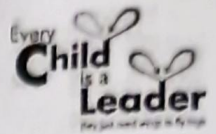




**ASPIRE INTERNATIONAL SCHOOL, NOIDA**  
**MID TERM EXAMINATION (2025-2026)**  
**SUBJECT- APPLIED MATHEMATICS (Code:241)**  
**SET- A**



Affiliated to C.B.S.E.

Roll No.: \_\_\_\_\_  
 Duration: 3 Hrs.

Grade: XII  
 Max. Marks: 80

**General Instructions:**

Read the following instructions carefully and follow them:

- (i) This question paper contains 38 questions. All questions are compulsory.
- (ii) **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.
- (iii) **Section B:** Questions no. 21 to 25 are Very Short Answer (VSA) type questions, carrying 2 marks each.
- (iv) **Section C:** Questions no. 26 to 31 are Short Answer (SA) type questions, carrying 3 marks each.
- (v) **Section D:** Questions no. 32 to 35 are Long Answer (LA) type questions, carrying 5 marks each.
- (vi) **Section E:** Questions no. 36 to 38 are case study based questions, carrying 4 marks each.

Q. NO.	SECTION-A [20 marks]	MARKS
1.	In what ratio must a grocer mix two varieties of pulses costing Rs 85 per kg and Rs 100 per kg respectively so as to get a mixture worth Rs 92 per kg? (a) 7:8 (b) 8:7 (c) 5:7 (d) 7:5	1
2.	The value of $-70 \pmod{13}$ is: (a) 5 (b) -5 (c) 8 (d) -8	1
3.	Two pipes A and B together can fill a tank in 4 hours. Pipe B takes 6 hours more than A to fill the tank, if they opened separately. The time taken by A to fill the tank alone is: (a) 4 hours 12 minutes (b) 4 hours 15 minutes (c) 5 hours (d) 5 hours 15 minutes	1
4.	The system of linear inequalities $2x-1 \geq 3$ and $x-3 > 5$ has solution: (a) $(2, \infty)$ (b) $(2, 8)$ (c) $(8, \infty)$ (d) $(-\infty, 8)$	1
5.	If $ 2x + 3  < 7, x \in \mathbb{R}$ , then, (a) $x \in (-5, 2]$ (b) $x \in (-5, 2)$ (c) $x \in (-\infty, -5) \cup (2, \infty)$ (d) $x \in (-\infty, -5] \cup [2, \infty)$	1
6.	If A and B are square matrices of same order, then $AB' - BA'$ is a : (a) skew symmetric matrix (b) symmetric matrix (c) null matrix (d) unit matrix	1
7.	If $[A]_{3 \times 2}, [B]_{x \times y} = [c]_{3 \times 1}$ , then, (a) $x = 1, y = 3$ (b) $x = 2, y = 1$ (c) $x = 3, y = 3$ (d) $x = 3, y = 1$	1
8.	If A is a square matrix of order 3, $B = kA$ and $ B  = x  A $ , then: (a) $x = 2k$ (b) $x = k^2$ (c) $x = k^3$ (d) $x = 3k$	1

9. If the points (1,3), (x,5) and (2,7) are collinear, then the value of x is: 1
- (a) 2 (b)  $\frac{3}{2}$   
(c) 1 (d)  $\frac{3}{4}$
10. If  $x = at^2$ ,  $y = 2at$ , then  $\frac{d^2y}{dx^2} =$  1
- (a)  $-\frac{1}{2at^3}$  (b)  $-\frac{1}{2at^2}$   
(c)  $\frac{1}{t^2}$  (d)  $-\frac{2a}{t}$
11. The function  $f(x) = x^4 - 4x$  is strictly: 1
- (a) decreasing in  $[1, \infty)$  (b) increasing in  $[1, \infty)$   
(c) increasing in  $(-\infty, 1]$  (d) increasing in  $[-1, 1]$
12. If the selling price of a commodity is fixed at Rs 45 and the cost function is  $C(x) = 30x + 240$  then the breakeven point is: 1
- (a)  $x = 10$  (b)  $x = 12$   
(c)  $x = 13$  (d)  $x = 16$
13. 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
14.  $\int (x-1)e^{-x} dx$  is equal to: 1
- (a)  $(x-2)e^{-x} + C$  (b)  $xe^{-x} + C$   
(c)  $-xe^{-x} + C$  (d)  $(x+1)e^{-x} + C$
15. If the demand function for a commodity is  $p = 20 - 2x - x^2$  and the market demand is 3 units, then the consumer's surplus is: 1
- (a) 27 (b) 38  
(c) 42 (d) 47
16.  $\int \frac{\log x}{x} dx$  is equal to: 1
- (a)  $\frac{\log x}{2} + C$  (b)  $\frac{\log x^2}{2} + C$   
(c)  $\log x + C$  (d)  $\log(\log x) + C$
17. If the objective function for a LPP is  $Z = 3x + 4y$  and the correct points of the unbounded feasible region are (9,0), (4, 3), (2,5) and (0,8), then the minimum value of Z occur at 1
- (a) (0,8) (b) (2,5)  
(c) (4,3) (d) (9,0)
18. If the corner points of the feasible region for an LPP are (0,2), (3, 0), (6, 0), (6,8). If  $z = 4x + 6y$  is the objective function of LPP then  $\max(z) - \min(z)$  is equal to: 1
- (a) 30 (b) 24  
(c) 21 (d) 9

**ASSERTION-REASON BASED QUESTIONS** (Questions number 19 and 20 are Assertion and Reason based questions carrying 1 mark each. Two statements are given, one labelled Assertion (A) and the other labelled Reason (R). Select the correct answer 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)** : If  $y = f(\log_e x)$  and  $f'(x) = e^x$ , then  $\frac{dy}{dx} = 1$

**Reason(R)**:  $\frac{du}{dx} = \frac{du}{dt} \cdot \frac{dt}{dx}$

1

20. **Assertion (A)**: If a,b,c are in AP, then the system of equations  $x + 2y + 3z = a$ ,  $2x + 3y + 4z = b$ ,  $3x + 4y + 5z = c$  are consistent.

1

**Reason(R)** : If  $|A| \neq 0$ , then the system of equations  $AX = B$  is consistent.

**SECTION-B [6 marks]**

21. In a 900 metre race, A gives B a start of 150 meters and defeats him by 50 seconds. If the speed of A is 4.5 m/sec, then find the speed of B.

2

22. Solve system of linear inequalities  $2x + 3y < 12$ ,  $x \geq 2$ ,  $y \geq 1$  graphically.

2

**OR**

Solve the system of inequality:  $-2 - \frac{x}{4} \leq \frac{1+x}{3}$ ,  $3 - x < 4(x-3)$

23. If A and B are symmetric matrices of the same order, prove that  $AB - BA$  is a skew symmetric matrix.

2

24. Evaluate:  $\int (e^{x \log a} + e^{a \log x} - e^{a \log a}) dx$ .

2

25. Evaluate:  $\int \frac{dx}{\sqrt{x+x}}$ .

2

**OR**

Evaluate:  $\int \frac{x^3}{(x^2 + 1)} dx$ .

**SECTION-C [15 marks]**

26(a). Show that the right circular cylinder which is open at the top, and has a given surface area will have the greatest volume if its height is equal to the radius of the base.

3

**OR**

26(b). A tank with rectangular base and rectangular sides, open at the top, is to be constructed so that its depth is 2 m and volume is  $8 \text{ m}^3$ . If the building of the tank costs Rs 70 per square metre for the base and Rs 45 per square metre for the sides, what is the cost of the least expensive tank?

27. If  $y = \log(x + \sqrt{x^2 + 1})$ , prove that  $(x^2 + 1) \frac{d^2y}{dx^2} + x \frac{dy}{dx} = 0$

3

28.(a) Using Cramer's rule, find the quadratic polynomial defined by  $f(x) = ax^2 + bx + c$  if  $f(1) = 0$ ,  $f(2) = -2$  and  $f(3) = -6$

3

**OR**

28. (b) By using determinants, solve the following system of equations:

$$x + y + z = 1, \quad x + 2y + 3z = 4, \quad x + 3y + 5z = 7$$

29. Solve the following inequalities:

(i) Solve the following inequality and represent the solution on the number line: 3

$$-\frac{2}{3} < -\frac{x}{3} + 1 \leq \frac{2}{3}, x \in R$$

(ii) Find all pairs of consecutive even positive integers, both of which are larger than 5, such that their sum is less than 23.

30. Three varieties A, B and C of tea are mixed together in the ratio 1:1:3 respectively. The Price of tea A is ₹ 127 per kg and that of tea B is ₹ 135 per kg. If the price of the mixture is ₹ 152 per kg, then find the price per kg of tea C. 3

31. Find graphically, maximum value of  $Z = 2x + 5y$ , subject to constraints given below: 3  
 $2x + 4y \leq 8, 3x + y \leq 6, x + y \leq 4, x \geq 0, y \geq 0$ **SECTION-D [20 marks]**32. The management committee of a Welfare Club decided to award some of its members (say  $x$ ) for sincerity, some (say  $y$ ) for helping others selflessly and some others (say  $z$ ) for effective management. The sum of all awardees is 12. Three times the sum of all awardees for helping others selflessly and effective management added to two times the number of awardees for sincerity is 33. If the sum of the numbers of the awardees for sincerity and effective management is twice the number of awardees for helping others, use a matrix method to find the number of awardees of each category. 533. (i) If  $x = \frac{2bt}{1+t^2}$  and  $y = \frac{a(1-t^2)}{1+t^2}$ , find  $\frac{dy}{dx}$  at  $t=2$  5(ii) if  $y = 3e^{2x} + 2e^{2x}$ , prove that  $\frac{d^2y}{dx^2} - 5\frac{dy}{dx} + 6y = 0$ 34. A firm has the cost function  $C = \frac{x^3}{3} - 7x^2 + 111x + 50$  and the demand function  $x = 100 - p$  5(i) Write the total revenue function in terms of  $x$ .(ii) Formulate the total profit function  $P$  in terms of  $x$ .(iii) Find the profit maximizing level of output  $x$ .

(iv) What is the maximum profit?

35. Evaluate the following integral:  $\int \frac{x^2}{(x^2 + 3x - 3)} dx$ . 5**CASE STUDY [12 marks]**36. The relation between the height of the plant ( $y$  in cm) with respect to sunlight is governed by the following equation  $y = 4x - \frac{1}{2}x^2$ , where  $x$  is the number of days exposed to sunlight.

Based on the above information, answer the following questions:

(i) Find the rate of growth of the plant with respect to the number of days exposed to sunlight. 1

(ii) What will be the height of the plant after 2 days? 1

(iii) (a) What is the number of days it will take for the plant to grow to the maximum height? What is the maximum height of the plant? 2

**OR**(iii) (b) If the height of the plant is  $\frac{7}{2}$  cm, find the number of days it has been exposed to sunlight.

37.

Three schools decided to organize a fair to collect money for helping the flood victims. They sold hand made fans, mats and plates from recycled material at a cost of ₹ 25, ₹ 100 and ₹ 50 for each respectively. The number of articles sold are given as:

School/Article	School A	School B	School C
Handmade fans	40	25	35
Mats	50	40	50
Plates	20	30	40

Based on the information given above, answer the following questions:

(i) What is the total amount of money (in ₹ ) collected by the school A? 1

(ii) What is the total amount of money (in ₹ ) collected by school B and school C? 1

(iii) (a) What is the total amount of money collected by all three schools? 2

**OR**

(iii) (b) If the number of hand made fans and plates are interchanged for all the schools, then what is the total money collected by all schools?

38.

A furniture trader deals in only two items - chairs and tables. He has ₹ 50000 to invest and a space to store utmost 35 items. A chair costs him ₹ 1000 and a table costs him ₹ 2000. The trader earns a profit of ₹ 150 and ₹ 250 on a chair and a table, respectively.

Based on the above information answer the following questions:

(i) If  $x$  and  $y$  are the number of chairs and tables, then write the expression of total profit. 1

(ii) Write the constraint that relates the investment. 1

(iii) (a) Determine the maximum profit earned by the trader(₹ ). 2

**OR**

(iii) (b) How many chairs and tables are to be purchased to earn maximum profit?.