CALCULUS 1

MATH 1710.621

SPRING 2013

Instructor: Dr. J. Iaia
Office: GAB 420
Office Hours: MW 11-1, or by appt.
Webpage: http://www.math.unt.edu/~iaia

Time: MTWR 10:00-10:50
Place: SAGE 230
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Text: Briggs and Cochran, *Calculus, 1st ed.*

GRADING POLICY

Homework	Daily	$16\frac{2}{3}\%$	
Exam 1	Feb. 7	$16\frac{2}{3}\%$	9:30-10:50
Exam 2	Mar. 7	$16\frac{2}{3}\%$	9:30-10:50
Project	Apr. 11	$16\frac{2}{3}\%$	
Exam 3	Apr. 18	$16\frac{2}{3}\%$	9:30-10:50
Final	May 7	$16\frac{2}{3}\%$	8am-10am

Exams: Exams **must** be taken on the dates listed above. Exceptions will be considered *only* if one has **written documentation** certifying one's absence.

Homework: Homework will be assigned each class and collected daily. Five problems will be chosen at random and graded. Homework is extremely important and students are highly encouraged to spend a lot of time working on the homework problems.

Attendance: Students are required to attend class.

Code of Conduct: Students are expected to be *respectful of others* at all times. This includes keeping talk and other noise to a minimum while a lecture is in progress or an exam is being taken. Any student being disruptive may be dismissed from the class meeting. **Cheating** will **not** be tolerated and anyone found guilty of cheating may receive an F for the semester.

The **Student Evaluation of Teaching Effectiveness (SETE)** is a requirement for all organized classes at UNT. This short survey will be made available to you at the end of the semester, providing you a chance to comment on how this class is taught. I am very interested in feedback from students, as I work to continually improve my teaching. I consider the SETE to be an important part of your participation in this class.

Students with disabilities: The University of North Texas makes reasonable academic accommodation for students with disabilities. Students seeking accommodation must first register with the Office of Disability Accommodation (ODA) to verify their eligibility. If a disability is verified, the ODA will provide you with an accommodation letter to be delivered to faculty to begin a private discussion regarding your specific needs in a course. You may request accommodations at any time, however, ODA notices of accommodation should be provided as early as possible in the semester to avoid any delay in implementation. Note that students must obtain a new letter of

accommodation for every semester and must meet with each faculty member prior to implementation in each class. For additional information see the Office of Disability Accommodation website at http://www.unt.edu/oda. You may also contact them by phone at 940.565.4323.

Semester grades are determined by averaging the grades on the 3 exams, the final exam, the homework, and the project. Letter grades will be based on this average and will follow this scheme:

A 90- ;B 80-89; C 70-79; D 60-69; F -59

Course Description

Calculus is an extremely useful course and has numerous applications in the sciences and any area where the rate of change of an object is being studied. Sir Isaac Newton invented calculus in an attempt to understand the motions of the planets and with this tool was able to mathematically verify Kepler's laws of planetary motion (probably the most famous of these is that the planets move in ellipses about the sun). The first part of this course is about finding the slope of a line which is tangent to a curve. This slope is the *derivative* of the curve and we will show how to find this slope for various functions such as $f(x) = x, x^2, \sin(x), \frac{x}{x^2+1}$, etc. All of this relies on a study of limits which is a major concept which will be seen throughout the semester. We will learn various ways to determine the limit of a function and what this tells us about the behavior of the function. Next we will learn some basic rules about derivatives - how to calculate the derivative of a product, a quotient, and a composition of functions. This will lead us to the calculation of the derivative of the trig functions and a study of what the first and second derivatives tell about the shape of a curve. We will calculate the local maxima and local minima of a function and be able to use this information to sketch the graph of a function. Next, we will learn about implicit differentiation and related rates. So if we know the rate at which the radius of a balloon is increasing then we will be able to determine the rate at which the surface area and the volume of the balloon are increasing.

The second part of the course is about finding the area under a curve. We will first approximate the area under the graph of a function and see how to obtain better and better approximations to the actual area. The fundamental theorem of calculus is a powerful tool that will allow us to precisely calculate these areas. In addition, we will be able to calculate the volume and surface area of a region revolved around the x-axis as well as the length of a curve. In order to do this we will need to be able to calculate antidervatives and we will learn various techniques for calculating these. Finally, we will learn how to find the length of a curve.

Course Objectives

At the end of the semester the student should be able calculate the derivative of a large variety of functions. The student should have a geometric understanding of the derivative of a function and should be able to look at the graph of a function and know whether or not the function has a derivative at a particular point. The student should also know the derivatives of the trig functions and should know what information about the first and second derivative tells about the graph of a

function. The student should be able to find any local maxima or local minima of a function and also determine any inflection points. In addition, the student should be able to solve word problems which involve finding the maximum or minimum of a function of one variable. Next, the student should understand implicit differentiation and related rates. The student should know how to solve word problems involving the rate of change of more than one function. For example, if a spherical balloon is increasing in volume at a rate of 4 ft^3/sec, then at what rate is the radius of the balloon increasing? The student should be familiar with finding the antiderivative of various functions and using this information to determine the area under a curve on an interval. The student should be proficient at applying the first and second fundamental theorems of calculus and also using u-substitution to calculate various integrals. Finally, the student should be able to calculate the volume or surface area obtained by revolving a region around the x or y axis and also how to calculate the length of a curve.

Course Outline

Meeting 1 - introduction to limits

Meeting 2 - more on limits

Meeting 3 - more on limits

Meeting 4 - limits and the squeeze law

Meeting 5 - the ϵ-δ definition of limit

Meeting 6 - more on the ϵ-δ definition of limit

Meeting 7 - definition of continuous

Meeting 8 - definition of derivative

Meeting 9 - computation of derivatives

Meeting 10 - proof that if f has a derivative at c then f is continuous at c

Meeting 11 - statement and proof of the product rule

Meeting 12 - statement and proof of the quotient rule

Meeting 13 - statement and proof of the chain rule

Meeting 14 - review for exam 1

Meeting 15 - more review for exam 1

Meeting 16 - exam 1

Meeting 17 - computation of derivatives using the product, quotient, and chain rules

Meeting 18 - proof that $\lim_{x \to 0} \frac{\sin(x)}{x} = 1$ when x is measured in radians

Meeting 19 - computation of the derivatives of the trig functions

Meeting 20 - the derivative as a rate of change

Meeting 21 - velocity as the derivative of position and acceleration as the derivative of the velocity

Meeting 22 - height of falling objects influenced only by gravity

Meeting 23 - implicit differentiation

Meeting 24 - related rates

Meeting 25 - the mean value theorem

Meeting 26 - increasing/decreasing functions and the sign of the first derivative

Meeting 27 - concavity and the sign of the second derivative

Meeting 28 - local maxima and local minima

Meeting 29 - concavity and inflection points

Meeting 30 - curve sketching

Meeting 31 - more on curve sketching

Meeting 32 - max/min word problems

Meeting 33 - approximation of the area under a curve

Meeting 34 - review for exam 2

Meeting 35 - more review for exam 2

Meeting 36 - exam 2

Meeting 37 - more on approximation of the area under a curve

Meeting 38 - more on approximation of the area under a curve

Meeting 39 - the first fundamental theorem of calculus

Meeting 40 - the second fundamental theorem of calculus

Meeting 41 - calculation of integrals

Meeting 42 - more calculation of integrals

Meeting 43 - calculation of integrals by u substitution

Meeting 44 - determining the area between two curves

Meeting 45 - finding the volume of a region revolved around the x-axis

Meeting 46 - finding the volume of a region revolved around the y-axis

Meeting 47 - finding the surface area of a region revolved around the x-axis

Meeting 48 - finding the length of a curve

Meeting 49 - more on finding the length of a curve

Meeting 50 - review for exam 3

Meeting 51 - more review for exam 3

Meeting 52 - exam 3

Meeting 53 - proof of the first fundamental theorem of calculus

Meeting 54 - proof of the second fundamental theorem of calculus

Meeting 55 - work as the integral of force

Meeting 56 - more on work as the integral of force

Meeting 57 - review for the final exam

Meeting 58 - more review for final exam

Meeting 59 - more review for final exam

Meeting 60 - final exam