



Delhi Public School, Howrah

PERIODIC TEST-III (2024 -2025)

Class-XI

Care must be taken not to write anything on the question paper. All the questions must be attempted in the correct sequence.

Subject:- Mathematics (Code 041)

Time: 3 Hours

F.M. 80

Read the following instructions very carefully and strictly follow them:

- (i) This Question paper contains 38 questions. All questions are compulsory.
- (ii) This Question paper is divided into five Sections - A, B, C, D and E.
- (iii) In Section A, Questions no. 1 to 18 are multiple choice questions (MCQs) and Questions no. 19 and 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 2 questions in Section B, 3 questions in Section C, 2 questions in Section D and one subpart each in 2 questions of Section E.
- (ix) Use of calculators is not allowed.

Section –A

(Multiple Choice Questions)

Each question carries 1 mark

1. The number of the proper subset of $\{a, b, c\}$ is:
(A) 3 (B) 8 (C) 6 (D) 7
2. If $f(x) = x$ and $g(x) = |x|$, then $(f + g)(x)$ is equal to
(A) 0 for all $x \in R$ (B) $2x$ for all $x \in R$ (C) $\begin{cases} 2x, & \text{for } x \geq 0 \\ 0, & \text{for } x < 0 \end{cases}$ (D) $\begin{cases} 0, & \text{for } x \geq 0 \\ 2x, & \text{for } x < 0 \end{cases}$
3. The radian measure of 520° is
(A) $13\pi/9$ (B) $26\pi/9$ (C) $17\pi/9$ (D) $6\pi/9$
4. If $\sin x + \operatorname{cosec} x = 2$, then $\sin^2 x + \operatorname{cosec}^2 x$ is equal to
(A) 1 (B) 4 (C) 2 (D) 6
5. If $i^{103} = a + ib$, then $a + b$ is equal to
(A) 1 (B) -1 (C) 0 (D) 2
6. If $x = -1 + i$, then the value of $x^2 + 2x - 1$ is
(A) -3 (B) 0 (C) 1 (D) -1
7. The length of a rectangle is three times the breadth. If the minimum perimeter of the rectangle is 160 cm, then
(A) breadth > 20 cm (B) length < 20 cm (C) breadth ≥ 20 cm (D) length ≤ 20 cm

8. Three of the six vertices of a regular hexagon are chosen at random. What is the probability that the triangle with these vertices is equilateral?
 (A) $\frac{3}{10}$ (B) $\frac{3}{20}$ (C) $\frac{1}{20}$ (D) $\frac{1}{10}$
9. If A and B are any two events having $P(A \cup B) = \frac{1}{2}$ and $P(\bar{A}) = \frac{2}{3}$, then $P(\bar{A} \cap B)$ is
 (A) $\frac{1}{2}$ (B) $\frac{2}{3}$ (C) $\frac{1}{3}$ (D) $\frac{1}{6}$
10. $\lim_{x \rightarrow \frac{1}{2}} \frac{4x^2 - 1}{2x - 1}$ is equal to
 (A) $\frac{1}{2}$ (B) $-\frac{1}{2}$ (C) 2 (D) -2
11. $\lim_{x \rightarrow 0} \frac{|\sin x|}{x}$ is equal to
 (A) 1 (B) -1 (C) does not exist (D) none of these
12. $9^{1/3} \times 9^{1/9} \times 9^{1/27} \dots$ to ∞ equals
 (A) 9 (B) 3 (C) 2 (D) 1
13. The distance of the point P (1, -3) from the line $2y - 3x = 4$ is
 (A) $\sqrt{13}$ (B) $\frac{7\sqrt{3}}{13}$ (C) 13 (D) $\frac{7}{13}$
14. The range of $(4 + 5 \cos x)$ is
 (A) $[-1, 9]$ (B) $(-1, 9]$ (C) $(-1, 9)$ (D) $[-1, 9)$
15. The equation of the parabola with vertex at origin and directrix the line $y + 3 = 0$ is
 (A) $y^2 = 12x$ (B) $y^2 = -12x$ (C) $x^2 = 12y$ (D) $x^2 = -12y$
16. The locus of a point for which $x = 0$ is
 (A) xy plane (B) yz plane (C) zx plane (D) none of these
17. If $f(x) = (2 - 3 \cos x)/\sin x$, then $f'(\pi/4)$ is equal to
 (A) $2\sqrt{2} - 6$ (B) $6 - 2\sqrt{2}$ (C) $3 - \sqrt{2}$ (D) $\sqrt{2} - 3$
18. Two dice are thrown simultaneously. The probability that the sum of the numbers appearing on them is a prime number is
 (A) $\frac{5}{12}$ (B) $\frac{1}{2}$ (C) $\frac{7}{12}$ (D) $\frac{2}{3}$

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): Slope of the line passing through the points (3,-2) and (3,4) is 0.
 Reason (R): If two lines having the same slope pass through a common point, then these lines will coincide.
20. Assertion (A): Centre of the circle $x^2 + y^2 - 6x + 4y - 12 = 0$ is (3, -2).

Reason (R): The coordinates of the centre of the circle $x^2 + y^2 + 2gx + 2fy + c = 0$ are $(-1/2 \text{ coefficient of } x, -1/2 \text{ coefficient of } y)$

Section – B

[This section comprises of very short answer type questions (VSA) of 2 marks each]

21. Let $A = \{a, b, c, d\}$, $B = \{b, d, e, f, g\}$ and $C = \{a, c, e, f, h, i\}$, verify that
 $A \cap (B - C) = (A \cap B) - (A \cap C)$
22. Solve the following system of linear inequalities and graph the solution on the number line
 $2y - 3 < y + 2 \leq 3y + 5$.
23. Find the equation of hyperbola whose foci are $(0, \pm 12)$ and length of latus-rectum is 36.
24. a) Find the equation of the set of points P so that its distances from the points A $(3, 4, -5)$ and B $(-2, 1, 4)$ are equal.

OR

- b) Find the coordinates of points on y-axis which are at a distance of $5\sqrt{2}$ from the point P $(3, -2, 5)$.
25. a) Evaluate $\lim_{x \rightarrow \frac{\pi}{4}} \frac{\sin x - \cos x}{x - \frac{\pi}{4}}$

OR

- b) Differentiate $(\sqrt{x} + \frac{1}{\sqrt{x}})^2$, with respect to x.

Section – C

[This section comprises of short answer type questions (SA) of 3 marks each]

26. a) Using Binomial theorem, prove that $6^n - 5n$ always leaves the remainder 1 when divided by 25, for all $n \in \mathbb{N}$.

OR

- b) Find the value of $(1.01)^5$ correct to 5 decimal places.
27. Four candidates A, B, C, D have applied for the assignment to coach a school cricket team. If A is twice as likely to be selected as B, and B and C are given about the same chance of being selected, while C is twice as likely to be selected as D, what are the probabilities that

- (a) C will be selected?
(b) A will not be selected?

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

29. a) Find the derivative of $(x \sin x)$ using first principle.

OR

- b) If $y = \sqrt{x} + \frac{1}{\sqrt{x}}$, prove that $2x \frac{dy}{dx} + y = 2\sqrt{x}$.

30. a) If α and β are different complex numbers with $|\beta| = 1$, then find $\left| \frac{\beta - \alpha}{1 - \bar{\alpha}\beta} \right|$.

OR

- b) If $z - x + iy$ and $|2z + 1| = |z - 2i|$, show that $3(x^2 + y^2) + 4(x + y) = 3$.

31. Prove that $\tan 20^\circ \cdot \tan 40^\circ \cdot \tan 80^\circ = \tan 60^\circ$.

Section – D

[This section comprises of long answer type questions (LA) of 5 marks each]

32. a) Find the value of $\cos^4 \frac{\pi}{8} + \cos^4 \frac{3\pi}{8} + \cos^4 \frac{5\pi}{8} + \cos^4 \frac{7\pi}{8}$.

OR

- b) If α and β are the solutions of the equation $a \tan \theta + b \sec \theta = c$, then show that $\tan(\alpha + \beta) = \frac{2ac}{a^2 - c^2}$.

33. i) Find n if $16 \cdot {}^{n+2}C_8 = 57 \cdot {}^{n-2}P_4$.

ii) A committee of 6 is to be chosen from 10 men and 7 women so as to contain at least 3 men and 2 women. In how many different ways can this be done if two particular women refuse to serve on the same committee? 3

34. (a) 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 $(q + p) : (q - p) = 17:15$.

OR

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

35. Let $A = \{x : x \text{ is a letter in the word 'GEORGE CANTOR'}\}$ and $B = \{x : x \text{ is a vowel in the word 'GEORGE CANTOR'}\}$, then

i) find $A \cup B$

ii) write the number of proper subsets of A

iii) write the power set of B

iv) find $A - B$

v) Is A subset of B? Justify.

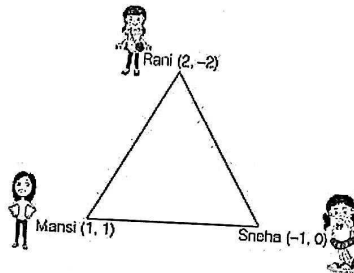
Section -E

[This section comprises of 3 case- study/passage based questions of 4 marks each with sub parts. The first two case study questions have three sub parts (i), (ii), (iii) of marks 1,1,2 respectively.

The third case study question has two sub parts of 2 marks each.]

36. Case Study I:

Three girls, Rani, Mansi, Sneha are talking to each other while maintaining a social distance due to covid-19. They are standing on vertices of a triangle, whose coordinates are given.



Based on the above information answer the following questions.

(i) Find the equation of lines formed by Rani and Mansi.

(ii) What is the slope of equation of line formed by Rani and Sneha?

(iii) a) Find the equation of median of lines through Rani.

1

1

2

OR

b) What will be the equation of line passing through the Rani which is parallel to line formed by Mansi and Sneha.

2

37. Case Study II:

A state cricket authority must choose a team of 11 members. To do it 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 can make up a team of 11 cricketers amongst 15 possible candidates.



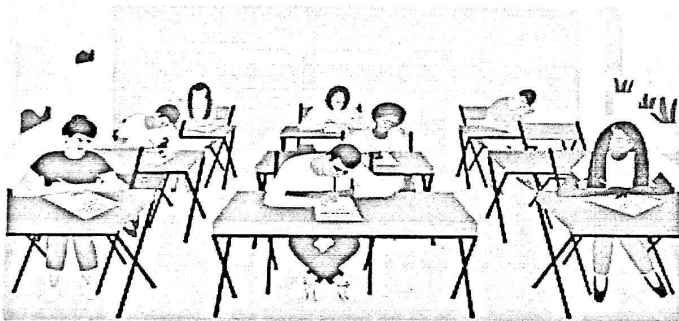
Based on the above information answer the following questions.

- (i) In how many ways can be the final eleven be selected from 15 cricket players if there is no restriction? 1
- (ii) In how many ways can be the final eleven be selected from 15 cricket players if one particular player must be included? 1
- iii. If two of them are leg spinners, in how many ways can be the final eleven be selected from 15 cricket players if one and only one leg spinner must be included? 2

OR

- iii. If there are 6 bowlers, 3 wicketkeepers, and 6 batsmen in all, in how many ways can be the final eleven be selected from 15 cricket players if 4 bowlers, 2 wicketkeepers and 5 batsmen are included? 2

38. **Case Study III:** 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

- (i) Find the probability that both Anil and Ashima will not qualify the exam. 2
- (ii) Find the probability that only one of them will qualify the exam. 2