

# PHY 310 - Mathematical Methods for Physicists I

Odd Term 2019, IISER Mohali

Instructor: Dr. Anosh Joseph

---

## Homework 4

---

1. Show that  $f(z) = z^*$  is not analytic in the complex plane.

2. Given  $f(z) = z^*$  show that  $f'(i)$  does not exist.

3. Show that the function

$$u(x, y) = \frac{1}{2} \ln(x^2 + y^2)$$

is harmonic. Find the harmonic conjugate of this function.

4. Evaluate the integral

$$I = \int_0^{1+i} dz(x^2 - iy)$$

along the path  $y = x^2$ .

5. Evaluate the integral

$$I = \int_C dz|z|,$$

where  $C$  is the left half of the unit circle  $|z| = 1$  from  $z = -i$  to  $z = i$ .

6. Evaluate the integral

$$I = \oint \frac{e^{-z}}{(z+1)} dz,$$

where  $C$  is the circle  $|z| = \frac{1}{2}$ .

7. Evaluate the integral

$$I = \oint \frac{e^{-z}}{(z+1)} dz,$$

where  $C$  is the circle  $|z| = 2$ .