

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

Given week:

Tutorial – 5

Submission week:

Part I: Differential Calculus

1. Show that $(1+x)^x = 1 + x^2 - \frac{1}{2}x^3 + \frac{5}{6}x^4 - \frac{3}{4}x^5 + \frac{33}{40}x^6 + \dots$
2. Prove that $\log(1+x+x^2+x^3+x^4) = x + \frac{1}{2}x^2 + \frac{1}{3}x^3 + \frac{1}{4}x^4 - \frac{4}{5}x^5 + \frac{1}{6}x^6 + \dots$
3. Expand $\cos^{-1}\left(\frac{x-x^{-1}}{x+x^{-1}}\right)$ in ascending powers of x . ($x > 0$).
4. Given $\log_{10} 4 = 0.6021$, calculate approximate value of $\log_{10} 404$.

Part-II Integral Calculus

1. Prove that the area of the loop of the Folium of Descartes: $x^3 + y^3 = 3xy$ is three times the area of one loops of the Lemniscate of Bernoulli: $(x^2 + y^2)^2 = a^2(x^2 - y^2)$.
2. Find the length of the arc of the hyperbolic spiral $r\theta = a$ from the point $r = a$ to $r = 2a$.
3. Find the length of the arc of the curve $x = e^\theta \sin \theta, y = e^\theta \cos \theta$ from $\theta = 0$ to $\theta = \pi/2$.
4. Show that the length of the loop of the curve $r = a(\theta^2 - 1)$ is $\frac{8a}{3}$.