The University of Waikato
Department of Mathematics

Advanced Calculus math311-07A 2007 Complex Assignment 2

Due Friday 11th May: Please hand back your completed assignment through the slot outside the Mathematics Office G3.19. It should be written up neatly and on no more than two sides of an A4 page or the equivalent.

1. Using the expression $f'(z) = u_x + iv_x$, **find the derivative of**

$$\frac{z+2}{z-3}$$

2. If $u = (3x-2y)(2x+3y)$ **show that** u **is an harmonic function on** R^2. **Find** v **such that** $f(z) = u + iv$ **is analytic as a function of x and y and then as a function of z .**

3. Prove that $\log z_1 z_2 = \log z_1 + \log z_2$.

4. Derive the complex chain rule, i.e.Assuming that if f **and** g **are analytic on suitable domains then** $f \circ g$ **is analytic, show that**

$$(f \circ g)'(z) = f'(g(z) \cdot g'(z).$$

Hint: Express the left hand side in terms of A_x **and** B_x.

5. Let $f(z) = \sqrt{z(z-i)}$**Find a domain in** $\mathbb{C}$ **including** $z = 1$ **on which** f **is single valued and satisfies** $f(z)^2 = z(z-i)$**. Evaluate** $f(1)$.

Kevin Broughan

4th May 2007