PARUL UNIVERSITY
Faculty of Engineering & Technology
Department of Applied Sciences and Humanities
1ST SEMESTER B.Tech PROGRAMME (CSE, IT)
CALCULUS(03019101BS01)
ACADEMIC YEAR – 2025-26

Tutorial 1A: Application of Functions of One Variable

Q. 1 Evaluate:

(a) $\lim_{n \to 2} \frac{x^3 - 8}{x - 2}$ (b) $\lim_{n \to 3} \frac{\sqrt{x+1} - 2}{x - 3}$ (c) $\lim_{n \to 0} \frac{\sin 3x}{2x}$.

Q. 2 Discuss the continuity of following functions:

(a) $f(x) = \begin{cases} -2x + 3 & x < 1 \\ x^2 & x \geq 1 \end{cases}$ (b) $f(x) = \begin{cases} \frac{x^2 - 1}{x - 1} & x \neq 1 \\ 2 & x = 1 \end{cases}$.

Q. 3 Apply definition of differentiation to prove that $\frac{d}{dx}(x^n) = nx^{n-1}$.

Q. 4 Evaluate $\frac{dy}{dx}$ for

(a) $y = x^3 + \sin x$ (b) $y = x^2 e^{-2x}$ (c) $y = \frac{\cos x}{x^2 + 1}$

(d) $x^2 + y^2 = 16$ (e) $x^4 + y^3 - 3x^2 y = 0$ (f) $x = a\cos^2 \theta$, $y = a\sin^2 \theta$

Q. 5 Using chain rule find the derivative of the following functions:

(a) $y = \log(\sin x)$ (b) $y = (ax + b)^n$ (c) $y = \tan(2x + 3)$

Q. 6 Show that $f(x) = |x|$ is continuous but not differentiable at $x = 0$.

Q. 7 State Rolle's theorem. Also, verify Rolle's theorem for the function $f(x) = x^2 - 4x + 3$ on the interval $[1, 3]$, and then find the values of $x = c$ such that $f'(c) = 0$.

Q. 8 Verify Lagrange's mean value theorem for $f(x) = 2x^2 - 4x + 5$ defined in the interval $[0, 2]$.

Q. 9 Find the maximum and minimum of $f(x) = x^3 - 6x^2 + 9x + 1$ on the interval $[0, 5]$.

Q. 10 Find all the local maxima and minima of the given function
$$f(x) = \frac{3}{4}x^4 + 8x^3 + \frac{45}{2}x^2 + 250.$$