INDIAN SCHOOL SALALAH

FIRST TERM EXAMINATION – SEPTEMBER 2024

MATHEMATICS (041)

Class: XI   **Date: 18/09/2024**

Time: 3 hours   **Maximum Marks: 80**

General Instructions:

a) This Question paper contains - five sections A, B, C, D and E. Each section is compulsory. However, there are internal choices in some questions.

b) Section A has 18 MCQs and 02 Assertion-Reason based questions of 1 mark each.

c) Section B has 5 Very Short Answer (VSA)-type questions of 2 marks each.

d) Section C has 6 Short Answer (SA)-type questions of 3 marks each.

e) Section D has 4 Long Answer (LA)-type questions of 5 marks each.

f) Section E has 3 source based/case based/passage based/integrated units of assessment of 4 marks each with sub-parts.

NO	SECTION A	MARKS
1	Let A = {x: x ∈ R, x > 4} and B = { x: x ∈ R, x < 5}. Then A ∩ B = (a) (4, 5] (b) (4, 5) (c) [4, 5) (d) [4, 5]	1
2	The difference of A and B is equal to – where A = {1, 2, 3} and B = {3, 4, 5} (a) {1, 2} (b) {1, 2, 3} (c) {5} (d) φ	1
3	If $(x + 1, 1) = (3, y - 2)$ then the value of $x^2 + y^2$ is (a) 5 (b) 13 (c) 9 (d) 4	1
4	The range of the Signum function is (a) R (b) N (c) R^+ (d) $\{-1, 0, 1\}$	1
5	The length of an arc of circle of radius 5 cm subtending a central angle measuring 15^0 is (a) $\frac{\pi}{12}$ cm (b) $\frac{5\pi}{12}$ cm (c) $\frac{3\pi}{12}$ cm (d) none of these	1
6	If $\tan x = \frac{5}{12}$, x lies in the third quadrant, then the value of $\cos x$ is (a) $\frac{-5}{13}$ (b) $\frac{12}{13}$ (c) $\frac{-12}{13}$ (d) $\frac{5}{13}$	1

7	The value of $\dfrac{\cos 3x}{2\cos 2x - 1}$ is equal to	1
	(a) $\tan x$ (b) $\cot x$ (c) $\sin x$ (d) $\cos x$	
8	The standard form of the complex number $(5 - 3i)^3$ is	1
	(a) $10 + 198i$ (b) $10 - 198i$	
	(c) $-10 - 198i$ (d) none of these	
9	If $z = \dfrac{1}{(2+3i)^2}$ then $|z| = $	1
	(a) $\dfrac{1}{\sqrt{13}}$ (b) $\dfrac{1}{13}$ (c) $\sqrt{13}$ (d) 13	
10	Solve $30x < 200$ when 'x' is a natural number, then the value of x is	1
	(a) $\{0, 1, 2, 3, 4, 5, 6\}$ (b) $\{1, 2, 3, 4, 5, 6\}$	
	(c) $\{0, 2, 3, 4, 5, 6\}$ (d) $\{1, 2, 3, 4, 5\}$	
11	The solution of $5 - x \le 3x + 1$ is	1
	(a) $(-\infty, 1]$ (b) $(-\infty, -1]$	
	(c) $[1, \infty)$ (d) $[-1, \infty)$	
12	A five-digit number divisible by 3 is to be formed using the numbers 0, 1, 2, 3, 4 and 5 without repetitions. The total number of ways this can be done is	1
	(a) 240 (b) 3125 (c) 216 (d) 600	
13	If $^{n}C_{12} = {}^{n}C_{8}$, then n is equal to	1
	(a) 20 (b) 12 (c) 6 (d) 30	
14	4 boys and 4 girls are to be seated in a row. The number of ways in which this can be done, if the boys and girls sit alternately, is	1
	(a) $4! \times 4!$ (b) $8!$ (c) $4!$ (d) $2 \times 4! \times 4!$	
15	Number of terms in the expansion of $(1 + x^2)^7$	1
	(a) 8 (b) 9 (c) 10 (d) 11	
16	$\sum_{r=0}^{n} 4^{r} \cdot {}^{n}C_{r}$ is equal to	1
	(a) 4^{n} (b) 5^{n} (c) 6^{n} (d) 8^{n}	
17	If 6 is the geometric mean of 2 and x then the value of x is	1
	(a) 12 (b) 18 (c) 24 (d) 36	
18	If $\dfrac{-3}{5}$, x, $\dfrac{-5}{3}$ are in GP then the value of x is	1
	(a) -1 (b) 1	
	(c) both -1 & 1 (d) none of these	

	ASSERTION-REASON BASED QUESTIONS	
	In the following questions 19 and 20, a statement of Assertion (A) is followed by a statement of Reason (R). Choose the correct answer out of the following choices.	
	(a) Both (A) and (R) are true and (R) is the correct explanation of (A).	
	(b) Both (A) and (R) are true but (R) is not the correct explanation of (A).	
	(c) (A) is true but (R) is false.	
	(d) (A) is false but (R) is true.	
19	**Assertion(A):** If A = {1, 2, 3}, B = {2, 4}, then the number of relations from A to B is equal to 32. **Reason(R):** The total number of relation from set A to set B is $2^{n(A).n(B)}$.	1
20	**Assertion(A):** The simplest form of i^{-2024} is $-i$. **Reason(R):** $i^4 = 1$.	1
	SECTION B	
21	Write the power set of the set $A = \{1, 2, \{3, 4\}\}$. **OR** Draw appropriate Venn diagrams for each of the following: (i) A′ ∪ B′ (ii) A′ ∩ B′	2
22	If $\cos x = -\frac{4}{5}$, x lies in second quadrant, find the value of $\cos \frac{x}{2}$.	2
23	If $\left(\frac{1-i}{1+i}\right)^{100} = a + ib$, then find out a and b.	2
24	A group consists of 4 girls and 7 boys. In how many ways can a team of 5 members be selected if the team has at least one boy and one girl? **OR** In how many of the distinct permutations of the letters in **MISSISSIPPI** do the four I's not come together?	2
25	The 5th term of G.P. is 81 and the 2nd term is 24. Find the G.P.	2
	SECTION C	
26	If U = {2, 3, 4, 5, 6, 7, 8, 9, 10, 11}, A = {2, 4, 7}, B = {3, 5, 7, 9, 11} and C = {7, 8, 9, 10, 11}, then compute (i) (A∩U) ∩ (B∪C) (ii) C – B (iii) (B − C)′	3
27	Find the domain and range for the real function f(x) = $\sqrt{9 - x^2}$	3

| 28	If $(x + iy)^3 = u + iv$, then show that $\frac{u}{x} + \frac{v}{y} = 4(x^2 - y^2)$.	3
29	Solve the system of linear inequalities $\frac{x}{2x+1} \geq \frac{1}{4}$, $\frac{6x}{4x-1} < \frac{1}{2}$ and represent the solutions on the number line.	3
30	How many numbers greater than 1000000 can be formed by using the digits 1, 2, 0, 2, 4, 2, 4? **OR** Find the number of arrangements of the letters of the word **INDEPENDENCE**. In how many of these arrangements, (i) do the words start with P (ii) do all the vowels always occur together	3
31	Show that $9^{n+1} - 8n - 9$ is divisible by 64, whenever n is a positive integer. **OR** Using binomial theorem, evaluate $(102)^5$	3
	SECTION D	
32	Prove that: $\cos^2 x + \cos^2\left(x + \frac{\pi}{3}\right) + \cos^2\left(x - \frac{\pi}{3}\right) = \frac{3}{2}$ **OR** Prove that: $\tan 4x = \frac{4\tan x(1 - \tan^2 x)}{1 - 6\tan^2 x + \tan^4 x}$	5
33	A solution of 9% acid is to be diluted by adding a 2% boric acid solution to it. The resulting mixture is to be more than 4% and less than 6% boric acid. If we have 700 liters of the 9% solution, how many liters of the 2% solution will have to be added?	5
34	Find $(x + 1)^6 + (x - 1)^6$, Hence, evaluate $\left(\sqrt{2} + 1\right)^6 + \left(\sqrt{2} - 1\right)^6$	5
35	The ratio of A.M. and G.M. of two positive numbers a and b is m : n. Show that $a : b = \left(m + \sqrt{m^2 - n^2}\right):\left(m - \sqrt{m^2 - n^2}\right)$ **OR** Find three real numbers in G.P. whose sum is 30 and product is 216.	5

|	**SECTION E**	

36	**Case Study.1**
	
	A function is a mapping from a set of inputs (the domain) to a set of possible outputs (the codomain). The definition of a function is based on a set of ordered pairs, where the first element in each pair is from the domain and the second is from the codomain.
	
	We can visualize a function as machine, where an input x from the domain X is fed into the machine and the machine spits out the element $y = f(x)$ from the codomain Y. Below, the domain is visualized as a set of spheres and the codomain as a set of cubes, so that the function machine transforms spheres into cubes.
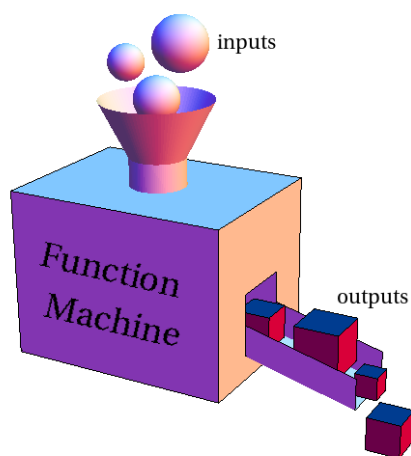	
	   a) What will be the output of 3.2 if the function in the machine is $f(x) = [x]$?
	
	   b) What will be the input, if output for the function $f(x) = x^2$ in the machine is 6.25?
	
	   c) If the ordered pairs in a relation are (1, 2), (1, 3), (2, 3), (3, 4), can we say that these belongs to any such machine? Justify your answer.
	
	 OR
	   c) If $x \in R, x > 0$ and the function in the machine is $f(x) = 3 - 2x$, then what would be the range of the function?
		1
		
		1
		
		2

37	**Case Study.2** Mr. Rajesh purchased a farm house in shape of quadrilateral ABCD with $\angle A = 90°$, $\angle B = 80°$, $\angle C = 100°$ and $\angle D = 90°$. He also purchased a horse and cow. One day, he tied the horse with a rope at vertex A and observed that it	

describes an arc of length 66 m when it moves along a circular path keeping the rope tight.
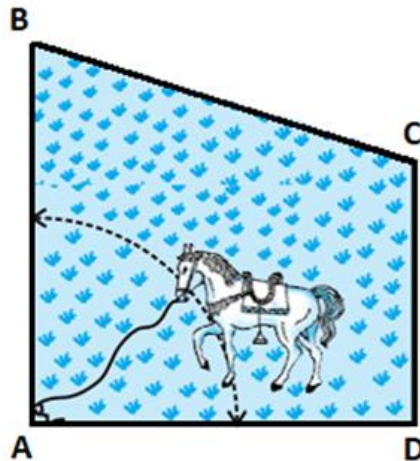
a) What is radian measure of $\angle B$?

b) What is the length of rope?

c) What will be the length of arc described by cow if it is tied at vertex C with the rope of same length as horse?

OR

c) If arcs of the same lengths in two circles subtend angles 55° and 70° at the centre, find the ratio of their radii.

38	**Case Study.3**	
	The purpose of the student council is to give students an opportunity to develop leadership by organizing and carrying out school activities and service projects. Create an environment where every student can voice out their concern or need. Raju, Ravi, Joseph, Sangeeta, Priya, Meena and Aman are members of student's council. There is a photo session in a school these 7 students are to be seated in a row for photo session.	
	a) Find the total number of arrangements so that Raju and Ravi are at extreme positions?	2
	b) Find the number of arrangements so that Joseph is sitting in the middle.	2

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