MATHEMATICS
TEXAS A&M UNIVERSITY

Math 147 Syllabus

Course title and number	**MATH 147, Sections 506, 510, and 511**
Term	**Fall 2018**
Class times and location	**Lecture (all sections):** Tues & Thurs 11:10am-12:25pm in HELD 113 **Recitation for Section 506:** Mon & Wed 10:20am-11:10am in HEB 203 **Recitation for Section 510:** Mon & Wed 11:30am-12:20pm in CHEN 111 **Recitation for Section 511:** Mon & Wed 1:50pm-2:40pm in CHEN 112

INSTRUCTOR INFORMATION

Name	**Heather Ramsey**
e-mail address	ramsey@math.tamu.edu
Office hours	Tues 1:45pm-2:45pm in BLOC 241B Wed 3:15pm-4:15pm in BLOC 241B Thurs 9:45am-10:45am in BLOC 241B
Help Sessions	Day Time in Room TBD Day Time in Room TBD

COURSE DESCRIPTION AND PREREQUISITES

Title and Description: ***Math 147 Calculus I for Biological Sciences (4 credit hours).*** Introduction to differential calculus in a context that emphasizes applications in the biological sciences. Only one of the following will satisfy the requirements for a degree: MATH 131, MATH 142, MATH 147, MATH 151, and MATH 171.

Prerequisites: MATH 150 or equivalent or acceptable score on TAMU Math Placement Exam (MPE1).

LEARNING OBJECTIVES

This course is focused on quantitative literacy in mathematics with an emphasis on real world applications, especially to the biological sciences. Upon successful completion of this course, students will be able to

- Recognize and construct graphs of basic functions, including polynomials, exponentials, logarithms, and trigonometric functions.
- Construct and interpret semilog and double-log plots used to model biological data.
- Evaluate limits of functions graphically and algebraically.
- Evaluate limits of functions analytically by applying the Sandwich Theorem or L'Hopital's Rule.
- Understand continuity and be able to justify whether a function is continuous or not using the mathematical definition of continuity.
- Explain the Intermediate Value Theorem and use it to estimate roots of functions.
- Compute derivatives using the limit definition of the derivative.
- Interpret derivatives as rates of change and as the slope of a tangent line.
- Compute derivatives of polynomials and rational, trigonometric, exponential, logarithmic, and inverse functions.
- Apply the product rule, quotient rule, and chain rule to take derivatives of compositions of functions.
- Set up and solve related rates problems.
- Compute the linear approximation of a function and use it in applications of approximation and error estimation.
- Analyze first and second derivatives to determine intervals where a function is increasing or decreasing, concave up or concave down, and to find the locations of local extrema and inflection points.
- Graph complicated functions by analyzing and evaluating the information obtained by differentiation.
- Set up and solve optimization problems.
- Evaluate limits of sequences and recursions.

- Model single-species populations and analyze population models.
- Find fixed points and analyze their stability using the cobwebbing method and the stability criterion.
- Interpret the definite integral as a sum of signed areas.
- Compute definite integrals using Riemann sums.
- Find the antiderivatives of basic functions.
- Compute definite integrals using the Fundamental Theorem of Calculus.
- Apply the substitution method to compute integrals.

Core Objectives

Critical Thinking

- Students will evaluate limits of functions graphically and algebraically.
- Students will evaluate limits of functions analytically by applying the Sandwich Theorem or L'Hopital's Rule.
- Students will justify whether a function is continuous or not using the mathematical definition of continuity.
- Students will compute derivatives using the limit definition of the derivative.
- Students will compute derivatives of polynomials and rational, trigonometric, exponential, logarithmic, and inverse functions.
- Students will use inquiry to determine the best method for taking derivatives of complicated functions.
- Students will apply calculus to find innovative ways to graph complicated functions without the aid of a graphing calculator or computer.
- Students will think creatively about how to accomplish a given optimization objective and apply calculus to achieve this goal.
- Students will compute the linear approximation of a function and use it in applications of approximation and error estimation.
- Students will think creatively about the relationship between two given rates of change and how they affect each other.
- Students will compute limits of sequences and recursions and synthesize the results by explaining the relationship between these limits and the long-term behavior of population growth.
- Students will evaluate and synthesize single-species population data to determine the best mathematical model to represent the population.
- Students will compute definite integrals using Riemann sums.
- Students will find the antiderivatives of basic functions.
- Students will compute definite integrals using the Fundamental Theorem of Calculus.
- Students will apply the substitution method to compute integrals.

Communication Skills

- Students will recognize and construct graphs of basic functions, including polynomials, exponentials, logarithms, and trigonometric functions.
- Students will construct and interpret semilog and double-log plots used to model biological data.
- Students will justify results that require the use of theorems such as the Sandwich Theorem and Intermediate Value Theorem or mathematical definitions such as the definition of continuity by writing mathematical proofs.
- Students will be required to answer questions during lecture concerning topics discussed in class.
- Students will be required to explain verbally in class the connection between derivatives, rates of change, and slopes of tangent lines.
- Students will explain the solutions to related rates problems and optimizations problems in writing.
- Students will develop sketches of the graphs of complicated functions by analyzing the function itself and its first and second derivatives.
- Students will analyze the stability of fixed points by applying the cobwebbing graphical technique.
- Students will interpret definite integrals as sums of signed areas under a graph.

Empirical and Quantitative Skills

- Students will analyze semilog and double-log plots and derive functional relationships associated with such plots.
- Students will analyze population data and determine whether an exponential discrete time model can be used to model the data.
- Students will understand the Intermediate Value Theorem and apply it to locate the roots of functions.

- Students will compute derivatives of functions and use derivatives in applications such as finding equations of tangent lines, computing the linear approximation of a function, solving related rates problems, solving optimization problems, and finding the rate at which a population is growing.
- Students will find the relationship between two given rates of change and make conclusions about how one is affecting the other.
- Students will make conclusions about monotonicity, concavity, extrema, and inflection points of a given function by analyzing the given function and its derivatives.
- Students will manipulate given information to develop a one-variable function to be used in an optimization problem and then apply calculus to find and interpret the optimal solution.
- Students will use antiderivatives and the Fundamental Theorem of Calculus to compute and interpret areas under curves.

Students in this course students will:

- Recognize and recall the main definitions and results explained in the course.
- Develop quantitative and problem-solving skills.
- Recognize situations in which calculus concepts and results can be applied to other areas in mathematics and related fields.
- Identify and reproduce the theoretical framework underlying the definition of integrals, the concept of Riemann sums and how it relates to definite integrals.
- Be able to set up and calculate definite integrals; use techniques of integration; use integrals to find areas, volumes and arc length; solve problems involving work and force.
- Master the concept of convergence and divergence of sequences and infinite series and the various convergence tests for series.
- Be able to make error estimates for series.
- Thoroughly understand the notion of power series and applications.
- Be expected to present simple proofs, definitions and statement of theorems.

TEXTBOOK AND OTHER REQUIRED MATERIALS

- *Calculus for Biology and Medicine*, Fourth Edition, by Claudia Neuhauser and Marcus Roper, Pearson 2017, ISBN-13: 978-0-13-412259-5
- Four gray TAMU Scantrons (8.5 in by 11 in)
- *Optional:* A four-function calculator, such as the Sharp EL233SB Pocket Calculator

CALCULATOR POLICY

The only calculator that will be allowed in this course is a four-function calculator, such as the Sharp EL233SB Pocket Calculator. Graphing calculators and scientific calculators will not be allowed. A four-function calculator may be used on all recitation assignments, quizzes, and exams.

GRADING POLICIES

The course grading will be based on the results of three midterm exams, weekly recitation assignments and quizzes, and a comprehensive final exam.

- **Midterm Exams:** Each midterm exam will consist of two parts: multiple choice (no partial credit) and work out (partial credit possible). The multiple choice part of the exam will be administered during recitation sessions (Wednesdays), and 50 minutes will be given. The work out part of the exam will be administered during lecture (Thursdays), and 60 minutes will be given. Both parts of each exam are closed book. Students are not allowed to use notes, formula sheets, books, or electronic devices, with one exception–an approved 4-function calculator may be used for all parts of all exams. The Sharp EL233SB Pocket Calculator is an example of an approved 4-function calculator that can be purchased for less than $4 at Wal-Mart. Students need to bring a No. 2 pencil and their TAMU student ID to each part of each exam. Students will also be asked to provide 4 gray TAMU Scantrons during the first week of classes.

- **Recitation Assignments:** A set of problems will be assigned during recitation each Monday and will be due during that class period. Students may work on these problems in groups of up to three. These assignments will be graded on a 10-point scale, and no make-up assignments will be given without

written verification of a University excused absence. **Contact your TA with verification that your absence is University excused and to schedule a make-up assignment.**

- **Quizzes:** Announced and unannounced quizzes and will be given throughout the semester during Wednesday recitations and possibly during TR lecture. Each quiz will be graded on a 10-point scale, and no make-up quizzes will be given without written verification of a University excused absence. One quiz grade will be dropped. **Contact your TA with verification that your absence is University excused and to schedule a make-up quiz.**

- **Homework Assignments:** Homework assignments will be posted on the course website. These assignments will not be collected for a grade, but completing them is essential to doing well in the course. I will assume that all students have worked all problems, so all material covered in the homework assignments is fair game for all exams and quizzes.

- **Final Exam:** The final will be a comprehensive, all multiple choice exam. No partial credit will be given. Note that the score earned on the final exam can be used to replace the lowest of the first three midterm exam grades, assuming that the final exam score is higher than this lowest score. At most one grade replacement will be made, and the final exam grade cannot be dropped (meaning the final is **required** for all students). Exam grades associated with acts of academic dishonesty cannot be replaced by the final exam score.

- **Course Timeline and Percentages**

Activity	*Date*	*Weight*
Exam I	Sept. 26 and 27	17%
Exam II	Oct. 24 and 25	17%
Exam III	Nov. 26 and 27	17%
Recitation Assignments	Weekly	12%
Quizzes	Weekly	14%
Final Exam	Friday, Dec. 7, 3-5pm	23%
TOTAL		100%

- **Grading Scale**

Range	Grade
90% ≤ Course Average	A
80% ≤ Course Average < 90%	B
70% ≤ Course Average < 80%	C
60% ≤ Course Average < 70%	D
Course Average < 60%	F

- **Excused absences**: Attendance is mandatory and may affect your grade. For excused absences we refer the student to Student Rule 7 at http://studentrules.tamu.edu/rule7.htm. Excuses for absences during an exam must be substantiated by appropriate documentation. No make-up recitation assignments, quizzes, or exams will be given without an official, written, University Excuse. Falsification of documentation is a violation of the Aggie Honor Code.

  You must notify me (ramsey@math.tamu.edu) for exams or your TA for recitation assignments and quizzes in advance to ensure the right to a make-up. If advance notice is not possible (i.e. sudden illness), you MUST contact me or your TA, as appropriate, within TWO working days of the missed exam/assignment/quiz; otherwise, you forfeit the right to a make-up.

  An absence for a non-acute medical service or regular check-up does not constitute an excused absence. Please note that I will NOT accept the Explanatory Statement for Absence from Class form as sufficient written documentation of an excused absence.

- **Missed Recitation Assignments and Quizzes:** Your teaching assistant will coordinate with you for making up a recitation assignment or quiz.

- **Missed Exams:** If you have a University approved absence for missing an exam, you will be expected to make up your exam according to the Math Department's Make-up Schedule that can be found at

  http://www.math.tamu.edu/courses/makeupexams.html

  starting with the first option for each exam. Only if you have a University approved absence for the day of the exam and the previous makeup day will you be allowed to use the later options or have other arrangements made. You must discuss (email is fine) the need for a make-up exam with me before going to a scheduled time.

AMERICANS WITH DISABILITIES ACT (ADA)

The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe you have a disability requiring an accommodation, please contact Disability Services, currently located in the Disability Services building at the Student Services at White Creek complex on west campus or call 979-845-1637. For additional information visit http://disability.tamu.edu/

ACADEMIC INTEGRITY

For additional information please visit: http://aggiehonor.tamu.edu

"An Aggie does not lie, cheat, or steal, or tolerate those who do."

In this course students can discuss homework assignments and solutions. However, it is NOT permissible to copy homework solutions from another student. It is NOT permissible to discuss any aspect of any test or examination until ALL students have completed the exam. The penalties for violating this policy will range from an F on an assignment or test, to failing in the course.

You are encouraged to work together on the homework assignments, but do not copy another student's work. Copying work done by others, either in class or out of class, is an act of scholastic dishonesty and will be prosecuted to the full extent allowed by University policy.

During recitation, you will be allowed to work in groups of up to three students. **All group members are expected to contribute to the assignment.** If the teaching assistant finds that one or more members of a group are not participating, and if this is a first offence, then all members of the group will be asked to work individually for the rest of the period and submit individual assignments. If this happens on a subsequent assignment, ALL members of the group will be submitted to the Aggie Honor Office for scholastic dishonesty. For example, if the name of a student who was absent appears on that day's recitation assignment, ALL students in that group will receive a 0 on the assignment and be reported to the Aggie Honor Office.

Using an unauthorized calculator during an exam or quiz will result in a zero on the assignment. Also, cell phone use during an exam, quiz, or recitation assignment will result in a zero on the assignment. These violations of the Aggie Honor Code will be reported.

Always abide by the Aggie Code of Honor: *An Aggie does not lie, cheat, or steal or tolerate those who do.* Please refer to Honor Council Rules and Procedures at http://www.tamu.edu/aggiehonor for more information on academic integrity and scholastic dishonesty. I have served as a member of the Aggie Honor Council, so I take these matters very seriously.

EXTRA HELP AND PREPARING FOR EXAMS

- **Your Instructor:** I want each and every one of my students to be successful in this class. Please feel free to ask questions in class. If you need more help, come by my office during office hours or make an appointment to see me. Remember, I am here to help, but I cannot do that if I don't know that there is a problem.

- **Recitation and TA:** You will attend recitation with a teaching assistant twice per week. During these class periods, you will be able to ask the TA to explain homework problems and review any topics from lecture, so be sure to take advantage of this class time.

- **Your Classmates:** Get to know your classmates. Form study groups and work on homework problems outside of class.

- **Practice:** Working ALL of the homework problems from your textbook is essential to doing well in this course. If you struggle with these problems the first time you work them, be sure to work them again AND work other problems from the textbook that are similar. I strongly recommend that you practice problems DAILY.

- **Dr. Glenn Lahodny's Math 147 Web Page:** Dr. Lahodny has very generously offered his course materials for our use. He has practice problems for each exam, along with blank copies of his lecture notes, posted at http://www.math.tamu.edu/~glahodny/Math147/Spring2017/

- **Free Tutoring!!! (a.k.a. Help Sessions):** Help sessions are an opportunity for you to ask questions and get help with your homework. The schedule for fall help sessions can be found on my webpage. These sessions are come-and-go, i.e., you can come at any point during the help session and leave whenever you want.

OTHER CLASS POLICIES

- **Email Policy:** Check your TAMU email account and eCampus EVERY day. You are responsible for any information I post in eCampus and send through email. If you send an email to me, be sure to include your full name, "Math 147," and section number in the message. NOTE: Because of privacy rights, I cannot discuss grades via email or over the phone.

- **Cell Phone/Laptop Computer Policy:** As a courtesy to me and your classmates, and to improve student participation and reduce distractions, all cell phones and laptop computers (unless they can be laid flat in tablet mode and are being used for notetaking) must be OFF and put away during lecture. If you disrupt class or distract your neighbor or distract me with your cell phone or other electronic device, you may be asked to leave class.

COURSE TOPICS (Tentative weekly schedule)

WEEK	TOPIC	REQUIRED READING
1	Lines, Unit Circle, Trigonometry, Exponentials and Logarithms, Exponential Functions, Inverse Functions, Logarithmic Functions, Trigonometric Functions, Graphing	Sections: 1.2, 1.3
2	Graphing, Emphasis on Semilog and Double-log plots, Limits	Sections: 1.4, 3.1
3	Continuity, Limits at Infinity, Sandwich Theorem, Trigonometric Limits	Sections: 3.2, 3.3, 3.4
4	Properties of Continuous Functions, Formal Definition of the Derivative, Properties of the Derivative	Sections: 3.5, 4.1, 4.2
5	Simple Derivatives, Product & Quotient Rule **Exam 1** (Covering 1.2–1.4, 3.1–3.5, 4.1, 4.2)	Sections: 4.3, 4.4
6	The Chain Rule, Derivatives of Trigonometric Functions, Implicit Differentiation	Sections: 4.5, 4.8, 4.6
7	Related Rates, Higher Derivatives, Derivatives of Exponential Functions	Sections: 4.6, 4.7, 4.9
8	Derivatives of Inverse Functions, Logarithmic Functions, and the Inverse Tangent Function	Sections: 4.10, 4.11
9	Extrema and the Mean Value Theorem, Monotonicity, Concavity, Extrema, Inflection Points **Exam 2** (Covering Sections 4.3–4.11)	Sections: 5.1, 5.2, 5.3
10	Graphing, Optimization	Sections: 5.6, 5.4
11	L'Hopital's Rule, Exponential Growth and Decay, Sequences, Recurrence Equations (Recursions)	Sections: 5.5, 2.1, 2.2, 2.3
12	Cobwebbing, Stability, Introduction to Antiderivatives	Sections: 5.7, 5.10
13	Antiderivatives, The Definite Integral	Sections: 5.10, 6.1
14	The Fundamental Theorem of Calculus, Substitution **Exam 3** (Covering Sections 5.1–5.7, 2.1–2.3, 6.1)	Sections: 6.2, 7.1
15	Substitution and Review	Sections: 7.1