Honors Multivariable Calculus  
2013-2014 Syllabus  
Mr. Sullivan Johnston  
Academic Magnet High School

Course Prerequisites

Enrollment in this course requires successful completion AP Calculus AB or AP Calculus BC, and a recommendation from your AP Calculus teacher.

Course Description

Multivariable calculus is generally the third quarter or semester of college calculus. It is considered a second year university level course. Currently, there are no state standards for this course, however this course will follow the content outline presented at the college level. The purpose of offering this course in high school is to offer a challenging math course for seniors that finished AP Calculus their junior year and to keep calculus and math skills fresh for these mathematically or STEM oriented students. The College Board does not yet offer an AP course in multi-variable calculus. Thus, this class is not designated AP and will not require an AP exam.

Scope and Sequence

This course will examine the calculus of real functions of two or more variables. The course begins with reviewing several AP Calculus BC topics including polar coordinate systems and vector calculus. In addition, differential calculus topics including functions of several variables and their derivatives, continuity, directional derivatives, tangent planes, and maximum-minimum theory. The course extends into integral calculus and incorporates the following concepts: double and triple integrals, and surface area. The timeline provides a list of more detailed topics.

Teaching Methodology

This course places a strong emphasis on problem solving, primarily in a pure mathematical context, but also oriented towards problems in the sciences, engineering, and economics. The class will have some lecture, but the majority of class time will be spent with the teacher as the facilitator. Discussion, collaborative groups, and activities are all important components in this course. Students are encouraged to express and justify their ideas and work. The methods used in class promote an atmosphere of questioning, exploration, and enthusiasm for mathematics. Students are expected to work collaboratively in order to collectively come up with a solution. There is an expectation that students are responsible for keeping up with assignments.
Learning Objectives and Performance Standards

Upon successful completion of the Multivariable Differential Calculus course, students will:

- Be able to work with and analyze functions of several variables represented in a variety of ways, including graphical, analytical, numerical, and verbal.
- Be able to work with vector-valued functions, including the unit tangent, normal, and binormal vectors.
- Understand the meaning of partial differentiation.
- Understand the chain rule for functions of two or more variables.
- Be able to work with common applications of partial differentiation such as tangent planes and maximum/minimum problems with and without constraints.
- Develop mathematical models for applications of mathematics to physical situations.
- Be able to use technology to assist in mathematical problem-solving.
- Be able to solve problems using verbal, numeric, algebraic, and graphic approaches.
- Be able to understand the underlying concepts in multivariable calculus and justify their reasoning.
- Communicate mathematically using precise mathematical notation in an organized and logical structure verbally or in effective written expression.

Required Textbook

Required Supplies
We will be using the TI-89 extensively in the course. You are highly encouraged to have one. In addition, you will need a 3-ring binder.

Timeline of Course Content

<table>
<thead>
<tr>
<th>1st Nine weeks</th>
<th>3rd Nine weeks</th>
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<tbody>
<tr>
<td>The Polar Coordinate System</td>
<td>Differentiability</td>
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<tr>
<td>Graphs of Polar Equations</td>
<td>Directional Derivatives and Gradients</td>
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<tr>
<td>Calculus in Polar Coordinates</td>
<td>The Chain Rule</td>
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<tr>
<td>Plane Curves: Parametric Representation</td>
<td>Tangent Planes, Approximations</td>
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<tr>
<td>Vectors in the Plane: Geometric Approach</td>
<td>Maxima and Minima</td>
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<tr>
<td>Vectors in the Plane: Algebraic Approach</td>
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<tr>
<td>Vector-Valued Functions and Curvilinear Motion</td>
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<tr>
<td>Cartesian Coordinates in Three-Space</td>
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<tr>
<td>Vectors in Three-Space</td>
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<tr>
<td>The Cross Product</td>
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Overview of Assignments and Grading Policy

- **In class participation:** Students are expected to participate in in-class discussion sections, and are expected to have a functioning graphing calculator for presenting problems and asking questions during discussion sections. Students will contribute to and be part of an active learning environment.

- **Homework assignments:** Homework will be assigned on a daily basis but will not always be collected. It will be checked occasionally and a grade assigned based on completion and effort. It is expected that the students will complete all homework assignments.

- **Quizzes:** Quizzes are generally given on a weekly basis and based on material from homework, class discussions, or activities.

- **Unit exams or Projects:** Students will complete written exams and creative projects designed to test depth of understanding of multivariable calculus concepts and the ability to integrate knowledge of course concepts to solve problems and write proofs. A unit exam will be given at the end of each chapter or major concept. There will be approximately 2-3 such exams/projects each 9 weeks.

- **Final exam:** There will be a comprehensive final exam at the end of the course. The final exam will include material covered in lecture, discussion, homework assignments, and exams. This will count as 20% of the yearly average.

**Make-up policy:** In the event that a student is absent, it is the responsibility of the student to see me on the day of his return to reschedule make-up work and get missed assignments. All missed assignments will be entered as a “0” in the grade book. All students present on the day of a test, quiz, or any other evaluation will be evaluated - no exceptions. However, I always give retests when justified by the proper documentation.

### Point Allocations for Assignments

<table>
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<tr>
<th>Point Allocations for Assignments</th>
<th>CCSD Grading Scale</th>
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<tbody>
<tr>
<td>Grades will be averaged on the total point system.</td>
<td>93-100</td>
</tr>
<tr>
<td>Classwork/Homework/Quizzes</td>
<td>85-92</td>
</tr>
<tr>
<td>Unit Exams/Projects</td>
<td>77-84</td>
</tr>
<tr>
<td>Final Exam</td>
<td>70-76</td>
</tr>
<tr>
<td>20% of the yearly average</td>
<td>Below 70</td>
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</table>

**CCSD Grading Scale**

- **A:** 93-100
- **B:** 85-92
- **C:** 77-84
- **D:** 70-76
- **F:** Below 70
To calculate a student’s average:
- Nine weeks average = Add up the points earned and divide by the total number possible
- Semester average = (first nine weeks + second nine weeks)/2)
- Final average = .8((1st semester average + 2nd semester average)/2) + .2(Final Exam)

Rules Of Conduct In The Classroom
1. Be on time.
2. Be prepared. (Bring all materials to class)
3. Be respectful to everyone and everything.
4. Be ready to learn.
   Note: All CCSD rules of conduct will be enforced at all times.

Consequences
1. Verbal warning
2. Detention
3. Parent contact
4. Referral to the administration
   Note: In extreme cases, a student may be directly referred to the administration.

Other Pertinent Information
- After School Help: (3:30-4:30 Monday or by appointment)
- Progress: Progress reports will be sent out during the middle of each nine weeks grading period. Report cards will be sent out every nine weeks. If there are severe problems, I will call when necessary.
- Conference times: (3:30-4:30 Monday)
- Email: john_johnston@charleston.k12.sc.us