$ **OR**	1 1 1 1

	$\cdot\ y = (\log_e x)^x + x^{\log_e x} = e^{\log\{(\log_e x)^x\}} + e^{\log\{x^{\log_e x}\}}$ $= e^{x \log\{(\log_e x)\}} + e^{\log_e x . \log_e x}$ $\frac{dy}{dx} . = e^{x \log\{(\log_e x)\}}\left[x . \frac{1}{\log x} . \frac{1}{x} + \log(\log x) . 1\right] + e^{\log_e x . \log_e x}\left[\frac{\log x}{x} + \frac{\log x}{x}\right]$ $= (\log_e x)^x\left[\frac{1}{\log x} + \log(\log x)\right] + x^{\log_e x}\left[2\frac{\log x}{x}\right]$	1 1
32.	$BA = [1\ -\ 1\ 0\ 2\ 3\ 4\ 0\ 1\ 2\ ][2\ 2\ -\ 4\ -\ 4\ 2\ -\ 4\ 2\ -\ 1\ 5\ ] = [6\ 0\ 0\ 0\ 6\ 0$ $B\left(\frac{1}{6}A\right) = I \quad \Rightarrow \quad B^{-1} = \frac{1}{6}A = \frac{1}{6}[2\ 2\ -\ 4\ -\ 4\ 2\ -\ 4\ 2\ -\ 1\ 5\ ]$ The given equations can be re-written as, x – y = 3, 2x + 3y + 4z = 17, and y + 2z = 7 $\therefore BX = C\ i.e.\ [1\ -\ 1\ 0\ 2\ 3\ 4\ 0\ 1\ 2\ ][x\ y\ z\ ] = [3\ 17\ 7\ ]$ $\Rightarrow X = B^{-1}C\ i.e.\ [x\ y\ z\ ] = \frac{1}{6}[2\ 2\ -\ 4\ -\ 4\ 2\ -\ 4\ 2\ -\ 1\ 5\ ][3\ 17\ 7\ ] = \frac{1}{6}[12$ Hence, $x = 2,\ y = -\ 1\ and\ z = 4$	2 1 1 1
33.	Let $y = \sin \varphi$ Then $dy = \cos \varphi\, d\varphi$ Therefore, $\int \frac{(3\sin\phi - 2)\cos\phi}{5 - \cos^2\phi - 4\sin\phi}\, d\phi = \int \frac{(3y - 2)\, dy}{5 - (1 - y^2) - 4y}$ $= \int \frac{3y - 2}{y^2 - 4y + 4}\, dy$ $= \int \frac{3y - 2}{(y - 2)^2} = I \text{ (say)}$ Now, we write $\frac{3y - 2}{(y - 2)^2} = \frac{A}{y - 2} + \frac{B}{(y - 2)^2}$ Therefore, $3y - 2 = A(y - 2) + B$ Comparing the coefficients of y and constant term, we get A = 3 and B – 2A = – 2, which gives A = 3 and B = 4.Therefore, the required integral is given by	1 1 1 1

	$I = \int [\frac{3}{y-2} + \frac{4}{(y-2)^2}] dy = 3\int \frac{dy}{y-2} + 4\int \frac{dy}{(y-2)^2}$ $= 3\log\|y-2\| + 4\left(-\frac{1}{y-2}\right) + C$ $= 3\log\|\sin\phi - 2\| + \frac{4}{2-\sin\phi} + C$ $= 3\log(2-\sin\phi) + \frac{4}{2-\sin\phi} + C$ (since, $2-\sin\phi$ is always positive) **OR** $\int \sqrt{(x+1)^2 + 2^2}dx \quad = \int \sqrt{(t)^2 + 2^2}dt$ $\int \sqrt{(t^2 + 2^2}dt = \frac{t}{2}\sqrt{t^2 + 2^2} + \frac{2^2}{2} log\|t + \sqrt{t^2 + 2^2} + C$ *put* $t = x + 1$, *we get* $\int \sqrt{((x+1)^2 + 2^2}dx = \frac{x+1}{2}\sqrt{(x+1)^2 + 2^2} + \frac{2^2}{2} log\|x + 1 + \sqrt{(x +$ $\int \sqrt{x^2 + 2x + 5}\, dx = \frac{x+1}{2}\sqrt{(x+1)^2 + 2^2} + \frac{2^2}{2} log\|x + 1 + \sqrt{x^2 +$	1 1 1 1 ½ 1 ½
34.	The given differential equation is the Linear differential equation of the type $\frac{dy}{dx} + Py = Q$. Here $P = \cot x$ and $Q = 2x + x^2\cot x$ Integrating factor (I.F.) $= e^{\int P\,dx} = e^{\int \cot x dx} = e^{\log\log \sin x} = \sin x$ So the general solution of the given equation is $y\sin x = \int (2x + x^2 \cot x) \sin x\, dx$ $\Rightarrow y\sin x = \int 2x\sin x\, dx + \int (x^2 \cos x) dx$ $\Rightarrow y\sin x = \sin x\,(\frac{2x^2}{2}) - \int (\cos x)\frac{2x^2}{2}\, dx + \int (x^2\cos x) dx$ $\Rightarrow y\sin x = x^2\sin x + c$ Now for the particular solution put $y = 0$ and $x = \frac{\pi}{2}$ So $0 = (\frac{\pi}{2})^2 \sin\frac{\pi}{2} + c \Rightarrow c = -\frac{\pi^2}{4}$ Therefore the particular solution of given differential equation is $y\sin x = x^2\sin x - \frac{\pi^2}{4}$ **OR** write the given equation as $\frac{dy}{dx} = \frac{x^2+y^2}{2xy}$ Since it is Homogeneous differential equation Put $y = vx \Rightarrow \frac{dy}{dx} = v + x\frac{dv}{dx}$ in the given equation	1 1 1 1 1 1 1 1

	So , $v + x\frac{dv}{dx} = \frac{1+v^2}{2v}$ $\Rightarrow x\frac{dv}{dx} = \frac{1+v^2}{2v} - v \Rightarrow x\frac{dv}{dx} = \frac{-(v^2-1)}{2v}$ Separating the variables and writing the equation as $\frac{2v}{v^2-1}dv = -\frac{dx}{x}$ Integrating both sides and getting $\int\frac{2v}{v^2-1}dv = -\int\frac{dx}{x} \Rightarrow \log\left\|(v^2-1)\right\| = -\log\|x\| + \log\|c\|$ $\Rightarrow \log\left\|x(v^2-1)\right\| = \log c \Rightarrow x(v^2-1) = \pm c = c_1$ Now replace v by $\frac{y}{x}$ to get $x^2 - y^2 = cx$	1 1
35.	**Sol.** Given lines are $\vec{r} = (3\hat{i}+5\hat{j}+7\hat{k}) + \lambda(\hat{i}-2\hat{j}+\hat{k})$, and $\vec{r} = (-\hat{i}-\hat{j}-\hat{k}) + \mu(7\hat{i}-6\hat{j}+\hat{k})\ \vec{r} = (-\hat{i}-\hat{j}-\hat{k}) + \mu(7\hat{i}-6\hat{j}+\hat{k})$ $\vec{a}_1 = 3\hat{i}+5\hat{j}+7\hat{k},\ \vec{b}_1 = \hat{i}-2\hat{j}+\hat{k};$ $\vec{a}_2 = -\hat{i}-\hat{j}-\hat{k},\ \ \vec{b}_2 = 7\hat{i}-6\hat{j}+\hat{k}$ $\vec{a}_2 - \vec{a}_1 = -4\hat{i}-6\hat{j}-8\hat{k},\ \ \vec{b}_1\times\vec{b}_2 = \begin{vmatrix}\hat{i} & \hat{j} & \hat{k}\\ 1 & -2 & 1\\ 7 & -6 & 1\end{vmatrix} = 4\hat{i}+6\hat{j}+8\hat{k}$ $S.D. = \frac{\left\|(\vec{a}_2-\vec{a}_1).(\vec{b}_1\times\vec{b}_2)\right\|}{\left\|\vec{b}_1\times\vec{b}_2\right\|} = \frac{\left\|(-4\hat{i}-6\hat{j}-8\hat{k}).(4\hat{i}+6\hat{j}+8\hat{k})\right\|}{\left\|4\hat{i}+6\hat{j}+8\hat{k}\right\|}$ $= \frac{\|-16-36-64\|}{\sqrt{16+36+64}} = \frac{116}{\sqrt{116}} = \sqrt{116} = 2\sqrt{29}$	1 1 1 1 1
36.	(i) Not symmetric (ii) Not reflexive (iii) Not equivalence OR 2^{12}	1 1 2
37.	(i) $P = 2\ [x + \sqrt{4a^2 - x^2}\ ]$ (ii) $X = a\sqrt{2}$ (iii) P is maximum as second derivative negative. OR $A = 40\sqrt{2}$	1 1 2
38.	(i) This can happen in two mutually exclusive ways:	½

	Gun A hits AND Gun B misses: P(A and B') = P(A) * P(B') = 0.3 * 0.8 = 0.24. Gun A misses AND Gun B hits: P(A' and B) = P(A') * P(B) = 0.7 * 0.2 = 0.14. The total probability of exactly one hit is the sum of these two: P(exactly one hit) = P(A and B') + P(A' and B) = 0.24 + 0.14 = 0.38. (ii) P(B | exactly one hit) = 0.14 / 0.38 = 14/38 = 7/19.	½ 1 2