

**INDIAN SCHOOL SALALAH**  
**FIRST TERMINAL EXAMINATION, 2017-18**  
**MATHEMATICS**

MARKS: 100  
TIME: 3HRS

CLASS: XI

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***General Instructions:***

- i. All questions are compulsory.
- ii. This question paper contains 29 questions.
- iii. Question 1- 4 in Section A are very short-answer type questions carrying 1 mark each.
- iv. Question 5-12 in Section B are short-answer type questions carrying 2 marks each.
- v. Question 13-23 in Section C are long-answer-I type questions carrying 4 marks each.
- vi. Question 24-29 in Section D are long-answer-II type questions carrying 6 marks each.

**Section. A**

**Questions 1 to 4 carry 1 mark each.**

1. Describe the set  $\{x \in N : x \text{ is a prime number , } 0 < x < 20\}$  in Roster form.
2. Find the domain of  $f(x) = \frac{1}{\sqrt{9-x^2}}$
3. Evaluate:  $\operatorname{cosec}\left(-\frac{19\pi}{3}\right)$
4. Express the conjugate of  $\frac{3-2i}{1+2i}$  in  $a+ib$

**Section.B**

**Questions 5 to 12 carry 2 marks each.**

5. Write power set of  $A = \{a, b, c\}$ .
6. Find the domain and range of the real function  $f$  defined by  $f(x) = \sqrt{x-1}$
7. Define modulus function and draw its graph.
8. Evaluate:  $\sin 105^\circ + \cos 105^\circ$
9. Prove that  $\cos 4x = 1 - 8\sin^2 x \cos^2 x$
10. If  $z = 2 - 3i$ , evaluate  $z^2 - 4z + 13$ .
11. Express  $\frac{1+2i}{1-(1-i)^2}$  in  $a+ib$  form.
12. Find all pairs of consecutive odd natural numbers, both of which are larger than 10, such that their sum is less than 40.

## Section.C

### Questions 13 to 23 carry 4 marks each.

13. Let  $U = \{x \in N \text{ such that } x \leq 9\}$ ;  $A = \{x: x \text{ is a even number, } 0 < x < 10\}$ ;  $B = \{2, 3, 5, 7\}$ .

Verify that a)  $(A \cup B)' = A' \cap B'$                       b)  $(A \cap B)' = A' \cup B'$

**OR**

By using Venn Diagram verify De-Morgan's Law.

14. In a survey it was found that people encourage their wards for science/ commerce stream. There are 40 students in chemistry class and 60 students in physics class. Find the number of students which are either in physics class or chemistry class in the following cases:

- a) The two classes meet at the same hour.
- b) The two classes meet at different time hour and 20 students enrolled in both subjects.
- c) How will you analyse the motive of parents?

15. If  $A = \{1, 2, 5\}$ ,  $B = \{1, 2, 3, 4\}$  and  $C = \{5, 6, 2\}$ . Verify that

a)  $A \times (B \cap C) = (A \times B) \cap (A \times C)$                       b)  $(A - B) \times C = (A \times C) - (B \times C)$

16. 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**

Show that  $\sqrt{2 + \sqrt{2 + \sqrt{2 + 2\cos 8\theta}}} = 2\cos\theta$

17. Let  $f(x) = \begin{cases} x^2, & \text{when } 0 \leq x \leq 2 \\ 2x, & \text{when } 2 \leq x \leq 5 \end{cases}$        $g(x) = \begin{cases} x^2, & \text{when } 0 \leq x \leq 3 \\ 2x, & \text{when } 3 \leq x \leq 10 \end{cases}$

Show that f is a function while g is not a function.

18. Convert the complex number  $z = \frac{1+2i}{1-3i}$  into polar form.

**OR**

Find the square root of  $7 + 24i$

19. Solve:  $\sin 2x - \sin 4x + \sin 6x = 0$

20. Solve  $\frac{2x-3}{4} + 6 \geq 2 + \frac{4x}{3}$  when a)  $x$  is an integer                      b)  $x$  is a real number
21. By using principle of mathematical induction prove that  $2 \cdot 7^n + 3 \cdot 5^n - 5$  is divisible by 24,  $\forall n \in \mathbb{N}$
22. If  $(x + iy)^3 = u + iv$ , then show that  $\frac{u}{x} + \frac{v}{y} = 4(x^2 - y^2)$
23. Solve the following inequalities and represent the solution on the number line:  
 $5(2x - 7) - 3(2x + 3) \leq 0$ ;  $2x + 19 \leq 6x + 47$

### Section.D

**Questions 24 to 29 carry 6 marks each.**

24. A survey of 500 television viewers produced the given information; 285 watch football, 195 watch hockey, 115 watch cricket, 45 watch football and cricket, 70 watch football and hockey, 50 watch cricket and hockey and 25 watch all the three games.
- How many watch at least one game?
  - How many watch exactly two subjects?
  - How many watch football but not hockey?
  - How many watch hockey and cricket but not football?
25. a) A relation  $R$  is defined on the set of natural numbers as  
 $R = \left\{ (1+x, 1+x^2) : x \leq 4, x \in \mathbb{N} \right\}$ . Find  $R$ , domain of  $R$  and range of  $R$ .
- b) If  $A = \{x : x^2 - 4x + 3 = 0\}$   $B = \{x : x^2 - x - 2 = 0\}$   $C = \{2, -2\}$   
 Find i)  $A \times B$     ii)  $(A - B) \times C$

**OR**

- a) Let  $A = \{0, 1, 2, 3, 4\}$  and  $B = \{1, 4, 9, 16, 25\}$ . Define a relation on a set  $A$  to  $B$  as  
 $R = \left\{ (x, y) : y = x^2, x \in A, y \in B \right\}$
- Depict this relation by arrow diagram
  - Find domain of  $R$  and co domain of  $R$ .
- b) If  $A = \{2, 3\}$ ,  $B = \{4, 5\}$  and  $C = \{5, 6\}$  then verify  $A - (B \cap C) = (A - B) \cup (A - C)$
26. Prove that  $\tan 4x = \frac{4 \tan x (1 - \tan^2 x)}{1 - 6 \tan^2 x + \tan^4 x}$

27. Prove that  $a(\cos C - \cos B) = 2(b - c)\cos^2 \frac{A}{2}$

**OR**

Prove that  $a \cos \left( \frac{B - C}{2} \right) = (b + c) \sin \frac{A}{2}$

28. By using principle of mathematical induction prove that

$$\frac{1}{2.5} + \frac{1}{5.8} + \frac{1}{8.11} + \dots + \frac{1}{(3n-1)(3n+2)} = \frac{n}{(6n+4)}, \forall n \in \mathbb{N}$$

**OR**

By using principle of mathematical induction prove that

$$1^2 + 2^2 + 3^2 + \dots + n^2 = \frac{1}{6}n(n+1)(2n+1)$$

29. Solve the following system of inequalities graphically:

$$x + 2y \leq 40; 3x + y \geq 30; 4x + 3y \geq 60; x \geq 0, y \geq 0$$

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