



III 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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Assigned by

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Question 1

Find all possible values of z such that

$$z^6 = 32\sqrt{2}(1 + i)$$

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

$$|z - 8i| - |z + 8i| = 13$$

Describe the above locus in the complex plane.

 **Solution:**

? Question 3

Consider the inequality

$$|z - 8i| - |z + 8i| \geq 10$$

Describe the above locus in the complex plane.

 Solution:

? Question 4

Solve the following equation for z :

$$e^{5z} = \frac{3\sqrt{2}(-1+i)}{2}$$

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

 Solution:

? Question 5

Prove that

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

 Solution:

? Question 6

Solve for z :

$$\sin^{-1} z = 4 + 6i$$

 Solution:

Question 7

Show that the limit, $\lim_{z \rightarrow 0} \frac{\operatorname{Re}\{z^2\}}{|z|^2}$ does not exist.

 **Solution:**

Question 8

Using the L'Hospital's rule, evaluate

$$\lim_{z \rightarrow 0} \left(\frac{\tan z}{z} \right)^{\frac{7 \sin(4z)}{z - \sin z}}$$

 **Solution:**

Question 9

Consider the function

$$f(z) = \frac{\tan 3z}{8z}.$$

Is $f(z)$ continuous at $z = 0$? If not, redefine f at $z = 0$ so that $f(z)$ becomes continuous. Also, find all the points of discontinuity of $f(z)$.

 **Solution:**

? Question 10

Using the definition show that

$$f(z) = 3z\bar{z} - 9z + 5\bar{z}$$

is not differentiable at $z = 0$.

 Solution:

Question 11

Using the definition, find the derivative of

$$f(z) = \frac{7}{z^2} \quad \text{at} \quad z = 4 + 7i$$

 Solution:

Question 12

Consider the function $f(z)$ defined by

$$f(z) = 3 \sinh(5z) - 4 \cos(9z)$$

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

 **Solution:**

Question 13

Consider the function $f(z)$ defined by

$$f(z) = 6|z|^2 + 2z - 4\bar{z}$$

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

 **Solution:**

? Question 14

Show that the given function v defined by

$$v(x, y) = 9e^{-8x} \cos(8y) - 7e^{6y} \sin(6x) + 12x^2y - 6x^2 - 4y^3 + 6y^2$$

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

 Solution:

? Question 15

Show that the given function v defined by

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

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

 Solution: