

Course Outline: Winter 2010
Mathematics 210: Introduction to Mathematical Computing
Section 201

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OFFICE HOURS: Monday 3:00–4:00, Thursday 1:00–2:00, Friday 11:00–12:00

PREREQUISITES: First year calculus (Math 101 or equivalent)

COREQUISITES: One of Math 215, Math 255, Math 256, Math 265 and one of Math 220, Math 226 and one of Math 152, Math 221, Math 223

This course is intended mainly for students majoring in mathematics, typically in second year. It gives an introduction to algebraic, numerical and graphical computational tools which are useful in many areas of mathematics, using the Maple computer algebra system. While the main focus is on the use of Maple's built-in commands, some programming in Maple will be included.

By the end of this course, it is hoped that you will be able to use Maple effectively to perform any of the computational tasks that you might meet in later mathematics courses.

TEXT: None.

You will be able to purchase Maple 14 for your own computer at a specially-discounted price, at the Maplesoft web store.

OUTLINE OF TOPICS

0. Introduction to Maple
 - (a) Symbolic and numerical computation
 - (b) Graphing
 - (c) Maple worksheets
 - (d) Variables, expressions and functions
1. Solution of nonlinear equations and systems:
 - (a) Equations in one variable. Solving with “solve” and “fsolve”. Floating point computations. Newton's Method and iteration. Cobweb diagrams. Stability and instability of fixed points and cycles.
 - (b) Systems of polynomials in several variables. Resultants and elimination. Newton's Method in several variables.
2. Integration:
 - (a) Symbolic integration. Integrating rational functions. Integration in elementary functions.
 - (b) Numerical integration. Methods of numerical quadrature: midpoint, trapezoid, Simpson's and Newton-Cotes rules. Richardson extrapolation.
 - (c) Improper integrals. Removal of singularities.
3. Series:
 - (a) Convergence of series. Evaluation of sums and errors.
 - (b) Power series.
 - (d) Asymptotic series. Euler-Maclaurin summation formula.
4. Recurrence relations:
 - (a) Fibonacci numbers.
 - (b) Solving recurrence relations.
 - (c) Stability of numerical computations.
 - (d) Approximation of functions.

GRADING:

20% Homework

30% Two midterms

50% Final exam

Homework will be due approximately every two weeks. It will be done using Maple (either in the lab or at home) and submitted electronically. Midterms and final exam will be written in the lab using Maple.