MATH 151 - FALL 2006

MATHEMATICS FOR THE LIFE SCIENCES

Time: 10:10 - 11:00 Monday and Wednesday, labs Tuesdays at various times

Place: Buehler 300. Recitation sections will meet in the rooms assigned. Labs will be held in Ayres 15.

Instructor: Dr. Louis Gross, Professor of Ecology and Evolutionary Biology and Mathematics

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Teaching Assistants:
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Course web page: http://www.tiem.utk.edu/~gross/math151.html

This course provides an introduction to a variety of mathematical topics of use in analyzing problems arising in the biological sciences. It is designed for students in biology, agriculture, forestry, wildlife, pre-medicine and other pre-health professions. Students who desire a strong mathematical grounding, enabling them to take most advanced math courses, should consider taking the sequence Math 141-2 instead. Math 151 is the first of a two course sequence, and depending upon your curriculum, will partially satisfy graduation requirements for your major. The general aim of the sequence is to show how mathematical and analytical tools may be used to explore and explain a wide variety of biological phenomena that are not easily understood with verbal reasoning alone. Prerequisites are two years of high school algebra, a year of geometry, and half a year of trigonometry.

This course includes a laboratory component which makes use of computer facilities in the Math Department. No prior background in the use of the main software package for the course (Matlab) is expected, though students are expected to have familiarity with standard word-processing and graphing (e.g. spreadsheet) tools. Although there is a textbook, we will not be following it very closely at times, and will be covering topics not in the text on occasion. As we will not be following the text for part of the course, students should plan to attend all class sessions, although no formal roll will be taken in lectures. The text for the course is: *Mathematics for the Biosciences* by Michael Cullen. A supplement which includes a variety of additional material not covered in the text, as well as projects and sample exams, is available from Graphic Creations (1809 Lake Ave., behind Wendy's on Cumberland Avenue) for approximately $4.

Course Goals:

Develop your ability to quantitatively analyze problems arising in the biological areas of interest to you.

Illustrate the great utility of mathematical models to provide answers to key biological problems.

Develop your appreciation of the diversity of mathematical approaches potentially useful in the life sciences.

Provide experience using computer software to analyze data, investigate mathematical models and provide some exposure to programming.

Course Grading: The grade will be based on several components: (a) There will be a set of brief (5-10 minute) quizes, generally given once a week at the end of a class period (during the lab period in weeks for which there is no exam scheduled); (b) There will be a set of assignments, some of which will be based on the use of the computer to analyze particular sets of data, or problems. These may be worked on within a study group, as long as it is clearly noted who participated, and each individual writes their own results; (c) There will be a set of three exams during the term, in addition to a comprehensive final. The exams will not be computer based. They will focus on the key concepts and techniques discussed in the course. Of the three regular exams given, the one with the lowest score will be dropped. The final exam will be given

Friday December 8 from 10:15-12:15 in the lecture room (Buehler 300). The weighting of these components of the grade are: (a) 20%, (b) 20%, (c) 60% (the final exam counts 30% of the course grade, and the two regular exams not dropped will together count 30% of the grade).

All students are expected during the first 2 weeks of class (by September 6) to take the Pre-Calculus Exam available on-line through http://www.mathclass.org (directions for taking this exam are on the course web-page). This is an assessment exam to ensure that you are prepared for this course. It is based solely on high-school level material. All students are expected to complete the exam with a score of 20 or better (out of 25). Your grade on this exam will be reported to your teaching assistant, and if you do not score 20 or above you will be expected to go through the variety of appropriate tutorials for the material you did not answer correctly, and retake a similar exam. You are welcome to go through some of the tutorials before taking the exam if you wish to refresh your memory.

Participants are expected to regularly work problems from the text, or problems assigned by the instructor. These should be worked on individually, but will not be graded. Questions about these problems may be addressed during lab periods or by attending the office hours of your teaching assistant. Note that the quiz problems will mostly be chosen directly from the assigned homework. Opportunities for extra credit may be made available as the course proceeds, for those desiring this. These are usually additional computer-based laboratory projects.

Course Outline: The pace of the material covered will be adjusted as necessary, but the approximate time to be spent on various topics over the semester and the dates of coverage are given below.

Descriptive statistics - analysis of tabular data, means, variances, histograms, linear regression - Aug. 23-30

Exponentials and logarithms, non-linear scalings, allometry, log-log and semi-log plots - Text sections 5 & 15 - Sept. 6 - Sept. 18

Exam 1 - Sept. 19

Matrix algebra - Text sections 55 & 56 with supplementary material - addition, subtraction, multiplication, inverses, matrix models in population biology, eigenvalues, eigenvectors, Markov chains, application to ecological succession - Sept. 20 - Oct. 16

Exam 2 - Oct. 17

Discrete probability - Text sections 57 to 61 with supplementary material - applications to population genetics, behavioral sequence analysis - Oct. 18 - Nov. 13

Exam 3 - Nov. 14

Difference equations - Text secions 47 to 49 with supplementary material - linear and nonlinear examples, equilibrium, stability and homeostasis, logistic model, introduction to limits - Nov. 15 - Dec. 5

Final Exam - Dec. 8 - 10:15AM-12:15PM