

MATH 123

syllabus

Fall, 2016

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Office Hours: MWF 1:30 - 3:30, TR 1:30 - 4:30 or by appointment
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Course

This is a course in **single variable calculus**, which is that subset of mathematics concerned with the theory and application of **limits**. Limits are sequences of numbers (or other objects) that either get infinitely close to each other or grow infinitely large. Many crucial mathematical constructions (such as a derivative, an integral, or many familiar functions) are built out of limits. These constructions are often necessary to model the physical world and gain information from it.

For example, a **derivative** is simply the rate of change of one variable with respect to another. This concept is essential to our civilization. Derivatives model real world quantities like **velocity/acceleration, marginal profit, chemical reaction rates, cooling rates, and population growth rates**. Often, derivatives are the *only* way to model real world processes, as we will see when we investigate **differential equations**. Derivatives are also very useful for *optimization*. For example, a profit function is maximized at a price where the marginal profit (derivative) is zero. Derivatives are also important in **statistical optimization**, for example to find the "best fitting" function to a set of multivariable data. Finally, the best methods for **solving equations** (a task that is essential to keep the world running) are based on derivatives.

An **integral** is simply the accumulation of one variable as another variable changes. This models **probability, mass, work/energy, cost, consumer surplus, blood volume, average temperature**, and other important real world concepts. The Fundamental Theorem of Calculus says that these accumulation functions (integrals) are actually **antiderivatives**, a fact that can be used to solve the (very important) differential equations mentioned above.

The words "single variable" mean that we will only consider applications of limits to functions and variables that depend on one input variable. **Math 124** extends these ideas to the multivariable case.

You will note from the above discussion that Calculus is by its very nature *interdisciplinary*. Indeed we will learn many connections with Economics, Biology, Chemistry, Physics, and Statistics.

Audience

This course is intended for students who have successfully completed Math 121, or were placed into Math 123 via the Calculus Readiness Test. Please note that Math 123 is **accelerated** and intended for students who have had calculus or have good precalculus skills. Work ethic and precalculus skill are actually the best predictors of success in calculus. Math 123 is needed if you want to go further and take Math 124 (Multivariable Calculus). All mathematics, data analytics, science, or economics majors should strongly consider taking Math 123 and Math 124.

Book

Calculus: Early Transcendentals 8th edition by Stewart

homework url and ebook text

You need to go to <https://www.webassign.net> and log in with your class key to do the regular homework. This key is **denison 5197 2761 for the 10:30 class** and **denison 6327 0884 for the 11:30 class**. After registering, you will enter the access code you purchased at the bookstore (or online) to get access to the assignments, in class problems, and the ebook version of the text.

Grades and Expectations

The grade will be calculated with the following weights:

- 17 % for each of four tests
- 16 % for homework
- 16 % Final exam

Grade Scale: 90-100 A 78-89 B 66-77 C 50-65 D 0-49 F

Final

The final takes place in our classroom on Tuesday, December 20th, 9-11 p.m. for the 10:30 class and Wednesday, December 21st, 2-4 p.m. for the 11:30 class

Tests

The Tests will occur on **Test #1 Wed, Sept. 21st**, **Test #2 Wednesday Oct 12th**, **Test #3 Thursday Nov 3rd**, and **Test #4 Thursday December 1st** from 7 - 10 on the Olin second floor. The tests will not take more than 2 hours but you may have 3 hours. If you cannot make a night test time you may schedule a time earlier that day. I will find a time for you. You are responsible to understand everything said in class or written in the text for the sections covered as well as every problem assigned. Note that “understand” does not mean “memorize” and problems on the test will not be completely identical to homework problems.

Homework

There are two types of homework. Unlike tests, you may work together on homework.

1. **Online homework** will be assigned using WebAssign. These problems are at easy to medium levels of difficulty and you get ten attempts. I will spot you 20 % so If you get 80 % correct or more you get 100 % credit. This work makes up 70 % of the homework grade.
2. Challenge homework: A few challenging problems are assigned each week on non test weeks to be completed on paper and turned in. This comprises the other 30 % of the homework grade

Tutors

You will be assigned student tutors for the class. They will be in Olin 215 from 7 - 10 on Sunday and in class on Tuesdays. You can also request tutors through Academic support, and (of course) you may see me for help.

Late Work

Late tests will receive a 20 % point penalty per day late unless there is a written note (such as a note from Whistler) that verifies a VERY strong excuse (such as illness or important sports team events). Late quizzes and homework are not accepted at all without a similar excuse.

Office Hours

Please come to office hours so I can help you and get to know you!

Disabilities

Any student who feels he or she may need an accommodation based on the impact of a disability should contact me privately as soon as possible to discuss his or her specific needs. I rely on the Academic Support and Enrichment Center in 104 Doane to verify the need for reasonable accommodations based on documentation on file in their 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 honesty, the cornerstone of teaching and learning, lays the foundation for lifelong integrity.

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. Students must clearly cite any sources consulted, not only for quoted phrases but also for ideas and information that are not common knowledge. Neither ignorance nor carelessness is an acceptable defense in cases of plagiarism. It is the students' responsibility to follow the appropriate format for citations.

Proposed and developed by Denison students, passed unanimously by DCGA and Denison's faculty, the Code of Academic Integrity requires that instructors notify the Associate Provost of cases of academic dishonesty, and it requires that cases be heard by the Academic Integrity Board. Further, the code makes students responsible for promoting a culture of integrity on campus and acting in instances in which integrity is violated.

For further information about the Code of Academic Integrity see <http://www.denison.edu/about/integrity.html>

Topics and Schedule

Week 0: 2.2, 2.6 Limits and infinity

Week 1: 2.5, 2.7, 2.8 Limits, Continuity, Discontinuity, Derivatives, Polynomials and Exponential Functions

Week 2: 2.7, 2.8, 3.2, 3.3, 3.4 More Derivatives, Product Rule, Quotient Rule, Trigonometric Functions, Chain Rule

Week 3: 3.3, 3.4, 3.5, 3.6 More Trigonometric Functions, More Chain Rule, **Test #1 Wed, Sept. 21st**, Implicit Differentiation and Logarithms

Week 4: 3.5, 3.6, 3.7, 3.8, 9.2 More Implicit Differentiation, More Logarithms, Rates of Change in Science and Social Science, Exponential Growth and Decay, Differential Equations

Week 5: 9.3, 9.4, 4.1, 4.3 More Differential Equations, Maximum and Minimum Values, Derivatives and the Shape of a Graph

Week 6: 4.1, 4.3, 4.4 More Max/Min, Shape of a Graph, **Test #2 Wednesday Oct 12th**, L'Hopital's Rule

Week 7: 4.4, 4.5, 4.7 More L'Hopital, Curve Sketching, Optimization

Week 8: 4.7, 4.8 More Optimization, Newton's Method

Week 9: 4.8, 5.1 More Newton, Area, **Test #3 Thursday Nov 3rd**

Week 10: 5.2, 5.3, 5.4 The Definite Integral, Fundamental Theorem of Calculus, Indefinite Integrals and the Net Change Theorem

Week 11: 5.4, 5.5, 6.3, 6.4 More Net Change Theorem, Substitution Rule, Work/Energy, Average Values

Thanksgiving Break

Week 12: 6.3, 6.4, 7.1 More Work/Energy, More Average Value, Integration by Parts, **Test #4 Thursday December 1st**

Week 13: 7.1, 8.4, 8.5 More Integration by Parts, Applications to Economics and Biology, Probability

Week 14: 8.5 More Probability, Course Review