Delhi Public School, Howrah

Periodic Test – III Examination

Session: 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 **20 MCQs 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 case studies**. 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

1) If the present time is 8:40 PM, then the time after $876\frac{1}{2}$ hours will be 1

(A) 8:40 A.M. (B) 9:10 A.M. (C) 6:10 P.M. (D) 10:40 P.M.

2) A and B can cover a 200 m race in 22 seconds and 25 seconds respectively. When A finished the race, B is at what distance from the finishing line? 1

(A) 24 m (B) 30 m (C) 48 m (D) 54 m

3) The function $y = \frac{1}{x}$ is strictly decreasing in the interval(s): 1

(A) $(0, \infty)$ (B) $(-\infty, 0)$ (C) $(-\infty, 0) \cup (0, \infty)$ (D) R

4) Increase in the number of patients in the hospital due to heat stroke is: 1

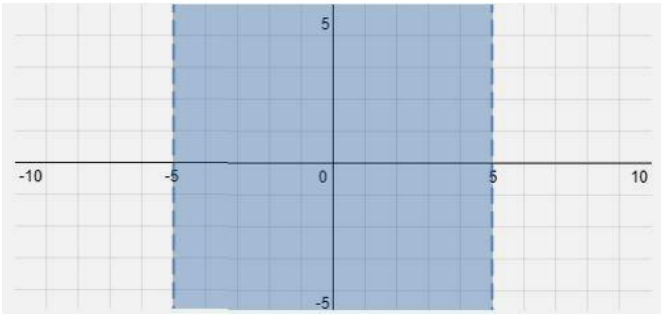
(A) Secular Trend (B) Irregular variation

(C) Seasonal Variation (D) Cyclical variations

5) A machine costing ₹ 50,000 has a useful life of 4 years. If the estimated scrap value is ₹ 10,000, then the annual depreciation is 1

(A) ₹ 20,000 (B) ₹ 10,000 (C) ₹ 5,000 (D) ₹ 2,500

6) The inequality representing the following graph is 1

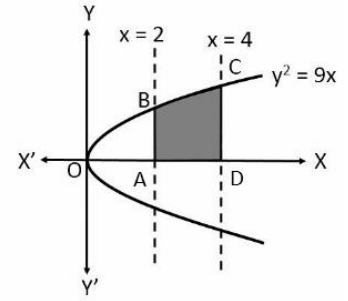


(A) | x | < 5 (B) | x | ≤ 5 (C) | x | > 5 (D) | x | ≥ 5

7) Total number of possible matrices of order 3×3 with each entry 2 or 0 is: 1

(A) 9 (B) 27 (C) 81 (D) 512

8) Find the area of the shaded region from the following figure. 1



A) $15 - 4\sqrt{2}$ B) $16 - 4\sqrt{3}$ C) $16 - 4\sqrt{2}$ D) None of these

9) The shape of the normal curve depends on its _____. 1

(A) Mean Deviation (B) Standard Deviation

(C) Quartile deviation (D) Correlation

10) A statement made about a population parameter for testing purpose is called 1

(A) Parameter (B) Hypothesis (C) Statistic (D) Level of Significance

11) If A is a square matrix of order 3 and $|A| = (-2)$, then $|adj\ A|$ is equal to 1

(A)(-8) (B) (-2) (C) 0 (D) 4

12) The order and degree of the differential equation: $\frac{d^3y}{dx^3} + x(\frac{dy}{dx})^2 = 2x^2 \log(\frac{d^2y}{dx^2})$, respectively are 1

(A) Order = 2, Degree = Undefined (B) Order = 2, Degree = 3

(C) Order = 3, Degree = 5 (D) Order = 3, Degree = Undefined

13) EMI depends on the following factor(s): 1

(A) The amount of loan (B) The loan Tenure

(C) The rate of interest (D) All of these

(14) $\int x^2 e^{x^3} dx$ is equal to 1

(A) $\frac{1}{3}e^{x^3} + C$ (B) $\frac{1}{3}e^{x^2} + C$ (C) $\frac{1}{2}e^{x^3} + C$ (D) $\frac{1}{2}e^{x^2} + C$

(15) In which quadrant(s), the bounded region for inequalities $x + y \leq 1, x - y \leq 1, x \geq 0, y \geq 0$ is situated? 1

(A) I, II (B) I, III (C) II, III (D) All the four quadrants

(16) A candidate claims 70 % of the people in her constituency would vote for her. If 1,20,000 valid votes are polled, then the number of votes she expects from her constituency is: 1

(A) 1,00,000 (B) 84,000 (C) 56,000 (D) 36,000

(17) If A is a skew – symmetric matrix of order 3, then the value of $|A|$ is 1

(A) 2 (B) (-1) (C) 1 (D) 0

(18) Reema has an initial investment of ₹ 1,00,000 in an investment plan. After 5 years, if it has grown to ₹ 2,00,000, then the rate of return is: 1

(A) 50 % (B) 100 % (C) 75 % (D) 200 %

For questions 19 and 20, two statements are given – one labelled Assertion (A) and the other labelled Reason (R). Select the correct answer to these questions from the codes (i), (ii), (iii) and (iv) as given below:

(A) Both A and R are true and R is the correct explanation of the assertion.

(B) Both A and R are true but R is not the correct explanation of the assertion.

(C) A is true, but R is false.

(D) A is false, but R is true.

(19) Assertion (A) :- If A is an invertible square matrix, then A^T is invertible. 1

Reason(R): Inverse of invertible symmetric matrix is a symmetric matrix.

(20) Assertion (A) :- For a Poisson distribution, $3P(X = 2) = P(X = 4), then\ P(X = 3) = 36e^{(-6)}$ 1

Reason (R): - In Poisson distribution, $P(X = r) = \frac{\lambda^r e^{-\lambda}}{r!}$

SECTION B

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

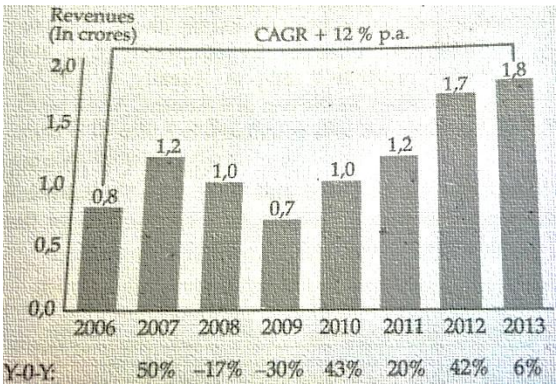
(21) (A) Mayank has 44 boxes of soda in his truck. The cans of soda in each box are packed oddly so that there are 113 cans of soda in each box. Mayank plans to pack the sodas into cases of 12 cans to sell. After making as many complete cases as possible, how many sodas will Mayank have leftover? 2

OR

(21)(B) If the boat takes 12 hours to row 48 km upstream and 8 hours to row the same distance downstream, then find the boat's speed in still water and speed of stream. 2

(22) If $P(X = 0) = P(X = 1) = a$ in a Poisson Distribution, then show that $a = \frac{1}{e}$. 2

(23) An interviewer gives the following graph on a client's sales in the last 7 years to candidate and said to find the CAGR.



Calculate the CAGR for the candidate. Given that $(\frac{9}{4})^{\frac{1}{7}} = 1.1228$. 2

(24) (A) A continuous random variable X has probability density function $f(x) = 5x^4, 0 \leq x \leq 1$.Find a_1 and a_2 such that (I) $P(X \leq a_1) = P(X > a_1)$ (II) $P(X > a_2) = 0.05$ 2

OR

(B) It is known from the past experience that the number of telephone calls made daily in a certain community between 3 p.m. and 4 p.m. has a mean of 352 and a standard deviation of 31. What percentage of time will the community receive more than 400 telephone calls between 3 pm and 4 pm? [Use: $P(0 \leq Z \leq 1.5) = 0.4394$] 2

(25) A mainframe computer whose cost is ₹ 5,00,000 will depreciate to a scrap value of ₹ 50,000 in 5 years. Using linear method of depreciation, find the book value of computer at the end of third year. 2

SECTION C

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

(26) Two pipes can fill a cistern in 14 hours and 16 hours respectively. The pipes are opened simultaneously and it is found that due to leakage in the bottom it took 32 minutes more to fill the cistern. When the cistern is full, in what time will the leak empty it? 3

(27) (A) Show that the function $f(x) = 4x^3 - 18x^2 + 27x - 7$ is always increasing on R. 3

OR

(27)(B) The total cost function (in thousands) for manufacturing x manipulators per year is given by $C(x) = 375 + 25x - 0.25x^2, 0 \leq x \leq 50$.

Answer the following questions:

(I) Use the marginal cost function to approximate the cost of producing the 31st manipulator. 1.5

(II) Use the total cost function to find the exact cost of producing the 31st manipulator. 1.5

(28) (A) A firm anticipates an expenditure of ₹ 5,00,000 for plant modernization at the end of 10 years from now. How much should the company deposit at the end of each year into a sinking fund earning interest 5 % per annum. [Given: $\log 1.05 = 0.0212,\ antilog\ (0.2120) = 1.629$] 3

OR

(28)(B) Rohan purchased a laptop worth ₹ 80000. He paid ₹ 20,000 as cash down and balance in equal monthly installments in 2 years. If bank charges 9 % p.a. compounded monthly, calculate the EMI.
[Given $(1.0075)^{24} = 1.1964$] 3

(29) In what ratio must a person mix two sugar solutions of 30% and 50% concentration respectively so as to get a 45 % solution? 3

(30) Find the student's – t statistic for the following variable values in a sample of eight: $(-4), (-2), (-2), 0, 2, 2, 3, 3$ taking the mean of the universe to be zero. 3

(31) A farmer has a supply of chemical fertilizer of type A which contains 10 % nitrogen and 6 % phosphoric acid and of type B which contains 5 % nitrogen and 10 % phosphoric acid. After soil test, it is found that at least 7 kg of nitrogen and same quantity of phosphoric acid is required for a good crop. The fertilizer of type A costs for ₹ 5.00 per kg and the type B costs ₹ 8.00 per kg. Formulate the above situation as a linear programming problem which will minimize the cost. 3

SECTION D

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

(32) (A) A total of ₹ 8,500 was invested in three interest earning accounts. The interest rates were 2%, 3% and 6% respectively. If the total simple interest for one year was ₹ 380 and the amount invested at 6% was equal to the sum of the amounts in the other two accounts, then how much was invested in each account? (Use Cramer's rule to solve the problem) 5

OR

(B) At marina, two types of games viz., Horse riding and Quad Bikes riding are available on hourly rent. Keren and Benita spent ₹ 780 and ₹ 560 during the month of May.

Name	Number of hours		Total amount spent (in ₹)
	Horse Riding	Quad Bike Riding	
Keren	3	4	780
Benita	2	3	560

By using matrix method, find the hourly charges for the two games (rides). 5

(33) Suppose the demand for a certain product is given by $p = -0.01x^2 - 0.1x + 6$, where p is the unit price given in ₹ and x is the quantity demanded per month given in the units of 1000. The market price for the product is ₹ 4 per unit. Answer the following questions:

(I) Find the quantity demanded at the given price. 2

(II) Find the consumer's surplus if the market price for the product is ₹ 4 per unit. 3

(34) (A) The table given below shows that the average number in lakhs, of working days lost in strikes during each year of period 2009 – 2018 was

Year	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Working days lost in strikes (in lakhs)	1.5	1.8	1.9	2.2	2.6	3.7	6.2	6.4	3.6	5.4

Calculate the three yearly moving averages and show these moving averages on a graph paper. 5

OR

(34)(B) Fit a straight - line trend by the method of least square to the following data on sales (₹ in lakhs) for the period 2011 – 2018. 5

Year	2011	2012	2013	2014	2015	2016	2017	2018
Sales (₹ lakhs)	76	80	130	144	138	120	174	190

(35) The cost of a TV depreciated by ₹ 800 during the second year and by ₹ 700 during the third year. Calculate:

(I) the rate of depreciation per annum. 1

(II) the original cost of the TV. 2

(III) the value of the TV at the end of third year. 2

SECTION E

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

(36) **CASE STUDY – I**

In a game, a man wins ₹ 8 for getting a number greater than 3 and loses ₹ 3 otherwise, when a fair die is thrown. The man decided to throw a die 4 times but to quit as and when he gets a number greater than 3.



Based on the given information, answer the following questions. Show steps to support your answer:

(A) If X denotes the amount which the man wins or loses, then find the possible values of X. 1

(B) Find the expected value of X. 1

(C)(I) Calculate the standard deviation of X. 2

OR

(C)(II) Calculate the variance of X. 2

(37) **CASE STUDY – II**

A company is selling a certain product. The demand function for the product is linear. The company can sell 2000 units when the price is ₹ 8 per unit and it can sell 3000 units when the price is ₹ 4 per unit. Let x be the units in demand.



Based on the above information, answer the following questions. Show steps to support your answer.

(A) Derive the demand function. 1

(B) Find the total revenue function. 1

(C)(I) Find the range of values of x for which the revenue is increasing. 2

OR

(C) (II) Find the value of x for which the total revenue will be maximum. 2

(38) **CASE STUDY – III**

A company manufactures two types of cardigans: type A and type B. It costs ₹ 360 to make a type A cardigan and ₹ 120 to make a cardigan of type B. The company can make at most 300 cardigans and spend at most ₹ 72000 a day. The number of cardigans of type B cannot exceed the number of cardigans of type A by more than 200. The company makes a profit of ₹ 100 for each cardigan of type A and ₹ 50 for each cardigan of type B.



Based on the above information, answer the following questions:

(A) Construct the Linear Programming Problem and draw the graph for feasible region. 2

(B) Write the corner points of feasible region and find the maximum profit. 2

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