Due Date: 19 October 2017, Thursday

NAME:.....

STUDENT NO:.....

Math 503 Complex Analysis - Midterm 1

1	2	3	4	TOTAL
25	25	25	25	100

Please do not write anything inside the above boxes!

Check that there are **4** questions on your booklet. Write your name on top of every page. Show your work in reasonable detail. A correct answer without proper or too much reasoning may not get any credit.
Submit your solutions on this booklet only. Use extra pages if necessary.

General Rules for Take-Home Assignments

(1) You may discuss the problems with your classmates or with me but it is absolutely mandatory that you **write your answers alone**.

(2) You must obey the usual rules of attribution: all sources you use must be explicitly cited in such a manner that the source is easily retrieved with your citation. This includes any ideas you borrowed from your friends. (It is a good thing to borrow ideas from friends but it is a bad thing not to acknowledge their contribution!)

(3) Even if you find a solution online, you must rewrite it in your own narration, fill in the blanks if any, making sure that you **exhibit your total understanding of the ideas involved**.

Affidavit of compliance with the above rules: I affirm that I have complied with the above rules in preparing this submitted work.

Please sign here:

NAME: STUDENT NO: DEPARTMENT:

Q-1) Let G be simply connected open subset of $\mathbb{C}$ and $u(x, y)$ a harmonic function on G. Show that a harmonic conjugate for u exists on G.

Solution:

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Q-2) Derive, in your own words, the polar form of the Cauchy-Riemann equations and use that to show that the $\log$ function is holomorphic on $\mathbb{C} \setminus \{z \leq 0\}$.

Solution:

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Q-3 Classify all holomorphic functions on a fixed connected open subset of $\mathbb{C}$ which take only real values.

Solution:

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Q-4) Calculate the following numbers, always using the fundamental branch of the logarithm whenever a logarithm is required.

(i) i^i

(ii) $(-2)^i$.

(iii) $\pi^{\frac{1+i}{1-i}}$

(iv) $\left(\sqrt{3}+i\right)^{1+i\sqrt{3}}$

(v) Let $a_0 = i$ and $a_n = (a_{n-1})^i$ for $n = 1, 2, \ldots$. Find a_n.

Solution: