



BRAC University

Department of Mathematics and Natural Sciences

Total Points: 150

 **Assignment - 01**

Course Code: MAT215

Complex Variables & Laplace Transform

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 **Section: 12**

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 **Submission Date: _____**

Assigned by


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Question 1

Find all possible values of z such that


$$z^5 = 16\sqrt{2}(1 + i)$$

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

Describe the above locus $\left| \frac{z+9i}{z-9i} \right| = 2$ in the complex plane.

 Solution:

Question 3

Describe the above locus $|z - 6| - |z + 6| \geq 8$ in the complex plane.

 Solution:

Question 4

Solve the following equation for z :

$$e^{3z} = -6$$


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

 Solution:

Question 5

Prove that

$$\coth^{-1} z = \frac{1}{2} \ln \left(\frac{z+1}{z-1} \right).$$

 Solution:

Question 6

Solve for z :

$$\sin^{-1} z = 4 + 9i$$

 Solution:

Question 7

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

 Solution:

Question 8

Using the L'Hospital's rule, evaluate

$$\lim_{z \rightarrow 0} \left(\frac{\tan z}{z} \right)^{\frac{2 \sin(9z)}{z - \sin z}}$$

 Solution:

Question 9

Consider the function

$$f(z) = \frac{\tan 6z}{4z}.$$

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


$$f(z) = 4z\bar{z} - 7z + 3\bar{z}$$

is not differentiable at $z = 0$.

 **Solution:**

Question 11

Using the definition, find the derivative of $f(z) = \frac{4}{6z+4}$ at $z = z_0$.

 Solution:

Question 12

Consider the function $f(z)$ defined by

$$f(z) = 3 \sinh(6z) - 6 \cos(6z)$$

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


 **Solution:**

Question 13

Consider the function $f(z)$ defined by

$$f(z) = 8ze^{-4z}$$

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


 **Solution:**

Question 14

Show that the given function v defined by

$$v(x, y) = 5e^{-6x} \cos(6y) - 5e^{5y} \sin(5x) + 21x^2y - 9x^2 - 7y^3 + 9y^2$$

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

 **Solution:**

Question 15

Show that the given function v defined by

$$v(x, y) = 6xe^{-4x} \cos(4y) + 6ye^{-4x} \sin(4y)$$

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

 **Solution:**