



Delhi Public School, Howrah

PERIODIC TEST – II (2025 - 2026)

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: - Applied Mathematics (Code No- 241)

Time: 3 Hours

F.M. 80

General Instructions:

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 5 Sections – Section **A, B, C, D** and **E**.
- (iii) In Section – **A**, Questions Number **1** to **18** are Multiple Choice Questions (MCQs) and Questions Number **19** and **20** are Assertion – Reason based questions of **1** mark each.
- (iv) In Section – **B**, Questions Number **21** to **25** are Very Short Answer (VSA) type Questions, carrying **2** marks each.
- (v) In Section – **C**, Questions Number **26** to **31** are Short Answer (SA) type Questions, carrying **3** marks each.
- (vi) In Section – **D**, Questions Number **32** to **35** are Long Answer (LA) type Questions, carrying **5** marks each.
- (vi) In Section – **E**, Questions Number **36** to **38** are case study-based questions, carrying **4** marks each.
- (vii) There is no overall choice. However, an internal choice has been provided in **2** questions in Section – **B**, **2** questions in Section – **C**, **2** questions in Section **D** and **3** questions in Section – **E**.
- (viii) Use of calculators is **NOT** allowed.

SECTION - A

This section comprises of Multiple Choice Questions (MCQs) of 1 mark each. Select the correct option (Question 1 to Question 18):

1. The decimal equivalent of the binary number 10101 is
(A) 21 (B) 12 (C) 22 (D) 31
2. It was Thursday on Feb 12, 2004. What was the day of the week on Feb 12, 2003?
(A) Friday (B) Wednesday (C) Saturday (D) Tuesday
3. Ramu is twice efficient as Komal. They together can finish a piece of work in 50 days. In how many day Komal can finish the same work alone?
(A) 75 days (B) 150 days (C) 160 days (D) 180 days
4. Let $\xi = \{1, 2, 3, \dots, 40\}$, $A = \{x: x \text{ is divisible by 2 and 3}\}$ and $B = \{x: x = n^2, n \in N\}$, then $n(A) - n(B)$ is
(A) 0 (B) 1 (C) 2 (D) 3
5. If $n(A - B) = 10$, $n(B - A) = 23$, $n(A \cup B) = 50$, then $n(A \cap B)$ is
(A) 7 (B) 17 (C) 27 (D) 33
6. Let R be a relation on the set N given by $R = \{(a, b): a = b - 2, b > 6\}$. Then which of the following is true?
(A) $(2, 4) \in R$ (B) $(3, 8) \in R$ (C) $(6, 8) \in R$ (D) $(8, 7) \in R$
7. The domain of definition of the function $f(x) = \sqrt{4x - x^2}$ is
(A) $R - [0, 4]$ (B) $R - (0, 4)$ (C) $(0, 4)$ (D) $[0, 4]$
8. If $f(x) = \begin{cases} \frac{\sqrt{4+x}-2}{x}, & x \neq 0 \\ k, & x = 0 \end{cases}$ is continuous at $x=0$, then the value of k is
(A) 1 (B) 4 (C) $\frac{1}{4}$ (D) 0
9. If the first, second and last term of an A.P. are a, b and 2a respectively, then its sum is
(A) $\frac{ab}{2(b-a)}$ (B) $\frac{ab}{(b-a)}$ (C) $\frac{3ab}{2(b-a)}$ (D) none of these
10. Which number should be added to the numbers 6, 10, 18 to make the resulting numbers in G.P?
(A) 4 (B) 2 (C) 5 (D) -2

11. If $y = \sqrt{x} + \frac{1}{\sqrt{x}}$, then $\frac{dy}{dx}$ at $x=1$ is
 (A) 1 (B) $\frac{1}{2}$ (C) $1/\sqrt{2}$ (D) 0
12. The score of a MCQ test of 10 students are given below: 37,48,35,49,29,46,49,40,33,50. The percentile rank of score 49 is
 (A) 75 (B) 80 (C) 85 (D) 90
13. A set of n variates $x_1, x_2, \dots, x_n$ has mean $\bar{x}$ and standard deviation σ . The mean and standard deviation of n values $\frac{x_1}{k}, \frac{x_2}{k}, \dots, \frac{x_n}{k}$ ($k \neq 0$) respectively are
 (A) $k\bar{x}, \frac{\sigma}{k}$ (B) $\frac{\bar{x}}{k}, \frac{\sigma}{k}$ (C) $k\bar{x}, k\sigma$ (D) $\frac{\bar{x}}{k}, k\sigma$
14. The equation of the line passing through (1,2) and perpendicular to $x+y+7=0$ is
 (A) $y-x+1=0$ (B) $y-x-1=0$ (C) $y-x+2=0$ (D) $y-x-2=0$
15. The distance between the lines $y = mx + c_1$ and $y = mx + c_2$ is
 (A) $\frac{c_1-c_2}{\sqrt{m^2+1}}$ (B) $\frac{|c_1-c_2|}{\sqrt{m^2+1}}$ (C) $\frac{c_2-c_1}{\sqrt{m^2+1}}$ (D) 0
16. If a circle passes through the points (0,0), (a,0) and (0,b), then the coordinates of its centre are
 (A) (a,b) (B) $(-\frac{a}{2}, -\frac{b}{2})$ (C) $(\frac{a}{2}, \frac{b}{2})$ (D) (-a,-b)
17. If the parabola $y^2 = 4ax$ passes through the point (3,2), then the length of its latus rectum is
 (A) $\frac{2}{3}$ (B) $\frac{4}{3}$ (C) $\frac{1}{3}$ (D) 4
18. If $\frac{\log x}{a-b} = \frac{\log y}{b-c} = \frac{\log z}{c-a}$, then xyz equal to
 (A) 0 (B) 1 (C) -1 (D) 2

Questions number 19 and 20 are Assertion – Reason based questions of 1 mark each. Two statements are given – one labelled Assertion (A) and other labelled Reason (R). Select the correct answer to these questions from the codes (A), (B), (C) and (D) as given below:

- (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):** The variance of 10 observations is 6. If each observation is multiplied by 3, then new variance is 54.

Reason(R): If σ^2 is the variance of n observations $x_1, x_2, \dots, x_n$, then variance of the observations $ax_1, ax_2, \dots, ax_n$ is $a^2\sigma^2$.

20. **Assertion(A):** If the mean of 100 observations is 48, then the sum of their deviations from 48 is zero.

Reason(R): The algebraic sum of the deviations about mean is zero.

SECTION – B

Questions Number 21 to 25 are Very Short Answer (VSA) type questions of 2 marks each.

21. If $a^2 + b^2 = 7ab$, prove that $\log\left(\frac{1}{3}(a+b)\right) = \frac{1}{2}(\log a + \log b)$
22. Two finite sets A and B have m and k elements respectively. If the ratio of cardinal number of power set of A to cardinal number of power set of B is 64:1 and $n(A)+n(B)=12$, then find the values of m and k .
23. (a) Evaluate: $\lim_{h \rightarrow 0} \frac{\sqrt{x+h} - \sqrt{x}}{h}$
- OR**
- (b) Find the derivative of the function $f(x) = \log(x + \sqrt{x^2 - a^2})$ with respect to x .
24. Let A be set of first ten natural numbers and let R be a relation on A defined by $R = \{(x, y) : x \in A, y \in A \text{ and } x + 2y = 10\}$. Express R as a set of ordered pairs. Also find $Dom(R^{-1})$.
25. (a) Find the equation of the perpendicular bisector of the line segment joining the points (1,1) and (2,3).

OR

- (b) Find the equation of the straight line which passes through the point (3,-2) and cuts off positive intercepts on the x-axis and y-axis which are in the ratio 4:3.

SECTION - C

Questions Number 26 to 31 are Short Answer (SA) type questions of 3 marks each.

26. If $y = \frac{\log(x+\sqrt{x^2+1})}{\sqrt{x^2+1}}$, prove that $(x^2 + 1) \frac{dy}{dx} + xy = 1$.

27. (a) In an AP, if p th term is $\frac{1}{q}$ and q th term is $\frac{1}{p}$, then prove that the sum of first pq terms is $\frac{1}{2}(pq + 1)$, where $p \neq q$.

OR

(b) Prove that $0.5 + 0.55 + 0.555 + \dots \dots \dots \text{upto } n \text{ terms} = \frac{5}{81} \left[9n - 1 + \frac{1}{10^n} \right]$

28. There are 200 individuals with a skin disorder; 120 had been exposed to the chemical C_1 , 50 to the chemical C_2 and 30 to both the chemicals C_1 and C_2 . Find the number of individuals exposed to:

- a) chemical C_1 but not C_2
- b) chemical C_1 or C_2
- c) neither chemical C_1 nor C_2

29. Find the derivative of $\sqrt{3x+4}$ using first principle.

30. (a) Find the mean deviation about the median for the following data:

x_i	15	21	27	30	35
f_i	3	5	6	7	8

OR

(b) Find the standard deviation for the following data:

x_i	6	10	14	18	24	28	30
f_i	2	4	7	12	8	4	3

31. If the intercept of a line between the coordinate axes is divided by the point $(-5,4)$ in the ratio 1:2, then find the equation of the line.

SECTION - D

Questions Number 32 to 35 are Long Answer (LA) type questions of 5 marks each.

32. (a) The ratio of the AM and GM of two positive numbers a and b is $m:n$. Show that

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

OR

(b) The sum of three numbers in a G.P. is 56. If we subtract 1,7,21 from the numbers in that order, we obtain an arithmetic progression. Find the numbers.

33. (a) Find domain and range of the function $f(x) = \frac{1}{\sqrt{25-x^2}}$

OR

(b) If the function $f(x)$ given by $f(x) = \begin{cases} 3ax + b, & x > 1 \\ 11, & x = 1 \\ 5ax - 2b, & x < 1 \end{cases}$ is continuous at $x=1$, find the values of a

and b .

34. The mathematical aptitude score of 10 computer programmers with their job preference is given below:

Person	A	B	C	D	E	F	G	H	I	J
Mathematics score	7	5	1	4	3	0	2	6	8	9
Job preference rating	8	16	8	9	5	4	3	8	17	12

Calculate Spearman's rank correlation.

35. On what dates of April 2015 did Friday fall? Use the concept of odd days to determine the dates.

SECTION – E

Questions Number **36** to **38** are case – study based questions of **4** marks each.

36. **Case Study 1:** A community health worker recorded the daily water usage (in litres) of 20 households in a small village. The grouped data is:

Daily Water Usage (litres)	No. of households
10 – 20	4
20 – 30	6
30 – 40	5
40 – 50	3
50 – 60	2

The worker wants to understand the typical usage and how consumption is spread out.

Based on the above information, answer the following questions:

- a) Find the average daily water usage for the village. 1
- b) Which water-usage class is the most common? 1
- c) (i) For planning purposes, the worker needs to compute the variance of daily water usage. Compute it. 2

OR

- (ii) If the government wants to support households that use within one standard deviation of the average, estimate how many households qualify. 2

37. Case Study 2:

The number of bacteria in a certain culture doubles every hour. Given that the number of bacteria present at the end of 4th hour was 160000.



Based on the above information, answer the following questions:

- a) Find the number of bacteria present originally. 1
- b) Find the number of bacteria present at the end of 7th hour. 1
- c) (i) Find the total number of bacteria present from the starting to the end of 8th hour. 2

OR

- (ii) If the number of bacteria triples every hour, then find the total number of bacteria present from the starting to the end of 8th hour. 2

38. **Case Study 3:** A chemical plant uses a sensor that reports concentration $f(x)$ (in arbitrary units) at time x (seconds). Due to a software update at $x=2$ seconds, the sensor's reading is modeled by the piecewise function

$$f(x) = \begin{cases} \frac{x^2 - 4}{x - 2}, & x < 2 \\ k, & x = 2 \\ x + 1, & x > 2 \end{cases}$$

where k is the recorded instantaneous value at $x=2$.

Based on the above information, answer the following questions:

- a) Find $\lim_{x \rightarrow 2^-} f(x)$. 1
- b) Is there a value of k that makes f continuous at $x=2$? 1
- c) (i) Determine whether the function $f(x)$ is continuous at $x=1$. Justify your answer. 2

OR

(ii) Modify the definition of $f(x)$ at $x=2$ so that the function becomes continuous at $x=2$. Is it possible? If yes, give the new definition. If not, explain the reason.

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