Syllabus for
MAT 201--Calculus I
4 Credit Hours
Summer 2006

I. COURSE DESCRIPTION

A thorough course in the differential calculus (with the introduction to anti-differentiation), dealing with the following functions and their applications: algebraic, vector, and transcendental and their inverses.
Prerequisite: MAT 114.
Academic technology fee: $45.

This course is a study of the introductory concepts of single variable calculus and is designed for students in engineering, economics, life science, mathematics, and physical science seeking basic skills and knowledge in those disciplines. The techniques of the calculus, which is often recognized as one of the major intellectual achievements of the human race, were discovered out of a necessity to solve some of the problems of physics dealing with the universal law of gravitation and planetary motion. Calculus has evolved into a branch of mathematics that now furnishes a convenient tool for solving not only many problems of physics but also many of the problems of the other sciences. It is even today influencing the other sciences and being influenced by them. Following a brief review of algebra and trigonometry, an intuitive study of the limit concept is made. Then the derivative is introduced followed by a study of techniques of differentiation. The properties of the transcendental exponential and logarithmic functions as well as the application of the derivative to these functions are then studied. A study of vectors and parametric equations is then made followed by applications of the derivative. There will be a computer laboratory component to this course in which the students will explore calculus through the use of the computer.

II. COURSE GOALS

The purpose of this course is to introduce the student to the differential calculus of functions of a single variable so that they are prepared for subsequent technical courses and possess experience in solving realistic, multi-step problems. The students will learn problem solving skills, especially flexibility, including the use of numerical, graphical, and symbolic representations of a problem or its solution. Also, the students will use a computer algebra system to explore the concepts of calculus and to find solutions to the more difficult problems.

III. STUDENT LEARNING OUTCOMES FOR THIS COURSE

A. Unit Objectives

Unit 1: Vectors, rates of change, limits and the derivative. As a result of successfully completing this unit, the student will be able to do the following:

1. Represent vector quantities graphically.
2. Use the dot product.
3. Explain slope as a rate of change.
4. Use the tangent line to a distance curve to compute velocity.
5. Calculate the limits of functions algebraically, numerically, and graphically.
6. Explain the derivative as a limit of the slope function.

Unit 2: The derivative of a function. As a result of successfully completing this unit, the student will be able to do the following:

1. Use the power, product, quotient, and chain rules for differentiation.

2. Find the derivative vector functions.
3. Find the tangent line to parametric equations.
4. Find the equation of the line tangent to a graph.
5. Use Newton's method to solve for roots of equations.

Unit 3: Inverse functions and applications. As a result of successfully completing this unit, the student will be able to do the following:

1. Find the derivative of inverse functions.
2. Use hyperbolic functions.
3. Find maximums and minimums of functions.
4. Find asymptotes of functions.
5. Graph functions using calculus.

Unit 4: Projects.

The student is expected to submit one project during the semester. The instructor has some related project topics. Most of the projects require use of a calculator or a computer algebra system. Students may work on an assigned project in small groups of no more than four (individual work is permitted if preferred). These project reports must be written up like a term paper and handed in at the appointed time. More details will follow in a few weeks.

B. Objectives for Students in Teacher Preparation Programs

The Teacher Preparation Program meets the competency-based requirements established by the Oklahoma Commission on Teacher Preparation. This course meets the following competencies: Subject Competencies (SC) 5,6,7,8, and 9.

SC 5: Has a broad and deep knowledge of the concepts, principles, techniques, and reasoning methods of mathematics that is used to set curricular goals and shape teaching.

SC 6: Understands significant connections among mathematical ideas and the applications of these ideas to problem solving in mathematics, in other disciplines, and in the world outside of school.

SC 7: Has experiences with practical applications of mathematical ideas and is able to incorporate these in curricular and instructional decisions.

SC 8: Is proficient in, at least, the mathematics content needed to teach the mathematics skills described in Oklahoma's core curriculum, from multiple perspectives. This includes, but is not limited to, a concrete and abstract understanding of number systems and number theory, geometry and measurement, statistics and probability, functions, algebra, discrete mathematics, and calculus necessary to effectively teach the mathematics skills addressed in the sixth through twelfth grade in the Oklahoma core curriculum. (The depth and breadth of knowledge should be much greater than for the Intermediate Mathematics certification.)

SC 9: Is proficient in the use of a variety of instructional strategies to include, but is not limited to, cooperative learning, use of concrete materials, use of technology (i.e., calculators and computers), and writing strategies to stimulate and facilitate student learning.

IV. TEXTBOOKS AND OTHER LEARNING RESOURCES

Required Materials

Textbooks
Stewart, James (1999). Calculus - Early Vectors (preliminary version), Brooks/Cole.

V. POLICIES AND PROCEDURES

A. University Policies and Procedures

1. Attendance at each class or laboratory is mandatory at Oral Roberts University. Excessive absences can reduce a student's grade or deny credit for the course.
2. Students taking a late exam because of an unauthorized absence are charged a late exam fee.
3. Students and faculty at Oral Roberts University must adhere to all laws addressing the ethical use of others' materials, whether it is in the form of print, video, multimedia, or computer software. By submitting an assignment in any form, the student gives permission for the assignment to be checked for plagiarism, either by submitting the work for electronic verification or by other means.
4. Final exams cannot be given before their scheduled times. Students need to check the final exam schedule before planning return flights or other events at the end of the semester.
5. Students are to be in compliance with University, school, and departmental policies regarding ePortfolio requirements. Students should consult the ePortfolio handbooks for requirements regarding general education and the students' majors.
   a. The penalty for not submitting electronically or for incorrectly submitting an ePortfolio artifact is a zero for that assignment.
   b. By submitting an assignment, the student gives permission for the assignment to be assessed electronically.

B. Department Policies and Procedures

1. Each student who uses the computer is given access to the appropriate computer resources. These limited resources and privileges are given to allow students to perform course assignments. Abuse of these privileges will result in their curtailment. Students should note that the contents of Computer directories are subject to review by instructors and the computer Administrative staff.
2. A fee of $15.00 will be assessed for all late exams if the instructor allows for such. This policy applies to all exams taken without notifying the professor prior to the regularly scheduled exam time, and to all exams taken late without an administrative excuse.

C. Course Policies and Procedures

1. Evaluation Procedures
   The standard grading scale will be used, A (90% - 100%), B (80% - 89%), C (70% - 79%), D (60% - 69%), F (0% - 59%). The composite score is determined by the following distribution:

Three fifty-minute exams @ 100 points	300 points
Homework, computer labs and quizzes	200 points
One written project @ 100 points	200 points
One final exam @ 200 points	200 points

   The ePortfolio artifact is a reflection paper on the Exponential Growth and Decay Lab that counts as 10% of the Maple Labs score and is therefore 1% of your course grade.
2. ePortfolio Requirements
   An ePortfolio artifact is required for this course or MAT 114. For

specific requirements check the General Education ePortfolio handbook at http://eportfolio.oru.edu/servlet/page?_pageid=1883&_dad=portal30&_schema =PORTAL30&p_page=GEH and click on the "General Education ePortfolio Handbook Fall 2005" link.

3. Other Information
   Most of the student's previous mathematics class time has probably been spent listening to an instructor lecture about the material while taking notes. This is a very passive approach, one which will be changed in this course. Rather than lecturing all of the time, some class time will be spent discussing the material with the student. The student will be surprised how much clearer things become once they are said out loud. In order for this to work, the student must prepare for each class by reading the book prior to class. Remember, **calculus is not a spectator sport!!!**
4. There are three types of activities—reading, text exercises, and computer laboratory. A daily assignment schedule is included in this syllabus. Each section of the text is to be read prior to the class discussion of that section. Assignments will be reviewed on the day on which they are due. Exercises and problems must be turned in at the end of the class period on the date they are due in order to receive credit (see Grading Scale above). The student may be asked to put some problems or exercises on the board in class.
5. Reading mathematics is very different from reading a novel. Every word and equation is important, and the student should consider each one carefully before going on. The student should keep a pencil and paper handy while reading so that details that may not be written down explicitly can be added. The student should try the exercises in the book. The answers are in the back of the book. The student should be ready to ask questions in class about the problems in class, and not be afraid to ask; surely, there are others with the same question.
6. Some exercises are routine and mechanical, much like the homework the student is accustomed to having in mathematics courses. Other exercises require more thought, and one may find them frustrating at the beginning. Some problem-solving strategies will be explored, but the best way to learn to solve problems is to persevere. The student will eventually learn what questions to ask, how to try simple cases, and how to generalize. The student should be patient—the effort is worth it. Problem solving is what mathematics is all about.
7. The computer laboratories are designed so students can explore the concepts that are covered in the text. The first two laboratories are designed to introduce one to the computer algebra system Maple. Afterwards, the first few minutes at the beginning of the lab period will be used to introduce the laboratory exercise. Then the student will spend the rest of the time investigating calculus with Maple by going through the laboratory assignment.
8. There will be four exams as scheduled (see the daily assignment schedule) as well as a final exam. Each exam will be like the exercises; the majority will be like the problems that were assigned for homework, possibly including some variations of those. From time to time throughout the semester, there may be a quiz on the material covered recently in class. These quizzes may or may not be announced in advance.
9. The students are encouraged to ask for help whenever they do not understand something or cannot solve a problem. The instructor will try to be available as much as possible. If the instructor's office hours are inconvenient, the student may call for help or make an appointment.

VI. COURSE CALENDAR

LESSON	SECTION	TOPIC	HOMEWORK ASSIGNMENTS
1	0.1-0.5	Review and Preview	Read Review Chapter
2	1.1	Vectors	# 1,3,5,7,11,15,19,27,28,30
3	1.2	Dot Product	# 3,5,7,13,17,29,35,41,49,63
4	1.3	Vector Functions	# 3,5,7,13,17,23,27,29,34, (Use Maple to do) 38
5	2.1	The Tangent and Velocity Problems	# 2,3,4,5,6,8,9,10,11,12
6	2.2	The Limit of a Function	# 1,3,7,11,15,17,21,25,27,29
7	2.3	Calculating Limits Using the Limit Laws	# 3,9,11,13,17,25,41,49,65,77
8	2.4	The Precise Definition of a Limit	# 1,2,3,4,9,11,23,31,33,41
9	2.5	Continuity	# 1,2,3,9,15,25,26,37,42,57
10	2.6	Limits at Infinity: Horizontal Asymptotes	# 3,7,13,15,29,31,41,43,45,55
11	2.7	Tangents, Velocities and Other Rates of Change	# 1,3,5,7,13,15,16,19,20,21
12	Review	Review of Chapters 1 & 2	
13	Exam I	Chapters 1 & 2	
14	3.1	Derivatives	# 1,2,7,9,11,15,23,26,35,57
15	3.2	Differentiation Formulas	# 1,3,9,15,25,31,41,57,63,72
16	3.3	Rates of Change in the Natural and Social Sciences	# 1,3,5,7,9,11,17,19,22,27
17	3.4	Derivatives of Trig Functions	# 3,7,13,15,21,25,33,35,39,56
18	3.5	The Chain Rule	# 1,5,7,9,25,39,47,51,63,77
19	3.6	Implicit Differentiation	# 1,5,11,13,17,19,23,35,43,45
20	3.7	Derivatives of Vector Functions	# 1,3,7,9,11,13,15,17,19,20
21	3.8	Higher Derivatives	# 1,2,3,9,17,23,31,33,43,53
22	3.9	Slopes and Tangents of Parametric Curves	# 1,3,5,7,11,13,15,19,23,25
23	3.10	Related Rates	# 1,3,5,7,11,17,19,23,29,33
24	3.11	Differentials: Linear and Quadratic Approximations	# 1,5,7,9,19,23,31,33,36,55
25	3.12	Newton's Method	# 3,5,7,9,11,13,17,19,25,28

26	Review	Review of Chapter 3	
27	Exam II	Chapter 3	
28	4.1	Exponential Functions and Their Derivatives	# 5,9,13,17,19,27,29,31,41,43
29	4.2	Inverse Functions	# 7,11,13,17,19,23,27,29,33,41
30	4.3	Logarithmic Functions	# 1,3,11,15,17,19,21,29,41,61
31	4.4	Derivatives of Logarithmic Functions	# 1,3,5,11,15,35,37,39,51,69
32	4.5	Exponential Growth and Decay	# 1,3,5,7,9,11,13,17,19,21
33	4.6	Inverse Trigonometric Functions	# 1,3,9,18,19,21,32,33,45,65
34	4.7	Hyperbolic Functions	# 1,4,7,9,15,31,33,37,39,41
35	4.8	Indeterminate Forms and L'Hopital's Rule	# 1,7,11,21,25,41,47,55,65,77
36	5.1	What does f' say about f?	# 1,2,3,11,12,13,19,20,21,22
37	5.2	Maximum and Minimum Values	# 3,5,7,25,27,31,39,41,45,53
38	5.3	Derivatives and Shapes of Curves	# 7,9,11,13,15,21,25,39,43,47
39	5.4	Graphing with Calculus	# 1,3,5,9,10,11,12,22,25,26
40	5.5	Applied Maximum and Minimum Problems	# 1,3,6,10,11,13,14,23,35,50
41	5.6	Applications to Economics	# 1,2,3,4,6,8,10,13,15,20
42	5.7	Anti-derivatives	# 1,11,17,30,31,41,46,61,67,82
43	Review	Review Chapters 4 & 5	
44	Exam 3	Chapter 4 & 5	
45	Review	Review For Final Exam	

Course Inventory for ORU's Student Learning Outcomes

MAT 201–Calculus I
Summer 2006

This course contributes to the ORU student learning outcomes as indicated below:
Significant Contribution – Addresses the outcome directly and includes targeted assessment.
Moderate Contribution – Addresses the outcome directly or indirectly and includes some assessment.
Minimal Contribution – Addresses the outcome indirectly and includes little or no assessment.
No Contribution – Does not address the outcome.

The Student Learning Glossary at http://ir.oru.edu/doc/glossary.pdf defines each outcome and each of the proficiencies/capacities.

OUTCOMES & Proficiencies/Capacities	Significant Contribution	Moderate Contribution	Minimal Contribution	No Contribution
1	**Outcome #1 – Spiritually Alive** Proficiencies/Capacities				
1A	Biblical knowledge			X	
1B	Sensitivity to the Holy Spirit			X	
1C	Evangelistic capability			X	
1D	Ethical behavior			X	
2	**Outcome #2 – Intellectually Alert** Proficiencies/Capacities				
2A	Critical thinking	X			
2B	Information literacy		X		
2C	Global & historical perspectives		X		
2D	Aesthetic appreciation				
2E	Intellectual creativity	X			
3	**Outcome #3 – Physically Disciplined** Proficiencies/Capacities				
3A	Healthy lifestyle			X	
3B	Physically disciplined lifestyle			X	
4	**Outcome #4 – Socially Adept** Proficiencies/Capacities				
4A	Communication skills	X			
4B	Interpersonal skills		X		
4C	Appreciation of cultural & linguistic differences			X	
4D	Responsible citizenship			X	
4E	Leadership capacity			X	