KENDRIYA VIDYALAYA SANGATHAN, LUCKNOW REGION
SESSION ENDING EXAM (2023-24)
CLASS: XI
SUBJECT: MATHEMATICS

MAX MARKS: 80 **TIME: 3 HRS**

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 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 case based questions** (4 marks each) with sub parts.

SECTION – A
(Questions 1 to 20 carry 1 mark each)

1. Which of the following is empty set

(a) $\{x: x^2-1=0, x\in \boldsymbol{R}\}$ (b) $\{x:3x-1=0, x\in \boldsymbol{R}\}$

(c) $\{x: x^2-2x+3=0, x\in \boldsymbol{R}\}$ (d) none of these

2. Let $A=\{x: x\in R, x>4\}$ and $B=\{x: x\in R, x<5\}$.Then $A\cap B$ =

(a) (4,5] (b) (4,5) (c) [4,5) (d) [4,5]

3. The number of proper subsets of the set {a, {1,2},c} are

(a) 7 (b) 15 (c) 8 (d) 16

4. Let R be a relation in N defined by R = {(x, y) : x + 2y = 8}. The range of R is

(a) {2, 4, 6} (b){1, 2, 3} (c){1, 2, 3, 4, 6} (d)None of these

5. If R is a relation from a set P to set Q, then

(a)$R \subset P \times Q$ (b)$R \subset Q \times P$ (c)$R = P \times Q$ (d) $R = P \cup Q$

6. The value of $\sin(45° + \theta) - \cos(45° - \theta)$ is

(a) $2\cos\theta$ (b) $2\sin\theta$ (c) 1 (d) 0

7. If $\cot x = 4/3$ and x lies in third quadrant, then find the value of sec x.

(a) 5/4 (b) –4/5 (c) 3/5 (d) –5/4

8. The modulus of the complex number $(4+3i)^2$ is equal to

(a) 5 (b) 25 (c) 7 (d) 49

9. The third term of a geometric progression is 4. The product of the first five terms is

(a) 4^3 (b) 4^5 (c) 4^4 (d) none of these

10. Line through the points (–2, 6) and (4, 8) is perpendicular to the line through the points (8, 12) and (x, 24). The value of x is

a) 4 b) 3 c) 2 d) 1

11. The mean deviation about mean of the data 14, 15, 16, 17, 13 is:

(a) 4 (b) 2.3 (c) 3 (d) 1.2

12. Value of $\lim_{x\to 2} \frac{x^2-4}{x^2+x-6}$

(a) $-4/5$ (b) 0 (c) 4/5 (d) 1/2

13. Distance of the point P (6, 7, 8) from Y axis

(a) 7 (b) 10 (c) 6 (d) 8

14. How many 4-digit numbers can be formed by using the digits 1 to 9, if repetition of digits is not allowed?

(a) 3024 (b) 3026 (c) 3040 (d) 3014

15. Number of terms in expansion of $(4x^2-4x+1)^{12}$ is

(a) 13 (b) 25 (c) 12 (d) 36

16. A bag contains 9 discs of which 4 are red, 3 are blue and 2 are yellow. The discs are similar in shape and size. A disc is drawn at random from the bag. Find the probability that it is either red or blue.

(a) 2/9 (b) 7/9 (c) 1/9 (d) 4/9

17. The probability of being 53 Tuesday in a leap year

(a) 1/7 (b) 53/366 (c) 2/7 (d) 1/366

18. Solution of system of linear inequalities $3x - 7 < 5 + x$, $11 - 5x \leq 1$ is

(a) (2,6) (b) {2,6} (c) [2,6) (d) (2,6]

ASSERTION-REASON BASED QUESTIONS

In the following questions, 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): Let A = {1, 2} and B = {3, 4}. Then, number of relations from A to B is 16.
Reason (R): If n(A) = p and n(B) = q, then number of relations is 2^{pq}.

20. Assertion (A): The value of θ = π/3 or 2π/3, when θ lies between (0, 2π) and sin2θ = 3/4.
Reason (R): sin θ is positive in the first and second quadrant.

SECTION – B
(Questions 21 to 26 carry 2 marks each)

21. Let $f = \{(1,1), (2,3), (0,-1), (-1,-3)\}$ be a function from Z to Z defined by $f(x) = ax + b$, for some integers a, b. Determine a, b.

22. If A $=\{3, 6, 9, 12, 15, 18, 21\}$, B $=\{4, 8, 12, 16, 20\}$, C $= \{2, 4, 6, 8, 10, 12, 14, 16\}$, D $= \{5,10, 15, 20\}$; find (i) $A \cup B$ $(ii) B \cap C$ $(iii) C - D$ $(iv) B - A$

23. Show that tan 5x tan 3x tan 2x = tan 5x – tan 3x – tan 2x

24. In how many of the distinct permutations of the letters in MISSISSIPPI do the four I's come together?

OR

How many words, with or without meaning, each of 2 vowels and 3 consonants can be formed from the letters of the word "EDUCATION"?

25. Evaluate $\lim_{x \to 0} (\operatorname{cosec} x - \cot x)$

SECTION – C
(Questions 27 to 31 carry 3 marks each)

26. Find domain and range of the function f defined as $f(x) = \frac{1}{\sqrt{1-x}}$.

OR

Find domain and range of the function f defined as $f(x) = \frac{3x-2}{2x-5}$.

27. If $x + iy$ *is conjugate of* $\frac{1+2i}{1-i}$, find the value of x + y

28. A man wants to cut three lengths from a single piece of board of length 111 cm.The second length is to be 3cm longer than the shortest and the third length is to be twice as long as the shortest. What are the possible lengths of the shortest board if the third piece is to be at least 5cm longer than the second?

29. Using the binomial theorem, show that $6^n - 5n - 1$ is divisible by 25 for all natural value of n.

OR

Expand $(x^2 + \frac{3}{x})^5$ using binomial theorem.

30. Find the equation of the circle passing through the points (2, 3) and (–1, 1) and whose diameter is the line x – 3y – 11 = 0.

OR

The cable of a uniformly loaded suspension bridge hangs in the form of a parabola. The roadway which is horizontal and 200 m long is supported by vertical wires attached to the cable, the longest wire being 60 m and the shortest being 12 m. Find the length of a supporting wire attached to the roadway 36 m from the middle.

31. Find the equation of the set of points P, the sum of whose distances from A (0,5,0) and B$(0,-5,0)$ is equal to 20.

SECTION – D

(Questions 32 to 35 carry 5 marks each)

32. Prove that: $\sin^2 x + \sin^2\left(x - \frac{\pi}{3}\right) + \sin^2\left(x + \frac{\pi}{3}\right) = \frac{3}{2}$

33. The sum of two numbers is 10 times their geometric means, show that numbers are in the ratio$(5 + 2\sqrt{6}) : (5 - 2\sqrt{6})$.

OR

If a and b are the roots of $x^2 - 3x + p = 0$ and c, d are roots of $x^2 - 12x + q = 0$, where a, b, c, d form a G.P. Prove that $(q + p) : (q - p) = 17:15$.

34. Evaluate (a)$\lim_{x \to 0} \frac{\sin x + 2 \quad 3x + \sin 5x}{x}$ (b)$\frac{d}{dx}\left(\frac{x + \cos x}{\tan x}\right)$ 3+2

OR

Using first principle find the derivative of $\sqrt{sin\ 3x}$ with respect to x.

35. Calculate mean, Variance and Standard Deviation for the following distribution.

Classes	0-30	30-60	60-90	90-120	120-150	150-180	180-210
Frequency	2	3	5	10	3	5	2

SECTION – E (Case Study Based Questions)
(Questions 36 to 38 carry 4 marks each)

36. Equation of straight line path is given by 2x+y-12=0. A man is standing at (2,3).He want to reach at straight line path travelling least distance. Find on the information above

(a)Slope of path travelled by man to reach on given path 1

(b)Equation of path through which man should travel. 2

(c)The coordinates of point on given path where man will reach. 1

37. A selection Committee wants to select a National Team. In a Sports group of 6 girls and 8 boys, in how many ways five children are to be selected for National team such that the team must have follow the conditions. Answer the following questions.

(a)Find the number of ways for selecting 2 girls & 3 boys. 2

(b) Find the number of ways for selecting 1 girl & 4 boys. 2

OR

Find the number of ways such that there is no girl in 5 selected children.

38. In a class of 100 students, 72 opted for NCC, 48 opted for NSS and 36 opted for both NCC and NSS. If one of the student is selected at random, then find the probability that

(a)The student opted for NCC or NSS. 1

(b)The student opted neither NCC nor NSS. 2

(c)The student has opted NSS but not NCC. 1