GOVERNMENT OF KARNATAKA
KARNATAKA SCHOOL EXAMINATION AND ASSESSMENT BOARD

II YEAR PUC EXAMINATION MARCH 2023

SCHEME OF VALUATION

Subject Code: **35** Subject: **Mathematics**

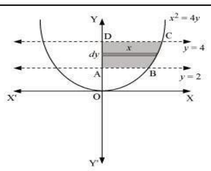
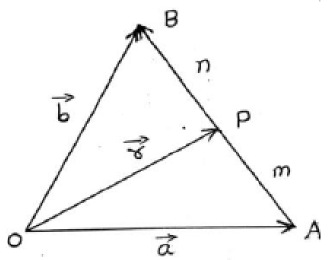
Instructions:

a) Any answer by alternate method should be valued and suitably awarded.
b) All answers (including extra, stuck off and repeated) should be valued. Answers with maximum marks must be considered.

Qn No	PART A	Marks
1	b) or Writing Symmetric	1
2	c) or Writing $\left(-\frac{\pi}{2},\frac{\pi}{2}\right)$	1
3	b) or Writing 6	1
4	a) Or Writing $\lvert A\rvert^{n-1}$	1
5	b) or Writing (-1, 1)	1
6	d) or Writing e^xsecx+c	1
7	a) or Writing $\left(\frac{i+j+2k}{\sqrt{6}}\right)$	1
8	d) or Writing 0, $\frac{1}{2}$, $\frac{\sqrt{3}}{2}$	1
9	d) or Writing 120	1
10	c) or Writing P(S)	1
	II	
11	2	1
12	11	1
13	0	1
14	4	1
15	3	1
	III	
16	5⋆7=35	1
17	Writing, $\frac{dy}{dx}$ =cos(x^2+5)2x **OR** Writing $f'(x) = \cos(x^2+5)2x$	1
18	Two or more vectors having the same initial point	1
19	The common region determined by all the constraints including non-negative constraints of a LPP is called feasible region	1
20	$\frac{3}{8}$	1

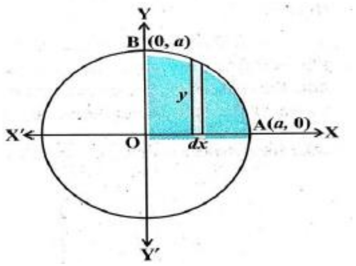
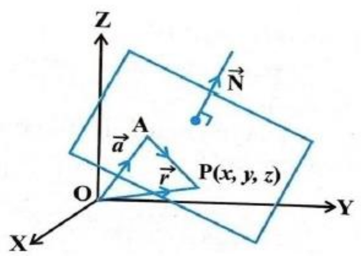
PART B		
21	Getting $(g\circ f)(x)=g(f(x))=g(\cos x)=3(\cos x)^2=3\cos^2 x$	1
	Getting $(f\circ g)(x)=f(g(x))=f(3x^2)=\cos(3x^2)$	1
22	Writing $\sin^{-1}x=\theta$ and $x=sin\theta=\cos\left(\frac{\pi}{2}-\theta\right)$	1
	Getting $\cos^{-1}x+\theta=\frac{\pi}{2}$ or $\cos^{-1}x+\sin^{-1}x=\frac{\pi}{2}$	1
23	Writing $\sin\left(\frac{\pi}{3}+\sin^{-1}\left(\frac{1}{2}\right)\right)$	1
	Getting $\sin\frac{\pi}{2}=1$	1
24	Writing Area=$\frac{1}{2}\begin{vmatrix}x_1 & y_1 & 1\\ x_2 & y_2 & 1\\ x_3 & y_3 & 1\end{vmatrix}$ **OR** Area=$\frac{1}{2}\begin{vmatrix}1 & 0 & 1\\ 6 & 0 & 1\\ 4 & 3 & 1\end{vmatrix}$	1
	Getting Area=$\frac{15}{2}$	1
25	Getting $\frac{dy}{dx}+\text{cosy}\frac{dy}{dx}=-sinx$	1
	Getting $\frac{dy}{dx}=\frac{-sinx}{1+cosy}$	1
26	Writing $y=x^x$ and logy=xlogx	1
	Getting $\frac{dy}{dx}=y(1+logx)$ **OR** $\frac{dy}{dx}=x^x(1+logx)$	1
27	Writing $f(x)=\sqrt{x}$ and $f'(x)=\frac{1}{2\sqrt{x}}$	1
	Getting $\sqrt{25.3}=5.03$	1
28	Writing $\int(2\sec^2 x-3secxtanx)\,dx$	1
	Getting $2tanx-3secx+c$	1
29	Getting $\int_1^{\sqrt{3}}\frac{1}{1+x^2}dx=[\tan^{-1}x]_1^{\sqrt{3}}$	1
	Getting $\frac{\pi}{3}-\frac{\pi}{4}=\frac{\pi}{12}$	1
30	Writing $y^2=4ax$ and $2y\frac{dy}{dx}=4a$	1
	Getting $2y\frac{dy}{dx}=\frac{y^2}{x}$ **OR** $y^2-2xy\frac{dy}{dx}=0$	1
31	Getting $\vec{a}\cdot\vec{b}=10$ and $\lvert\vec{b}\rvert=\sqrt{6}$ **OR** Writing Projection of $\vec{a}$ *on* $\vec{b}=\frac{\vec{a}\cdot\vec{b}}{\lvert\vec{b}\rvert}$	1
	Getting Projection of $\vec{a}$ *on* $\vec{b}$ is $\frac{10}{\sqrt{6}}$	1

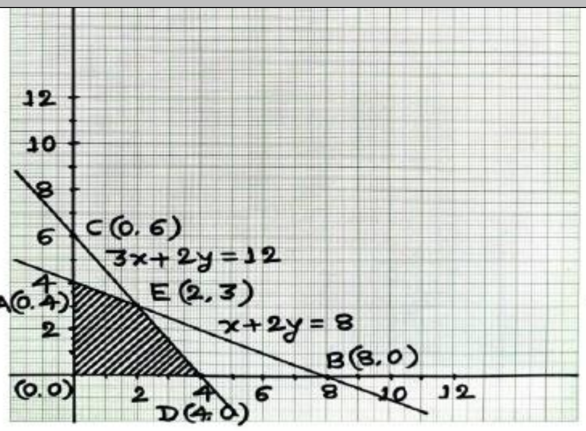
<table>
<tr><td rowspan="2">32</td><td>Getting $\vec{a} \times \vec{b} = 20\,\hat{\imath} + 5\hat{\jmath} - 5\hat{k}$</td><td>1</td></tr>
<tr><td>Getting
Area of parallelogram=$\sqrt{450}$ $sq\ units\ OR\ 15\sqrt{2}\ sq\ units$</td><td>1</td></tr>
<tr><td rowspan="2">33</td><td>Getting $\overrightarrow{b_1} \cdot \overrightarrow{b_2} = 19\ \ and\ \ |\overrightarrow{b_1}| = 7,\ \ |\overrightarrow{b_2}| = 3$
OR $Writing\ \ cos\theta = \left|\frac{\overrightarrow{b_1} \cdot \overrightarrow{b_2}}{|\overrightarrow{b_1}||\overrightarrow{b_2}|}\right|$</td><td>1</td></tr>
<tr><td>Getting $\theta = \cos^{-1}\left(\frac{19}{21}\right)$</td><td>1</td></tr>
<tr><td rowspan="2">34</td><td>Writing $S = \{HHH, HHT, HTH, HTT, TTT, TTH, THT, THH\}$</td><td>1</td></tr>
<tr><td>Getting
<table>
<tr><td>X</td><td>0</td><td>1</td><td>2</td><td>3</td></tr>
<tr><td>P(X)</td><td>$\frac{1}{8}$</td><td>$\frac{3}{8}$</td><td>$\frac{3}{8}$</td><td>$\frac{1}{8}$</td></tr>
</table>
OR Writing the table allot 2 marks</td><td>1</td></tr>
<tr><td colspan="3">PART-C</td></tr>
<tr><td rowspan="3">35</td><td>Reflexive: Every triangle is congruent to itself</td><td>1</td></tr>
<tr><td>Showing R is symmetric</td><td>1</td></tr>
<tr><td>Showing R is transitive and hence R is an equivalence relation</td><td>1</td></tr>
<tr><td rowspan="3">36</td><td>Getting $2\tan^{-1}\frac{1}{2} = \tan^{-1}\frac{4}{3}$</td><td>1</td></tr>
<tr><td>Writing $\tan^{-1}x + \tan^{-1}y = \tan^{-1}\left(\frac{x+y}{1-xy}\right)$ OR
$\tan^{-1}\frac{4}{3} + \tan^{-1}\frac{1}{7} = \tan^{-1}\left(\frac{\frac{4}{3}+\frac{1}{7}}{1-\frac{4}{3}\times\frac{1}{7}}\right)$</td><td>1</td></tr>
<tr><td>Getting $\tan^{-1}\frac{31}{17}$</td><td>1</td></tr>
<tr><td rowspan="3">37</td><td>Writing $A' = \begin{bmatrix} 1 & -1 \\ 5 & 2 \end{bmatrix}$</td><td>1</td></tr>
<tr><td>Getting $\frac{1}{2}(A + A') = \begin{bmatrix} 1 & 2 \\ 2 & 2 \end{bmatrix} = P$</td><td>1</td></tr>
<tr><td>Getting $\frac{1}{2}(A - A') = \begin{bmatrix} 0 & 3 \\ -3 & 0 \end{bmatrix} = Q$ and Getting P+Q=$\begin{bmatrix} 1 & 5 \\ -1 & 2 \end{bmatrix}$</td><td>1</td></tr>
<tr><td rowspan="2">38</td><td>Writing, $\frac{dx}{d\theta}$ = a(1 – cosθ)</td><td>1</td></tr>
<tr><td>Writing, $\frac{dy}{d\theta}$ = -asinθ</td><td>1</td></tr>
</table>

	Getting $\frac{dy}{dx} = \frac{-a\sin\theta}{a(1-\cos\theta)}$ **OR** Getting $\frac{dy}{dx} = -\cot\frac{\theta}{2}$	1
39	Writing, f is continuous in [−2, 2] and f is differentiable in (−2, 2)	1
	Getting $f^{I}(x)$ = 2x **OR** Getting f(-2) = 6 and f(2) = 6	1
	Writing c = 0 ∈ (-2, 2)	1
40	Writing, $f^{I}(x)$ = 4x – 3 **OR** Getting x = $\frac{3}{4}$	1
	Writing, f is increasing in $(\frac{3}{4}, \infty)$	1
	Writing, f is decreasing in $(-\infty, \frac{3}{4})$	1
41	Writing, $\frac{1}{(x+1)(x+2)} = \frac{A}{(x+1)} + \frac{B}{(x+2)}$	1
	Getting, A = 1 and B = -1	1
	Getting, I = log(x + 1) – log(x + 2) + c **OR** I = $\log\left\|\frac{x+1}{x+2}\right\|$ + c	1
42	Writing, I = x $\int sin3x\, dx - \int(\frac{d}{dx}(x) \cdot \int sin3x\, dx)$ dx	1
	Getting, I = -x $\frac{cos3x}{3} + \int \frac{cos3x}{3} dx$	1
	Getting I = -x $\frac{cos3x}{3} + \frac{sin3x}{9}$ + c	1
43	 **OR** Writing Area, A=$\int_2^4 x dy = \int_2^4 2\sqrt{y}\ dy$	1
	Writing, Area, A = 2 $\left[\frac{y^{\frac{3}{2}}}{\frac{3}{2}}\right]_2^4$	1
	Getting, Area = $\frac{4}{3}\left[4^{\frac{3}{2}} - 2^{\frac{3}{2}}\right]$ OR Getting $\frac{4}{3}[8 - 2\sqrt{2}\ ]$	1
44	Writing, $\frac{dy}{1+y^2} = (1 + x^2)dx$	1
	Writing, $\int \frac{dy}{1+y^2} = \int(1 + x^2)dx$	1
	Getting, $\tan^{-1} y = x + \frac{x^3}{3} + C$	1
45	 **OR** Writing $\frac{m}{n} = \frac{AP}{PB}$	1
	Writing $m(\overrightarrow{OB} - \overrightarrow{OP}) = n(\overrightarrow{OP} - \overrightarrow{OA})$	1
	Getting $\overrightarrow{OP} = \frac{m\overrightarrow{OB}+n\overrightarrow{OA}}{m+n}$ **OR** $\overrightarrow{OP} = \frac{m\vec{b}+n\vec{a}}{m+n}$	1
46	Writing, LHS = $(\vec{a} + \vec{b}).\ [(\vec{b} + \vec{c})\ X\ (\vec{c} + \vec{a})]$	1

	Writing, $(\vec{a}+\vec{b})\cdot[\vec{b}\times\vec{c}+\vec{b}\times\vec{a}+\vec{c}\times\vec{a}]$	1
	Getting, RHS = $\vec{a}\cdot(\vec{b}\times\vec{c})$+0+0+0+0+ $\vec{b}\cdot(\vec{c}\times\vec{a})$= 2$[\vec{a}\ \vec{b}\ \vec{c}]$	1
47	Writing, $\vec{a_1}$ = $\hat{\imath}$ + 2$\hat{\jmath}$ - 4$\hat{k}$, $\vec{a_2}$ = 3$\hat{\imath}$ + 3$\hat{\jmath}$ - 5$\hat{k}$, $\vec{b}$ = 2$\hat{\imath}$ + 3$\hat{\jmath}$ +6$\hat{k}$ **OR** $(\vec{a_2}-\vec{a_1})$ =2 $\hat{\imath}$ + $\hat{\jmath}$ - $\hat{k}$ **OR** $(\vec{a_2}-\vec{a_1})\times\vec{b}$ = 9 $\hat{\imath}$ -14$\hat{\jmath}$ + 4$\hat{k}$ **OR** $\lvert(\vec{a_2}-\vec{a_1})\times\vec{b}\rvert=\sqrt{293}$ **OR** $\lvert\vec{b}\rvert$=7	1
	Writing, d= $\frac{\lvert(\vec{a_2}-\vec{a_1})\times\vec{b}\rvert}{\lvert\vec{b}\rvert}$	1
	Getting, d = $\frac{\sqrt{293}}{7}$	1
48	$P(E_1)=\frac{60}{100}=\frac{3}{5}$, $P(E_2)=\frac{40}{100}=\frac{2}{5}$, $P(A\|E_1)=\frac{30}{100}=\frac{3}{10}$ $P(A\|E_2)=\frac{20}{100}=\frac{1}{5}$	1
	Writing $P(E_1\|A)=\frac{P(A\|E_1)P(E_1)}{P(A\|E_1)P(E_1)+P(A\|E_2)P(E_2)}$	1
	Getting, $P(E_1\|A)=\frac{9}{13}$	1
	PART D	
49	Writing $f(x)=y=\ 4x+3$ and getting $g(y)=\frac{y-3}{4}$	1
	Showing $fog(y)$ = y	1
	Showing $gof(x)=x$	1
	Writing $f\circ g=I_Y$ and $gof=I_N$ and concluding f is invertible or f^{-1} inverse exists.	1
	Getting $f^{-1}(x)=\frac{x-3}{4}$ or Writing g is the inverse of f	1
	OR	
	Proving $f(x_1)=f(x_2)\Rightarrow x_1=x_2$	1
	Hence f is one-one	1
	Writing $x=\frac{y-3}{4}$	1
	$\forall\ y\in$ R there exist $x\in$ R such that f(x)=y hence f is onto **OR** Proving $f\left(\frac{y-3}{4}\right)=y$	1
	Writing f is invertible and getting $f^{-1}(x)=\frac{x-3}{4}$	1
50	Getting A+B=$\begin{bmatrix}0&7&8\\-5&0&10\\7&-8&0\end{bmatrix}$	1
	Getting AC=$\begin{bmatrix}9\\12\\30\end{bmatrix}$	1
	Getting BC=$\begin{bmatrix}1\\8\\-2\end{bmatrix}$	1

	Getting (A+B)C= $\begin{bmatrix}10\\20\\28\end{bmatrix}$	1
	Getting AC+BC= $\begin{bmatrix}10\\20\\28\end{bmatrix}$ and hence (A+B)C=AC+BC	1
51	Writing $A=\begin{bmatrix}3 & -2 & 3\\2 & 1 & -1\\4 & -3 & 2\end{bmatrix}$, $X=\begin{bmatrix}x\\y\\z\end{bmatrix}$ *and* $B=\begin{bmatrix}8\\1\\4\end{bmatrix}$ **OR** Getting $\lvert A\rvert=-17\neq 0$ ***Note:*** *Award a mark, if student writes directly* $\lvert A\rvert=-17$.	1
	Getting adj(A) = $\begin{bmatrix}-1 & -5 & -1\\-8 & -6 & 9\\-10 & 1 & 7\end{bmatrix}$ ***Note:*** *If any 4 cofactors are correct award 1 mark.*	2
	Writing $X=A^{-1}B=\frac{1}{\lvert A\rvert}(adjA)B$ **OR** $X=-\frac{1}{17}\begin{bmatrix}-1 & -5 & -1\\-8 & -6 & 9\\-10 & 1 & 7\end{bmatrix}\begin{bmatrix}8\\1\\4\end{bmatrix}$	1
	Getting x =1 , y =2 , z =3	1
52	Getting: $\frac{dy}{dx}=6e^{2x}+6e^{3x}$	1
	Getting: $\frac{d^2y}{dx^2}=6e^{2x}(2)+6e^{3x}(3)$	1
	Writing $\frac{d^2y}{dx^2}=12e^{2x}+18e^{3x}$	1
	Substituting the values of $\frac{d^2y}{dx^2}$, $\frac{dy}{dx}$, and y in the LHS	1
	Getting $\frac{d^2y}{dx^2}-5\frac{dy}{dx}+6y=0$	1
53	Writing $\frac{dx}{dt}=-5$ and $\frac{dy}{dt}=4$	1
	Writing Perimeter of the rectangle, $P=2(x+y)$	1
	Getting $\frac{dp}{dt}=2\left(\frac{dx}{dt}+\frac{dy}{dt}\right)=2(-5+4)=-2$	1
	Writing Area of the rectangle, $A=x.y$	1
	Getting $\frac{dA}{dt}=x\frac{dy}{dt}+y\frac{dx}{dt}=8(4)+6(-5)=2$	1
54	Taking: $x=a\tan\theta$	1
	Writing $I=\int\frac{a\sec^2\theta d\theta}{\sqrt{a^2\tan^2\theta+a^2}}=\int\sec\theta\, d\theta$	1
	$I=\log\lvert x+\sqrt{x^2+a^2}\rvert-\log\lvert a\rvert+c_1=\log\lvert x+\sqrt{x^2+a^2}\rvert+c$,	1
	Writing $\int\frac{1}{\sqrt{x^2+2x+2}}dx=\int\frac{1}{\sqrt{(x+1)^2+1}}dx$	1

	Getting $\log\left|(x+1)+\sqrt{(x+1)^2+1}\right|+C$	1
55	Correct Figure:  	1
	Writing Area A $=4\int_0^a y\,dx$	1
	Writing Area A $=4\int_0^a \sqrt{a^2-x^2}\,dx$	1
	Getting Area A $=4\left[\frac{x}{2}\sqrt{a^2-x^2}+\frac{a^2}{2}\sin^{-1}\frac{x}{a}\right]_0^a$	1
	Getting Area$=\pi a^2$ square unit. **Note:** Units are not compulsory	1
56	Writing $\frac{dy}{dx}+\frac{2}{x}y=x$ **OR** Writing $P=\frac{2}{x}$ *and* $Q=x$	1
	Getting $I.F.=e^{\int Pdx}=e^{\int \frac{2}{x}dx}=e^{2\log(x)}=x^2$	1
	Writing $\therefore\ y(I.F.)=\int Q(I.F.)\,dx+C$	1
	Getting $yx^2=\int x\,.x^2dx+C$ **OR** $yx^2=\int x^3\,dx+C$	1
	Getting general solution $yx^2=\frac{x^4}{4}+C.$	1
57	 Correct figure: **Note**: Award mark for other correct figure writing w.r.t. Co-ordinate axis.	1
	Writing $\overrightarrow{AP}\cdot\vec{N}=0$	1
	Writing $(\overrightarrow{OP}-\overrightarrow{OA})\cdot\vec{N}=0$ and $(\vec{r}-\vec{a})\cdot\vec{N}=0$	1

<table>
<tr><td rowspan="2"></td><td>Writing $\vec{r} = x\hat{i} + y\hat{j} + z\hat{k}$, $\vec{a} = x_1\hat{i} + y_1\hat{j} + z_1\hat{k}$
and $\vec{N} = A\hat{i} + B\hat{j} + C\hat{k}$</td><td>1</td></tr>
<tr><td>Getting:Cartesian form $A(x - x_1) + B(y - y_1 + C(z - z_1) = 0$</td><td>1</td></tr>
<tr><td rowspan="5">58</td><td>n=6, $p = \frac{1}{2}$ and $q = \frac{1}{2}$</td><td>1</td></tr>
<tr><td>Writing $P(X = x) = nC_x p^x q^{n-x}$</td><td>1</td></tr>
<tr><td>Getting P(x=5)=$6C_5 \left(\frac{1}{2}\right)^6 = \frac{3}{32}$</td><td>1</td></tr>
<tr><td>$P(X = 5) + P(X = 6) = 6C_5 \left(\frac{1}{2}\right)^6 + 6C_6 \left(\frac{1}{2}\right)^6 = \frac{7}{64}$</td><td>1</td></tr>
<tr><td>Getting $P(X \leq 5) = 1 - P(X = 6) = 1 - 6C_6 \left(\frac{1}{2}\right)^6 = 1 - \frac{1}{64} = \frac{63}{64}$</td><td>1</td></tr>
<tr><td colspan="3">PART E</td></tr>
<tr><td rowspan="4">59</td><td>

Drawing the graph of 2 lines carries 2 mark and shading the feasible region carries 1 mark</td><td>2+1=3</td></tr>
<tr><td>Getting corner points A(0,4),D(4,0),E(2,3) and O(0,0)</td><td>1</td></tr>
<tr><td><table>
<tr><th>Corner points</th><th>Z=-3x+4y</th></tr>
<tr><td>A(0,4)</td><td>16</td></tr>
<tr><td>D(4,0)</td><td>-12</td></tr>
<tr><td>E(2,3)</td><td>6</td></tr>
<tr><td>O(0,0)</td><td>0</td></tr>
</table></td><td>1</td></tr>
<tr><td>Minimum of Z is -12 at ((4,0) OR showing it in the above second row</td><td>1</td></tr>
<tr><td colspan="3">OR</td></tr>
<tr><td></td><td>$I = \int_0^a f(x)\,dx$
Putting $x = a - t$, then $dx = -dt$ and $x = 0, then\ t = a\ and$
$x = a, then\ t = 0$</td><td>1</td></tr>
</table>

	Getting $I = -\int_a^0 f(a-t)\,dt$	1
	Getting $I = \int_0^a f(a-x)\,dx$	1
	Writing $I = \int_0^{\frac{\pi}{2}} \frac{\cos^5 x}{\sin^5 x + \cos^5 x}\,dx$. and Getting I= $\int_0^{\frac{\pi}{2}} \frac{\sin^5 x}{\sin^5 x+\cos^5 x}\,dx$	1
	Getting 2I =$\int_0^{\frac{\pi}{2}} 1\,dx$	1
	Getting $I = \frac{\pi}{4}$	1
60	Writing $\lim_{x\to 2^-} f(x) = \lim_{x\to 2^+} (x) = f(2)$	1
	Getting $\lim_{x\to 2^-} f(x) = 4k$	1
	Getting $\lim_{x\to 2^+} (x) = 3$	1
	Getting k=$\frac{3}{4}$	1
	OR	
	Applying $R_1 \to R_1 + R_2 + R_3$ and getting $\begin{vmatrix} a+b+c & a+b+c & a+b+c \\ 2b & b-c-a & 2b \\ 2c & 2c & c-a-b \end{vmatrix}$	1
	$a+b+c)\begin{vmatrix} 1 & 1 & 1 \\ 2b & b-c-a & 2b \\ 2c & 2c & c-a-b \end{vmatrix}$	1
	Applying $c_2 = c_2 - c_1$ and $c_3 \to c_3 - c_1$ and getting $a+b+c)\begin{vmatrix} 1 & 0 & 0 \\ 2b & -(a+b+c) & 0 \\ 2c & 0 & -(a+b+c) \end{vmatrix}$	1
	On expansion getting $(a+b+c)^3$	1

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