

Nirma University
Institute of Technology
Department of Mathematics & Humanities
B. Tech. (ALL) – Semester - I
Calculus (MA101)
Assignment – 1

Part I: Differential Calculus

1. Find n^{th} derivative of $y = \log(1-x^2)$.
2. If $y = \sin nx + \cos nx$, show that $y_r = n^r \sqrt{1+(-1)^r} \sin 2nx$.
3. Find n^{th} derivative of $y = \frac{1}{x^2 + x + 1}$.
4. Find n^{th} derivative of the following functions:
5. (i) $y = \frac{x}{(4x+3)(x-1)}$ (ii) $y = \log\left(\frac{3x-1}{3x+1}\right)^{\frac{1}{3}}$
6. Find n^{th} derivative of $y = a^{2x} + \frac{x}{x-1}$.

Part-II Integral Calculus

1. Evaluate $\int_0^1 \frac{1}{\sqrt{-\log x}} dx$.
2. Show that $\int_0^\infty e^{-a^2 x} x^{\frac{3}{2}} dx = \frac{3}{4a^5} \sqrt{\pi}$.
3. Show that $\int_0^\infty 3^{-x^2} dx = \frac{1}{2} \sqrt{\frac{\pi}{\log 3}}$.
4. Show that $\int_0^1 \left(x \log \frac{1}{x}\right)^{\frac{1}{3}} dx = \left(\frac{3}{4}\right)^{\frac{4}{3}} \frac{4}{3}$.
5. A particle of mass m starts moving from rest along the x -axis towards the origin from its initial position $x=1$. Its initial potential is given by $V = -\frac{1}{2} m \log x$. Find the time required for the particle to reach the origin.