GOVERNMENT OF KARNATAKA

KARNATAKA SCHOOL EXAMINATION AND ASSESSMENT BOARD

II YEAR PUC SUPPLEMENTARY EXAMINATION - 2

AUGUST / SEPTEMBER - 2023

SCHEME OF EVALUATION

SUBJECT : **MATHEMATICS** **SUBJECT CODE : 35**

INSTRUCTIONS:

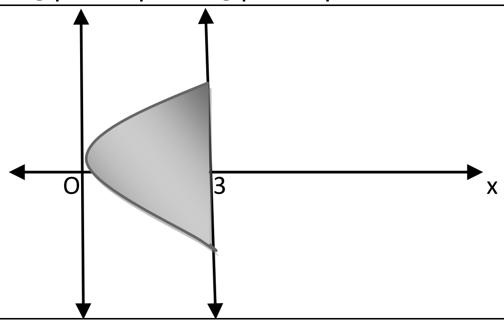
a) Any answer by alternate method should be valued and suitably awarded.

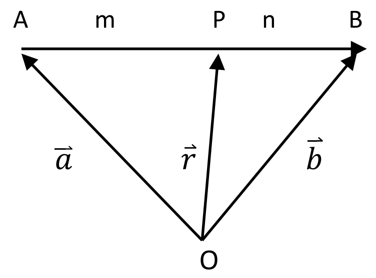
b) All answers (including extra, stuck off and repeated) should be valued . Answers with maximum marks must be considered.

Q. No	PART - A	Marks
	I	
1	b) or writing 16	1
2	c) or writing $5\pi/6$	1
3	d) or writing 512	1
4	a) or writing $\pm\sqrt{3}$	1
5	b) or writing 2x	1
6	b) or writing $e^{x}secx + C$	1
7	a) or writing -7 $\hat{\imath}$ and 6$\hat{\jmath}$	1
8	b) or writing 6x + 4y + 3z = 12	1
9	b) or writing 3a = b	1
10	a) or writing 0.32	1
	I I	
11	-2	1
12	24	1
13	3	1
14	$\frac{3}{13}$	1
15	0.12	1

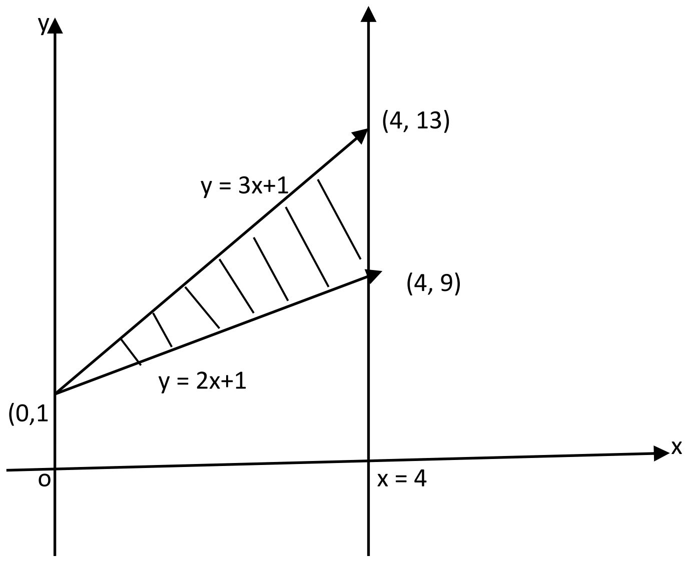
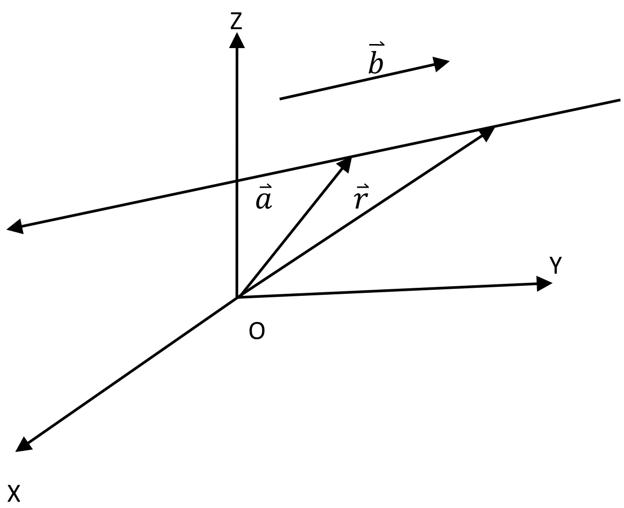
III		
16	On the set A = { 1, 2, 3 }, R = { (1, 2), (2, 1) } OR Any other Suitable example	1
17	$\frac{dy}{dx} = \frac{-2x\, cosec^2\left(x^2\right)}{\sqrt{(cotx^2)}}$	1
18	I = Log 3 – log 2 or $\log\frac{3}{2}$	1
19	$\frac{1}{\sqrt{14}}$, $\frac{2}{\sqrt{14}}$, $\frac{3}{\sqrt{14}}$	1
20	The common region determined by all the constraints including non-negative constraints of a LPP.	1
PART - B		
21	Getting a ∗ (b ∗ c) = a ∗ ($\frac{bc}{4}$) = $\frac{abc}{16}$ Getting (a ∗ b) ∗ c = ($\frac{ab}{4}$) ∗ c = $\frac{abc}{16}$	1 1
22	Writing $\tan^{-1}1/2 + \tan^{-1}2/11 = \tan^{-1}\left\{\frac{\frac{1}{2}+\frac{2}{11}}{1-\frac{1}{11}}\right\}$ Getting RHS = $\tan^{-1}3/4$	1 1
23	Writing $\sin^{-1}x = \theta$ OR x = $\sin\theta$ and x = cos $(\frac{\pi}{2} - \theta)$ Wirting $\cos^{-1}x = (\frac{\pi}{2} - \theta)$ and getting $\sin^{-1}x + \cos^{-1}x = \frac{\pi}{2}$	1 1
24	Writing area = $\frac{1}{2}\begin{vmatrix} 1 & 2 & 1 \\ 3 & 6 & 1 \\ x & y & 1 \end{vmatrix}$ Getting y = 2x	1 1
25	Getting a + 2 by. $\frac{dy}{dx}$ = $siny\frac{dy}{dx}$ Getting $\frac{dy}{dx}$ = - $\frac{a}{2by+siny}$	1 1
26	Writing log y = x log (log x) Getting $\frac{dy}{dx} = y\left\{\frac{1}{logx} + \log(logx)\right\}$	1 1

27	Writing $f(x) = \sqrt{x}$, x = 49 and $\triangle$ x = 0.5 Getting $f^1(x) = \frac{1}{2\sqrt{x}}$ Getting $\sqrt{49.5} \approx 7 + \frac{1}{14}(0.5) = 7.035$	1 1
28	Writing $1 - \tan x = t$ and $-\sec^2 x\, dx = dt$ Getting $I = \frac{1}{1-tanx} + C$	1 1
29	Writing $I = x(-cosx) - \int(-cosx)dx$ Getting $I = -x(cosx) + \sin x + C$	1 1
30	Writing $\frac{1}{a} + \frac{1}{b} \cdot \frac{dy}{dx} = 0$ and Getting $\frac{dy}{dx} = -\frac{b}{a}$ Getting $d^2y / dx^2 = 0$	1 1
31	Writing $\vec{a} = \hat{\imath} + 3\hat{\jmath} + 7\hat{k}$ and $\vec{b} = 7\hat{\imath} - \hat{\jmath} + 8\hat{k}$ and getting $\vec{a} \cdot \vec{b} = 60$ and $\lvert\vec{b}\rvert = \sqrt{114}$ getting projection of $\vec{a}$ on $\vec{b} = \frac{60}{\sqrt{114}}$	1 1
32	Writing $\vec{a} \times \vec{b} = \begin{vmatrix} \hat{\imath} & \hat{\jmath} & \hat{k} \\ 1 & -7 & 7 \\ 3 & -2 & 2 \end{vmatrix}$ Getting $\vec{a} \times \vec{b} = 19\hat{\jmath} + 19\hat{k}$ and $\lvert\vec{a} \times \vec{b}\rvert = 19\sqrt{2}$	1 1
33	Writing $\vec{b} = 2\hat{\imath} + 3\hat{\jmath} + 6\hat{k}$ and $\vec{n} = 10\hat{\imath} + 2\hat{\jmath} - 11\hat{k}$ And $\sin \varnothing = \left\lvert \frac{\vec{b} \cdot \vec{n}}{\lvert\vec{b}\rvert\, \lvert\vec{n}\rvert} \right\rvert$ OR getting $\vec{b} \cdot \vec{n} = -40$ and $\lvert\vec{b}\rvert = 7$ and $\lvert\vec{n}\rvert = 15$ Getting $\sin \varnothing = \frac{8}{21}$ Or $\varnothing = \sin^{-1}\frac{8}{21}$	1 1
34	Writing $0+k+2k+2k+3k+k^2+2k^2+7k^2+k=1$ Or writing $10k^2+9k=1$ Getting $k = 1/10$	1 1

PART - C		
35	Proving R is not reflexive Proving R is not symmetric Proving R is not Transitive	1 1 1
36	Writing $X = \sec\theta$ and $\theta = \sec^{-1}x$ Writing $Y = \tan^{-1}\frac{1}{\sqrt{x^2-1}} = \tan^{-1}\frac{1}{tan\theta}$ Getting $Y = \tan^{-1}\ \tan(\frac{\pi}{2}-\theta)$ Getting $Y = \frac{\pi}{2} - \sec^{-1}x$	1 1 1
37	Getting $A+A' = \begin{bmatrix} 2 & 4 \\ 4 & 4 \end{bmatrix}$ Getting $A-A' = \begin{bmatrix} 0 & 6 \\ -6 & 0 \end{bmatrix}$ Writing $A = \frac{1}{2}(A+A') + \frac{1}{2}(A-A')$	1 1 1
38	Getting $\frac{dx}{d\theta} = a(1-\cos\theta)$ Getting $\frac{dy}{d\theta} = -a\sin\theta)$ Getting $\frac{dy}{dx} = -\frac{\sin\theta}{1-\cos\theta}$ or $\frac{dy}{dx} = -\cot(\frac{\theta}{2})$	1 1 1
39	Writing f(x) is continuous in [2,4] and differentiable in (2,4) Writing $f^1(x) = 2x$ or $f(2) = 4$ and $f(4) = 16$ Writing $f^1(c) = \frac{f(4)-f(2)}{4-2}$ and Getting $C = 3 \in (2,4)$	1 1 1
40	Writing $f^1(x) = 2x + 2$ or getting $x = -1$ Writing f(x) is strictly increasing in $(-1, \infty)$ Writing f(x) is strictly decreasing in $(-\infty, -1)$	1 1 1
41	Writing $I = \int \frac{(1-2sin^2x)+2sin^2x}{cos^2x}\,dx$ Writing $I = \int sec^2 dx$ Writing $I = \tan x + c$	1 1 1
42	Writing $\frac{x}{(x-1)(x-2)} = \frac{A}{(x-1)} + \frac{B}{(x-2)}$ Getting A = -1 and B = 2 Getting $I = -\log\lvert x-1\rvert + 2\log\lvert x-2\rvert + C$	1 1 1
43	Figure  	

	Or Writing area A = 2 $\int_0^3 y\,dx$ or area A = 2 $\int_0^3 2\sqrt{x}\,dx$ Getting area A = $8\sqrt{3}$ sq. Units	1 2
44	Writing $\frac{dy}{1+y^2}$ = $(1+x^2)\,dx$ Writing $\int \frac{dy}{1+y^2}$ = $\int (1+x^2)\,dx$ Writing $\tan^{-1} y$ = x + $\frac{x^3}{3}$ + c	1 1 1
45	Figure  Writing m $\overrightarrow{PB}$ = n $\overrightarrow{AP}$ Getting $\overrightarrow{OP} = \frac{m\,\vec{b} + n\,\vec{a}}{m+n}$	1 1 1
46	Writing $\overrightarrow{AB} = -4\hat{\imath} - 6\hat{\jmath} - 2\hat{k}$, $\overrightarrow{AC} = -\hat{\imath} + 4\hat{\jmath} + 3\hat{k}$, $\overrightarrow{AD} = -8\hat{\imath} - \hat{\jmath} + 3\hat{k}$ Writing $[\overrightarrow{AB}, \overrightarrow{AC}, \overrightarrow{AD}] = \begin{vmatrix} -4 & -6 & -2 \\ -1 & 4 & 3 \\ -8 & -1 & 3 \end{vmatrix}$ Getting $[\overrightarrow{AB}, \overrightarrow{AC}, \overrightarrow{AD}] = 0$ and writing the given points are coplanar.	1 1 1
47	Writing (3x –y +2z -4) + μ (x+y+z-2) = 0 Getting μ = $-\frac{2}{3}$ Getting the equation of the plane : 7x -5y+4z-8=0	1 1 1
48	Writing P (E_1) = 1/3 = P (E_2) = P (E_3) Or Writing P(A /E_1) = 1 P(A /E_2) = 0 P(A /E_3) = ½ Writing P(E_1 /A) = $\frac{P(E_1)\,P(A/E_1)}{P(E_1)\,P\left(\frac{A}{E_1}\right) + P(E_2)\,P(A/E_2) + P(E_3)\,P(A/E_3)}$ Getting Answer = 2/3	1 1 1
	PART D	
49	Writing f (x) = y = x^2+4 and getting x = g(y) = $\sqrt{y-4}$ Showing (g.f) (x)= x Writing (f.g) (y) = y Writing (f.g) = $I_{[4,\infty)}$ and (g.f) = I_{R^+} writing f is invertible and f^{-1} (x) = $\sqrt{x-4}$ or Proving f is one – one Proving f is on to and f is invertible and f^{-1} (x) = $\sqrt{x-4}$	1 1 1 1 1 2

50	Getting A + B = $\begin{bmatrix} 4 & 1 & -1 \\ 9 & 2 & 7 \\ 3 & -1 & 3 \end{bmatrix}$ Getting B-C = $\begin{bmatrix} -1 & -2 & 0 \\ 4 & -1 & 3 \\ 1 & -2 & 0 \end{bmatrix}$ Getting A + (B – C) = $\begin{bmatrix} 0 & 0 & -3 \\ 9 & -1 & 5 \\ 2 & 1 & 1 \end{bmatrix}$ Writing (A +B) – C = $\begin{bmatrix} 0 & 0 & -3 \\ 9 & -1 & 5 \\ 2 & 1 & 1 \end{bmatrix}$ Writing A + (B-C)= (A+B) –C	1 1 1 1 1
51	Writing A = $\begin{bmatrix} 2 & 3 & 3 \\ 1 & -2 & 1 \\ 3 & -1 & -1 \end{bmatrix}$ X = $\begin{bmatrix} x \\ y \\ z \end{bmatrix}$, B = $\begin{bmatrix} 5 \\ -4 \\ 3 \end{bmatrix}$, Or Getting $\lvert A \rvert$ = 40 $\neq 0$ Note : award a mark if student directly writes $\lvert A \rvert$ = 40 Getting adjA = $\begin{bmatrix} 5 & 3 & 9 \\ 5 & -13 & 1 \\ 5 & 11 & -7 \end{bmatrix}$ Note : If any 4 co-factors award 1 mark Writing X = A $^{-1}$ B = $\frac{1}{\lvert A \rvert}$ (adjA) B or X = $\frac{1}{40}\begin{bmatrix} 5 & 3 & 9 \\ 5 & -13 & 1 \\ 5 & 11 & -7 \end{bmatrix}\begin{bmatrix} 5 \\ -4 \\ 3 \end{bmatrix}$ Getting x = 1 y = 2 z = -1	1 2 1 1
52	Getting y_1 = -3 sin (logx) 1/x + 4 cos (logx) 1/x Writing xy_1 = -3 sin (logx) + 4 cos (logx) Getting $xy_2 + y_1$ = -3 cos (logx) 1/x – 4sin (logx) 1/x Writing $x^2y_2 + xy_1$= -3 cos (logx) - – 4sin (logx) Getting $x^2y_2 + xy_1 + y = 0$	1 1 1 1 1
53	Writing $\frac{dx}{dt}$ = -3 cm / min , $\frac{dy}{dt}$ = 4 cm / min Writing P = 2 (x+y) Writing $\frac{dp}{dt} = 2\left[\frac{dx}{dt} + \frac{dy}{dt}\right]$ and $\frac{dp}{dt}$ = -2 cm / min Writing A = xy Writing $\frac{dA}{dt} = x\frac{dy}{dt} + y\frac{dx}{dt}$ and $\frac{dA}{dt}$ = 2 sq.cm/min	1 1 1 1 1
54	Taking x = a tan θ and $\theta = \tan^{-1}\left(\frac{x}{a}\right)$ Getting I = $\frac{1}{a}\int 1\, d\,\theta$ Getting I = $\frac{1}{a}\tan^{-1}\left(\frac{x}{a}\right) + c$ Writing I = $\int \frac{1}{(x+1)2+1}$	1 1 1 1

	Getting $I = \tan^{-1}(x+1) + C$	1
55	Figure  Getting the points of intersection, A = (0,1), B (4,9), C = (4, 13) Writing area A = $\int_0^4 [(3x+1) - (2x+1)]dx$ Getting A = $\int_0^4 x\,dx$ and area A = 8 sq.uints	1 2 1 1
56	Writing $\frac{dy}{dx} + \frac{2}{x}$ y = x or writing p = 2/x , Q = x Getting I.F = $e^{\int p dx}$ = x^2 writing y (I.F) = $\int Q$(IF) dx + C Getting $yx^2 = \int x^3 dx + C$ Getting General Solution : $yx^2 = \frac{x^4}{4} + C$	1 1 1 1 1
57	Figure 	1

<table>
<tr><td></td><td>Writing $\overrightarrow{AP}$ is Parallel to $\vec{b}$ or $\overrightarrow{AP} = \lambda\, \vec{b}$
Getting $\vec{r} = \vec{a} + \lambda \vec{b}$ Vector Form
Writing $\vec{r} = x\hat{\imath} + y\hat{\jmath} + z\hat{k}$
$\vec{a} = x_1\hat{\imath} + y_1\hat{\jmath} + z_1\hat{k}$
$\vec{b} = a\hat{\imath} + b\hat{\jmath} + c\hat{k}$
Getting the Cartesian form
$\frac{x-x_1}{a} = \frac{y-y_1}{b} = \frac{z-z_1}{c}$</td><td>1
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1

1</td></tr>
<tr><td>58</td><td>Writing n = 6, P = ½ , q = 1- ½ = ½
Writing P (X) = $nC_x\, P^x\ q^{n-x}$
Writing P(X = 5) = $6C_5(1/2)^6 = \frac{3}{32}$
Writing P (X ≥ 5) = P (X = 5) + P (X = 6) and
Getting P (X ≥ 5) = $\frac{3}{32}$ + = $6C_6(1/2)^6$
= $\frac{3}{32} + \frac{1}{64} = \frac{7}{64}$
Getting P (X ≤ 5) = 1 – P (x = 6)
= 1 - $\frac{1}{64} = \frac{63}{64}$</td><td>1
1
1

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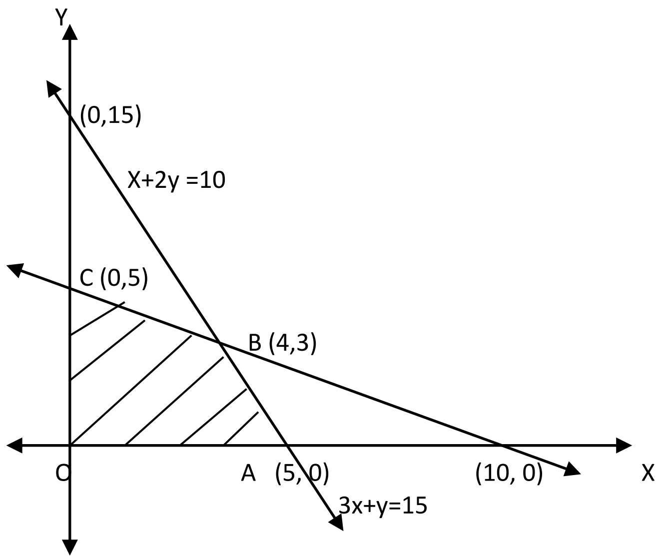
1</td></tr>
<tr><td>59</td><td>

Drawing the graphs of 2 lines carries 2 marks and shading the feasible region carries 1 marks
Getting corner points : (0,0) (5,0) (0,5) (4,3)

Corner Points	Z = 3x + 2y
(0,0)	0
(5,0)	15
(0,5)	10
(4,3)	18

</td><td>2+1

1

1</td></tr>
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	The Maximum value `of Z is 18 at the corner point (4, 3) OR Writing $I = \int_{-a}^{a} f(x)dx = \int_{-a}^{0} f(x)dx + \int_{0}^{a} f(x)dx$ Put x = -t in the first integral on RHS dx = -dt and x = -a, => t = a x = 0 , => t = 0 Writing $I = \int_{-a}^{a} f(x)dx = \int_{-a}^{0} f(-x)dx + \int_{0}^{a} f(x)dx$ Getting f(x) is even, $\int_{-a}^{a} f(x)dx = 2\int_{0}^{a} f(x)dx$ f(x) is odd , $\int_{-a}^{a} f(x)dx = 0$ Getting $I = \int_{-\frac{\pi}{2}}^{\frac{\pi}{2}} \sin^7 x\, dx = 0$ (because it is an odd function)	1 1 1 1 1 1 1
60	Writing $\lim_{x\to 2} f(x) = f(2)$ or RHL = LHL = $f(2)$ Getting LHL = $\lim_{x\to 2} = ((Kx^2) = 4k$ Getting RHL = $\lim_{x\to 2} 3 = 3$ Getting 4k = 3 and K = $\frac{3}{4}$ Or $\Delta = \begin{vmatrix} y+k & y & y \\ y & y+k & y \\ y & y & y+k \end{vmatrix}$ Apply : $C_1 \to C_1 + C_2 + C_3$ $\Delta = \begin{vmatrix} 3y+k & y & y \\ 3y+k & y+k & y \\ 3y+k & y & y+k \end{vmatrix}$ $\Delta = (3y+x) \begin{vmatrix} 1 & y & y \\ 1 & y+k & y \\ 1 & y & y+k \end{vmatrix}$ Apply $R_2 \to R_2 - R_1$ and $R_3 \to R_3 - R_1$ $\Delta = \begin{vmatrix} 1 & y & y \\ 0 & k & 0 \\ 0 & 0 & k \end{vmatrix}$ Getting $\Delta = (3y+k)\,k^2$	1 1 1 1 1 1 1 1