



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

Q. 2 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. 3 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. 4 Show that $f(x) = |x|$ is continuous but not differentiable at $x = 0$.

Q. 5 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. 6 Verify Rolle's theorem for the function $(x) = x^2 + 2x - 8, x \in [-4, 2]$.

Q. 7 State Lagrange's mean value theorem. Also, verify Lagrange's mean value theorem for $f(x) = e^x$ in $[0, 1]$.

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

$$f(x) = \frac{3}{4}x^4 + 8x^3 + \frac{45}{2}x^2 + 250.$$