



BRAC University
Department of Mathematics and Natural Sciences
MAT215: Complex Variables & Laplace Transform
Assignment-01

Section: 12

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Total Marks: 15

Use this page as the cover page of your assignment

1. Using the definition **5×5=25**

a) Find the derivative of $f(z) = \frac{a - az - a - b}{a - cz + a - d}i$ at $z = i$.

b) Find the derivative of $f(z) = \frac{a - kb}{a - bz + a - b}i$ at $z = z_0$.

c) Show that $f(z) = a - az^2 + a - bz - a - c$ is differentiable at all points.

d) Show that $f(z) = a - az\bar{z} - a - bz + a - c\bar{z}$ is not differentiable at $z = 0$.

e) Find the derivative of $f(z) = \frac{a - ke}{z^2}$ at $z = a - e - a + a - b$.

2. Using C-R equations determine whether the functions are analytic or not. **5×5=25**

a) $f(z) = a - a \sinh(a - bz)$

b) $f(z) = a - a \cos(a - bz)$

c) $f(z) = a - a|z|^2 + a - bz - a - c\bar{z}$

d) $f(z) = \frac{a - ke}{z + a - a - a - b}i$

e) $f(z) = a - az^2 e^{a - bz}$

3. Show that the given function U (or V) is harmonic. Determine the harmonic conjugate V (or U) such that $U + iV$ becomes analytic. **5×10=50**

a) Given $V = a - k \ln((x - a - a)^2 + (y - a - b)^2)$, show that V is harmonic and find U .

b) Given $U = a - 3ax^2y - a - bx^2 - a - by^3 + a - by^2$, show that U is harmonic and find V .

c) Given $V = a - pe^{-a - ax} \cos(a - ay) - a - qe^{a - bx} \sin(a - bx)$, show that V is harmonic and find U .

d) Given $U = a - k \sin(a - ax) \cosh(a - ay)$, show that U is harmonic and find V .

e) Given $V = a - aye^{-a - bx} \cos(a - by) + a - aye^{-a - bx} \sin(a - by)$, show that V is harmonic and find U .