

PH3103 Mathematical Methods of Physics
Autumn Semester - 2025
Indian Institute of Science Education and Research, Kolkata
Instructor: Koushik Dutta

Class Test: 1

Submission Date: 25/8/2025

1. Let $f(z) = x + 2iy$. By calculating the limit along the straight line $y = mx$ with m arbitrary, but real, find out whether the function is analytic or not. **Marks: 10**
2. Evaluate the following integral explicitly

$$I_1 = \int_C z^2 dz, \quad (1)$$

over a unit circle $C : |z| = 1$, and argue your final answer w.r.t Cauchy's integral theorem. **Marks: 10**

3. Consider an analytic function $f(z) = u(x, y) + iv(x, y)$. Show that two families of planar curves corresponding to $u(x, y) = C_1$ and $v(x, y) = C_2$ are mutually orthogonal, where C_1 and C_2 are constants. **Marks: 5**
4. Find out the following integral

$$I_2 = \int_C \frac{\tan \xi}{(\xi - \pi/3)^3} d\xi \quad (2)$$

where $C : |\xi| = 1.5$. **Marks: 5**