

The **Differential and Integral Calculus** is a major intellectual achievement. Genius (Archimedes, Galileo, Fermat, Newton, Leibniz; Cauchy, Riemann) created/discovered/developed it, but there are a variety of ways for mortals (us) to learn, use, and ponder it. **We will study change:** rates of change, accumulation of change, and a fundamental theorem connecting those concepts; ideas about limits are pervasive.

TEXT: *Calculus*, single variable, 6th edition — Hughes-Hallett, Gleason, et al.; ©2013

The core of our explorations in Calculus I will begin at section 1.7 (continuity) and go through chapter 6 of this text.

PREREQUISITE: Precalculus (m151 or m121+m122, passed with grade of C or better). A paraphrase of *Learning Objectives* for those prerequisites: A precalculus class studies several families of functions: linear, quadratic, exponential, logarithmic, periodic, power, polynomial, rational. After successful completion of a precalculus class, a student will be able to

- manipulate (algebraically) functions from each family, e.g., expand $f(w + p)$ for $f(x) = x^2$ or 2^x or $\sin(x)$
- demonstrate role of key parameters for each function family, e.g., compare $2 \sin(x)$ with $\sin(2x)$, $\sin(x/2)$, $\sin(x-2)$
- analyze a “real-world” situation with an appropriate model (plus solution, exact or approximate, where desired)

Sections 1.1 through 1.6 of our calculus text review major topics which you need to have learned in prior courses. There will be many opportunities for you to exploit your mastery of prerequisites (algebra and functions) for this course. In addition to work with equations, we will also work with inequalities. Some notions about approximation will be refined by considering limits.

LEARNING OUTCOMES: The official list proclaims: “upon [successful] completion of [m171], a student will be able to”

- 1) Explain the definition of limit, compute it in elementary cases, and determine the limits of transcendental, rational and piecewise defined functions;
- 2) Compute infinite limits, limits at infinity, asymptotes, and indeterminate forms (the latter using l’Hôpital’s Rule);
- 3) Explain the limit definition of continuity;
- 4) Explain the limit definition of the derivative of a function, and use it to compute derivatives;
- 5) Use derivatives to find tangent lines to curves and velocity for particle motion;
- 6) Apply the power, sum, product, quotient and chain rules of differentiation;
- 7) Compute the derivatives of exponential, logarithmic, and trigonometric functions;
- 8) Use implicit differentiation;
- 9) Explain the Intermediate and Mean Value Theorems in concrete settings;
- 10) Analyze the graph of a function, using continuity and differentiation, to determine local and global extrema, concavity, and inflection points;
- 11) Use the derivative to solve related rate and optimization word problems;
- 12) Use Newton’s Method to estimate the zeros of a function;
- 13) Use the Fundamental Theorem of Calculus to calculate Riemann integrals, find the area under a given graph and compute the derivative of a function defined by an integral.

One of my objectives is to help calculus students understand the terminology and relevance of those declarations.

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office	Math 005	
office hours	noon – 12:50pm on Mon, Wed, Fri	<u>AND</u> by appointment at other times
office phone	243-5207	(voice mail after 4 rings)
e-mail	Dick.Lane@umontana.edu	
class website	lennes.math.umt.edu/171	(Note: this URL does not begin with “www”.)
online homework	lennes.math.umt.edu/webwork2/171-Lane	(bookmark this URL to aid frequent use)

<i>Mathematics Learning Center</i>	Math 011	tutors for students in math courses numbering under 200; open 8–4, Mon–Thu
<i>Undergraduate Study Room</i>	Math 212	open 7:30 am – 7 pm, Monday–Friday

IMPORTANT DATES for section 3 of Math 171 (14 instructional weeks with 55 class sessions in 2017-Spring semester)

17 Feb	Fri	Exam 1	
27 March	Mon	Exam 2	<i>First day after Spring Break</i>
21 April	Fri	Exam 3	
10 May	Wed	comprehensive Final Exam	— 6–8 PM (same day & time for all sections of Math 171)

GRADE: Your course grade will be based upon your performance on the following items.

- 30% homework and quizzes (15% for each half of the semester — see below for details)
- 50% midterm Exams
- 20% comprehensive Final Exam (taken by all m171 classes on Wednesday, 10–May–2017, 6–8 pm)
- mandatory **Differentiation Skills Test (DST)** given first after we study §3.7, can retake (at most once per day) during a three-week period until scoring 80% or better. **Passing the DST is a NECESSARY (but not sufficient) condition for passing this course.** If you pass the DST on its first day, you will receive a 2% bonus on your Final Exam score. *On the other hand, if you never pass the DST, your course grade will be decreased by one step, e.g., C to C-minus.*

Letter grades for this course will be assigned as follows (numerical values are percentages of composite score):

90–100 %: A– to A 80–89 %: B– to B+ 65–79 %: C– to C+ 55–64 %: D– to D+ below 55 %: F

Since UM has plus/minus grading, the more precise “cut points” are 93 (A), 90 (A–); 87 (B+), 83 (B), 80 (B–); 75 (C+), 70 (C), 65 (C–); 62 (D+), 58 (D), 55 (D–). Grades are based on demonstrated achievement, not quotas (i.e., grades will not be “curved”). I would be delighted if each student earned an A or B. My judgment of borderline cases will be influenced by classroom participation.

CONDUCT: All students need to be familiar with the Student Conduct Code. You can find it in the “A to Z Index” on the UM home page. (http://www.umt.edu/vpsa/policies/student_conduct.php)

HONESTY: All students must practice academic honesty. Academic misconduct is subject to an academic penalty by the course instructor and/or a disciplinary sanction by the University.

DISABILITY: The University of Montana assures equal access to instruction through collaboration between students with disabilities, instructors, and Disability Services for Students (DSS). If you think you may have a disability adversely affecting your academic performance, and you have not already registered with Disability Services, please contact Disability Services in Lommasson Center 154 or 406-243-2243. I will work with you and Disability Services to provide an appropriate modification.

For exams to be taken at the DSS facility, DSS requires prior scheduling at least one week before the exam.

STUDY: I encourage students in each of my classes to create study groups. After group discussion of one member’s version of an online problem, the other members will need to adapt key ideas in order to solve their own version of the same problem. For an assignment of written homework, each person’s document submitted for grading must be stated in their own words.

HOMEWORK AND QUIZZES: 30% share of work scored for course grade. My plan is to allocate 15% for each half-semester: 23–January through 11–March (first half) and 12–March thru 5–May (second half). For each of those periods, a student’s HwQ score will be the sum of all homework and quiz scores, after conversion to percentage of total available for the period.

- ONLINE: WeBWorK provides individualized homework via the internet. About half of these online problems are of the skills-practice variety which I would not assign to be written-up. WeBWorK provides immediate feedback; an incorrect answer can be revised and resubmitted for scoring — answers & solutions are available after closing date for each set.
 - WRITTEN: Each non-exam week will have an assignment for written homework — problems for which there is work to be shown, important features identified on a graph, and results to be interpreted. Written homework must be submitted at beginning of class on the designated day (usually a Friday) — it will be graded and returned, with comments, at next class. Write legibly in dark ink or pencil on one side of a page; if more than one page is used, then staple them in the upper-left corner. Print your name in upper-right of each page. **Late homework will not be accepted for grading.**
 - IN CLASS: Brief quizzes will be given frequently, often on Tuesday and sometimes on other days. Some quizzes will be announced, but some will not; some weeks may have more than one quiz. The lowest quiz-score in each half-semester will be dropped, but **no make-up quizzes will be given.**
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MATHEMATICAL SKILLS: A BALANCE BETWEEN SYMBOLIC MANIPULATION AND TECHNOLOGY

“To use calculus effectively, students need skill in both symbolic manipulation [with pencil & paper] and the use of technology. . . . Students are expected to use their own judgment to determine where technology is useful.” (page vi of our text)

It is very important to identify where (& how) a particular high-tech tool might be a major aid, it is equally important to identify where a prepared mind (with aid of pen-and-paper) suffices. For this class, you may use suitable tools while studying the text and working on homework. Some quizzes may allow use of a graphing tool (calculator, tablet, computer) while others will permit only paper-and-pencil work. For my midterm exams given during a class period, a graphing tool may be used only during the last 15 minutes of the exam period. By agreement among the m171 instructors, **a graphing tool may not be used during our common Final Exam.**