



**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.**

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

**Q. 2 Discuss the continuity of the given functions.**

$$(a) f(x) = \begin{cases} \frac{e^x - 1}{x} & x \neq 0 \\ c & x = 0 \end{cases} \text{ . Find } c \text{ such that } f(x) \text{ is continuous at } x = 0$$

$$(b) f(x) = \begin{cases} x^2 & x < 2 \\ kx & x \geq 2 \end{cases} \text{ . Find for which value of } k, \text{ the function is continuous.}$$

**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**

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

**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:**

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

**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  $n = 4$ .

Q. 13 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  $n = 4$ .

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.