The Professor

The Class — Overview

The Class...

Introduction

Outline

1 The Professor
   - Contact Information, Office Hours
   - TA Contact Information, Office Hours

2 The Class — Overview
   - Syllabus
   - Grading
   - Expectations and Procedures

3 The Class...
   - Computer Lab
   - Formal Prerequisites

4 Introduction
   - Why Math 124 is needed for Biologists
   - Mathematical Models

Contact Information

Professor Joseph M. Mahaffy

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Email Derek Moree
dmoree@sdsu.edu

Office Hours TBA in GMCS 421, and by appointment
Basic Information: The Book

**Title:**
“Calculus: A Modeling Approach for the Life Sciences”

**Volumes I and II**

**Authors:**
Joseph M. Mahaffy & Alexandra Chávez-Ross

**Publisher:**
Pearson Custom Publishing

**ISBN:**
0-558-17036-6
0-536-90522-3

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Basic Information: Syllabus

- Functions and Models
- Discrete Dynamical Models
- The Derivative
- Optimization
- Differential Equations and Integration

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Basic Information: Grading

Detailed information is found on the **Homework and Assignment Web Page**

- Lecture Material is 70% of grade
  - Lecture Participation, i-clicker (7% of Lecture grade)
  - Homework with WeBWorK (9% of Lecture grade)
  - Weekly HW Quizzes, 3 Exams, and Final (84%)
    - Scientific Calculator (TI-30X) only - HW Quizzes, Exams, and Final
    - 1 3x5 notecard for HW Quizzes and Exams and 3 3x5 notecards for Final
    - No cell phone visible (ZERO on Exam)
  - Lab Work is 30% of grade
    - 13-14 Lab assignments
    - 3 Lab Exams worth twice a regular Lab assignment
    - Open notes, Computer (except email), No cell phone

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Expectations and Procedures, I

- Lecture class attendance is required for the participation part of the grade — Homework and announcements will be posted on the class web page. If/when you attend class:
  - Please be on time.
  - Please pay attention.
  - Please turn off mobile phones.
  - Please be courteous to other students and the instructor.
  - Abide by university statutes, and all applicable local, state, and federal laws.
Expectations and Procedures, II

- WeBWorK assignments are posted with a specific due date. It is your responsibility to complete the assignment on time.
- The instructor will make special arrangements for students with documented learning disabilities and will try to make accommodations for other unforeseen circumstances, e.g. illness, personal/family crises, etc. in a way that is fair to all students enrolled in the class. Please contact the instructor EARLY regarding special circumstances.
- Students are expected and encouraged to ask questions in class!
- Students are expected and encouraged to make use of office hours! If you cannot make it to the scheduled office hours: contact the instructor to schedule an appointment!

Expectations and Procedures, III

- Missed Exams or Lab Exams: Don’t miss Exams! You will receive a ZERO for any missed exam, except for written/documented excuses (illness, personal/family crises, etc.).
- Lab assignments:
  - Attendance is mandatory or automatic 10 point deduction
  - Partners are assigned and must work with given partner
  - Arriving 20 minutes late or missing a Lab means working the lab alone
  - Labs due promptly by Thursday 9 PM following a given Lab unless told otherwise.
  - Lowest lab score is dropped
  - Your responsibility to back up Lab work – No excuses accepted or extensions granted for lost material

Computer Lab

- Computer Labs are located in GMCS 421, 422 and 425 – Hours are posted on the Lab doors
- Completed Lab Reports are turned into Math 124 box located in GMCS 421/422
- Software used
  - Excel
  - Word
  - Maple
- Labs are 70% WeBWorK and 30% written report
- Please direct questions first to your Lab TA
Math 124: Technology

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The Class — Overview
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Computer Lab
Formal Prerequisites

Math 124: Technology

Design of Calculus for Life Sciences - Math 124

- Lecture and HW
  - Work problems with only Scientific Calculator (TI-30X)
  - Primarily, developing skills through mental activity
  - See Math Learning web page (Miscellaneous)
- Computer Lab
  - Manage more complex (realistic) problems and data fitting
  - Use computer programs to help solve these problems
  - Computer Lab problems are linked to Lecture material

No Wolfram Alpha

Students find that Wolfram Alpha easily manages their HW Using this for anything but checking answers often results in failing the course

Math 124: Introduction

Why Math 124 is needed for Biologists

- Biology is rapidly expanding - more quantitative analysis of the data
- Mathematics and computers are more important
- This course in Calculus for Biology
  - Emphasis on mathematical modeling of biological systems
  - Lecture notes show how Calculus naturally arises in biological examples
  - Begin with a biological model
  - Mathematical theory required to analyze the biological problem
- Use real or realistic examples
- Computer labs aid the more complicated models

Mathematical Biology

- Mathematical tools
  - Better qualitative and quantitative understanding of biological problems
  - Suggest alternate possibilities
  - Reject inconsistent ideas
- Biological problems
  - Often stretch mathematical techniques
  - Illustrate mathematical tools well
  - Build intuition for problem techniques
A mathematical model is a representation of a real system.
- It is simple in design.
- It exhibits the basic properties of the real system.
- The model should be testable against empirical data.
- Comparisons of the model to the real system should lead to improved mathematical models.
- The model may suggest improved experiments.
- Often there is not an exact answer, differing from K-12 training in mathematics.

### Biological Information
- Metabolic disease characterized by too much sugar in the blood and urine.
- $\beta$-cells in the pancreas release insulin in response to rises in levels of glucose in the blood.
- Stores energy as glycogen in the liver.
- Juvenile diabetes (Type I) - failure of the $\beta$-cells to release insulin to blood glucose levels – an autoimmune response killing $\beta$-cells.
- Adult onset diabetes (Type II) results in insulin resistance – cells fail to use insulin properly.
Introduction – Example – Predator-Prey Model

Classic Lynx-Hare Data

- Records of the Hudson Bay Company show that the pelts of the lynx and hares seemed to oscillate with a fairly regular period
- Simple ecological system, as the lynx is a very specialized predator that primarily feeds on snowshoe hares
- Books often cherry-pick to show limited data - Model fails badly over the complete data set
- We’ll examine this model late in the semester

Graph shows a clear correlation between the populations of lynx and hares.

Rapid rise in the population of the hares is followed by a rapid rise in the lynx population.

Next the hare population plummets, which is followed by lynx population plummeting.