B.K. BIRLA CENTRE FOR EDUCATION
SARALA BIRLA GROUP OF SCHOOLS
A CBSE DAY–CUM–BOYS' RESIDENTIAL SCHOOL

POST MID TERM (2025-26)
MATHEMATICS

Class: XI	**Time: 1hrs**
Date: 07-01-26	**Max Marks: 25**
Admission no:	**Roll no:**

General Instructions:
1. This Question Paper has 5 Sections A, B, C, D and E.
2. Section A has 6 MCQs carrying 1 mark each
3. Section B has 2 questions carrying 02 marks each.
4. Section C has 2 questions carrying 03 marks each.
5. Section D has 1 question carrying 05 marks each.
6. Section E has 1 case-based integrated units of assessment (04 marks each) with sub-parts.
7. All Questions are compulsory.
8. Draw neat figures wherever required. Take π =22/7 wherever required if not stated.

SECTION A

1. **Q1. Find the value of:**   1M
$$\lim_{y \to 2} \frac{y^2 - 4}{y - 2}$$

a) 2
b) 4
c) 1
d) 0

2. **Q2. Find the value of:**   1M
$$\lim_{y \to \infty} \frac{2}{y}$$

a) 0
b) 1
c) 2
d) Infinity

3. **Find the value of:**   1M
$$\lim_{x \to 4} \frac{x^2 - 2x - 8}{x - 4}$$

a) 0
b) 2
c) 8
d) 6

4. **Find the value of:** 1M
$$\lim_{x \to 3} \frac{x^2 - 9}{x - 3}$$

a) 0
b) 3
c) Infinity
d) 6

5. **Find the value of:** 1M
$$\lim_{x \to \infty} \frac{x^2 - 9}{x^2 - 3x + 2}$$

a) 1
b) 2
c) 0
d) Limit does not exist

6. **Which of the following limits does NOT yield 1?** 1M
a) $\lim_{x \to 0} 1$
b) $\lim_{x \to \infty} (x^{-2} + x^{-1} + 1)$
c) $\lim_{x \to \infty} \frac{1}{e^x} + 1$
d) $\lim_{x \to \infty} \frac{x^3 + x^2 + 32x + 1}{x^2 - 3x + 2}$

SECTION B

7. **Find the limits:** 2M
(i) $\lim_{x \to 1} (x^3 - x^2 + 1)$
(ii) $\lim_{x \to 3} [x(x + 1)]$

8. **Find the derivative of the function** $f(x) = 2x^2 + 3x - 5$ **at** $x = -1$. **Also prove that** 2M
$$f'(0) + 3f'(-1) = 0.$$

SECTION C

9. **Find the derivative of** $\cos x$ **from first principle.** 3M

10. **If the function** $f(x)$ **satisfies** $\lim_{x \to 1} \frac{f(x) - 2}{x^2 - 1} = \pi$, **evaluate** $\lim_{x \to 1} f(x)$. 3M

SECTION D

11. **Evaluate** 5M
(a) Let $a_1, a_2, \ldots, a_n$ be real numbers and define
$$f(x) = (x - a_1)(x - a_2) \cdots (x - a_n).$$

Evaluate
$$\lim_{x \to a_k} f(x) \text{ for some } a_k \in \{a_1, a_2, \ldots, a_n\}.$$

(b) The function $f(x)$ is defined as
$$f(x) = \begin{cases} mx + n, & 0 \le x \le 1 \\ nx^3 + m, & x > 1 \end{cases}$$

For what integer values of m and n does the limit $\lim_{x \to 1} f(x)$ exist?

SECTION E

12. A toy manufacturing company programs a cutting machine that works using mathematical functions. The first cutting program uses the function: **4M**

$$P(x) = \frac{x^{15} - 1}{x^{10} - 1}$$

To calibrate the machine, the output must be known as x approaches 1.
Answer the following:
(a) State the algebraic identity used to factor the expressions $x^{15} - 1$ and $x^{10} - 1$.
(b) Evaluate: $\lim_{x \to 1} P(x)$.
(c) Later, the company updates the program to use another expression:

$$Q(x) = 1 + x + x^2 + \cdots + x^{10}$$

Find: $\lim_{x \to 1} Q(x)$.

*****************BEST OF LUCK****************