



PARUL UNIVERSITY
Faculty of Engineering & Technology
Department of Applied Sciences and
Humanities
1ST SEMESTER B.Tech PROGRAMME
(CSE, IT)
CALCULUS(03019101BS01)
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Assignment 1: Application of Functions of One Variable

Q. 1 Evaluate the following limits.

(a) $\lim_{x \rightarrow 1} \frac{x^3 - 1}{x - 1}$ (b) $\lim_{x \rightarrow \infty} \sqrt{x^2 + 2x} - x$ (c) $\lim_{x \rightarrow 0^+} x \ln x$

Q. 2 Discuss the continuity of the given functions.

(a) $f(x) = \begin{cases} \frac{e^x - 1}{x} & x \neq 0 \\ c & x = 0 \end{cases}$. Find c such that $f(x)$ is continuous at $x = 0$
(b) $f(x) = \begin{cases} x^2 & x < 2 \\ kx & x \geq 2 \end{cases}$. Find for which value of k , the function is continuous.

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

Q. 4 Differentiate $f(x) = 9x^3 - 6x + 5$ with respect to x .

Q.5 Find $\frac{dy}{dx}$, if $x = t \sin t, y = \cos t$ at $t = \frac{\pi}{2}$.

Q. 6 Find $\frac{dy}{dx}$ for each of the following by using implicit differentiation

(a) $2x^4 - 3y^3 = -14$ (b) $\sqrt{x} + \sqrt{y} = 100$

Q. 7 Find the derivative of the function $f(x) = \sin(2x^2 - 6x)$.

Q. 8 Using chain rule find the derivative of the following functions:

(a) $f(t) = \sin(3x^2 + x)$ (b) $g(t) = (4t^2 - 3t + 2)^{-2}$

Q. 9 Examine $f(x) = 10x^6 - 24x^5 + 15x^4 - 40x^3 + 108$ for maximum and minimum values.

Q. 10 Verify Rolle's theorem for the function $f(x) = 2 + (x - 1)^{\frac{2}{3}}$, $x \in [0, 2]$.

Q. 11 Using Lagrange's mean value theorem find the value of c if

$$f(x) = x(x-1)(x-2), x \in \left[0, \frac{1}{2}\right]$$

Q. 12 Use left and right endpoints to find the approximate area of the region between the graph of the function $f(x) = 2x + 5$ and the x -axis over the interval $[0, 2]$, use $n = 4$.

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Q. 14 Evaluate the definite integral by Riemann integral

(a) $\int_1^4 4x^2 + 3 \, dx$

(b) $\int_0^2 (x+2)^2 \, dx$

Q. 15 Find the area of the region bounded by the curve $y = 4 - x^2$ and the x -axis.

Q. 16 Find the area of the region bounded by the curve $y = x^2$ and $y = x^3$.

Q. 17 Find the length of the arc of the circle $x^2 + y^2 = 4$ from $x = 0$ to $x = \sqrt{2}$.

Q. 18 Find the length of the arc of the parabola $y^2 = 4x$ from $x = 0$ to $x = 2$.

Q. 19 Find the surface area generated by revolving the curve $y = \sqrt{x}$ from $x = 0$ to $x = 4$ about the x -axis.

Q. 20 Find the volume of the solid generated by revolving the curve $y = x^2$ from $x = 0$ to $x = 1$ about the x -axis.