

KENDRIYA VIDYALAYA SANGATHAN REGIONAL OFFICE LUCKNOW

SESSION ENDING EXAMINATION 2024-25

CLASS: XI

SUBJECT: MATHEMATICS

TIME: 3 HOURS

M. MARKS: 80

General Instructions:

- (i) This Question Paper contains 38 questions. All questions are compulsory.
- (ii) Question Paper is divided into five Sections – Section A, B, C, D and E.
- (iii) In Section A – Questions no. 1 to 18 are Multiple Choice Questions (MCQs) and Questions no. 19 & 20 are Assertion - Reason based questions of 1 mark each.
- (iv) In Section B – Questions no. 21 to 25 are Very Short Answer (VSA) type questions, carrying 2 marks each.
- (v) In Section C – Questions no. 26 to 31 are Short Answer (SA) type questions, carrying 3 marks each.
- (vi) In Section D – Questions no. 32 to 35 are Long Answer (LA) type questions, carrying 5 marks each.
- (vii) In Section E – Questions no. 36 to 38 are case study based questions, carrying 4 marks each.
- (viii) There is no overall choice. However, an internal choice has been provided in some questions.

SECTION A

This section comprises multiple choice questions (MCQs) of 1 mark each.

1. Which of the following is a null set?

- (a) $\{0\}$
- (b) $\{x : x \text{ is prime, } 90 < x < 96\}$
- (c) $\{x : x \in \mathbb{N}, 1 < x \leq 2\}$
- (d) $\{x : x^2 + 1 = 0, x \in \mathbb{R}\}$

2. Let R be a relation in the set N given by $R = \{(a, b) : a = b - 2, b > 4\}$. Then

- (a) $(8, 7) \in R$
- (b) $(6, 8) \in R$
- (c) $(3, 8) \in R$
- (d) $(2, 4) \in R$

3. Let $f : \mathbb{R} \rightarrow \mathbb{R}$ given by $f(x) = x^2$ then range of f is

- (a) $\mathbb{R}$
- (b) $(-\infty, 0)$
- (c) $[0, \infty)$
- (d) $(0, \infty)$

4. If $A = \{3, \{4, 5\}, 6\}$, then which of the following statements is true?

- (a) $\{4, 5\} \subseteq A$
- (b) $\{4, 5\} \in A$
- (c) $4 \in A$
- (d) $\{3, 4, 5\} \subseteq A$

5. If $f(x) = x^3 - \frac{1}{x^3}$ then $f(x) + f\left(\frac{1}{x}\right)$ is equal to

- (a) $2x^3$
- (b) $2\left(\frac{1}{x^3}\right)$
- (c) 0
- (d) 1

6. The degree measure of the angle subtended at the centre of a circle of diameter 50 cm by an arc of length 11 cm is

- (a) $20^\circ 15'$
- (b) $25^\circ 15'$
- (c) $25^\circ 12'$
- (d) $28^\circ 12'$

7. If $\sin x = \frac{-1}{2}$ and x lies in fourth quadrant then value of $\cos 2x$ is

- (a) -2
- (b) $\frac{-1}{2}$
- (c) 2
- (d) $\frac{1}{2}$

8. Value of $\left(i^{37} + \frac{1}{i^{67}}\right)$ is

- (a) $2i$ (b) i (c) -1 (d) 0

9. Solution of the inequality $|x + 1| > 4$, $x \in \mathbb{R}$ will be

- (a) $(3, \infty)$ (b) $(-\infty, 3)$ (c) $(-5, 3)$ (d) $(-\infty, -5) \cup (3, \infty)$

10. If ${}^n P_3 = 20 \times {}^n P_2$ then value of n is

- (a) 18 (b) 20 (c) 22 (d) 24

11. In how many can the letters of the word 'PENCIL' be arranged so that E and N always come together?

- (a) 120 ways (b) 240 ways (c) 720 ways (d) 360 ways

12. Fourth term in the expansion of $\left(x^2 + \frac{3}{x}\right)^4$ is

- (a) x^8 (b) $54x^2$ (c) $108x$ (d) $108/x$

13. If a , b and c are in GP and r is the common ratio between them, then value of $\frac{a-b}{b-c}$ is equal to

- (a) r (b) ar (c) $\frac{a}{r}$ (d) $\frac{1}{r}$

14. In which octant does the point $(-6, 5, -1)$ lie?

- (a) II octant (b) III octant (c) VI octant (d) VII octant

15. What is the perpendicular distance of the point $P(6, 7, 8)$ from xy -plane?

- (a) 8 (b) 7 (c) 6 (d) None of these

16. Mean deviation about the median for the data 11, 3, 8, 7, 5, 14, 10, 2, 9 is given by

- (a) 3 (b) 4 (c) 5 (d) 6

17. If E and F are events such that $P(E) = \frac{1}{4}$, $P(F) = \frac{1}{2}$ and $P(E \text{ and } F) = \frac{1}{8}$, what is the probability of event not E and not F ?

- (a) $\frac{5}{8}$ (b) $\frac{7}{8}$ (c) $\frac{1}{2}$ (d) $\frac{3}{8}$

18. Three coins are tossed once, then probability of getting at least two heads is given by

- (a) $\frac{2}{3}$ (b) $\frac{1}{2}$ (c) $\frac{3}{8}$ (d) $\frac{1}{3}$

ASSERTION – REASON BASED QUESTIONS

In the following questions 19 & 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 $A = \{x : x \text{ is a multiple of } 3\}$ and $B = \{x : x \text{ is a multiple of } 5\}$ then

$$A \cap B = \{x : x \text{ is a multiple of } 15\}$$

Reason (R): $A \cap B$ is a set which contains common elements of set A and B.

20. Assertion (A): If $\tan \theta = \frac{4}{3}$, then $\sin \theta$ is $\frac{4}{5}$ but not $-\frac{4}{5}$.

Reason (R): If $\tan \theta$ is positive θ lies either in first quadrant or third quadrant.

SECTION – B

This section comprises of Very Short Answer Type (VSA) questions, each of 2 marks.

21. Let $U = \{1, 2, 3, 4, 5, 6\}$, $A = \{2, 3\}$ and $B = \{3, 4, 5\}$, then verify that $(A \cup B)' = A' \cap B'$.

22. If $x + iy = \frac{a+ib}{a-ib}$, prove that $x^2 + y^2 = 1$.

23. Find the value of $\tan \frac{13\pi}{12}$.

OR

Prove that: $\cos 6x = 32 \cos^6 x - 48 \cos^4 x + 18 \cos^2 x - 1$.

24. Find the mean and variance of first 10 natural numbers.

25. A person has 2 parents, 4 grandparents, 8 great grandparents and so on. Find the number of his ancestors during the 10 generations preceding his own.

OR

Which term of the G.P. 2, 8, 32..... up to n terms is 131072?

SECTION – C

The section comprises Short Answer (SA) type questions of 3 marks each.

26. Evaluate $\left(a^2 + \sqrt{a^2 - 1}\right)^4 + \left(a^2 - \sqrt{a^2 - 1}\right)^4$.

OR

Expand using Binomial Theorem $\left(1 + \frac{x}{2} - \frac{2}{x}\right)^4$, $x \neq 0$.

27. Find the coordinates of the foci, the vertices, the length of major and minor axes, eccentricity and length of latus rectum of the ellipse $9x^2 + 4y^2 = 36$.

28. A manufacturer has 600 litres of 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%?

OR

Find all pairs of consecutive odd natural numbers, both of which are larger than 10, such that their sum is less than 40.

29. If three lines whose equations are $y = m_1x + c_1$, $y = m_2x + c_2$ and $y = m_3x + c_3$ are concurrent, then show that $m_1(c_2 - c_3) + m_2(c_3 - c_1) + m_3(c_1 - c_2) = 0$.

30. Calculate the mean, variance and standard deviation for the following distribution:

Class	30 – 40	40 – 50	50 – 60	60 – 70	70 – 80	80 – 90	90 – 100
Frequency	3	7	12	15	8	3	2

31. Evaluate :

(i) $\left[\frac{x^3 - 2x^2}{x^2 - 5x + 6} \right]$

(ii) $\frac{ax + x \cos x}{b \sin x}$

OR

Find the derivative of $\frac{4x + 5 \sin x}{3x + 7 \cos x}$.

SECTION – D

This section comprises Long Answer type (LA) questions of 5 marks each.

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

OR

The ratio of A.M. and G.M. of two positive numbers a and b is m : n. Show that

$$a : b = \left(m + \sqrt{m^2 - n^2} \right) : \left(m - \sqrt{m^2 - n^2} \right)$$

33. Find the derivative of $f(x) = \sin x + \cos x$ from the first principles.

34. Find the domain and range of the function $f = \left\{ \left(x, \frac{1}{1-x^2} \right) : x \in \mathbb{R}, x \neq \pm 1 \right\}$.

35. Prove that:

$$\cos 20^\circ \cos 40^\circ \cos 60^\circ \cos 80^\circ = \frac{1}{16}.$$

OR

If $\tan x = \frac{3}{4}$ and $\pi < x < \frac{3\pi}{2}$, find the values of $\sin \frac{x}{2}$, $\cos \frac{x}{2}$ and $\tan \frac{x}{2}$.

SECTION – E

This section comprises 3 source based/ case-based/ passage- based questions of 4 marks each.

36. A state cricket authority has to choose a team of 11 members. For this the authority asks 2 coaches of a government academy to select the team members that have experience as well as the best performers in last 15 matches. They have to make a team of 11 cricketers amongst 15 possible candidates.



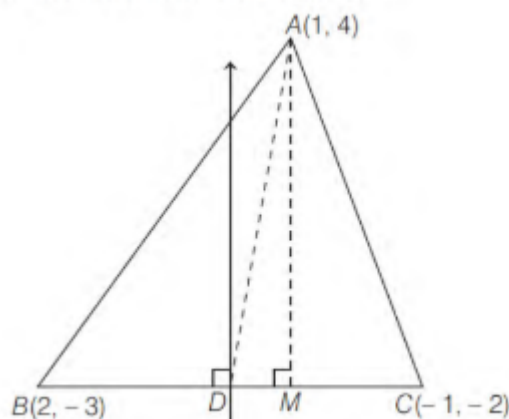
In how many ways can the final eleven be selected from 15 cricket players if:

- (i) If one player must be included. (1)
- (ii) one of them, who is in bad form, must be excluded. (1)
- (iii) (a) Two of them being leg spinners, only one leg spinner must be included. (2)

OR

- (b) If 6 players can bowl and team must include exactly 5 bowlers. (2)

37. Consider the triangle ABC with vertices $A(1, 4)$, $B(2, -3)$ and $C(-1, -2)$ as shown in the given figure. AD is the median and AM is the altitude through A.



Based on the above information, answer the following questions:

- (i) Find the equation of BC. (1)
- (ii) find length of altitude AM. (1)
- (iii) (a) Find the equation of altitude AM. (2)

OR

- (b) Find the equation of right bisector of side BC. (2)

38. From the employees of a company, 5 persons are selected to represent them in the managing committee of the company. Particulars of five persons are as follows:

S. No.	Name	Sex	Age in years
1	Harish	M	30
2	Rohan	M	33
3	Sheetal	F	46
4	Alis	F	28

5	Salim	M	41
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A person is selected at random from this group to act as a spokesperson. Based on the above information answer the following questions:

- (i) What is the probability that the spokesperson will be either female or over 35 years? (2)
- (ii) What is the probability that the spokesperson will be neither male nor below 40 years? (2)