
Math 124: Calculus II (Multivariable)

Spring, 2017

Course Description: This is a second course in calculus. We will extend the study of calculus from functions of the form $y = f(x)$ to functions of the form $z = f(x, y)$ and $w = f(x, y, z)$, which occur much more frequently in real life. We will study how to represent these functions graphically in higher dimensional space, how to approximate their solutions numerically, and how to represent them analytically using matrices and linear algebra. Single-variable calculus is concerned with derivatives and integrals, and they are related by the Fundamental Theorem of Calculus. The multivariable analogues are partial derivatives, the gradient, and multiple integrals. We will study these concepts, with an emphasis on how to use them when building and using mathematical models of the world. We will use the computer program Sage to carry out calculations, allowing us to de-emphasize hand calculations and algebra. Additionally, we will study sequences and series (which form a bridge between this class and Math 321) and differential equations (which form a bridge to Math 231).

Class Details:

Instructor:	David White
Office:	Olin 202
Extension:	6644
Email:	david.white@denison.edu
Meetings:	10:30-11:20am MWF, Section 03, Olin 221 11:30-12:20 MWF, Section 01, Olin 221
Labs:	Thursday 3:00-3:50 in Olin 221 or Friday 3:00-3:50 in Olin 222
Office Hours:	Fill-In:
Course Assistant:	Andrew Read-McFarland (readmc_a1@denison.edu)
Study Session:	Fill-In:
Final Exam:	For Section 03, it's Wednesday, May 3, 9-11am, Olin 221 For Section 01, it's Monday, May 8, 9-11am, Olin 221
Web Resources:	http://personal.denison.edu/whiteda/math124spring2017.html

Course Goals:

1. Practice how to break a complex problem into simple pieces.
2. Develop your analytic thinking skills. Develop the ability to reason abstractly, to understand the importance of proofs, to pay attention to details, and to be methodical.
3. Develop the ability to visualize higher dimensional space and be comfortable solving problems featuring partial derivatives and multiple integrals.
4. Learn the basics of differential equations and linear algebra, as well as the connection between them.
5. Learn how to represent real-world problems mathematically and solve them using calculus, differential equations, and linear algebra, carried out in Sage.

-
6. Develop time management skills, group work skills, test-taking skills, computer skills, and the ability to read mathematics slowly and carefully.

Textbooks: *Calculus: Early Transcendentals*, 7th edition, by James Stewart. Homework will be collected via WebAssign, so you are encouraged to purchase a copy of the textbook which includes WebAssign support (these are the versions sold by the campus bookstore).

Supplemental: *Linear Algebra: A Modern Introduction*, 3rd edition, by David Poole. We will draw WebAssign problems from this text at the end of the course, but your subscription for the text above will allow you to access this text as well.

Course Evaluation:

Written Exams 1 and 2	15% each (= 30% total)
Final Exam	20%
Labs & Homework	35%
Participation	5%
Quizzes	10%

Keys to Success

- Be able to solve every homework problem quickly prior to exams.
- Learn to apply the basic concepts and do not simply memorize solutions to specific problems. Exam problems which are different from the homework can be solved using the same underlying concepts.
- Read and re-read the textbook, giving particular attention to examples.
- Review the lecture the same day it is given. Find a way to attach this new knowledge to things you already understand.
- Study calculus every day rather than in bursts just before an exam.
- Attempt every homework problem in each assignment. Even if it is confusing, simply trying to write something cohesive down on paper will help you learn much more than watching someone else present the solution.
- Keep a list of key definitions, formulas, and theorems, and commit them to memory throughout the course. Keep a list of key commands in Sage, and example files where you can find examples. Test your memory each week.
- Have a perfect, hand-written copy of each homework assignment within one day after the problems have been discussed in class. Use this to study for exams.

Reading and Homework: We will cover approximately one section per class. You are expected to read the section before class and try to understand which concepts might be difficult for you *and why*. This will help you have questions in mind when you arrive in class and will help you get the most out of class. Almost every day we will have homework problems on the section most recently covered, and these problems should be completed before the following class. After class is over you should re-read the section to make sure everything is completely clear, then do the homework

problems. Expect to spend at least an hour or two working on calculus each day (i.e. 8-12 hours per week). Homework will be turned in and graded through the WebAssign system, so make sure to get a copy of the textbook that has a WebAssign code. If you are having trouble getting WebAssign to accept the specific form of your answer, please do not stress. Instead, email the course TA (readmc_a1@denison.edu) for advice about the way the answer is expected. As a last resort, you can email me and I can manually accept your answer, assuming it is correct. Homework is fairly low-stakes, so it is not worth getting stressed out about. If you are spending more than 1 hour per night on the homework, please seek help (from me, or the TA, or your classmates) and we will find a way to get through it faster.

Collaboration on homework is strongly encouraged, but you should write up your submission yourself, and you should never share answers with classmates who did not work with you to find those answers. I encourage you to come to office hours or seek help from the Course Assistant if you are confused about anything. You will get the most out of this time if you attempt the homework first and come with questions already prepared. **Neither the professor nor the course assistant will give you answers.** Furthermore, Late homework will not be accepted. In consideration for sickness, personal emergencies, etc. I will drop the lowest homework grade.

Labs: Each week, we will have a lab section devoted to learning Sage, a computer algebra system that can do many of your calculations for you. Sage will help you visualize functions of several variables, solve difficult problems with more real-world applications, and guess at the limits of sequences and series via simulation. Each lab will have a written part that you hand in a week later. Each lab will be worth approximately 2-3% of your final course grade.

Late labs will not be accepted. In consideration for sickness, personal emergencies, etc. I will drop the lowest lab grade.

Exams: Each exam will cover material presented in lecture, homework, and the textbook. The final exam will be cumulative. All exams will contain questions taken directly from the homework, so be sure you know how to solve all homework problems and that you understand the concepts presented in the textbook and in class.

Participation and Quizzes: Class meetings will be highly interactive and our goal will be to involve all participants. Attending class, answering questions, and asking questions is therefore essential and will be a significant factor in determining your participation grade. Every day you will receive a participation grade between 0 and 3. In order to get a 3 you should ask or answer a question, either in class or one-on-one. There will also be periodic group exercises which will factor into your participation grade, as will your ability to work well with your partner(s). In a class this small, any absence will be detrimental for the group as a whole, so please make your best effort to arrive on time for every class. There will also be surprise quizzes on the reading, to make sure students are doing the reading before class. There will also be quizzes related to Sage and quizzes (weighted more) in which you solve calculus problems similar to the homework. Note that being able to do a homework problem at home with the book in front of you is much easier than being able to solve it under time pressure. The former skill alone is insufficient to pass the class. Thus, quizzes are the best practice for the exam, and when you study for the exam you should try to replicate the quiz environment.

Grading Scale: A standard 10% grading scale will be used. Therefore, 60% is required to pass the class, 70% will be a C-, 80% will be a B-, and 90% will be an A-.

Course Format: Each class meeting is 50 minutes. Please arrive on time or even early, as we will begin promptly. Class will begin with a review of old material and an introduction of new material. Please take advantage of this review time to ask questions on things which are confusing you. We're all in this together and don't want to leave anyone behind. Note however that because we are on a tight schedule specific questions on homework are best asked before class or during office hours. When we cover new material we will often form small groups to work on problems and then share solutions with the class as a whole. Use this time to diagnose which areas to study more carefully before doing the daily homework.

Communication: It cannot be stressed enough how essential communication is to succeeding in this course. After identifying topics that may be giving you trouble, please communicate this information to me. There's no such thing as a bad or unwelcome question. Additionally, please communicate with each other. I view the class as a team trying to learn the material together. Collaboration will help all parties achieve this goal, as explaining concepts and examples to each other is a great way to learn.

Disability: Any student who feels he/she may need an accommodation based on the impact of a disability should contact me privately as soon as possible to discuss his/her specific needs. I rely on the Academic Support & Enrichment Center in Doane 104 to verify the need for reasonable accommodations based on documentation on file in that office.

Academic Integrity: The students and faculty of Denison University and the Department of Mathematics and Computer Science are committed to academic integrity and will not tolerate any violation of this principle. Academic dishonesty is, in most cases, intellectual theft. It includes, but is not limited to, providing or receiving assistance in a manner not authorized by the instructor in the creation of work to be submitted for evaluation. This standard applies to all work ranging from daily homework assignments to major exams. As is indicated in Denison's Student Handbook, available through my.denison.edu, instructors must refer every act of academic dishonesty to the Associate Provost, and violations may result in failure in the course, suspension, or expulsion. (For further information, see the Academic Misconduct and Sanctions sections of the Student Handbook or Section VII.B. of the Faculty Handbook.)

I expect that you will all abide by the honor code in this course. Please do not use resources outside of me, your fellow students, the tutors, and the textbooks. Collaboration on homework with students in this class is permitted, but you are not allowed to share numerical answers and you should make sure you know how to solve all problems yourself (this is the best preparation for quizzes and exams). Collaboration on quizzes and exams is not permitted. All violations of the honor code will be reported.

Appropriate Use of Course Materials: The materials distributed in this class, including the syllabus, exams, handouts, study aides, and in-class presentations, may be protected by copyright and are provided solely for the educational use of students enrolled in this course. You are not permitted to re-distribute them for purposes unapproved by the instructor; in particular you are not permitted to post course materials or your notes from lectures and discussions online. Unauthorized uses of course materials may be considered academic misconduct.

Email: I will frequently send out emails to the class, so I expect you to check your email regularly. I will also check my email regularly, but often not after 7pm. Please consider emailing the course TA (readmc_a1@denison.edu) for questions related to Sage, labs, or WebAssign.