

MAT3930
Functions and Modeling (FSU-Teach)
Tues/Thurs 9:30 – 10:45, MCH 220
Course Syllabus
Fall 2010

| | |
|---|--|
| Instructor: Alec Kercheval Office: LOV 113 Office Phone: 644-8701 Office Hours: MWF 10-11 E-mail: kercheva@math.fsu.edu | Instructor: Kathy Clark Office: G135 STB or 203B MCH Office Phone: 644-8497 Office Hours: Tuesdays, 1 – 3 PM (usually in MCH) E-mail: kclark@fsu.edu |
|---|--|

Course Prerequisite(s):

- Successful completion of Step 2, Inquiry-based Lesson Design in Mathematics (for FSU-Teach students)
- MAC 2312, Calculus with Analytic Geometry II, or the equivalent, or permission of instructor
- An interest in exploring teaching

Course Description/Overview

The purpose of this course is to deepen and broaden your mathematical knowledge, with an emphasis on understanding concepts connected to secondary mathematics at a deeper level than before. Additionally, the philosophy of the course (if a course can have a philosophy!) is to have each student participate in ways that may not have been the norm of other undergraduate mathematics courses. That is, we expect students to dig in and get their hands dirty, so-to-speak, so that each is able to take risks, propose conjectures, test solution methods, raise questions, and contribute daily to small group or whole class discussions and investigations.

Thus, you will engage in explorations and lab activities designed to strengthen and expand your mathematical knowledge. Course activities are designed to:

- (1) guide you to a second, deeper look at topics you should have been exposed to previously;
- (2) illuminate the connections between secondary and college mathematics;
- (3) illustrate good use of technology in teaching and learning mathematics;
- (4) illuminate the connections between various areas of mathematics; and
- (5) engage you in serious (i.e., non-routine) problem solving, in problem-based learning, and in applications of mathematics.

The course consists of four generally-themed units: 1) Functions, 2) Modeling, 3) Overlooked Topics and Explorations, and 4) Geometry of Complex Numbers. Specific topics of investigation include function properties and patterns, complex numbers, parametric equations, polar equations, vectors, and exponential growth and decay. Explorations involve the use of multiple representations, transformations, data analysis techniques (such as curve fitting) and interconnections among topics in algebra, analytic geometry, statistics, trigonometry, and calculus. The lab investigations involve the use of various technologies including computers, calculators, and computer graphing software.

Course Objectives and Expectations

| Course Objectives and Evidence of Student Learning | |
|--|--|
| <i>Students will be able to...</i> | <i>Evidence of Student Learning:</i> |
| demonstrate proficiency in working with the concept of function and function related topics such as rate of change, limit, and accumulation. | <ul style="list-style-type: none"> classroom activities, student presentation of findings, assessments, and classroom performance (e.g., participation) |
| demonstrate a depth of content knowledge with regard to important secondary mathematics topics such as parametric relations, polar relations, matrices, exponential and logarithmic functions, vectors, and complex numbers. | <ul style="list-style-type: none"> classroom activities, student presentation of findings, assessments, and classroom performance |
| generate or work with relevant lab or exploration data and use regression, matrix, function pattern, and other methods to generate and model the data. | <ul style="list-style-type: none"> classroom activities and classroom lab write up (e.g., analysis) |
| present mathematical ideas and topics in a knowledgeable and effective manner. | <ul style="list-style-type: none"> classroom presentations of findings, small group participation, and whole-class participation, and classroom performance |
| demonstrate proficiency in the use of technology in the mathematics classroom. | <ul style="list-style-type: none"> classroom activities, labs, assessments, and classroom performance |
| search for and identify mathematics content connections between the various levels of secondary mathematics curriculum and between secondary and university level curriculum. | <ul style="list-style-type: none"> classroom activities, student presentation of findings, and classroom performance |

Expectations

You are expected to:

1. Contribute to classroom discussion (small group and whole-class) and continue projects begun in class on your own time.
2. Use e-mail for communication with the instructor(s) and as necessary, classmates.
3. Check email and the course web site **daily** (or at least on class days!) for course information and updates.

Course Requirements

Students must be able to:

- Create Microsoft® Word documents or PDF documents.
- Bring to class a TI 83/84+ calculator or laptop with spreadsheet, or preferably both.
- Maintain organization of course materials (a binder with loose-leaf paper and dividers is strongly recommended!), especially given the interconnectivity of topics we will cover during the course.

Tentative Course Schedule

| Class | Topic |
|-----------------------------------|--|
| Topic 1: | Course Orientation |
| Topic 2 (begin Unit 1): | Function: Definition and Classification |
| Topic 3: | Complex Roots and the Quadratic Function Exploration |
| Topic 4: | Qualitative Graphing (Part 1) |
| Topic 5: | Part I: Physics Review |
| Topic 5: | Part II: Qualitative Graphing (Part 2) |
| Topic 6: | Conic Sections |
| Topic 7: | Air Pressure Lab (or similar alternative) |
| Topic 8: | Sequences |
| | Test #1 |
| Topic 9: | Difference Columns |
| Topic 10: | Function Patterns, Part 1 |
| Topic 11: | Function Patterns, Part 2 |
| Topic 12 (begin Unit 2): | Construction of the Least-Squares Regression Line |
| Topic 13: | Modeling Functions and Linear Regression |
| Topic 14: | More on Regression (Residuals) |
| Topic 15: | Modeling Functions with Matrices, Part 1 |
| Topic 16: | Modeling Functions with Matrices, Part 2 |
| | Test #2 |
| Topic 17: | Terminal Speed Lab |
| Topic 18 (begin Unit 3): | Parametric Models |
| Topic 19: | Parametric Explorations (Vectors) |
| Topic 20: | Polar Coordinate System |
| Topic 21: | Exponential/Logistic Models |
| | Test #3 |
| Topic 22: | Comprehensive Applications, Part 1 (Roller Coaster) |
| Topic 23: | Comprehensive Applications, Part 2 (TBA) |
| Topic 24 (begin Unit 4): | Geometry of Complex Numbers |
| Topic 25: | Polar Complex Numbers |
| Topic 26: | Mandelbrot Set |
| Topic 27: | Course Review |
| December 8, 7:30 – 9:30 AM | Final Exam |

Attendance Policy

Because a majority of the learning depends on group work done during class time, **attendance** is required and of utmost importance. **Two points** will be deducted for each absence. If you contact one of the instructors before the class begins, only one point will be deducted, unless you have a valid excuse (see below). **One point** will be deducted for each unexcused tardy after the first. Arriving to class more than 20 minutes may result in losing **two points**. **NOTE:** We reserve the right to lower your grade by one letter or fail you for excessive absences.

You will be given the opportunity to make-up work missed due to excused absences. An excused absence is one of the following: documented illness of yourself or serious illness of a dependent child; deaths in the immediate family and other documented crises; call to active military duty or jury duty; religious holy days; and official University activities. **You must e-mail Dr. Clark (kclark@fsu.edu) to request materials or assignment information for the class sessions that you missed.**

Students must provide, when possible, advance notice of absences as well as relevant documentation regarding absences to the instructor as soon as possible following the illness or event that led to an absence. Regardless of whether an absence is excused or unexcused, the student is responsible for making up all work that is missed. University-wide policy requires all students to attend the first class meeting of all classes for which they are registered. Students who do not attend the first class meeting of a course for which they are registered will be dropped from the course by the academic department that offers the course.

For further information, consult the *FSU General Bulletin* at:
<http://registrar.fsu.edu/bulletin/undergrad/apdefault.htm>.

Assignments/Grading Policy

| Activities | Points |
|--|---------------------------------|
| Tests. There will be three in-class exams to test your knowledge of the concepts we are currently discussing in class | 30 |
| Written Assignments, Labs, Homework. There will be frequent in-class and take-home explorations and labs, as well as four graded end-of-unit homework assignments. | 35 |
| Attendance and Participation. Since a majority of the course work will be completed in small groups during the class time, attendance is of utmost importance and you are expected to be in class each and to participate (see below) | 5 (or more; see p. 4, above) |
| Midterm Project. You will explore the beauty of mathematics. Details will be given later. | 10 |
| Final Exam. On Wednesday, December 8, 2010, 7:30 – 9:30 AM | 20 |
| TOTAL | 100 |

A Note on Assignments, Participation, and “Graded Items”

Assignments: What will be graded?

Each class day will vary somewhat with regard to lecture (very little, by the way!), whole-class discussion, small-group work, and presentations/discussions of student work. While we intend for much of the time in class to be spent working on authentic mathematics, you will also be expected to complete assignments outside of class. It is important that you stay organized during the course. We recommend keeping a course binder, divided into sections, so that notes, assignments, explorations, labs, and tests are easy to find and reference. Each week (approximately) you will hand in at least one graded item. In most cases, these will be either: completed labs (done as a small-group effort), unit homeworks, or selected explorations. If we intend to collect your work, we will note this in advance.

We take ‘participation’ seriously!

After implementing the course several times now we have witnessed the importance of student participation and correspondingly, we have designed a quantitative way to evaluate it. This will be done in two ways: periodic self- and peer-assessment and instructor assessment of student participation. **Self- and peer-assessment will occur periodically** (e.g., every 3 to 5 class sessions) during the semester and will be unannounced. The two rubrics that will be used can be found in the Appendix.

Grading Scale

90 – 100 = A

80 – 89 = B

75 – 79 = C

70 – 74 = D

Below 70 = F

Late Work Policy

Assignments must be submitted on the dates indicated. Late work will not be accepted unless there is a documented excuse as listed in the **Attendance Policy** on page 4 (also given below).

Additional University Policies

University Attendance Policy

Excused absences include documented illness, deaths in the family and other documented crises, call to active military duty or jury duty, religious holy days, and official University activities. These absences will be accommodated in a way that does not arbitrarily penalize students who have a valid excuse. Consideration will also be given to students whose dependent children experience serious illness.

Academic Honor Policy

The Florida State University Academic Honor Policy outlines the University's expectations for the integrity of students' academic work, the procedures for resolving alleged violations of those expectations, and the rights and responsibilities of students and faculty members throughout the process. Students are responsible for reading the Academic Honor Policy and for living up to their pledge to ". . . be honest and truthful and . . . [to] strive for personal and institutional integrity at Florida State University." (Florida State University Academic Honor Policy, found at <http://dof.fsu.edu/honorpolicy.htm>.)

ADA Requirements

Americans With Disabilities Act

Students with disabilities needing academic accommodation should:

- (1) register with and provide documentation to the Student Disability Resource Center; and
- (2) bring a letter to the instructor indicating the need for accommodation and what type. This should be done during the first week of class.

This syllabus and other class materials are available in alternative format upon request.

For more information about services available to FSU students with disabilities, contact the:

Student Disability Resource Center
874 Traditions Way
108 Student Services Building
Florida State University
Tallahassee, FL 32306-4167
(850) 644-9566 (voice)
(850) 644-8504 (TDD)
sdrc@admin.fsu.edu
<http://www.disabilitycenter.fsu.edu/>

Syllabus Change Policy

Except for changes that substantially affect implementation of the evaluation (grading) statement, this syllabus is a guide for the course and is subject to change with advance notice.

Appendix: Participation Rubrics

Small Group Work Self- and Peer-Assessment MAT 3930 Fall 2010

Successful group work involves members who contribute equally to the collaborative process. Print the names of the members of your group, including your own, in the appropriate boxes below. Then, place a number in the boxes under each category indicating the degree of effort on a scale of 0 – 3 with 3 being highest and 0 representing no effort expended. If you feel hesitant about giving someone a low score in a particular category, provide a brief explanation of your reasoning in the comments section below the table. Likewise, if you feel that someone did an exceptional job, elaborate on the details. If a category was not appropriate for a given work session or a particular group member (e.g., “offered unique solution strategies”), record **NA** in the box.

| Name | | | | | |
|--|--|--|--|--|--|
| Respected other members' ideas | | | | | |
| Listened well/encouraged others | | | | | |
| Worked collaboratively | | | | | |
| Prepared for work session | | | | | |
| Focused on task | | | | | |
| Suggested or shared resources | | | | | |
| Offered unique solution strategies | | | | | |
| Displayed a positive attitude/exhibited perseverance | | | | | |

Comments:

Appendix: Participation Rubrics, *continued*

**Instructor Assessment of Student Participation
MAT 3930
Fall 2010**

The course instructors will use the following rubric to assess student participation in MAT 3930.

| Behavior/Action | 3 = Exceeds Standard | 2 = Meets Standard | 1 = Partially Meets Standard | 0 = Does Not Meet Standard | Score |
|---|---|---------------------------------------|-------------------------------------|-----------------------------------|--------------|
| Prepared for class sessions | Student exceptionally well-prepared for class | Student adequately prepared for class | Student poorly prepared for class | Student not prepared for class | |
| Displayed a positive attitude/exhibited perseverance | | | | | |
| Respected other members' ideas | | | | | |
| Listened well/encouraged others | | | | | |
| Contributed to whole-class discussions | | | | | |
| Focused on tasks | | | | | |
| Suggested or shared resources | | | | | |
| Offered unique (novel; alternative) solution strategies | | | | | |
| Displayed ownership of learning | | | | | |

Comments: