



Delhi Public School, Howrah

Periodic Test - II Examination (2025 - 2026)

Class-XII

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:

1. This question paper contains five sections A, B, C, D and E. Each section is compulsory.
2. Section - A carries 20 marks weightage, Section - B carries 10 marks weightage, Section - C carries 18 marks weightage, Section - D carries 20 marks weightage and Section - E carries 3 case-based with total weightage of 12 marks.

Section – A:

3. It comprises of **18 MCQs and 2 Assertion Reason based questions of 1 mark** each.

Section – B:

4. It comprises of **5 VSA type questions of 2 marks** each.

Section – C:

5. It comprises of **6 SA type of questions of 3 marks** each.

Section – D:

6. It comprises of **4 LA type of questions of 5 marks** each.

Section – E:

7. It has **3 source based/case based/passage based/integrated units of assessment** (04 marks each) with sub parts. Each case study comprises of 3 case-based questions, where **2 VSA type questions are of 1 mark** each and **1 SA type question is of 2 marks**. Internal choice is provided in **2 marks** question in each case-study.
8. Internal choice is provided in **2 questions in Section - B, 2 questions in Section – C, 2 questions in Section - D**. You have to attempt only one of the alternatives in all such questions.

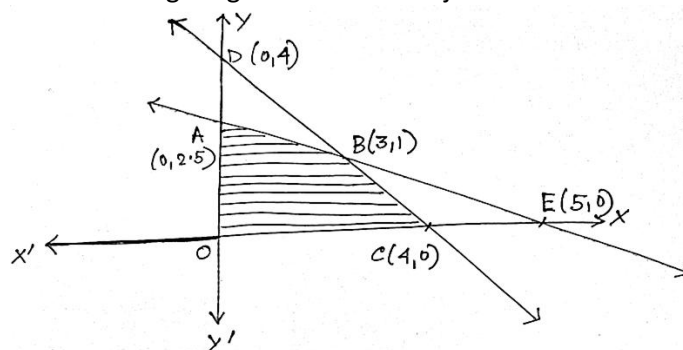
SECTION A

(All Questions are compulsory. No internal choice is provided in this section)

- (1) $\int \frac{(\log x)^5}{x} dx$ is equal to 1
(A) $\frac{\log x^6}{6} + C$ (B) $\frac{(\log x)^6}{6} + C$ (C) $\frac{(\log x)^6}{3x^2} + C$ (D) None of these
- (2) If the total cost function of producing x units of a commodity is given by $360 - 12x + 2x^2$, then the level of output at which the total cost is minimum is 1
(A) 24 (B) 12 (C) 6 (D) 3
- (3) The minimum value of $x^2 + \frac{250}{x}$ is 1
(A) 75 (B) 55 (C) 50 (D) 25
- (4) The matrix $\begin{bmatrix} 2 & -1 & 3 \\ \alpha & 0 & 7 \\ -1 & 1 & 4 \end{bmatrix}$ is not invertible for 1
(A) $\alpha = -1$ (B) $\alpha = 1$ (C) $\alpha = 0$ (D) $\alpha \in R - \{1\}$
- (5) Find the sum of the order and the degree of the following differential equation: 1
$$3 - \left(\frac{dy}{dx}\right)^2 = \left(a \frac{d^2y}{dx^2}\right)^{\frac{2}{3}}$$

(A) 4 (B) 2 (C) 5 (D) 3
- (6) In a 2 km race, P can give Q, a start of 200 m and R, a start of 560 m, then in the same race Q can give R a start of 1
(A) 360 m (B) 380 m (C) 400 m (D) 430 m
- (7) In a Linear Programming Problem, which of the following statement is true? 1
(A) objective function is linear (B) constraints are linear
(C) both objective function and constraints are linear (D) None of the above

- (8) If $\int_{10}^{40} \frac{dx}{2x+1} = \log k$, then the value of k is 1
 (A) 3 (B) $\sqrt{3}$ (C) $\frac{9}{2}$ (D) None of these
- (9) The rise in prices before Durga Puja is an example of 1
 (A) Seasonal Trend (B) Cyclical Trend (C) Long term trend (D) Irregular Trend
- (10) If $y = 5x^3 - 2$, then $\frac{d^2y}{dx^2}$ at $x = 0$ is equal to 1
 (A) 10 (B) 3 (C) 0 (D) 15
- (11) If A and B are symmetric matrices of same order, then $(AB - BA^T)^T$ is a 1
 (A) Symmetric Matrix (B) Skew – symmetric Matrix
 (C) Zero matrix (D) None of these
- (12) If A is a square matrix of order 3×3 such that $|adj A| = 25$, then $|4A|$ is equal to 1
 (A) 27 (B) 81 (C) 108 (D) None of these
- (13) If it is currently 6:00 pm in 12 hours clock then what will be the time after 375 hours? 1
 (A) 6 am (B) 6 pm (C) 9 am (D) 9 pm
- (14) If $y = e^{2x} + e^{-2x}$, then the value of $\frac{d^2y}{dx^2}$ is 1
 (a) e (B) $4y$ (C) $\frac{dy}{dx}$ (D) e^2
- (15) Besides non negativity constraint the figure given below is subject to which of the following constraints: 1



- (A) $x + 2y \leq 5 ; x + y \leq 4$ (B) $x + 2y \geq 5 ; x + y \leq 4$
 (C) $x + 2y \geq 5 ; x + y \geq 4$ (D) $x + 2y \leq 5 ; x + y \geq 4$
- (16) In an L.P.P if the objective function $Z = ax + by$ has same maximum value on two corner points of the feasible region, then the number of points at which maximum value of Z occurs is 1
 (A) 0 (B) 2 (C) finite (D) infinite
- (17) If a random variable X has the Poisson Distribution with mean 2. Then $P(X > 1.5)$ is 1
 (A) $2e^{-2}$ (B) $3e^{-2}$ (C) $1 - 2e^{-2}$ (D) $1 - 3e^{-2}$
- (18) In a 300 m race, A beats B by 22.5 m or 6 seconds. B's time over the race course is 1
 (A) 80 sec (B) 82 sec (C) 76 sec (D) 90 sec

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.

- (i) Both A and R are true and R is the correct explanation of A.
 (ii) Both A and R are true and R is not the correct explanation of A.
 (iii) A is true but R is false.
 (iv) A is false and R is true.

(19) Assertion(A): $A = [a_{ij}] = \begin{cases} m, & i = j \\ 0, & i \neq j \end{cases}$ where m is a scalar, is an identity matrix if $m = 1$.

Reason (R): Every identity matrix is not a scalar matrix.

- (A) (i) (B) (ii) (C) (iii) (D) (iv)

(20) Assertion: If a random variable X follows a binomial distribution with parameters n and p , then the mean of X is always less than its variance. 1

Reason: Probability of an event lies in between 0 and 1 (0 and 1 are included).

- (A) (i) (B) (ii) (C) (iii) (D) (iv)

SECTION B

(All Questions are compulsory. In case of internal Choice, attempt any one question only)

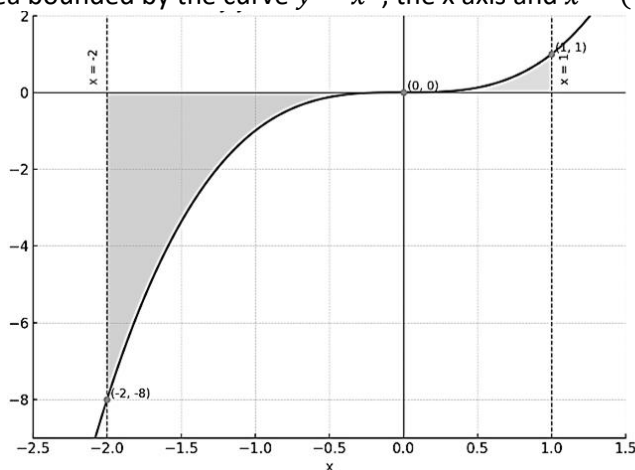
- 21) If A is a square matrix $\begin{bmatrix} 2 & -2 \\ -2 & 2 \end{bmatrix}$ such that $A^2 = pA$, then find the value of p . 2

- 22) (a) In what ratio water must be added in milk costing ₹ 60 per litre, so that the resulting mixture would be of worth ₹ 50 per litre? 2
- OR**
- (b) Find the last digit of 17^{17} . 2
- 23) The supply function for a commodity is $p = 4 + x$. Determine producer's surplus if 12 units of goods are sold. 2
- 24) (a) Find the differential equation of the family of concentric circles with center at (1,2). 2
- OR**
- (b) Solve: $\frac{dy}{dx} = x^2 e^{-3y}$, when $y(0) = 0$. 2
- 25) Evaluate: $\int_2^8 |x - 5| dx$. 2

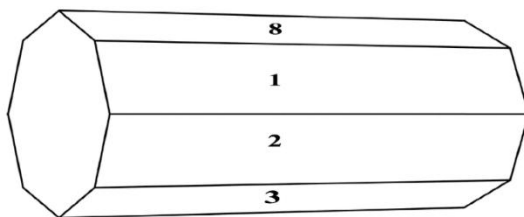
SECTION C

(All Questions are compulsory. In case of internal Choice, attempt any one question only)

- 26) (a) Determine the binomial distribution whose mean is 9 and whose standard deviation is $\frac{3}{2}$. Find the probability of obtaining at most one success. 3
- OR**
- (b) The lifetime of an item produced by a machine has a normal distribution with mean 12 months and standard deviation of 2 months. Find the probability of an item produced by this machine will last
- (i) less than 7 months (ii) between 7 and 14 months. 3
- (Given $P\left(Z < \frac{5}{2}\right) = 0.9938, P(Z < 1) = 0.8413$)
- 27) Find the remainder when 5^{61} is divided by 7. 3
- 28) Solve the following system of linear equations using Cramer's Rule Method: 3
- $$\frac{2}{x} + \frac{3}{y} + \frac{10}{z} = 1, \frac{4}{x} - \frac{6}{y} + \frac{5}{z} = 2, \frac{6}{x} + \frac{9}{y} - \frac{20}{z} = 4$$
- 29) (a) The average cost function associated with producing and marketing x units of an item is given by $AC = 2x - 11 + \frac{50}{x}$. Evaluate the following: 3
- (i) the total cost function and the marginal cost function.
- (ii) the range of values of the output x , for which AC is increasing. 3
- OR**
- (b) Using Integration, find the area bounded by the curve $y = x^3$, the x axis and $x = (-2)$ & $x = 1$. 3



- 30) An octagonal prism is a three-dimensional polyhedron bounded by two octagonal bases and eight rectangular side faces. It has 24 edges and 16 vertices.



The prism is rolled along the rectangular faces and number on the bottom face (touching the ground) is noted. Let X denotes the number obtained on the bottom face and the following table gives the probability distribution of X .

$X:$	1	2	3	4	5	6	7	8
$P(X):$	p	$2p$	$2p$	p	$2p$	p^2	$2p^2$	$7p^2 + p$

- On the above context, answer the following questions. (i) Find the value of p . (ii) Find the mean, $E(X)$. 3
 31) If the sum and the product of the mean and variance of Binomial Distribution are 1.8 and 0.8 respectively, find the probability distribution and the probability of at least one success. 3

SECTION D

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

- 32) (a) Evaluate: $\int \frac{2x-3}{(x^2-1)(2x+3)} dx$ 5

OR

- (b) Evaluate: $\int_{-1}^1 \frac{x^3 + |x| + 1}{x^2 + 2|x| + 1} dx$ 5

- 33) A manufacturer has employed 5 skilled men and 10 semi-skilled men and makes two models A and B of an article. The making of one item of model A requires two hours work by a skilled men and 2 hours work by a semi-skilled man. One item of model B requires 1 hour by a skilled men and 3 hours by a semi-skilled man. No man is accepted to work more than 8 hours per day. The manufacturer's profit on item of model A is ₹ 15 and on an item of model B is ₹ 10. How many items of each model should be made per day in order to maximize daily profit? Formulate the above L.P.P and solve it graphically to find the maximum profit. 5

- 34) (a) The following table shows the annual rainfall (in mm) recorded for Cherrapunji, Meghalaya:

Year	Amount of Rainfall
2001	1.2
2002	1.9
2003	2
2004	1.4
2005	2.1
2006	1.3
2007	1.8
2008	1.1
2009	1.3

- Determine the trend of rainfall by 3 – year moving average using a graph. 5

OR

- (b) Below are given the figures of production (in m. tones) of a rice factory: 5

Year	Production (In m. tones)
2004	26
2005	26
2006	44
2007	42
2008	108
2009	120
2010	166

- Fit a straight line trend by the method of least squares and calculate trend values from the above data. 5
 35) Find the shortest distance of the point $C(0,c)$ from the parabola $y = cx^2$. 5

SECTION E

(This section comprises of 3 source based questions (Case Studies) of 4 marks each)

36) Case Study – 1 :

Rohit is passionate about cars. He visits a car showroom where 70% of the customers usually prefer SUVs, while 30% prefer sedans. To check this trend, he observes the choices of 5 randomly selected customers on a weekend. Let X denote the number of customers who choose SUVs. Based on the above information, answer the following questions.

- (A) Write the distribution of X with parameters n and p . 1
 (B) Find the probability that exactly 3 customers choose SUVs. 1



(C) Find the probability that at least 4 customers choose SUVs. 2

OR

(D) Find the expected number of customers (out of 5) who will prefer SUVs. 2

37) Case Study – 2:

A dog shelter houses three different breeds of dogs: Labradors, Beagles, and German Shepherds.



They are divided into two age groups: Puppies and Adults. Among the Puppies, there are 12 Labradors, 8 Beagles, and 10 German Shepherds. Among the Adults, there are 18 Labradors, 12 Beagles, and 20 German Shepherds. The shelter manager wants to analyse this data using mathematics. Based on the above information, answer the following questions:

(A) Represent the above data in the form of a (2×3) matrix A, where rows represent age groups and columns represent breeds. 1

(B) If the monthly cost of food per dog for Labradors, Beagles, and German Shepherds is ₹ 3000, ₹ 2500, and ₹ 3500 respectively, represent this information in a (3×1) matrix B. 1

(C) Find the product AB and interpret the result in the context of total monthly food cost for each age group. 2

OR

(D) Find the overall monthly food cost for all the dogs in the shelter. 2

38) Case Study – 3:

Rohit owns a small toy manufacturing unit where he makes two popular toys:

- ❖ Toy A (Robots) – Kids love them for their flashing lights.
- ❖ Toy B (Cars) – Known for their speed and durability.

To make these toys, two types of work are needed: cutting work (shaping and parts preparation) and assembling work (fitting, wiring, and finishing)

- Resources available weekly: Cutting section: 100 hours and Assembling section: 120 hours
- Time required per toy:

Toy Type	Cutting (in hrs)	Assembling (in hrs)
Toy A (Robot)	1	3
Toy B (Car)	2	2

- Profit earned: Toy A = ₹ 60 and Toy B = ₹ 80

Rohit's Challenge: Rohit wants to decide how many Robots (A) and how many Cars (B) he should manufacture each week so that his profit is maximized, without exceeding the available hours. Based on the above information, answer the following question.

(A) Formulate Rohit's business problem as a Linear Programming Problem. 2

(B) Find the optimal solution and maximum profit. 2