🏛 BRAC University

Department of Mathematics and Natural Sciences

Total Points: 15

📋 Assignment-01

Course Code: MAT215

Complex

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👥 **Section: 12**

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🕐 **Submission Date: _____**

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❓ **Question 1**

Find all possible values of z such that

$$z^6 = \frac{729\sqrt{2}\,(-1-i)}{2}$$

Locate them in the complex plane. Show that they are contained in a circle and find the radius of that circle. Also find the angular distance between two adjacent roots.

✒ **Solution:**

❓ Question 2

Consider the equation

$$\left|\frac{z + 4i}{z - 4i}\right| = 3$$

Describe the above locus in the complex plane.

✏️ **Solution:**

❓ **Question 3**

Consider the inequality

$$\left|\frac{z + 9i}{z - 9i}\right| \geq 2$$

Describe the above locus in the complex plane.

✏️ **Solution:**

❷ Question 4

Solve the following equation for z:

$$e^{5z} = -\frac{5}{2} + \frac{5\sqrt{3}i}{2}$$

Express z as $x + iy$ where $x, y, \in \mathbb{R}$.

✏️ **Solution:**

❷ Question 5

Prove that

$$\sin^{-1} z = \frac{1}{i} \ln \left(iz + \sqrt{1 - z^2} \right),$$

✏ **Solution:**

❓ Question 6

Solve for z:

$$\tanh^{-1} z = 5 - 9i$$

✏️ **Solution:**

❓ Question 7

Solve

✏️ **Solution:**

❓ Question 8

Solve

✏️ Solution:

❓ Question 9

Solve

✏ **Solution:**

❓ Question 10

Using the definition show that
$$f(z) = 4z^2 + 6z - 3$$
is differentiable at all points. Also find the derivative.

✏️ **Solution:**

❷ Question 11

Using the definition, find the derivative of

$$f(z) = \frac{3z - 2}{9z + 8i} \quad \text{at} \quad z = i$$

.

✎ **Solution:**

❓ Question 12

Consider the fuction $f(z)$ defined by

$$f(z) = 5\sinh(7z) - 5\cos(7z)$$

Using C-R equations determine whether the function is analytic or not.

✏️ **Solution:**

❓ Question 13

Consider the fuction $f(z)$ defined by

$$f(z) = 8|z|^2 + 4z - 2\bar{z}$$

Using C-R equations determine whether the function is analytic or not.

✒ **Solution:**

❓ **Question 14**

Show that the given function u defined by

$$u(x, y) = 6e^{-9x} \cos(9y) - 5e^{3y} \sin(3x) + 27x^2 y - 9x^2 - 9y^3 + 9y^2$$

is harmonic. Find the harmonic conjugate v of u such that **u+vi** becomes analytic.

✏️ **Solution:**

❓ Question 15

Show that the given function u defined by

$$u(x, y) = 2xe^{-8x}\cos{(8y)} + 2ye^{-8x}\sin{(8y)}$$

is harmonic. Find the harmonic conjugate v of u such that $\mathbf{u+vi}$ becomes analytic.

✏ **Solution:**