



SECOND YEAR

Kerala Board Answer Key 2023

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ANSWER KEY

Code No

SY 551

SECOND YEAR HIGHER SECONDARY EXAMINATION MARCH 2023

PART-I/II/III

SUBJECT: MATHAMATICS (COMMERCE)60 SCORES2 HOURS

Qn. No	Sub Qns	Answer Key/Value Points	Score	Total Score
1		$A = \begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix}$ $a_{ij} = 2i + j$ $a_{11} = 3 \qquad a_{12} = 4$ $a_{21} = 5 \qquad a_{22} = 6$ $\therefore A = \begin{bmatrix} 3 & 4 \\ 5 & 6 \end{bmatrix}$	$\frac{1}{2}$ $\frac{1}{2}$	3
2	(i)	$A = \begin{bmatrix} 3 & 5 \\ 1 & -1 \end{bmatrix} \quad A' = \begin{bmatrix} 3 & 1 \\ 5 & -1 \end{bmatrix}$ $A + A' = \begin{bmatrix} 6 & 6 \\ 6 & -2 \end{bmatrix}$ $A - A' = \begin{bmatrix} 0 & 4 \\ -4 & 0 \end{bmatrix}$	$\frac{1}{2}$ $\frac{1}{2}$	3
	(ii)	$P = \frac{1}{2} (A + A') = \begin{bmatrix} 3 & 3 \\ 3 & -1 \end{bmatrix}, \text{ is Symmetric}$ $Q = \frac{1}{2} (A - A') = \begin{bmatrix} 0 & 2 \\ -2 & 0 \end{bmatrix}, \text{ is Skew-Symmetric}$ $P + Q = \begin{bmatrix} 3 & 5 \\ 1 & -1 \end{bmatrix} = A$ <p>Remark : $P = \frac{1}{2} (A + A^T)$ $\frac{1}{2}$ score $Q = \frac{1}{2} (A - A^T)$ $\frac{1}{2}$ Score</p>	 	

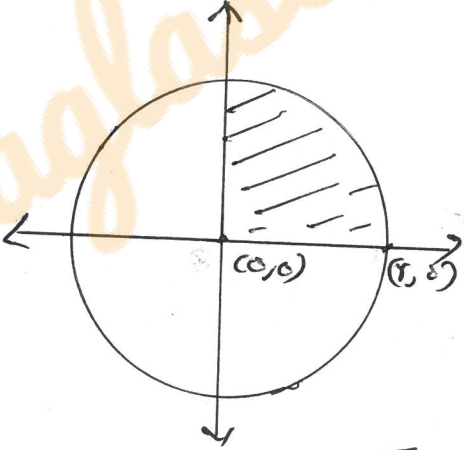
(1/11)

Qn. No	Sub Qns	Answer Key/Value Points	Score	Total Score
3	(i)	$\begin{vmatrix} 2 & 4 \\ 5 & 1 \end{vmatrix} = \begin{vmatrix} 2x & 4 \\ 6 & x \end{vmatrix}$ $2 - 20 = 2x^2 - 24$ $x^2 = 3$ $x = \pm \sqrt{3}$	$\frac{1}{2}$ $\frac{1}{2}$	3
	(ii)	<p>Area of the $\Delta^{1c} = \frac{1}{2} \begin{vmatrix} x_1 & y_1 & 1 \\ x_2 & y_2 & 1 \\ x_3 & y_3 & 1 \end{vmatrix}$</p> $= \frac{1}{2} \begin{vmatrix} 2 & 7 & 1 \\ 1 & 1 & 1 \\ 10 & 8 & 1 \end{vmatrix}$ $= \frac{47}{2} \text{ sq. units}$	1 $\frac{1}{2}$ $\frac{1}{2}$	
4	(i)	$\lim_{x \rightarrow 5^-} f(x) = \lim_{x \rightarrow 5} kx + 1 = 5k + 1$ $\lim_{x \rightarrow 5^+} f(x) = \lim_{x \rightarrow 5} 3x - 5 = 10$	1 1	3
	(ii)	<p>$\therefore f$ is continuous</p> $\lim_{x \rightarrow 5^-} f(x) = \lim_{x \rightarrow 5^+} f(x)$ $5k + 1 = 10$ $k = \frac{9}{5}$	$\frac{1}{2}$ $\frac{1}{2}$	

Qn. No	Sub Qns	Answer Key/Value Points	Score	Total Score
5		<p>let 'r' be the radius and 'A' be the area</p> <p>given $\frac{dr}{dt} = 3 \text{ cm/s}$</p> $A = \pi r^2$ $\frac{dA}{dt} = 2\pi r \frac{dr}{dt}$ $= 6\pi r$ $\left(\frac{dA}{dt}\right)_{r=10} = 60\pi \text{ cm}^2/\text{sec}$	<p>$\frac{1}{2}$</p> <p>1</p> <p>1</p> <p>$\frac{1}{2}$</p>	3
6	(i) (ii)	<p>$\int \frac{1}{x} dx = \log x + C$</p> <p>$\int \frac{x}{1+x^2} dx$</p> <p>put $1+x^2 = u$</p> <p>$2x dx = du$</p> <p>$x dx = \frac{du}{2}$</p> $\int \frac{x}{1+x^2} dx = \frac{1}{2} \int \frac{1}{u} du$ $= \frac{1}{2} \log u + C$ $= \frac{1}{2} \log 1+x^2 + C$	<p>1</p> <p>$\frac{1}{2}$</p> <p>$\frac{1}{2}$</p> <p>$\frac{1}{2}$</p> <p>$\frac{1}{2}$</p>	3
7	(i)	<p>$\vec{a} \cdot \vec{b} = 1 \times 7 + 3 \times -1 + 7 \times 8$</p> <p>$= 60$</p> <p>Remark: $\vec{a} \cdot \vec{b} = a_1 b_1 + a_2 b_2 + a_3 b_3$</p> <p>Give $\frac{1}{2}$ score</p>	<p>$\frac{1}{2}$</p> <p>$\frac{1}{2}$</p>	3

Qn. No	Sub Qns	Answer Key/Value Points	Score	Total Score
	(ii)	$ \vec{b} = \sqrt{7^2 + (-1)^2 + 8^2}$	$\frac{1}{2}$	
		$= \sqrt{114}$	$\frac{1}{2}$	
	(iii)	Remark: $ \vec{a} = \sqrt{x^2 + y^2 + z^2}$ give $\frac{1}{2}$ score Projection of $\vec{a}$ on $\vec{b} = \frac{\vec{a} \cdot \vec{b}}{ \vec{b} }$	$\frac{1}{2}$	
		$= \frac{60}{\sqrt{114}}$	$\frac{1}{2}$	
8	(i)	$P(A \cup B) = P(A) + P(B) - P(A \cap B)$	1	3
		$\frac{7}{11} = \frac{6}{11} + \frac{5}{11} - P(A \cap B)$	$\frac{1}{2}$	
		$P(A \cap B) = \frac{4}{11}$	$\frac{1}{2}$	
	(ii)	$P(A B) = \frac{P(A \cap B)}{P(B)}$	$\frac{1}{2}$	
		$= \frac{4/11}{5/11} = \frac{4}{5}$	$\frac{1}{2}$	
9	(i)	$f(2) = 5 \quad f(-2) = 5$	1	
	(ii)	$f(2) = f(-2)$	$\frac{1}{2}$	
		$\therefore f$ is not 1-1	$\frac{1}{2}$	
	(iii)	$-1 \in R$ in the co-domain is not an image of any element of domain R	1	
		$\therefore f$ is not onto	1	
		Remark: for the concept of 'onto function' give 1 score		4

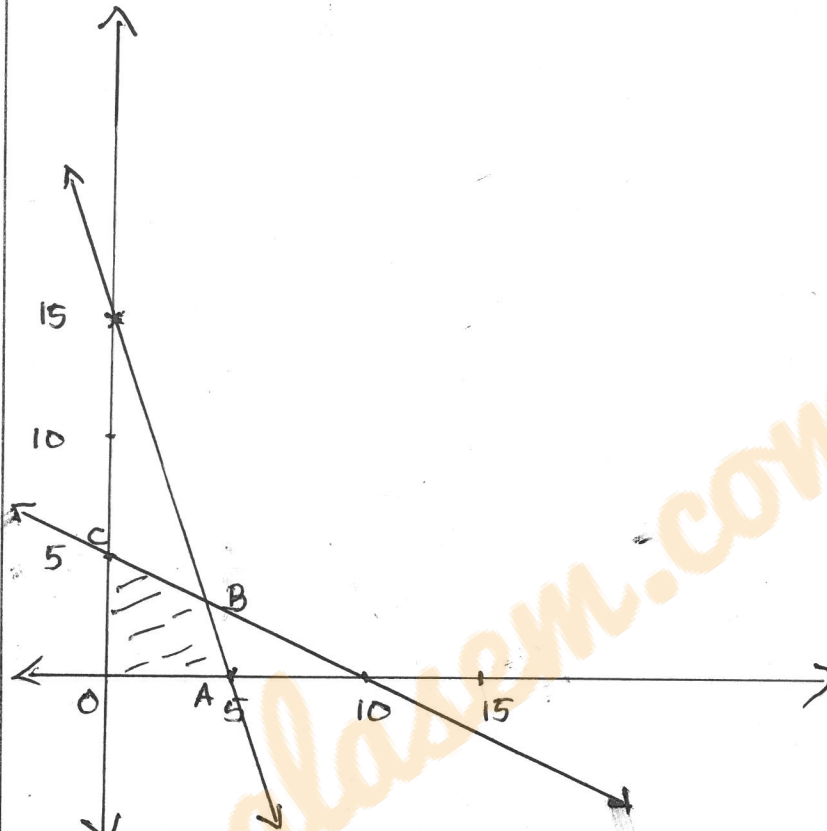
Qn. No	Sub Qns	Answer Key/Value Points	Score	Total Score
10		<div style="display: flex; justify-content: space-around;"> <div style="text-align: center;">A</div> <div style="text-align: center;">B</div> </div> <div style="display: flex; justify-content: space-around;"> <div> (i) $\sin^{-1}(\frac{1}{2})$ (ii) $\tan^{-1}(-1)$ (iii) $\cos^{-1}(\frac{1}{\sqrt{2}})$ (iv) $\sec^{-1}(-2)$ </div> <div> (c) $\frac{\pi}{6}$ (a) $-\frac{\pi}{4}$ (e) $\frac{\pi}{4}$ (b) $\frac{2\pi}{3}$ </div> </div>	1 1 1 1	4
11	(i)	$A^2 = \begin{bmatrix} 3 & -2 \\ 4 & -2 \end{bmatrix} \begin{bmatrix} 3 & -2 \\ 4 & -2 \end{bmatrix}$ $= \begin{bmatrix} 9-8 & -6+4 \\ 12-8 & -8+4 \end{bmatrix}$ $= \begin{bmatrix} 1 & -2 \\ 4 & -4 \end{bmatrix}$ <p>Remark: $A^2 = A \cdot A$ give $\frac{1}{2}$ score</p>	$\frac{1}{2}$ 1 $\frac{1}{2}$	4
	(ii)	$A^2 - A + 2I$ $= \begin{bmatrix} 1 & -2 \\ 4 & -4 \end{bmatrix} - \begin{bmatrix} 3 & -2 \\ 4 & -2 \end{bmatrix} + \begin{bmatrix} 2 & 0 \\ 0 & 2 \end{bmatrix}$ $= \begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix} = 0$ <p>Remark: for $I = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$ give $\frac{1}{2}$ score</p>	1 1	
12	(i)	$f'(x) = 2x + 2$	1	4
	(ii)	$f'(x) = 0$ $2x + 2 = 0$ $x = -1$	1 1	

Qn. No	Sub Qns	Answer Key/Value Points	Score	Total Score
		$\ln(-\infty, -1)$, $f(x)$ is decreasing and in $(-1, \infty)$, $f(x)$ is increasing Remark: For definition of increasing & decreasing give 1 score	$\frac{1}{2}$ $\frac{1}{2}$	
13	(i)	$\int_0^1 \frac{1}{\sqrt{1-x^2}} dx = (\sin^{-1} x)_0^1$ $= \sin^{-1}(1) - \sin^{-1}(0)$ $= \frac{\pi}{2} - 0 = \frac{\pi}{2}$	1 $\frac{1}{2}$ $\frac{1}{2}$	4
	(ii)	$\int x \sin x dx = x \int \sin x dx - \int \frac{d(x)}{dx} \int \sin x dx dx$ $= -x \cos x - \int 1 \times \cos x dx$ $= -x \cos x + \sin x + C$ Remark: For formula for integration by parts give 1 score	$\frac{1}{2}$ $\frac{1}{2}$	
14		 $x^2 + y^2 = r^2 \Rightarrow y = \sqrt{r^2 - x^2}$ Required Area = 4 × Area of shaded region $= 4 \int_0^r y dx$ $= 4 \int_0^r \sqrt{r^2 - x^2} dx$	$\frac{1}{2}$ 1 $\frac{1}{2}$ 1	

Qn. No	Sub Qns	Answer Key/Value Points	Score	Total Score
		$= 4 \left[\frac{x}{2} \sqrt{r^2 - x^2} + \frac{r^2}{2} \sin^{-1} \frac{x}{r} \right]_0^r$ $= 4 \cdot \frac{r^2}{2} \sin^{-1}(1) = 4 \cdot \frac{r^2}{2} \cdot \frac{\pi}{2}$ $= \pi r^2$ <p>Remark : for the formula $\int \sqrt{a^2 - x^2} dx$ give 1 score</p> <p>Area = $\int_a^b y dx$ $\frac{1}{2}$ score</p> <p>for direct answer 'πr^2' give 1 score</p>	$\frac{1}{2}$ $\frac{1}{2}$	4
15	(i) (ii)	<p>(c) 2</p> $\frac{dy}{1+y^2} = (1+x^2) dx$ $\int \frac{dy}{1+y^2} = \int (1+x^2) dx$ $\tan^{-1} y = x + \frac{x^3}{3} + c$	1 1 1 1	4
16		$\vec{a}_1 = \hat{i} + 2\hat{j} + 3\hat{k} \quad \vec{b}_1 = \hat{i} - 3\hat{j} + 2\hat{k}$ $\vec{a}_2 = 4\hat{i} + 5\hat{j} + 6\hat{k} \quad \vec{b}_2 = 2\hat{i} + 3\hat{j} + \hat{k}$ $\vec{a}_2 - \vec{a}_1 = 3\hat{i} + 3\hat{j} + 3\hat{k}$ $\vec{b}_1 \times \vec{b}_2 = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 1 & -3 & 2 \\ 2 & 3 & 1 \end{vmatrix}$ $= -9\hat{i} + 3\hat{j} + 9\hat{k}$ $ \vec{b}_1 \times \vec{b}_2 = \sqrt{171}$	1 $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$	

Qn. No	Sub Qns	Answer Key/Value Points	Score	Total Score
		$S.D = \left \frac{(\vec{a}_2 - \vec{a}_1) \cdot (\vec{b}_1 \times \vec{b}_2)}{ \vec{b}_1 \times \vec{b}_2 } \right $ $= \frac{9}{\sqrt{17}}$	1 $\frac{1}{2}$	4
17	(i)	$A X = B$ $\begin{bmatrix} 3 & -2 & 3 \\ 2 & 1 & -1 \\ 4 & -3 & 2 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 8 \\ 1 \\ 4 \end{bmatrix}$	1	6
	(ii)	$Adj A = \begin{bmatrix} -1 & -5 & -1 \\ -8 & -6 & 9 \\ -10 & 1 & 7 \end{bmatrix}$	2	
	(iii)	$ A = 3 \times -1 + 2 \times 8 + 3 \times -10 = -17$	$\frac{1}{2}$	
		$A^{-1} = \frac{1}{ A } (adj A)$ $= \frac{-1}{17} \begin{bmatrix} -1 & -5 & -1 \\ -8 & -6 & 9 \\ -10 & 1 & 7 \end{bmatrix}$	$\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$	
		$X = A^{-1} B$ $= \frac{-1}{17} \begin{bmatrix} -1 & -5 & -1 \\ -8 & -6 & 9 \\ -10 & 1 & 7 \end{bmatrix} \begin{bmatrix} 8 \\ 1 \\ 4 \end{bmatrix}$ $= \frac{-1}{17} \begin{bmatrix} -8-5-4 \\ -64-6+36 \\ -80+1+28 \end{bmatrix}$ $= \frac{-1}{17} \begin{bmatrix} -17 \\ -34 \\ -51 \end{bmatrix} = \begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix}$ <p>$x=1, y=2, z=3$</p> <p>Remark : In Qn (ii) for 7 correct entries give 2 scores</p>	$\frac{1}{2}$	

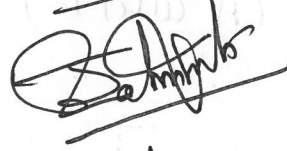
Qn. No	Sub Qns	Answer Key/Value Points	Score	Total Score
18	(i)	$2x + 3y = \sin x$ D.W. r.t. x $2 + 3 \frac{dy}{dx} = \cos x$ $3 \frac{dy}{dx} = \cos x - 2$ $\frac{dy}{dx} = \frac{\cos x - 2}{3}$	1 1	6
	(ii)	$x = at^2$ $y = 2at$ $\frac{dx}{dt} = 2at$ $\frac{dy}{dt} = 2a$ $\frac{dy}{dx} = \frac{dy/dt}{dx/dt} = \frac{2a}{2at} = \frac{1}{t}$	1 $\frac{1}{2} + \frac{1}{2}$	
	(iii)	$y = 2 \sin x + 3 \cos x$ $\frac{dy}{dx} = 2 \cos x - 3 \sin x$ $\frac{d^2y}{dx^2} = -2 \sin x - 3 \cos x$ $\frac{d^2y}{dx^2} = -y$ $\therefore \frac{d^2y}{dx^2} + y = 0$	1 $\frac{1}{2}$ $\frac{1}{2}$	

Qn. No	Sub Qns	Answer Key/Value Points	Score	Total Score																								
19		<div style="display: flex; justify-content: space-around;"> <div> $x + 2y = 10$ <table border="1" style="margin-top: 10px;"> <tr><td>x</td><td>0</td><td>10</td></tr> <tr><td>y</td><td>5</td><td>0</td></tr> </table> </div> <div> $3x + y = 15$ <table border="1" style="margin-top: 10px;"> <tr><td>x</td><td>0</td><td>5</td></tr> <tr><td>y</td><td>15</td><td>0</td></tr> </table> </div> </div> <div style="text-align: center; margin-top: 20px;">  </div> <div style="margin-top: 20px;"> <p>Corner points</p> <table style="width: 100%;"> <tr> <td>O (0, 0)</td> <td>$Z = 3x + 2y$</td> <td>0</td> </tr> <tr> <td>A (5, 0)</td> <td></td> <td>15</td> </tr> <tr> <td>B (4, 3)</td> <td></td> <td>18</td> </tr> <tr> <td>C (0, 5)</td> <td></td> <td>10</td> </tr> </table> <p>Maximum $Z = 18$ at $x = 4, y = 3$.</p> <p>Remarks: 1) for x & y axis $\frac{1}{2}$ score each 2) for each correct line give $1\frac{1}{2}$ score 3) For incorrect shading and correct graph give $3\frac{1}{2}$ score</p> </div>	x	0	10	y	5	0	x	0	5	y	15	0	O (0, 0)	$Z = 3x + 2y$	0	A (5, 0)		15	B (4, 3)		18	C (0, 5)		10	1	6
x	0	10																										
y	5	0																										
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O (0, 0)	$Z = 3x + 2y$	0																										
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C (0, 5)		10																										

Qn. No	Sub Qns	Answer Key/Value Points	Score	Total Score
20	(i)	$P(A \text{ and } B) = P(A \cap B)$ $= P(A) \cdot P(B)$ $= 0.3 \times 0.6 = 0.18$	$\frac{1}{2}$ $\frac{1}{2}$	
	a)	$P(A \text{ and not } B) = P(A \cap B')$ $= P(A) \cdot P(B')$ $= 0.3 \times 0.4 = 0.12$	$\frac{1}{2}$ $\frac{1}{2}$	
		Remark: for $P(B')$ give $\frac{1}{2}$ score		
	ii)	E_1 : Selecting 1 st bag E_2 : Selecting 2 nd bag $P(E_1) = P(E_2) = \frac{1}{2}$ A - Selecting Red ball $P(A E_1) = \frac{3}{7}$ $P(A E_2) = \frac{4}{9}$ Required Probability = $P(E_1 A)$ $= \frac{P(E_1) \cdot P(A E_1)}{P(E_1) \cdot P(A E_1) + P(E_2) \cdot P(A E_2)}$ $= \frac{\frac{1}{2} \times \frac{3}{7}}{\frac{1}{2} \times \frac{3}{7} + \frac{1}{2} \times \frac{4}{9}} = \frac{27}{55}$	$\frac{1}{2}$ $\frac{1}{2}$ 1 $\frac{1}{2}$ 1 $\frac{1}{2}$	6
		NB: Give full score for alternative methods in any question		

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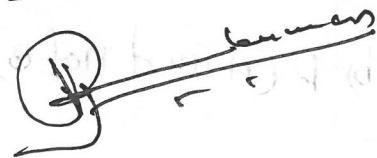
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