

Sr. No. 323106

December 2023

B.Sc. (H) Mathematics/B.Sc. Mathematics and Computing Re-Appear 1<sup>st</sup> SEMESTER  
Calculus (BMH-101A)

Time: 3 Hours

Max. Marks:75

- Instructions:
1. It is compulsory to answer all the questions (1.5 marks each) of Part -A in short.
  2. Answer any four questions from Part -B in detail.
  3. Different sub-parts of a question are to be attempted adjacent to each other.

PART -A

Q1 (a) Find

$$\lim_{x \rightarrow 1} (x^7 - 2x^5 + 1)^{35} \quad (1.5)$$

(b) Find

$$\lim_{x \rightarrow -\infty} 2x^5 \quad (1.5)$$

(c) Find the values of  $x$ , if any, at which the given function is not continuous (1.5)

$$f(x) = \frac{x}{x^2 - 1}$$

(d) If  $f(x) = 3x^4 - 2x^3 + x^2 - 4x + 2$ , find  $f''(x)$ . (1.5)

(e) State Lagrange's mean value theorem. (1.5)

(f) Find all the critical points of  $f(x) = x^3 - 3x + 1$ . (1.5)

(g) Find the intervals on which the function  $f(x) = x^3$  is increasing and the intervals on which it is decreasing. (1.5)

(h) Sketch the graph of the parametric equations (1.5)

$$x = \cos t, \quad y = \sin t \quad (0 \leq t \leq 2\pi)$$

(i) Find the rectangular coordinates of the point  $P$  whose polar coordinates are (1.5)

$$(r, \theta) = \left(4, \frac{2\pi}{3}\right).$$

(j) Give an example of a function which is continuous but not differentiable. (1.5)

PART -B

Q2 (a) Using  $\epsilon - \delta$  definition, prove that  $\lim_{x \rightarrow 3} x^2 = 9$ . (7)

(b) Find (8)

$$\lim_{x \rightarrow 0} (1 + \sin x)^{\frac{1}{x}}$$

Q3 (a) State and prove Cauchy's Mean Value Theorem. (7)

(b) Find the  $n^{\text{th}}$  derivative of  $y = x \log x$ . (8)

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