



# INDIAN SCHOOL AL WADI AL KABIR

ASSESSMENT-III (2023-24)

**SUB: Mathematics (041)**

Date: 20/02/2024

Set-II

Time Allowed :3 hours

Class: XI

Maximum Marks: 80

## General Instructions:

1. This Question paper contains - five sections A, B, C, D and E. Each section is compulsory. However, there are internal choices in some questions.
2. Section A has 18 MCQ's and 02 Assertion-Reason based questions of 1 mark each.
3. Section B has 5 Very Short Answer (VSA)-type questions of 2 marks each.
4. Section C has 6 Short Answer (SA)-type questions of 3 marks each.
5. Section D has 4 Long Answer (LA)-type questions of 5 marks each.
6. Section E has 3 source based/case based/passage based/integrated units of assessment (4 marks each) with sub parts.

### SECTION A (MCQ)

Mark

1. If  $A = \{x: x^2 - x = 0\}$ ,  $B = \{y: y \text{ is a prime number less than } 5\}$ , then  
**A**  $A \cap B = \emptyset$    **B**  $A \subset B$    **C**  $A = B$    **D**  $A \cup B = A$  1
2. If X and Y are two sets such that  $X \cup Y$  has 50 elements, X has 28 elements and Y has 32 elements, then number of elements of  $X \cap Y$ :  
**A** 12   **B** 22   **C** 110   **D** 10 1
3.  $A = \{0, 1, 2, 3, 4\}$ ,  $B = \{-2, -1, 0, 1, \dots, 10\}$  and  $R = \{(0, -2), (1, 0), (2, 2), (3, 4), (4, 6)\}$ . Which of the following is correct?  
**A**  $R = \{(x, y): y = x - 2, x \in A, y \in B\}$    **B**  $R = \{(x, y): y = 2x + 2, x \in A, y \in B\}$   
**C**  $R = \{(x, y): y = 2x - 2, x \in A, y \in B\}$    **D**  $R = \{(x, y): x = 2y + 2, x \in A, y \in B\}$  1
4. If  $x \sin \frac{7\pi}{6} + \cos^2 \left( \frac{7\pi}{4} \right) = 0$  then value of x:  
**A** 0   **B** 1   **C** -1   **D**  $\sqrt{2}$  1
5. For two distinct positive numbers a and b, which of the following is always true ? 1  
**A**  $a + b > 2\sqrt{ab}$    **B**  $\frac{a+b}{2} > ab$    **C**  $\sqrt{ab} > \frac{a+b}{2}$    **D**  $\frac{2ab}{a+b} > \sqrt{ab}$

6. If  $(1 + i)(2 + i)(3 + i) = a + ib$  then  $a^2 + b^2 = \underline{\hspace{2cm}}$ . 1  
**A** 10      **B** 50      **C** 100      **D** 25
7.  $\sin(2\pi + \theta)\cos\left(\frac{\pi}{2} - \theta\right) + \sin\left(\frac{3\pi}{2} + \theta\right)\cos(\pi - \theta) = \underline{\hspace{2cm}}$ . 1  
**A** 1      **B**  $\sin 2\theta$       **C** 0      **D**  $\cos 2\theta$
8. The number of ways of selection of a 6 member team with equal number of boys and girls from a group of 5 boys and 4 girls is           . 1  
**A** 40      **B** 20      **C** 36      **D** 200
9. If  $(x + iy)(2 + i) = 3 + 4i$ , where  $x$  and  $y$  are real values, then  $x + y = \underline{\hspace{2cm}}$ . 1  
**A** 1      **B** 3      **C** -1      **D** 7
10. The cost and revenue functions of a product are given by  $C(x) = 30x + 5000$  and  $R(x) = 70x + 3000$ , respectively, where  $x$  is the number of items produced and sold. The number of items must be sold to realise some profit is: 1  
**A** 31      **B** 41      **C** 51      **D** 61
11. The number of 4 -digit numbers with distinct digits which are divisible by 5 =            1  
**A** 9000      **B** 1800      **C** 1296      **D** 952
12.  $nC_0 + nC_1 + nC_2 + \dots + nC_n = \underline{\hspace{2cm}}$  1  
**A**  $n^n$       **B**  $n^2$       **C**  $2^n$       **D**  $n!$
13. The sum of 10 terms of the series  $1 + 2 + 4 + 8 + \dots$  is 1  
**A** 121      **B** 1023      **C** 512      **D** 729
14. If the line  $kx + 5y + k^2 - 9 = 0$  passes through origin, then  $k = \underline{\hspace{2cm}}$ . 1  
**A** 5      **B**  $\pm 1$       **C**  $\pm 3$       **D** 0
15. The distance to the line  $3(x - 1) + 4y = 0$  from the point  $(2, 1)$  is: 1  
**A** 7      **B** 1.4      **C** 5      **D** 1.2
16.  $\lim_{x \rightarrow 2} \frac{x^4 - 16}{x^3 - 8} = \underline{\hspace{2cm}}$  1  
**A** 2      **B**  $\frac{16}{3}$       **C**  $\frac{8}{3}$       **D**  $\frac{1}{2}$
17. The derivative of  $x \cos x - \sin x$  with respect to  $x$  is            1  
**A**  $\cos x$       **B** 0      **C**  $-x \cdot \sin x$       **D**  $x \cdot \sin x + \cos x$
18. In triangle ABC,  $A(0, 0, 6)$ ,  $B(0, 4, 0)$  and  $C(6, 0, 0)$ , then length of median through A 1  
**A**  $\sqrt{34}$       **B**  $6\sqrt{2}$       **C** 7      **D** 10

### 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. (A)  $\lim_{x \rightarrow \frac{\pi}{2}} \frac{\cos x}{\pi - 2x} = \frac{1}{2}$  (R)  $\lim_{h \rightarrow 0} \frac{\cos(x+h) - \cos x}{h} = \sin x$  1

A

B

C

D

20. (A) For two mutually exclusive events A and B,  $P(A \text{ or } B) = \frac{1}{2}$ , and  $P(A) = 3 P(B)$ , then  $P(B) = \frac{1}{8}$ . 1

(R) For any event A,  $0 \leq P(A) \leq 1$ .

A

B

C

D

### SECTION B

21. If  $A = \{0, 1, 2, 3, 4\}$ ,  $B = \{2, 3, 5, 7\}$  and  $C = \{3, 4, 5, 6, 7\}$  Write i)  $(A - B) \cup (B - C)$  and ii)  $A \cap (B \cup C)$  in roster form. 2

22. Two finite sets have m and n elements ( $m > n$ ). The total number of subsets of the first set is 112 more than the total number of subsets of the second set. Find the values of m and n. 2

23. a) Evaluate a and b if  $(2a + 3b, 3a - 2b) = (b + 20, 0)$  2

**OR**

b) Write the relation  $R = \{(x, y) : 2x + 3y = 24, x, y \in W\}$  in roster form and hence write the range of R.

24. a) Evaluate:  $\lim_{x \rightarrow 0} \frac{x \cos x + \sin 2x}{3x}$  2

**OR**

b) If  $f(x) = \frac{x^2}{(2x+1)}$  then evaluate  $f'(1)$ .

25. In an experiment, a solution of hydrochloric acid is to be kept between  $30^\circ\text{C}$  and  $35^\circ\text{C}$ . What is the range of temperature in degree Fahrenheit if conversion formula is given by  $C = \frac{5}{9} (F - 32)$ , where C and F represent temperature in degree Celsius and degree Fahrenheit, respectively. 2

### SECTION C

26. a) Given:  $A + B + C = \pi$ . Prove:  $\tan A + \tan B + \tan C = \tan A \tan B \tan C$  3

**OR**

b) If  $\tan A = \frac{4}{3}$ ,  $A \in III$  quadrant, then evaluate  $\sin \frac{A}{2}$  and  $\cos \frac{A}{2}$ .

27. a) If  $a, b, c$  are in GP and  $a^{\frac{1}{x}} = b^{\frac{1}{y}} = c^{\frac{1}{z}}$ , then prove that  $x, y, z$  are in AP. 3

OR

- b) The sum of some terms of a G.P. is 315 whose first term and the common ratio are 5 and 2 respectively. Find the last term and the number of terms.

28. a) Find the number of permutations of the letters of the word 'PERMUTATIONS'. In how many of these arrangements 3

- i) do the words start with P and end with S?  
ii) do all the vowels occur together?

OR

- b) Determine n if  $C(2n, 3): C(n, 3) = 11:1$

29. Find mean deviation about median: 3

|   |    |    |    |    |    |
|---|----|----|----|----|----|
| x | 10 | 11 | 12 | 13 | 14 |
| f | 4  | 5  | 6  | 3  | 2  |

30. If  $y = \frac{\sin x - \cos x}{\sin x + \cos x}$ , prove that  $\frac{dy}{dx} = \frac{2}{1 + \sin 2x}$ . 3

OR

Using first principle, find the derivative of  $\sqrt{x}$  with respect to x

31. Two students Anil and Ashima appeared in an examination. The probability that Anil will qualify the examination is 0.05 and that Ashima will qualify the examination is 0.10. The probability that both will qualify the examination is 0.02. Find the probability that 3

- a) only Anil will qualify for the examination  
b) *at least one of them will qualify for the examination*  
c) only one of them will qualify the examination.

#### SECTION D

32. Prove:  $\frac{\sin 5x - 2\sin 3x + \sin x}{\cos 5x - \cos x} = \tan x$  5

33. a) If  $C(n-1, r): C(n, r): C(n+1, r) = 6:9:13$ , find n and r 5

OR

- b) Using Binomial theorem expand and simplify:  $(\sqrt{3} + \sqrt{2})^5 + (\sqrt{3} - \sqrt{2})^5$ .

34. Assuming that straight line work as the plane mirror for a point, find the image of the point (1, 2) in the line  $x - 3y + 4 = 0$ . 5

OR

The vertex of an equilateral triangle is (3, 4) and the equation of opposite side is  $x + y = 1$ . Find i) equations of other two sides.

- ii) the length of altitude of the triangle.

35. Find mean, variance and standard deviation for the following frequency distribution: 5

| Class | 0-20 | 20-40 | 40-60 | 60-80 | 80-100 | 100-120 | 120-140 |
|-------|------|-------|-------|-------|--------|---------|---------|
| f     | 2    | 5     | 10    | 12    | 6      | 3       | 2       |

**SECTION E** Case study-based Questions

36. Two friends X and Y are playing Ludo. While rolling the dice, they observed and noted that the possible outcomes of the throw every time belongs to set  $\{1,2,3,4,5,6\}$ . Let A be the set of players while B be the set of all possible outcomes. Based on the above information answer the following:



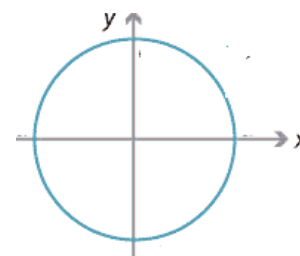
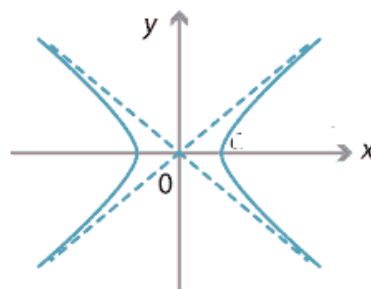
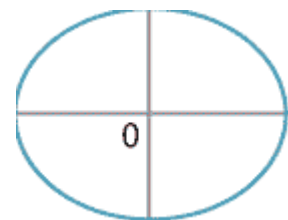
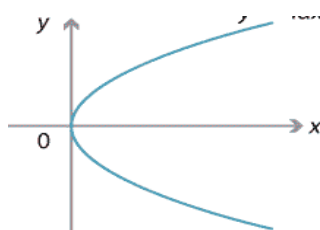
4

- Write the number of relations from A to B.
- Write the relation  $R = \{(x, y): y \text{ is divisible by } x \text{ and } x, y \in B\}$  in roster form
- a) Determine whether  $R = \{(x, y): y = 2x, x, y \in B\}$  is a function or not. Justify your answer.

OR

- Write domain and range of the function  $f(x) = \frac{1}{x^2+1}$ .

37. In coordinate geometry we studied the properties of simplest geometric figure, straight line, curves like circle, ellipse, parabola etc. These curves have a very wide range of applications in fields such as planetary motion, design of telescopes and antennas, reflectors in flashlights and automobile headlights, etc. Find the equations of various figures given below and answer the questions:



4

- $x^2 = 12y$
- $4x + 3y - 12 = 0$
- $16x^2 + 25y^2 = 400$
- $x^2 - y^2 = 9$
- $x^2 + y^2 = 9$

- Which of the above equations represent a circle? Write its centre and radius.
- Express the equation of straight line given above in intercepts form.
- a) Find the coordinates of the foci, the vertices and the length of the latus rectum of the given ellipse.  
OR  
b) Find the coordinates of the foci, the vertices, the eccentricity and the length of the latus rectum of the given hyperbola.

38. A group of students planned a trip to a nearby amusement park. The park offers various attractions including roller coasters, water slides, bumper cars and arcade games. There are 4 roller coasters, 3 water slides, 1 bumper car ride and 5 arcade games available in the park.



Based on the above information answer the following:

- i) If the group decides to experience one attraction of each type, how many different combinations of attractions can they choose?
- ii) If the group decides to experience 6 activities from all the available attractions which includes 2 roller coasters 1 water slide 1 bumper car and 2 arcade games, then how many different combinations of attractions can they choose?

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