Math 1101 Calculus I Section 002 (5 cr)

Meeting Time: Spring 2014 MWF 11:45–12:50 and Thu 10:00–11:40 in Sci 3510
Instructor: Barry McQuarrie
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Office Hours:
Email: mcquarrb@morris.umn.edu (preferred communication) Phone: (320) 589–6302 (I do not use voicemail)
Course moodle site: https://ay13.moodle.umn.edu/course/view.php?id=9205

Course UMM Student Learning Outcomes

Knowledge of Human Cultures and the Physical and Natural World through:

- SLO-1a.(R) Core studies in the liberal arts: mathematics
- SLO-1b.(R) In-depth study in a particular field: its schools of thought, advanced theories, language, and methods of inquiry

Intellectual and Practical Skills, practiced extensively across students college experiences, including:

- SLO-2a.(R) Inquiry and Analysis
- SLO-2b.(R) Critical thinking and problem-solving
- SLO-2d-1.(I) Written
- SLO-2e.(R) Quantitative literacy
- SLO-2f.(R) Information and technology literacy
- SLO-2g.(R) Collaboration

Capacity for integrative learning, including:

- SLO-4b.(R) Application of knowledge, skills, and responsibilities to new settings and progressively more complex problems
- SLO-4c.(R) Skills for sustained learning and personal development

Course Prerequisites: Precalculus

To succeed in this course you will need to have mastered basic algebra, trigonometry, and have a solid foundation of working with functions and functional notation. You should also be comfortable working both graphically and algebraically with basic function types (polynomials, rational, exponentials, logarithms, trig functions, etc.).

There is a WeBWorK assignment called "Prerequisite Algebra Review" that is due the first week of class. If you do not complete it satisfactorily, I will ask you to meet with me, because if you have difficulty with those questions you will have difficulty with this course.

Learning Objectives

The primary goals of a student taking this course are to

- learn how to work with limits, including the limit laws and indeterminant forms,
- learn how the concept of a derivative can be defined in terms of a limit,
- understand and apply various aspects of differentiation, including:
  - derivatives of common functions,

  - rules of differentiation (product rule, quotient rule, power rule, chain rule, etc.) and their application to complicated functions,
  - special techniques of differentiation (implicit differentiation, logarithmic differentiation, approximate differentiation, etc.),
  - applications of derivatives in other fields
- understand how the concept of areas under curves leads to the concept of an integral,
- understand how integrals and derivatives are related (The Fundamental Theorem of Calculus),
- be able to evaluate certain classes of integrals (antiderivatives of basic forms, substitution rule)
- extend the concepts of functions and derivative to higher dimension (surfaces in three dimensions, partial derivatives),
- gain fluency in a powerful computer algebra system, *Mathematica* (this entails learning some of the syntax of *Mathematica*).

Beyond the curriculum, you should also expect to

- develop skill at presenting solutions to problems,
- think beyond technique, and understand the problems studied in some depth,
- develop confidence in your problem solving skills,
- see the benefit of computers to aid calculation, but also see the *absolute necessity* of understanding the theory completely before using a computer.

Time Commitment

University policy says "one credit is defined as equivalent to an average of three hours of learning effort per week (over a full semester) necessary for an average student to achieve an average grade in the course". Our course is a five-credit course, meeting approximately five hours per week: 5 credits times 3 hours/week/credit - 5 hours/week in lecture = 10 hours/week outside class. Thus, you are expected to spend 10 hours per week working outside of class, reading the textbook and working problems.

Please make the most of my office hours! The content of the course can be difficult at times and I expect to see you all in my office at some time or other. To get the most out of the course you should

- do homework every day (more on this later),
- allot time to think about what it is we are doing,
- discuss the techniques we are studying and their implementation with your classmates,
- discuss any difficulties with me during office hours.

Textbook

The required textbook is James Stewart Single Variable Calculus, early transcendentals 7th, 6th or 5th Ed–the bookstore will have the 6th Edition, and the course calendar is based on the 6th Edition. The differences between the editions is minimal, but if you use an earlier edition be aware that some of the sections may be numbered differently, content may be slightly different, and problems listed as practice below may not line up with your older edition. We will be covering Chapters 1–5 from this book. As well, I will provide some notes for our look at multivariable functions and the derivatives.

We will be using the computer algebra system (CAS) *Mathematica*. This program is not described in our text. Rather you will be learning it as you go in class, using resources I will provide.

Course Components

I am demanding that solutions be written up well. This means solutions should be a self-contained document. They should be written legibly, contain diagrams or tables where appropriate, and should state the problem and explain the solution. Interspersing English sentences which explain what you are doing can help in this regard. With its worked-out examples, the book provides many examples of a good solution. There are also examples in the homework in the course calendar below. To say it in a more concrete way, *solutions with totally correct computations lacking in necessary good explanations will tend to receive a B, not an A.* We will be discussing the importance of communicating your results in more detail at various times in the course.

The course is hosted on a moodle site, and organized by week. For each topic you have a few days to learn the material and ask questions.

Textbook. The book presents the material we will be learning in an organized and comprehensive way. You should try to understand the main point of a given section before coming to the corresponding class.

Class periods. We meet four times a week in Sci 3510. Class periods will be a mixture of activities. I will lecture on some of the high points of the section. I will work out solutions to problems like your homework problems. Generally we will do a fair amount of work using *Mathematica*. I will be asking the class questions and you should always feel free to ask questions throughout the class period. It is important that you attend lectures because announcements regarding the class (upcoming tests, possible take-home assignments or homework, etc.) will be made in class, and assignments are due in class. *If you miss a lecture it is your responsibility to find out what you have missed–start by looking at the course moodle site.*

Practice. Practice questions will not be collected. Mastery of the topics we study will only come with practice, making homework beyond the graded WeBWorK and Homework a crucial component of our course. Every day when we cover a new section there are example problems with complete solutions available on the course moodle site. You should faithfully write out solutions to many of these ungraded homework problems, before the next class begins! If you're wondering where to put in those ten weekly out-of-class hours, this is the main place! Although only a few practice questions are suggested for each lecture, you should do as many problems as needed to understand the day's lecture.

WeBWorK. You will be completing some assignments using the online homework utility WeBWorK, which you can learn more about on the course moodle site. The WeBWorK problems are provided to give you practice implementing the computational techniques we will be studying, although occasionally a problem will be more theoretical in nature. WeBWorK is assigned by section, and typically contains 5-7 problems and due the evening we cover the material in class. If you do not start the WeBWorK early, you will have difficulty completing it! Due dates are available in WeBWorK.

Not all types of problems you will see on tests are represented in WeBWorK, so it is important to also be reading the text and doing example problems that are not graded.

Graded Handwritten Homework. Every Thursday you will turn in handwritten solutions to a few homework problems that were assigned the previous week. Some Thursdays I may have you complete a problem in class that is turned in with the homework (if I ask you to do it without reference to your notes, this would give you practise answering questions in a test environment). On weeks where we have tests, you will turn in homework on Wednesday so I can post solutions before the test. It is important in mathematics to be able to clearly explain your thought process in solutions, and the homework will allow me to give you feedback on your entire solution (not just the final answer, which is all WeBWorK cares about for the most part).

Tests. There will be five in-class tests and then a cumulative final. All tests (including the final) will be no-aid tests, and you will not be allowed to use calculators or *Mathematica*. All the tests will emphasize the assigned

homework problems. Also there may be questions similar to the concept-check questions and true-false quizzes.

Applied Projects. There will be a few applied projects you will work on during the semester. These are meant to give you a chance to see calculus in action, outside of the bounds of specific questions. The applied projects will be handed out in class, and are due on the dates shown on the course moodle site. You may work in groups of up to four people on the applied projects, and each group turns in one solution. Each group member will receive the same grade. Your groups can change for each applied project you do. The solutions for the applied projects must be well explained, written legibly and use correct mathematics.

Mathematica. We will be learning *Mathematica* as the semester progresses. *Mathematica* is a powerful computer algebra system that can do far more than a calculator. The skills you acquire when you learn *Mathematica* will translate to other technologies, and other areas of your life. If you are a math major, *Mathematica* is used throughout UMM's math major in virtually all of our courses to some extent, so this introduction will prepare you to do very interesting things with it later on in your academic career. If you are not a math major, studying *Mathematica* is an important aspect of understanding mathematics in a liberal arts setting–computation and using tools like *Mathematica*, maple, fortran, C, C++, Java, MuPad, SAS, Origin, etc, are increasingly an important part of mathematics. *Mathematica* will never do our thinking for us. It will help us understand concepts and answer questions that would be difficult to answer if we were working the solution out solely by hand. Our goal in Calculus II is to become fluent in basic *Mathematica* syntax.

Grading

The University utilizes plus and minus grading on a 4.000 cumulative grade point scale in accordance with the following:

A	4.000	Represents achievement that is outstanding relative to the level necessary to meet course requirements
A−	3.667	
B+	3.333	
B	3.000	Represents achievement that is significantly above the level necessary to meet course requirements
B−	2.667	
C+	2.333	
C	2.000	Represents achievement that meets the course requirements in every respect
C−	1.667	
D+	1.333	
D	1.000	Represents achievement that is worthy of credit even though it fails to meet fully the course requirements
S		Represents achievement that is satisfactory, which is equivalent to a C- or better

The grade for the course will be calculated by the following formula (there is no extra credit):

Applied Projects (Feb 10, Mar 17, Apr 7, Apr 28)	10%
Homework (due weekly every Thu, except when we have tests when it is due Wed)	15%
Tests (Jan 30, Feb 13, Mar 6, Apr 3, Apr 17)	40%
WeBWorK (see WeBWorK for exact due dates; typically every Tue, Thu, Fri, Sat at 11pm)	15%
Final Exam (Mon May 5 11:00am-1:00pm Sci 3510)	20%

Your numerical grades will be converted to letter grades and finally Grade Points via the following cutoffs (grades are not rounded up):

Numerical	95.0%	90.0%	87.0%	83.0%	80.0%	77.0%	73.0%	70.0%	65.0%	60.0%	Below 60.0%
Letter	A	A−	B+	B	B−	C+	C	C−	D+	D	F
Grade Point	4.000	3.667	3.333	3.000	2.667	2.333	2.000	1.667	1.333	1.000	0.000

A Healthy Learning Environment

- **Attendance.** Attendance does not count towards your final grade, but missing class means you don't get the benefit of what we do in class, so please come to class and make sure to be in class on time. Neither I nor your fellow classmates enjoy the disruption late arrival causes. I know that situations crop up that will entail late arrival (please come even if you are late!) but try to ensure it is the exception and not the rule. Buy an alarm clock with a battery backup, as the power often goes out for a moment in Morris. If you are coming from another class and fear you may be late often, just let me know and don't stress about it. If you need to leave class early, let me know before class and slip out as unobtrusively as possible.
- **Computers/Cell Phones.** During class, cell phones and music devices should be turned off, and headphones removed from ears. If I find you are surfing the internet during class I will ask you to leave.
  http://policy.umn.edu/Policies/Education/Education/STUDENTRESP.html
- **Personal Conduct In Class and Online.** Be mindful of your peers around you, and keep stray chatter in class to a minimum. In the discussion forums and email communications, please consider the tone of your writing. We must maintain a respectful, open environment if we hope to have effective forum discussions. Also, make sure to use correct grammar, spelling, and punctuation in all your electronic communications. The UMM Student Conduct Code is available at www1.umn.edu/regents/policies/academic/Student_Conduct_Code.pdf
- **Academic Dishonesty.** Cooperation is vital to your future success, which ever path you take. I encourage cooperation amongst students where ever possible, but the act of copying or other forms of cheating will not be tolerated. Academic dishonesty in any portion of the academic work for a course is grounds for awarding a grade of F or N for the entire course. Any act of plagiarism (presenting the ideas, words, or work of someone else as your own) that is detected will result in a mark of zero on the entire assignment or test for both parties. I will make it clear during class what is appropriate collaboration for each activity, but if you still have questions about what constitutes academic dishonesty, please come and talk to me. UMM's Academic Integrity policy and procedures can be found at www.morris.umn.edu/committees/scholastic/academicintegrity/.

  Academic Dishonesty FAQ: http://www.oscai.umn.edu/integrity/student/index.html
- **Late Work/Missed Exams.** Since the assignments are handed out days in advance, only under exceptional circumstances (which can be officially documented) will I accept late work. You will receive a mark of zero if an assignment is submitted late. **However, please talk with me asap (do not wait until the next class) if you missed turning something in, even if it is after the deadline.** If an assignment is partially complete but you are not granted an extension, still submit the work you have completed so you can earn some partial credit. This is far preferable to earning zero on the assignment by not submitting anything.

  If you are going to miss a test (for a documented reason), let me know in advance so we can work out alternate plans. If you unexpectedly miss an exam/quiz/etc for a documentable reason, get in touch with me asap so we can work out alternate arrangements, or schedule a make-up.

  Assignments are due in class (come to class and turn them in). Slipping assignments into my mailbox or under my office door while I am teaching your course is **severely frowned upon** unless we have agreed that you will be doing this.
- **Your Health.** As a student you may experience a range of issues that can cause barriers to learning, such as strained relationships, increased anxiety, alcohol/drug problems, feeling down, difficulty concentrating, and/or lack of motivation. These mental health concerns or stressful events may lead to diminished academic performance or reduce a student's ability to participate in daily activities. If you have any special needs or requirements to help you succeed in the class, come and talk to me as soon as possible, or visit the appropriate University service yourself. You can learn more about the range of services available on campus by visiting the websites:
  - The Academic Assistance Center www.morris.umn.edu/services/dsoaac/aac/
  - Student Counseling www.morris.umn.edu/services/counseling/
  - Disability Services www.morris.umn.edu/services/dsoaac/dso
  - Multi-Ethnic Student Program www.morris.umn.edu/services/msp/

Other Policies

- **Makeup Work for Legitimate Absenses.**
  http://policy.umn.edu/Policies/Education/Education/MAKEUPWORK.html.
- **Appropriate Student Use of Class Notes and Course Materials.**
  http://www.policy.umn.edu/Policies/Education/Education/STUDENTRESP.html.
- **Student Conduct.**
  http://www1.umn.edu/regents/policies/academic/Student_Conduct_Code.html.
- **Sexual Harassment.**
  http://www1.umn.edu/regents/policies/humanresources/SexHarassment.html.
- **Equity, Diversity, Equal Opportunity, and Affirmative Action.**
  http://www1.umn.edu/regents/policies/administrative/Equity_Diversity_EO_AA.html.
- **Academic Freedom and Responsibility**.
  http://www1.umn.edu/regents/policies/academic/Academic_Freedom.pdf.

Topics

- 1.1 Four Ways to Represent a Function
- 1.2 Mathematical Models: Catalog of Essential Functions
- 1.3 New Functions from Old Functions
- 1.4 Graphing Calculators and Computers
- 1.5 Exponential Functions
- 1.6 Inverse Functions and Logarithms
- 2.1 Tangent and Velocity Problems
- 2.2 The Limit of a Function
- 2.3 Calculating Limits Using Limit Laws
- 2.5 Continuity
- 2.6 Limits at Infinity; Horizontal Asymptotes
- 2.7 Derivatives and Rates of Change
- 2.8 The Derivative as a Function
- 3.1 Derivatives of Polynomial and Exponential Functions
- 3.2 The Product and Quotient Rules
- 3.3 Derivatives of Trig Functions
- 3.4 The Chain Rule
- 3.5 Implicit Differentiation
- 3.6 Derivatives of Logarithmic Functions
- 3.7 Rates of Change in Natural and Social Sciences
- 3.9 Related Rates
- 3.10 Linear Approximation and Differentials
- 4.1 Maximum and Minimum Values
- 4.2 The Mean Value Theorem
- 4.3 How Derivatives Affect Shape of Graph
- 4.4 Indeterminant Forms and l'Hospital's Rule
- 4.5 Summary of Curve Sketching
- 4.7 Optimization
- 4.8 Newton's Method
- 4.9 Antiderivatives
- 5.1 Areas and Distances
- 5.2 The Definite Integral
- 5.3 The Fundamental Theorem of Calculus
- 5.4 Indefinite Integrals and Net Change Theorem
- 5.5 Substitution Rule
- 10.1 Parametric Equations
- 10.2 Tangents and Areas
- Handout: Surfaces and Traces
- Handout: Space Curves and Contour Plots
- Handout: Partial Derivatives
- Handout: Extrema