

ANSWER KEY

YEAR HIGHER SECONDARY EXAMINATION 20

PART-I/II/III

SUBJECT: MATHEMATICS (Comp 60)CODE NO: SY-51

VERSION: _____

60 SCORES2 HOURS

Qn. No	Sub Qns	Answer Key/Value Points	Score	Total Score
1		(b) y	1	1
2.		(a) $\frac{\pi}{2}$	1	1
3.		(a) 5	1	1
4.		(b) $(0, \frac{\pi}{2})$	1	1
5.		(c) 1	1	1
6.		(a) 1	1	1
7.		0	1	1
8.		$5\hat{i} - 4\hat{j} + 6\hat{k} + \lambda(3\hat{i} + 7\hat{j} + 2\hat{k})$	1	1
9.		(a) $\frac{3}{25}$	1	1
10.		(b) $\frac{\pi}{3}$	1	1
11.		(d) $9 A $	1	1
12.		(c) $\frac{1}{x}$	1	1

Qn. No	Sub Qns	Answer Key/Value Points	Score	Total Score
13.		(d) $\frac{1}{\sqrt{3}}, \frac{1}{\sqrt{3}}, \frac{1}{\sqrt{3}}$	1	1.
14.		$x=1, y=4, z=3$ Remark: For any two correct answer give $\frac{1}{2}$ score.	2	2
15.		$y = x^2$ $\frac{dy}{dx} = 2x$ $\frac{dy}{dx}(1, 2) = 2 \times 1 = 2$ $y - y_1 = \frac{dy}{dx}(x - x_1)$ $y - 2 = 2(x - 1)$ $2x - y = 0.$ Remark: For writing $y - y_1 = \frac{dy}{dx}(x - x_1)$ give $\frac{1}{2}$ score.	$\frac{1}{2}$ $\frac{1}{2}$ 1	2
16.	i)	$f'(x) = 2e^{2x}.$	1	
	ii)	Since $f'(x) = 2e^{2x} > 0$ f is increasing on $\mathbb{R}.$	1	2
17		$\frac{dy}{1+y^2} = \frac{dx}{1+x^2}$	1	

Qn. No	Sub Qns	Answer Key/Value Points	Score	Total Score
		$\int \frac{dy}{1+y^2} = \int \frac{dx}{1+x^2}$ $\tan^{-1} y = \tan^{-1} x + c.$	$\frac{1}{2}$ $\frac{1}{2}$	2.
18.		$\frac{dy}{dx} = 2x + 3$ $\frac{d^2y}{dx^2} = 2$	1 1	2.
19.		$P = \frac{2}{x} \quad Q = x$ $I.F = e^{\int P dx} = e^{\int \frac{2}{x} dx}$ $= e^{2 \log x}$ $= x^2$ $\therefore y \cdot I.F = \int Q \cdot I.F dx + c$ $y \cdot x^2 = \int x \cdot x^2 dx$ $= \int x^3 dx$ $= \frac{x^4}{4} + c.$	$\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$	2.
20		$d = \left \frac{6 \times 2 - 3 \times 5 + 2 \times -3 - 4}{\sqrt{6^2 + (-3)^2 + 2^2}} \right $ $= \left \frac{12 - 15 - 6 - 4}{\sqrt{36 + 9 + 4}} \right $ $= \frac{13}{\sqrt{49}} = \frac{13}{7}$	1 $\frac{1}{2}$ $\frac{1}{2}$	2.

NB: For writing for finding the distance give $\frac{1}{2}$ score.

Qn. No	Sub Qns	Answer Key/Value Points	Score	Total Score
21.		$f(x_1) = f(x_2)$ $\Rightarrow 4x_1 + 3 = 4x_2 + 3$ $\Rightarrow 4x_1 = 4x_2$ $\Rightarrow x_1 = x_2 \therefore f \text{ is one-one}$ Let $y \in \mathbb{R}$ then $y = 4x + 3$ $x = \frac{y-3}{4} \in \mathbb{R}$ $\therefore f \text{ is onto}$	$\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$	3.
22.	(i)	$A+B = \begin{bmatrix} 10 & 1 \\ 6 & 3 \end{bmatrix}$	1	3.
	ii)	$2A = 2 \begin{bmatrix} 8 & 0 \\ 3 & 1 \end{bmatrix} = \begin{bmatrix} 16 & 0 \\ 6 & 2 \end{bmatrix}$	1	
	iii)	$A^{-1} = \begin{bmatrix} 8 & 3 \\ 0 & 1 \end{bmatrix}$	1	
23.	i)	$\vec{a} \cdot \vec{b} = x + - x = 0$ For writing $\vec{a} \cdot \vec{b} = a_1 a_2 + b_1 b_2 + c_1 c_2$ give $(\frac{1}{2})$ score	1	3
	ii)	projection of \vec{a} on $\vec{b} = \frac{\vec{a} \cdot \vec{b}}{ \vec{b} }$ $= \frac{0}{\sqrt{2}}$	1	
		Remark Finding $ \vec{b} = \sqrt{2}$ give 1 score.		
24.	i)	$K + 2K + 3K = 1$ $6K = 1$ $K = \frac{1}{6}$	1 $\frac{1}{2}$ $\frac{1}{2}$	
		Remark: For writing $\sum P_i = 1$ give 1 score		

Qn. No	Sub Qns	Answer Key/Value Points	Score	Total Score
	ii)	$P(x < 2) = P(x = 0) + P(x = 1)$ $= K + 2K$ $= 3K$ $= 3 \times \frac{1}{6} = \frac{1}{2}$	 $\frac{1}{2}$	3.
25.	i) ii) iii)	$5 \times 7 = 35$ $a \times b = ab$ $b \times a = ba = ab$ $\therefore a \times b = b \times a$ $\therefore \times$ is commutative Identity element of \times in \mathbb{N} is 1 Remark: For writing $a \times e = e \times a = a$ give $\frac{1}{2}$ score.	 1 $\frac{1}{2}$ $\frac{1}{2}$ 1	3.
26.		$A = I A.$ $\begin{bmatrix} 1 & -1 \\ 2 & 3 \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} A$ $\begin{bmatrix} 1 & -1 \\ 0 & 5 \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ -2 & 1 \end{bmatrix} A ; R_2 \rightarrow R_2 - 2R_1$ $\begin{bmatrix} 1 & -1 \\ 0 & 1 \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ -2/5 & 1/5 \end{bmatrix} A ; R_2 \rightarrow \frac{1}{5} R_2$ $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} = \begin{bmatrix} 3/5 & 1/5 \\ -2/5 & 1/5 \end{bmatrix} A$ $R_1 \rightarrow R_1 + R_2$	$\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$	3

Qn. No	Sub Qns	Answer Key/Value Points	Score	Total Score
		$A^{-1} = \begin{bmatrix} \frac{3}{5} & \frac{1}{5} \\ -\frac{2}{5} & \frac{1}{5} \end{bmatrix}$ <p>Remark: For finding A^{-1} directly give 1 score.</p>		
27.		<p>A: First ball drawn is black B: Second ball is red</p> $P(A) = \frac{10}{18}$ $P(B/A) = \frac{8}{17}$ $P(A \cap B) = P(A) \times P(B/A)$ $= \frac{10}{18} \times \frac{8}{17}$ $= \frac{40}{153}$	$\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$	3
28	i) ii)	$\tan^{-1} \left(\frac{x+y}{1-xy} \right)$ $\tan^{-1} \frac{1}{2} + \tan^{-1} \frac{2}{11} = \tan^{-1} \left(\frac{\frac{1}{2} + \frac{2}{11}}{1 - \frac{1}{2} \cdot \frac{2}{11}} \right)$ $= \tan^{-1} \left(\frac{\frac{11+4}{22}}{\frac{22-2}{22}} \right)$ $= \tan^{-1} \left(\frac{15}{20} \right)$ $= \tan^{-1} \left(\frac{3}{4} \right)$	1 1 1 1	4.

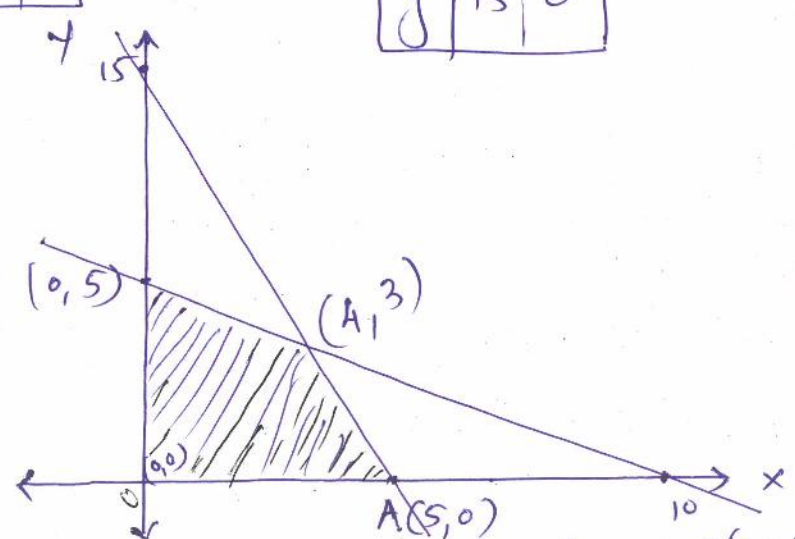
Qn. No	Sub Qns	Answer Key/Value Points	Score	Total Score
29.		<p>Since f is continuous at $x=2$</p> $\lim_{x \rightarrow 2^-} f(x) = \lim_{x \rightarrow 2^+} f(x)$ $\lim_{x \rightarrow 2^-} kx^2 = \lim_{x \rightarrow 2^+} 3.$ $4k = 3$ $k = \frac{3}{4}.$	<p>1</p> <p>1</p> <p>1</p> <p>1</p>	4.
30	<p>i)</p> <p>ii</p>	$f(x) = 2x^2 - 3x$ $f'(x) = 4x - 3$ $f'(x) = 0 \Rightarrow 4x - 3 = 0$ $x = \frac{3}{4}$ <p>f is decreasing increasing in $(\frac{3}{4}, \infty)$</p> <p>f is decreasing in $(-\infty, \frac{3}{4})$</p> <p><u>Remark:</u></p> <p>i) For writing $f'(x) > 0$, the function is increasing give 1 score</p> <p>ii) For writing $f'(x) < 0$, the function is decreasing give 1 score.</p>	<p>1</p> <p>$\frac{1}{2}$</p> <p>$\frac{1}{2}$</p> <p>2</p>	4.

Qn. No	Sub Qns	Answer Key/Value Points	Score	Total Score
31.		$\vec{a}_1 = \hat{i} + \hat{j} + 0\hat{k} \quad \vec{b}_1 = 2\hat{i} - \hat{j} + \hat{k}$	1	
		$\vec{a}_2 = 2\hat{i} + \hat{j} - \hat{k} \quad \vec{b}_2 = 3\hat{i} - 5\hat{j} + 2\hat{k}$		
		$\vec{a}_2 - \vec{a}_1 = \hat{i} + 0\hat{j} - \hat{k}$	$\frac{1}{2}$	
		$\vec{b}_1 \times \vec{b}_2 = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 2 & -1 & 1 \\ 3 & -5 & 2 \end{vmatrix}$	$\frac{1}{2}$	
		$= \hat{i}(-2+5) - \hat{j}(4-3) + \hat{k}(-10+3)$		
		$= 3\hat{i} - \hat{j} - 7\hat{k}$	$\frac{1}{2}$	
		$ \vec{b}_1 \times \vec{b}_2 = \sqrt{9+1+49} = \sqrt{59}$	$\frac{1}{2}$	4.
		$(\vec{a}_2 - \vec{a}_1) \cdot (\vec{b}_1 \times \vec{b}_2) = 3+0+7$ $= 10$	$\frac{1}{2}$	
		$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 $		
		$= \frac{10}{\sqrt{59}}$	$\frac{1}{2}$	
		<p>Remark: For writing the formula give 1 score</p>		
		P.T.O		


Qn. No	Sub Qns	Answer Key/Value Points	Score	Total Score
32.		$\begin{vmatrix} x+y & y+z & z+x \\ z & x & y \\ 1 & 1 & 1 \end{vmatrix}$ $= \begin{vmatrix} x+y+z & x+y+z & x+y+z \\ z & x & y \\ 1 & 1 & 1 \end{vmatrix} \quad R_1 \rightarrow R_1 + R_2$ $= (x+y+z) \begin{vmatrix} 1 & 1 & 1 \\ z & x & y \\ 1 & 1 & 1 \end{vmatrix}$ $= (x+y+z) \times 0 = 0$ <p>Remark: The Given Qn. is wrong. So for attempting give full score.</p>	2 1 1	4
33	i)	$P = \frac{1}{2}$ $q = 1 - P = 1 - \frac{1}{2} = \frac{1}{2}$ $n = 5$ $P(x=4) = {}^5C_4 \left(\frac{1}{2}\right)^4 \left(\frac{1}{2}\right)^{5-4}$ $= 5 \times \left(\frac{1}{2}\right)^5 = \frac{5}{32}$	$\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$	
	ii)	$P(x=5) = {}^5C_5 \left(\frac{1}{2}\right)^5 \left(\frac{1}{2}\right)^{5-5}$ $= \left(\frac{1}{2}\right)^5 = \frac{1}{32}$	$\frac{1}{2}$ $\frac{1}{2}$	4
		$\therefore P(x \geq 4) = P(x=4) + P(x=5)$ $= \frac{5}{32} + \frac{1}{32}$	$\frac{1}{2}$ $\frac{1}{2}$	

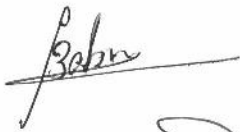
Qn. No	Sub Qns	Answer Key/Value Points	Score	Total Score
		$= \frac{6}{32}$ $= \frac{3}{16}$		
		<p>Remark: For part i & ii any other method give full score.</p>		
34.	i)	$Ax = B$ $\begin{bmatrix} 1 & -1 & 1 \\ 2 & 1 & -3 \\ 1 & 1 & 1 \end{bmatrix} \cdot \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 4 \\ 0 \\ 2 \end{bmatrix}$	1	
	ii)	$ A = \begin{vmatrix} 1 & -1 & 1 \\ 2 & 1 & -3 \\ 1 & 1 & 1 \end{vmatrix}$ $= 1(1+3) - 1(2+3) + 1(2-1)$ $= 4 + 5 + 1 = 10$	$\frac{1}{2}$	
		$\text{adj}(A) = \begin{bmatrix} 4 & 2 & 2 \\ -5 & 0 & 5 \\ 1 & -2 & 3 \end{bmatrix}$	1	
		$A^{-1} = \frac{1}{ A } \text{adj}(A)$ $= \frac{1}{10} \begin{bmatrix} 4 & 2 & 2 \\ -5 & 0 & 5 \\ 1 & -2 & 3 \end{bmatrix}$	$\frac{1}{2}$	
	iii)	$X = A^{-1} \cdot B$	$\frac{1}{2}$	


Qn. No	Sub Qns	Answer Key/Value Points	Score	Total Score
		$X = \frac{1}{10} \begin{bmatrix} 4 & 2 & 2 \\ -5 & 0 & 5 \\ 1 & -2 & 3 \end{bmatrix} \begin{bmatrix} 4 \\ 0 \\ 2 \end{bmatrix}$ $= \frac{1}{10} \begin{bmatrix} 16+0+4 \\ -20+0+10 \\ 4+0+6 \end{bmatrix}$ $= 10 \begin{bmatrix} 20 \\ -10 \\ 10 \end{bmatrix} = \begin{bmatrix} 2 \\ -1 \\ 1 \end{bmatrix}$ <p>$x = 2, y = -1, z = 1$</p>	<p>$\frac{1}{2}$</p> <p>$\frac{1}{2}$</p> <p>$\frac{1}{2}$</p>	<p>6</p>
35	i)	$\int \frac{e^{\tan^{-1}x}}{1+x^2} dx$ <p>put $\tan^{-1}x = u$ $\frac{1}{1+x^2} dx = du$</p> $= \int e^u du$ $= e^u + C$ $= e^{\tan^{-1}x} + C$	<p>$\frac{1}{2}$</p> <p>$\frac{1}{2}$</p> <p>$\frac{1}{2}$</p> <p>$\frac{1}{2}$</p>	
	ii)	$\int x \cdot \sin x dx$ $= x \int \sin x dx - \int 1 \cdot \cos x dx$ $= -x \cos x + \int \cos x dx$ $= -x \cos x + \sin x + C$	<p>1</p> <p>$\frac{1}{2}$</p> <p>$\frac{1}{2}$</p>	
		Remark. Formula for integration by parts give	1 score	

Qn. No	Sub Qns	Answer Key/Value Points	Score	Total Score																						
	iii)	$\int_0^1 \frac{2x}{x^2+1} dx$ $x^2+1 = t$ $2x dx = dt$ $x=0, t=1$ $x=1, t=2$ $= \int_1^2 \frac{1}{t} dt$ $= [\log t]_1^2 = \log 2 - \log 1$ $= \log 2.$	$\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$	6																						
36		<div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> $x+2y=0$ <table border="1" style="margin: auto;"> <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 style="text-align: center;"> $3x+y=15$ <table border="1" style="margin: auto;"> <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>  <p>Corner p. (s) are (0, 0), (5, 0), (0, 5) & (4, 3)</p> <table border="1" style="margin: auto;"> <thead> <tr> <th>Corner p. (s)</th> <th>Z = 3x + 2y</th> </tr> </thead> <tbody> <tr> <td>(0, 0)</td> <td>0</td> </tr> <tr> <td>(5, 0)</td> <td>15</td> </tr> <tr> <td>(0, 5)</td> <td>10</td> </tr> <tr> <td>(4, 3)</td> <td>18 \Rightarrow Maximum</td> </tr> </tbody> </table>	x	0	10	y	5	0	x	0	5	y	15	0	Corner p. (s)	Z = 3x + 2y	(0, 0)	0	(5, 0)	15	(0, 5)	10	(4, 3)	18 \Rightarrow Maximum	<p>1</p> <p>3</p> <p>1</p> <p>1</p>	6
x	0	10																								
y	5	0																								
x	0	5																								
y	15	0																								
Corner p. (s)	Z = 3x + 2y																									
(0, 0)	0																									
(5, 0)	15																									
(0, 5)	10																									
(4, 3)	18 \Rightarrow Maximum																									

Remark: If the graph of one line is crossed give 2 score

1. J. John Victor 
9446171748

2. Baburaj: M. 9446116949 

3. Shaji Mathew 9400743554 

4. Dhanish.T.V 9496759270 Dhanish