

CALCULUS

Mr. TJ Middleton
E-mail: tmidd@bosqueschool.org

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School Phone: 898-6388, Ext. 216

OBJECTIVE

The major goal of this course is to provide an understanding of limits, derivatives, and integrals, along with the interpretations and applications thereof. More specifically, we will:

- review critical aspects of functions
- develop the concept of a limit numerically and graphically, and explore the continuity of functions
- gain mastery of analytic techniques for evaluating limits
- develop the concept of a derivative numerically and graphically, as well as through applications
- gain mastery of analytic techniques for finding derivatives
- utilize derivatives to analyze and graph functions, investigate rates of change, and explore optimal solutions
- develop the concept of both definite and indefinite integrals numerically and graphically, as well as through applications
- gain mastery of analytic techniques for evaluating integrals
- utilize integrals to solve simple differential equations, find areas of irregular 2-D regions, and find volumes of 3-D objects (as time allows)

The following excerpt from a calculus text provides a fairly lucid overview of the purpose of calculus and some noteworthy examples of extended real-world applications.

Calculus, which is sometimes called the “mathematics of change,” is the branch of mathematics concerned with describing the precise way in which changes in one variable relate to changes in another. In almost every human activity we encounter two types of variables: those that we can control directly and those that we cannot. Fortunately, those variables that we cannot control directly often respond in some way to those that we can.

For example, the acceleration of a car responds to the way in which we control the flow of gasoline to the engine, the inflation rate of an economy responds to the way in which the national government controls the money supply, and the level of an antibiotic in a person’s bloodstream responds to the dosage and timing of a doctor’s prescription. By understanding quantitatively how the variables we cannot control directly respond to those we can, we hope to make predictions about the behavior of our environment and gain some mastery over it. Calculus is one of the fundamental mathematical tools used for this purpose.

Howard Anton, *Calculus: A New Horizon (Brief Edition)*,
John Wiley & Sons: NY, 1999, Pg. 1

In addition to the specific skills and concepts mentioned above, this course aims to develop students’ ability to communicate technical information and mathematical knowledge, ***which places a heavy emphasis on the processes and reasoning used to arrive at answers, as well as proper mathematical notation.***

CALCULATORS

The use of calculators is allowed and even expected, as appropriate, in this course. Calculators, especially those that graph functions, have become increasingly important in the curriculum of high school math courses. I believe that these devices allow students to see mathematics as a dynamic and useful subject. Students are able to analyze actual data taken from real-world examples rather than simply manipulate contrived problems. As a teacher, I have witnessed how calculators encourage more discussion and enthusiasm about mathematics, thereby increasing student understanding of concepts and decreasing rote memorization. Furthermore, technology is becoming increasingly pervasive in our lives and each student's future success will depend, in part, on his or her ability to adequately interact with this technology. The preferred models of calculators for this class are the various versions of the Texas Instruments TI-83 and TI-84. Specifically, I will be using a TI-84 Plus Silver Edition. The other versions of TI-83 and TI-84 are also quite compatible with and useful for this class. **If you buy a new Texas Instruments calculator, PLEASE bring me the Technology Rewards code from the package. The school can obtain free equipment with these Rewards Points.**

TEXTBOOKS

No single book can do justice to the variety of topics and activities that can be studied in Calculus. Also, many different approaches to mathematical concepts and skills have been developed recently due to advances in technology and an emphasis on meaning-making in mathematics. Thus, in addition to the textbooks listed below, students may receive numerous printed or electronic supplements derived from other sources. This is not meant to burden or confuse students, but to enrich their experience with mathematics and to strengthen their grasp of the topics. Students are responsible each day for bringing the appropriate textbook and supplementary materials to class. Textbooks must be returned in *good condition* at the end of the course.

Hughes-Hallett, et al., *Calculus: Single Variable, 2nd Edition*, John Wiley & Sons: NY, 1998
Larson, Hostetler, and Edwards, *Calculus of a Single Variable: Early Transcendental Functions, 3rd Edition*,
Houghton Mifflin: Boston, 2003

GRADING POLICY

Grades for each semester are determined with respect to performance on Daily Grades and Major Grades (as well as a Semester Final Exam). With occasional exceptions, each item within these two categories counts as equal in weight to the other items in that respective category. Daily Grades are described below. Major Grades include Regular Exams and Alternative Assessments, which are also described below. In general, the Daily Grades will account for 35% of the final grade each semester, Major Grades will account for 50%, and the Semester Final will account for 15%. However, adjustments to these proportions may be necessary depending on the number of assignments in a semester, time restraints of the course, or other factors. The final (year-long) course grade will be calculated by averaging the fall and spring semester grades.

Daily Grades

Daily Grades consist of quizzes given during class, homework completed outside of class, and in-class assignments. Each of these types of assessment occurs FREQUENTLY and RANDOMLY. Students must keep up constantly with the various assignments, especially homework.

Daily assignments are given one of the three following types of grades:

Numerical Grade – Many assignments are collected, carefully scrutinized for their correctness, and awarded points based on accuracy and thoroughness of one, several, or all problems.

NOTE: In order to receive full credit on these assignments, a student must not only provide a correct answer, but also provide appropriate work AND REASONING to support that answer.

*** "Work" means more than a few scribbled calculations. ***

Completion Grade – Some assignments are checked simply for their completeness and the grade reflects a student's effort to finish the assignment *thoroughly*.

Qualitative Grade – Some assignments may be checked for their accuracy, but the emphasis of the grade will be placed on its demonstration of synthesis and effort. These assignments will be given a general letter grade reflecting the overall QUALITY of the work.

(The last page describes these grades in more detail.)

Regular Exams

Three to five Regular Exams will be given each semester. The format of the exams will vary due to the nature of the material being studied. Exams may contain free response items, for which the student can receive partial credit, and/or objective items (multiple choice, true/false, etc.). Some exams may have a take-home portion since application problems often require extended time for investigation. After the exams are graded, provisions will be made for students to improve their score on *some* of these Regular Exams.

Alternative Assessments

Each semester, students *may* be assigned one or two major projects or other type of culminating assignment related to the units studied during the course. These projects provide students with an alternate method for demonstrating their understanding and appreciation of mathematics, while also incorporating their talents in other areas. Some class time may be spent completing these, but most work will be done outside of class.

Semester Final Exam

A Semester Final Exam will be given at the end of each semester. This exam requires students to synthesize a larger amount of material, thus providing greater review and retention of the course's content. Also, the Semester Final Exam grade can replace the *lowest* Regular Exam grade for that semester if it improves the student's average.

SPECIAL NOTE

Calculus is an EXCITING course that not only hopes to provide an understanding of the incredible complexity and beauty of math, but also to foster the self-responsibility necessary in anticipation of college. As such, it is often the responsibility of the STUDENT to seek help with troublesome homework problems or with concepts not understood in class. I am nearly always available before or after school and at lunch or activity blocks, and I **STRONGLY** encourage students to get additional help at that time.

Near the end of this course, students may be able to take an Advanced Placement Exam, which can give them college credit for a calculus course. Although students are NOT required to take this exam, I highly recommend the AP Exam for strong and enthusiastic students (extra work outside of class will be required in order to fully prepare for the exam). Numerous references to this test and its contents may be made throughout the course because the AP Exam happens to provide a comprehensive standard against which I can measure the excellence of this course. However, my focus on the exam should NOT be misconstrued as pressure to take it. There are many advantages and some possible disadvantages to attempting the AP Exam, and I am always eager to discuss them with you.

LATEWORK

Missing work may be turned in late up to three days after it was originally due, but will receive only half credit. Of course, in the case of an excused absence or extenuating circumstances, missing work will be accepted for full credit, provided the student completes it in a *timely manner*.

ABSENCES

If a student is absent, IT IS HIS OR HER RESPONSIBILITY to determine what classwork and notes were missed, and to arrange to make up quizzes, tests, and other assignments before or after school. Generally, students must complete these activities *within three days* after returning to class.

CLASSROOM EXPECTATIONS

Members of the Bosque community are expected to conduct themselves in such a way as to foster educational excellence for all. This includes arriving to class prepared and on time, as well as participating appropriately in the lessons. Students should strive to create an atmosphere indicative of an academic community in which each member feels safe and encouraged. Also, they should be mindful of their environment and keep it clean.

ACADEMIC INTEGRITY

Bosque School is a learning community dedicated to fostering intellectual growth and development and a sense of responsibility in each child. For students, academic integrity means that they are absolutely honest in their intellectual efforts. Violations of academic integrity, in any form, are, therefore, contrary to the values of Bosque School and detrimental to the students' own development as young scholars and responsible members of this community. For more specifics about Bosque's policy regarding academic integrity, please see the Student Handbook.

Below are some general guidelines to help students make correct decisions regarding academic integrity in this course:

Homework -- Students are usually allowed to seek help from teachers, other students, or their parents with homework. This help should guide the student toward an understanding of the material, rather than simply provide the student with answers. Directly copying another student's paper is a violation of academic integrity.

Quizzes and Tests -- Unless otherwise stated by the teacher, students must complete quizzes and tests without any outside help. Students may not use unauthorized notes or other aids for a test. They may not copy or otherwise allow themselves to be influenced by another student's work during a test. Providing other students with help is also considered dishonest. Students should not share their work during a test and should not discuss the contents of a test with students who have not yet taken/completed the test.

If you have any questions regarding the standards of academic integrity in this course or on a given assignment, you should talk with me prior to doing any work.

Grading Rubric for Daily Assignments

The grading scheme below will be used to assess the quality and accuracy of some daily assignments. The purpose of this system is to center student attention on accuracy and thoroughness, rather than merely on point values. Although the following rubric is intended to serve as a guide for students, the descriptions are NOT entirely comprehensive or binding in every case.

A

- The problems or proofs are complete and all answers are correct.
- Any writing or algebra errors are *truly* minor and have little bearing on the problem's accuracy.
- "Word problems" have "word answers" with appropriate units of measure. Any graphs are drawn neatly on a set of clearly labeled axes with at least 2 exact points specified directly on the graph.
- All the steps displayed in the solutions are appropriate. The steps demonstrate a clear understanding of each problem and the reasoning used to solve it, while exemplifying a mastery of the necessary math skills. Also, the assignment clearly indicates that effort and time were expended to complete the problems.
- The solution uses the correct methods, as specified in the directions, and the correct mathematical notation for each problem.

B

- The assignment is complete and clearly displays the reasoning used to solve each problem.
- The methods used are mostly correct and generally arrive at the correct answers.
- NO more than two noticeable flaws exist throughout the entire assignment or problem set, such as failure to provide a "word problem" with a "word answer," using a decimal approximation inappropriately, showing incorrect algebraic techniques, not including an essential step in a proof, not labeling axes or points on a graph, or being illegible.
- The assignment clearly indicates that effort and time were expended to complete the problems.
- The assignment definitely exemplifies a mastery of the necessary math skills.

C

- The student attempts to solve the problems in the correct manner, yet often fails to produce correct results due to major algebraic errors or other incorrect techniques.
- OR The assignment demonstrates a grasp of the mathematics involved and the reasoning needed to solve the problems, yet arrives at the answers without showing supporting work or through methods other than those specified in the directions.
- OR More than two noticeable flaws (listed above) exist within the assignment or problem set.
- OR The assignment is obviously less than complete.

D

- The student demonstrates some familiarity with the problems, yet the assignment falls very short of completion due to a lack of comprehension about some of the mathematics involved.
- OR The assignment contains combinations of the errors discussed above for a 'C.'
- OR The assignment is only halfway complete.

<D

- The student clearly demonstrates an attempt, yet indicates very little knowledge about the problems or their solution.
- OR The assignment is very incomplete.

Please print this page, sign it, and return it to Mr. Middleton.

I have read and understood the class policies listed above and the grading rubric for qualitative grades. If I have any questions, I will be sure to ask – in person, by phone (898-6388, ext. 216), or by email (tmidd@bosqueschool.org).

Student Name (Printed Legibly) _____

Student Signature _____

Parent Signature _____