MA-111-B: Calculus I - Fall 2024 Syllabus
Department of Mathematics, Albert Nerken School of Engineering
The Cooper Union for the Advancement of Science and Art

Instructor	Robert Smyth, Professor, Mathematics. See `faculty.cooper.edu/smyth` for office hours and contact information.
Class Hours	Tuesdays 6-7:50 PM (Room 506), Wednesdays 3-5:50 PM (Room 506)
Catalog Description	Functions; limit of functions, continuity. The derivative and its applications: curve sketching, maxima and minima, related rates, velocity and acceleration in one dimension; trigonometric, exponential, logarithmic and hyperbolic functions. Definite and indefinite integrals; area, the fundamental theorem, techniques of integration. *4 credits. Prerequisite: none*
Textbook	Thomas, Weir, and Hass, "Thomas' Calculus", 12th edition, Pearson (2009), ISBN-13: 978-0321587992
Tech Companion	`faculty.cooper.edu/smyth/TechCompanion/Calc1/TechCompanion_Calc1.htm`
Course Objectives	1. Develop the rigorous defintion of a limit of a function and apply it to prove limits and basic theorems about limits. 2. Define the derivative and apply it to mathematical and scientific problems. 3. Prove elementary results of differential calculus. 4. Study a repertoire of elementary functions used in mathematics, science, and engineering. 5. Motivate and define the definite integral. 6. Prove the mean value theorem for definite integrals and the fundamental theorem of calculus. 7. Develop various techniques of integration.
Course Topics	1. Real numbers and the real line. Functions and their graphs. Combining functions; shifting and scaling graphs. Trigonometric functions. 2. Rates of change and tangents to curves. Limit of a function and limit laws. The precise definition of a limit. One-sided limits. 3. Continuity. Limits involving infinity; asymptotes of graphs. Oblique asymptotes (general case). 4. Tangents and the derivative at a point. The derivative as a function. Differentiation rules. The derivative as a rate of change. 5. Derivatives of trigonometric functions. The chain rule. Implicit differentiation. Related rates. 6. Linearization and differentials. Extreme values of functions. The mean value theorem. Monotonic functions and the first derivative test. 7. Inverse functions and their derivatives. Inverse trigonometric functions. L'Hôpital's rule I (basic indeterminate forms and the Cauchy mean value theorem). Concavity and curve sketching. 8. Applied optimization. Newton's method. Antiderivatives. Area and estimating with finite sums.

9. Sigma notation and limits of finite sums. The definite integral. The fundamental theorem of calculus.

10. Indefinite integrals and the substitution method. Substitution and area between curves. Natural logarithms. Exponential functions.

11. Exponential change and separable differential equations. L'Hôpital's rule II (exponential indeterminate forms).

12. Hyperbolic functions. Relative rates of growth. Integration by parts. Trigonometric integrals.

13. Trigonometric substitutions. Integration of rational functions by partial fractions. Integral tables and computer algebra systems.

14. The substitution $z = \tan(x/2)$. Numerical integration. Improper integrals.

Tutoring   Tutoring is available for this course both through the Math Help Room (Rm 409, 9/9-12/10, M 7-8pm, T 4-5pm, Th 1-2pm), and via individual tutoring. Click `here` for current scheduling information for one-on-one tutoring.

Assessment   Your term grade will be determined by homework (8%), three midterms (20% each) and a cumulative final exam (32%). Homework problems and due dates are listed online at `faculty.cooper.edu/smyth/ma111new/hw.htm`. The exams will test your familiarity with the principles of the subject with routine problems and your ability to extrapolate creatively from these principles on challenging problems. See the section on **Grades of Record** at `cooper.edu/engineering/curriculum/academic-standards-regulations` for the letter grades used for this course and their proper interpretation. The exam schedule is posted at `http://faculty.cooper.edu/smyth/ma111new/ma111.htm`.

Homework Policies   You may work individually or in groups of at most three students. A group must make a single joint submission with all team members listed at the top of the front page. In the case of a group submission all members will receive the same grade for the assignment. You should make sure you understand all the solutions your team is submitting, even if other team members came up with them. Any assistance you (or your group) receives and all sources you use in preparing your homework assignments must be properly credited in writing on your submission. Groups may be re-formed on an assignment-by-assignment basis. Homework assignments must be submitted at the beginning of the class period on the assignment due date. Each assignment includes all problems from the list at `faculty.cooper.edu/smyth/ma111new/hw.htm` not previously submitted up to and including those pertaining to the last section completed as of the end of the week *before* the assignment due date. Select problems from each assignment will be graded according to the rubric posted at `faculty.cooper.edu/smyth/ma111new/calcHWgradingRubric.pdf`. Credit will not be awarded for late submissions. However your lowest homework grade will be dropped.

Exam Policies   All exams are closed book / closed notebook exams. You may use a basic scientific calculator, but no graphing or programmable calculators, computers, cellphones, books, notebooks, or other resources may be used. Bring a pencil or pen on the day of the exam. Paper will be provided. Exams are timed. Your score may be reduced if you do not stop working on your exam after time has been called. If you choose to leave the exam room during the exam period you will not be permitted to resume working on the exam after returning. Registered students must sit for the course

examinations on the scheduled day and time. Failure to do so will generally result in forfeiture of the percentage credit allotted to the missed exam. Students who have medical excuses for missing an exam should contact the Dean of Students promptly. Failure to register a request for a medically excused absence in a timely manner with the Dean of Students may complicate and potentially invalidate the request. Any student requesting a medically excused absence must provide the Dean of Students with documentation from a medical provider justifying the absence. The Dean of Students will inform me when an absence is due to a valid medical issue/condition so that the absence can be considered excused. In the event of an excused absence, the student must schedule an oral makeup exam with me as soon as is possible.

ADA
Accommodations   If you believe you are entitled to an accommodation through the Americans with Disabilities Act you must self-identify to the Office of Student Affairs, and meet with me during the first or second week of the term to discuss arrangements for meeting your accommodation. You should either come to this meeting with a copy of your Accommodation Verification Letter from the Office of Student Affairs, or email a copy to me *prior* to the meeting. Cooper Union has limited resources and extra time may be required for accommodation arrangement to be feasible. If you are entitled to an accommodation on exams, you must confirm exam accommodation requests with me (by email) promptly after our meeting discussing your Accommodation Verification Letter. Students will not be afforded any special accommodations retroactively, i.e., for academic work completed prior to disclosure of the disability to me. Support services for students are described `here`.