

Nirma University  
Institute of Technology  
Department of Mathematics & Humanities  
B. Tech. (ALL) – Semester - I  
Calculus (MA101)  
**Tutorial – 4**

**Part I: Differential Calculus**

1.  $\lim_{x \rightarrow 0} \left( \frac{1^x + 2^x + 3^x + 4^x}{4} \right)^{1/x}$ .
2.  $\lim_{x \rightarrow 0} \frac{a^x \sin bx - b^x \sin ax}{\tan bx - \tan ax}$ .
3. If an electric field  $E$  acts on a liquid or a gaseous polar dielectric, the net dipole moment  $p$  per unit volume is  $P(E) = \frac{e^E + e^{-E}}{e^E - e^{-E}} - \frac{1}{E}$ . Show that  $\lim_{E \rightarrow 0^+} p(E) = 0$ .
4. Find  $\lim_{x \rightarrow a} \frac{\sqrt{2a^3x - x^4} - a \sqrt[3]{a^2x}}{a - \sqrt[4]{ax^3}}$  using L'Hospital Rule. (Marquis de L'Hospital first used the above example to illustrate his rule.)

**Part-II Integral Calculus**

1. Trace the Cartesian curves: a)  $y^2 = \frac{x^2(x+a)}{x-a}$   
b)  $x^3 + y^3 = 3ax^2$ .
2. Trace the following polar curves:
  - a)  $r = a \sin 2\theta$ , ( $a > 0$ )
  - b)  $r = a(1 + \sin \theta)$ , ( $a > 0$ ).
  - c)  $r^2 = \sec 2\theta$ ,
  - d)  $r = (1 - 2 \sin 2\theta)$