MA 200, Calculus I, Section 1
Worcester State University, Spring 2020

**Instructor:** Hy Ginsberg
email: hginsberg@worcester.edu
office: S-145C
office hours:
Tuesdays 1:00 – 2:00, Wednesdays 11:00 – 12:00, Fridays 11:00 – 12:00,
and by appointment or luck (you are welcome to stop in anytime).
website: http://www.hyginsberg.com

**Meetings:** MWF 8:00 – 9:10, S-118.

**Prerequisites:** MA 190 with a grade of at least C-, or math placement code 7.

Note that credit will not be awarded for both this class and MA 202, Business Calculus.

**Content:** This course is an introduction to differential and integral calculus. We will study limits and continuity, differentiation and integration of functions, as well as applications to optimization, related rates, and area. See the "Approximate Schedule" and "Student Learning Outcomes" sections for details.

**Text:** There is no required textbook, but you will probably find it useful to have one anyway, for reference (and additional exercises).

The library has 56 copies of one of the best calculus texts (various similar editions by James Stewart) available at the reserve desk. Most of these can be checked out for the entire semester (they may keep a few on 2-hour reserve).

If you would prefer to buy your own textbook, there are many excellent older edition calculus texts that can usually be found used for $10 or less, including shipping. These include:

- *Calculus* or *Calculus: Early Transcendentals* by James Stewart.
- *Calculus* or *Calculus: Early Transcendental Functions*, by Larson and Edwards, or Larson, Hostetler, and Edwards.

(There are other good texts, but these are the most commonly available. If you have questions about the suitability of a particular textbook, let me know.)

Note: Officially, the math department uses *University Calculus: Elements with Early Transcendentals*, by Hass, Weir, and Thomas. If you go on to take Calculus II after this course, you may need this book.

There are also online sites that can be very helpful; see the class website for suggestions.

**Calculators:** In general we will not be using calculators (and they will never be permitted on quizzes and exams). We may indulge now and then for the sake of an interesting application, but do not go out and buy one.

**Homework:** We will be using the *free* "WeBWork" online homework system (compliments of the Mathematical Association of America). Homework assignments will be posted at:

https://webwork.worcester.edu/webwork2/MA200S20Ginsberg/

Use your usual Worcester State username and password to login.

You are free to discuss homework problems and seek assistance as needed, but *all submitted work must be your own.*

Please see *How to Do Your Homework*, later in this document, for further details and the best advice I could muster.

**Quizzes:** Quizzes will usually be held weekly on Wednesdays; exceptions will be announced in class. No makeup quizzes will be given, but your two lowest quiz grades will be dropped. If you miss a quiz, ask me for a copy (so you have it for studying), and let me know if you have legitimate reasons for missing more than two quizzes.

**Midterms:** There will be two midterm exams. They are tentatively scheduled for Wednesday, March 4th, and Wednesday, April 22nd, but may be rescheduled to better fit the timing of the course, if necessary. You might be able to talk me into a make-up exam if you have a good enough reason; if you care to try, let me know as soon as possible.

**Final:** The final exam is cumulative, and will be held in our usual classroom on Friday, May 8th, 8:30 AM – 11:30 AM (according to the schedule set by the registrar).

**Grading:** Your grade will be the higher of:

(1) 20% for each of the two midterm exams, 15% for your quiz average, 15% for your homework average, and 30% for your final exam;

(2) Your final exam grade (100%);

*subject to the following conditions*:

(i) If you miss more than five classes, two quizzes, two homework assignments, or either midterm exam, then you will not be eligible to receive your final exam grade as your grade in the class.

(ii) If your homework average is 20 percentage points or more higher than both your final exam grade and the average of your midterm exam grades, then your homework will not be counted towards your final grade. In this case the weight of your other grades will be increased proportionately to account for the 15% allocated for homework in the formula above.

Grades will not be curved or rounded, and final letter grades will be assigned as follows:

| | | | |
|---|---|---|---|
| | $B^+ \geq 87$ | $C^+ \geq 77$ | $D^+ \geq 67$ |
| $A \geq 93$ | $B \geq 83$ | $C \geq 73$ | $D \geq 63$ |
| $A^- \geq 90$ | $B^- \geq 80$ | $C^- \geq 70$ | $D^- \geq 60$ |

**Answering Quiz and Exam Questions:** For computational questions, your careful, precise, and well-organized explanation of why the answer is what you claim it is is *far* more important than your actual answer – in essence, such questions ask you to provide a mathematical argument *proving* that your answer is correct. For all such questions your complete response should be a series of mathematical expressions, separated by "equals" signs, with each expression clearly and obviously equal to the one before it and the one after it. The first of these expressions should be the statement of the problem; the last should be the answer. In particular:

- Just giving the answer is insufficient (and may not receive full credit);
- The answer with a disorganized jumble of supporting computations is insufficient (and may not receive full credit);
- You do not get to make up your own symbols, such as "$\rightarrow$" or "$\implies$", to join expressions – the mathematical world has settled on the symbol "=", and you are expected and required to use it;
- Whenever you put an equals sign between two expressions, they had better actually be equal!;
- The concept of infinity is pervasive in calculus; you may never indulge in various travesties involving the symbol $\infty$, such as $1/\infty = 0$ (it isn't), or $e^\infty = \infty$ (not so). (We will discuss how to state these concepts correctly in terms of limits.)

As an example from basic algebra:

$$\begin{aligned}\sqrt{50} + \sqrt{18} &= \sqrt{25 \cdot 2} + \sqrt{9 \cdot 2} \\ &= \sqrt{25}\sqrt{2} + \sqrt{9}\sqrt{2} \\ &= 5\sqrt{2} + 3\sqrt{2} \\ &= 8\sqrt{2}\end{aligned}$$

Every day in class you will see further examples of how to properly format answers to computational questions; pay attention not just to the concepts and techniques, but also to the written presentation of the argument, and make sure to learn how to format your answers appropriately.

Note especially that being able to compute the correct answers for the online homework does not imply that you are prepared to work the problems out correctly on quizzes and exams – you must also diligently practice presenting your work in an organized, logical, and coherent manner.

**Extra Credit:** In general there will be no extra credit available. If you are interested in raising your grade, take the time that you would have spent on an extra credit assignment and spend it making sure you get more "regular credit" instead – master a topic you've found difficult, find some exercises in your textbook to work on, spend a few extra hours studying, etc. One exception: I will give a very small amount of extra credit to anyone with a perfect homework score (usually half a point – just enough to raise your grade if it is truly borderline).

**Attendance:** You are expected to attend *every* class. If you must miss a class, *you are still responsible for the material we cover.* In particular, you are expected to read a textbook, get the class notes, and do the homework so that you are caught up with the rest of the class when you return. Falling behind is usually *disastrous.*

Class will start on time. If you come 5 or 10 minutes late it is quite likely that you will be lost from the moment you sit down, and you might find it very difficult to catch up.

Missing 6 or more classes without legitimate *documented* reasons for almost all of them will result in an automatic failing grade in the class.

**Academic Honesty:** You are expected to uphold the university's high standards of academic honesty at all times. Please see the WSU undergraduate catalog's Academic Honesty page for details. All incidents of academic dishonesty will be reported to the office of Academic Affairs.

**Tutoring:** Free drop in tutoring is available at the Math Tutoring Center; hours and location to be announced.

**Accommodations:** If you anticipate issues related to the format or requirements of this course, please meet with me as early as possible in the semester to discuss ways to ensure your full participation. If you believe that formal, disability-related accommodations are appropriate, it is very important that you register with Student Accessibility Services (SAS) and notify me of your eligibility for such accommodations. We can then plan how to best coordinate your accommodations. SAS is located in the Administration Building, Room 131 and can be reached by phone ((508)929-8733) or email (sas@worcester.edu).

**Credit hours:** Inherent in the idea of a credit hour is the expectation that for each hour of class time the student will spend a minimum of two hours outside of class on homework, studying, reading the text, and similar activities. This is a four credit course; you should spend at least eight hours per week outside of class working on the class material.

**Approximate Schedule:**

| Week of | Topics |
|---|---|
| 1/13 | Limits, limit laws, continuity |
| 1/20 | Precise definition of a limit, Intermediate Value Theorem, limits at infinity |
| 1/27 | Tangents, instantaneous velocity, derivative function, differentiability |
| 2/3 | Derivatives of polynomials, $e^x$, products and quotients |
| 2/10 | Derivatives of trigonometric and logarithmic functions, the chain rule |
| 2/17 | Complicated chain rule derivatives, implicit differentiation |
| 2/24 | Derivatives of inverse trigonometric functions, linearization, hyperbolic trigonometric functions |
| 3/2 | Related rates, **exam**, extrema definitions |
| 3/9 | Critical points, Extreme Value Theorem, the Mean Value Theorem, the first derivative test |
| 3/16 | Spring break |
| 3/23 | Concavity, the second derivative test, L'Hospital's rule |
| 3/30 | Curve sketching |
| 4/6 | Optimization, antiderivatives |
| 4/13 | Motion, Riemann sums, definite integrals |
| 4/20 | **Exam**, the Fundamental Theorem of Calculus, differentials |
| 4/27 | Substitution, area between curves |
| 5/4 | Review |

## How to do your Homework

First, *keep a notebook*. You will need it for studying. Although you will be entering only the answers online, you should work each problem as neatly and thoroughly as possible, as if it were a problem on an exam. Aside from being good practice, when you go back to look at your homework weeks or months later you need to be able to follow your reasoning. In essence, work as if you are carefully explaining the answer to yourself.

*Don't rush!* I get it, you have other things to do, and there are lots of possible shortcuts. But the homework is the key to success in the class – make sure you can do the problems with confidence, and on your own. If you're relying heavily on your notes, your friends, a textbook, a calculator, or the internet, then you are setting yourself up for failure. To put it another way, a good homework grade will not earn you a good grade in the class – only the understanding that comes from doing the homework carefully and well can do that.

WeBWork will usually give you as many tries as you need to get the problem correct, with no penalty for initial wrong answers. *Don't abuse this feature by guessing!* Guessing the right answer, maybe after a few tries, does nothing to help you learn the concepts and techniques you will need to succeed in the class, and, more concretely, to get similar questions right on quizzes and exams – on quizzes and exams you will have only one chance to give the correct answer, and I will require detailed justification, so guessing will get you nowhere. Instead, try to get every question right the first time. If you get one wrong, try to find your mistake, fix it, and enter the correct answer with confidence. If you can't find a mistake, then go back through your notes or your textbook to see if there is some concept you have confused or technique you are missing or misapplying. Struggling to find and correct errors can be a very effective way to learn material that might initially seem difficult.

If you can't make progress on a problem, *don't give up*. Get help. Ask a friend, family member, classmate, random stranger, or me (not necessarily in that order). Ask in class if you can't get your question answered sooner. A homework problem that you can't do might indicate that you've missed something. You cannot afford to just let it go – it is entirely possible that the next topic we cover will build upon the concept or technique you've missed, and you could quickly find yourself falling behind. Although it will certainly take considerable effort, it is *much* easier to master the material as we cover it than to catch up once you've fallen behind.

Homework assignments will usually be due the morning of the following class, and will then remain open for an additional week at reduced credit (75%). (The "due date" that WeBWork displays is the end of the reduced-credit period, i.e. the last possible time to submit an answer. Keep in mind that for full credit you will need to submit your answers before the beginning of the reduced-credit period.)

In the past I have tried – and failed – to maintain a "no homework extensions" policy. So, as a compromise and in the interest of fairness, I will grant *one* homework extension per student. If you would like a homework assignment extended, let me know. Please do not ask twice.

**LASC:** This is a *Quantitative Reasoning* course in the *Liberal Arts and Sciences Curriculum.*

**Student Learning Outcomes**: Students will

- be able to justify their mathematical reasoning.
- understand the concept of a limit and be able to compute limits of functions graphically, algebraically, and from the definition.
- understand the definition of continuity, the Intermediate Value Theorem and its consequences, and classify discontinuities graphically.
- be able to connect the first derivative of a function with the instantaneous rate of change and extend this to higher order derivatives.
- understand the relationship between linear approximation of a function and tangent lines.
- be able to compute derivatives for a variety of functions (e.g. polynomial, rational, exponential and trigonometric functions and their inverses) implicitly and explicitly using the definition and the rules of differentiation.
- use derivatives in graphing, related rates and optimization applications.
- understand the concept of anti-derivatives and compute anti-derivatives using basic rules including substitution.
- understand the connection between the area problem and the definite integral.
- understand the significance of the Fundamental Theorem of Calculus and apply it in calculating definite integrals.
- Be able to use L'Hôspital's rule to find limits.

The course addresses the following **LASC Quantitative Reasoning objectives**:

- Acquaint students with formal systems, procedures, and sequences of operations.
- Strengthen students' understanding of variables and functions.
- Apply mathematical techniques to the analysis and solution of real-life problems.
- Emphasize the importance of accuracy, including precise language and careful definitions of mathematical concepts.
- Understand both the underlying principles and practical applications of one or more fields of mathematics.
- Strengthen understanding of the relationship between algebraic and graphical representations.

and the following **LASC overarching objectives**:

- Communicate effectively orally and in writing.
- Understand and employ quantitative and qualitative reasoning.
- Apply skills in critical thinking.
- Understand the roles of science and technology in our modern world.
- Make connections across courses and disciplines.
- Develop as healthy individuals – physically, emotionally, socially, ethically, and intellectually.