

Department of Mathematical and Statistical Sciences
College of Science
Clemson University

MATH 1060-300 (Architecture)
Calculus of One Variable I

Fall 2019
MTWF 8:00–8:50am
Martin Hall, Room M-104 (M-202 on Tuesdays)

Instructor: Matthew Macauley, Associate Professor.

Contact: Martin Hall, Room O-325; macaule@clemson.edu; 656-1838 (no voicemail).

Office hours: MWF 8:55–9:55am, or by appointment (see details below).

Course website: We will rarely use Canvas except to upload slides that contain copyrighted material. Everything else will be made available on the course website:

http://www.math.clemson.edu/~macaule/classes/f19_math1060/

Course Description: It is no a coincidence that historical periods of heightened intellectualism have witnessed the synergistic flourishing of mathematics, the arts and humanities, and architecture. The Ancient Greeks are known as much for Euclid’s *The Elements* as they are for the writings of the Plato and Socrates, the grandeur of the Parthenon and Acropolis, and the art that adorned it. The European Renaissance produced artist and mathematician Leonardo da Vinci, as well as Newton and Leibniz, who invented the Calculus. The architecture of this period exhibits beauty while emphasizing visually pleasing mathematical concepts such as geometric structure and proportion. Though the traces of these ideas date back to ancient times, they were inspired by the inherent beauty and harmony of mathematics that drew people like da Vinci, Newton, and Leibniz to their scholarship. It is unfortunate that in modern times, Calculus is taught without a historical context, and without an emphasis of the beauty that lies within.

This class will attempt to buck that trend. It is primarily a mathematics course, and students will still learn the main ideas from Calculus I and the first part of Calculus II in the same level of rigor as they would in an engineering course. This should *not* be thought of as a “light” version of calculus, but rather a more fun version, with a particular appeal to students in the arts, architecture, and humanities. We will begin with a historical tour of math and architecture, starting with the ancient Babylonians and Egyptians, to the ancient Greeks and Romans, and up to modern times. That will lead us to the concept of infinity and the infinitesimal, which in turn, will lead us to calculus. The middle portion of this class will resemble many typical Calculus classes, but in the last few weeks, we will apply what we learned to historical architectural structures. In particular, we will use calculus to compute the weight of the Hagia Sophia in Istanbul, the volume of the Roman Pantheon, and to understand mathematically why the St. Louis arch is an “ideal arch.”

Prerequisite: Score of 80 or better on the Clemson Mathematics Placement Test.

Textbooks: As a first generation college student, I am acutely aware of the struggle that many students face due to overly expensive course materials, and I do my best to support (freely available) *Open Educational Resources*. You do not need to purchase any books for this class. I will utilize the following:

Mathematical Excursions to the World's Great Buildings, by Alexander J. Hahn. Princeton University Press, 2012. [E-book is freely available from the Clemson University Library](#).

Ideas of Calculus, by J.F. Fleron, P.K. Hotchkiss, and C. von Renessee with V. Ecke. Published online in the *Discovering the Art of Mathematics* project on *Mathematical Inquiry in the Liberal Arts*. 2015. [Freely available online](#).

Active Calculus 2.0, by M. Boelkins, D. Austin, and S. Schlicker. CreateSpace Independent Publishing Platform, 2018. [Freely available online](#).

APEX Calculus, by G. Hartman. CreateSpace Independent Publishing Platform. 4th edition, 2018. [Freely available online](#).

Calculus as a Liberal Art, by W.M. Priestley. Springer, 1998. [Not necessary to obtain](#).

Finally, with the exception of the specific applications to architecture, *all* of the fundamental Calculus topics that we will cover are mainstream. They should be in *any* Calculus textbook, and given that it's 2019, there are plenty of supplemental online resources that can easily be Googled.

Homework: Most homework will be assigned using the open source program WeBWork, freely available online at https://webwork.science.clemson.edu/webwork2/MATH_1060-300/. Late assignments will NOT be accepted, so plan ahead!

Schedule: I will post the weekly schedule on the course website so you can keep track of which topics we covered, and to which Chapters they correspond to in the *Active Calculus* book.

Quizzes: There will be a number of short quizzes. Some will be announced and others will be spontaneous. I will drop your lowest 2 quiz grades. To encourage you to stay at home and rest if you're sick, I will drop an additional quiz grade if you miss one. *Because of this, there will be no make-up quizzes.*

Exams: There will be 2 in-class midterm exams, and one final exam. I will drop either your lowest midterm or one-half the final exam's weight. All exams will be closed notes and closed book.

Office Hours & Communication Strategy:

My "official" office hours are between my MWF 8am and 10am classes. However, I am around *a lot* more often than that. I am on campus almost every day and my door is usually open when I am in my office. You are welcome to stop by anytime, though I do have sporadic meetings, seminars, etc. Alternatively, you can email me for an appointment. If you send me an email with a block of available times, I will pick from one of those and put in on my Google calendar.

Email is the best way to reach me. I have not set up voicemail on my phone. The best use of a phone call is as a quick way to see if I'm in my office, in case you're thinking of stopping by.

Though I have the Gmail app, I do not get email notifications on my phone. However, I check it multiple times a day. *If you send me an email and I do not get back to you within 24 hours, please re-send it again as a reminder* – just click "Reply", then "Send"; no need to add any more text. The most common explanation for such a lapse is an email that requires a thoughtful response that gets put aside, and then buried in my inbox. Emails sent after 9pm may not get replies until the next day. Also, sometimes I don't check email on Saturdays.

Tutoring: The *Academic Success Center* holds free tutoring sessions for Math 1060, six days a week. The current weekly schedule can be found here: <https://www.clemson.edu/asc/courses/tutoring/index.html>.

Attendance: Please make an effort to attend all classes, and to be on time. After the first few weeks when I learn everyone's name, I will take attendance. Everybody will get an attendance scores of 0–5, and this will be 5% of your final grade. In other words, a 0 (e.g., only showing up for announced quizzes) will drop your final grade by 5 percentage points.

It is rare, but I have been late to 8am classes due to accidents on Highway 123. In the unlikely scenario that I am absent 5 minutes after class has started, check your email. If you have not heard from me 10 minutes after class has begun, you may assume that class has been canceled.

Academic continuity plan: If class is canceled due to celestial powers (e.g., hurricane, snow day, power outage, football), I will assign video lecture(s) as a make-up.

Technology in class: One particular study on multitasking showed that students on laptops score 11% lower than those not on laptops. Moreover, students who were not on laptops but had a laptop in their “line of sight” scored *17% lower!* Therefore, the use of laptops and cell phone in class will not be allowed. Tablets may be used *only* for taking notes, and must be in Airplane Mode.

Grading: Your final grade will be computed as follows:

Homework	20%
Attendance	5%
Quizzes	15%
Midterm 1	20%
Midterm 2	20%
Cumulative Final Exam	40%

I will drop either your lowest midterm grade, OR half the weight of the final exam; whichever is lowest. Also, if you get at least an A or B on the final exam, then you will get at least that grade in the course, *assuming you have a passing grade on the homework.*

Make-Up Policy: No make-up exams will be given. I will drop your lowest midterm, which means that if you miss a midterm, then your final exam grade will replace it. The homework deadlines will not be extended for individual students, and assigned homework must be turned in by the deadline.

Student Learning Outcomes: Upon successful completion of the course, students will be able to:

Describe the role of mathematics and architecture in a number of advanced societies, from the ancient Babylonians, Egyptians, to the Greeks, and Romans, to the Renaissance, to modern day.

Explain the significance of the infinite and the infinitesimal to calculus, architecture, and philosophy, and what these all have in common.

Compute derivatives of a wide variety of single-variable functions.

Use differential calculus to solve optimization problems.

Apply the Fundamental Theorem of Calculus to relate the rate of a function to its cumulative sum over an interval.

Apply integration techniques (e.g., integration by parts, trigonometric integrals, trigonometric substitution, partial fractions, and improper integrals) to evaluate integrals, with applications in engineering and science.

Use calculus to analyze architectural structures such as domes and arches.

Key Dates

Aug 21 (Wed)	Classes begin; late enrollment fee applies
Aug 27 (Tues)	Last day to register or add a class
Sep 3 (Tue)	Last day to drop a class or withdraw from the University without a W grade
Oct 14-15 (M-Tu)	Fall break
Oct 29 (Tue)	Last day to drop a class or withdraw from the University without final grades
Nov 27-29 (W-Fr)	Fall break
Dec 6 (Fri)	Last day of class
Dec 9 (Mon)	Final Exam, 11:30–2:00pm
Dec 19 (Thu)	Graduation

Social media: If you want to connect with me on Social Media, then use LinkedIn. I will not accept friend requests on Facebook, there is just too much potential for risk and liability all around.

Academic Integrity: “As members of the Clemson University community, we have inherited Thomas Green Clemson’s vision of this institution as a ‘high seminary of learning’. Fundamental to this vision is a mutual commitment to truthfulness, honor, and responsibility, without which we cannot earn the trust and respect of others. Furthermore, we recognize that academic dishonesty detracts from the value of a Clemson degree. Therefore, we shall not tolerate lying, cheating, or stealing in any form.”

Special Accommodations: Students with disabilities who need accommodations should make an appointment with Dr. Arlene Stewart, Director of Disability Services, to discuss specific needs within the first week of classes. Students should present a Faculty Accommodation Letter from Student Disability Services when they meet with instructors. Student Disability Services is located in Suite 239 Academic Success Building (656-6848; sds-1@clemson.edu). Please be aware that accommodations are not retroactive and new Faculty Accommodation Letters must be presented each semester.

Title IX: Clemson University is committed to a policy of equal opportunity for all persons and does not discriminate on the basis of race, color, religion, sex, sexual orientation, gender, pregnancy, national origin, age, disability, veterans status, genetic information or protected activity (e.g., opposition to prohibited discrimination or participation in any complaint process, etc.) in employment, educational programs and activities, admissions and financial aid. This includes a prohibition against sexual harassment and sexual violence as mandated by Title IX of the Education Amendments of 1972. The policy is located at <http://www.clemson.edu/campus-life/campus-services/access/non-discrimination-policy.html>. Alesia Smith serves as Clemsons Title IX Coordinator and may be reached at alesias@clemson.edu or (864) 656-3181.

Copyright Statement: Some of the materials in this course are possibly copyrighted. They are intended for use only by students registered and enrolled in this course and only for instructional activities associated with and for the duration of the course. They may not be retained in another medium or disseminated further. They are provided in compliance with the provisions of the Teach Act. Refer to the Use of Copyrighted Materials and “Fair Use Guidelines” policy on the Clemson University website for additional information: <http://clemson.libguides.com/copyright>