CLASS XII
PRE MID TERM EXAMINATION (2025 – 26)
APPLIED MATHEMATICS (241)
SET A

Time Allowed:2 hrs.   **Max Marks:50**

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 9 **MCQ's and 01 Assertion-Reason** based questions of 1 mark each.
3. **Section B** has 3 **Very Short Answer (VSA)**-type questions of 2 marks each.
4. **Section C** has 5 **Short Answer (SA)**-type questions of 3 marks each.
5. **Section D** has 3 **Long Answer (LA)**-type questions of 5 marks each.
6. **Section E** has 1 **source based/case based/passage based/integrated units of assessment**
(4 marks) with sub parts.

SECTION A

Q1. Let A be a non-singular square matrix of order 3×3 such that $|A| = -2$.
Then, $|adjA| + |A(adjA)|$ is equal to
   (a) 12   (b) 4   (c) – 12   (d) – 4

Q2. If the sum of all the elements of a 3×3 scalar matrix is 12, then the product of all its
elements is
   (a) 64   (b) 12   (c) 0   (d) 36

Q3. If $A = \begin{bmatrix} 2 & -1 \\ 0 & 3 \end{bmatrix}$ and $kA = \begin{bmatrix} 6 & 3a \\ 0 & 9 \end{bmatrix}$, then the value of k^a is
   (a) 3   (b) $\frac{1}{3}$ (c) 2   (d) 0

Q4. The function x^2 – 6x, x $\in$ [0, 5] attains minimum value at

   (a) x = 0   (b) x = 5   (c) x = 3   (d) can't be determined

Q5. $\int \frac{(\log x)^5}{x} dx$ is equal to
   (a) $\frac{\log x^6}{6} + k$ (b) $\frac{(\log x)^6}{3x^2} + k$ (c) $\frac{\log x^6}{3x^2} + k$ (d) $\frac{(\log x)^6}{6} + k$

Q6. If the radius of a circle is increasing at the rate of 2 cm/sec, then the rate at which the area
of the circle is increasing when its radius is 20 cm is
   (a) $80\pi\ m^2/sec$ (b) $80\ m^2/sec$ (c) $80\pi\ cm^2/sec$ (d) $80\ cm^2/sec$

Q7. If the S.P. of a commodity is fixed at Rs. 45 and the cost function is C(x) = $30x + 240$,
        then the breakeven point is

   (a) 12   (b) 15   (c) 10   (d) 16

Q8. If $\int_0^{40} \frac{dx}{2x+1} = \log k$, then the value of k is

(a) 4   (b) 9   (c) 3   (d) 1

Q9. If the demand function for a commodity is $p = 20 - 2x - x^2$ and the market demand is $3\ units$, then consumer's surplus is:

(a) 27   (b) 38   (c) 42   (d) 47

Q10. **ASSERTION-REASON BASED QUESTION:**

In the following question, 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.

Assertion (A): If $f'(x) = 10\ x + 7\ and\ f(1) = 20, then\ f(x) = 5x^2 + 7x + 8$.
Reason(R): $\int f'(x)dx = f(x) + c$

SECTION B
(This section comprises of very short answer type-questions (VSA) of 2 marks each.)

Q11. Find the matrices X and Y, if $2X + 3Y = \begin{bmatrix} 2 & 3 \\ 4 & 0 \end{bmatrix}$ and $3X + 2Y = \begin{bmatrix} 2 & -2 \\ -1 & 5 \end{bmatrix}$.

Q12. It is given that at $x = 1, the\ function\ x^4 - 62x^2 + ax + 9$ attains it maximum value in the interval [0, 2]. Find the value of a.

Q13. Evaluate: $\int \frac{1}{(1+e^x)(1+e^{-x})} dx$

OR

Evaluate: $\int \frac{1}{\sqrt{x+a}+\sqrt{x+b}} dx$

SECTION C
(This section comprises of short answer type questions (SA) of 3 marks each.)

Q14. Find the values of x and y, if $A = \begin{bmatrix} 3 & 1 \\ 7 & 5 \end{bmatrix}$ $satisfies\ the\ equation\ A^2 + xI - yA = 0$. Hence, find A^3.

OR

Verify the result $(AB)' = B'A'$ for the matrices $A = \begin{bmatrix} 1 & -2 \\ 3 & 0 \\ 5 & 6 \end{bmatrix}$ and $B = \begin{bmatrix} 0 & -3 & 4 \\ 1 & 2 & 0 \end{bmatrix}$.

Q15. Differentiate $\frac{x^2}{1-x^2}\ w.r.t.x^2\ at\ x = 2$.

OR

The cost function C(x) of a commodity is given as $C(x) = 2x\left(\frac{x+3}{x+2}\right) + 2$. Prove that the marginal cost falls as the output 'x' increases.

Q16 If $x^m \cdot y^n = (x+y)^{m+n}$, then show that $\frac{dy}{dx} = \frac{y}{x}$.

Q17. Using properties of definite integral, evaluate: $\int_0^1 \frac{\log x}{\log x + \log (1-x)} dx$.

Q18. The supply function for a commodity is $p = 4 + x$. Using integration, determine producer's surplus if 12 units of goods are sold.

SECTION D

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

Q19. If $x = \frac{t^2}{1+t}$ and $y = \frac{t}{1+t}$, find $y_1 \ and \ y_2$.

OR

Find the intervals in which the function $f(x) = 3x^4 - 4x^3 - 12x^2 + 5$ is (i) Increasing

and (ii) Decreasing.

Q20. $Evaluate: \int_3^5 \frac{x^2}{(x-1)(x-2)} dx$

Q21. $If \ A = \begin{bmatrix} 1 & -1 & 1 \\ 2 & 1 & -3 \\ 1 & 1 & 1 \end{bmatrix}, find \ A^{-1}$. Hence, solve the system of equations:

$x + 2y + z = 4, \qquad -x + y + z = 0, \qquad x - 3y + z = 2$

SECTION E

(This section comprises of one case-based question of 4 marks with three sub-parts (i), (ii) and (iii) of 1, 1 and 2 marks each.)

Q22. A student Shivam is running on a playground along the curve given by

$y = x^2 + 7$. Another student Manita is standing at the point (3, 7) on playground wants to hit Shivam with a paper ball when Shivam is nearest to Manita.

Based on the above information, answer the following questions:

(i)   Let (x, y) be the position of Shivam at any instant while running along the given curve. Find the expression for the distance (D) between Shivam and Manita in terms of 'x'.

(ii)   Find the critical point(s) of the distance function

(iii) (a) What is the distance between Shivam and Manita when they are at least distance from each other.

OR

(b)Find the position of Shivam when he is closest to Manita.