# Math 329: Numerical Analysis

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Fall 2014
Office Hours: M 1:30-3 T 2-4
and by appointment.

**Books:** There are many good textbooks on numerical analysis. We will use two books that are available both online and in print:

Numerical Computing with Matlab, Cleve Moler, SIAM 2008.
(http://www.mathworks.com/moler/chapters.html)

The other book has no exercises but is an excellent reference:

Numerical Recipes in C, Second Edition, William H. Press, Saul A. Teukolsky, William T. Vetterling and Brian P. Flannery, Cambridge Press, 1992.
(http://www.nrbook.com/a/bookcpdf.php)

There are versions for Fortran, Basic, Pascal, C and C++.

**Course Objectives:** By the end of this course, you should be able to use a computer to simulate a physical system. This process involves:

1. expressing the physical system in terms of a mathematical model,
2. expressing the mathematical model in a form conducive to solution on a computer,
3. implementation of a numerical method to approximate the solution,
4. interpretation and/or presentation of the results.

Most of the lecture time will be spent discussing items 3 and 4 with some discussion of 2. The first, while probably the most difficult and important, will not be a focus of the lectures.

**Numerical Methods to be Focused On:** Root finding (Solving $f(x) = 0$). Solving Linear Systems of equations. Interpolation from data lists to functions. Numerical Integration and Differentiation. Numerical Solution of Ordinary Differential Equations. Numerical Solution of Partial Differential Equations.

**Course Structure:**

**Computer Problem Sets:** Approximately every two weeks, a problem set will be assigned involving the use of computers to implement the methods we discuss in class. Questions not involving computer work will also be included.

**Final Project:** A final project will involve the simulation and subsequent presentation of results for a problem of your choice. This problem should be chosen carefully with advice from the instructor. The physical system should be of interest to you. The mathematical model should be tractable with solutions providing quantities of interest. Comparison with expected results should be possible. We will talk more about this in class. Possible topics include simulation of a chemical reactor, a simple ecosystem, fluid flow in a channel, traffic flow, or a simple economic model. The hard part in choosing a topic will be finding a question that can be stated in a mathematical manner.

**Exams:** There will be a single mid-term exam and a final exam.
The mid-term will take place near the end of October on a date to be arranged.
The final exam will be **9-11 Friday December 19**.

**Grades:** Your grade will be determined by your work on computer problem sets (30%), the mid-term exam (20%), the final project (30%) and the final exam (20%).