Millikin University
Student Learning in the Mathematics and Computer Science Major
By Daniel Miller
July 1, 2012

Executive Summary

The Department of Mathematics supports

1. To prepare students for professional success.
    a. Applied mathematics we provide core mathematical experiences and a range of application areas to prepare students for work or graduate study.
    b. Mathematics education we prepare students for the Illinois State Certification Exam, give them experience in teaching, and keep them current on the use of technology in mathematics education. 543.58 Tm( )]TJETBTh3t/F1 1 edu543.58

assessment data necessary for the mathematics education major beyond what is collected for the yearly NCATE report.

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, 24 students are following one of our major programs of study.

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 21, traditional program spring 12 4 of 7 fall 11 4 of 10, PACE 4 of 4).

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 Metcal ed SOA) hipo2013petin undecoursepo2to o014), t0 0 1 90.024 391.75 Tm[Appli7

interpreting mathematical relationships from numerical, graphical and symbolic points of view was necessary to pass the exams.

a. See attached final exams and reviews of these finals by the individual faculty members.

3. be able to read and construct mathematical proofs in analysis and algebra, and

   All Applied Mathematics majors are required to take and pass Discrete Mathematics, Calculus III and Linear Algebra. It is the consensus of the department that it would not be possible to pass these three courses without the ability to read and construct mathematical proofs in analysis and algebra. Therefore verifying the completion of these two courses by all Applied Mathematics majors will assess fulfillment of this goal. Additionally, the department chair will collect copies of all Discrete Mathematics, Calculus III and Linear Algebra final exams each semester to verify the assertion that reading and constructing mathematical proofs in analysis and algebra was necessary to pass the exams.

   a. Discrete Mathematics, Calculus III and Linear Algebra were all offered this year. A copy of the final exams from Calculus III and Linear Algebra are attached. A review of these exams support the contention that it would not be possible to pass these three courses without the ability to read and construct mathematical proofs in analysis and algebra. See attached final exams and reviews of these finals by the individual faculty members.

4. be able to apply mathematics to at least two areas taken from biology, physics, chemistry, economics or computer science.

   All Mathematics majors are required to take Calculus I and II and Discrete Mathematics. The final exams from all sections of these courses will be review by the department chair to ensure that these routinely contain problems from biology, physics, chemistry, economics or computer science. Specifically, physics will be covered in Calculus I; biology, chemistry, and

chair will note and analyze the subject area sub scores on an ongoing basis to determine the need for curricular change.

a. Two out of three students passed the state secondary content exam. Note the state wide passing rate was below 50%.
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 was not offered this year.

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 plans 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. Lesson plans for MA 425 and MA471 were collected and reviewed by the department. Dr. Paula R. Stickles has taken over this assessment.

4. have served as a 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 a 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.

   a. All secondary mathematics majors taking MA 471 were required to complete an end of course reflection. These reflections were reviewed by Dr. Paula R. Paula

The assessment data collected for 2011-
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. Assessment of the Actuarial Science program will be delayed until enrollment increases.

Review of 2011-2012 Improvement Plans

Assign a permanent faculty member to oversee MA 471 as part of load

This was instituted and Dr. R. Stickles has been placed in charge.

Redesign the developmental and QR sequence to better match the current student body and faculty lines

Dr. Rauff has agreed to develop and assess this course

Develop a new method for calculus placement

Starting fall 2012 all students wanting calculus will be required to pass the new Millikin Calculus readiness exam.

Obtain a fulltime faculty line for developmental mathematics at the instructor level

We continue to **FAIL** at convincing the University of our needs for an additional line for developmental mathematics (see data above).

Obtain a funding line within the department for undergraduate research

The university has developed some support in this area

Develop an intradepartmental marketing program

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Student Publications and Presentations
Department of Mathematics
2010-2012

Peck, H. Summer Undergraduate Research Fellowship, Millikin University. One of five recipients. (Summer 2012)

Bloome, L. Accepted to the Summer Mathematics Institute at Cornell University, Ithica, NY. One of twelve participants in a summer program learning analysis and completing a research project (June-July 2012)

Bloome, L. Conference Presentation. *Connections between Central Sets and Cut Sets in Zero-Divisor Graphs of Commutative Rings*, Rose-Hulman Undergraduate Mathematics Conference, Terre Haute, IN, twenty minutes. Recognized as one of the five best talks of the conference. (April 2012)

Buhrmann, J. Conference Presentation. *The U.S. Life Insurance Industry: Time Series Analysis*, Rose-Hulman Undergraduate Mathematics Conference, Terre Haute, IN, twenty minutes. Recognized as one of the five best talks of the conference. (April 2012)

Perkins, M. Conference Presentation. *The Predicted Success Rate in Lower 10 Percent of Accepted Students*, Rose-Hulman Undergraduate Mathematics Conference, Terre Haute, IN, twenty minutes. Recognized as one of the five best talks of the conference. (April 2012)

Woods, M. Conference Presentation. *Good or Bad: Lowering Entrance Standards*, Rose-Hulman Undergraduate Mathematics Conference, Terre Haute, IN, twenty minutes. Recognized as one of the five best talks of the conference. (April 2012)

Lee, E., Lee, S., Elliot, D., Mathy, K., and **Walker, D.** Interval Estimation for Extreme Value Parameter with Censored Data, *ISRN Applied Mathematics* (2011), Article ID 687343, 1-12.

Weber, D. Zero-Divisor Graphs and Lattices of Finite Commutative Rings, *Rose-Hulman Undergraduate Math Journal*, **12** (2011), no. 1.

Coté, B., Ewing, C., Huhn, M. and Plaut, C., **Weber, D.** Cut-sets in Zero-Divisor Graphs of Finite Commutative Rings, *Communications in Algebra*, **39** (2011), no. 8, 2849-2864

Bloome, L. Conference Presentation. *Compressed Zero-Divisor Graphs of Finite Commutative Rings*, University of Dayton Undergraduate Mathematics Day, Dayton, OH, fifteen minutes (November 2011)

Morin, M. Conference Presentation. *Formalizing Course Materials for a Quantitative Reasoning Course*, University of Dayton Undergraduate Mathematics Day, Dayton, OH, fifteen minutes (November 2011)

Stickles, P. and **Morin, M.** Conference Presentation. *Undergraduate Fellows Program AKA Getting an Undergraduate to Do Your Work and Enjoy it!* Annual Meeting of the Illinois Council of Teachers of Mathematics. Springfield, IL, sixty minutes (October 2011)

Stickles, J., **Helding, C.**, and **Morin, M.** Conference Presentation. *Undergraduate Teaching Internship Program at Millikin University*, Annual Meeting of the Illinois Council of Teachers of Mathematics. Springfield, IL, sixty minutes (October 2011)

Bloome, L. Conference Presentation. Compressed Zero-divisor Graphs of Finite Commutative Rings, Millikin Undergraduate Mathematics Research Conference, Decatur, IL, twenty minutes (November 2010)

Luciano, G. Conference Presentation. Using Data Mining to Analyze Admissions Data, Millikin Undergraduate Mathematics Research Conference, Decatur, IL, twenty minutes (November 2010)

Weber, D., Conference Presentation. Zero-Divisor Lattices on Commutative Rings, Millikin Undergraduate Mathematics Research Conference, Decatur, IL, twenty minutes (November 2010)

Weber, D., Conference Presentation. Cut-Vertices and Cut-Sets on Zero-Divisor Graphs, Special Session in Commutative Rings, AMS Sectional Meeting, St. Paul, MN, twenty minutes (April 2010)

Weber, D., Conference Presentation. Cut-Sets in Zero-Divisor Graphs of Finite Commutative Rings, Rose-

Table 1. Full time faculty: Mathematics

Faculty	Highest Degree	Rank	Tenure Status	Year Hired	Specialty Field	Courses taught
James Rauff	Ph.D.	Professor	Tenured	1988	Formal Languages, Computational Linguistics, Ethnomathematics.	

Appendix 1

Curriculum Matrix
Applied Mathematics

	MA 140	MA 208	MA 240	MA 303	MA 304	MA 305	MA 313	MA 340	MA 403	MA 440	MA 499		MA 308	MA 314	MA 320	MA 420	MA 472	MA 491
Goal 1	■		■		■	■	■	■						■				
Goal 2	■		■		■	■	■	■			■			■				
Goal 3		■		■					■	■	■		■		■	■		
Goal 4						■	■				■		■				■	
				Required Course									Elective Courses (Two-required)					

An applied mathematics major will

Goal 1: be able to integrate and differentiate functions.

Goal 2: be able to express and interpret mathematical relationships from numerical, graphical and symbolic points of view.

Goal 3: be able to read and construct mathematical proofs in analysis and algebra.

Goal 4: be able to apply mathematics to at least two areas taken from biology, physics, chemistry, economics or computer science.

Appendix 2

Curriculum Matrix
Mathematics Education

	MA 140	MA 240	MA 208	MA 301	MA 303	MA 304	MA 320	MA 425	MA 471		MA 340	MA 403	MA 305	MA 313	MA 314	MA 420	MA 440
Goal 1	■	■	■	■	■	■	■	■	■		■	■	■	■	■	■	■
Goal 2							■										
Goal 3								■	■								
Goal 4									■								
		Required Course									Elective Courses (Two-required)						

Goal 1: A mathematics education major will be able to pass the Illinois high school mathematics certification exam.

Goal 2: A mathematics education major will know in broad terms the history of calculus, algebra, and probability.

Goal 3: A mathematics education major will have prepared at least 4 lesson plans.

Goal 4: A mathematics education major will have served as a teaching intern for a member of the mathematics faculty.

Detailed Assessment of Selected Courses and Final Exams

Assessment of MA 140 Final Exam for Fall 2011

Goal: An applied mathematics major will be able to integrate and differentiate functions.

Assessment of goal:

Differentiation: Of the 18 problems on this final exam, problems 2, 4, 5, and 6 on the calculator part, and problems 1, 5, 6, and 7 on the non-calculator part either explicitly or implicitly required the students to take a derivative of some function in order to be able to solve the problem. Problem 1 on the non-calculator part required the students to understand the definition of the derivative. Problem 7 on the non-calculator part required the students to connect the first derivative of a function with the function increasing or decreasing and to connect the second derivative with the concavity of the function. Problem 2 on the calculator part required the students to apply differentiation techniques without having an explicitly stated function. Problem 4 on the calculator part required students to connect the derivative to optimizing a quantity given certain restrictions. Problem 5 on the calculator part required students to connect the derivative to a change in quantities with respect to timehe non

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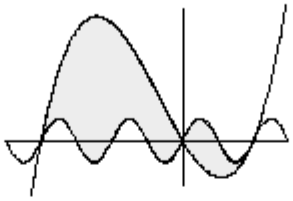
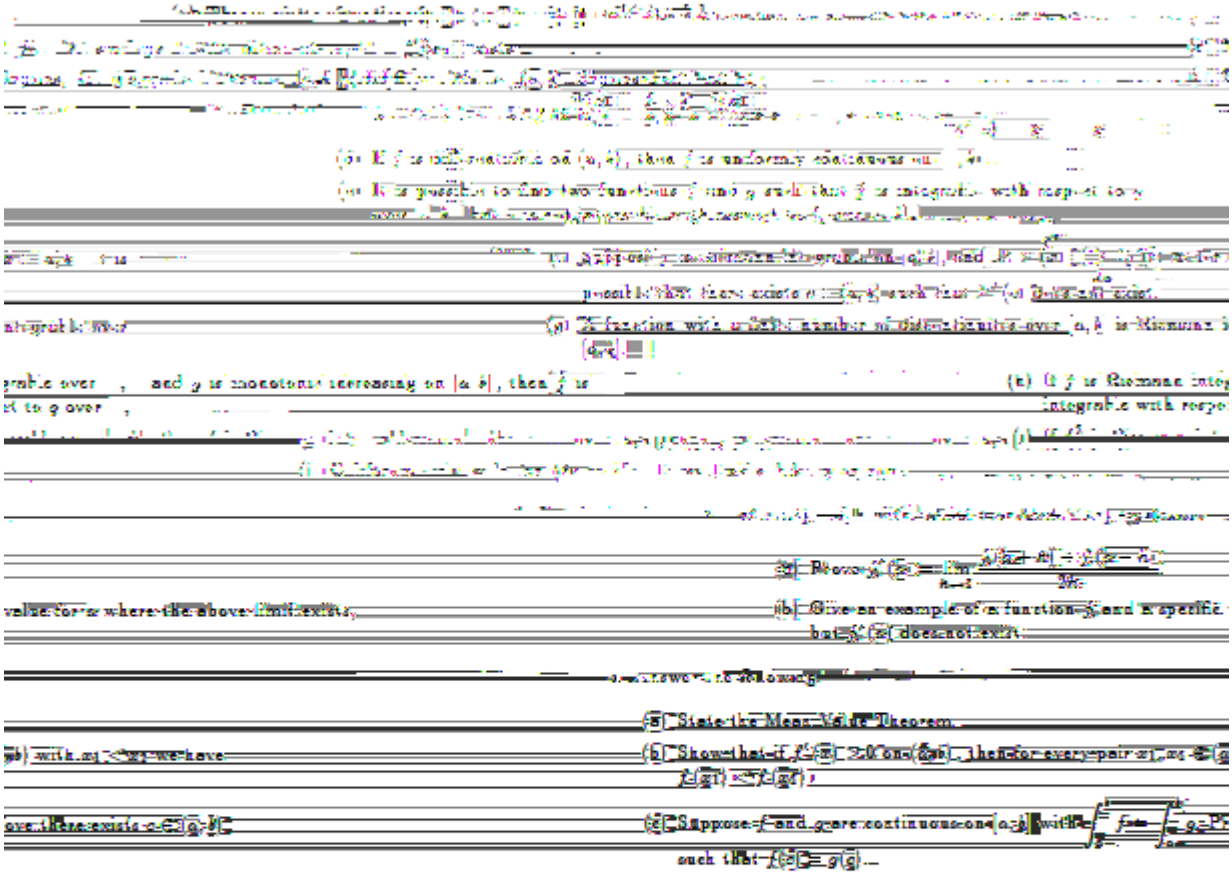


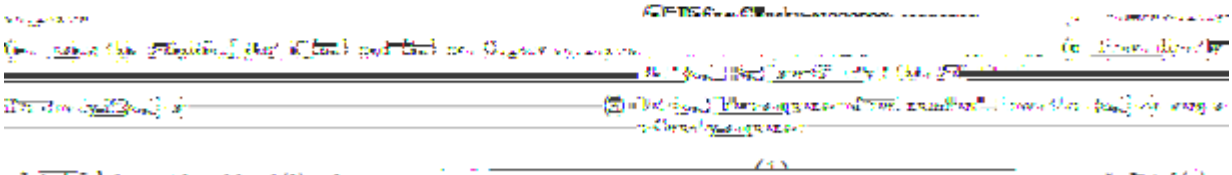
: An applied m0(n2m TJ(8BT/F5 13ljm3(jor w ETBT/F5/MCID 3>B44 12)8 13l393lj5 13lja3ljm3a3ljnc

MA440 - Final Exam - Fall 2011

1. TRUE or FALSE?



4. Answer the following.



$x^2 \sin\left(\frac{1}{x}\right)$ for $x \neq 0$ and let $f(0) = 0$.

5. Let $f(x) =$

that $f(x)$ is continuous at $x = 0$.

(a) Show

: An applied mathematics major will be to read and construct mathematical proofs in analysis and algebra.

: Problems 6 9 require students to construct proofs, while the rest of the exam requires students to understand the concepts presented in proofs in order to complete the problems. Therefore, students must be successful in reading and constructing mathematical proofs in analysis and algebra in order to pass this exam.

: A mathematics education major will be able to pass the Illinois high school mathematics certification exam.

: This course addresses the following Illinois State Board of Education and NCTM Content Standards.

Illinois State Board of Education: 3A, 3B, 3C, 9B, 9C3, 9D2, 9D3, 9E4, 9E8.
NCTM Content Standards: 3.1, 3.2, 3.3, 3.4, 6.1, 11.1, 11.2, 11.3, 11.4, 11.5, 11.6, 11.7, 15.1, 15.2

Further, this course addresses Subarea IV of the Illinois Certification Testing System Mathematics (115) exam. (http://www.icts.nesinc.com/PDFs/IL_field115_SG.pdf) An examination of the final exam will show that these indicators and standards have been addressed.

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wer the following with either TRUE of FALSE.

1. Ans

In a protractor geometry, it is impossible to have a triangle with two right angles. (a)

(b) A set that is connexin the Poincaré plane but is not connexin the E

e plane with base angles that are not congruent.

(d) An isosceles triangle in the max distanc

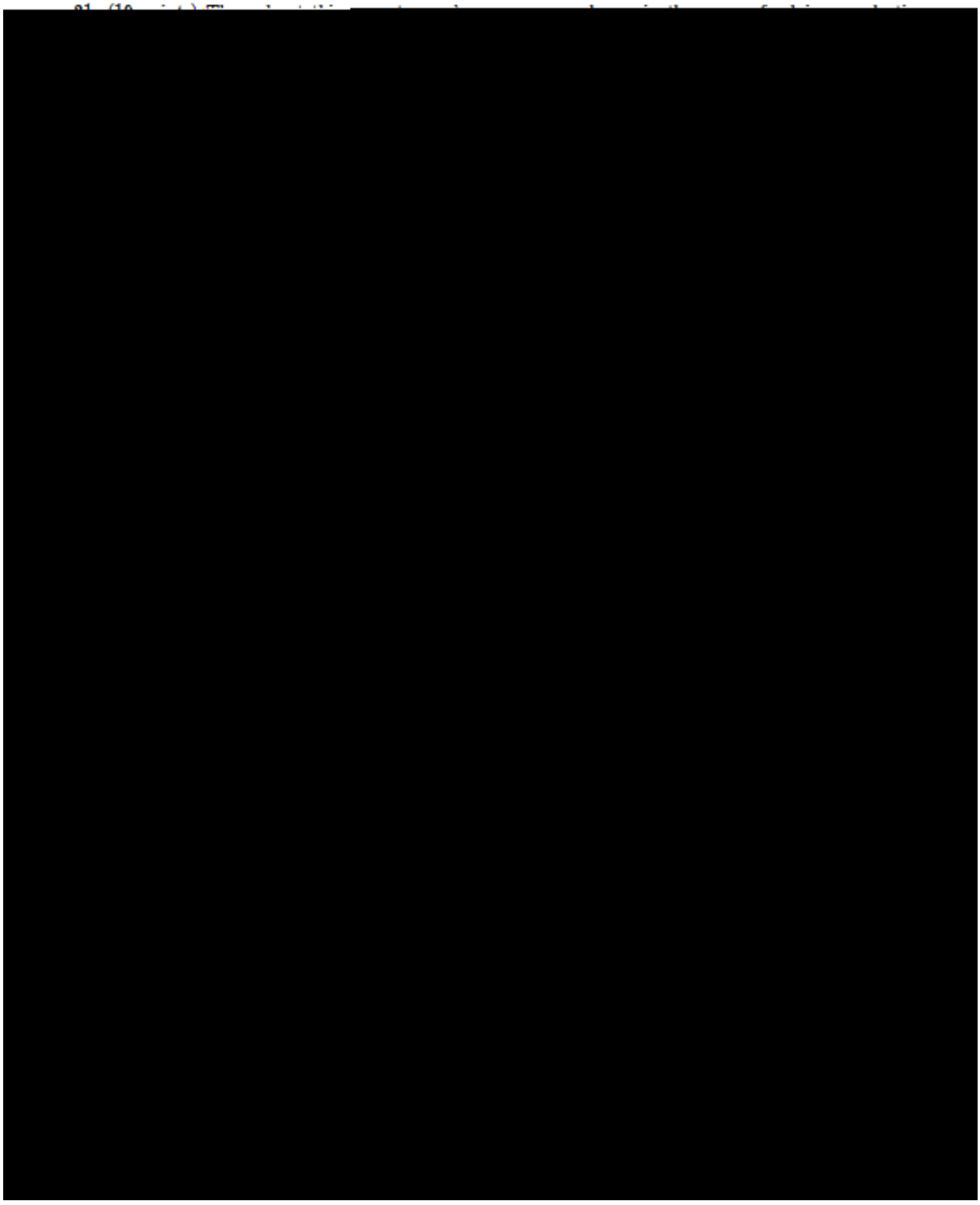
Assessment of MA 320 for Fall 2011

: A mathematics education major will be able to pass the Illinois high school mathematics certification exam.

: This course addresses Subarea I, item 0002 of the Illinois Certification Testing System Mathematics (115) exam. Specifically, this course provides students with the emonstrate knowledge of the historical development of mathematics, including contributions of men and women from various cultures (http://www.icts.nesinc.com/PDFs/IL_field115_SG.pdf)

: A mathematics education major will know in broad terms the history of calculus, algebra, and probability.

: A quick perusal of the final exam for this course will give the reader ample evidence that this goal has been met.



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