INDIAN SCHOOL SOHAR

TERM – I (2023-24)

MATHEMATICS

CLASS: XI **MAX. MARKS: 80**

DATE: 21/09/2023 **TIME: 3 Hours**

General Instructions:

1. This Question paper contains - four sections A, B, C and D. Each section is compulsory. However, there are internal choices in some questions.
2. Section A has 18 MCQ's and 2 Assertion-Reason based questions of 1 mark each.
3. Section B has 5 Very Short Answer (VSA)-type questions of 2 mark each.
4. Section C has 6 Short Answer (SA)-type questions of 3 mark each.
5. Section D has 4 Long Answer (LA)-type questions of 5 mark each.
6. Section E has 3 source based/case based/passage based/integrated units of assessment of 4 marks each with sub parts.

	SECTION – A	
1.	The smallest set A such that $A \cup \{1,2\} = \{1,2,3,5\ 9\}$ is (a) {3, 5, 9} (b) {1, 2, 3, 5, 9} (c) {1,2,5, 9} (d) $\emptyset$	**MARKS** 1
2.	Empty set is a _____ (a) Finite set (b) Infinite set (c) invalid set (d) $\{\emptyset\}$	1
3.	If X and Y are two sets, then $X \cap (X \cup Y)'$ is equal to (a) X (b) $X \cap Y$ (c) {0} (d) $\emptyset$	1
4.	Which of the following is correct for A – B ? (a) $A \cap B$ (B) $A' \cap B$ (c) $A' \cap B'$ (d) $B' \cap A$	1
5.	The domain of the function $f(x) = \frac{1}{1+x^2}$ (a) R – {1} (b) R – {- 1 } (c) R-{-1, 1} (d) R	1
6.	The domain for which the functions defined by $f(x) = 5x^2 - 1$ and $g(x) = 5 + x$ are equal is: (a) $\left\{-1, \frac{5}{6}\right\}$ (b) $\left\{-1, -\frac{6}{5}\right\}$ (c) $\left\{-1, \frac{6}{5}\right\}$ (d) $\left\{-1, \frac{-6}{5}\right\}$	1
7.	The range of the function given by $f(x) = 5 - \lvert x+4 \rvert$ (a) $\{-5, \infty\}$ (b) [5, ∞) (c) $(-\infty, 5]$ (d) {0, 5}	1
8.	The radian measure corresponding to $-37°30'$ (a) $-\frac{24\pi}{5}$ (b) $-\frac{5\pi}{24}$ (c) $\frac{24\pi}{5}$ (d) $\frac{5\pi}{24}$	1
9.	The value of$\tan(-1590°)$ is (a) -1 (b) $-\frac{1}{\sqrt{3}}$ (c) $\frac{1}{\sqrt{3}}$ (d) $\sqrt{3}$	1
10.	In a triangle ABC, $cosec\ A(\sin B \cos C + \cos B sin\ C)$ equals to (a) 1 (b) -1 (c) 0 (d) none of these	1
11.	The value of i^{-999} is (a) $-i$ (b) i (c) -1 (d) 1	1

12.	The value of $\sqrt{-25} + 3\sqrt{-4} + 2\sqrt{-9}$ is (a) $-13i$ (b) $13i$ (c) $-17i$ (d) $17i$	1
13.	The value of x and y if (3y – 2) – i(7 – 2x) = 0 (a) x = 7/2, y = 2/3 (b) x = 2/3, y = 2/7 (c) x = –7/2 , y = -2/3 (d) x= 7, y =2	1
14.	The solution of the inequality | x – 1| < 2 is (a) $[-1, \infty]$ (b) $(-1, \infty)$ (c) $[-1,\ 3]$ (d) $(-1,\ 3)$	1
15.	The domain of the function f given by $f(x) = \frac{x^2+2x+1}{x^2-x-6}$ is (a) R – {3, – 2} (b) R – {– 3, 2} (c) R – [– 3, 2] (d) R – (– 3, 2)	1
16.	The number of triangles which can be formed by joining the angular points of a polygon of 8 sides as vertices: (a) 56 (b) 65 (c) 336 (d) 24	1
17.	If ${}^{n}_{r}P = 720 \times {}^{n}_{r}C$, then r is equal to (a) 6 (b) 4 (c) 7 (d) 3	1
18.	In how many ways can the letters of the word ABACUS be rearranged such that the vowels always appear together? (a) $\frac{6!}{2!}$ (b) $3! \times 3!$ (c) $\frac{4!\times 3!}{2!}$ (d) $\frac{5!}{2!}$	1
	Q. 19 and q. 20 based on Assertion and reason based. **Select the correct answer from the codes (a), (b), (c) and (d) as given below** **(a) Both A and R are true and R is the correct explanation of A** **(b) Both A and R are true and but R is not the correct explanation of A** **(c) A is true and R is false.** **(d) A is false and R is true.**	1
19.	**Assertion (A) :** $\emptyset' \cap \boldsymbol{A} = \boldsymbol{U}'$ **Reason (R) :** Let U be universal set and A be subset of then $\boldsymbol{A'} = \{\boldsymbol{x} : \boldsymbol{x} \in \boldsymbol{U}\ \boldsymbol{and}\ \boldsymbol{x} \notin \boldsymbol{A}\}$	1
20.	**Assertion (A):** The inequality 3x + 2y >5 is strictly inequality. **Reason (R):** The solution of 5x – 3 < 7, when x is a real number is $(-\infty, 2)$	1
	SECTION – B	
21.	If $S = \{ x : x\ is\ a\ multiple\ of\ 3\ less\ than\ 100 \}$ and $P = \{ x: x\ is\ a\ prime\ number\ less\ than\ 20\}$, then find n(S) – n(P).	2
22.	If the arcs of the same length in two cirles subtend angles of 65° and 110° at their respective centres, find the ratio of their radii. **OR** The perimeter of a certain sector of a circle is equal to the length of the arc of semicircle having the same radius. Find the angle of sector in degree ($\pi = \frac{22}{7}$)	2
23.	If $z = 2 - 3i$, then find the value of $z^2 - 4z + 13 = 0$. Hence, find the value of $4z^3 - 3z^2 + 2z + 170$. **OR** If $i = \sqrt{-1}$ prove that $(x + 1 + i)(x + 1 - i)(x - 1 + i)(x - 1 - i) = x^4 + 4$	2

24.	Solve the following inequality and graph the solution set on the number line: $2y - 3 < y + 2 \leq 3y + 5$	2
25.	Using Binomial theorme expand : $(3x^2 - 3y)^5$	2
	SECTION – C	
26.	If $A = \{1, 3, 5, \ldots\ldots 17\} and\ B = \{2, 4, 6, \ldots\ldots, 18\}$ and N the set of natural numbers is the universal set, then show that $A' \cup \big((A \cup B) \cap B'\big) = N$. **OR** Let A and B be sets. If $A \cap X = B \cap X = \emptyset\ and\ A \cup X = B \cup X$ for some set X, show that A = B.	3
27.	If A= {2, 4, 6, 9}, B= {4, 6, 18, 27, 54} and a relation R from A to B is defined by $R = \{(a, b): a \in A, b \in B, a\ factor\ of\ b\ and\ a < b\ \}$, then find R in roster form. Also find its domain and range.	3
28.	Prove that : $\tan\left(\frac{\pi}{4} - x\right) + \tan\left(\frac{\pi}{4} + x\right) = 2\sec 2x$	3
29.	$If\ (x + iy)^3 = p + iq$ then show that $\frac{p}{x} + \frac{q}{y} = 4(x^2 - y^2)$ **OR** If $\alpha\ and\ \beta$ are different complex numbers with $\lvert\beta\rvert = 1$, then prove that $\left\lvert\frac{\beta - \alpha}{1 - \bar{\alpha}\beta}\right\rvert$=1	3
30.	If ${}^{n}_{r}C : {}^{n}_{r+1}C : {}^{n}_{r+2}C = 1 : 2 : 3$, find n and r. **OR** In how many ways 3 mathematics books, 4 history books, 3 chemistry books, and 2 biology books can be arranged on a shelf so that all the books on the same subject are together?	3
31.	Using the Binomial Theorem indicate which is larger : $1.2^{4000}\ or\ 800$	
	SECTION – D	
32.	Find the domain and range of the following functions: (i) $f(x) = 1 - \lvert x - 2\rvert$ (ii) $f(x) = \frac{1}{\sqrt{9 - x^2}}$	2+3
33.	Prove that : $\cos x = 16\ cos^5 x - 20\ cos^3 x + 5\cos x$ **OR** Prove that : $\cos 6°\ cos\ 42° \cos 66° \cos 78° = \frac{1}{16}$	5
34.	If $z = x + iy$ and imaginary part of $\frac{2z+1}{iz+1}$ is –2, then show that x + 2y – 2 = 0	5
35.	Find the number of arrangements of the letters of the word '**EXAMINATION'**. In how many of these arrangements (i) do the words start with M (ii) do all the vowels always together (iii) do the words begin with M and end with T? **OR** If all the letters of the word 'MOTHER' are written in all possible orders and the words so formed are arranged as in a dictionary order, then find the rank of word 'MOTHER'.	1+1+ 2+1= 5

	SECTION – E	
36.	During the examination days friends are revising mathematics topics and they started with the chapter on sets and topic related to operation in sets. One of the questions taken was A ={ 1,2,3,4,5} , B= {2, 3} and C= {5} then (i) $B \cup C$ is (a) (2, 3, 5) (b) { } (c) {5, 3, 2} (d) {5} (ii) $A - (B \cup C)$ is (a) {1,2,3,4,5} (b) {2, 3,5} (c) {1,4} (d) {0, 3, 5} (iii) $(B - C)$ is (a) ∅ (b) {0} (c) {2, 3} (d) {5} (iv) $(A \cap C) \cup (A \cup C)$ is equal to (a) A (b) C (c) { } (d) $B \cup C$	4
37.	A chemical factory has 920 litres of a 9% solution of acid. How many litres of a 3% acid solution must be added to it so that acid content in the resulting mixture will be more than 5% but less than 7%? Based on the above information answer the following : (i) Write the inequality to find how many litres of 3% solution will have be added. (ii) How many litres of 3% solution will have to be added? **OR** If water is added instead of 3% acid solution, how many litres of water to be added to get a required percent of diluted solution?	4
38.	A group of consists of 4 girls and 7 boys. In how many ways can a team of 5 members can be selected if the team has (i) no girl ? (ii) exactly 2 girls ? (iii) at least 2 girls ? **OR** At most 4 boys?	4

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THS **TERM I** -2023-24

SCORING KEY

STD XI

	SECTION A	
	1- a 2- a 3- d 4- d 5- d 6- c 7- b 8- c 9- a 10- b	
	11- b 12- a 13- d 14- a 15- a 16- c 17- a 18- c 19- d 20- b	
21	S={3,6,9,12…….99} , P={2,5,7,11,13,17,19} n(S)= 33, n(P)= 8 ∴ $n(S)-n(P)=25$	1 1
	SECTION B	
22	Let r1 and r2 be radii, $\theta_1 = 65\times\frac{\pi}{180}$, $\theta_2 = 110 \Rightarrow \theta_1 = \frac{13\pi}{6}, \theta_2 = \frac{22\pi}{6}$ $\therefore \frac{13\pi}{6}\times r_1 = \frac{22\pi}{6}\times r_2 \Rightarrow r_1 : r_2 = 22:13$ Let radius of circle r , sector angle θ, $\therefore r+r+r\theta = \pi r \Rightarrow \theta = \pi - 2 \Rightarrow \theta = \frac{8}{7}$ Angle in degree=$65°27'18''(appx)$	1 1 1
23	Z= 2-3i $\Rightarrow z-2=-3i \Rightarrow (z-2)^2=(-3i)^2 \Rightarrow z^2-4z+4=-9 \Rightarrow z^2-4z+13=0$ Now $4z(z^2-4z+13)+13(z^2-4z+13)+2z+1 \Rightarrow 4z(0)+13(0)+2(2-3i)=5-6i$ **OR** **LHS** $\{(x+1)^2-i^2\}\{(x-1)^2-i^2\} \Rightarrow (x^2+2x+2)(x^2-2x+2) \Rightarrow (x^2+2)^2-(2x)^2 \Rightarrow x^4+4=RHS$	1 1
24	$2y-3<y+2\ and\ y+2\le 3y+5 \Rightarrow y<5\ and\ y\ge -\frac{3}{2} \Rightarrow -\frac{3}{2}\le y<5$ In set form : $y\in\left[-\frac{3}{2},5\right)$	2
25	Using binomial th. Ans> $32x^{10} - 240x^8y + 720x^6y^2 - 1080x^4y^3 + 810x^2y^4 - 243y^5$	2
	SECTION C	
26	Proof;	3
27	R={(2,4), (2,6), (2,18), (2,54), (6,18),(6,54), (9,18), (9, 27),(9,4)} Domain={2,6,9}, Range={4,6,18,27,54}	1+1+1
28	Proof	3
29	Proof	3
30	${}^nC_r : {}^nC_{r+1} = 1:2 \Rightarrow \frac{n!}{r!(n-r)!}\times\frac{(n-r-1)!(r-1)!}{n!} = \frac{1}{2} \Rightarrow \frac{r+1}{n-r} = \frac{1}{2} \Rightarrow n = 3r+2$ …. (i) ${}^nC_{r+1} : {}^nC_{r+2} = 2:3 \Rightarrow \frac{n!}{(r+1)!(n-r-1)!}\times\frac{(n-r-2)!(r+1)!}{n!} = \frac{2}{3} \Rightarrow \frac{r+2}{n-r-1} = \frac{2}{3} \Rightarrow 2n = 5r+8$.. (ii) Solving (i) and (ii) **n = 14 and r = 4** **OR** **No.** of ways maths= 3!, history = 4!, chemistry = 3!, biology = 2! Total number of arrangement= 4! X 3! X 4! X 3! X 2! Answer = 42472	1 1 1 1 1 1
31	$1.2^{4000} = (1+0.2)^{4000} = {}^{4000}_{0}C + {}^{4000}_{1}C\,(0.2) + other\ positive\ terms$ 1 + 4000(0.2) + other positive terms $\Rightarrow 1+800+other\ positive > 800$	3
	SECTION D	
32	**(i)** $domain = R,\ \ for\ range\ |x| \ge 0 for\ all\ x \in R \Rightarrow |x-2| \ge 0$ for all x ∈ R $\Rightarrow -|x-2| \le 0 \Rightarrow 1-|x-2| \le 1$ ∴ Range $= (-\infty, 1]$ **(ii)** Real domain : $9-x^2>0 \Rightarrow x^2-9<0 \Rightarrow (x+3)(x-3)<0 \Rightarrow D_f = (-3,3)$ Range: Let $y = \frac{1}{\sqrt{9-x^2}} \Rightarrow x^2 = 9-\frac{1}{y^2}$ ⇒ as x ∈ R $\therefore 9-\frac{1}{y^2}\ge 0$ $but\ y^2>0 \Rightarrow 9y^2-1\ge 0$	1+1=2 1 2

	$\Rightarrow \left(y+\frac{1}{3}\right)\left(y-\frac{1}{3}\right) \geq 0 \Rightarrow y \leq -\frac{1}{3}\ or\ y \geq \frac{1}{3}\ but\ y > 0\ \Rightarrow R_f = [\frac{1}{3}, \infty)$	
33	Proof	5
34	Proof	5
35	Total words in examination =$\frac{11!}{2!2!2!}$=4989600 (i) Start with = $\frac{10!}{2!2!2!}$= 453600, (ii) v owels together= $\frac{6!}{2!} \times \frac{6!}{2!21}$=64800 (ii) Start with M and with T $= \frac{9!}{2!2!2!} = 45360$ **OR** Number of word begin with E= 5!= 120, with H= 5!=120, with ME= 4!=24, MH= 4!=24, with MOE= 3!=6, MOH= 3!=6, MOR= 3!=6, with MOTE= 2!=2 total wo rd till now= 120+120+24 +24+6+6+6+2=308 next word will be MOTHER i.e. 308+1=309	1 1 +2 +1 3 1 1
36	(i) c (ii) c (iii) c (iv) a	1x4=4
37	Let x Lit re be added the inequalities: (i)3% of x + 9% of 920 > 5% of (x+920) ----eq(1) and 3% of x + 9% of 920 <7% of (x+920)---Eq(2) (ii) solving eq (1) and eq(2) 460<x<1840 OR let w ater be added x l 5% of (920 + x)< 9% of 920 < 7% of (920 + x) on solving 262.9(appx)<x<736	1+1 2
38	(i) ${}^{7}_{5}c$ (ii) ${}^{4}_{2}C$ x ${}^{7}_{3}C$ (iii) ${}^{4}_{2}C \times {}^{7}_{3}C + {}^{4}_{3}C \times {}^{7}_{2}C + {}^{4}_{4}C \times {}^{7}_{1}C$ **OR** ${}^{7}_{1}C \times {}^{4}_{4}C + {}^{7}_{2}C \times {}^{4}_{3}C + {}^{7}_{3}C \times {}^{4}_{2}C + {}^{7}_{4}C \times {}^{4}_{1}C$	1 +1 2

MATHEMATICS TERM I 2023-24

STD XI

BLUE PRINT

Ch.. NO.	CHAPTER NAME	1 MARKS	2 MARKS	3 MARKS	5 MARKS	4 marks (case std.)	Total mks
1	Sets	5	1	1	--	1	14
2	Relations & Functions	4	--	1	1	--	12
3	Trigonometric Functions	3	1	1	1	--	13
5	Complex Numbers	3	1	1	1		13
6	Linear Inequalities	2	1	--	--	1	08
7	Permutations & Combinations	3	--	1	1	1	15
8	Binomial Theorem	--	1	1	--	--	05
		20	**10**	**18**	**20**	**12**	**80**