KENDRIYA VIDYALAYA SANGATHAN ,ERNAKULAM REGION

FIRST PRE-BOARD EXAMINATION

CLASS XII

SESSION 2026-27

MATHEMATICS (CODE-041)

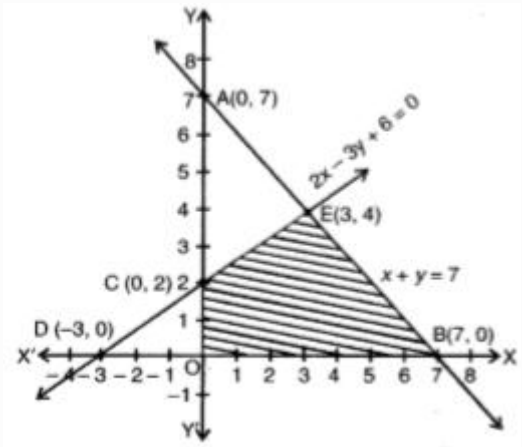
TIME ALLOWED: 3 HOURS **MAXIMUM MARKS: 80**

MARKING SCHEME

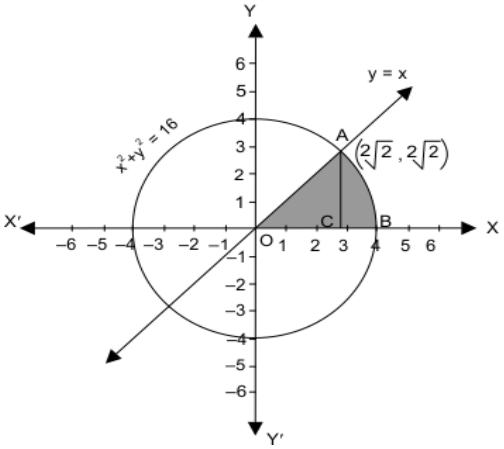
SI NO.	ANSWER KEY	MARKS
1	C	1
2	A	1
3	A	1
4	D	1
5	A	1
6	B	1
7	B	1
8	C	1
9	B	1
10	A	1
11	B	1
12	B	1
13	C	1
14	B	1
15	A	1
16	D	1
17	A	1
18	D	1
19	A	1
20	C	1
21	$A^2 = A.A = \begin{bmatrix} 2 & 1 \\ -4 & -2 \end{bmatrix}\begin{bmatrix} 2 & 1 \\ -4 & -2 \end{bmatrix} = \begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}$ $A^3 = A^2.A = O$……. $I+2A+3A^2+4A^3$……..= $I+2A = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} + \begin{bmatrix} 4 & 2 \\ -8 & -4 \end{bmatrix} = \begin{bmatrix} 5 & 2 \\ -8 & -3 \end{bmatrix}$	1 ½ ½
22	$\frac{dy}{dx} = -cosec\,(cot^{-1}\,x)\cot(cot^{-1}\,x) \times \frac{-1}{1+x^2}$ $= \frac{\sqrt{1+x^2}\times x}{1+x^2}$ $\frac{dy}{dx}\sqrt{1+x^2} - x = 0$	1 ½ ½
23A.	$\int \frac{1-cosx}{1+cosx}\,dx = \int \tan^2\frac{x}{2}\,dx$	1

	$= \int(\sec^2\frac{x}{2} - 1)\,dx$ $=2\,tanx/2\, - x + C$	½ ½
23B	$\int_0^{\pi/4}\sqrt{1-sin2x}\ \text{dx} = \int_0^{\pi/4}\sqrt{sin^2x + cos^2x - 2sinxcosx}\ \text{dx}$ $\int_0^{\pi/4}\sqrt{(cosx - sinx)^2}\ \text{dx} = \int_0^{\pi/4}(cosx - sinx)dx$ $=[sinx + cosx]_0^{\pi/4} = [sin\pi/4 + cos\pi/4] - [sin0 + cos0] = \frac{1}{\sqrt{2}} + \frac{1}{\sqrt{2}} - [0+1] = \frac{2}{\sqrt{2}} - -1 = \sqrt{2} - 1$	1 1
24A	$2\vec{a} - \vec{b} + 3\vec{c} = \hat{\imath} - 2\hat{\jmath} + 2\hat{k}$ $\left\lvert 2\vec{a} - \vec{b} + 3\vec{c}\right\rvert = 3$ Required unit vector $= \frac{1}{3}\hat{\imath} - \frac{2}{3}\hat{j} + \frac{2}{3}\hat{k}$	1 ½ ½
24B	$\cos\theta = \frac{6}{\sqrt{84}}$ $\sin\theta = \frac{2}{\sqrt{7}}$	1 1
25	Both the points satisfy all the constraints and hence they are in the feasible region. Z at (9,1) is 49 and Z at $(2,8)$ is 42.The profit is maximum at (9,1).	1 1
26	$\begin{bmatrix}1 & x & 1\end{bmatrix}\begin{bmatrix}6\\12\\14\end{bmatrix} = 0$ $12x + 20 = 0$ $x = -5/3$	1 1 1
27A	$x\sqrt{1+y} + y\sqrt{1+x} = 0$ $x\sqrt{1+y} = -y\sqrt{1+x}$ $x^2(1+y) = y^2(1+x)$ $x^2 - y^2 = y^2x - x^2y$ $(x+y)(x-y) = -xy\,(x-y)$ $x + y = -xy$‘; $x = -y - xy$ ‘ $y(1+x) = -x;$ $y = -\frac{x}{1+x}$[$since, x \neq y$] $\frac{dy}{dx} = -\left\{\frac{(1+x)\times 1 - x\,(0+1)}{(1+x)^2}\right\}$ $\frac{dy}{dx} = -\frac{1}{(1+x)^2}$	½ ½ 1 1
27B	$logy = xlog(tanx)$	1

	Differentiating both sides with respect to x using the product rule, $\frac{1}{y}\frac{dy}{dx} = \log(\tan x) + x\frac{\sec^2 x}{\tan x}$ $\boxed{\frac{dy}{dx} = (\tan x)^x\left[\log(\tan x) + \frac{x\sec^2 x}{\tan x}\right]}$	1 1
28A	According to the question $\frac{dV}{dt} = K\times(\text{surface area})$ $V = \frac{4}{3}\pi r^3, SA = 4\pi r^2$ $\frac{d(\frac{4}{3}\pi r^3)}{dt} = K\times 4\pi r^2$ $\frac{4\pi}{3}\frac{dr^3}{dt} = 4\pi K r^2$ $\frac{4\pi}{3}\times 3r^2\times\frac{dr}{dt} = 4\pi K r^2$ $\frac{dr}{dt} = K$	1 1 1
28B	$V = 25\times 40\times h$ $\frac{dV}{dt} = 25\times 40\times\frac{dh}{dt}$ $\Rightarrow 500 = 1000\times\frac{dh}{dt}$ $\frac{dh}{dt} = 0.5\ m/min$	1 1 1
29.A	$\int\frac{dy}{y}=\int\cot 2x\ dx$ $\log\lvert y\rvert = \frac{1}{2}\log\lvert\sin 2x\rvert + \log C$ $y=C\sqrt{(\sin 2x)}$ when $y(\pi/4)=2$, gives $C=2$ $y=2\sqrt{\sin 2x}$ is the required particular solution of the given differential equation.	1 1 1
29B	Given that, $x^2\frac{dy}{dx} = x^2 + xy + y^2$ $\Rightarrow \frac{dy}{dx}=1+\frac{y}{x}+\frac{y2}{x^2}$ which is homogeneous equation. Put $y= vx\Rightarrow \frac{dy}{dx}= v + x\frac{dv}{dx}$ On substituting these values in Eq. (i) we get $\left(v+\frac{dv}{dx}\right)=1+v+v^2$ $\Rightarrow x\frac{dv}{dx} = 1 + v + v^2-v$	1

	⇒ $x\frac{dv}{dx} = 1+ v^2$ ⇒ $\frac{dv}{1+ v2} = \frac{dx}{x}$ On integrating both sides, we get $\tan^{-1}v=\log[x]+C$ ⇒ $\tan^{-1}\left(\frac{y}{x}\right)=\log [x]+C$	1 1
30.	The given line is $\frac{x-5}{\frac{1}{5}} = \frac{y-2}{-\frac{1}{7}} = \frac{z}{\frac{1}{35}}$ Cartesian equation of a line passing through $A(1,2,-1)$ and parallel to this is $$\frac{x-1}{\frac{1}{5}} = \frac{y-2}{-\frac{1}{7}} = \frac{z+1}{\frac{1}{35}} \; or \; \frac{x-1}{7} = \frac{y-2}{-5} = \frac{z+1}{1}$$ and the corresponding vector equation is $\vec{r} = \hat{\imath} + 2\hat{\jmath} - \hat{k} + \lambda(7\hat{\imath} - 5\hat{\jmath} + \hat{k})$.	1 1 1
31.	Solution:  The feasible region OBEC is bounded, so, minimum value will obtain at a comer point of this feasible region. Corner points are O(0, 0), B(7, 0), E(3, 4) and C(0, 2) $Z = 13x - 15y$ $At\ O(0,0),, Z = 0$ $At\ B(7,0), Z = 13(7) - 15(0) = 91$ $At\ E(3,4), Z = 13(3) - 15(4) = -21$ $At\ C(0,2), Z = 13(0) - 15(2) = -30\ (minimum)$ Hence , the minimum value is -30 at the point (0, 2).	Correct lines 1 mark Correct region ½ mark Corner points and values 1 mark Conclusion ½ mark
32	Given a function f: R→ $R\ defined\ as\ f(x) = x^2 + x + 1$ Let $x_1, x_2 \in R\ such\ that\ f(x_1) = f(x_2)$ => $x_1^2 + x_1 + 1 = x_2^2 + x_2 + 1$ $(x_1^2 - x_2^2) + (x_1 - x_2) = 0$ $(x_1 - x_2)(x_1 + x_2) + (x_1 - x_2) = 0$ $(x_1 - x_2)(x_1 + x_2 + 1) = 0$ $(x_1 - x_2) = 0 \; or \; (x_1 + x_2 + 1) = 0$ $x_1 = x_2 \; or \; x_1 = -(x_2 + 1)$ f is not one-one. Onto: Let y=f(x) $y = x^2 + x + 1$	½ 1

	$x^2 + x + 1 - y = 0$ For x$\in R, discriminant\ D \geq 0$ $1^2 - 4 \times 1 \times (1 - y) \geq 0$ $1 - 4 + 4y \geq 0$ $4y - 3 \geq 0$ $4y \geq 3$ $y \geq \frac{3}{4}$ $y \in [\frac{3}{4}, \infty)$ Range of f(x) is $[\frac{3}{4}, \infty) \neq Co - domain\ of\ f\ i.e., R$ f is not onto. Hence f is neither one-one nor onto. Also we have $f(x) = 3$ $\Rightarrow x^2 + x + 1 = 3$ $\Rightarrow x^2 + x - 2 = 0$ $\Rightarrow x^2 + 2x - x - 2 = 0$ $\Rightarrow x(x + 2) - (x + 2) = 0$ $\Rightarrow (x + 2)(x - 1) = 0$ $\Rightarrow x = 1, -2$	1 1 ½ 1
33A	Let I=$\int_0^\pi \frac{xsinx}{1+3cos^2x}dx$----------(1) $=\int_0^\pi \frac{(\pi-x)\sin(\pi-x)}{1+3cos^2(\pi-x)}dx$ $=\int_0^\pi \frac{\pi sinx}{1+3cos^2x}dx$-$\int_0^\pi \frac{xsinx}{1+3cos^2x}dx$------(2) Adding (1) and (2) 2I=$\int_0^\pi \frac{\pi sinx}{1+3cos^2x}dx$ Put $cosx = t, sinx\,dx = -dt$ 2I= - $\pi\int_1^{-1} \frac{dt}{1+3t^2}$ =$\pi/3\int_{-1}^{1} \frac{dt}{(\frac{1}{\sqrt{3}})^2+t^2}$ On solving we get I = $\frac{\sqrt{3}\,\pi}{3}.\frac{\pi}{3} = \frac{\sqrt{3}\pi^2}{9}$	1 1 1 1 1
33B	I=$\int \frac{2x+1}{(x^2+1)(x^2+4)}$	

	Let $\frac{2x+1}{(x^2+1)(x^2+4)} = \frac{Ax+B}{(x^2+1))} + \frac{Cx+D}{(x^2+4)}$ Getting $A = 2/3, B = 1/3, C = -2/3, D = -1/3$ I= $\frac{1}{3}\log\|x^2+1\| + \frac{1}{3}\tan^{-1}x - \frac{1}{3}log\|x^2+4\| - \frac{1}{6}\tan^{-1}\frac{x}{2}$ +C	1 ½ mark for each value=2 ½ for each integral=2
34.	Equation of the circle is $x^2 + y^2 = 16$ and the line $y = x$. Solving these two equations, we obtain $x = y = \pm 2\sqrt{2}$. Hence, the line intersects the circle at the point$(2\sqrt{2},2\sqrt{2})$ in the first quadrant. The area enclosed between the circle $x^2 + y^2 = 16$ and the line $y = x$ in the first quadrant is as shown by the shaded area OABCO  $= \int_0^{2\sqrt{2}} x dx + \int_{2\sqrt{2}}^{4} \left(\sqrt{16-x^2}\right) dx$ $= \left[\frac{x^2}{2}\right]_0^{2\sqrt{2}} + \left[\frac{x}{2}\sqrt{16-x^2} + \frac{16}{2}\sin^{-1}\frac{x}{4}\right]_{2\sqrt{2}}^{4}$ $= \left[\frac{\left(2\sqrt{2}\right)^2}{2}\right] + \left[\frac{4}{2}\sqrt{16-(4)^2} + \frac{16}{2}\sin^{-1}\frac{4}{4}\right.$ $\left. - \frac{2\sqrt{2}}{2}\sqrt{16-\left(2\sqrt{2}\right)^2} - \frac{16}{2}\sin^{-1}\frac{2\sqrt{2}}{4}\right]$ $= 4 + \left[8\sin^{-1}(1) - \sqrt{2}\times\sqrt{16-8} - 8\sin^{-1}\frac{1}{\sqrt{2}}\right]$ $= 4 + \left[8\times\frac{\pi}{2} - 4 - 8\times\frac{\pi}{4}\right]$ $= 4 + [4\pi - 4 - 2\pi]$ $= 2\pi$	1 1 1 1 1
35A	The midpoint of line joining points $A(2,3,4)$ and $B(4,5,8)$ is $(3,4,6)$	1

	Equation of line passing through $(3,4,6)$ is $\frac{x-3}{a}=\frac{y-4}{b}=\frac{z-6}{c}$ Since this line is perpendicular to $\frac{x-8}{3}=\frac{y+19}{-16}=\frac{z-10}{7}$ and $\frac{x-15}{3}=\frac{y-29}{8}=\frac{z-5}{-5}$ $\Rightarrow 3a-16b+7c=0$ $\Rightarrow 3a+8b-5c=0$ Using cross multiplication method and solving the required line is $\frac{x-3}{2}=\frac{y-4}{3}=\frac{z-6}{6}$	1 1 1 1
35B	The lines are perpendicular to each other if $1\times 0+2\times(-3)+3\times p=0$ $\Rightarrow p=2$ Any point on the line $\vec{r}=\lambda\hat{\imath}+(2\lambda+1)\hat{\jmath}+(3\lambda+2)\hat{k}$ is $(\lambda,2\lambda+1,3\lambda+2)$ Any point on the line $\vec{r}=\hat{\imath}-3\mu\hat{\jmath}+(p\mu+7)\hat{k}$ is $(1,-3\mu,2\mu+7)$ Equating the coordinates and solving we get $\lambda=1$ and $\mu=-1$ The point of intersection is $(1,3,5)$	1 1 1 1 1
36	(i) $\begin{bmatrix}1&1&1\\1&2&0\\1&0&1\end{bmatrix}\begin{bmatrix}x\\y\\z\end{bmatrix}=\begin{bmatrix}10\\12\\7\end{bmatrix}$ (ii) $\lvert A\rvert=-1$ (iii) adj(A) = $\begin{bmatrix}2&-1&-2\\-1&0&1\\-2&1&1\end{bmatrix}$ $A^{-1}=\begin{bmatrix}-2&1&2\\1&0&-1\\2&-1&-1\end{bmatrix}$ OR (iii) $A^2=\begin{bmatrix}3&3&2\\3&5&1\\2&1&2\end{bmatrix}$ $A^2-5A=\begin{bmatrix}-2&-2&-3\\-2&-5&1\\-3&1&-3\end{bmatrix}$	1 1 1 1 1 1
37	(i)Let the total profit be P=60x+80y subject to $x^2+y^2=k$, where $x, y \geq 0$. $P=60x+80\sqrt{k-x^2}$ $\frac{dP}{dx}=60-\frac{80\,x}{\sqrt{k-x^2}}$ For maximum profit, $\frac{dP}{dx}=0$	1 1 1/2

	$60 - \frac{80\,x}{\sqrt{k-x^2}} = 0$ $\frac{x}{y} = \frac{60}{80}$ or $x : y = 3 : 4$ $\frac{d^2P}{dx^2} = \frac{-80k}{(k-x^2)^{3/2}} < 0$ P is maximum	1 1/2
38	$(i)\quad \overrightarrow{AC} = 22\hat{I} + 18\hat{J} - 6\hat{k}$ $(ii)\qquad \overrightarrow{AB} = 2\hat{I} + 2\hat{J} - 3\hat{k}$ (iii)Area of $\Delta\, ABC = \frac{1}{2}\left\lvert \overrightarrow{AC} \times \overrightarrow{AB} \right\rvert$ $\overrightarrow{AC} \times \overrightarrow{AB} = 42\hat{I} - 54\hat{J} - 8\hat{k}$ Area of $\Delta\, ABC = \sqrt{1186}$ units OR vector perpendicular to the plane containing $\overrightarrow{AC}$ and $\overrightarrow{AB} = \overrightarrow{AC} \times \overrightarrow{AB}$ $= 42\hat{I} - 54\hat{J} - 8\hat{k}$	1 1 1 1 OR 1 1