



MATH 382    COMPLEX ANALYSIS    Spring semester 2012  
Frank Jones

Dear MATH 382 students,

Welcome to this introductory semester of complex analysis.

I can confidently state that you are in for a *thrilling* semester of mathematics! The beautiful subject you are embarking upon will amaze and surprise you. Most of the calculus you have learned up to this point will find great fulfillment in this course. You'll understand what the radius of convergence of a power series is really all about, and all the functions you deal with will be *analytic*. An amazing feature is that the assumption of the existence of a single *complex* derivative of a function automatically guarantees the existence of derivatives of all orders!

You will see integrals evaluated and infinite sums calculated that will astonish you. You will learn the beauty and importance of conformal mappings.

When we reach Cauchy's formula on about February 6, you will have one of the most amazing and important tools in all of mathematics.

You will see the famous fundamental theorem of algebra proved in a couple of lines, and you will completely understand why it's true.

By the way, the adjective in the phrase complex analysis does not refer to the intricacies of the subject, rather simply refers to the fact that we'll always be using complex numbers, not just real numbers. A very weak analogy might be this: solving quadratic equations using just real numbers is fraught with difficulties which immediately disappear when complex numbers are employed.

## COURSE DETAILS

The text book for the course is Stephen Fisher's *Complex Variables: Second Edition*, a Dover publication. We'll go through the entire book, but we'll have to skip a few topics along the way.

### INSTRUCTORS

Besides myself, we are going to have the services of **Dr. Betul Orcan-Ekmekci**, a G.C. Evans Instructor of Mathematics.   bo2@rice.edu

We'll also have two graduate students as teaching assistants, **James Cooper** and **Paul Munger**.

These friends will at least hold office hours. I have yet to work out other ways they may be of assistance to us during the semester. I welcome suggestions!

### GRADING

Homework will be assigned regularly. You may certainly work together on these assignments. There will be probably two midterm take-home exams, and there will be a final exam. These are all extremely important, and I'll assign grades as follows:

HW 40%, Midterm exams 40%, Final exam 20%.

## TENTATIVE CALENDAR

M Jan 9

Complex numbers

W Jan 11

$e^z$  and Euler's formula

F Jan 13

Roots of 1

M Jan 16

*Martin Luther King, Jr.*

W Jan 18

$\log z$

F Jan 20

Möbius transformations

M Jan 23

More Möbius,  
Riemann sphere

W Jan 25

Chapter 2,  
Analytic functions

F Jan 27

Derivatives of  $e^z$ ,  $\log z$ ,  
and Möbius functions

M Jan 30

Power series

W Feb 1

Review:  
Green's theorem

F Feb 3

CAUCHY'S  
THEOREM!

M Feb 6

CAUCHY'S  
FORMULA! (MATH  $2\pi i$ )

W Feb 8

Applications

F Feb 10

Fundamental theorem  
of algebra

M Feb 13

Morera's theorem

W Feb 15

Isolated singularities

F Feb 17

Laurent series,  
rational functions

M Feb 20

RESIDUES!

W Feb 22

RESIDUE THEOREM!

F Feb 24

Integrals

-----*SPRING BREAK*-----

M Mar 5  
Integrals

W Mar 7  
Infinite series

F Mar 9  
Infinite series

M Mar 12  
Chapter 3, Mappings

W Mar 14  
Local behavior,  
inverse function theorem

F Mar 16  
Lagrange-Burmann  
formula

M Mar 19  
Argument principle

W Mar 21  
Rouché's theorem,  
FTA again

F Mar 23  
*MIDTERM RECESS*

M Mar 26  
Maximum modulus  
principle

W Mar 28  
Liouville's theorem

F Mar 30  
Schwarz' lemma

M Apr 2  
RIEMANN MAPPING  
THEOREM (proof omitted)

W Apr 4  
Basic examples

F Apr 6  
More examples

M Apr 9  
Conformal bijections  
of the unit disk

W Apr 11  
Schwarz-Christoffel  
mappings

F Apr 13  
More Schwarz-  
Christoffel

M Apr 16  
Gamma function

W Apr 18  
Gamma function

F Apr 20  
Laplace transform

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