



Delhi Public School, Howrah

PERIODIC TEST-II (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

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 of 4 marks each with sub-parts.

Section –A

(Multiple Choice Questions)

Each question carries 1 mark

1. Let $U = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$, $P = \{1, 2, 5\}$, $Q = \{6, 7\}$. Then $P \cap Q'$ is:
(a) P (b) Q (c) Q' (d) P'
2. Let $A = \{x, y\}$ and $B = \{1, 2\}$, then number of non empty relations from set A to set B will be
(a) 64 (b) 32 (c) 16 (d) 15
3. The value of $4 \cos^3 15^\circ - 3 \cos 15^\circ$ is
(a) -1 (b) 0 (c) 1 (d) $\frac{1}{\sqrt{2}}$
4. Value of $\sec^2 x + \cos^2 x$ is:
(a) < 0 (b) < 1 (c) ≥ 2 (d) < 2
5. If $(2+5i)z = (3-7i)$, where z is a complex number, then $z =$ _____.
(a) $1+i$ (b) $1-i$ (c) $-1+i$ (d) $-1-i$
6. The real part of $\frac{(1+i)^2}{3-i}$ is
(a) $\frac{1}{3}$ (b) $-\frac{1}{5}$ (c) $-\frac{1}{3}$ (d) 0
7. Given that x,y and b are real numbers and $x < y$, $b > 0$, then which of the following is true?
(a) $\frac{x}{b} < \frac{y}{b}$ (b) $\frac{x}{b} \leq \frac{y}{b}$ (c) $\frac{x}{b} > \frac{y}{b}$ (d) $\frac{x}{b} \geq \frac{y}{b}$
8. Everybody in a room shakes hands with everybody else. The total number of handshakes is 66. The total number of person is :
(a) 11 (b) 12 (c) 13 (d) 14

9. The number of ways in which 5 prizes be distributed among 4 boys, while each boy can have any number of prizes is:

- (a) 54 (b) 45 (c) $4! \times 24$ (d) $4! \times 5$

10. Number of terms in $(1 + 5\sqrt{2}x)^9 + (1 - 5\sqrt{2}x)^9$ if $x > 0$ is _____.

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

11. The first term of a G.P. is 2 and the sum to infinity is 6. Then the common ratio is

- (a) $1/2$ (b) $1/3$ (c) $1/4$ (d) $2/3$

12. If x, y, z are positive integers then value of expression $(x + y)(y + z)(z + x)$ is

- (a) $= 8xyz$ (b) $> 8xyz$ (c) $< 8xyz$ (d) $= 4xyz$

13. If the fourth, seventh and tenth terms of a G.P. are p, q, r respectively, then which of the following is true?

- (a) $p^2 = q^2 + r^2$ (b) $q^2 = pr$ (c) $p^2 = qr$ (d) $pqr + pq + 1 = 0$

14. Which one is True?

- (a) $(1.2)^{4000} > 800$ (b) $(1.2)^{4000} < 800$ (c) $(1.2)^{4000} = 800$ (d) $(1.2)^{4000} = 1600$

15. Set A and B have 3 and 6 elements respectively. What can be the minimum number of elements in $A \cup B$?

- (a) 3 (b) 6 (c) 9 (d) 18

16. The relation f is defined by $f(x) = \begin{cases} x^3, & 0 \leq x \leq 3 \\ 9x, & 3 \leq x \leq 10 \end{cases}$ and the relation g is defined by $g(x) = \begin{cases} x^2, & 0 \leq x \leq 5 \\ 3x, & 5 \leq x \leq 10 \end{cases}$, then which one of the following is true?

- (a) f, g are functions
(b) f is not a function and g is a function.
(c) f is a function and g is not a function.
(d) f and g both are not functions.

17. $1 + \cos 2x + \cos 4x + \cos 6x =$ _____.

- (a) $2 \cos x \cos 2x \cos 3x$ (b) $4 \sin x \cos 2x \cos 3x$
(c) $4 \cos x \cos 2x \cos 3x$ (d) None of these

18. The solution set of $-x^2 > 16$, where x is a real number, is

- (a) $(-4,4)$ (b) $(0,4)$ (c) $(-4,0)$ (d) Empty set

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): ${}^{13}C_9 = {}^{13}C_6$.

Reason(R): Selection of the r distinct things out of n is equal to the rejection of the $(n-r)$ distinct things out of n .

20. Assertion (A): If the function $f: A \rightarrow B$ defined by $f = \{(1, x), (2, y), (3, x)\}$, then its domain is $A = \{1, 2, 3\}$ and range is $\{x, y\}$.

Reason (R): The range of the function f is always the co-domain set.

Section –B

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

21. If $A + B = 45^\circ$, then find the value of $(\cot A - 1)(\cot B - 1)$.

22. (a) Find r , if ${}^n P_r = 2880$ and ${}^n C_r = 120$.

OR

b) How many rectangles can be formed from the chess board of any size?

23. $X = \{1, 2, 3\}$ and $Y = \{2, 4\}$ and R is a relation from X to Y , $(x, y) \in R$ such that $x < y$. Depict this relation by an arrow diagram.

24. a) Expand: $(x^2 + 1 - 2x)^3$

OR

b) Find an approximation of $(0.99)^5$ using the first three terms of its expansion.

25. Let $V = \{a, e, i, o, u\}$, $V - B = \{e, o\}$ and $B - V = \{k\}$. Find the set B .

Section – C

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

26. a) Show that $2^{4n+4} - 15n - 16$, where $n \in \mathbb{N}$ is divisible by 225.

OR

b) If a and b are distinct integers, prove that $a - b$ is a factor of $a^n - b^n$, whenever n is a positive integer.

27. a) Solve the system of linear inequalities and represent the solution graphically on the number line.

$$2(2x + 3) - 10 < 6(x - 2) \text{ and } \frac{2x-3}{4} + 6 \geq 2 + \frac{4x}{3}.$$

OR

b) In drilling world's deepest hole it was found that the temperature T in degree Celsius, x km below the earth's surface was given by $T = 30 + 25(x - 3)$, $3 \leq x \leq 15$. At what depth will the temperature be between 155°C and 205°C ?

28. For all sets A , B and C , is $(A \cap B) \cup C = A \cap (B \cup C)$? Justify your statement

29. If $z = x + iy$ and $w = \frac{1-iz}{|z-i|}$ and $|w| = 1$ then show that z is purely real.

30. If z_1, z_2 are $1 - i$ and $-2 + 4i$ respectively find $\text{Im}\left(\frac{z_1 z_2}{z_1}\right)$

31. If $\tan\alpha=1/7$, $\sin\beta=1/\sqrt{10}$, Prove that : $\alpha+2\beta=\pi/4$, where $0<\alpha<\pi/2$ and $0<\beta<\pi/2$.

Section – D

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

32. a) Prove that $\cos 5A = 16 \cos^5 A - 20 \cos^3 A + 5 \cos A$.

OR

b) If α and β are the distinct roots of the equation $a \cos \theta + b \sin \theta = c$, then prove that $\sin(\alpha + \beta) = \frac{2ab}{a^2+b^2}$.

33. A milk of 80% concentration is diluted at home by the seller by adding some water to it, so that the milk concentration is reduced between 65%-70%. If 640 litres of milk of 80% concentration is available, how much water has been added?

34. a) If a, b, c, d and p are different real numbers such that $(a^2 + b^2 + c^2) p^2 - 2(ab + bc + cd) p + (b^2 + c^2 + d^2) \leq 0$, then show that a, b, c and d are in G.P.

OR

b) If A and G be A.M. and G.M., respectively between two positive numbers, prove that the numbers are $A \pm \sqrt{(A + G)(A - G)}$.

35. i) Find the domain and range of the real function $f(x)$ defined by

$$f(x) = \begin{cases} 1 - x, & x < 0 \\ 1, & x = 0 \\ x - 1, & x > 0 \end{cases} \text{ Also draw its graph.}$$

ii) Find the domain and range of the function $f(x) = \frac{1}{2 - \sin 3x}$.

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:

The purpose of the student council is to give students an opportunity to develop leadership by organizing and carrying out school activities and service projects. It also aims to create an environment where every student can voice out their concern or need. Raju, Ravi Joseph, Sangeeta, Priya, Meena and Aman are members of student's council of a school. There is a photo session in the school where these 7 students are to be seated in a row for photo session.



- (i) Find the total number of arrangements so that Raju and Ravi are at extreme positions? (1)
- (ii) Find the number of arrangements so that Joseph is sitting in the middle. (1)

(iii) Find the number of arrangements so that three girls are together. (2)

OR

Find the number of arrangements so that Aman and Ravi are not together? (2)

37. Case Study II:

In a certain city all telephone numbers have seven digits. City is divided into six zones. Each zone is allotted a specific non – zero digit which is to be used as first digit of each telephone number of that zone.



Based on the above information, answer the following questions.

(i) How many telephone numbers are there in the city if there is no restrictions? (1)

(ii) How many telephone numbers are there in the city with all digits distinct? (1)

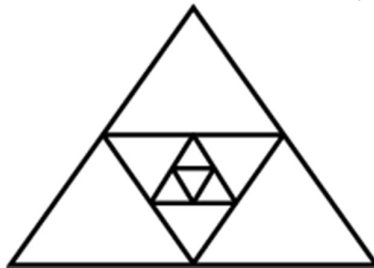
(iii) a) How many telephone numbers are there in each zone, if digit on first place is not used again? (2)

OR

b) How many different telephone numbers are there in the city if the first two digits of different zones are 12, 23, 34, 45, 56 and 67? (2)

38. Case Study III:

A trophy is to be made from waste material in the form of equilateral triangle as base. On this base another equilateral triangle is kept so that its vertices are the mid point of the sides of the base, again another equilateral triangle is obtained in the same manner and the process continues. Now, sides of each triangle are decorated with green ribbon to give natural environmental look. The side of the equilateral triangle at the base is 72 cm.



Based on above information, answer the following questions.

(i) Find the side of 10th triangle (in cm). (2)

(ii) Find the sum of the perimeter of all the triangles. (2)