MAT141 Calculus I
Fall 2016

General Information

Meeting Time and Place

MAT141A: Monday, Wednesday, and Friday: 9:10 – 10:10 a.m., KOS 127.
MAT141B: Monday, Wednesday, and Friday: 2:10 – 3:10 p.m., KOS 127.

Professor

Dr. Jonathan Senning, 246 Ken Olsen Science Center
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Office Hours

Monday, Wednesday: 3:20 – 4:20 p.m.,
Tuesday, Thursday 10:30 a.m. – 12:00 p.m.,
and by appointment.

Textbook

Calculus: Early Transcendental Functions, 4th Edition, Robert T. Smith and Roland B. Minton, McGraw-Hill, 2012.

You may use a graphing calculator in this course. While we will not usually be using calculators in the class room, you may find it helpful to have one with you during lecture to explore concepts we are discussing. You will be permitted to use a calculator on exams.

Prerequisite

Precalculus (functions, trigonometry, logarithms, and exponentials). The first chapter of the text provides a very quick review of precalculus concepts designed to highlight key concepts but not to introduce this material for those who have not seen it before. No previous exposure to calculus is assumed, although the course is appropriate for students who have had some calculus before.

Online Materials

A copy of the course syllabus and homework assignments can be found on the Blackboard server at *https://blackboard.gordon.edu*. The online WeBWorK problems for this class are at *http://webwork.math.gordon.edu/webwork2/MAT141-2016FA*.

Students with Disabilities

Gordon College is committed to assisting students with documented disabilities. (See Academic Catalog Appendix C, for documentation guidelines.) A student with a disability who may need academic accommodations should follow this procedure:

1. Meet with a staff person from the Academic Support Center (Jenks 412, x4746) to:

1. make sure documentation of your disability is on file in the ASC,
2. discuss the accommodations for which you are eligible,
3. discuss the procedures for obtaining the accommodations, and
4. obtain a **Faculty Notification Form**.

2. Deliver a Faculty Notification Form to each course professor *within the first full week of the term* and make an appointment to discuss your needs with each professor.

Failure to register in time with your professor and the ASC may compromise our ability to provide the accommodations. Questions or disputes about accommodations should be immediately referred to the Academic Support Center. See Grievance Procedures available from the ASC.

Course Description

Introduction

The world we live in is not static; *change* is an inherent feature. In diverse areas such as the analysis of moving bodies, the maximization of a company's profits, the behavior of the stock market, the flow of blood through the heart, and the growth of populations, change is *the* fundamental characteristic. The ability to understand change, predict it, and anticipate what its effects will be is perhaps a uniquely human characteristic. The discovery of calculus in the late seventeenth century revolutionized mathematics and subsequently the scientific realm. For the first time a language that allowed change to be described, modeled, and calculated existed and was put to use understanding processes in a variety of areas. Today we live in a world in which changes have accelerated. Studying calculus provides not only a formal language that some will use to describe change, but also, and perhaps more importantly, it provides a framework for understanding change; how it is measured, and the cumulative effects of continually changing processes.

This course introduces the study of the calculus, which can be thought of as a study of continuous functions. Calculus is composed of two main branches, *differential calculus* and *integral calculus*. Differential calculus is primarily concerned with problems involving rates of change of a relationship between two variables, particularly the instantaneous rate of change. We might, for example, examine the velocity of a particle at a particular instant in time. The second branch, integral calculus, studies and quantifies the cumulative effects of change and is usually associated with problems like the calculation the areas of regions with curved or irregular boundaries. From these problems many additional applications of the techniques of integral calculus have been realized.

An important idea that forms the basis of calculus is the notion of the *limit*. Both differential and integral calculus involve uses of limits and the limiting process. In the seventeenth century the connection between the two branches of calculus was discovered independently by two mathematicians, Sir Isaac Newton and Gottfried Wilhelm Leibniz.

Learning Outcomes

Students successfully completing this course will be able to:

- Understand and discuss the concept of *limit* and compute the limits of many elementary functions.
- Understand and discuss the concept of *rate of change* as computed using the *derivative*, be able to compute derivatives of algebraically and estimate them numerically and graphically, and to solve problems which involve derivatives.
- Understand and use summation ("sigma") notation and compute Riemann sums.
- Understand and discuss the concept of *integration*, compute *definite integrals* and evaluate simple *indefinite integrals* and understand their relationship to each other through the *Fundamental Theorem of Calculus*.
- Apply the tools of calculus to develop mathematical models from areas such as biology, economics, business, and the physical and social sciences.
- Have a deepened appreciation for how calculus and analytical reasoning allows one to understand various processes observed in our world and to make predictions based on those processes, thus allowing them to make more informed decisions.

Massachusetts Teacher Licensure

This course satisfies the following topics described in 603 CMR 7.06 *Subject Matter Knowledge Requirements for Teachers* required by the Massachusetts Department of Education and Secondary Education:

(17)(a) 2. Algebra (assessed via homework, exams)
(17)(b) 3. Trigonometry (assessed via homework, exams)

Gordon College Core Curriculum

Students successfully completing this course are prepared to meet the following learning outcomes in the College's Core Currculum:

(2) Students will be able to identify some of the central principles of the creation, as discovered by the natural sciences, mathematics, or computer science.

(7b) Students will select quantitative information that is relevant to an argument, present it in an effective format, and draw accurate conclusions from it.

Procedure and Workload Expectation

Class time will primarily be devoted to presentation and discussion. I encourage you to ask questions during class regarding the material presented and at times I may ask you to perform some work during our class meeting times. *You are expected to have read the sections which will be discussed in class prior to the class meeting*.

For each semester hour of credit, students should expect to spend a minimum of 2–3 hours per week outside of class in engaged academic time. This time includes reading, writing, studying, completing assignments, lab work, or group projects, among other activities.

Course Requirements

Attendance and Participation

You are expected to attend class and will be responsible for what transpires in class regardless of your attendance. As a courtesy to others, please avoid arriving late and do not leave during class unless it is an emergency or you have made prior arrangements with me. Each student is allowed six (6) absences during the term for whatever reason. For each absence after the sixth you should expect a four percent (4%) reduction in your final average. Exceptions to this policy are rare and decided on a case-by-case basis. If you are aware of classes you will need to miss because of field trips, athletic events, or for personal reasons, plan to include those among your allowed absences. Note that 5% of your final grade is determined by your participation during class. This means you are present and engaged in all classroom activity.

I expect that during class you will not use your cell phone, tablet or laptop for non-class related conversations or activities. These activities prevent you from fully concentrating on our topic and they are often distracting to those around you.

Homework

Your assigned work outside of class will take three forms, explained below.

1. *WeBWorK problems* (**graded instantly**). This on-line homework provide immediate feedback on how well you understand the material we've just covered. You may repeatedly offer answers to each problem until you get the correct answer. Only your final score for each set is recorded (the number attempts does not matter) so a perfect score is obtainable by everyone. These sets are assigned for most days and must be completed before their due date and time. *I strongly suggest that you complete the WeBWorK problems **before** writing solutions to the problem sets.*
2. *Practice problems* from the textbook (**checked**). You should plan on working these problems according to the provided schedule. While these problems are not graded, they will be checked for completeness and returned to you. You may ask questions about them at the start of class and during my office hours. *You must not wait until preparing for an exam to do these problems.* Please do not treat these as optional problems; you're certainly welcome to do more than those assigned, but at a minimum you should work these along with the WeBWorK problems and the sets of problems you'll be turning in.
3. *Problems Sets* (**graded**). Each week of the semester you will have a problem set due, usually on Wednesday. These problems will be graded for correctness (is your answer correct), completeness (have you show proper supporting work or justification for your answer), and clarity (is the solution well laid out and clear). Homework will be accepted late but the score will be reduced by 10% if turned by by first class meeting after it was due, 25% if turned in by the second class meeting after it was due, and 50% if turned in by the third class meeting. Later homework will not be accepted. Exceptions to this policy may be made in exceptional cases. The following is expected on all problem sets:
    - Assignments are to be done on 8.5×11 paper and must not have ragged edges from spiral bound notebooks.
    - Solutions should presented in an organized, legible manner. Use sufficient paper

and do not squeeze your work into corners and margins.
- Final answers should be clearly marked.
- Multiple page assignments must be stapled together (**no folded corners**).
- **Proper presentation is important.** Pay attention to detail. For example, axes should be drawn using a straightedge and should be correctly labeled.

You are permitted to work together on all forms of homework, especially the practice problems. However, the work you turn in on the problem sets should reflect *your own* understanding of the material. All assigned problems are tools to help you better understand the theory and to become more proficient with the techniques of this course. *It is essential that you understand the solution to each problem in order to derive the greatest benefit from this course.*

Examinations

There will be three hour-long exams scheduled during the term and a comprehensive final exam. Missed exams will receive the grade of zero. Speak with me as soon as possible if you have a conflict with a scheduled exam.

Grading Procedure

Your final average will be computed using the following table:

Component	***Points***	***Component***	***Points***
WeBWorK Problems	15%	Exam 2	15%
Checked Problems	5%	Exam 3	15%
Problem Sets	15%	Final Exam	15%
Exam 1	15%	Participation	5%

The following table shows the correspondence between the final average and the letter grades that will be assigned.

[100, 97]	A+	(90, 87]	B+	(80. 77]	C+	(70, 67]	D+
(97, 94]	A	(87, 84]	B	(77, 74]	C	(67, 64]	D
(94. 90]	A–	(84, 80]	B–	(74, 70]	C–	(64, 60]	D–

Tentative Schedule

Date	**Section(s)**	**Topic**
Aug 24, Wed		Introduction
Aug 26, Fri	0.1, 0.3	Polynomials and Rational Functions; Inverse Functions
Aug 29, Mon	0.4	Trigonometric and Inverse Trigonometric Functions
Aug 31, Wed	0.5	Exponential and Logarithmic Functions
Sep 2, Fri	0.6	Transformations of Functions
Sep 5, Mon	No Class	*Labor Day*
Sep 7, Wed	1.1	A Brief Preview of Calculus

Date	**Section(s)**	**Topic**
Sep 9, Fri		**Exam 1**: Chapter 0
Sep 12, Mon	1.2	The Concept of Limit
Sep 14, Wed	1.3	Computation of Limits
Sep 16, Fri	1.3	Computation of Limits (continued)
Sep 19, Mon	1.4	Continuity and its Consequences
Sep 21, Wed	1.5	Limits Involving Infinity; Asymptotes
Sep 23, Fri	2.1	Tangent Lines and Velocity
Sep 26, Mon	2.2	The Derivative
Sep 28, Wed	2.3	Computation of Derivatives: The Power Rule
Sep 30, Fri	2.4	The Product and Quotient Rules
Oct 3, Mon	2.5	The Chain Rule
Oct 5, Wed	2.5	The Chain Rule (continued)
Oct 7, Fri	2.6	Derivatives of Trigonometric Functions
Oct 10, Mon	2.7	Derivatives of Exponential and Logarithmic Functions
Oct 12, Wed		**Exam 2:** Sections 1.1–1.5 and 2.1–2.5
Oct 14, Fri	No Class	*Quad Finals*
Oct 17, Mon	2.8	Implicit Differentiation and Inverse Trigonometric Functions
Oct 19, Wed	2.8	Implicit Differentiation and Inverse Trigonometric Functions (con't)
Oct 21, Fri	2.10	The Mean Value Theorem
Oct 24, Mon	3.1	Linear Approximations and Newton's Method
Oct 26, Wed	3.2	Indeterminate Forms and l'Hopital's Rule
Oct 28, Fri	3.3	Maximum and Minimum Values
Oct 31, Mon	3.3	Maximum and Minimum Values (continued)
Nov 2, Wed	3.4	Increasing and Decreasing Functions
Nov 4, Fri	3.5	Concavity and the Second Derivative Test
Nov 7, Mon	3.7	Optimization
Nov 9, Wed	3.7	Optimization (continued)
Nov 11, Fri		**Exam 3**: Sections 2.6–2.8, 2.10, and 3.1–3.5
Nov 14, Mon	3.7	Optimization (continued)
Nov 16, Wed	3.9	Rates of Change in Economics and the Sciences
Nov 18, Fri	4.1	Antiderivatives
Nov 21, Mon	4.2	Sums and Sigma Notation
Nov 23, Wed	No Class	*Thanksgiving Recess*
Nov 25, Fri	No Class	*Thanksgiving Recess*
Nov 28, Mon	4.3	Area & Riemann Sums
Nov 30, Wed	4.3	Area & Riemann Sums (continued)
Dec 2, Fri	4.4	The Definite Integral
Dec 5, Mon	4.5	The Fundamental Theorem of Calculus
Dec 7, Wed		Applications of Integration
Dec 14, Wed		**MAT141A Final Exam** 9:00 – 11:00 a.m.
Dec 15, Thur		**MAT141B Final Exam** 9:00 – 11:00 a.m.