ANNEXURE -A

SAHODAYA

SAHODAYA PRE BOARD EXAMINATION- 2024-25

CLASS: XII, SUBJECT: MATHEMATICS (041) SET-1

BLUE PRINT OF QUESTION PAPER

Sl No.	Chapters / units	Marks Allotted in Syllabus	LA (4 Nos.)	SA-II 06 Nos.)	SA-I (5Nos.)	MCQ (18Nos.) +AR(2Nos.) = 20(Nos.)	Case-Based (3 Nos.)	TOTAL (38 NOS.)
1	Relations and Functions	08	-	-	2(1)	1(2)	4(1)	04
2	Algebra	10	5(1)	-	-	1(5)	-	06
3	Calculus	35	5(2)	3(3)	2(2)	1(8)	4(1)	16
4	Vectors and Three - Dimensional Geometry	14	5(1)	3(1)	2(2)	1(2)	-	06
5	Linear Programming	05		3(1)	-	1(2)	-	03
6	Probability	08	-	3(1)	-	1(1)	4(1)	03
MARKS		**80**	**20**	**18**	**10**	**20**	**12**	**80**

Subject: Mathematics **Class: XII** **Full Mark: 80** **Nos. of Questions: 38**

As per the syllabus the typology of question as follows:

R →Remembering 15% of 80 marks: (12 MARKS)	1(6) + 3(2)	08
U →Understanding 40% of 80 marks: (32 MARKS)	1(7)+2(3)+3(2)+5(1)+4(2)	15
A →Application 25% of 80 marks: (20 MARKS)	1(1)+2(2)+3(2)+5(1)+4(1)	07
A →Analysing 5% of 80 marks: (11.2 MARKS= 04)	1(4)	04
E →Evaluation 7.5% of 80 marks: (12.8 MARKS = 06)	1(1) + 5(1)	02
C→Creativity 7.5% of 80 marks: (12.8 MARKS = 06)	1(1) + 5(1)	02
	Total Number of Question	**38**

ANNEXURE -B

SAHODAYA

SAHODAYA PRE BOARD EXAMINATION- 2024-25

CLASS: XII, SUBJECT: MATHEMATICS (041) SET-1

QUESTIONWISE ANALYSIS

Sl No.	Chapters / units	Forms of Question - (LA , SA-II, SA-I, VSA)	Marks Allotted	(R), (U), (A), (C), (E)
1	Algebra	VSA	1	Remembering
2	Algebra	VSA	1	Understanding
3	Calculus	VSA	1	Understanding
4	Algebra	VSA	1	Understanding
5	Calculus	VSA	1	Analysing
6	Algebra	VSA	1	Analysing
7	Algebra	VSA	1	Remembering
8	Probability	VSA	1	Analysing
9	3D and Vector	VSA	1	Understanding
10	3D and Vector	VSA	1	Analysing
11	Calculus	VSA	1	Remembering
12	LPP	VSA	1	Understanding
13	Calculus	VSA	1	Understanding
14	Calculus	VSA	1	Application
15	Relation and function	VSA	1	Remembering
16	LPP	VSA	1	Remembering
17	Calculus	VSA	1	Remembering
18	Calculus	VSA	1	Evaluation
19	Calculus	VSA	1	Creativity
20	Relation and function	VSA	4	Understanding
21	Relation and function	SA-I	2	Understanding
22	Calculus	SA-1	2	Application
23	Calculus	SA-1	2	Understanding
24	3D and Vector	SA-1	2	Understanding
25	3D and Vector	SA-I	2	Application
26	Calculus	SA-II	3	Remembering

27	Calculus	SA-II	3	Remembering
28	3D and Vector	SA-II	3	Application
29	Calculus	SA-II	3	Application
30	LPP	SA-II	3	Understanding
31	Probability	SA-II	3	Understanding
32	Calculus	VSA	5	Application
33	Calculus	SA-I	5	Understanding
34	Algebra	SA-I	5	Evaluation
35	3D and Vector	SA-I	5	Creativity
36	Calculus	CASE-BASED	4	Application
37	Probability	CASE-BASED	4	Understanding
38	Relation and function	CASE-BASED	4	Understanding

ANNEXURE –C

SAHODAYA

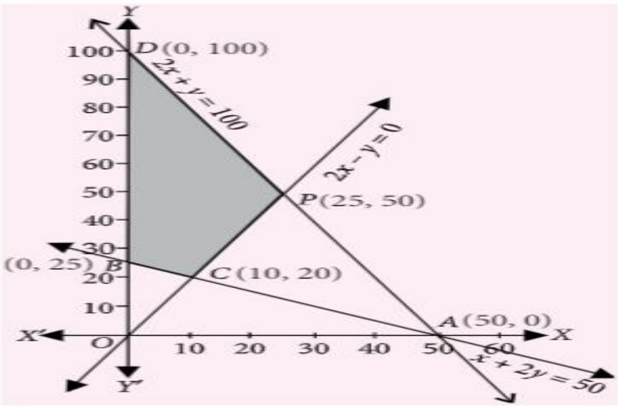
SAHODAYA PRE BOARD EXAMINATION- 2024-25

CLASS: XII, SUBJECT: MATHEMATICS (041) SET-1

MARKING SCHEME

QST N NO	Value Points	Marks Allotted
	SECTION-A	
1	(D) $a_{ij} = a_{ji}, \forall i, j$	1
2	(D) none of these	1
3	(C) $1 < x < 3$	1
4	(D) ± 3	1
5	(A) 2	1
6	(D) 1	1
7	(D) -216	1
8	(A) $\frac{10}{9}$	1
9	(A) $1/\sqrt{3}$	1
10	(C) $\frac{\pi}{2}$	1
11	(C) $\frac{x^3}{3} - \frac{1}{x} + c$	1
12	(B) Open half plane not containing the origin	1
13	(B) 1/2	1
14	(A) $\frac{e^x}{x}$	1
15	(B) $y = cos^{-1}x$	1
16	(C) $x - y \geq 1$	1
17	(C) 3	1
18	(B) $\frac{8}{3}$	1
19	Both A and R are true and R is the correct explanation of A	1
20	(D) A is false but R is true	1
	SECTION-B	
21	$cos^{-1}\left(cos\frac{5\pi}{3}\right) + sin^{-1}\left(cos\frac{5\pi}{3}\right)$ $= cos^{-1}\left(cos\frac{\pi}{3}\right) + sin^{-1}\left(cos\frac{\pi}{3}\right)$ $=\frac{\pi}{3} + \frac{\pi}{2} - \frac{\pi}{3} = \frac{\pi}{2}$	 1 1
22	$f(x) = x^3 + x$ $f'(x) = 3x^2+1 > 0$ ⇒ It has no critical points.	 1 1
OR	Let v be the velocity of the car at t seconds. $x = t^2\left(2 - \frac{t}{3}\right) = 2t^2 - \frac{t^3}{3}$ $\Longrightarrow v = \frac{dx}{dt} = 4t - t^2 = t(4 - t)$ When the car starts from P and reach Q at those point v = 0 That is when t = 0 sec(at P) and when t = 4sec(at Q). So, reach Q after 4 seconds. Distance PQ = x (at t = 4) = $4^2\left(2 - \frac{4}{3}\right) = \frac{32}{3}$metres	 0.5 0.5 0.5 0.5
23	Given $f(x) = (x - 1)e^x + 1$	

	$\Rightarrow f'(x) = xe^x$ $x > 0 \; and \; e^x > 0 \; for \; all \; x$ $\because f'(x) > 0$ $\Rightarrow f$ is increasing function.	1 0.5 0.5
24	$\left\|\vec{a}+\vec{b}\right\| = \|\vec{a}\| \Rightarrow \left\|\vec{a}+\vec{b}\right\|^2 = \|\vec{a}\|^2$ $\Rightarrow \|\vec{a}\|^2 + \left\|\vec{b}\right\|^2 + 2\vec{a}.\vec{b} = \|\vec{a}\|^2$ $\Rightarrow \left\|\vec{b}\right\|^2 + 2\vec{a}.\vec{b} = 0$ $\Rightarrow (2\vec{a}+\vec{b}) \perp \vec{b}$	0.5 0.5 0.5 0.5
25	$\left\|\left(\vec{a}+2\vec{b}\right)\times\left(2\vec{a}-3\vec{b}\right)\right\|^2$ $= \left\|7\left(\vec{a}\times\vec{b}\right)\right\|^2$ $= \left(7 \times 2 \times 3 \times sin\frac{\pi}{4}\right)^3$ = 882	0.5 0.5 1
OR	Horizontal component = 200 $\cos 60^0$ = 100N Vertical component = 200 $\sin 60^0$= $100\sqrt{3}$ N	1 1
	SECTION-C	
26	$\frac{dy}{dx} + \frac{2x}{(x^2-1)}y = \frac{1}{(x^2-1)^2}$ $IF = e^{\int pdx} = (x^2-1)$ $\therefore$ Solution is $y(x^2-1) = \int \frac{1}{(x^2-1)}dx$ Hence $y(x^2-1) = \frac{1}{2}\, log\left\|\frac{x-1}{x+1}\right\| + C$	0.5 1 0.5 1
27	$\frac{dA}{dt} = \frac{1}{6\sqrt{t}}$ $\frac{d^2A}{dt^2} = -\frac{1}{12t\sqrt{t}} < 0$ for all $t \in [5, 18]$ This means that the rate of change of the ability to understand spatial concepts decreases (slows down) with age.	1 1 1
28	$\overrightarrow{a_1} = \hat{\imath} + \hat{\jmath}$, $\overrightarrow{a_2} = 2\hat{\imath} - \hat{\jmath} - \hat{k}, \overrightarrow{b_1} = 2\hat{\imath} - \hat{\jmath} + \hat{k} \overrightarrow{b_2} = 2\hat{\imath} + \hat{\jmath} + 2\hat{k}$ $\overrightarrow{a_2} - \overrightarrow{a_1} = \hat{\imath} - 2\hat{\jmath} - \hat{k}, \overrightarrow{b_1} \times \overrightarrow{b_2} = \begin{vmatrix} \hat{\imath} & \hat{\jmath} & \hat{k} \\ 2 & -1 & 1 \\ 2 & 1 & 2 \end{vmatrix} = -3\hat{\imath} - 2\hat{\jmath} + 4\hat{k}$ S.D=$\left\|\frac{(\overrightarrow{a_2}-\overrightarrow{a_1}).(\overrightarrow{b_1}\times\overrightarrow{b_2})}{\|\overrightarrow{b_1}\times\overrightarrow{b_2}\|}\right\|$ units $= \frac{3}{\sqrt{29}}$ units	0.5 0.5 1 1
OR	At the point of intersection $\left(-2\hat{\imath} + 3\hat{\jmath} + 5\hat{k}\right) + \lambda\left(9\hat{\imath} - 3\hat{\jmath} - 6\hat{k}\right) = \left(-3\hat{\imath} - 2\hat{\jmath} - 5\hat{k}\right) + \mu\left(6\hat{\imath} + 6\hat{\jmath} + 12\hat{k}\right)$ $\Rightarrow -2 + 9\lambda = -3 + 6\mu,\ 3 - 3\lambda = -2 + 6\mu,\ 5 - 6\lambda = -5 + 12\mu$ $\Rightarrow \lambda = \frac{1}{3}$ Putting it in equation of first line, we get point of intersection as (1, 2, 3)	1 1 1

29	$\int \frac{x^2+9}{x^4-2x^2+81}dx$ $=\int \frac{1+\frac{9}{x^2}}{x^2-2+\frac{81}{x^2}}dx$ $=\int \frac{1+\frac{9}{x^2}}{\left(x-\frac{9}{x}\right)^2+18-2}dx$ $=\int \frac{dt}{t^2+16}=\frac{1}{4}\tan^{-1}\frac{t}{4}+c$ $=\frac{1}{4}tan^{-1}\left(\frac{x^2-9}{4x}\right)+c$	 1 1 1
OR	$\int_0^{\frac{\pi}{4}} \frac{dx}{\cos^3 x\sqrt{2\sin 2x}}$ $=\int_0^{\frac{\pi}{4}} \frac{dx}{2\cos^4 x\sqrt{\tan x}}$ $=\frac{1}{2}\int_0^{\frac{\pi}{4}} \frac{\sec^4 xdx}{\sqrt{\tan x}}$ $=\frac{1}{2}\int_0^1 \frac{1+t^2}{\sqrt{t}}dt=\frac{1}{2}\left[2t^{\frac{1}{2}}+\frac{2}{5}t^{\frac{5}{2}}\right]_0^1=\frac{6}{5}$	 1 1 1
30	 4. **Corner points** / **Value of Z = x + 2y**: B(0, 25) — 50(minimum) C(10,20) — 50(minimum) P(25,50) — 125 D(0,100) — 200 Z has minimum value 50 at every point of segment joining B(0, 25) and C(10,20). Hence there are infinite number of solutions.	1.5 1 0.5
31	Let E_1 be the event that letter is from TATA NAGAR and E_2 be the event that letter is from CALCUTTA. Also, let E_3 be the event that on the letter, two consecutive letters TA are visible.	

If letter is from TATANAGAR, we see that the events of two consecutive letters visible are {TA, AT, TA, AN, NA, AG, GA, AR}, So $P(E_3/E_1)$ = 2/8 — 1

If letter is from CALCUTTA, we see that the events of two consecutive letters to visible are {CA, AL, LC, CU, UT, TT, TA}. So $P(E_3/E_2)$ = 1/7 — 1

So $P(E_1/E_3) = \frac{P(E_1)P(E_3/E_1)}{P(E_1)P(E_3/E_1)+P(E_2)P(E_3/E_2)} = \frac{\frac{1}{2}\times\frac{2}{8}}{\frac{1}{2}\times\frac{2}{8}+\frac{1}{2}\times\frac{1}{7}} = \frac{7}{11}$ — 1

OR

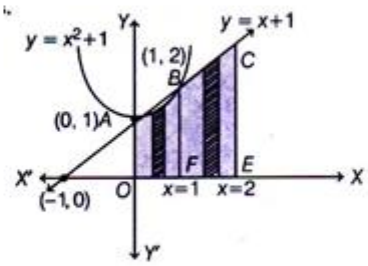
X	5	4	3	-3
P(X)	1/3	2/9	4/27	8/27

— 2

E(X) = $\sum XP(X) = Rs\ 2\frac{1}{9}$ — 1

SECTION-D

32



x
( )

— 1

Point of intersection are (0,1) and (1,2) — 2

Area = Area of OABFO + Area of FECBF =

$= \int_0^1 (x^2+1)dx + \int_1^2 (x+1)dx = \frac{4}{3}+\frac{5}{2} = \frac{23}{6}$ square unit — 1+1

33

$x = sin\theta$, $y = \cos p\theta$

$\frac{dx}{d\theta} = \cos\theta$ $\frac{dy}{d\theta} = -psinp\theta$ — 1

$\Rightarrow \frac{dy}{dx} = \frac{-psinp\theta}{\cos\theta} = \frac{-p\sqrt{1-y^2}}{\sqrt{1-x^2}}$ — 1

$\Rightarrow \left(\frac{dy}{dx}\right)^2 = \frac{p^2.(1-y^2)}{1-x^2}$ — 1

$\Rightarrow (1-x^2)\left(\frac{dy}{dx}\right)^2 = p^2(1-y^2)$ — 1

Again differentiating with respect to x — 1

$(1-x^2)\frac{d^2y}{dx^2} - x\frac{dy}{dx} + p^2y = 0$

OR

$y = x^x$

$logy = xlogx \Longrightarrow \frac{dy}{dx} = x^x(1+logx)$ ----(1) — 2

$\frac{d^2y}{dx^2} = \frac{x^x}{x} + (1+logx)\frac{d}{dx}x^x = \frac{x^x}{x} + (1+logx)\frac{dy}{dx}$ — 2

$= \frac{y}{x} + \frac{1}{y}\frac{dy}{dx}\frac{dy}{dx}$ using (1)

$\frac{d^2y}{dx^2} - \frac{y}{x} - \frac{1}{y}\left(\frac{dy}{dx}\right)^2 = 0$ — 1

34

$\begin{bmatrix}1 & -1 & 2\\ 0 & 2 & -3\\ 3 & -2 & 4\end{bmatrix}\begin{bmatrix}-2 & 0 & 1\\ 9 & 2 & -3\\ 6 & 1 & -2\end{bmatrix} = \begin{bmatrix}1 & 0 & 1\\ 0 & 1 & 0\\ 0 & 0 & 1\end{bmatrix}$ — 1

	$\Rightarrow \begin{bmatrix}1 & -1 & 2\\ 0 & 2 & -3\\ 3 & -2 & 4\end{bmatrix}^{-1} = \begin{bmatrix}-2 & 0 & 1\\ 9 & 2 & -3\\ 6 & 1 & -2\end{bmatrix}$ Now, given system of equations can be written, in matrix form, as follows $\begin{bmatrix}1 & -1 & 2\\ 0 & 2 & -3\\ 3 & -2 & 4\end{bmatrix}\begin{bmatrix}x\\ y\\ z\end{bmatrix} = \begin{bmatrix}1\\ 1\\ 2\end{bmatrix}$ $\Rightarrow \begin{bmatrix}x\\ y\\ z\end{bmatrix} = \begin{bmatrix}1 & -1 & 2\\ 0 & 2 & -3\\ 3 & -2 & 4\end{bmatrix}^{-1}\begin{bmatrix}1\\ 1\\ 2\end{bmatrix}$ $\Rightarrow \begin{bmatrix}x\\ y\\ z\end{bmatrix} = \begin{bmatrix}-2 & 0 & 1\\ 9 & 2 & -3\\ 6 & 1 & -2\end{bmatrix}\begin{bmatrix}1\\ 1\\ 2\end{bmatrix} = \begin{bmatrix}-2+0+2\\ 9+2-6\\ 6+1-4\end{bmatrix} = \begin{bmatrix}0\\ 5\\ 3\end{bmatrix}$ $\Rightarrow$x=0, y=5, z=3	1 1 1 1
35	Let Q(a,b,c) be the required image Let $\frac{x}{1} = \frac{y-1}{2} = \frac{z-2}{3} =$ k x=k,y=2k+1,z=3k+2 Co-ordinate of M(k,2k+1,3k+2) Drs of PQ is (k-1,2k-5,3k-1) Now1(k-1)+2(2k-5)+3(3k-1)=0 14k-14=0,k=1 Co-ordinate of foot M(1,3,5) $\frac{a+1}{2} = 1$,a=1 $\frac{b+6}{2}$ = 3,b=0 $\frac{c+3}{2}$ =5,c=7 The reqd. image is (1,0,7)	1 1 1 1 1
OR	$\frac{x-1}{2} = \frac{y-2}{3} = \frac{z-3}{4}$ = r and $\frac{x-4}{5} = \frac{y-1}{2} = z$ = s Any point on the first line are (2r+ 1 , 3r+2, 4r+3) and any point on the second line are (5s+4 , 2s+1 ,s) If the lines intersects for some values of r and s , we must have 2r+ 1 =5s+4 , 3r+2 = 2s+1 and 4r+3 = s Solving first two equations , we have r = -1 , s = -1 As these values satisfies the third equation , so the lines intersects at (-1 , -1 ,-1) Now the equation of the line passing through (-1 , -1 ,-1) and parallel to z – axis are $\frac{x+1}{0} = \frac{y+1}{0} = \frac{z+1}{1}$	1 1 1 1 1
	SECTION-E	
36	i) Price = Rs (300- 3x), Quantity = 80 + x quintals ii) Revenue = Quantity × Price = (80 + x)(300-3x) = 24000 + 60x - $3x^2$ iii) $R'(x) = 60 - 6x = 0 \Rightarrow x = 10$, $R''(10) < 0$, So x = 10 OR Maximum revenue = R(10) = 24300	1 1 2 2
37	(i) 90% (ii) 1%	1 1 2

	(iii) 99.9% OR 8.3%	2

38	**(i)** No. of relations from B to G = $2^{2\times3} = 2^6 = 64$
	No. of functions from B to G = $2^3 = 8$
	(ii) Let x ∈B. That means, x is a boy.
	Clearly (x, x) ∈ R for all x ∈B. Therefore, R is a reflexive relation.
	Let x, y ∈ B. That means, x and y are boys.
	If (x, y) ∈ R, then (y, x) ∈ R. Therefore, R is symmetric relation.
	Let x, y, z ∈ B. That means, x, y and z are boys.
	If (x, y) ∈R and (y, z) ∈R, then (x, z) ∈R. Therefore, R is transitive relation.
	Hence, R is an equivalence relation.
		1
		1
		0.5
		0.5
		1