



Class Quiz 1
 Ph. D. Coursework, NAS-MUNA
Mathematical Methods of Physics
 (NWTP 501)
 Instructor: Kumar Abhinav
 Date: April 20th, 2025
 Time 09:00 - 10:00 hrs

Name: _____
 Student ID: _____

Total time: 60 minutes

Semester 2/2025

Total marks: 25

Instructions

- I. Attempt **All** question.
- II. **ONLY** your class notebook(s) are allowed.
- III. Tick the correct boxes. Multiple options can be correct, in that case you need to tick **ALL** correct options to get full marks.
- IV. Each question carries 5 marks.

Questions:

1. Consider all the points inside of a unit circle in the complex plane centered at the origin. They form,

- | | |
|---|---|
| <input type="checkbox"/> A field | <input type="checkbox"/> A group under multiplication |
| <input type="checkbox"/> A group under addition | <input type="checkbox"/> None of the previous |

2. Consider the equation $Z^3 = 1$. Which one/ones of the following are its root(s)?

- | | |
|---|--|
| <input type="checkbox"/> $\cos(120^\circ) + i \sin(60^\circ)$ | <input type="checkbox"/> $\cos(60^\circ) + i \sin(30^\circ)$ |
| <input type="checkbox"/> $\cos(60^\circ) - i \sin(60^\circ)$ | <input type="checkbox"/> 1 |

3. Consider the complex function $\omega(z) = 1 + z^2$. What would be the origin and radius of the circle in the ω -plane under this map corresponding to a circle of radius r centered at the origin in the z -plane?

- | | |
|--|--|
| <input type="checkbox"/> $(0, 0), r^2$ | <input type="checkbox"/> $(1, 0), r^2$ |
| <input type="checkbox"/> $(0, 1), r$ | <input type="checkbox"/> $(1, 1), r$ |

4. Consider the complex function $f(z) = u(x, y) + iv(x, y)$ where $v(x, y) = 3xy$. What would be a correct form of $u(x, y)$ so that $f(z)$ is analytic?

☐ $-\frac{3}{2}(y^2 - x^2) + 32$

☐ $\frac{3}{2}xy$

☐ $\frac{1}{2}(x^2 + y^2)$

☐ $(x - y)^2 + 9$

5. What will be the value of the complex integral,

$$\oint_C \frac{\sinh(z)}{(2Z + 1)^2(z + 2)} dz,$$

where the contour C corresponds to the curve $x^2 + y^2 = 1$?

☐ $i\pi \left[\frac{1}{2} \cosh(2) - \frac{1}{3} \sinh(2) \right]$

☐ $i\frac{2}{3}\pi \left[\frac{1}{2} \cosh\left(\frac{1}{2}\right) + \frac{1}{3} \sinh\left(\frac{1}{2}\right) \right]$

☐ $i4\pi \left[\cosh\left(\frac{1}{2}\right) + \frac{1}{3} \sinh\left(\frac{1}{2}\right) \right]$

☐ $i2\pi \left[(\sinh\left(\frac{1}{2}\right) + \cosh(2)) \right]$

Best wishes