Millikin University
Student Learning in the Mathematics and Computer Science Major

By Daniel Miller
July 1, 2010

Executive Summary

The Department of Mathematics supports

The assessment results for data collected from July 2009- July 2010 constitute the department's ongoing systemic attempt to quantify student achievement within the department. The results suggest that for students in both Mathematics and Mathematics Education program goals are being met. It will take at least another year to develop the goals for the Actuarial Science option and determine if they are being met. Additionally, Mathematics Education received NCATE special program accreditation from NCTM. There should be no additional assessment data necess aEducation

Report

Goals

The Department of Mathematics supports the mission of the university in preparing students for professional success, democratic citizenship in a global community, and a personal life of meaning and value. The mission of the department is to produce graduates who achieve the following learning outcome goals:

1. Applied Mathematics
   An applied mathematics major will
   a. be able to integrate and differentiate functions,
   b. be able to express and interpret mathematical relationships from numerical, graphical and symbolic points of view,
   c. be able to read and construct mathematical proofs in analysis and algebra, and
   d. be able to apply mathematics to at least two areas taken from biology, physics, chemistry, economics or computer science.
2. Mathematics Education
   A mathematics education major will
   a. be able to pass the Illinois high school mathematics certification exam,
   b. know in broad terms the history of calculus, algebra, and probability,
   c.

b. Mathematics education- in a world where political leaders are becoming increasingly numbers driven, we provide the teachers the skills to empower children by enhancing their ability to reason quantitatively.
c. Computer science- we provide the skills necessary for students to succeed in an increasingly technological world

3. To prepare students for a personal life of meaning and value we help our students develop the intellectual framework, and instill in them the mindset, that will enable them to remain life-long learners. Our students are taught to think rigorously and rationally, and to revel in the sheer pleasure of thinking.

Snapshot

The Department of Mathematics guides students in the completion of three different majors: mathematics education, applied mathematics and actuarial science. Currently, 34 students are following one of our major programs of study. The Department also serves elementary education students with mathematics concentrations, currently 6.

General Description. The Department of Mathematics includes the disciplines of mathematics and statistics. The department offers mathematic majors with options in Applied Mathematics, Mathematics- Secondary Teaching, and Actuarial Science. Additionally, a minor in Applied Mathematics is offered. Elementary Education majors may take a concentration in mathematics. The curriculum is structured to meet the overlapping needs of students who fall in one or more of the following categories:

those who plan to become high school mathematics teachers;
those who intend to pursue graduate work in applied mathematics, computer science, or other related fields; and
those who will apply mathematics and/or computer science in the natural sciences, social sciences, business or other areas of quantitative studies such as actuarial science.

Additional Comments.

The three majors offered in the Department share courses and faculty. The applied mathematics and mathematics secondary education majors are particularly entwined with students taking common courses and interacting with the same faculty members. In many respects these two majors cannot be disentangled for analysis.
Students can earn either the Bachelor of Arts or Bachelor of Science. The choice of

There is no distinction in Departmental coursework between the B.A. and B.S. degrees. Therefore, this report will not separate the B.A. from the B.S.

All fulltime tenure-track members of the Department have doctorate degrees. (See Table 1.) The department continues to **rely heavily** on adjunct faculty for most of our developmental offerings (12 of 22).

Description Applied Mathematics**.** The applied mathematics major is for students interested in immediate employment or further study in applied mathematics or in actuarial sciences. Applied mathematics majors take a minimum of 33 credit hours in mathematics. The core courses and required advanced courses are those specified in *Undergraduate Programs and Courses in the Mathematical Sciences: CUPM Curriculum Guide 2004* by the Committee on the Undergraduate Program in Mathematics of The Mathematical Association of America.

Description Mathematics Education. The Mathematics-Secondary Teaching major is a rigorous course of study in mathematics and education. The major has 38 required credit hours in mathematics. Unique among institutions of comparable size we require a mathematics teaching internship experience as part of our program. During this experience the student is paired with a member of the faculty in teaching an undergraduate mathematics course.

Description Actuarial Science Concentration. This option is a rigorous treatment of the mathematics and business skills necessary for a major to enter the workforce as an entry-level actuary.   Students who completed this option and all highly recommended courses in business will be prepared to take the first two Actuarial Examinations (1/P and 2/FM) of the Casualty Actuarial Society and the Society of Actuaries. The department is currently working with Tabor School of Business to offer additional course to our majors to prepare them for additional exams. Currently through this corporation, Millikin students can obtain Verification of Educational Experiences (VEE) credit from the Society of Actuaries (SOA) in Applied Statistical Methods (through 2011), Corporate Finance (through 2010), and Economics (through 2010).

The Learning Story

Applied mathematics and mathematics education majors follow nearly the same curriculum within the Department. The Department believes that to be a good mathematics teacher one needs to know mathematics. Therefore, the education majors are expected to successfully compete with the applied majors in most of their mathematics courses. The program assumes entering students can start with calculus the fall of their freshmen year. Additionally, education majors are advised to have completed the core of their mathematics courses by the spring of their junior year so that they are prepared for the state certification examination that must be passed prior to being placed for student teaching.

The applied mathematics curriculum focuses on the integration of mathematical theory and mathematical practice. Our majors learn concepts and techniques appropriate for actuarial science, ecological modeling, engineering, numerical analysis, and statistical inference. We assume that most of our applied mathematics major will seek employment in commerce or industry, but the curriculum also prepares them for post-graduate work in mathematics.

The current curriculum maps are included as Appendix 1-2.

All students are required to pass the Millikin mathematics placement exam prior to taking a QR course or receive an equivalent math ACT score. The Department expects our majors to score an ACT math sub score of 28 or higher or a placement score of 5 (the suggested score for placement into Calculus I). Students are assessed within our programs in numerous ways: course exams, problem sets, and written and oral demonstrations. Additionally, the Department requires every student in Computer Science and Mathematics Education to complete an internship. Written evaluations from these experiences including

pass the state certification examination and submit to a portfolio review. Applied Mathematics majors lead a graduate school like seminar their last semester.

Assessing the Applied Mathematics Major Goals
　　　　An applied mathematics major will
　　1. be able to integrate and differentiate functions,

　　　　　　　All Applied Mathematics majors are required to take and pass both Calculus I and Calculus II to graduate with an Applied Mathematics degree. It is the consensus of the department that it would not be possible to pass these two

finals by the individual faculty members.

Assessing the Mathematics Education Major Goals
        A mathematics education major will
    1. be able to pass the Illinois high school mathematics certification exam,

        The department chair will verify that each Mathematics Education major has
        passed the state certification exam prior to student teaching. Additionally, the
        chair will note and analyze the subject area sub scores on an ongoing basis to
        determine the need for curricular change.
        a. All students passed the state exam!
        b. The program is nationally accredited!!

    2. know in broad terms the history of calculus, algebra, and probability,
        All Mathematics Education majors are required to take and pass Mathematics
        History to graduate with an Mathematics Education degree. It is the consensus
        of the department that it would not be possible to pass this course without
        knowing in broad terms the history of calculus, algebra, and probability.
        Therefore verifying the completion of this course by all Mathematics
        Education majors will assess fulfillment of this goal. Additionally, the
        department chair will audit the Mathematics History syllabus each semester to
        verify the assertion that the assignments cover the history of calculus, algebra,
        and probability. Samples of student work will also be collected.
        a. Math History syllabus was collected and reviewed along with student
            work (see attached)

    3. have prepared at least 2 lesson plans in mathematics, and

        All Mathematics Education majors will be required to submit 2 graded lesson
        plans to the department chair prior to student teaching. These lesson plan may
        come from a variety of courses; MA 425 Teaching Secondary and Middle
        School Mathematics, MA 471 Mathematics Internship, or any other education
        course that required the completion of a mathematics lesson plan.
        a. MA425 was not offered during the 2008-2009 academic year. Lesson
            plans for MA471 were collected and review by the department
            chairperson.

    4. have served as an teaching intern for a member of the mathematics faculty

        In support of this goal, all Mathematics Education majors are required to take
        and pass the departmental teaching internship MA 471 to graduate with an
        Mathematics Education degree. The departmental chair will collect and
        analyze the end of course reflection required for this internship to determine
        the effectiveness of the experience.

Table 1.   Full time faculty: Mathematics and Computer Science

Faculty	Highest Degree	Rank	Tenure Status	Year Hired	Specialty Field	Courses taught

Appendix 1

Curriculum Matrix
Applied Mathematics

MA 140	MA 240	MA 208	MA 301	MA 303	MA 304	MA 320	MA 471		MA 250	MA 302	MA 305	MA 313	MA 314

11

Curriculum Matrix
Mathematics Education

MA	MA	MA	MA	MA
1	2	2	3	3
4	4	0	0	
0	0	8	1	

completed this problem have learned a technique they can use to solve application problems in physics and chemistry.

determine the rate of change of a physical quantity with respect to another physical quantity, which is a topic from physics.

stated goals of MA208 are:
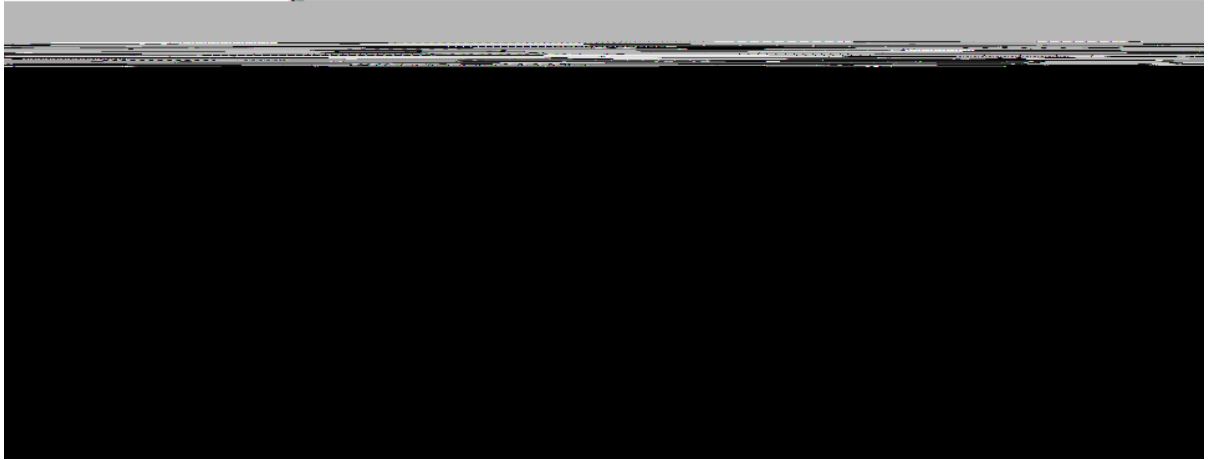
Assessment of goal:

17. Find the equation of the line (in parametric form) tangent to the parametric curve

$$x = t^2 - 2t$$
$$y = t^3 - t$$

at the point $(0,10)$.

3

4

    r

5 $\mathbf{r}(t) = <\ 2,\ \sin(\ t),\ \ln(t)\ >$ at $t = 1$.

a   c

b   d

MA 250
Beck   **Final Examination**
12/15/9

7

8
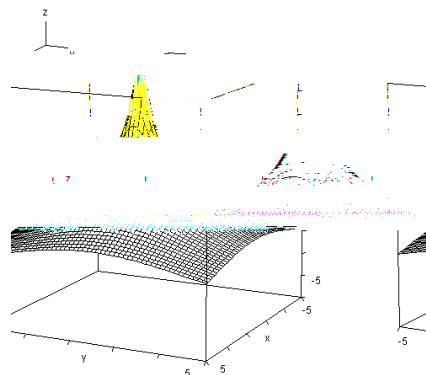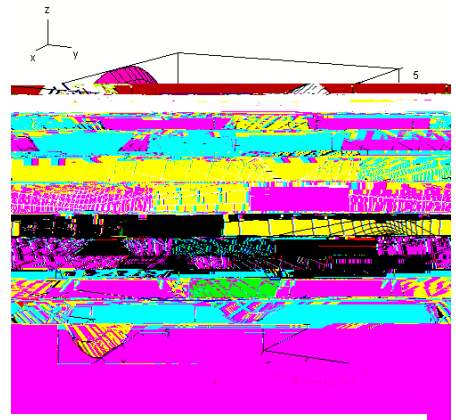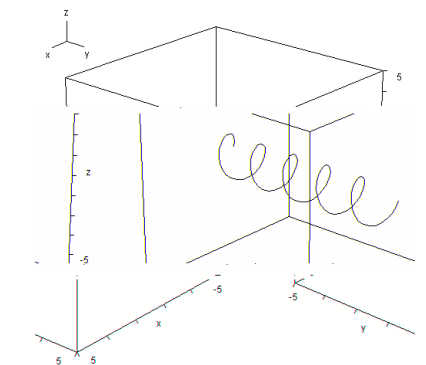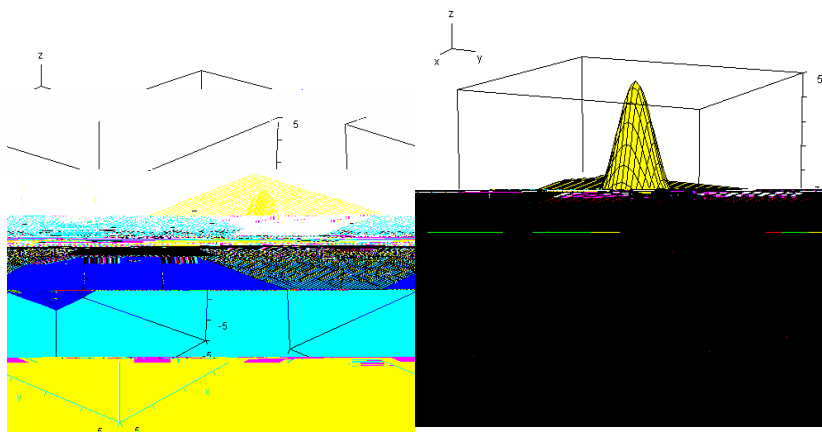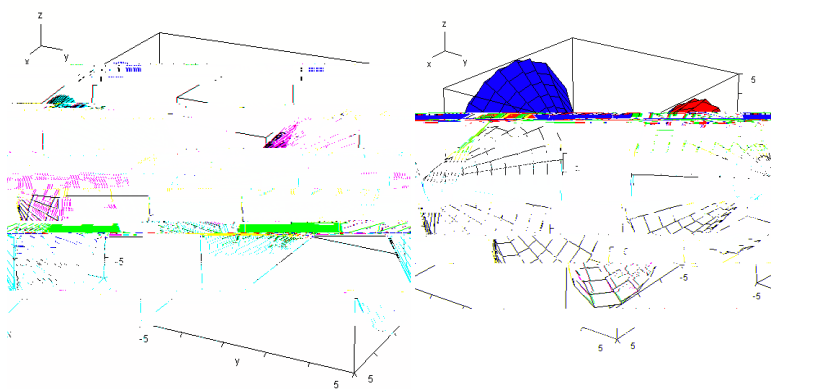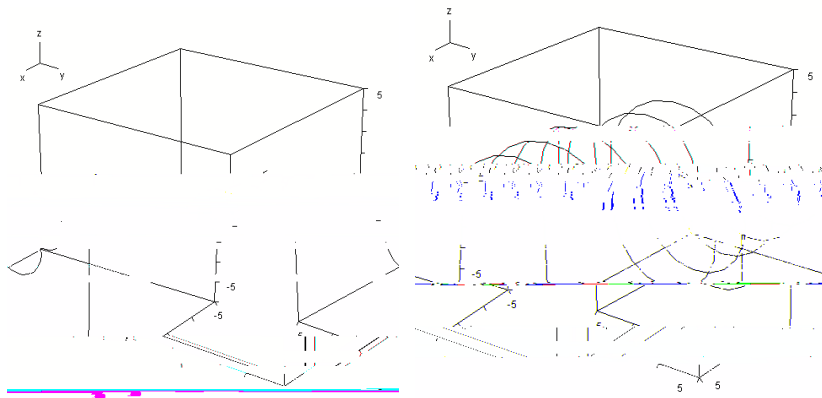
a $\displaystyle\int_{1}^{4}\int_{0}^{2} 6xy^2 \, dy \, dx$

b $\displaystyle\int_{0}^{1}\int_{\sqrt{y}}^{1} 3e^{x^3} \, dx \, dy$

MA 250
Beck   **Final Examination**
12/15/9

10

4.
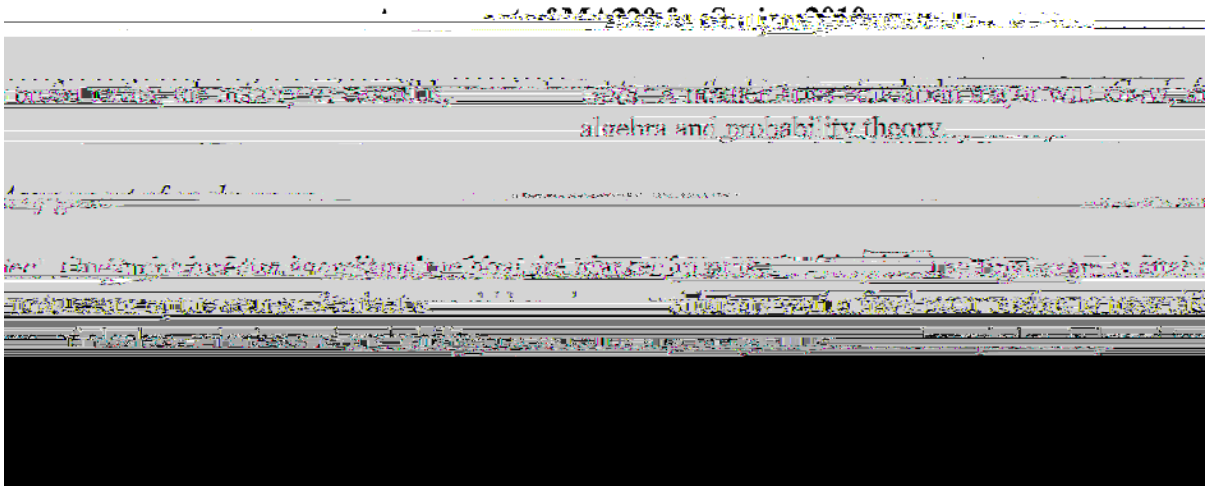
See Departmental copy for exam.