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Course web page: http://academics.davidson.edu/math/heyer/courses/mat112/mat112.html

Course description: Life consists of change. Growth, metabolism, and senescence are examples of changes that occur in every living thing. In humans, change is evident in movement, blood circulation, learning, and disease. This course investigates mathematical approaches to describing and understanding change. Topics include single variable differential and integral calculus, difference equations and differential equations. Students will be guided in the discovery and mastery of mathematical techniques in the context of problems in the life sciences.

This course aims to prepare students for the increasingly prevalent role of quantitative analysis in the life sciences by supplying a foundation in calculus and other mathematical methods for modeling change. After MAT 112, students can choose to continue to either Multivariable Calculus and Modeling (MAT 140) or Calculus II (MAT 113), either of which counts toward a minor or major in mathematics, and satisfies medical school requirements. Premed students may also wish to consider a course in statistics.

Prerequisites: You should have strong pre-calculus preparation for this course. In particular, you should have mastered the material in chapters R and 1 (except section 1.2), plus section 2.4, in the textbook. Some previous exposure to calculus is beneficial, but not required. I will not assume you have any particular level of proficiency in calculus. Students with AP credit for MAT 111, Calculus I (i.e., a 3 or higher on the AB test), will lose that course credit by taking this course, and should consider enrolling in MAT 113, Calculus II, instead. Students with BC calculus experience and at least a 4 on the BC test should consider enrolling in MAT 160 (Calculus III), or MAT 150 (Linear Algebra).


Technology: We will use Wolfram Alpha on a regular basis. I encourage you to bring a device to class each day that is capable of accessing Wolfram Alpha. If you use a smartphone or tablet, I recommend downloading the Wolfram Alpha app. We will occasionally use Excel. On those days, you will be encouraged to bring a laptop or tablet capable of running Excel.
Learning Outcomes: At the end of this course, students will be able to:

- Construct and analyze discrete and continuous models of phenomena in the life sciences
- Compute derivatives and integrals of functions, both analytically and numerically
- Qualitatively and graphically analyze functions
- Optimize a function of one variable, in the presence or absence of parameters
- Characterize the rate of change of one variable in an equation in terms of the rate of change of another variable
- Apply definite integrals to model accumulation
- Solve first order linear differential equations – analytically and numerically

Course components:

Reading: Students are expected to read the assigned section of the textbook before each class and learn the basic skills independently, so class time may be devoted to deeper understanding of ideas and applications. I will post a brief reading guide with questions you should be able to answer and/or problems you should be able to do before class. I will begin each class by calling on students to answer these questions and write solutions to these problems on the board, so we can make sure everyone understands the basic concepts. If you have not read the section or tried to answer the questions before class, your learning will be greatly diminished and your performance will suffer.

Classwork: Class time will be a discussion of the reading, including examples and hands-on problem solving activities. You need not bring your book every day. Much of our in-class work each day will be captured in a PDF file that will be posted on the Moodle page. You will grade yourself each day on your preparation and participation using a provided scoring rubric.

Homework: Mathematics is a subject best learned by doing. Homework will be assigned and due each class period. In addition to written work, we will experiment with an online homework system that provides instant feedback on certain kinds of problems. Assignments will emphasize both understanding of concepts and application of skills to problems in the life sciences. A subset of the problems will be graded by a student assistant and returned to you the following class period. You are responsible for checking the accuracy of problems that are not graded. Please see me right away if you have any questions or concerns about the way your homework is graded.

Projects: Pairs of students will complete a project during the semester. Projects will consist of reading and understanding a published mathematical
model, and presenting it to the class in the form of a scientific poster. Projects will be presented on class on December 1. You can start watching the textbook now for references you might want to use for your project.

**Reviews:** Four reviews will be given during the semester, scheduled for September 8, September 25, October 23 and November 20. Put these dates on your calendar now!

**Final Exam:** The final will be self-scheduled and cumulative.

**Classroom community expectations:** The classroom is not my space, it is a shared learning space. Students are expected to respect each other's learning process and help each other learn as much as possible. I encourage you to introduce yourself, get to know your classmates, and study together outside of class. Unless you have a dire emergency, you should not get up and leave class, because it interrupts concentration for other students. Texting and emailing in class are rude and disruptive.

**Access and accommodation:** Davidson College values the diversity of its community and is an equal access institution that admits otherwise qualified applicants without regard to disability. The college seeks to accommodate requests for accommodations related to disability that are determined to be reasonable and do not compromise the integrity of a program or curriculum. To make such a request or to begin a conversation about a possible request, please contact Beth Bleil, Director of Academic Access and Disability Resources, in the Center for Teaching and Learning by visiting her office in the E.H. Little Library, by emailing her at bebleil@davidson.edu, or by calling 704-894-2129. It is best to submit accommodation requests within the drop/add period; however, requests can be made at any time in the semester. Please keep in mind that accommodations are not retroactive.

Together, we will strive for your success in meeting the above learning goals. The components of the course, including the modes of assessing your progress toward these goals, require a range of skills and abilities. Every student’s success is important to me, and I am happy to work with you to develop strategies that will meet your needs while fulfilling the requirements of the course. I will make every effort to accommodate absences that allow you to observe your religious faith or participate in athletic contests. Please look carefully at the class schedule and notify me in advance if there are any such conflicts with classes and/or assignments during the semester.

**Attendance policy:** Missing class will adversely affect your grade in many ways. In addition, the college attendance policy will be enforced: missing more than 25% of class meetings makes you eligible for a failing grade.

**Additional resources and strategies for success:**

**Office hours:** The best place to get help with the course material is from the instructor. Office hours are times that are specifically set aside to meet with students. I will have the following regular drop-in office hours, for which you need no appointment, first-come, first-served:
Monday – Thursday 2:00-3:30
If these times are not convenient for you, or you would like more one-on-one time with me, I encourage you to email me for an appointment, or simply drop by my office and see if I am available to help. I am typically on campus from 9:00-6:00 every day. Email is a great way to reach me, day and night.

**Peer instruction:** An important part of learning mathematics is studying with a group of friends. Everyone learns at a deeper level by explaining concepts and problem-solving techniques to each other. I strongly encourage you to work together on homework. Use the diversity of previous experience and gifts for different subjects among your classmates.

**Other assistance:** The Math & Science Center (MSC) offers free assistance to students in all areas of math and science, with a focus on the introductory courses. Trained and highly qualified peers hold one-on-one and small-group tutoring sessions on a drop-in basis or by appointment, as well as timely recap sessions ahead of scheduled reviews. Emphasis is placed on thinking critically, understanding concepts, making connections, and communicating effectively, not just getting correct answers. In addition, students can start or join a study group and use the MSC as a group or individual study space. Located in the Center for Teaching & Learning (CTL) on the first floor of the College Library, drop-in hours are Sunday through Thursday, 8-11 PM, and Sunday, Tuesday, Thursday, 4-6 PM, beginning Sunday, August 27. Appointments are available at other times. For more information, visit [http://www.davidson.edu/offices/ctl/students/math-science-and-economics-center](http://www.davidson.edu/offices/ctl/students/math-science-and-economics-center), or contact Dr. Mark Barsoum (mabarsoum or ext. 2796).

**Honor code considerations:** You may discuss homework assignments with anyone in the class, and you may ask me or the Math and Science Center tutors for help. However, what you turn in for grading should reflect your own understanding of the assignment, not simply a copy of someone else’s written or verbal understanding. Projects will be done in pairs, without consultation outside of the pair (other than me). Reviews and exams will be done individually, and with authorized resources only. You will be asked to sign the honor code pledge on each review.

**Grades:** Course grades will be computed as follows:

- **Homework** 15%
- **Reading/Participation** 10%
- **Reviews I(a) and I(b)** 10% each
- **Reviews II and III** 15% each
- **Final Exam** 15%
- **Project** 5%