

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

MAX.MARKS: 100

CLASS: XI

TIME: 3 HOURS

***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. Find the domain of the function f given by  $f(x) = \frac{x^2 + 2x + 1}{x^2 - x - 6}$
2. Find  $\left| (1+i) \frac{(2+i)}{(3+i)} \right|$
3. Find the distance of the point  $(-1, 1)$  from the line  $12(x + 6) = 5(y - 2)$ .
4. Find the number of permutations of the letters of the word ALLAHABAD.

**Section.B**

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

5. In a group of 26 persons, 8 take tea but not coffee and 16 take tea. How many take coffee but not tea?
6. If  $(a + ib)^2 = x + iy$ , prove that  $x^2 + y^2 = (a^2 + b^2)^2$
7. Prove that  $\cos\left(\frac{\pi}{4} + x\right) + \cos\left(\frac{\pi}{4} - x\right) = \sqrt{2} \cos x$
8. Find 10<sup>th</sup> term of  $\left(2x^2 + \frac{1}{x}\right)^{12}$ ,  $x \neq 0$
9. Find the sum of 11 terms of an A.P whose middle term is 30.

10. Line through the points  $(-2, 6)$  and  $(4, 8)$  is perpendicular to the line through the points  $(8, 12)$  and  $(x, 24)$ . Find the value of  $x$ .
11. In a G.P., the 3<sup>rd</sup> term is 24 and the 6<sup>th</sup> term is 192. Find the 10<sup>th</sup> term.
12. Express  $\frac{3\pi}{7}$  radian in degree measure.

### Section.C

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

13. If  $U = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$ ,  $A = \{1, 2, 3, 4\}$ ,  $B = \{3, 4, 5, 6\}$ , and  $C = \{5, 6, 7, 8\}$
- i) Show that  $A - (B \cap C) = (A - B) \cup (A - C)$
- ii) Show that  $A \cap (B^1 \cup C^1) = A \cap (B \cap C)^1$
14. Let  $R$  be a relation on  $N$  defined by  $\{(a, b) : a, b \in N, 2a + b = 31\}$ .
- (i) Write  $R$  in roster form (ii) Find the domain of  $R$  (iii) Find the range of  $R$ .
15. For any triangle  $ABC$ , prove that  $a \cos A + b \cos B + c \cos C = 2a \sin B \sin C$

**OR**

For any triangle  $ABC$ , prove that  $a(b \cos C - c \cos B) = b^2 - c^2$

16. How many terms of the G.P.  $3, \frac{3}{2}, \frac{3}{4}, \dots$  are needed to give the sum  $\frac{3069}{512}$ ?
17. Find the equation of the line whose perpendicular distance from the origin is 4 units and the angle which the normal makes with positive direction of  $x$ -axis is  $15^\circ$ .

**OR**

The slope of a line double of the slope of another line. If tangent of the angle between them is  $\frac{1}{3}$ , find the slopes of the other line.

18. Many students have habit to arrange their book shelf properly in a particular manner. A student wants to arrange 3 Mathematics, 4 Hindi, and 5 English books on a shelf. In how many ways books can be arranged? How many arrangements are possible if all the books on the same subject are to be together? Assume that books on the same subject are different. State any quality of such students.
19. If  $\alpha$  and  $\beta$  are different complex numbers with  $|\beta| = 1$ , then find  $\left| \frac{\beta - \alpha}{1 - \overline{\alpha}\beta} \right|$
20. Find the square root of  $5 - 12i$

21. Prove that  $1^2 + 3^2 + 5^2 + \dots + (2n-1)^2 = \frac{n(2n-1)(2n+1)}{3}$  by using the principle of mathematical induction for all  $n \in \mathbb{N}$ .
22. The sum of  $n$  terms of two arithmetic progressions are in the ratio  $(3n + 8) : (7n + 15)$ . Find the ratio of their 12th terms.

**OR**

The product of three numbers in G.P is 216. If 2, 8, 6 be added to them, the results are in A.P. Find the numbers.

23. Assuming that straight lines work as the plane mirror for a point, find the image of the point  $(1, 2)$  in the line  $x - 3y + 4 = 0$

### Section.D

Questions 24 to 29 carry 6 marks each.

24. If  ${}^{n-1}C_r : {}^nC_r : {}^{n+1}C_r = 6 : 9 : 13$ , find  $n$  and  $r$ .

**OR**

Find the value of  $(a^2 + \sqrt{a^2 - 1})^4 + (a^2 - \sqrt{a^2 - 1})^4$

25. a) Prove that  $\sin 2x + 2\sin 4x + \sin 6x = 4\cos^2 x \sin 4x$   
 b) Solve  $2\cos^2 x + 3\sin x = 0$

**OR**

a) Prove that  $\sin 3x + \sin 2x - \sin x = 4\sin x \cos \frac{x}{2} \cos \frac{3x}{2}$

b) Prove that  $2\cos \frac{\pi}{13} \cos \frac{9\pi}{13} + \cos \frac{3\pi}{13} + \cos \frac{5\pi}{13} = 0$

26. If  $p$  and  $q$  are the lengths of perpendiculars from the origin to the lines  $x\cos\theta - y\sin\theta = k \cos 2\theta$  and  $x\sec\theta + y\operatorname{cosec}\theta = k$  respectively, prove that  $p^2 + 4q^2 = k^2$ .

27. Let  $S$  be the sum,  $P$  the product and  $R$  the sum of reciprocals of  $n$  terms in a G.P. Prove that  $P^2 R^n = S^n$

**OR**

Find the sum of the series up to  $n$  terms:  $\frac{1^3}{1} + \frac{1^3 + 2^3}{1+3} + \frac{1^3 + 2^3 + 3^3}{1+3+5} + \dots$

28. a) Find the equation of a line perpendicular to the line  $x - 2y + 3 = 0$  and passing through the point  $(1, -2)$
- b) Find the coordinates of the foot of perpendicular from the point  $(-1, 3)$  to the line  $3x - 4y - 16 = 0$
29. A manufacturer has 600 litres of a 12% solution of acid. How many litres of a 30% acid solution must be added to it so that acid content in the resulting mixture will be more than 15% but less than 18%?

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