Math 40480 Complex Variables, Spring 2015

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Office hours: by appointment and Tues. and Thurs. 4-5:30 p.m. and Wed. 4:30-5:30 p.m.
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Text: Fisher, *Complex Variables*, second edition

Syllabus: We will begin with the complex plane, its geometry, and important examples of functions on the complex plane. Then we will study analytic functions, the basic objects of study in complex variables, and their real and imaginary parts, the harmonic functions. We will study the Cauchy Integral Theorem, Cauchy's formula, the Residue Theorem and its application to calculating integrals. We will then study analytic functions as mappings and learn the famous Riemann Mapping Theorem. We will conclude with a detailed study of harmonic functions, with applications to solving physical problems. This material is in chapters 1-3 and the first part of chapter 4 of the textbook.

Have you ever wondered:

> Is is possible to take a math course with a textbook which costs under $20 (list price)?
>
> When and where did imaginary numbers first appear, and who named then "imaginary"?
>
> Why does every polynomial have a root (possibly complex)?
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> Why is $\sum_{n=1}^{\infty} \frac{1}{n^2} = \frac{\pi^2}{6}$?
>
> What is $\int_0^{\infty} \frac{\sin x}{x}\, dx$?
>
> What is the lift force on the Joukowski airfoil?
>
> How can you compute the inverse Laplace transform of a function?
>
> What is an elliptic curve, what do elliptic curves have to do with Fermat's Last Theorem, and why was this on the front page of the *New York Times*?
>
> What is the Riemann Hypothesis, and why was it one of the Clay Mathematics Institute's Millennium Problems, with a prize of $1,000,000 for solving it?
>
> (See http://www.claymath.org/millennium-problems.)

You've already figured out the answer to the first question or will when you buy the book. By the end of the semester you will know how to answer the next five questions and be able to understand the inverse Laplace transform and you will know enough to understand something about the last two.

There will be weekly homework assignments, a midterm, a project, a portfolio, and a final exam.

Homework: The first two homework assignments are posted on the course web page. Assignment 0, your mathematical autobiography, is due Monday, January 19. Assignment 1 is due Wednesday, January 21. Future assignments will be posted on the course web site.

Portfolio: Your portfolio will contain problems you select from the homework and midterm, redone to be completely correct and well written. When your portfolio is complete, it should give a clear picture of some of your major accomplishments in the course and why you consider these to be major accomplishments. The final portfolio will be due Monday, April 27, but you will be expected to submit a preliminary version of at least part of it earlier. Detailed instructions will be given out later.

Project: The project will be due on Monday, April 13. Suggestions for projects will be handed out in early March.

Exams: The exams will be take-home. The midterm will be due in class on Wednesday, March 25 (unless the class wants it due before the deadline for discontinuing courses). The final will be due at the time of the regularly scheduled exam (tentatively at 5 p.m. on Tuesday, May 5).

Honor Code: The Honor Code is in effect for all exams, assignments and projects. I encourage you to work together on the assignments and projects, but copying from any source or submitting work done by others as your own is a violation of the Honor Code.

Web site: The course web site is

http://www3.nd.edu/∼nancy/Math40480/info.html

On this site under Information, in addition to a copy of this handout, you will find a page with tips for reading the book and a page with links to sites for visualizing complex functions.

Grading: The homework will count for 25% of your grade, the midterm, portfolio and project will each count for 15%, and the final will count for 30%.