Unit Program Review
Department of Mathematics
Thomas Harriott College of Arts and Sciences

For the Period
2002-2009

Submitted by
Evaluation Committee
Of the Mathematics Department

Zach Robinson, Chair
Robert Bernhardt
John Crammer
David Pravica
Michael Spurr

With input from
Graduate Committee

Chal Benson, Chair

Undergraduate Committee

Heather Ries, Chair

Chair of Mathematics

Tom McConnell

Department of Mathematics Vote on Approval
For: 10 Against: 5
(not approved by 3/5 of 18)
October 7, 2009

Open Forum 1: 9/11/09 Benson, Bernhardt, Carolan, Crammer, McConnell, Pravica, Randriampiry, Ries, Robinson, Spurr, Xiao

Open Forum 2: 9/18/09 Abdulali, Benson, Bernhardt, Carolan, Crammer, Katsoulis, McConnell, Pravica, Randriampiry, Rentmeesters, Ries, Robinson, Shlapetokh, Spurr, Xiao, Dean Alan White

Open Forum 3: 9/25/09 Benson, Bernhardt, Crammer, McConnell, Pravica, Ries, Robinson, Spurr

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I. PROGRAM DESCRIPTION

1.1 *Exact Title(s) of Unit Program:* Give title(s) exactly as indicated in the university catalog.

Department of Mathematics

BA in Mathematics

BS in Mathematics

MA in Mathematics

1.2 *Department or Interdisciplinary Group Authorized to Offer Degree Program(s):*

Department of Mathematics

1.3 *Exact Title(s) of Degrees granted:* e.g., Bachelor of Science, Bachelor of Arts, Master of Science, Doctor of Education, etc.

Bachelor of Arts in Mathematics

Bachelor of Science in Mathematics

Master of Arts in Mathematics

1.4 *College or School:*

Thomas Harriott College of Arts and Sciences

1.5 *Brief History and Mission:* Provide a brief history of the development of the unit undergraduate and graduate program(s). Briefly describe the vision and the mission of the program(s).

History of the Mathematics Department

The first undergraduate degree in Mathematics was established in the mid-1940s and at this time significant courses were added to the curriculum. Modern Algebra appeared in the catalog for the first time in 1950-51. The first class in Statistics was offered at the undergraduate level in 1946-47, and from then on, Statistics was offered both at the graduate and undergraduate level.

Differential Equations was offered at the graduate level as well as at the undergraduate level beginning in 1952-53.

By 1959, it had become possible to earn a Master's Degree solely in Mathematics, whereas, previously Mathematics was a possible concentration within a graduate degree in Education. The 1958-59 catalog shows that departmental courses included Advanced Calculus, Foundations of Mathematics and a graduate course in Complex Variables. In 1962-63, the department also listed Probability and graduate Linear Algebra among its courses.

The first computer science course, Introduction to Digital Computation, was offered in the mid-1960s. This course was soon followed by classes in Programming, Information Processing, Machine Organization, Theory of Automata, and Systems Simulation. A minor in Information Science was offered in the 1969-70 and in 1971-72 an option in computer and information science became available as part of the Mathematics BA degree. Following the addition of additional computer science classes in subsequent years, a major in computer science was established by the beginning of the 1977-78 school year. Mathematics course offerings had expanded to include Analysis, Point Set Topology, Combinatorics, and Graduate Advanced Calculus.

By the mid-1980s it was possible to obtain a BA in Mathematics, Computer Science, or in Mathematics with an option in Computer Science. The BS degree was in Mathematics Education and prepared students to teach Mathematics at the high school level. But the degree required essentially the same Mathematics courses as those taken for the BA. Minors could be earned in either Mathematics or Statistics. Graduate offerings consisted of a master of arts in Mathematics or a masters degree in Education with a major in Mathematics. A few years later the department added the following to its offerings: a BA with an option in Statistics, a BS in Computer Science, and a minor in Statistics.

The demand for Computer Science curriculum continued to grow, and in 1995-96 a MS degree in Computing and Information was established. The Computer Science faculty voted to leave the Mathematics Department in 2000 to become a Computer Science Department in the newly established School of Computer Science and Communication.

Then in 2002, the Mathematics Education Faculty were administratively reassigned to the School of Education (now the College of Education). The BS degree in Mathematics Education moved with them, which proved to be a significant drain on the number of majors in the department. The Mathematics Department has continued to work closely with the Mathematics Education faculty to make it possible for the students to double major, They can earn the BS in Mathematics Education and the BA in Mathematics by taking only three additional Mathematics courses in addition to those required for the BS in Mathematics Education. As a consequence of losing the BS in Mathematics Education, the department has recently established a BS in Mathematics. The degree requires a strong mathematics core and in addition a concentration in one of the four areas of Mathematics, Science, Statistics, or Computer Science.

Mission of the Mathematics Department

The primary obligation of the Department of Mathematics is to serve the best educational interests of the students of East Carolina University. Consequently, the Department is obliged to assemble and maintain a competent faculty that is capable of discerning, implementing, and perpetuating curricula of excellence which are consistent with the primary obligation and which enhance and support the objectives of the Department, the University, and the mathematics community.

The principal objectives of the Department are:

- To provide and support broad liberal and professional education in the disciplines of mathematics, and statistics that prepare students for life-long learning and that nurture greater comprehension of the truths, precision, and deductive reasoning that characterize these disciplines.

- To prepare students for meaningful careers in teaching, research, and other professions.

- To promote programs of excellence in the aforementioned disciplines and to encourage participation of its students and faculty in the professional and cultural activities of those disciplines.

- To design and offer to non-majors appropriate service courses in the aforementioned disciplines.

- To cooperate and coordinate with other disciplines and academic institutions in the promotion of advanced study, excellence in teaching, research, and the dissemination of knowledge.

- To provide service to the profession and the community.

In pursuit of these important objectives, the Department's main functions are:

To develop and sustain excellent academic programs for undergraduate and graduate students, both major and non-major.

To maintain a competent and productive faculty who are dedicated to quality teaching, research, scholarship, and service.

To create and maintain a stimulating academic environment for teaching, scholarship, research, and the intellectual development of students and faculty.

To encourage faculty and students to participate in professional activities and to provide service to the region.

To seek adequate resources and facilities to accomplish the departmental objectives.

1.6 *Relationship of the Program to UNC's Strategic Goals and to the ECU Mission and to ECU's Strategic Directions* (Describe how each degree program relates to the UNC system's strategic goals, to ECU's mission, and to ECU's strategic directions.)

The BA/BS program in Mathematics:

1) Supports undergraduate study and learning in mathematics,
2) Produces teachers who serve as instructors in the area high schools (in conjunction with the Science and Mathematics Education Department),
3) Produces students who enter graduate programs in mathematics in ECU's graduate mathematics program as well as other programs in the southeast.
4) Prepares students for further study at the graduate level in numerous quantitative areas,
5) Supports students in other programs such as Mathematics Education, Economics, Chemistry, Physics, and the Sciences.
6) Produces statisticians and mathematicians who contribute to the overall economic well being and to the labor force in the East and in North Carolina.

As such our graduate program relates to ECU's Mission (http://www.ecu.edu/ecu/ecumission.cfm) by:

i) Helping to meet the educational need of North Carolina,
ii) Providing a rich and distinctive educational experience,
iii) Advancing knowledge, encouraging creative activity, solving significant human problems, and providing the foundation for professional practice,
iv) Supporting public education.

Furthermore, our undergraduate program relates to the goals of ECU/UNC tomorrow (http://www.ecu.edu/mktg/ecu_tomorrow/_) by:

i) Preparing our students to compete and succeed in the global economy by providing quantitative expertise, logical precision, and analytical precision which are all critical components of knowledge necessary to succeed in the twenty first century;
ii) Supporting economic prosperity in the East by providing the quantitative, numerical, and analytic skills to compete and thrive in the twenty first century workplace, and by providing educational opportunities in support of a competitive workforce for North Carolina;
iii) Providing mathematically and statistically sophisticated graduates who can creatively contribute to the workforce and generate intellectual capital.

The MA program in Mathematics

1) Supports graduate study and research in mathematics,
2) Produces teachers who serve as instructors in the community colleges,
3) Produces teachers who serve as lecturers at ECU,
4) Prepares students for further study in mathematics at the Ph.D. level,
5) Supports students in other graduate programs such as Mathematics Education and Economics,
6) Produces statisticians and mathematicians who contribute to the overall economic well being and to the labor force in the East and in North Carolina.

As such our undergraduate program relates to ECU's Mission (http://www.ecu.edu/ecu/ecumission.cfm) by:

v) Helping to meet the educational need of North Carolina,
vi) Providing a rich and distinctive graduate experience,
vii) Advancing knowledge, encouraging creative activity, solving significant human problems, and providing the foundation for professional practice,
viii) Supporting public education.

Furthermore, our graduate program relates to the goals of ECU/UNC tomorrow (http://www.ecu.edu/mktg/ecu_tomorrow/_) by:

7) Preparing our students to compete and succeed in the global economy by providing quantitative expertise, logical precision, and analytical precision which are all critical components of knowledge necessary to succeed in the twenty first century;
8) Supporting economic prosperity in the East by providing the quantitative, numerical, and analytic skills to compete and thrive in the twenty first

century workplace, and by providing educational opportunities in support of a competitive workforce for North Carolina;
9) Providing mathematically and statistically sophisticated graduates who can creatively contribute to the workforce and generate intellectual capital.

1.7 *Degree Program Objectives, Outcomes and Uniqueness:* For each degree program, list the objectives and outcomes (faculty expectations) from the unit's current assessment plan. Describe the breadth and depth of the program, and indicate special features or innovations.

Undergraduate

The undergraduate programs are designed to train students for a variety of professions that value quantitative skills, or will be enrolled in scientific or technical graduate programs. The undergraduate majors are expected to gain knowledge of Mathematics at a level generally considered by the profession to be appropriate for undergraduate education. The majors are also expected to learn to write proofs of mathematical propositions.

The B.A. program is meant to train students with a broad foundation in the liberal arts with a deeper understanding of Mathematics. The B.S. program is designed for students who wish to narrow their focus to Mathematics and a related field like the Sciences or Computer Science etc.

Graduate

The department's MA program prepares students for
- Careers as community college teachers,
- Careers in industry and the financial sector, and
- Subsequent study at the doctoral level elsewhere.

The program includes evening course offerings to meet the needs of part-time students. It is the only Mathematics MA program in the large region of Eastern North Carolina lying between the Research Triangle, Wilmington and Elizabeth City. Many of our alumni have been employed as instructors in our own department and in community colleges throughout Eastern North Carolina. The program plays an essential role in the preparation of college mathematics teachers for this region.

Program learning goals are discussed in the departmental Assessment Plan. (See Section VI.) These include
- Mastery and synthesis of domain specific knowledge,
- Sudent research experience, and
- Preparation of college Mathematics instructors.

The department currently includes nineteen in-rank graduate faculty members with research expertise in Mathematical Logic, Algebra, Algebraic

Geometry, pure and applied Analysis, Probability Theory and Statistics. They provide instruction and supervise all theses and research projects within the program.

1.8. *Program Enrichment Opportunities.* List and describe special events, activities and programs (e.g., lecture series) that enhance the academic and research/creative activity environment.

Our majors are encouraged to get involved in the community by helping the department organize high school math contest for area schools. They are also encouraged to get involved in grading the MathCounts contest, a math contest for middle school students.

Periodically students are invited to a faculty presentation. These provide a mechanism for students to meet faculty who may not be currently teaching a graduate course but could serve as a potential thesis director. In addition students are encouraged to attend departmental colloquia and research seminars. Active seminars in the past two years have focused on Wavelets and topics in Algebraic Geometry. More popular with the students, however, are the presentations given by their peers of results of theses and research projects.

1.9 *Responsiveness to Local and National Needs:* Describe the nature of the discipline and the type of educational experiences provided by the degree program(s) in the unit. In what way is the program(s) responsive to the needs of North Carolina, the region and the nation?

Undergraduate

The BA/BS program provides a knowledge base in mathematics spanning the range from the calculus sequence, through linear algebra and introduction to proofs, and culminating in the more advanced proofs courses in modern algebra and advanced calculus. These are supplemented by electives and by concentration areas, which include statistics, mathematics, and the sciences. Many of our majors are double majors in mathematics education and thus serve North Carolina through teaching in area high schools, with the mathematics department providing discipline based content knowledge. Others of our majors proceed to graduate school, many in mathematics at ECU, with a high number of these latter students eventually teaching in community colleges or here at ECU. Our majors have gone on to excel in a wide range of fields which include the above mentioned educational areas along with areas including medicine, physics, pharmacy, economics, actuarial, statistics, and other quantitatively based areas.

Graduate

The program provides a traditional educational experience at the Masters level in Mathematics and/or Statistics. We meet a regional need in preparing future college mathematics instructors. During the 2008 fall semester our own department employed twenty-five non-tenure track faculty. Of these ten had earned an MA or MAEd degree from East Carolina University. (Note: The MAEd degree in Mathematics Education was housed in our department until 2002.)

1.10 *Program Quality:* Provide an assessment of the quality of the unit program(s) as compared to other programs in the Southeast and the rest of the nation, and explain the basis of the assessment. How does the unit program rank nationally? What is considered to be the best objective measure for national comparisons in the field? What award recognition has the program received?

Undergraduate

The department sees our undergraduate program as near the median among programs in the nation, and in the top 5 within the UNC system for these reasons: our BA/BS students have access to a strong faculty; there is an increase in the number of BA/Bs graduates who go on to graduate school (see section 3.6); our placement record in high school mathematics teaching is traditionally strong, and we fill a need for quantitative positions in statistics and industry. The program needs to be strengthened with: increased numbers; with increased recruiting efforts; with an increase in the number of electives at the junior/senior level undergraduate mathematics offerings; with a revitalization of the math club and other student oriented activities; and with an increased focus and commitment on the part of our faculty toward our undergraduate majors.

Graduate

The American Mathematical Society collects annual employment and salary data from US Mathematics departments. Our department is one of 192 "Group M" departments for which the highest degree granted is a Masters degree. No national ranking exists for these departments or programs.

The department sees our graduate program as in the upper third of masters granting programs in the nation for these reasons: our MA students have access to a very strong research faculty; our track record for having MA graduates go on for further advanced degrees is growing (see section 3.6); our placement record for our graduates is strong, including placement in community college and university lecturer positions, high school mathematics teaching positions, and quantitative positions in industry; and the number of our MA graduates seeking PhD’s is improving. The program could be strengthened with increased numbers, an increased pipeline from our undergraduate program, higher stipend support, and increased out of state tuition remissions.

1.11 *Administration:* Provide an organizational chart of the unit including all personnel. Briefly describe the program's administrative structure. List the major committees of the unit that relate to undergraduate and/or graduate education and their structure and function. Address leadership and describe any important formal and informal relationships the unit has with other units, institutes, centers, etc. at ECU and beyond.

The Mathematics Area Coordinator and the Statistics Area Coordinators report to the chair, and recommend course offerings and scheduling, interface with faculty for teaching preferences, curriculum development, and area goals. The Director of Graduate Studies also reports to the chair, serves as the departmental representative to the Graduate Assembly, consults with and advises prospective and current graduate students, recommends qualified students for admission into the Mathematics graduate program, prepares graduate course recommendations, and chairs the Mathematics Graduate Committee, among other duties. The Director of the Mathematics Laboratory, a part-time faculty member, reports to the chair and organizes and schedules teaching and tutoring in the Math Lab. The Lead Administrative Assistant reports directly to the chair, and supervises the two Administrative Support Associates. The regular faculty and the teaching faculty interact with the Area Coordinators and report to the chair. The Math and Statistics Area Coordinators and the Director of Graduate Studies have leadership roles in the operation of the department.

The standing committees of the department are: the Evaluation Committee, Graduate Committee, Personnel Committee, Teaching Committee, and Undergraduate Curriculum Committee. The elected (excepting the Graduate Committee) chairs of these committees all play leadership roles in the operation of the department. The Promotion Committees and Tenure Committee are special committees.

Mathematics has particularly strong relationships with both Engineering and Math Education. These ties include extensive mathematics educational support, including accreditation support, retention efforts, graduate student support, and course offering flexibility. Demonstrated accomplishments of the Department of Mathematics in retention efforts of students in our own and particularly in other departments as part of our service mission include:

- Established the joint Engineering/Math Committee (Spring 2007), with the primary focus of retention of Engineering Students. This Committee jointly created a four course Calculus/Differential Equations sequence (MATH 2151-2154) that is offered by the Math Department and taken only by Engineering Majors.
- Offering of special sections of Statistics (MATH 3307), Pre-calculus (MATH 1083), and College Algebra (MATH 1065) to enhance the retention of Engineering students, as initially recommended and currently guided by the joint Engineering/Math Committee.
- Monitoring and communication concerning attendance and academic progress of engineering students in Department of Mathematics courses, initiated and facilitated by the joint Engineering/Math Committee. Based on students' past performance and progress, the committee revised placement criteria each year to ensure that the students are placed in the appropriate course. The committee also discussed hurdles the students face during the course of the semester and tried to find ways to help students overcome their problems through additional tutoring. With oversight from the committee, the Math faculty teaching the courses taken by the Engineering students provided regular updates on student attendance, homework, and test scores to the advising staff in the Engineering Department so they could intervene and retain students having difficulties.
- Established the Math/Mathematics Education Committee, whose primary focus is to work on issues related to both programs, including communication on course offerings to ensure progress to graduation is not impeded, and promoting a double major option in Math and Mathematics Education at the secondary level by discussing and preventing potential obstacles.
- Offered a special summer section of statistics (MATH 3307) with additional tutoring, as recommended and supported by the Math/Mathematics Education Committee, to support retention of students having difficulty with statistics.
- Offering of three special sections of MATH 1065 for cohorts of students in the College of Human Ecology (CHE), and acknowledged by CHE as critical for retention of their students.
- Offering of two sections of MATH 2127 for cohorts of students to be offered specifically for the College of Education beginning fall, 2009, with emphasis on concepts of mathematics for retention of elementary education students.
- Remedial math taught to 400-500 students at ECU per semester, in association with Pitt Community College, shown to be essential in preparing students at academic risk for college algebra and other math courses.
- Offering Mathematics Laboratory tutoring, available for virtually all students enrolled in math courses from remedial math to statistics and calculus.

East Carolina University
Academic Affairs, Thomas Harriot College of Arts and Sciences
Department of Mathematics
6065-5000-00
AA-26, September 4, 2009
____
Dr. Thomas J. McConnell, Interim Chair

Chair/Professor
Dr. Thomas J. McConnell/Interim Chair
(EPA) (37801)

Professor & Coordinator of Graduate Studies
Benson (EPA) (37818)

Associate Professor & Coordinator of Statistics
Said (EPA) (37826)

Associate Professor & Coordinator of Mathematics
Ravi (EPA) (37803)

Director of Math Lab
Szucs (EPA) (37860)
Pitt Community College
Math Tutors/Self Help Students

Regular Faculty (EPA) (Tenure)

Abdulali 37812
Benson 37818
Bernhardt 37807
Carolan 37830
Crammer 40687
Jantzen 37828
Katsoulis, E 37846
Pravica 37838
Ratcliff 37816
Ravi 37803
Ries 37825
Robinson 37847
Said 37826
Shlapentokh 37805
Spurr 37837
Vacant 37816
Vacant 37817
Vacant 37806
Vacant 37810

Regular Faculty (EPA) (Tenure- Track)

Alexandrova 37864
Randriampiry 29852
Sastry 37863
Xiao (37802)

Brenda J. Morton
Supervisor
Administrative Support Associate (SPA) (38004)

Gwen Hardin
Administrative Support Associate (SPA) (38001)

Administrative Support Associate Teri Coleman
(SPA) (38002)

Teaching Faculty (EPA) Faculty

Abdelfattah 33604
Andrews 37809
Archava 29926
Bland 000388
Burns 37806
Butcher 39403
Church 34407
Edwards 37861
Ferrell 37801
Gkigkitzis 37817
Heritage 37848
Hjouj 37801
Huber 32867
Jambor 37815
Kornegay 37810
Lowe 30670
MacLeod 29849
McGlohon 37801
Mullis 37801
Obuchowska 33606
Ouellette 37806
Pleasant 38623
Rentmeesters 38603
Stanley 37815
Szucs 37860
Tabor 37817
Van Hoy 33607
Wilkerson 33607
Williams 37801
Worthington 29751

II. CURRICULUM/INSTRUCTION

2.1 *Foundation Curriculum:* Indicate the contributions the unit program makes to the Foundations Program and foundation course cognate requirements of other units and the university. Describe the unit's quality enhancement process for Foundations courses. State the full-time equivalents (FTE's) utilized for Foundations courses and the student credit hours (SCH) produced per 1.0 FTE for each academic year under review. Describe the percentage of the unit's resources (funding, time, faculty, other) supporting Foundations courses per academic year under review and whether a greater or lesser amount of resources needs to be allocated to Foundations courses.

Data below indicates the Mathematics Department is central to quantitative foundation course offerings, and it uses approximately 80% of its overall Semester Credit Hours for foundations courses. While we are allocated 28.5 permanent FTEs, the data indicates we devote 30.5 FTE to foundations courses and 39.2 FTE to total course offerings. The department is left with a gap of nearly 11 FTE positions. Remedying this gap between permanently allocated FTE positions and actual utilization of FTE positions (which is currently covered with temporarily allotted "swing positions") is a priority for the Mathematics Department. Further growth in the engineering and mathematics education sectors, along with overall projected student growth and the accompanying growth in foundations SCH will expand this gap beyond 11 FTE positions. This needs remedying via a recommended allocation of 1 FTE position per year for the next decade.

The following is a list of foundations courses listed in the course catalog under the Department of Mathematics. College Algebra (Math 1065) is the Foundations course most commonly taken by ECU students as the departments teaches this course to thousands of students each semester. Note that
Math 2775 (Topics in Discrete Mathematics), Math 3237 (Discrete Mathematics), and Math 3239 (Applied Mathematics via Modeling) were established and taught by Mathematics Education faculty.
They have been offered infrequently since Mathematics Education was removed from the Mathematics Department in 2002.

Math 1050- Explorations in Mathematics
Math 1065- College Algebra
Math 1066- Applied Math for Decision Making
Math 1067- Algebraic Concepts & Relationships
Math 1083- Introduction to Functions
Math 1085- Precalculus
Math 2119- Elements of Calculus
Math 2121- Calculus for Life Sciences I

Math 2127- Basic Concepts of Mathematics
Math 2151- Engineering Calculus I
Math 2152- Engineering Calculus II
Math 2153- Engineering Calculus III
Math 2171- Calculus I
Math 2172- Calculus II
Math 2173- Calculus III
Math 2228- Elementary Statistics
Math 2282- Data Analysis and Probability
Math 2283- Stats for Business
Math 2775- Topics in Discrete Mathematics
Math 3166- Euclidean Geometry
Math 3237- Discrete Mathematics
Math 3239- Applied Mathematics via modeling

Mathematics Foundations courses are required courses in various programs in the sciences, economics, mathematics education, and other departments in addition to the mathematics department, impacting FTE allocations.

Included as Appendix F, is a table that lists each of the Foundations courses above followed by a list of the programs that utilize the course either as a requirement, a cognate, or a recommended co-requisite. These lists are very long and demonstrate the magnitude and centrality of the contributions of the Mathematics Department to the university.

The Mathematics Department currently performs assessment and quality enhancement for Math 1065 (College Algebra) since this is by far the math course taken most commonly by ECU students. The process is described in the departmental assessment document, which states:

Foundations Goal: **Students in Foundations Curriculum Courses will Mathematics that is appropriate to their background and educational needs.**

1. *Measured Outcome:* Students in College Algebra, Math 1065, will acquire adequate skills in the following areas:
   - Lines and linear functions
   - Setting up and solving equations and inequalities
   - Plotting points and graphing functions
   - Mathematical models (word problems)

2. *Direct Metric:* Student performance on the common final examination in math 1065 will be analyzed each semester by the Undergraduate and

College Algebra Committees. The common final will have a number of questions in each of the skill areas mentioned in part 1, above.

3. *Results:* The results of the assessment will be semester-by-semester statistics on student performance on the Math 1065 common final. The statistics will report overall student performance on the exam as well as student performance on the questions in each of the skill areas above.

4. *Analysis:* Strengths and weaknesses in the course will be determined by analyzing the statistics. Performance criteria will be set at the time of the first pass through the process. In subsequent passes, the performance criteria will consist of percentages of students to meet or exceed low, medium, and high benchmarks of achievement on the common final in each skill area, as well as overall.

5. *Improvement Action:* The committees involved with this assessment will meet (i) to discuss the impact of improvement actions taken in prior cycles and (ii) to determine how to enhance those sections of the curriculum where weaknesses in student performance are identified.

6. *Note:* As it gains experience implementing its assessment plans, the Mathematics Department will consider broadening assessment of its Foundations Curriculum offerings to cover other courses with high student enrollment, such as Applied Mathematics for Decision Making (Math 1066), Math 2228 (Statistics) and Math 2283 (Statistics for Business).

The Mathematics Department plays a fundamental role in support of basic and higher level quantitative/analytic understanding throughout the university with Foundations courses in particular focused on the ECU Tomorrow goals: Education for a New Century, Economic Prosperity in the East, Health Care and Innovation, and The Leadership University. Education in mathematics is fundamental to understanding science related education and to education in applied fields such as engineering and mathematics education. This mathematics education also fulfills the UNC Tomorrow goal of Our Global Readiness. The Department of Mathematics is a very active and essential participant in educating virtually all students entering East Carolina University, in order for the students to understand the various processes, concepts, and critical thinking approaches they will be studying. Prosperity in our region of North Carolina requires a growing and expanding economic base, requiring knowledge of mathematics for engineering, business activities, computational needs, and other fields. The expanding health care needs of our region, as listed for ECU tomorrow, require an understanding of mathematical processes from the very early stages of students working towards becoming the nurses, physicians, physical therapists, and other health-related careers, and these students are enrolled in our math courses. The ECU goal of Leadership and the UNC Tomorrow goals of Access to Higher Education and Improving Public Education all require high quality mathematics education to prepare students for critical thinking and fundamental understanding of natural and man-made processes that students need for self development and advancing their career opportunities. Mathematics is fundamental to both the natural sciences and the social sciences, as well as to the applied fields that will lead to opportunities for our growing student population.

The UNC-GA defines 1 FTE as generated by 708.64 UG FC-SCH for a category I department such as Mathematics. The number of full-time equivalents (FTEs) that would be generated directly by Foundation courses and total Mathematics course enrollments is shown below in Table 2.1a. This table demonstrates that the Mathematics Department generates approximately 31 faculty positions with Foundations courses and approximately 39 positions overall. Moreover, 79% of the total student credit hours produced in Mathematics are from Foundations courses.

Table 2.1a – SCH and FTE of Math Foundation Courses (FC) and Total SCH

	2005-2006	2006-2007	2007-2008	2008-2009
Annual FC-SCH	19,003	19,912	21,877	21,920
FC-SCH/708.64	26.8	28.1	30.87	30.9
Earned Total Math SCH/708.64 generated FTE	33.8 (23,983 SCH/ 708.64)	35.3 (25,036 SCH/708.64)	38.5 (27,298 SCH/708.64)	39.2 (27,803 SCH/708.64)
% FC-SCH of total SCH in Math	79%	79%	80%	79%

Table 2.1b shows the actual number of permanent faculty positions allocated to Mathematics by East Carolina University. It shows that in 2008-09, 28.25 FTE positions were allocated to Mathematics – about 25% fewer positions than the 39 generated by the GA funding formula as shown in Table 2.1a. Because 28.25 positions are not nearly enough to cover the teaching needs for the Foundations courses and the teaching needs overall for the Department, each year the College of Arts and Sciences allocates several swing positions to the Mathematics Department. However, the Department does not control these positions and must request them every year. It is often late summer before the last few needed positions can be allocated to Mathematics – requiring the department to hire fixed term faculty into these positions very close to the beginning of the fall semester which makes it difficult to hire the strongest candidates.

The Mathematics Department thus needs several more permanently allocated positions for several reasons. It faces increasing demands for Foundations and/or service courses for other programs on campus that have dramatically increasing enrollments, Nursing and Engineering are prime examples. The Engineering courses for the most part need to be taught by faculty with PhD's and as mentioned above they are difficult to hire into swing positions because of issues of timing. But the department could also use more permanent positions to further its research mission and to enhance its current programs, topics that will be discussed elsewhere in this document.

Table 2.1b –Faculty Positions Allocated Permanently to Department of Mathematics

	2005-2006	2006-2007	2007-2008	2008-2009
FTE total assigned, Academic Affairs	23.5	26.5	28.25	28.25

The Mathematics Department is somewhat limited in the number of student credit hours it can produce in Foundations courses due to the lack of access to large classrooms -- most of the classrooms that are available to Math have a limit of around 50 students. However, even if larger rooms were available the Department may not choose to use them for pedagogical reasons. Keeping the number of students in each section relatively low makes it possible to better educate the students in complex concepts and makes it possible to engage the students in working through problems during class.

In the table below, 2.1c, the percentage of resources used for foundation courses is calculated based on the fact that in 2008-09 Mathematics taught 21,920 FC-SCH and 27,803 total SCH. Therefore Foundations SCH made up 79% of the total SCH produced by Mathematics. The three years previous to 2008-09 also show 79% or higher of total SCH produced coming from Foundations courses. The Mathematics Department is expending the great majority of our teaching resources upon Foundations Courses. Travel, Colloquium, and general research support are underfunded and are not a part of this set of calculations.

Table 2.1c – Percentage of Unit's Resources Supporting Foundation Courses per Academic Year

Funding Source	**Total $(s)/yr.**	**79% Cost**	**Total 5-yr Cost for Foundation Courses**
Supplies	$5,408	$4,272	$21,362
Copying	$16,000	$12,640	$63,200

Maintenance Software	$2,300	$1,896	$9,480
SPA Salary	$88,130	$69,622.70	$348,114
Self-help Students	$2,293	$1,811.47	$9,057
TOTAL	$114,231	$90,242	$451,212

More resources need to be invested in Mathematics for teaching foundations courses, as the department is heavily dependent upon borrowed ("swing") positions to meet the heavy service demands of the foundation courses in mathematics. In addition, it should be recognized that there was a shift a number of years ago to hiring a significant number of fixed-term teaching faculty. While the fixed term faculty work very well in helping to balance the Department's teaching needs, there has been a continual increase in the number of sections of mathematics that must be offered to meet the growing population of ECU students. This striking increase in teaching demand has led to the cannibalization of professorial positions that must now be occupied by fixed term faculty, leaving fewer and fewer positions available for expanding, or even maintaining, the research program of Mathematics.

2.2 *Instructional Relationship to Other Programs:* Describe how instruction and research in this program supports or is otherwise related to other programs (undergraduate, graduate, professional) within unit and/or in other units or schools at East Carolina University. Cite other programs whose students frequently take minors or other program options with the unit's program. List courses in the unit program that are also required or are prerequisites within other degree programs.

Undergraduate

The discussion of the Foundation Curriculum in Question 2.1 above shows that instruction in the Mathematics Department supports many, many programs throughout the university. The list of programs that do not require a mathematics course is short and appears as the last page of Appendix F.

Also included in Appendix F is a spreadsheet listing all the mathematics courses that are not Foundations courses followed by a list of programs that require them. The program supported to the greatest degree by the Mathematics Department is the BS in Mathematics Education. The students in that program take several courses in the Math Department including Calculus I-III (Math 2171-Math 2173), Linear Algebra (MATH 3256), Transition to Higher Mathematics (MATH 2300), Modern Algebra (MATH 3263), Mathematical Statistics (MATH 3307), and Foundations of Mathematics (MATH 5322). In fact, the program is so closely aligned with the BA in Mathematics that the students in the BS in Mathematics Education can double major by taking 3 additional Mathematics Courses.

Several of them each year do complete the double major. Other programs requiring non-Foundations mathematics courses are the Computer Science BS (MATH 2724, MATH 3229, and MATH 3584) , The Economics BS (Linear Algebra (MATH 3256) and Mathematical Statistics (MATH 3307)), and the Physics BS (Differential Equations (MATH 4331).

The Mathematics Department has developed courses or sequences of courses in support of other programs. In particular, the department offers Business Math (MATH 1066), Business Statistics (MATH 2283), Calculus for the Life Sciences I and II (MATH 2121, MATH 2122) which is required for students taking the General Biology degree, the Chemistry BA , the Pre-Optometry Curriculum , and the BS in Science Education. MATH 2121 is required for the degree in Ecology or Environmental Biology and is a course that may be taken for the Chemistry minor, the Neuroscience studies Minor, the Physics Minor, and the Pre-Pharmacy Curriculum. The Mathematics Department also offers Calculus for Engineering I-III (MATH 2151-2153) and Engineering Calculus and Differential Equations for the Engineering BS degree. The Engineering Students also take Mathematical Statistics. MATH 3301 Foundations of Geometry was developed for mathematics education majors.

The Mathematics Department has data on minors for the last 5 semesters, since Banner was implemented at ECU. There are 6-7 students listed each semester as taking the minor. These students are enrolled in a variety of programs for their major including Psychology BA, the Chemistry BA and BS, the Physics BS, the Computer Science BS, the Economics BS, and the Engineering BS.

Graduate

The degree requirements for students in the MAEd program in Mathematics Education (formerly housed in our department) include 15 sh of graduate coursework in Mathematics. It has recently become possible for such students to simultaneously earn our MA degree and the MAEd degree, counting 15 hours of graduate Mathematics coursework towards both degrees. We currently have one such dually enrolled student.

Our graduate offerings in Probability and Statistics are often taken by students from the MS program in Applied and Resource Economics. Graduate and undergraduate students in Physics have also taken various of our introductory level graduate courses.

One course is cross listed with the Physics department (MATH 5311, Mathematical Physics) and two are cross listed with Computer Science (MATH 5002, Logic for Mathematics and Computer Science, and MATH 5774, Programming for Research).

2.3 *Curriculum Assessment and Curricular Changes:* Describe the assessment process and the metrics involved in measuring learning outcomes and implementing quality enhancement. Describe any significant changes in curriculum and instruction in the unit program as a result of the quality enhancement process or since the last self-study. Explain the reason for the changes, such as different needs of students, shifts of emphasis in the discipline, changes in faculty, perceived weaknesses in the program, problems with facilities, etc.

Undergraduate

The Mathematics Department is currently performing four types of assessment on the undergraduate programs: Calculus knowledge, mathematical writing, an overall assessment of student knowledge as students are about to leave the program, and the effectiveness of the programs in preparing students for careers. The details of each type of assessment appear in the departmental document on assessment and are as follows:

***Program Learning Goal 1*: Mathematics majors will acquire sufficient knowledge of Calculus.**

1. *Measured Outcome*: The undergraduate program is built on the Calculus sequence, Math 2171, 2172, and 2173. In this sequence, students will learn:
    - Differentiation and its interpretation as slope and rate of change
    - Optimization
    - Partial derivatives
    - Limits
    - Integration
    - Computation of tangent planes.

2. *Direct metrics*:
    a) *Embedded Questions.* Each outcome area listed above will be measured every semester with 6 embedded questions in the final exam of all the Math 2173 sections. The questions will be designed by the Calculus Textbook and Undergraduate Committees and the exam will be administered by the instructor of each section. The results of the student performance on the embedded questions will be collected by the instructors and collated by the committees involved with this assessment.
    b) *Senior exam.* Each year, a cumulative senior assessment exam will be given (see Program Learning Goal 3). Student performance data on those questions that relate to the three-semester calculus sequence will be given to the Calculus Textbook and Undergraduate Committees for the purpose of measuring retention of the skills and concepts.

3. *Results*: The results for this assessment are in two parts, the lower division portion consists of student scores on the embedded questions in the Math 2173 final exam, and the upper division portion consists of student scores on the calculus portion of the senior assessment exam. In each part, the data will be reported both as an overall score, as well as broken down by the outcome areas listed above.

4. *Analysis*: The Calculus Textbook and Undergraduate Committees will analyze the student performance and assess the effectiveness of the Calculus courses. Performance criteria will be set at the time of the first pass through the process. In subsequent passes, the performance criteria will be used as a comparator. The performance criteria will consist of percentages of students to meet or exceed low, medium and high benchmarks of achievement (i) on the embedded questions in the Math 2173 final, and (ii) on the calculus portion of the senior assessment exam.

5. *Improvement Action*: The committees involved with this assessment will meet (i) to discuss the impact of improvement actions taken in prior cycles and (ii) to determine how to enhance those sections of the curriculum where weaknesses in student performance are identified.

Program Learning Goal 2: Mathematics majors will develop an ability to communicate mathematics effectively.

1. *Measured Outcome*: Mathematics majors will learn to write proofs of mathematical propositions.

2. *Direct Metric*: Student writing samples from each of Math 2300 and 3263 will be maintained. They will be scored every fall semester by the Undergraduate Committee according to a rubric based on the following criteria: clarity; citation of relevant theorems, definitions and axioms; proper use of terminology and symbols; proper use of the rules of deduction; mathematical correctness.

3. *Results*: The results of the assessment will be the writing samples of the individual Mathematics majors, together with their rubric scores.

4. *Analysis*: The Undergraduate Committee will analyze the writing samples and rubric scores every fall semester with a view to assessing progress that students make toward the goal as they pass through the program. Performance criteria will be set at the time of the first cycle through the process. Note that a full cycle takes two to three years to elapse. In subsequent cycles, the performance criteria will be used as a comparator. The performance criteria will consist of percentages of students to meet or

exceed low, medium and high benchmarks of achievement according to the rubric in each of the assessed courses.

5. *Improvement Action*: The committees involved with this assessment will meet (i) to discuss the impact of improvement actions taken in prior cycles and (ii) to determine how to enhance those sections of the curriculum where weaknesses in student performance are identified.

Program Learning Goal 3: Mathematics majors will gain an adequately broad base of knowledge.

1. *Measured Outcome*: Students will gain knowledge of Mathematics at a level generally considered by the profession to be appropriate to undergraduate education.

2. *Metrics*: There will be both a direct an indirect metric for this outcome.
    a) *Indirect Metric*: The Mathematics Department office will survey the seniors every spring semester on the effectiveness of the program with a survey instrument that measures opinions of each course taken as well as of the overall program. The survey will provide space for comments.
    b) *Direct Metric*: The Mathematics Department will create or otherwise obtain a standard exam for undergraduates (such as the GRE). The exam will have various parts corresponding to the different courses in the undergraduate Mathematics curriculum. This senior assessment exam will be administered each year to students in Math 4101, as a required part of the course. The grade will not count toward the course grade.

3. *Results*: The results will be (i) the survey responses and (ii) the student scores on the senior assessment exam, overall and on each of the sections.

4. *Analysis*: The survey responses and senior assessment exam scores will be reviewed by the Undergraduate Committee. Performance criteria will be set at the time of the first pass through the process. In subsequent passes, the performance criteria will be used as a comparator. The performance criteria will consist of percentages of students to meet or exceed low, medium and high benchmarks of achievement overall and on each section of the senior assessment exam. Exam scores will be compared with survey responses to determine any correlation.

5. *Improvement Action*: The committees involved with this assessment will meet (i) to discuss the impact of improvement actions taken in prior cycles and (ii) to determine how to enhance those sections of the curriculum where weaknesses in student performance are identified. Special attention

will be directed to any area in the curriculum where low exam scores correlate to problems that surface in the survey responses. Comments on the survey will be considered to gain additional insight on how to make improvements to the curriculum or instructional techniques.

Note: The Mathematics Department will consider submitting a catalog revision of our undergraduate program description to add the degree requirement of enrolling in a zero credit hour course in which the senior assessment exam will be given.

Program Learning Goal 4: Students will be prepared for careers requiring quantitative skills.

1. *Measured Outcome*: Graduates will find employment in a variety of professions that value quantitative skills, or will be enrolled in scientific or technical graduate programs.

2. *Metric*: The Mathematics Department office will survey alumni every three years to collect data about their current occupations and the effectiveness of the program in preparing them for their jobs or educational programs.

3. *Results*: The results will be the survey responses.

4. *Analysis*: The Undergraduate Committee will review the survey responses.

5. *Improvement Action*: The committees involved in this assessment will recommend program changes to the Mathematics department based on the survey responses.

Partner Program Goal: Students will acquire adequate Mathematics skills to provide a foundation for their chosen fields of study.

1. *Measured Outcome*: Engineering students will acquire adequate skills in Calculus and Statistics to provide a strong foundation for Engineering.

2. *Metric*: This outcome will have three metrics.
    a. *Indirect Metric*: Students in the Engineering program will be surveyed annually by the Mathematics/Engineering Committee to determine if they feel that they have achieved the objectives of their Mathematics courses.
    b. *Direct Metric 1*: Student performance on the *Mathematics component* of the annual Fundamentals of Engineering (FE) Exam will be obtained from the Engineering Program by the Mathematics/Engineering Committee.

c. *Direct Metric 2*: The Engineering/Mathematics Committee will determine questions from the FE Exam each semester to embed in exams in the Engineering Calculus sequence.

3. *Results*: The results will be (i) the survey responses, (ii) the statistics from the Mathematics component of the FE exam, and (iii) the statistics from the embedded questions.

4. *Analysis*: The survey responses and various exam scores will be reviewed by the Mathematics/Engineering Committee. Performance criteria will be set at the time of the first pass through the process. In subsequent passes, the performance criteria will be used as a comparator. The performance criteria will consist of percentages of students to meet or exceed low, medium and high benchmarks of achievement overall and on each exam or section thereof. Exam scores will be compared with survey responses to determine any correlation. Survey responses will be reviewed.

5. *Improvement Action*: The committees involved with this assessment will meet (i) to discuss the impact of improvement actions taken in prior cycles and (ii) to determine how to enhance those sections of the curriculum where weaknesses in student performance are identified. Special attention will be directed to any area in the curriculum where low exam scores correlate to problems that surface in the survey responses. Comments on the survey will be considered to gain additional insight on how to make improvements to the curriculum or instructional techniques.

Note: as it gains experience implementing its assessment plans, the Mathematics Department will consider broadening this portion of its assessment to include students enrolled in the Mathematics Education program.

The Mathematics Department has only been following the above assessment plan for one year so there have been no changes to the curriculum based on this current assessment process. However, the department has made several changes to the curriculum over the past several years based on other factors.

The Mathematics Department included faculty in Mathematics Education until they were removed at the end of the 2001-2002 academic year. Prior to that time, the two main undergraduate degrees offered by the department were a BA in Mathematics and a BS in Mathematics Education. When the Mathematics Education faculty were removed, the BS in Mathematics Education followed them. In response to this and to give students more options, the department designed a new BS degree. The students taking the degree were required to complete a strong math core and also one of four concentrations. The possibilities included several additional math courses and a minor, a statistics concentration, a computer science concentration, and a science concentration.

There have also been many changes involving the creation of new courses in response to student needs:

1. Explorations in Mathematics (MATH 1050) is a liberal arts mathematics course that was established to meet the needs of students who didn't need to take College Algebra or a similar course for their majors. It is often the case that students have had a bad experience with algebra in high school and would prefer not to take College Algebra to fulfill their Foundations math requirement. The topics in MATH 1050 are chosen by the instructor from a set of suggested topics that include statistics, number theory, etc… The course has proven to be very successful with the department offering several sections a semester. The students genuinely seem to like the material and the chance to take an alternative to algebra.

2. Transition to Advanced Mathematics (MATH 2300) was created as a course to introduce students to proof writing. Previously the students first exposure to extensive proof writing in the curriculum occurred in Modern Algebra (MATH 3263) which was typically taken in their junior year. Many students were not successful initially in this course which made it hard for them to finish on time. The Transitions course can be taken in their sophomore year which introduces the students to proofs earlier and in a simpler context than Modern Algebra. The BS in Mathematics Education majors in particular have experienced greater success in Modern Algebra after first taking the Transitions course.

3. Foundations of Geometry (MATH 3301) was developed in conjuction with the Mathematics Education Faculty because they believed that the geometry course offered previously by the Mathematics Department was not meeting the needs of the students in their BS program.

4. Combinatorics (MATH 3273) was created to enhance the course elective offerings for both the Mathematics BA and BS majors and the Mathematics Education BS majors.

5. Engineering Calculus I-III and Engineering Linear Algebra and Differential Equations (MATH 2151-MATH 2153 and MATH 2154). The courses were developed via extensive collaboration with the Engineering Faculty to meet the needs of the students in their new BS program. The Calculus courses are each 3 credit hours instead of the usual 4 credit hours per course in the traditional Calculus sequence taken by Mathematics majors. The Engineering Linear Algebra and Differential Equations class is 4 hours and covers both Linear Algebra and Differential Equations as thoroughly as

possible given that constraint. All the courses emphasize Engineering applications.

Graduate

During the 2008 fall semester the department drafted a comprehensive Program Assessment Planning Document in response to a university wide directive. The proposed assessment procedures are detailed in Section VI of this self-study. As the assessment cycle has only just begun no curricular changes have resulted to date. In brief, assessment metrics related to the program learning goals discussed in section 1.7 above are as follows:

- **Mastery and synthesis of domain specific knowledge**: To demonstrate such mastery we require successful completion of a comprehensive exam as a degree requirement. Each exam is designed and graded by a committee of four departmental graduate faculty members and covers subject matter treated in four graduate level courses.
- **Student research experience**: Students in the *Mathematics* and *Statistics* concentrations are required to either write a thesis or complete a research project under the direction of a graduate faculty member. Students present the results of their research projects in talks open to all faculty and students. A committee of three graduate faculty members is formed to perform a closed oral examination upon completion of a student presentation. The student's work is judged by the committee on a pass/fail basis.
- **Preparation of college Mathematics instructors**: Students in the *Mathematics in the Community College* concentration are required to take MATH 6271-Teaching Collegiate Mathematics. As part of this course students are required to produce a teaching portfolio, which is graded according to a rubric. In addition, each student is required to give a presentation to an undergraduate audience. (This degree requirement substitutes for the research requirement in the other two concentrations.)

A fourth assessment goal concerns assuring quality of instruction provided by the Graduate Teaching Assistants. This is discussed below in section 3.8 as it does not directly pertain to curriculum assessment.

2.4 *Bachelor's Degree:* Describe the bachelor's degree curriculum, indicating the total number of required credits and the credit distribution among various units. If more than one concentration is available, then list the concentrations and their curricula separately. (Use Appendix C for this purpose.) If there is substantial dependence on some other unit program, describe and comment on the relationship between it and the unit's program. Indicate any associated professional certification. Include any additional information concerning curricular emphasis that would aid in characterizing the program as oriented to practice or training.

The Mathematics Dept. offers two degrees, a BA and a BS. The BA has two concentrations and the BS offers four concentrations. See Appendix C for a description of the degrees, the requirements for each, and a list of courses.

The Mathematics Department has two undergraduate degree programs, the BA in Mathematics and the BS in Mathematics. The requirements for the two degrees are summarized in Appendix C.

The BA in Mathematics (CIP code 27.0101) requires a minimum of 126 credit hours. This includes 42 hours of Foundations courses and 12 hours of Foreign Language. All students must take a common math core of 30 hours and also must complete a concentration in either Math or Statistics.

The Math concentration ranges from 30-36 hours and requires the students to take two math electives (6 hours) and to complete a minor (24-30 hours). The Statistics concentration requires 27 hours, 3 math electives (9 hours) and 18 hours of cognates from Math, Economics, and Computer Science.

The BS in Mathematics (CIP code 27.0101) requires a minimum of 126 credit hours. This includes 42 hours of Foundations courses. The students are required to complete a common core of 37 hours – 33 hours of Mathematics courses and 4 hours in Computer Science. The students must also complete a concentration in one of four areas: Mathematics, Science, Statistics, or Computer Science. The Math concentration ranges from 27-33 hours and requires the students to complete 12 additional hours of mathematics (Complex Variables and three electives) and a minor (24-30 hours). The Science Concentration requires the students to complete 6 additional hours of mathematics (Complex Variables and one elective) and 27-28 hours of courses in sciences. Of these hours, the students must take at least 8 hours of Chemistry and 8 hours of Physics. The Statistics Concentration requires that the students take 15 additional hours of Math courses that focus on statistics, 3 hours of English, and 3 hours of Philosophy. There is a requirement of 9 additional hours of electives, 6 of which must be in mathematics. The Computer Science concentration requires that the students complete 16 hours in Computer Science and 12 additional hours of electives, 9 in Computer Science and 3 in Mathematics.

The following table shows the total number of students enrolled in the BA or BS program in a given semester for the last five years:

Semester	BA	BS
Fall 2004	21	2
Spring 2005	16	8
Fall 2005	10	14
Spring 2006	12	13
Fall 2006	8	16
Spring 2007	6	15
Fall 2007	14	24
Spring 2008	14	24
Fall 2008	14	23
Spring 2009	20	29

There are about 18-20 tenured and tenure-track faculty that teach the courses for the BA and the BS programs. Fixed term faculty typically do not teach courses for the BA or the BS program.

2.5 *Certificate Programs:* Describe the certificate curriculum, indicating the total number of required credits and the credit distribution among various units as in 2.4 above. If there is substantial dependence on some other unit program, describe and comment on the relationship between it and the unit's program.

Graduate Program

Certificate in Statistics

The statistics certification requires a minimum of 9-15 s.h. credit as follows:

- Students who have successfully completed MATH 3307, 3308 must complete 9 s.h. as follows: CSCI 5774; MATH 5000, 5031.
- Students who have successfully completed MATH 3307 must complete 12 s.h. as follows: CSCI 5774; MATH 5000, 5031, 6802.
- Students who have not successfully completed MATH 3307 must complete 15 s.h. as follows: CSCI 5774; MATH 5000, 5031, 5801, 6802.

2.6 *Master's Degree:* Describe the master's degree curriculum, indicating the total number of required credits and the credit distribution among various units as in 2.4 above. If more than one concentration is available, then list the concentrations or areas of emphasis and their curricula separately. (Use Appendix C for this purpose.) If there is substantial dependence on some other unit program, describe and comment on the relationship between it and the unit's program. Indicate any associated professional certification. Include any additional information concerning curricular emphasis that would aid in characterizing the program as oriented toward practice-training. Describe the research orientation of the thesis programs.

The program has three concentrations:

- *Mathematics*,
- *Statistics*, and
- *Mathematics in the Community College*.

The third concentration first appeared in the 2007-2008 Graduate Catalog. It heavily overlaps the Mathematics concentration, but recognizes explicitly the career objective for many of our students.

Students in the *Mathematics* and *Statistics* concentrations may elect a thesis or non-thesis option. Students writing theses must complete at least 30 sh of coursework, including 6 sh of Math 7000 – Thesis. This means that they complete eight courses (for 3 sh each) and enroll for two semesters in Math 7000. Students in the *Mathematics* and *Statistics* concentrations who elect the non-thesis option must complete 33 sh of coursework (eleven courses) and a research project under the direction of a graduate faculty member. Students present the results of their research projects in talks open to all faculty and students. The research project does not count for course credit.

Students in the *Mathematics in the Community College* concentration must complete 35 sh of coursework: eleven 3 sh courses together with the 2 sh course Math 6271, Teaching Collegiate Mathematics. In addition they are required to produce a teaching portfolio and give a presentation to an undergraduate audience.

Required courses for the *Mathematic*s concentration are:

- Advanced Calculus I (single variable analysis), Advanced Calculus II (multi-variable analysis), Modern Algebra I, Complex Variables I, Toplogy, Real Analysis (Lebesgue Theory) and one of Mathematical Physics/Probability Theory/ODE/PDE.

The required courses for the *Mathematics in the Community College* concentration are as above but also include:

- Teaching Collegiate Mathematics, Applied Statistical Analysis and one of Number Theory/Statistical Inference.

Required courses for the *Statistics* concentration are:

- Advanced Calculus I, Advanced Calculus II, Matrix Algebra, Applied Statistical Analysis, Probability Theory, Statistical Inference and Stochastic Processes.

In addition to the above requirements, students must pass a comprehensive exam and demonstrate reading proficiency in a foreign language (or satisfy the Graduate School's alternate Research Skills Requirement). A comprehensive exam covers material from four graduate courses chosen by the student.

This section concludes with a list of the thirteen theses written since 2002. Titles, Authors, and Advisors are listed. This gives an indication of the research orientation of the program.

- Wavelet Sets in R^2, by Derek Williams, 2009 (Ratcliff)
- Finite Reflection groups, by Paul Kornegay, 2008 (Benson)

- Hyperbolic Iterated Function Systems, Fractals, and Fractal Dimension, by Julian Allen Brooks, Jr., 2008 (Spurr)
- Wavelet Frames, by David L. Edwards, 2008 (Spurr)
- An Introduction to Clifford Algebra, by Stephanie Lynn Phillips, 2007 (Spurr)
- Missing data and the EM algorithm, by Holly Walrath, 2006 (Carolan & Said)
- Binary response variables: an approach through logistic regressions, by Jason L. Haynes, 2006 (Said & Carolan)
- Representations of the finite Heisenberg group, by Jonathan D. Dunbar, 2006 (Ratcliff)
- A Markov chain approach for economic design of control charts, by Ting Yang, 2005 (Carolan)
- A study of the first polynomial time primality algorithm, by Jason Scott Brinkley, 2003 (Ravi)
- Introduction to de Rham's Cohomology, by Alycia Aucoin, 2003 (Pravica)
- Matrix square roots, by Jennifer R. Mayo, 2003 (Hudson)
- The inverse-closed property of C*-algebras in banach algebras, by Joseph Lawrence Vittitow, 2002 (Daughtry)
- Cost efficient monitoring of a process, by Jason Brian Kincaid, 2002 (Carolan and Said)
- Applications of the Gibbs sampler in Bayesian statistical analysis, by Robert Conrad Lee, 2002 (Carolan & Said)

MA in Mathematics

The MA in Mathematics comprises three concentrations: Mathematics, Statistics and Mathematics in the Community College. Full time students enrolled in the Mathematics in the Community College concentration generally hold teaching assistantships to gain experience as they complete their MA program. The degree requirements are as follows.

1. The Graduate School’s research skills requirement is satisfied by demonstrating competency in an appropriate foreign language or by completing certain courses depending on the concentration. Students should see the Graduate Director for information specific to their concentrations.
2. All students complete at least 24 s.h. of coursework including required courses specific to each concentration area as detailed below. Specific course requirements may be waived for students who have previously taken equivalent courses.

   Mathematics: MATH 5101, 5102, 6011, 6111, 6121, 6651, 5311 or 5801 or 6401 or 6411; plus electives to equal at least 24 s.h.
   Statistics: MATH 5031, 5101, 5102, 5801, 6001, 6802, 5000 or 6804, 5774.

Mathematics in the Community College: MATH 5101, 5102, 5031, 6011, 6111, 6121, 6271, 6651 and at least one of MATH 5021, 6022 or 6802, plus electives to equal at least 26 semester hours (if some of the preceding courses were taken before graduate work was begun).

3. Students must score satisfactorily on a comprehensive examination.
4. Students specializing in Mathematics or Statistics must either write a thesis or complete a research project under the direction of a member of the graduate faculty. Students electing the thesis option enroll in MATH 7000 for 6 s.h. Students electing the non-thesis option are required to complete an additional 9 s.h. of course work prefixed MATH and numbered above 4999.
5. Students pursuing the Mathematics in the Community College concentration must prepare a teaching portfolio under the direction of a faculty mentor. They must also give a presentation to an undergraduate audience and complete an additional 9 s.h. of course work prefixed MATH and numbered above 4999.

Statistics Minor

Twelve s.h. of graduate course work for the statistics minor is required as follows: MATH 5031, 5801, 6802; one additional graduate-level statistics course.

Certificate in Statistics

The statistics certification requires a minimum of 9-15 s.h. credit as follows:

Students who have successfully completed MATH 3307, 3308 must complete 9 s.h. as follows: CSCI 5774; MATH 5000, 5031.

Students who have successfully completed MATH 3307 must complete 12 s.h. as follows: CSCI 5774; MATH 5000, 5031, 6802.

Students who have not successfully completed MATH 3307 must complete 15 s.h. as follows: CSCI 5774; MATH 5000, 5031, 5801, 6802.

2.7 *Doctoral Degree:* Describe the doctoral degree curriculum, noting the credit and general distribution of requirements as in 2.4 above. When concentrations are offered, describe their curricula separately. (Use Appendix C.). Indicate whether the master's degree is required or usually completed before proceeding to the doctoral program and note the most common minor fields of study. Describe the preliminary examination requirements. Indicate any associated professional certification. Include any additional information concerning curricular emphasis that would aid in characterizing this program as oriented toward practice or research.

The Department currently does not offer a Ph.D.

III. STUDENTS

3.1 *Enrollment:* Provide student credit hour data on unit degree programs and, as appropriate, on the unit's contribution to the Foundations Program. Assess the strength of student demand for the degree program and for courses in the Foundations Program. Utilizing appropriate data, comment on student enrollment trends in the degree program and as appropriate in Foundations courses. What are the implications of these trends for future unit planning?

I. Introduction

Student Credit Hour (SCH) productivity is measured by computing the total number of Student Credit Hours produced for each funded course, number and section on the tenth day of class. This is the census data which is used for all University of North Carolina campuses. Funded courses for Mathematics include all on-campus and distance education courses for Fall and Spring, Distance Education classes for Summer Session I and Summer Session II and Long Summer Session 11 week courses. Remedial courses are not included in this report because they are not funded classes. Information on remedial courses will be included in a separate report.

All courses are worth three (3) student credit hours except for those listed below:

- Math 2171, 2172 and 2173 are 4 student credit hour courses.
- Math 1085 is a 5 student credit hour course.
- Math 1074 is a 2 student credit hour course.

II. Foundation Courses

Foundation courses are those courses that satisfy the requirements in the foundations curriculum for baccalaureate degrees. For Mathematics the following courses are considered foundation courses. They are highlighted in <u>orange</u> in the report below. Please note that not all Math foundation courses were taught in the years represented in the table.

- Math 1050, Math 1065, Math 1066, Math 1067, Math 1083, 1085
- Math 2119, Math 2121, Math 2127, Math 2171, Math 2172, Math 2173, Math 2228, Math 2282, Math 2283, Math 2775, Math 2935
- Math 3166, Math 3237, and Math 3239

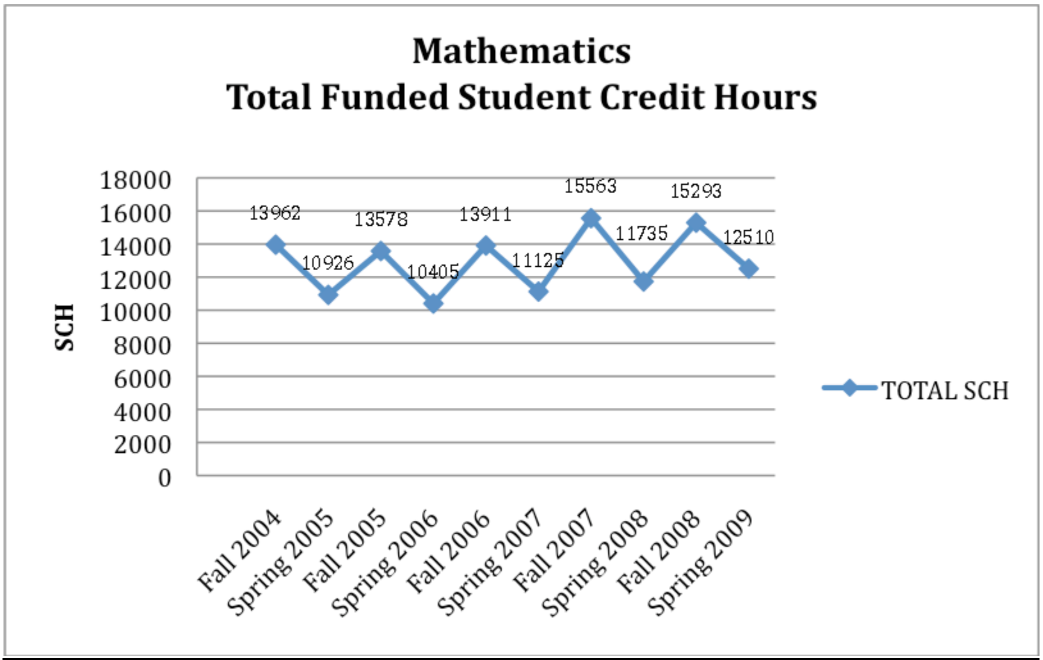
III. Class Size

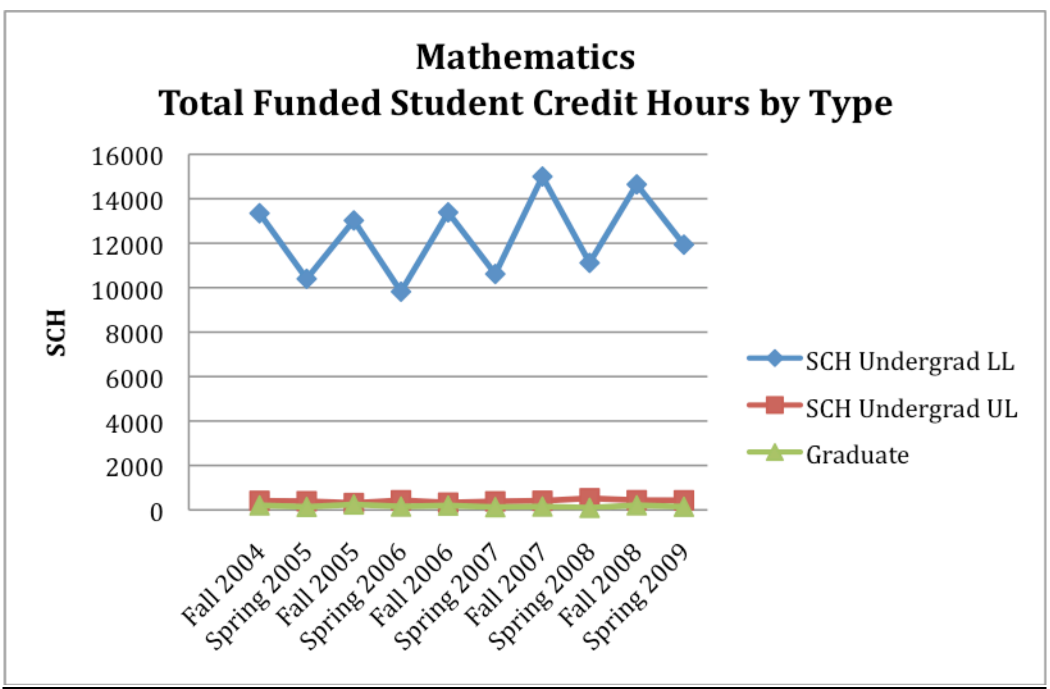
Class size was computed by using the following formula:

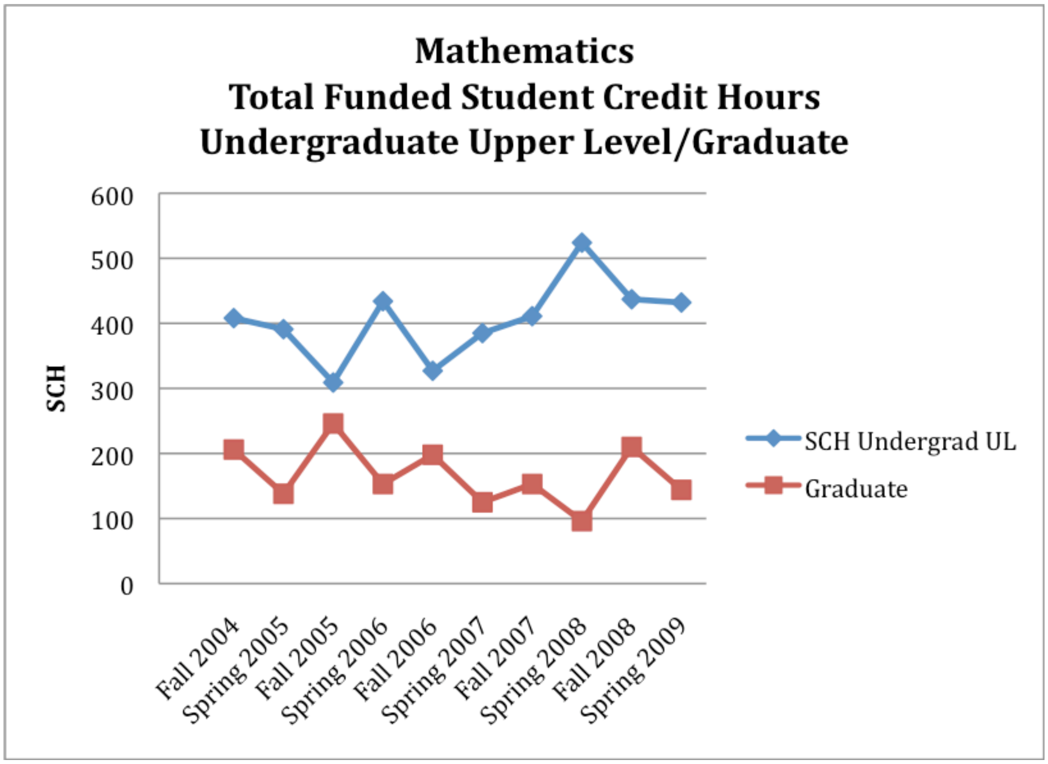
Total number of Student Credit Hours on Census Day for each course, number & section/3

Except in cases (noted in Section I) where that course was worth more than three (3) student credit hours. There were no variable student credit hour courses for Mathematics.

IV. **Total Math Funded Student Credit Hours Fall 2004-Spring 2009**







Total Fall/Spring Funded Student Credit Hours and Class Size Data by Semester, Course, Number and Section (2005-2008) as of Census Date (10th Day)

Total Fall/Spring Funded Student Credit Hours and Class Size has been computed by Fiscal Year, Semester (Date), Level, Course Number and Section. For a complete listing of this data see SCH & Class Size table in the attached Excel Spread Sheet.

Total Student Credit Hours Accumulated by Mathematics Department Faculty Members by Semester

For a listing of Total Student Credit Hours Accumulated by Mathematics Department faculty please see attached Excel Spread Sheet Teach.

3.2 *Quality of Incoming Students:* Comment on how evaluation and assessment of the quality of students in the unit's degree programs and, as appropriate in Foundations courses, is accomplished. Referring to appropriate data, comment on incoming student quality and trends over the past 10 years. What specific measures does the unit use to evaluate the quality of entering students? (For example, what use is made of the GPA or of standardized test scores?). Is the quality of the enrolling students as good as desired? What does the annual applications/acceptance ratio indicate about the quality of entering students and the faculty's standards of student quality?

General Foundations Student

Most of ECU's entering students do not place into Calculus or higher level courses. The most recent data in Appendix M indicate that 76% of entering students are placed in Math 1065 College Algebra, with 42% of entering students having sufficient SAT math scores (at least 540) to place into Math 1065 while another 34% produce math placement test scores (at least 14 of a possible 32) to also enter Math 1065. A relatively high percentage, 23%, require remedial math.

Undergraduate

At the due date of this report, the department has been unable to procure SAT entry data for mathematics majors. As compared to ECU's entering student population, mathematics majors tend to place beyond the general student body into pre-calculus and sometimes into the calculus sequence.

Graduate

Applicants to the program submit undergraduate transcripts, scores on the GRE General Test, three letters of reference and a statement of purpose. These materials form the basis for admission decisions. During the two year period 1/2007-12/2008 twenty four complete applications were received and all were granted admission. The mean GRE scores and undergraduate GPA's for these applicants were:

GRE-Verbal	465 (st dev 88)
GRE-Quantitative	689 (st dev 104)
GRE-Total	1155 (st dev 142)
GPA-Senior Year	3.54 (st dev 0.43)
GPA-Overall	3.48 (st dev 0.47)

According to ETS 8,890 applicants to graduate programs in the Mathematical Sciences took the GRE General Test during the period 7/2004-6/2007. The mean scores for these test takers were 504 (Verbal) and 732 (Quantitative). 53.9% scored above 500 on the Verbal portion and 75.9% scored above 690 on the Quantitative portion. So, as measured by the GRE, our applicants are somewhat below the national average. One should bear in mind, however, that the ETS data includes applicants to PhD programs and thus we believe our applicants to be close to the norm for masters granting departments.

ECU's Graduate School combines the GRE and GPA values into a single *Admissibility Index* according to the formula:

AI = GRE + 400 x GPA.

The mean admissibility index for our twenty-four 1/2007-12/2008 applicants was 2508 (st dev 417). An admissibility index of at least 2000 is required for regular admission. All of our applicants met this minimal requirement.

Data from earlier periods is incomplete in our departmental files. A sample of twelve applicants admitted during the period 1/2002-12/2006 yielded the following:

GRE-Verbal	492 (st dev 131)
GRE-Quantitative	655 (st dev 137)
GRE-Total	1147 (st dev 235)
GPA-Senior Year	3.48 (st dev 0.52)
GPA-Total	3.37 (st dev 0.40)
Admissibility Index	2563 (st dev 364)

This supports the view that the quality of applications received has not changed appreciably over time.

3.3 *Quality of Current/Ongoing Students:* Are current students performing as well as desired? If not, what are the contributing factors? (Briefly refer to the findings of the outcomes assessment document, which is described in more detail in another section). Describe measures of student accomplishment (ex. major field tests, licensure scores, course-embedded assessment, etc.). List student recognition data such as research/creative activity publications and exhibits, campus awards, presentations, fellowships, and scholarships.

Undergraduate Program

Undergraduate Cumulative GPAs in the Fall Semester 2004-2009 Mathematics vs. All Students*

Year	Math	All Students
2004-2005	3.16	2.81
2005-2006	3.08	2.85
2006-2007	3.01	2.87
2007-2008	3.07	2.92
2008-2009	2.95	2.9

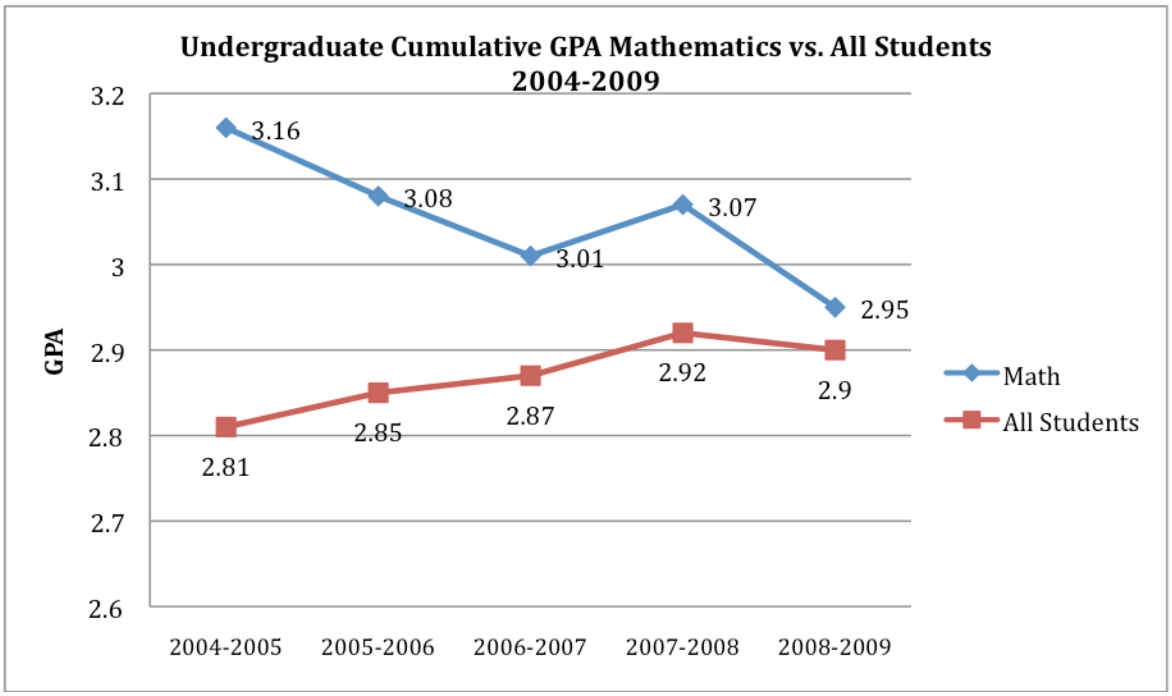
Source: Fpr 2004-2007 East Carolina University
Fact Book 2007-2008, pp. 67 & 69
2008-2009 All Student GPA and Math GPA computed
using same formula.

Graduate Program

Our current students are performing adequately. During the 2008-2009 academic year

- Seven students received their MA degrees,
- Four students successfully completed their comprehensive exams,
- Three theses and three research projects were defended.

Four students are on track to finish the program during the current academic year, two each in the Mathematics and Statistics concentrations.



3.4 *Degrees Granted:* Using appropriate data, comment on the trends in the number of degrees awarded annually and the average length of time required to complete each degree program. What has been the trend in attrition over the past seven years? If attrition has been increasing, what measures, if any, have been taken to address that increase?

Undergraduate

The following table from the ECU Fact Book shows the number of mathematics undergraduate graduates for each academic year ending in the years 2003-7

		2003	2004	2005	2006	2007
27.0101	Mathematics	8	18	6	1	4

This gives an average of 7 majors each academic year, but our numbers are low.

The following table shows the total number of students enrolled in the BA or BS program in a given semester for the last five years.

Semester	BA	BS
Fall 2004	21	2
Spring 2005	16	8
Fall 2005	10	14
Spring 2006	12	13
Fall 2006	8	16
Spring 2007	6	15
Fall 2007	14	24
Spring 2008	14	24
Fall 2008	14	23
Spring 2009	20	29

Undergraduate		**2003**	**2004**	**2005**	**2006**	**2007**	**2008**
27.0101	Mathematics, Secondary Education	20	21	20	23	25	22
	Mathematics, Secondary Major		4	3	0	10	13
Graduate							
27.0101	Mathematics, Secondary Education	7	9	12	12	10	16
	Mathematics, Secondary Specialty	0	0	0	0	0	1

The above table shows math education majors, many of whom are double majors

Other information is yet to be provided at the due date of this report.

Graduate

Thirty-two students graduated from the MA program during the past seven years. So on average we are producing 4.6 graduates per year. Full time students have generally been able to complete the program within two years. The exceptions include students who needed to complete some undergraduate course work during their first semester to address deficiencies in background. Part time students enroll in at most two courses per semester and require more than two years to complete the degree. Attrition from the program has been quite low. At least one student was unable to maintain adequate academic standing and was dropped from the program. Fortunately this situation is rare. Occasionally students making good progress have left the program for other reasons. Several have switched from our MA program to the MAEd program in Mathematics Education and one student left after her first year to begin a PhD program at elsewhere.

3.5 *Diversity of Student Population:* Provide student profiles relative to gender, age, minority, and international status. Describe plans to promote diversity.

In lieu of more refined data which is currently unavailable, we insert overall 2006 – 2007 ethnic comparative student profiles from the 2008 ECU Fact Book:

University Ethnic Profile			
Amer. Indian or Alaskan Native	189 179 -5%	173 164 -5%	16 15 -6%
Asian or Pacific Islander	537 539 0%	502 498 -1% 3	5 41 17%
Black, Non-Hispanic	3,761 3,851 2%	3,559 3,666 3%	202 185 -8%
Hispanic	419 461 10%	356 402 13%	63 59 -6%
White, Non-Hispanic	18,634 19,565 5%	16,285 17,283 6%	2,349 2,282 -3%
Other/Unknown	625 1,162 86%	525 962 83%	100 200 100%
Nonresident Alien	186 233 25%	31 99 219%	155 134 -14%
Total	**24,351 25,990** 7%	**21,431 23,074** 8%	**2,920 2,916** 0%
1st-Time Freshman Ethnicity			
Amer. Indian or Alaskan Native	34 26 -24%	32 24 -25%	2 2 0%
Asian or Pacific Islander	94 84 -11%	87 71 -18%	7 13 86%
Black, Non-Hispanic	642 544 -15%	599 508 -15%	43 36 -16%
Hispanic	73 85 16%	60 68 13%	13 17 31%
White, Non-Hispanic	2,866 3,145 10%	2,318 2,556 10%	548 589 7%
Other/Unknown	143 309 116%	116 256 121%	27 53 96%
Nonresident Alien	3 29 867%	0 13 3 16 433%	
Total	**3,855 4,222** 10%	**3,212 3,496** 9%	**643 726** 13%
1st-Time Freshman Avg. SAT	**1031 1,019** -1%	**1031 1,016** -1%	**1033 1,033** 0%
New Undergraduate Transfers	**1,581 1,668** 6%	**1,427 1,538** 8%	**154 130** -16%

and gender profiles from the 2008 ECU Fact Book

	Part-Time	**Full-Time**	**Total Grand**	
Year	**Women Men**	**Women Men**	**Women Men**	**Total**
2003	2,839 1,562	10,313 7,042	13,152 8,604	**21,756**
2004	3,175 1,644	10,745 7,203	13,920 8,847	**22,767**
2005	3,452 1,656	10,851 7,205	14,303 8,861	**23,164**
2006	3,899 1,845	11,172 7,435	15,071 9,280	**24,351**
2007	4,313 2,026	11,690 7,961	16,003 9,987	**25,990**

With further gender profile by class:

Level / Classification	**Gender**	**Full-Time**	**Part-Time**	**Total**
Undergraduate				
Freshman	**Women**	3,305 58.7%	126 64.3%	3,431 58.9%
	Men	2,325 41.3%	70 35.7%	2,395 41.1%
		5,630 100.0%	**196 100.0%**	**5,826 100.0% 22.4% 29.5%**
Sophomore	**Women**	2,213 58.8%	250 66.0%	2,463 59.5%
	Men	1,549 41.2%	129 34.0%	1,678 40.5%
		3,762 100.0%	**379 100.0%**	**4,141 100.0% 15.9% 20.9%**
Junior	**Women**	2,011 56.4%	424 61.6%	2,435 57.3%
	Men	1,552 43.6%	264 38.4%	1,816 42.7%
		3,563 100.0%	**688 100.0%**	**4,251 100.0% 16.4% 21.5%**
Senior	**Women**	2,639 60.8%	642 58.8%	3,281 60.4%
	Men	1,702 39.2%	450 41.2%	2,152 39.6%
		4,341 100.0%	**1,092 100.0%**	**5,433 100.0% 20.9% 27.5%**
Unclassified	**Women**	5 38.5%	62 60.2%	67 57.8%
	Men	8 61.5%	41 39.8%	49 42.2%
		13 100.0%	**103 100.0%**	**116 100.0% 0.4% 0.6%**
Total Undergraduate	**Women**	10,173 58.8%	1,504 61.2% 1	1,677 59.1% **44.9%**
	Men	7,136 41.2%	954 38.8%	8,090 40.9% **31.1%**
Subtotal 100.0%		**17,309 100.0%**	**2,458 100.0%**	**19,767 100.0% 76.1%**
Graduate	**Women**	1,378 67.1%	2,807 72.4%	4,185 70.5% 16.1%
	Men	677 32.9%	1,070 27.6%	1,747 29.5% 6.7%
	Subtotal	**2,055 100.0%**	**3,877 100.0%**	**5,932 100.0% 22.8%**
Medical	**Women**	139 48.4%	2 50.0%	141 48.5% 0.5%
	Men	148 51.6%	2 50.0%	150 51.5% 0.6%
Subtotal		**287 100.0%**	**4 0.0% 291**	**100.0% 1.1%**
Grand Total	**Women**	11,690 59.5%	4,313 68.0%	16,003 61.6%
	Men	7,961 40.5%	2,026 32.0%	9,987 38.4%
	Total	**19,651 100.0%**	**6,339 100.0%**	**25,990 100.0% 100.0%**

And Age profiles from the ECU 2008 Fact Book

Age	**2003**	**2004**	**2005**	**2006**	**2007**
18 and under	3,054 18.0%	3,082 17.6%	2,909 16.4%	3,415 18.4%	3,695 18.7%
19-21	8,569 50.6%	8,760 50.0%	8,830 49.8%	8,929 48.0%	9,390 47.5%
22-24	3,123 18.4%	3,220 18.4%	3,312 18.7%	3,382 18.2%	3,474 17.6%
25-30	1,035 6.1%	1,131 6.5%	1,216 6.9%	1,232 6.6%	1,384 7.0%
31-40	712 4.2%	798 4.6%	904 5.1%	976 5.3%	1,083 5.5%
41-64	433 2.6%	512 2.9%	549 3.1%	645 3.5%	734 3.7%
65 and over	9 0.1%	7 0.0%	8 0.0%	8 0.0%	7 0.0%
Total	**16,935 100%**	**17,510 100%**	**17,728 100%**	**18,587 100%**	**19,767 100%**

These percentages are not drastically different from the percentages of the students in the various mathematics programs.

3.6 *Need/Placement:* Comment on the strength of employers or others' demand for students with the knowledge and skills provided by the unit's courses. Describe past, present and future need for graduates from the program in the region, state, Southeast, and the nation. Cite any pertinent studies. Present data on the placement of students who have earned their degrees in the unit in the past seven years (Appendix B). Report those that have entered into graduate or professional schools. Report any information and data available on the level of employer satisfaction with unit graduates. Describe the level and kinds of assistance provided by the unit in placement of graduates.

Undergraduate

Placement data on our undergraduate majors tends to be incomplete. Below is a sampling of some of our high achieving majors. The largest block of our majors are mathematics/mathematics-education majors and teach in area high schools.

A number of our BA mathematics graduates have entered graduate programs and received advanced degrees since 2002 (or are currently pursuing advanced degrees). These include:

- Matthew Higgins (BA ECU 2003) received his MD from the ECU Brody School of Medicine in 2007. He is currently a Family Practice Physician at the Anderson Area Medical Center in South Carolina.
- Kristina Batchelor (BA ECU 2005) received her Masters in Economics from North Carolina State University in 2007. She is currently a Credit Analyst at GMAC.
- Shannon Pollard Duvall (BA ECU 1997) received her PhD in Computer Science from Duke University in 2007. She is currently a recently tenured Associate Professor in the Department of Computer Sciences at Elon University.
- Leah Yates (BA ECU 2004) received her Masters in Arts in Teaching from Duke University in 2006. She is currently teaching mathematics at Riverside High School in Durham. As an undergraduate at ECU Leah published a mathematics article in the Rose-Hulman Undergraduate Math Journal: "Tight Subdesigns of the Higman-Sims Design" http://www.rose-hulman.edu/mathjournal/v5n2.php
- Shannon McClintock (BA ECU 2004) is currently pursuing her PhD in Biostatistics at Emory University under the direction of Prof. Lance Waller, Chair of the Biostatistics Department in the Rollins School of Public Health.
- Jonathan Dunbar (BA ECU 2003) is in the PhD program in Mathematics at North Carolina State University, studying Vertex Algebras.

- Brain Bucklein (BA ECU 2002 Physics/Math Double major) is in the PhD program in Physics and Astronomy at Brigham Young University in Utah, studying under J. Ward Moody.
- The first eight of the ECU MA graduates listed immediately below in this section as receiving/pursuing PhD's are ECU BA graduates.

Graduate

There is a strong regional need for qualified college mathematics teachers. Our graduates have been very successful gaining employment at nearby community colleges and in our own department. Graduates of our Statistics concentration have found gainful employment in business/industry, especially the financial sector.

Thirty-eight students have received their MA degrees since 1/2002. Using addresses provided by Alumni Relations, we sent a mailing to 23 of these former students for whom we were uncertain as to their current employment status. We received 9 replies and 3 cards were returned as undeliverable by the Postal Service. Of these 37 graduates

- 6 are employed as high school teachers throughout Eastern North Carolina,
- 11 are employed as college mathematics instructors (6 of these in our own department, 5 at community colleges),
- 7 entered PhD programs (2 in Math Education, 2 in Mathematics, 3 in Statistics or Applied Mathematics),
- 7 hold technical positions in business, industry, or government,
- 1 is on military deployment, and
- 2 are deceased.

We have no information on the remaining 4 graduates.

Seven ECU MA graduates since 2002 have entered PhD programs. Five ECU Mathematics MA program graduates have completed PhD's during the period of this program review. Four of these are currently university faculty. These include:

- Charles Touron (MA ECU 1999) received his PhD in Applied and Computational Mathematics from Old Dominion University in August 2009. He has taught at Old Dominion and at Tidewater Community College, and he is currently seeking employment in industry.
- Jason Brinkley (MA ECU 2003) received his PhD in Statistics from North Carolina State University in 2008. He is currently an Assistant Professor in the Department of Biostatistics at East Carolina University.
- Adam Harbaugh (MA ECU 1999) received his PhD in Curriculum and Instruction from Texas A&M University in 2005. He is currently an Assistant Professor in the Department of Middle, Secondary, & K-12 Education at the University of North Carolina at Charlotte.

- John David Herron (MA ECU 1999) received his PhD in Mathematics from the University of North Carolina at Charlotte in 2004. He is currently an Assistant Professor in the Department of Biology, Chemistry, and Mathematics at the University of Montevallo, Alabama.
- Robin Rider (MAEd ECU 1990) received her PhD in Mathematics Education from North Carolina State University in 2004. She is currently an Assistant Professor in the College of Education at the University of Washington, Bothell.

Also:

- Derek Williams (MA ECU 2009),
  Jonathan Dunbar (MA ECU 2006), and
  Peter Holt Wilson (MA ECU 2003) are in the PhD program in Mathematics at North Carolina State University.
- Ting Yang (MA ECU 2005) is in the PhD program at University of Maryland
- Tianle Hu (MA ECU 2005) is in the PhD program at University of Michigan

Graduates of the ECU Masters Program who currently hold positions as mathematics instructors at area community colleges include:

- Stephanie Woodley, Chair, Pitt Community College
- Lara Smith, Pitt Community College
- Meg Boles, Pitt Community College
- Bonnie Galloway, Pitt Community College
- Kim Mullis, Beaufort County Community College
- Ravi Sharma, Beaufort Community College
- Allen Brooks, Cartaret Community College
- Carolyn Winfree, Edgecombe Community College
- Jonathan Tyndall, Lenoir Community College
- Mary Frances Uzzell, Wayne Community College

Graduates of the ECU Masters Program who currently hold positions as Teaching Faculty in the Mathematics Department at ECU include:

- Beth Andrews
- Joe Bland
- April Church
- David Edwards
- Debbie Ferrell
- Bonnie Galloway
- Anne Heritage
- Paul Kornegay
- Gerry MacLeod
- Jennifer Mayo
- Vicky McGlohorn

- Kimberly Mullis
- Maxine Ouellette
- Kathy Stanley
- Anthony Van Hoy
- Cathy Wilkerson
- Darlene Worthington

3.7 *Funding:* Describe the scholarship and stipend support packages available for students and the approximate annual number of each type that have been received. Include Graduate Teaching Assistantships (GTA's), Graduate intern Assistantships (GIA's), and Graduate Research Assistantships (GRA's), fellowships, traineeships, etc. Include the number of semesters the average master's and doctoral student spends on a GTA or GRA. How are GTA/GRA positions publicized, and how are students selected for those appointments?

Undergraduate

N/A to the undergraduate programs in mathematics.

Graduate

The Mathematics Department receives funds for GTA positions each year from the College of Arts and Sciences. The GTA's provide 20 hours of work per week to our department. Their instructional duties are discussed below in section 3.8.

Our annual GTA budget has been fixed at $78,400 for at least the past seven years. Until the current academic year this budget was used to pay eight GTA's a stipend of $9,800 ($4,900 per semester). During spring of 2009 we decided to raise the stipend to $11,200 ($5,600 per semester) and hire only seven GTA's. This was in response to a thin applicant pool and the feeling that our GTA compensation package was inferior to that at a number of other UNC campuses. The TA-ships do not carry medical benefits and we have not been able to give any remissions for in-state fees. While our GTA stipend was frozen at $9,800 ECU's tuition and fees had inflated considerably. In-state tuition and fees for a full-time graduate student during the 2008-2009 academic year were $4,667, close to one half of our stipend. This fact has hampered our ability to attract strong candidates for these positions. Data collected during the 2007-2008 academic year showed that each of UNC-Charlotte, UNC-Greensboro and UNC-Wilmington provide partial in-state tuition remissions to at least some of their Mathematics MA students. During the 2007-2008 academic year GTA stipends at these campuses were $11,700, $10,800 and $9,500 respectively, with UNC-Wilmington's having grown significantly beyond the $9,500 mark recently.

UNC-Wilmington also offers one-time entrance scholarships to some applicants.

GTA's who are non-residents of North Carolina may receive an out-of-state tuition remission. The department has received an allocation of three such out-of-state remissions in recent years. During the current academic year we are used these remissions to support two students from China and one South Carolina resident.

Most of our GTA's hold their positions for two academic years as they complete the program. The positions are advertised on our web site and candidates indicate their interest in their application materials and via direct correspondence with the graduate director via email or phone. Most applicants for full-time study ask to be considered for a TA-ship. Decisions are based on the strength of the application. Letters of recommendation play an important role in this regard.

3.8 *Student Involvement in the Instructional Process:* Indicate the degree of participation by students in formal or informal teaching activities within the unit and/or in other programs on campus. Describe any preparatory training and/or ongoing mentoring that undergraduate or graduate students receive.

Undergraduate

Students in the Mathematics BA and BS programs often work in the Mathematics Tutoring Lab. They are trained and mentored extensively by Dr. Katalin Szucs who runs the lab. In addition to tutoring a variety of classes, these students also assist with placement testing.

Graduate

GTA's are assigned various types of instructional duties.

- Math Lab: A GTA may serve as a tutor in the Math Lab. The Math Lab primarily serves undergraduate students in remedial and introductory level courses (College Algebra, Business Statistics, etc.) Tutors are available to work one-on-one with students during specified hours. Training and oversight for the tutors is provided by Dr. Katalin Szucs, who manages the Math Lab and remedial instruction.
- Calculus Lab: A GTA may be assigned hours as a tutor in the Calculus Lab. The Calculus Lab serves students in our Calculus I-II-III sequence as well as our service Calculus courses for Business, Life Sciences and Engineering. Oversight is provided by a faculty mentor and by the graduate director.
- Math 0001: A GTA may teach *Intermediate Algebra-A*, a remedial course in basic algebra. Oversight is provided by a faculty mentor and by the graduate director.

- Math 1065: A GTA may teach *College Algebra*. Oversight is provided by a faculty mentor and by the graduate director. A GTA must have completed 18 sh of graduate level coursework in Mathematics before being allowed to teach Math 1065, as this is deemed to be a college level course.

Typically an entering graduate student on a TA-ship will be asked to work in the Math Lab during their first semester. During their second semester they may be asked to work some hours in the Math and/or Calculus Lab and perhaps teach one section of Math 001. During their second year they may be asked to teach two class sections of either Math 001 or Math 1065. Work assignments vary from semester to semester based on departmental needs and student interest. We do assign course sections to GTA's whose career goal is college teaching. The experience they gain is a very important part of their training and enhances their employability upon graduation.

Each GTA is assigned an experienced faculty mentor who provides advice and feedback on teaching matters. The mentors perform at least one class observation per semester for each GTA who is currently teaching. The mentors evaluate and document these observations using the same departmental rubric employed with untenured faculty. The observation is graded on a scale of 1 to 5 on 10 teaching aspects and an overall score is assigned. The completed forms are provided to the GTA as feedback and to the graduate director for use in connection with outcomes assessment (see Section VI).

In addition to the training they receive in the Math Lab and from their mentors we require our GTA's to take Math 6271, Teaching Collegiate Mathematics. This 2 sh course addresses practical issues of pedagogy and has each student develop a teaching portfolio. The course is a requirement for the *Mathematics in the Community College* concentration and serves a dual role in connection with GTA training.

3.9 *Professional Development Opportunities:* Describe any formalized research training that doctoral students in the unit receive. How are these training experiences supported, and how are students selected for them?

N/A (This item concerns formalized research training for doctoral students.)

IV. FACULTY

4.1 *Faculty List and Curricula Vita:* As attachments to the Self-Study narrative, provide:

a. An alphabetical list of faculty members, including the rank of each and the number of master's and doctoral advisory committees that each member has chaired during the past seven years.

Department of Mathematics

Thomas J. McConnell, Professor of Biology and Interim Chairperson
(BS, PhD, University of Florida)
Ahmed Abdelfattah, Teaching Instructor
(BS, University of Cairo; MS, Oregon State University)
Chaired 0 Masters Thesis Committees; Chaired 0 PhD Thesis Committees
Salman Abdulali, Professor
(MSc, Birla Institute of Technology and Science, India; PhD, State University of New York, Stony Brook)
Chaired 0 Masters Thesis Committees; Chaired 0 PhD Thesis Committees
Ivana Alexandrova, Assistant Professor
(BS, Furman University; MA, PhD, University of California, Berkeley)
Chaired 0 Masters Thesis Committees; Chaired 0 PhD Thesis Committees
Beth Andrews, Teaching Instructor
(BA, University of North Carolina at Wilmington; MAEd, East Carolina University)
Chaired 0 Masters Thesis Committees; Chaired 0 PhD Thesis Committees
Sviatoslav Archava, Teaching Assistant Professor
(MA, PhD, University of California)
Chaired 0 Masters Thesis Committees; Chaired 0 PhD Thesis Committees
F. Chal Benson, Professor, Director of Graduate Studies
(BS, McMaster University; PhD, Yale University)
Chaired 1 Masters Thesis Committee; Chaired 0 PhD Thesis Committees
Robert L. Bernhardt, Professor
(BS, MA, University of North Carolina, Chapel Hill; PhD, University of Oregon)
Chaired 0 Masters Thesis Committees; Chaired 0 PhD Thesis Committees
Jason Burns, Teaching Assistant Professor
(BS, MA, University of South Carolina; PhD, Massachusetts Institute of Technology)
Chaired 0 Masters Thesis Committees; Chaired 0 PhD Thesis Committees
Joseph Bland, Teaching Instructor
(BS, Campbell University; MS, East Carolina University)
Chaired 0 Masters Thesis Committees; Chaired 0 PhD Thesis Committees
Gene Drew Butcher, Teaching Assistant Professor
(BS, PhD, University of Kentucky)
Chaired 0 Masters Thesis Committees; Chaired 0 PhD Thesis Committees
Christopher A. Carolan, Associate Professor
(BS, Creighton University; MS, PhD, University of Iowa)
Chaired 5 Masters Thesis Committees; Chaired 0 PhD Thesis Committees
John Richard Crammer, Assistant Professor
(BS, PhD, Clemson University)
Chaired 0 Masters Thesis Committees; Chaired 0 PhD Thesis Committees
April Church, Teaching Instructor
(BS, East Carolina University; MS, East Carolina University)
Chaired 0 Masters Thesis Committees; Chaired 0 PhD Thesis Committees

David Edwards, Teaching Instructor
(BA, BS, MA, East Carolina University)
Chaired 0 Masters Thesis Committees; Chaired 0 PhD Thesis Committees
Deborah Keyes Ferrell, Teaching Instructor
(BS, Wake Forest University; MA, East Carolina University)
Chaired 0 Masters Thesis Committees; Chaired 0 PhD Thesis Committees
Ioannis Gkigkitzis, Teaching Assistant Professor
(BS, University of Athens; MA, MS, PhD Columbia University)
Chaired 0 Masters Thesis Committees; Chaired 0 PhD Thesis Committees
Anne Heritage, Teaching Instructor
(BS, University of North Carolina, Greensboro; MAT, University of North Carolina, Chapel Hill)
Chaired 0 Masters Thesis Committees; Chaired 0 PhD Thesis Committees
Fawaz Hjouj, Teaching Assistant Professor
(BS, Yarmouk University; MS, Colorado State University; PhD, Southern Illinois University
Chaired 0 Masters Thesis Committees; Chaired 0 PhD Thesis Committees
Carl Huber, Teaching Instructor
(BS, Cleveland State University; PhD, Carnegie-Mellon University)
Chaired 0 Masters Thesis Committees; Chaired 0 PhD Thesis Committees
Paul Jambor, Visiting Professor
(MA Columbia University, New York, PhD, Charles University Prague)
Chaired 0 Masters Thesis Committees; Chaired 0 PhD Thesis Committees
Chris S. Jantzen, Professor
(BS, University of Wisconsin; MS, PhD, University of Chicago)
Chaired 0 Masters Thesis Committees; Chaired 0 PhD Thesis Committees
Elias Katsoulis, Professor
(BA, MS, PhD, University of Athens, Greece)
Chaired 0 Masters Thesis Committees; Chaired 0 PhD Thesis Committees
Paul Kornegay, Teaching Instructor
(BA, MA, East Carolina University)
Chaired 0 Masters Thesis Committees; Chaired 0 PhD Thesis Committees
Serign Omar Lowe-Nicolas, Teaching Instructor
(BA, Shaw University; MS, North Carolina Central University)
Chaired 0 Masters Thesis Committees; Chaired 0 PhD Thesis Committees
Geraldine MacLeod, Teaching Instructor
(BA, Saint-Mary-of-the-Woods College; MA, University of Central Florida)
Chaired 0 Masters Thesis Committees; Chaired 0 PhD Thesis Committees
Vickie McGlohon, Teaching Instructor
(BS, MAEd, East Carolina University)
Chaired 0 Masters Thesis Committees; Chaired 0 PhD Thesis Committees
Kimberly Mullis, Teaching Instructor
(BS, MAEd, East Carolina University)
Chaired 0 Masters Thesis Committees; Chaired 0 PhD Thesis Committees
Wieslawa Teresa Obuchowska, Teaching Associate Professor

(MA, University of Wroclaw; PhD, Wroclaw University of Economics; MSc, University of Windsor; PhD, University of Windsor)
Chaired 0 Masters Thesis Committees; Chaired 0 PhD Thesis Committees
Maxine Ouellette, Teaching Instructor
(BS, MAEd, East Carolina University)
Chaired 0 Masters Thesis Committees; Chaired 0 PhD Thesis Committees
James C. Pleasant, Teaching Professor
(BS, MA, East Carolina University; PhD, University of South Carolina)
Chaired 0 Masters Thesis Committees; Chaired 0 PhD Thesis Committees
David W. Pravica, Professor
(BS, PhD, University of Toronto)
Chaired 1 Masters Thesis Committees; Chaired 0 PhD Thesis Committees
Njinasoa Randriampiry, Assistant Professor
PhD, Kansas State University)
Chaired 0 Masters Thesis Committees; Chaired 0 PhD Thesis Committees
Gail Ratcliff, Professor
(BSc, University of Sydney; PhD, Yale University)
Chaired 2 Masters Thesis Committees; Chaired 0 PhD Thesis Committees
M. S. Ravi, Associate Professor, Coordinator of Mathematics
(BE, Birla Institute of Technology and Science, Pilani, India; MA, PhD, University of Rochester)
Chaired 1 Masters Thesis Committees; Chaired 0 PhD Thesis Committees
Mark J. Rentmeesters, Teaching Instructor
(BS, Purdue University; MS, Cornell University; PhD, University of California, Irvine)
Chaired 0 Masters Thesis Committees; Chaired 0 PhD Thesis Committees
Heather L. Ries, Associate Professor
(BA, Bates College, Lewiston; MA, PhD, State University of New York, Binghamton)
Chaired 0 Masters Thesis Committees; Chaired 0 PhD Thesis Committees
Zachary Robinson, Professor
(BS, Massachusetts Institute of Technology; MA, PhD, Harvard University)
Chaired 0 Masters Thesis Committees; Chaired 0 PhD Thesis Committees
Said Elmahdy Said, Associate Professor, Coordinator of Statistics
(BS, Cairo University; MS, PhD, North Carolina State University)
Chaired 4 Masters Thesis Committees; Chaired 0 PhD Thesis Committees
Pramathanath Sastry, Assistant Professor
(BSc, University of Delhi; PhD, Purdue University)
Chaired 0 Masters Thesis Committees; Chaired 0 PhD Thesis Committees
Alexandra Shlapentokh, Professor
(BSE, BA, MA, University of Pennsylvania; PhD, New York University)
Chaired 0 Masters Thesis Committees; Chaired 0 PhD Thesis Committees
Michael J. Spurr, Professor
(BS, Marquette University; MS, PhD, Tulane University)
Chaired 3 Masters Thesis Committees; Chaired 0 PhD Thesis Committees
Katherine E. Stanley, Teaching Instructor

(BS, MAE, East Carolina University)
Chaired 0 Masters Thesis Committees; Chaired 0 PhD Thesis Committees

Katalin Szucs, Teaching Instructor
(BS, Tancsics M. Gimnazium, Kaposvar, Hungary; MA, PhD, University Jozsef Attila, Szeged, Hungary)
Chaired 0 Masters Thesis Committees; Chaired 0 PhD Thesis Committees

Wayne Tabor, Teaching Assistant Professor
(BS, MS, Iowa State University; PhD, Washington State University)
Chaired 0 Masters Thesis Committees; Chaired 0 PhD Thesis Committees

Anthony VanHoy, Teaching Instructor
(BA, MA, East Carolina University)
Chaired 0 Masters Thesis Committees; Chaired 0 PhD Thesis Committees

Cathy S. Wilkerson, Teaching Instructor
(BS, MAEd, East Carolina University)
Chaired 0 Masters Thesis Committees; Chaired 0 PhD Thesis Committees

Ronald Williams, Teaching Instructor
(BS, University of Louisville; MS, Air Force Institute of Technology, MA, University of Kentucky)
Chaired 0 Masters Thesis Committees; Chaired 0 PhD Thesis Committees

Darlene Worthington, Teaching Instructor
(BA, MA, East Carolina University)
Chaired 0 Masters Thesis Committees; Chaired 0 PhD Thesis Committees

Peng Xiao, Assistant Professor
(BS, University of Science and Technology of China; PhD, University of Texas, Dallas)
Chaired 0 Masters Thesis Committees; Chaired 0 PhD Thesis Committees

b. A current, brief, Sedona-generated curriculum vitae for each faculty member covering the last 7 years.

See Appendix D

4.2 Faculty Profile Summary: Provide summary data on: tenured/non-tenured, terminal/non-terminal degree, gender, minority, and international status. Describe hiring trends over the past 7 years and present hiring needs.

Summary data on faculty: 19 tenure-track(TT)/tenured (T) faculty members, including 4 TT faculty. All 19 TT/T faculty have terminal (Ph.D.) degrees. There are 15 male and 4 female TT/T faculty. There are 14 White Not of Hispanic Origin, 1 Black Not of Hispanic Origin, 4 Asian or Pacific Islander TT/T faculty members. Of the 19 TT/T faculty, 15 have either USA citizenship or a green card while 4 do not.

Hiring trends over the last 7 years have been of a general nature, including hiring faculty in both the mathematics area and the statistics area. Present hiring needs will be the subject of faculty discussion in the near future.

4.3 *Visiting, Part-Time and Other Faculty:* Describe the extent to which visiting and part-time faculty participate in the undergraduate and graduate programs. A list of graduate courses taught by adjunct faculty for the last seven years should be included. Also, if faculty members from other university units serve important roles in the program, please specify.

Visiting, Part-time and Adjunct faculty have had no involvement in the MA program n Mathematics.

The Mathematics Department employs several part-time faculty who primarily teach Foundations courses such as College Algebra or Statistics. These faculty usually do not teach courses that count towards the Mathematics BA and BS programs. In the Fall of 2004, the Math Department employed 6 part-time faculty. Every semester since then, the Math Department has employed 8-10 part-time faculty. Each part-time faculty member usually teaches 2 courses a semester but could possibly do 1 course or as many as 3 courses.

There are 30 fixed-term faculty, with 24 of these as full-time faculty and 6 as part-time faculty. Of these fixed-term faculty, 8 have Ph.D. degrees in Mathematics and 22 have a Masters degree in Mathematics or equivalent. There are 17 male and 13 female fixed term faculty. Of the 30 fixed term faculty, 27 have either USA citizenship or a green card, and 3 do not.

Adjunct faculty, from other university units, have occasionally assisted with teaching overloads, but do not play key operational or advisory roles in the Mathematics department.

4.4 Advising: Describe how and when faculty advisors are assigned to students in the unit programs, as well as any guidance that new faculty are given in directing undergraduate/graduate student research.

Undergraduate

Faculty advisors are assigned by the Chair on a volunteer basis to declared majors in the Mathematics BA and BS programs.

Graduate

As explained in 3.8 above, each GTA is assigned a faculty mentor upon entering the program. The graduate director advises all students concerning course selection and related matters. He also works with faculty to coordinate comprehensive exams, theses and research projects.

1.5 Faculty Quality: Provide summary faculty productivity data such as: books, articles, exhibitions, performances, presentations, awards, grants, patents, service/outreach activities, number serving as theses advisors, number serving on theses committees, and number supervising honors and/or senior projects. Describe the ways in which the unit evaluates the quality of its faculty (e.g., teaching evaluations, peer review, publications, research grants, graduate students advised and their time to degree, etc.) and how it uses the results of these evaluations.

In the five year time-frame from 2004-2009 (extending the period back further predates the institution of the Sedona database, limiting reliability), Mathematics faculty have produced 62 articles, 52 presentations, 35 research grants, 9 conference proceedings, 5 chapters, 2 monographs, 1 patent, 1 book, among other intellectual contributions. Eleven internal grants have been awarded for $68,747. Twenty-four external grants have been awarded for a total of $1,222,183 in this time period. In addition, 9 honors and 4 awards, including an NC Board of Governors Award for Excellence in Teaching, have been awarded in this time period. The number of faculty serving as theses advisors and committee members are listed elsewhere.

The quality of the work of individual faculty members is currently evaluated annually as described below, with individual scores determining the annual raise percentage of the faculty member.

Faculty Merit Evaluation Guidelines (McConnell) - Mathematics

According to the Faculty Evaluation Form, we have the following descriptors:

Outstanding	4.5 or 5
Very good	3.5, 4, or 4.5
Good	2.5, 3, or 3.5
Fair	1.5, 2, or 2.5
Poor	0, 0.5, 1.0, or 1.5

This numerical system, required by the Faculty Manual, has the inherent defect of some scores falling into two categories. Until we have a better system in place, approved by the faculty, the Chair will make the decision of the descriptor category for borderline scores. Also, combinations of activities within or between categories that are not specifically listed may nonetheless be considered for a higher category assignment. Evaluation score within a category/descriptor also depend on the quantity and quality of the activities described.

Teaching

The following lists indicate the minimum activities and performance level required to earn an annual evaluation score in teaching within each point category (e.g. 3.5-4.5) identified by the Annual Evaluation forms made available by Academic Affairs. The descriptors to the left are the descriptors required for each point category, as specified by Academic Affairs.

Outstanding: 4.5-5.0

In addition to "Very Good" below, some or all of the following: publication of significant pedagogical materials (e.g. textbook or refereed journal articles), teaching grant, teaching and advising awards external to the department, organizing teaching workshop or conference, major presentation of pedagogical data at national/international teaching conference, innovations in advising

Very Good: 3.5-4.5

Three of the following: excellent student ratings (a standard deviation above the departmental average) and peer reviews (if applicable), active and effective in advising of Mathematics undergraduate students, submission of teaching grant, development of new course (counts double), attending national/international teaching conference, guidance of undergraduate honor students with honor research project presentation, chairing graduate student committee (to count either in teaching OR research)

Good: 2.5-3.5

Student ratings approximately at the departmental means (within one standard deviation of the mean), active in improving teaching effectiveness, participation in teaching workshops, maintain appropriate office hours, advising undergraduate student(s), guiding independent study of students, member of graduate student committee (to count either in teaching OR research)

Fair: 1.5-2.5

Student ratings below the mean (more than one standard deviation below) for the unit, inconsistent in achieving course objectives, ineffective in some aspects of teaching as indicated by formal and/or informal input

Poor: 0-1.5

Student ratings below the mean (more than one standard deviation below) for the unit in combination with significant numbers of student complaints regarding teaching or advising, consistent lack of achievement of course objectives, materials fail to demonstrate proper preparation

Research

The following lists indicate the minimum activities and performance level required to earn an annual evaluation score in research within each point category (e.g. 3.5-4.5) identified by the Annual Evaluation forms made available by Academic Affairs. The descriptors to the left are the descriptors required for each point category, as specified by Academic Affairs. Note that numeric designation of "high quality" is not given, but journal impact factor and journal rank will be considered.

Outstanding: 4.5-5.0

2 publications* in high quality national/international journals
Or 1 publication in a very high quality national/international journal plus a grant award or continuation of a grant
Or 1 plenary presentation combined with "Very Good" below
(Note: very high quality papers may be sufficient for this category)

Very Good: 3.5-4.5

1 publication*
Or grant award (external to ECU)/continuation of grant (external to ECU) as Co-PI
Or grant award (ECU) or continuation of grant (ECU) as PI

Good: 2.5-3.5

1 or more article submissions
Grant submission as PI or Co-PI
Research presentation at national or international meeting
Graduate (Chairing student's committee) and undergraduate research project guidance

Fair: 1.5-2.5

Local conference presentations
Undergraduate student research project guidance
Participation on graduate student's committee

Poor: 0-1.5

No research activity

*Acceptance or in press equals publication, at faculty member's discretion to count this AY or next

**Due to the importance of developing the Department's undergraduate and graduate student involvement, faculty may elect to count direction of undergraduate or graduate student research into either the teaching or the research category

Service

The following lists indicate the minimum activities and performance level required to earn an annual evaluation score in service within each point category (e.g. 3.5-4.5) identified by the Annual Evaluation forms made available by Academic Affairs. The descriptors to the left are the descriptors required for each point category, as specified by Academic Affairs.

Outstanding: 4.5-5.0

In addition to "Very Good" below, one of the following: editor of journal, election to national professional office, key role (e.g. program Chair) in national conference, major role in department administration (e.g. program coordinator) if not designated as Other Duties

Very Good: 3.5-4.5

In addition to "Good" below, any two of the following: key role (e.g. program Chair) in regional or local conference, reviewer for national conference (abstracts), reviewed two or more manuscripts for journal(s), Chair of a standing departmental committee, site visitor at another institution (e.g. for assessment, grant, or program evaluation), member of regional/national task force or Chair of University task force, major role in curriculum development

Good: 2.5-3.5

Any two of the following: active in department and university committee work, strong supportive role in curriculum development, professional service work (e.g. participation in Math Contest , Math Counts, etc.), peer reviews (e.g. teaching, manuscripts, service), community engagement (may count more depending on level of effort)

Fair: 1.5-2.5

Some active committee work in the department/college/university

Poor: 0-1.5

Limited to no involvement in department/university committees and activities; limited to no involvement in professional conferences or organizations

1.6 Faculty Distribution: Describe the faculty workload relative to teaching, research/creative activity, and service/community engagement. Is the unit staffed adequately to meet the needs of various fields of specialization in the discipline? If not, please explain how the unit could achieve an appropriate distribution of faculty across specializations offered, given no growth in resources.

Faculty workload is dependent upon productivity of the faculty member and their levels of activity in teaching, research, and service. The department currently assigns an average of 2 mathematics courses (typically 6 or 7 credit hours per each academic semester) to tenure/tenure-track faculty members that have an active research record of some combination of refereed publications, research presentations, proposal submissions, and grant activity. Faculty members that are less active in research but more active in service and teaching have additional teaching responsibilities. The department is in need of hiring additional tenure-track faculty, with three retirements in the last four years, but is focusing on a chair search initially.

V. RESOURCES

5.1 *Budget:* Provide data for: the unit operating budget (expenditures), sponsored projects, F&A returns, fees, royalties, special services, assistantships, scholarships, etc.

The Department of Mathematics operates with six major categories of budget allocations: (1) State Departmental Operating Budget, (2) Mathematics Overhead Account, (3) Graduate Student Assistantships, (4) Remedial Math Account, (5) Supplemental Instruction Funds and, (6) Scholarship Fund.

(1) Departmental Operating Budget. The Mathematics Department Operating Budget begins fiscal year 2009-10 at $44,000. Of the approximately $45,000 in the 2008-09 fiscal year (after budget reversions mid-year) Adopted Budget , $11,855 was allotted for the double category of travel and copying, $10,115 was allotted for Property Plant Equipment Budget Pool, a one-time allotment of $6,006 was provided by the College for supplies, $5,460 was allotted for Other Fixed Charges (licenses, e.g. Maple, and maintenance contracts), $5,408 was allotted for supplies, $3,883 was allotted for Contractual Services (e.g. departmental memberships), and $2,293 was specifically designated for Student (helper) pay. There is some flexibility in moving funds among these subcategories, initially designated by Academic Affairs, on an as-needed basis and with ready justification.

(2) Mathematics Overhead Account. There is currently $8,000 in the overhead account, generated as Facilities and Administrative costs as the indirect portion of total grant revenue that is returned to the Department of

Mathematics. Of that $8,000 in the account line, $4,500 is due back to principal investigators in Math, leaving $3,500 for Departmental expenses.

(3) Assistantships. The Graduate School of ECU provides the Mathematics Department with support for eight graduate students in the fiscal year 2008-09 at the Masters level at a rate of $9,800 per student, for total graduate student support of $78,400 .

(4) Remedial Mathematics Account. The Department receives just over $10,000 (variable on a year-to-year basis) in a separate account based on funds derived from student registration in remedial math courses (MATH 0001 & 0045). These funds are directed towards providing math tutors and for supplies and equipment for the tutoring laboratory.

(5) Supplemental Instruction funds. The Department typically receives supplemental funds of $7,400 specifically designated for student help/assistance. These funds are used for provision of math tutors in the supplemental tutoring laboratory provided by the Department of Mathematics. These funds are provided to the department from Academic Affairs and the Thomas Harriot College of Arts and Sciences on a provisional, year-to-year basis.

(6) Scholarships. The Mathematics Department offers six undergraduate scholarships with a total annual dollar value of $2,100.

5.2 *Space:* Describe scope, quality, and need-projections.

Office space needs for tenure-track and tenured faculty are currently adequate, but campus planning needs to work with the Department now to ensure at least five new offices for tenure-track hires over the next five years. In addition, another five offices need to be allocated to Mathematics as teaching loads increase and more fixed-term faculty are hired. Typically, two fixed-term faculty members are sharing one office, a situation that creates problems for student learning when both faculty members have students in their offices at the same time. In addition to the need for smart classrooms discussed below (Technology Support), more of our classrooms need to be equipped with wide top-to-bottom sliding chalkboards. This feature would enable faculty to choose the appropriate media forum for the material being taught, and would allow for great flexibility in the scheduling of classrooms, which is a significant problem. Classroom assignments are now being controlled by the University. The relatively new Banner system of scheduling needs to allow for more flexibility and control by the departments, for example, priority for Austin classrooms for Math faculty.

5.3 *Technical/Equipment Support:* Describe equipment and technical personnel support provided to faculty, staff and students.

The most important technical feature/support needed for Mathematics is a conversion of at least five additional rooms, typically used and scheduled for teaching by Mathematics, to Smart Classrooms.

5.4 *Library Support:* Provide assessment of library holdings and services related to the unit program.
The mathematics department is served by Joyner Library which is the main library on campus. Spending on Mathematics has varied over the years, with good support during the past few years. The library budget has been cut by 17.9% this year with monograph purchases heaviest hit.

Journals are the most important library resource for mathematics. Access to the major databases (Science Direct, SpringerLInk, Wiley-Blackwell, Cambridge, Oxford) is provided through the Carolina Consortium. A number of backfile packages have been purchased (JSTOR, Springer and ScienceDirect in particular), but more are needed. Access to older literature is particularly important for mathematics; according to JSTOR:

"In most of the major fields included in JSTOR, the articles in the top ten were older than one might have expected they would be. In economics, for example, the average age of the top ten articles most frequently printed and viewed was 13 years. More dramatically, in the field of mathematics, the average age of the most used articles was 32 years. These data are by no means conclusive, as some of the JSTOR journals have only been digitized relatively recently, but the early findings seem to contradict existing assumptions about the value of older literature."
(See http://news.jstor.org/jstornews/2000/06/june_2000_no_4_issue_2_jstor_u.html)

Specific Recommendations:

1. Purchase the electronic backfiles of Springer Lecture Notes in Mathematics. The print collection is only comprehensive starting around volume 1000.
2. Purchase the electronic backfiles of various key journals such as Duke Mathematical Journal.
3. When hiring new faculty, include library requests, especially any new journal subscriptions needed, as part of a start-up package.
4. Most research universities have specialized Science and/or Mathematics libraries. Starting a new library is not feasible here, but there is a need for a specialized Science/Math Librarian. Currently there is none.

Total Items in Library Catalog with LC classification QA	27,840

Number of books purchased on Approval Plan, last five years	Amount Spent	Number of Items
2008-2009	$ 16,681.00	265
2007-2008	$ 14,795.00	242
2006-2007	$ 31,658.00	443
2005-2006	$ 20,129.00	287
2004-2005	$ 17,883.00	274

Firm Orders/Requested Monographic Purchases, last five years	Amount Spent	Number of Items
2008-2009	$ 6,900.00	219
2007-2008	$ 5,922.00	184
2006-2007	$ 11,636.00	265
2005-2006	$ 4,290.00	161
2004-2005	$ 4,436.00	122

Monographic Standing Orders for Math, last 3 years (previous years did not track Subject support)	Amount Spent	Number of Items
2008-2009	$ 2,975.00	45
2007-2008	$ 2,385.00	36
2006-2007	$ 2,982.00	37

Currently Subscribed Databases and Print & Electonic Journal Titles	Approximate Cost
	$ 91,914.00

Acta arithmetica.
Acta informatica - Online
Acta mathematica Hungarica - Online
Advances in mathematics
American mathematical monthly.

Annales de l'Institut Fourier.
Annales Scientifiques de l Ecole Normale Super
Annals of mathematics.
Anziam Journal Internet
Applied artificial intelligence : AAI. Online
Bulletin de la Société Mathématique de France.
Bulletin of symbolic logic - Online
Bulletin of the Australian Mathematical Society.
Canadian journal of mathematics = Journal canadien
Canadian mathematical bulletin = Bulletin canadien
College mathematics journal.
Commentarii mathematici Helvetici - Online
Comptes rendus mathématiques de l'Académie des
Duke mathematical journal. Online
Educational studies in mathematics - Online
Electronic design.
Enseignement Mathematique
For the learning of mathematics : an international
Forum mathematicum - Online
Houston Journal of Mathematics - Print + Online
Illinois journal of mathematics.
Indiana University mathematics journal. Online
Institute of mathematical statistics online journal collection
Integral equations and operator theory - Online
International journal of mathematics.
International mathematics research notices IMRN.
Inventiones mathematicae - Online
Israel journal of mathematics - Online
Journ Research Mathematicics Educat & Mathen
Journal für die reine und angewandte Mathematik -
Journal of algebra
Journal of algebraic geometry
Journal of applied mechanics.
Journal of Computational and Graphical Statistics
Journal of differential equations
Journal of differential geometry.
Journal of functional analysis
Journal of Lie theory - Online
Journal of mathematical analysis and applications
Journal of multivariate analysis
Journal of number theory
Journal of operator theory - Online

Journal of recreational mathematics
Journal of symbolic logic - Online
Journal of the American Mathematical Society -
Journal of the American Statistical Association -
Journal of the Ramanujan Mathematical Society.
Journal of the Royal Statistical Society. Online
Journal of the Royal Statistical Society. Series B
Journal of the Royal Statistical Society. Series C
Journal Reine & Angewandte Mathematik online
Learning & leading with technology : the ISTE
Lecture notes in statistics
L'Enseignement mathématique.
Linear & multilinear algebra - Online
Math reviews database fee
Mathematica scandinavica.
Mathematical gazette.
Mathematical research letters MRL. Online
Mathematical thinking and learning - Online
Mathematics magazine
Mathematics of computation - Online
Mathematics teaching.
Mathematika.
Mathematische Annalen - Online
Mathematische Zeitschrift - Online
Memoirs of the american mathematical society
Nagoya mathematical journal.
Pacific journal of mathematics
Pi Mu Epsilon journal.
PRIMUS : problems, resources, and issues in
Probability theory and related fields - Online
Proceedings of the American Mathematical Society -
Quarterly journal of mathematics - Online
Sankhy : the Indian journal of statistics.
SIAM membership package
Significance - Online
Stata journal.
Statistical science.
Teaching children mathematics.
Technometrics - Online
The Canadian journal of statistics La revue
The Fibonacci quarterly.
The Journal of the Australian Mathematical
The Michigan mathematical journal.

The Pentagon.
Tôhoku mathematical journal
Transactions of the American Mathematical Society
Transactions of the ASME E Journal

VI. ASSESSMENT OF OUTCOMES/FACULTY EXPECTATIONS

Introduction

The material in this portion of the Self-Study should reflect the *continuous and ongoing* assessment of program outcomes: planning, information gathering, self-review, and use of results for improving the quality of the program.

Quality Enhancement Guidelines for Unit Programs

Outcomes assessment is a part of a broader shift in higher education. Traditionally, academics have taken an inputs-based perspective on what they do. That is, they have designated a set of courses and other experiences that students will have and simply assumed that graduates will possess the knowledge, skills, and other attributes we expect of them. *An outcomes-based perspective reverses that relationship*. Instead of beginning with inputs, one begins by defining the knowledge, skills, and other attributes that are expected of graduates—program outcomes—and then rethinks the curricula to better enable students to achieve the expectations the faculty have placed before them. Program outcomes, then, are a reflection of what faculty value for their students. Outcomes assessment is a way of determining how effectively the unit programs enable students to achieve unit program values. Outcomes assessment may be understood as a process of asking and responding to the following three questions.

6.1 What are the unit program values of the faculty, that is, the knowledge, skills, and other attributes faculty expect their graduates to attain?

Unit programs at East Carolina University have answered this question. Unit faculty have established broad objectives for their programs, typically related to the students' professional and career goals. For each of these objectives, unit faculty have identified outcomes by which they have defined their particular program's expectations for students' professional development and career goals. Objectives and outcomes for each program are provided by the unit.

The BA/BS program had the following goals:

Program Learning Goal 1: Mathematics majors will acquire sufficient knowledge of Calculus.

Program Learning Goal 2: Mathematics majors will develop an ability to communicate mathematics effectively.

Program Learning Goal 3: Mathematics majors will gain an adequately broad base of knowledge.

Program Learning Goal 4: Students will be prepared for careers requiring quantitative skills.

The Department agreed on the following Partner Program Goal:

Partner Program Goal: Students will acquire adequate Mathematics skills to provide a foundation for their chosen fields of study.

The Foundations Curriculum had these goals:

1. *Foundations Goal*: Students in Foundations Curriculum courses will learn Mathematics that is appropriate to their background and educational needs.

2. Potential Additional Objective:

Science students in Foundations Curriculum courses will learn Mathematics that is appropriate to their science program needs.

The MA program had these goals:

Outcome Goal 1: Mastery and synthesis of domain specific knowledge..

Outcome goal 2: Student research experience.

Outcome goal 3: Preparation of college Mathematics instructors.

Outcome goal 4: Insuring quality of instruction by GTA's.

Outcome goal 5: Increased enrollment.

A recently added global objective is:

Outcome goal for Global Objective: Uses disciplinary concepts to explain how global and local issues are interconnected.

6.2 How well is the program achieving faculty expectations?

Units have generated plans for assessing their program outcomes: assessment data to be collected, the source of the data, how often the data are to be collected, and when the assessment results will be reported. Assessment plans are provided by the unit. Unit faculty are in the process of collecting and analyzing data and using the results to evaluate their programs.

BA/BS Educational Objective:

Program Learning Goal 1: Mathematics majors will acquire sufficient knowledge of Calculus.

Means of Assessment & Criteria for Success:

1. The Calculus Textbook Committee has created and forwarded 6 questions for embedding into the final exam in Math 2173 (Calculus III). The questions are on the topics:

- Differentiation and its interpretation as slope and rate of change
- Optimization
- Partial derivatives
- Limits
- Integration
- Computation of tangent planes.

2. *Direct metrics*:

a) Zach Robinson and Pramath Sastry, instructors of Math 2173 in Spring 2009 will give final exams with these embedded questions and provide data to the Undergraduate and Assessment Committees.

b) *Senior exam.* The Senior Assessment Committee arranged for the ETS Major Field Test to be given majors in Math 4101 (Advanced Calculus). The tests will be analyzed by ETS and the data forwarded to the Calculus Textbook and Undergraduate Committees for the purpose of measuring retention of Calculus skills and concepts.

Description of Data Collection & Assessment Results:

Data collection and analysis is underway in both i) the embedded questions in Math 2173 and ii) the ETS Major Field Test in Math 4101

Use of Results to Improve Program:

Data will be analyzed in early Fall 2009, with recommendations to follow later in Fall 2009.

BA/BS Educational Objective:

Program Learning Goal 2: Mathematics majors will develop an ability to communicate mathematics effectively.

First Means of Assessment for Objective Identified above:

Means of Assessment & Criteria for Success:

1. *Measured Outcome*: Mathematics majors will learn to write proofs of

mathematical propositions.
2. *Direct Metric*: Student writing samples from each of Math 2300 and 3263 will be maintained. They will be scored every fall semester by the Undergraduate Committee according to a rubric based on the following criteria: clarity; citation of relevant theorems, definitions and axioms; proper use of terminology and symbols; proper use of the rules of deduction; mathematical correctness.
3. *Results*: The results of the assessment will be the writing samples of the individual Mathematics majors, together with their rubric scores.
4. *Analysis*: The Undergraduate Committee will analyze the writing samples and rubric scores every fall semester with a view to assessing progress that students make toward the goal as they pass through the program. Performance criteria will be set at the time of the first cycle through the process. Note that a full cycle takes two to three years to elapse. In subsequent cycles, the performance criteria will be used as a comparator. The performance criteria will consist of percentages of students to meet or exceed low, medium and high benchmarks of achievement according to the rubric in each of the assessed courses.
5. *Improvement Action*: The committees involved with this assessment will meet (i) to discuss the impact of improvement actions taken in prior cycles and (ii) to determine how to enhance those sections of the curriculum where weaknesses in student performance are identified.

Description of Data Collection & Assessment Results:

Writing Assessment Committee Report

Date: 3/24/09
Committee Members: Robert Bernhardt, Alexandra Shlapentokh

The Committee analyzed around 50 random samples of student writing consisting of solutions to homework and test problems in Mathematics 3263, ranging over 2007-2009. The following characteristics of writing were considered: clarity; citations of relevant definitions, theorems and axioms; proper use of terminology and symbols; proper use of deduction or logical consistency; Mathematical correctness. (Each committee member recorded the data in the attached spread sheet.)
The committee members observed the following in the examined writing samples:

1. The statement being proved is often not stated and this seriously detracts from the clarity of the argument.
2. Citations of any kind are seldom present.
3. Use of symbols is generally correct, though on the average very few symbols are used and the symbols are often not defined. In other words, sentences of the sort “Let x be …” are lacking.
4. Students often use a combination of a narrative and a symbolic proof. While this practice is in general acceptable, the narrative part often lacks complete sentences,

again detracting from clarity.
5. There is a high variance in the use of deduction and general Mathematical correctness. One of the common mistakes is the restating of the original problem in lieu of proof.

Use of Results to Improve Program:

In view of the above, the Committee recommends the following steps:

1. Students should be encouraged to do the following, at least while writing down homework problems: (a) write down clear statements of the claims being proved; (b) write down definitions of the symbols used; (c) indicate what definitions, axioms, theorems are used; (d) use complete sentences in the narrative part of the proof.
2. The Department should create a database of the most common errors. Instructors could be asked to contribute to the database at least two instances of writing errors they find to be the most characteristic of the mistakes made by the students in their class.
3. The department is supposed to track the progress of student writing over time. This could be done either from comparing writing in MATH 2300 to writing in MATH 3263, or else to comparing writing from the beginning of one of these courses to the end of the course. We recommend and request that the Undergraduate Committee establish a procedure for accomplishing this comparison.

BA/BS Educational Objective:

Program Learning Goal 3: Mathematics majors will gain an adequately broad base of knowledge.

First Means of Assessment for Objective Identified above:

Means of Assessment & Criteria for Success:
1. *Measured Outcome*: Students will gain knowledge of Mathematics at a level generally considered by the profession to be appropriate to undergraduate education.
2. *Metrics*: There will be both a direct an indirect metric for this outcome.

a) *Indirect Metric*: The Mathematics Department office will survey the seniors every spring semester on the effectiveness of the program with a survey instrument that measures opinions of each course taken as well as of the overall program. The survey will provide space for comments.
b) *Direct Metric*: The Mathematics Department will create or otherwise obtain a standard exam for undergraduates (such as the GRE). The exam will have various parts corresponding to the different courses in the undergraduate Mathematics curriculum. This senior assessment exam will be administered each year to students in Math 4101, as a required part of the course. The grade will not count toward the course grade.

Description of Data Collection & Assessment Results:

The Senior Assessment Committee met and agreed that the department would administer the Princeton based Educational Testing Service (ETS) Major Field of Study (MFS) test to all students in Math 4101 (Advanced Calculus). These tests were ordered through IPAR. Michael Poteat notified the Math Department that the tests arrived in early April. Michael Spurr, the instructor for Math 4101 in Spring 2009, has made taking the ETS MFS test a requirement for the course. He picked up the ETS MFS tests April 13. These were administered to all students in Math 4101 on April 21. The Math Department will negotiate with the Math and Science Education Department to test their Math Ed students as well, to gauge effectiveness of the program. This will take place in the Fall 2009 semester.

3. *Results*: The results will be (i) the survey responses and (ii) the student scores on the senior assessment exam, overall and on each of the sections.
4. *Analysis*: The survey responses and senior assessment exam scores will be reviewed by the Undergraduate Committee. Performance criteria will be set at the time of the first pass through the process. In subsequent passes, the performance criteria will be used as a comparator. The performance criteria will consist of percentages of students to meet or exceed low, medium and high benchmarks of achievement overall and on each section of the senior assessment exam. Exam scores will be compared with survey responses to determine any correlation.

Use of Results to Improve Program:

Testing in Math 4101 was finished April 21, 2009. The tests are forwarded to ETS for analysis. This will be reviewed by the Senior Assessment Committee in Fall 2009, along with other relevant committees including the Calculus Texbook Committee and the Undergraduate Committee. No data or recommendations are currently available.

5. *Improvement Action*: The committees involved with this assessment will meet (i)

to discuss the impact of improvement actions taken in prior cycles and (ii) to determine how to enhance those sections of the curriculum where weaknesses in student performance are identified. Special attention will be directed to any area in the curriculum where low exam scores correlate to problems that surface in the survey responses. Comments on the survey will be considered to gain additional insight on how to make improvements to the curriculum or instructional techniques.

Note: The Mathematics Department will consider submitting a catalog revision of our undergraduate program description to add the degree requirement of enrolling in a zero credit hour course in which the senior assessment exam will be given.

BA/BS Educational Objective:

Program Learning Goal 4: Students will be prepared for careers requiring quantitative skills.

First Means of Assessment for Objective Identified above:

Means of Assessment & Criteria for Success

1. *Measured Outcome*: Graduates will find employment in a variety of professions that value quantitative skills, or will be enrolled in scientific or technical graduate programs.
2. *Metric*: The Mathematics Department office will survey alumni every three years to collect data about their current occupations and the effectiveness of the program in preparing them for their jobs or educational programs.

Description of Data Collection & Assessment Results:

3. *Results*: The results will be the survey responses. These have not been administered this year.

Use of Results to Improve Program:

4. *Analysis*: The Undergraduate Committee will review the survey responses.
5. *Improvement Action*: The committees involved in this assessment will recommend program changes to the Mathematics department based on the survey

responses

Department Partner Educational Objective:

Partner Program Goal: Students will acquire adequate Mathematics skills to provide a foundation for their chosen fields of study.

First Means of Assessment for Objective Identified above:

Means of Assessment & Criteria for Success

1. *Measured Outcome*: Engineering students will acquire adequate skills in Calculus and Statistics to provide a strong foundation for Engineering.
2. *Metric*: This outcome will have three metrics.
a. *Indirect Metric*: Students in the Engineering program will be surveyed annually by the Mathematics/Engineering Committee to determine if they feel that they have achieved the objectives of their Mathematics courses. These surveys have been administered in Spring 2009.
b. *Direct Metric 1*: Student performance on the *Mathematics component* of the annual Fundamentals of Engineering (FE) Exam will be obtained from the Engineering Program by the Mathematics/Engineering Committee. This is currently being negotiated with the Engineering Department.
c. *Direct Metric 2*: The Engineering/Mathematics Committee will determine questions from the FE Exam each semester to embed in exams in the Engineering Calculus sequence. The embedded FE questions will be administered in selected sections of Math 2151, Math 2152, Math 2154, and Math 3307 (embedded questions in these sections were administered on tests throughout the semester).

The Engineering/Mathematics Committee will discuss each topic above on Friday April 24, 2009.

Description of Data Collection & Assessment Results:

3. *Results*: The results will be (i) the survey responses, (ii) the statistics from the Mathematics component of the FE exam, and (iii) the statistics from the embedded questions. The results are not complete as of the date of this preliminary report.
4. *Analysis*: The survey responses and various exam scores will be reviewed by the Mathematics/Engineering Committee. Performance criteria will be set at

the time of the first pass through the process. In subsequent passes, the performance criteria will be used as a comparator. The performance criteria will consist of percentages of students to meet or exceed low, medium and high benchmarks of achievement overall and on each exam or section thereof. Exam scores will be compared with survey responses to determine any correlation. Survey responses will be reviewed.

Use of Results to Improve Program:

5. *Improvement Action*: The committees involved with this assessment will meet (i) to discuss the impact of improvement actions taken in prior cycles and (ii) to determine how to enhance those sections of the curriculum where weaknesses in student performance are identified. Special attention will be directed to any area in the curriculum where low exam scores correlate to problems that surface in the survey responses. Comments on the survey will be considered to gain additional insight on how to make improvements to the curriculum or instructional techniques. This will take place in Fall 2009.

Note: as it gains experience implementing its assessment plans, the Mathematics Department will consider broadening this portion of its assessment to include students enrolled in the Mathematics Education program.

Foundation Educational Objective:

1. *Foundations Goal*: Students in Foundations Curriculum courses will learn Mathematics that is appropriate to their background and educational needs.

College Algebra assessment narrative

First Means of Assessment for Objective Identified above:

Means of Assessment & Criteria for Success:

1. *Measured Outcome*: Students in College Algebra, Math 1065, will acquire adequate skills in the following areas:

 Lines and linear functions

2. *Direct Metric:* Student performance on the common final examination in Math 1065 will be analyzed each semester by the Undergraduate and College Algebra Committees. The common final will have a number of questions in the skill areas mentioned in part 1, above.

3. *Results:* The results of the assessment will be semester-by-semester statistics on student performance on the Math 1065 common final. The statistics will report overall student performance on the exam as well as student performance on the questions in the skill areas above.

4. *Analysis:* Strengths and weaknesses in the course will be determined by analyzing the statistics. Performance criteria will be set at the time of the first pass through the process. In subsequent passes, the performance criteria will be used as a comparator. The performance criteria will consist of percentages of students to meet or exceed low, medium and high benchmarks of achievement on the common final in each skill area, as well as overall.

5. *Improvement Action:* The committees involved with this assessment will meet (i) to discuss the impact of improvement actions taken in prior cycles and (ii) to determine how to enhance those sections of the curriculum where weaknesses in student performance are identified.

Note: as it gains experience implementing its assessment plans, the Mathematics Department will consider broadening assessment of its Foundations Curriculum offerings
to cover other courses with high student enrolment, such as Math 1066 and Math 2228/2283.

Description of Data Collection & Assessment Results:

The Fall 2008 MATH 1065 was used for assessment purposes. There are four versions of the common exam (A, B, C, D) set up as follows. Version A is the first version created. Version B rearranges the order of the questions and the order of the answers in the questions. Version C modifies several of the questions (e.g., changing signs of values, numbers used) from version A (14 of the 40 questions were modified). Version D rearranges the order of the questions and the order of the answers in the questions from version C. After the exams were graded, the opscans were collected in the Mathematics Department office for analysis. 1790 exams were used for the analysis.

A preliminary criteria for High, Medium, and Low performance on a give question was proposed to be:

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High:     80% or higher
Medium:   60 to 79%
Low:      less than 60%
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These preliminary criteria will be reviewed in Fall 2009.

The questions were identified by the topic covered in the question. The topics suggested for more detailed analysis by the Foundations Goals documents and the questions covering those topics (numbers identify where the question was in version A):

Lines and Linear Functions:
Questions 5, 24, 40 (as labeled on Exam A):

Lines and Linear Functions:	**% correct**	**performance**
slope-intercept of ax + by + c = 0	84%	High
slope of line through two points	75%	Medium
line through (d,e) perpendicular to ax + by = c	50%	Low

Analysis was done to report the percent correct for each question topic across the four versions and overall. The average scores for the four versions were from 59.04 to 60.76 (note: each question is worth 2.5 points). Although the averages were very close together; there were difference of more than ten percent on the percent correct for some questions across the different versions (on the solve an absolute value equation, version A which asked for the smaller solution had 33% correct and version C which asked for the larger solution had 64% correct). Difference of more than ten percent between the lowest and highest percents across the versions was indicated in bold. The overall percent correct was between a low of 28% (solve logarithmic equation) and 84% (slope-intercept of ax + by + c=0).

For each version of the exam, a more detailed report was generated with the frequency for each answer reported along with the percent correct for each question. It was annotated to show wrong answers that (a) attracted 80 to 99 students (b) attracted 100 or more students and (c) were more popular than the correct answer. Each version of the test was also annotated to indicate this information. A frequency distribution table of exam scores for each version and overall was also created.

Use of Results to Improve Program:

The Math 1065 committee will be further reviewing the above results in Fall 2009 with the intent of reaching the educational objective. Any further refinement of criteria for High, Medium, and Low will be determined at that time.

All of the above was distributed to the faculty who taught MATH 1065 during Fall 2008 and discussed at a meeting with Ms Cathy Wilkerson and the Department Chair. The discussion included looking at the questions and what might have been source of the students' confusion. This information will be used in creating the Spring 2009 common exam. Faculty who are teaching the course this semester, and who taught it last semester, can use this information in helping their students prepare for the final exam.

After the meeting, faculty who taught the course in the fall, were given a report for each of their sections as to the percent correct for each question across all four versions and the exam score distribution along with the section's average and standard deviation. This can be used to address topics where their students had problems last semester.

Finally, a report was generated showing, for each version and for each topic, the percent wrong for students scoring at or above 90, 80, 70, etc.. For example, on version A, 42% of students scoring 90 or higher on the exam missed the question on solving the absolute value equation and 41% of students scoring 80 or higher missed the question on factoring the sum/difference of cubes.

Second Means of Assessment for Objective Identified above:

Means of Assessment & Criteria for Success:

1. *Measured Outcome*: Students in College Algebra, Math 1065, will acquire adequate skills in the following areas:
 Setting up and solving equations and inequalities
2. *Direct Metric:* Student performance on the common final examination in Math 1065 will be analyzed each semester by the Undergraduate and College Algebra Committees. The common final will have a number of questions in each of the skill areas mentioned in part 1, above.
3. *Results:* The results of the assessment will be semester-by-semester statistics on student performance on the Math 1065 common final. The statistics will report overall student performance on the exam as well as student performance on the questions in each of the skill areas above.
4. *Analysis:* Strengths and weaknesses in the course will be determined by analyzing the statistics. Performance criteria will be set at the time of the first pass through the process. In subsequent passes, the performance criteria will be used as a comparator. The performance criteria will consist of percentages of students to meet or exceed low, medium and high benchmarks of achievement on the common final in each skill area, as well as overall.
5. *Improvement Action:* The committees involved with this assessment will meet (i)

to discuss the impact of improvement actions taken in prior cycles and (ii) to determine how to enhance those sections of the curriculum where weaknesses in student performance are identified.
Note: as it gains experience implementing its assessment plans, the Mathematics Department will consider broadening assessment of its Foundations Curriculum offerings
to cover other courses with high student enrolment, such as Math 1066 and Math 2228/2283.

Description of Data Collection & Assessment Results:

The Fall 2008 MATH 1065 was used for assessment purposes. There are four versions of the common exam (A, B, C, D) set up as follows. Version A is the first version created. Version B rearranges the order of the questions and the order of the answers in the questions. Version C modifies several of the questions (e.g., changing signs of values, numbers used) from version A (14 of the 40 questions were modified). Version D rearranges the order of the questions and the order of the answers in the questions from version C. After the exams were graded, the opscans were collected in the Mathematics Department office for analysis. 1790 exams were used for the analysis.

A preliminary criteria for High, Medium, and Low performance on a give question was proposed to be:
High: 80% or higher
Medium: 60 to 79%
Low: less than 60%
These preliminary criteria will be reviewed in Fall 2009.

The questions were identified by the topic covered in the question. The topics suggested for more detailed analysis by the Foundations Goals documents and the questions covering those topics (numbers identify where the question was in version A):

Setting up and solving equations and inequalities:
From Questions 1, 3, 6, 8, 13, 19, 22, 25, 38 (as labeled on Exam A)

Setting up and solving equations and inequalities:	**% correct**	**performance**
solve linear inequality	77%	Medium
solve a x^2 - b = 0	71%	Medium
solve linear equation	70%	Medium
solve linear system	62%	Medium
solve absolute value equation	48%	

Low

solve quadratic inequality 41%

Low

Analysis was done to report the percent correct for each question topic across the four versions and overall. The average scores for the four versions were from 59.04 to 60.76 (note: each question is worth 2.5 points). Although the averages were very close together; there were difference of more than ten percent on the percent correct for some questions across the different versions (on the solve an absolute value equation, version A which asked for the smaller solution had 33% correct and version C which asked for the larger solution had 64% correct). Difference of more than ten percent between the lowest and highest percents across the versions was indicated in bold. The overall percent correct was between a low of 28% (solve logarithmic equation) and 84% (slope-intercept of ax + by + c=0).

For each version of the exam, a more detailed report was generated with the frequency for each answer reported along with the percent correct for each question. It was annotated to show wrong answers that (a) attracted 80 to 99 students (b) attracted 100 or more students and (c) were more popular than the correct answer. Each version of the test was also annotated to indicate this information. A frequency distribution table of exam scores for each version and overall was also created.

Use of Results to Improve Program:

The Math 1065 committee will be further reviewing the above results in Fall 2009 with the intent of reaching the educational objective. Any further refinement of criteria for High, Medium, and Low will be determined at that time.

All of the above was distributed to the faculty who taught MATH 1065 during Fall 2008 and discussed at a meeting with Ms Cathy Wilkerson and the Department Chair. The discussion included looking at the questions and what might have been source of the students' confusion. This information will be used in creating the Spring 2009 common exam. Faculty who are teaching the course this semester, and who taught it last semester, can use this information in helping their students prepare for the final exam.

After the meeting, faculty who taught the course in the fall, were given a report for each of their sections as to the percent correct for each question across all four versions and the exam score distribution along with the section's average and standard deviation. This can be used to address topics where their students had problems last semester.

Finally, a report was generated showing, for each version and for each topic, the percent wrong for students scoring at or above 90, 80, 70, etc.. For example, on version A, 42% of students scoring 90 or higher on the exam missed the question on solving the absolute value equation and 41% of students scoring 80 or higher missed the question on factoring the sum/difference of cubes.

Third Means of Assessment for Objective Identified above:

Means of Assessment & Criteria for Success:
1. *Measured Outcome*: Students in College Algebra, Math 1065, will acquire adequate skills in the following areas:
 Plotting points and graphing functions
2. *Direct Metric:* Student performance on the common final examination in Math 1065 will be analyzed each semester by the Undergraduate and College Algebra Committees. The common final will have a number of questions in each of the skill areas mentioned in part 1, above.
3. *Results:* The results of the assessment will be semester-by-semester statistics on student performance on the Math 1065 common final. The statistics will report overall student performance on the exam as well as student performance on the questions in each of the skill areas above.
4. *Analysis:* Strengths and weaknesses in the course will be determined by analyzing the statistics. Performance criteria will be set at the time of the first pass through the process. In subsequent passes, the performance criteria will be used as a comparator. The performance criteria will consist of percentages of students to meet or exceed low, medium and high benchmarks of achievement on the common final in each skill area, as well as overall.
5. *Improvement Action:* The committees involved with this assessment will meet (i) to discuss the impact of improvement actions taken in prior cycles and (ii) to determine how to enhance those sections of the curriculum where weaknesses in student performance are identified.
Note: as it gains experience implementing its assessment plans, the Mathematics Department will consider broadening assessment of its Foundations Curriculum offerings
to cover other courses with high student enrolment, such as Math 1066 and Math 2228/2283.

Description of Data Collection & Assessment Results:

The Fall 2008 MATH 1065 was used for assessment purposes. There are four versions of the common exam (A, B, C, D) set up as follows. Version A is the first version created. Version B rearranges the order of the questions and the order of the answers in the questions. Version C modifies several of the questions (e.g., changing signs of values, numbers used) from version A (14 of the 40 questions were modified). Version D rearranges the order of the questions and the order of the answers in the questions from version C. After the exams were graded, the opscans were collected in the Mathematics Department office for analysis. 1790 exams were used for the analysis.

A preliminary criteria for High, Medium, and Low performance on a give question was proposed to be:

```
High:     80% or higher
Medium:   60 to 79%
Low:      less than 60%
```

These preliminary criteria will be reviewed in Fall 2009.

The questions were identified by the topic covered in the question. The topics suggested for more detailed analysis by the Foundations Goals documents and the questions covering those topics (numbers identify where the question was in version A):

Plotting points and graphing:
From Questions 4, 7, 17, 21, 31, 35 (as labeled on Test A):

Plotting points and graphing:	% correct	performance
translate graph of g(x) = |x|	74%	Medium
given graph, determine square root function	68%	Medium
point of symmetry around the origin	67%	Medium
given graph: intercepts, domain, even/odd	61%	Medium
quadratic function vertex and decreasing	56%	Low
general equation for circle --> center and radius	49%	Low

Analysis was done to report the percent correct for each question topic across the four versions and overall. The average scores for the four versions were from 59.04 to 60.76 (note: each question is worth 2.5 points). Although the averages were very close together; there were difference of more than ten percent on the percent correct for some questions across the different versions (on the solve an absolute value equation, version A which asked for the smaller solution had 33% correct and version C which asked for the larger solution had 64% correct). Difference of more than ten percent between the lowest and highest percents across the versions was indicated in bold. The overall percent correct was between a low of 28% (solve logarithmic equation) and 84% (slope-intercept of ax + by + c=0).

For each version of the exam, a more detailed report was generated with the frequency for each answer reported along with the percent correct for each question. It was annotated to show wrong answers that (a) attracted 80 to 99 students (b) attracted 100 or more students and (c) were more popular than the correct answer. Each version of the test was also annotated to indicate this information. A frequency distribution table of exam scores for each version and overall was also created.

Use of Results to Improve Program:

The Math 1065 committee will be further reviewing the above results in Fall 2009 with the intent of reaching the educational objective. Any further refinement of criteria for High, Medium, and

Low will be determined at that time.

All of the above was distributed to the faculty who taught MATH 1065 during Fall 2008 and discussed at a meeting with Ms Cathy Wilkerson and the Department Chair. The discussion included looking at the questions and what might have been source of the students' confusion. This information will be used in creating the Spring 2009 common exam. Faculty who are teaching the course this semester, and who taught it last semester, can use this information in helping their students prepare for the final exam.

After the meeting, faculty who taught the course in the fall, were given a report for each of their sections as to the percent correct for each question across all four versions and the exam score distribution along with the section's average and standard deviation. This can be used to address topics where their students had problems last semester.

Finally, a report was generated showing, for each version and for each topic, the percent wrong for students scoring at or above 90, 80, 70, etc.. For example, on version A, 42% of students scoring 90 or higher on the exam missed the question on solving the absolute value equation and 41% of students scoring 80 or higher missed the question on factoring the sum/difference of cubes.

Fourth Means of Assessment for Objective Identified above:

Means of Assessment & Criteria for Success:

1. *Measured Outcome*: Students in College Algebra, Math 1065, will acquire adequate skills in the following areas:
 Mathematical models (word problems)
2. *Direct Metric:* Student performance on the common final examination in Math 1065 will be analyzed each semester by the Undergraduate and College Algebra Committees. The common final will have a number of questions in each of the skill areas mentioned in part 1, above.
3. *Results:* The results of the assessment will be semester-by-semester statistics on student performance on the Math 1065 common final. The statistics will report overall student performance on the exam as well as student performance on the questions in each of the skill areas above.
4. *Analysis:* Strengths and weaknesses in the course will be determined by analyzing the statistics. Performance criteria will be set at the time of the first pass through the process. In subsequent passes, the performance criteria will be used as a comparator. The performance criteria will consist of percentages of students to meet or exceed low, medium and high benchmarks of achievement on the common final in each skill area, as well as overall.
5. *Improvement Action:* The committees involved with this assessment will meet (i) to discuss the impact of improvement actions taken in prior cycles and (ii) to determine how to enhance those sections of the curriculum where weaknesses in

student performance are identified.
Note: as it gains experience implementing its assessment plans, the Mathematics Department will consider broadening assessment of its Foundations Curriculum offerings
to cover other courses with high student enrolment, such as Math 1066 and Math 2228/2283.

Description of Data Collection & Assessment Results:

The Fall 2008 MATH 1065 was used for assessment purposes. There are four versions of the common exam (A, B, C, D) set up as follows. Version A is the first version created. Version B rearranges the order of the questions and the order of the answers in the questions. Version C modifies several of the questions (e.g., changing signs of values, numbers used) from version A (14 of the 40 questions were modified). Version D rearranges the order of the questions and the order of the answers in the questions from version C. After the exams were graded, the opscans were collected in the Mathematics Department office for analysis. 1790 exams were used for the analysis.

A preliminary criteria for High, Medium, and Low performance on a give question was proposed to be:
High: 80% or higher
Medium: 60 to 79%
Low: less than 60%
These preliminary criteria will be reviewed in Fall 2009.

The questions were identified by the topic covered in the question. The topics suggested for more detailed analysis by the Foundations Goals documents and the questions covering those topics (numbers identify where the question was in version A):

Word problems:
From Questions 9, 15, 16, 18, 20, 32, 34, 39 (as labeled on Test A):

Word problems:	**% correct**	**performance**
compound investment (evaluate formula)	83%	High
exponential decay (evaluate formula)	80%	High
mixture problem (set up equation)	64%	Medium

variation (inversely and directly) 60%
Medium

exponential growth (extrapolate from y_0 and y_1) 56%
Low
variation (jointly and square) 51%
Low
maximize fenced enclosure (quadratic) 45%
Low
time when two work together ($x/a + x/b = 1$) 45%
Low

Analysis was done to report the percent correct for each question topic across the four versions and overall. The average scores for the four versions were from 59.04 to 60.76 (note: each question is worth 2.5 points). Although the averages were very close together; there were difference of more than ten percent on the percent correct for some questions across the different versions (on the solve an absolute value equation, version A which asked for the smaller solution had 33% correct and version C which asked for the larger solution had 64% correct). Difference of more than ten percent between the lowest and highest percents across the versions was indicated in bold. The overall percent correct was between a low of 28% (solve logarithmic equation) and 84% (slope-intercept of ax + by + c=0).

For each version of the exam, a more detailed report was generated with the frequency for each answer reported along with the percent correct for each question. It was annotated to show wrong answers that (a) attracted 80 to 99 students (b) attracted 100 or more students and (c) were more popular than the correct answer. Each version of the test was also annotated to indicate this information. A frequency distribution table of exam scores for each version and overall was also created.

Use of Results to Improve Program:

The Math 1065 committee will be further reviewing the above results in Fall 2009 with the intent of reaching the educational objective. Any further refinement of criteria for High, Medium, and Low will be determined at that time.

All of the above was distributed to the faculty who taught MATH 1065 during Fall 2008 and discussed at a meeting with Ms Cathy Wilkerson and the Department Chair. The discussion included looking at the questions and what might have been source of the students' confusion. This information will be used in creating the Spring 2009 common exam. Faculty who are teaching the course this semester, and who taught it last semester, can use this information in helping their students prepare for the final exam.

After the meeting, faculty who taught the course in the fall, were given a report for each of their sections as to the percent correct for each question across all four versions and the exam score distribution along with the section's average and standard deviation. This can be used to address topics where their students had problems last semester.

Finally, a report was generated showing, for each version and for each topic, the percent wrong for students scoring at or above 90, 80, 70, etc.. For example, on version A, 42% of students scoring 90 or higher on the exam missed the question on solving the absolute value equation and 41% of students scoring 80 or higher missed the question on factoring the sum/difference of cubes.

Second Foundation Educational Objective:

2. Potential Additional Objective:

Science students in Foundations Curriculum courses will learn Mathematics that is appropriate to their science program needs.

First Means of Assessment for Objective Identified above:

Means of Assessment & Criteria for Success:
1. *Measured Outcome*: Students in College Algebra, Math 1065, will acquire adequate skills in the following areas:
 Exponential and Logarithmic Equations
2. *Direct Metric:* Student performance on the common final examination in Math 1065 will be analyzed each semester by the Undergraduate and College Algebra Committees. The common final will have a number of questions in the skill areas mentioned in part 1, above.
3. *Results:* The results of the assessment will be semester-by-semester statistics on student performance on the Math 1065 common final. The statistics will report overall student performance on the exam as well as student performance on the questions in the skill areas above.
4. *Analysis:* Strengths and weaknesses in the course will be determined by analyzing the statistics. Performance criteria will be set at the time of the first pass through the process. In subsequent passes, the performance criteria will be used as a comparator. The performance criteria will consist of percentages of students to meet or exceed low, medium and high benchmarks of achievement on the common final in each skill area, as well as overall.
5. *Improvement Action:* The committees involved with this assessment will meet (i) to discuss the impact of improvement actions taken in prior cycles and (ii) to determine how to enhance those sections of the curriculum where weaknesses in student performance are identified.

Note: as it gains experience implementing its assessment plans, the Mathematics Department will consider broadening assessment of its Foundations Curriculum offerings
to cover other courses with high student enrolment, such as Math 1066 and Math 2228/2283.

Description of Data Collection & Assessment Results:

The Fall 2008 MATH 1065 was used for assessment purposes. There are four versions of the common exam (A, B, C, D) set up as follows. Version A is the first version created. Version B rearranges the order of the questions and the order of the answers in the questions. Version C modifies several of the questions (e.g., changing signs of values, numbers used) from version A (14 of the 40 questions were modified). Version D rearranges the order of the questions and the order of the answers in the questions from version C. After the exams were graded, the opscans were collected in the Mathematics Department office for analysis. 1790 exams were used for the analysis.

A preliminary criteria for High, Medium, and Low performance on a give question was proposed to be:

High:	80% or higher
Medium:	60 to 79%
Low:	less than 60%

These preliminary criteria will be reviewed in Fall 2009.

The questions were identified by the topic covered in the question. The topics suggested for more detailed analysis by the Foundations Goals documents and the questions covering those topics (numbers identify where the question was in version A):

Exponential and Logarithmic:
From Questions 2, 11, 13, 25, 6 (as labeled on Test A):

Exponential and Logarithmic:	**% correct**	**performance**
change exponential equation to log equation	72%	Medium
statements about solution to log equation	66%	Medium
exponential equation (number answer)	61%	Medium
exponential equation (log answer)	49%	Low
solve logarithmic equation	28%	Low

Analysis was done to report the percent correct for each question topic across the four versions and overall. The average scores for the four versions were from 59.04 to 60.76 (note: each question is worth 2.5 points). Although the averages were very close together; there were difference of more than ten percent on the percent correct for some questions across the different versions (on the solve an absolute value equation, version A which asked for the smaller solution had 33% correct and version C which asked for the larger solution had 64% correct). Difference of more than ten percent between the lowest and highest percents across the versions was indicated in bold. The overall percent correct was between a low of 28% (solve logarithmic equation) and 84% (slope-intercept of ax + by + c=0).

For each version of the exam, a more detailed report was generated with the frequency for each answer reported along with the percent correct for each question. It was annotated to show wrong answers that (a) attracted 80 to 99 students (b) attracted 100 or more students and (c) were more popular than the correct answer. Each version of the test was also annotated to indicate this information. A frequency distribution table of exam scores for each version and overall was also created.

Use of Results to Improve Program:

The Mathematics Department is working with the Science Departments to ensure that students are familiar with aspects of exponential and logarithmic computations needed by their programs. The Math 1065 committee will be further reviewing the above results in Fall 2009 with the intent of reaching the educational objective. Any further refinement of criteria for High, Medium, and Low will be determined at that time.

All of the above was distributed to the faculty who taught MATH 1065 during Fall 2008 and discussed at a meeting with Ms Cathy Wilkerson and the Department Chair. The discussion included looking at the questions and what might have been source of the students' confusion. This information will be used in creating the Spring 2009 common exam. Faculty who are teaching the course this semester, and who taught it last semester, can use this information in helping their students prepare for the final exam.

After the meeting, faculty who taught the course in the fall, were given a report for each of their sections as to the percent correct for each question across all four versions and the exam score distribution along with the section's average and standard deviation. This can be used to address topics where their students had problems last semester.

Finally, a report was generated showing, for each version and for each topic, the percent wrong for students scoring at or above 90, 80, 70, etc.. For example, on version A, 42% of students scoring 90 or higher on the exam missed the question on solving the absolute value equation and 41% of students scoring 80 or higher missed the question on factoring the sum/difference of cubes.

Second Means of Assessment for Objective Identified above:

Means of Assessment & Criteria for Success:

1. *Measured Outcome*: Students in College Algebra, Math 1065, will acquire adequate skills in the following areas:

 Other Exponential and Logarithmic Problems

2. *Direct Metric:* Student performance on the common final examination in Math 1065 will be analyzed each semester by the Undergraduate and College Algebra Committees. The common final will have a number of questions in the skill areas mentioned in part 1, above.

3. *Results:* The results of the assessment will be semester-by-semester statistics on student performance on the Math 1065 common final. The statistics will report overall student performance on the exam as well as student performance on the questions in the skill areas above.

4. *Analysis:* Strengths and weaknesses in the course will be determined by analyzing the statistics. Performance criteria will be set at the time of the first pass through the process. In subsequent passes, the performance criteria will be used as a comparator. The performance criteria will consist of percentages of students to meet or exceed low, medium and high benchmarks of achievement on the common final in each skill area, as well as overall.

5. *Improvement Action:* The committees involved with this assessment will meet (i) to discuss the impact of improvement actions taken in prior cycles and (ii) to determine how to enhance those sections of the curriculum where weaknesses in student performance are identified.

Note: as it gains experience implementing its assessment plans, the Mathematics Department will consider broadening assessment of its Foundations Curriculum offerings
to cover other courses with high student enrolment, such as Math 1066 and Math 2228/2283.

Description of Data Collection & Assessment Results:

The Fall 2008 MATH 1065 was used for assessment purposes. There are four versions of the common exam (A, B, C, D) set up as follows. Version A is the first version created. Version B rearranges the order of the questions and the order of the answers in the questions. Version C modifies several of the questions (e.g., changing signs of values, numbers used) from version A (14 of the 40 questions were modified). Version D rearranges the order of the questions and the order of the answers in the questions from version C. After the exams were graded, the opscans were collected in the Mathematics Department office for analysis. 1790 exams were used for the analysis.

A preliminary criteria for High, Medium, and Low performance on a give question was proposed to be:

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High:      80% or higher
Medium:    60 to 79%
Low:       less than 60%
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These preliminary criteria will be reviewed in Fall 2009.

The questions were identified by the topic covered in the question. The topics suggested for more detailed analysis by the Foundations Goals documents and the questions covering those topics (numbers identify where the question was in version A):

Other exponential and logarithmic problems:
From Questions 23, 28 (as labeled on Test A):

Other exponential and logarithmic problems:	**% correct**	**performance**
change of base formula for log base b of a	63%	Medium
convert log of product/quotient to sum/diff of logs	29%	Low

Analysis was done to report the percent correct for each question topic across the four versions and overall. The average scores for the four versions were from 59.04 to 60.76 (note: each question is worth 2.5 points). Although the averages were very close together; there were difference of more than ten percent on the percent correct for some questions across the different versions (on the solve an absolute value equation, version A which asked for the smaller solution had 33% correct and version C which asked for the larger solution had 64% correct). Difference of more than ten percent between the lowest and highest percents across the versions was indicated in bold. The overall percent correct was between a low of 28% (solve logarithmic equation) and 84% (slope-intercept of ax + by + c=0).

For each version of the exam, a more detailed report was generated with the frequency for each answer reported along with the percent correct for each question. It was annotated to show wrong answers that (a) attracted 80 to 99 students (b) attracted 100 or more students and (c) were more popular than the correct answer. Each version of the test was also annotated to indicate this information. A frequency distribution table of exam scores for each version and overall was also created.

Use of Results to Improve Program:

The Mathematics Department is working with the Science Departments to ensure that students are familiar with aspects of exponential and logarithmic computations needed by their programs. The Math 1065 committee will be further reviewing the above results in Fall 2009 with the intent of reaching the educational objective. Any further refinement of criteria for High, Medium, and Low will be determined at that time.

All of the above was distributed to the faculty who taught MATH 1065 during Fall 2008 and discussed at a meeting with Ms Cathy Wilkerson and the Department Chair. The discussion included looking at the questions and what might have been source of the students' confusion. This information will be used in creating the Spring 2009 common exam. Faculty who are teaching the course this semester, and who taught it last semester, can use this information in helping their students prepare for the final exam.

After the meeting, faculty who taught the course in the fall, were given a report for each of their sections as to the percent correct for each question across all four versions and the exam score distribution along with the section's average and standard deviation. This can be used to address topics where their students had problems last semester.

Finally, a report was generated showing, for each version and for each topic, the percent wrong for students scoring at or above 90, 80, 70, etc.. For example, on version A, 42% of students scoring 90 or higher on the exam missed the question on solving the absolute value equation and 41% of students scoring 80 or higher missed the question on factoring the sum/difference of cubes.

MA Educational Objective:

1. *Program Learning Goal 1:* Mastery and synthesis of domain specific knowledge.

First Means of Assessment for Objective Identified above:

Means of Assessment & Criteria for Success:
1. *Measured Outcome*: Graduate students in Mathematics are exposed to a wide range of deep mathematical and/or statistical concepts through their coursework. Students will achieve a high level of conceptual mastery and synthesize knowledge across sub-disciplines treated in separate courses.
2. *Direct Metric*: To demonstrate such mastery we require successful completion of a *comprehensive exam* as a degree requirement. Each exam is designed and graded by a committee of four departmental graduate faculty members and covers subject matter treated in four graduate level courses. Exams are administered at most once per semester, according to student demand.

Description of Data Collection & Assessment Results:

3. *Results*: Results to be reported for this assessment will be the comprehensive exam grades achieved in each of the four areas each year by students in the program.
4. *Analysis*: Students must achieve an overall grade of at least B in order to pass their comprehensive exam. Areas of weakness will be identified. Analysis of comprehensive exam results by the Graduate Committee is underway at the writing of this report.

Use of Results to Improve Program:

5. *Improvement Action*: The Graduate Committee will review the comprehensive exams on an annual basis to ensure uniformity of standards and identify areas of weakness in student performance. Failing students will be counseled by their exam committee regarding areas of deficiency and allowed a second attempt (with a new exam) after further study. These are being undertaken by the Graduate Committee at the writing of this report.

MA Educational Objective:

2. *Program Learning Goal 2*: Student research experience.

First Means of Assessment for Objective Identified above:

Means of Assessment & Criteria for Success:

1. *Measured Outcome*: Graduate students pursuing a *Mathematics* or *Statistics* MA degree concentration will develop the ability to work independently on open-ended problems.
2. *Direct Metric*: Students in these concentrations who choose not to write a *thesis* are required to complete a *research project* under the direction of a graduate faculty member. Students present the results of their research projects in talks open to all faculty and students. A committee of three graduate faculty members is formed to perform a closed oral examination upon completion of a student presentation. The student's work is judged by the committee on a pass/fail basis.

Description of Data Collection & Assessment Results:

3. *Results*: Results to be reported for this assessment are the outcomes (pass/fail) for research projects and theses completed each year. Projects are still being completed and presented at the writing of this report.
4. *Analysis*: A performance criterion will be set by the Graduate Committee at the first pass through the assessment. In subsequent cycles, the performance criterion will be used as a comparator. The performance criterion will consist of a percentage of students to pass the assessment. The Graduate Committee will meet in early Fall 2009 to discuss results and set standards.

Use of Results to Improve Program:

5. *Improvement Action*: The Graduate Committee will provide oversight as regards the appropriateness and rigor of theses and research projects undertaken. Students whose projects are judged unacceptable will be required to perform further work under the supervision of their examination committee. The Graduate Committee will meet in Fall 2009 to review the results and make recommendations.

MA Educational Objective Graduate Program:

3. *Program Learning Goal 3*: Preparation of college Mathematics instructors.

First Means of Assessment for Objective Identified above:

Means of Assessment & Criteria for Success:

1. *Measured Outcome*: Some students in this program intend to pursue careers as instructors in community colleges and in our own department. Interested students will be well prepared for such careers.
2. *Metrics*: The *Mathematics in the Community College* concentration is tailored to the needs of prospective college teachers. This concentration includes several assessments.

a) Each student is required to take Math 6271, Teaching Collegiate Mathematics. This course is generally offered once per year, according to student demand. As part of this course students are required to produce a *teaching portfolio*, which is scored according to a rubric.
b) Each student is required to give a *presentation* to an undergraduate audience. (This degree requirement substitutes for the research requirement in the other two concentrations.)
c) Each year, the Mathematics Department office will survey recent graduates who sought employment as college teachers, enquiring as to their present employment status.

Description of Data Collection & Assessment Results:

3. *Results*: Results to be reported for these assessments are the rubric scores received on teaching portfolios and the number of successful undergraduate presentations delivered each year. In addition, we will use the survey data to compute the success rate of recent graduates who sought employment as college teachers.
4. *Analysis*: The Graduate Committee will discuss the results to determine if correlated areas of weakness emerge.

Use of Results to Improve Program:

5. *Improvement Action*; The Graduate Committee will meet with faculty teaching Math 6271 to provide a forum for discussion of issues related to the preparation of college mathematics instructors. Faculty teaching Math 6271 will provide guidance in the development of Teaching Portfolios. The Graduate Committee will address this in Fall 2009.

MA Educational Objective Graduate Program:

4. Program Learning Goal 4: Ensuring quality of instruction by GTAs.

First Means of Assessment for Objective Identified above:

Means of Assessment & Criteria for Success:
1. *Measured Outcome*: Some students in this program are supported as Graduate Teaching Assistants. Their duties may include teaching sections of remedial and introductory level college courses. It is our goal to provide adequate training and supervision to ensure the quality of instruction provided by our TAs.
2. *Metrics*: Two metrics are employed.
a) Each TA is required to take Math 6271, Teaching Collegiate Mathematics. This course is generally offered once per year, according to student demand. As part of this course students are required to produce a *teaching portfolio*, which is scored according to a rubric.
b) Each TA is assigned an experienced *faculty mentor* who provides advice and feedback on teaching matters. The mentors perform at least one *class observation* per semester for each TA who is currently teaching. The mentors evaluate and document these observations using the same *departmental rubric* employed with untenured faculty. The observation is graded on a scale of 1 to 5 on 10 teaching aspects and an overall score is assigned. The completed forms are provided to the TA as feedback and to the graduate director.

Description of Data Collection & Assessment Results:

3. *Results*: Results to be reported for this assessment are the rubric scores received on teaching portfolios, as well as the overall scores (1-5) achieved by the TAs in class observations performed during the past year.
4. *Analysis*: Faculty mentors and the Graduate Director will discuss the results,

noting the impact of any improvement action taken in previous cycles. Analysis is underway as of the writing of this report.

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Use of Results to Improve Program:

5. *Improvement Action*: The graduate director provides oversight of all TA assignments and may reassign TA duties to ensure the integrity of instruction provided. TAs judged deficient in teaching will be provided with additional training and observation by mentors and the graduate director. No data is in the hands of the Department Assessment Committee as of the writing of this report.

Global Objective:

1. Uses disciplinary concepts to explain how global and local issues are interconnected.

First Means of Assessment for Strategic Direction Outcome Identified above:

Means of Assessment:

Embedded essay question on test in Math 5322 (Foundations of Math) on different societal/cultural contributions to mathematics and quantitative analysis.

Criteria for Success:

75% of responses will fall in high category
High: Knows contributions of more than three major cultures and can cite multiple contributions from each culture
Medium: Knows contributions of two to three major cultures and can cite contributions from each culture
Low: Knows contributions of one ore less major cultures and can cite a contributions from each culture

Description of Data Collection & Assessment Results:

Data will be collected in Fall 2009 offering of Math 5322

Use of Results to Improve Program: assessment is underway now

Second Means of Assessment for Strategic Direction Outcome Identified above:

Means of Assessment:
Embedded essay question on test in Math 5322 (Foundations of Math) on interconnection and dynamics of geometry in multiple cultures

Criteria for Success:
75% will fall into high category.
High: Students write precise detailed essays on impact of geometry
Middle: Students write essays on impact of geometry without all relevant details
Low: Students write incomplete essays on impact of geometry

Description of Data Collection & Assessment Results:

Data will be collected in Fall 2009 offering of Math 5322

Use of Results to Improve Program: assessment is underway now

6.3 What changes should be made in the program so that it can better achieve faculty expectations? What ongoing process does the unit utilize to promote quality enhancement?

This is the most important of the three questions, focusing on the goal of outcomes assessment: improving programs. Outcomes assessment provides data that unit faculty can use to identify aspects of the program that are not meeting their expectations and then to make decisions for improving the program. Continuous collection of data can provide unit faculty the information they need to determine the extent to which changes they have made in their programs are having the desired effect of improving outcomes. Summaries of what unit faculty have learned about their programs based on outcomes assessment and what changes in their programs they will make are given in their unit outcomes/assessment reports.

The Review Committee report (including its recommendations) will be shared with the academic unit to assist faculty in developing a planned quality enhancement procedure.

At the writing of this report, the Mathematics Department has made the most progress in closing the assessment loop in the area of Foundation Goals. The College Algebra assessment has produced a wealth of information on student performance on every question of the comprehensive common final exam, with a sampling of these questions used in the actual assessment goal/objective. The Math 1065 committee met on the first day of the Fall 2009 semester and discussed the performance of the student on every question and category of topic. Poor performance on problems were identified and corrective strategies were identified.

We point out that the current assessment process just began during the last academic year, with the establishment of the goals/objectives and the corresponding metrics established in 2008-2009. The first sets of data are beginning to appear for analysis and this academic year 2009-2010.

In addition the Writing Assessment Committee met last spring 2009 to examine the mathematical writing of the BA/BS program majors, and they have identified 5 specific writing patterns to be improved and closed the loop with 5 specific recommendations for improvement in students' mathematical and proof writing skills. See Appendix O, BA/BS Program Objective/Goal 2.

A Senior Assessment exam was given in Spring 2009, but due to budgetary concerns had been delay for sending to ETS at Princeton. This data will be examined and analyzed in the near future.

The MA comprehensive exams were given just two weeks ago, and the review committees will be meeting in the near future to compare and analyze performance.

All of these can be seen in further detail in section 6.2 as well as in Appendix O.

6.4 Assessment Reports

In order to document the efforts of unit faculty to improve their programs, each unit has instituted a report of the assessment of program outcomes and the actions taken in response to the key findings of those assessments. The report could consist of brief responses to a set of questions with an emphasis on summarizing as opposed to providing details of assessment results. Possible questions that units may be posing are:

6.4.1 What outcomes were scheduled to be assessed during the present reporting period? What outcomes were actually assessed? [Please refer to the unit program assessment plan].

See 6.1 above

6.4.2 What data were collected? Summarize findings for these data.

See 6.2 above

6.4.3 What did the unit program administration and the faculty learn about the program and/or the students from the analysis of the data? What areas of concern have emerged from the assessment?

See Assessment Report in Appendix O

6.4.4 As a result of the assessment, what changes, if any, have the unit program administration and the faculty implemented or considered implementing to address areas of concern? (These can include changes in the program and in the assessment plan.) How will the effectiveness of these changes be measured?

See Assessment Report in Appendix O

6.4.5 What outcomes are being planned for assessment for the upcoming reporting period? (If they are different from what have been proposed in the assessment plan, please update the assessment plan to reflect the change).

See Assessment Report in Appendix O

6.4.6 If the program has had an external review in the past 7 years, summarize progress in achieving the Final Action Plan for the most recent review (The Final Action Plan from the unit program can be located at the Embedded Web-Site). How many action items have been completed? What items have yet to be completed? Briefly describe plans for completing these items and/or obstacles to completion.

N/A The math department has not had an external review in the past 7 years.

VII. CURRENT RESEARCH/CREATIVE ACTIVITY

7.1 *Current Research/Creative Activity:* Provide a brief description of significant ongoing research in the unit program. Indicate the major strengths or emphases of this research. Describe any unique programs that have national prominence. Describe three to five major research/creative activity accomplishments over the past seven years by faculty and/or graduate students in the unit and any new emphases planned for the near future (through new faculty hires, redirection of current faculty's research/creative activity, etc.)

The Mathematics Department has a strong research reputation, with established and recognized research programs in algebraic geometry, control theory, differential equations, harmonic analysis, logic, mathematical physics, number theory, operator algebras, representation theory, ring theory, statistics, and wavelets. Collaborative efforts within the department include: a group working in statistics; a group working in representation theory and harmonic analysis; a group working in logic and number theory; a group working in algebraic geometry; a group working in the overlap area of wavelets, advanced differential equations, and theta functions. Extramural collaborative efforts include: a faculty member working in mathematical physics with a number of physicists; a faculty member working with the medical school on the biomathematics of vascular flow and early detection of bruits; faculty members working on issues in an interdisciplinary approach to science, mathematics, and mathematics education; a faculty member working with early math placement testing and collegiate mathematics performance.

Professor Sasha Shlapentokh:
My research centers on questions of logic over algebraic objects such as questions of definability and decidability, e. g. extensions of Hilbert's Tenth Problem to number fields and function fields, and computable model theory of algebraic objects. This research to date has resulted in 48 published or accepted papers (authored and co-authored by me) and one monograph published by Cambridge University Press. I have also obtained funding from the National Security Agency (3 grants), the National Science Foundation (3 grants) and the Templeton Foundation.

Professors Chal Benson and Gail Ratcliff: study representation theory and harmonic analysis on Lie groups. They have been involved in a long term collaborative program to develop the theory of Gelfand pairs (K,N) associated with actions of compact groups K on nilpotent Lie groups N. Their recent results include a parametrization of the space of bounded spherical functions for such a pair (K,N) via certain orbits for the action of K on the dual for the Lie algebra of N (Transformation Groups, vol 13, no 2, 2008, pp. 243-281). Benson and Ratcliff conjecture that the correspondence between spherical functions and K-orbits is a topological homeomorphism. They have established this for several families of examples. Work on the general conjecture is ongoing.

Professor Chris Jantzen: Studies representation theory of reductive p-adic groups
Publications: 9 papers appeared/accepted (5 with coauthor)
Grants: 2 NSA grants funded/accepted (as well as 2 ECU grants and 2 College Research Awards)

Professor Robert L. Bernhardt: is Director of the North Carolina Early Mathematics Placement Testing Program. The Program is in its 14th year of funding as a grant to East Carolina University by the NC State Legislature. The 2009-10 budget is in excess of $187,000. The program underwent an outside review in June of 2008, at which time it was designated as the most outstanding EMPT program in the nation. A research program is being established to further study the effectiveness of the Program.

Professors David Pravica, Njina Randriampiry, and Michael Spurr: study multiplicatively advanced/delayed differential equations and their connection to the theories of wavelets, theta functions, and solutions of partial differential equations. Recent articles can be viewed at
http://dx.doi.org/10.1016/j.acha.2009.08.007 and
http://dx.doi.org/10.1016/j.acha.2008.09.002

Professor Ivana Alexandrova: My research lies in the area of scattering theory and semi-classical analysis. My most significant papers are the following:
Resolvent and Scattering Matrix at the Maximum of the Potential. With Jean-Francois Bony and Thierry Ramond. Serdica Mathematical Journal, 34 (2008): 267 - 310. Issue Dedicated to the 65th Anniversary of Professor Vesselin Petkov.
Semi-Classical Scattering Amplitude at the Maximum of the Potential. With Jean-Francois Bony and Thierry Ramond. Asymptotic Analysis, 58 (2008), 57 - 125.
Semi-Classical Wavefront Set and Fourier Integral Operators, Canadian Journal of Mathematics, 60 (2008), 241 - 263.
Prof. Alexandrova currently has an NSF grant from June 2008 until May 2011. I have been invited to present my work to many national and international conferences over the past five years.

Professor Abdulali's research in Algebraic Geometry has been focussed on the Hodge conjecture, especially in the context of abelian varieties. This research has so far led to 13 publications, including one in the Annals of Mathematics. These papers have been cited over 30 times by 13 different authors. The research has been supported by a grant from the National Security Agency, and several grants from East Carolina University.

Professor Elias Katsoulis
My research interests are focused on operator algebras with an emphasis on the non-selfadjoint aspects of the theory. I am currently interested in the classification problem for operator algebras and its relation with representation theory. Over the years, I have worked on various non-selfadjoint algebras such as nest algebras, CSL algebras and triangular AF algebras, free semigroup algebras, graph algebras and semicrossed products. Topics of investigation include the geometry of the unit ball, representation theory and isomorphic/epimorphic theory. I am also interested in Banach spaces and their isometric theory (extreme points, M-ideals, etc.).

Professor Zachary Robinson
Interests lie in the intersection of Model Theory and Algebraic Geometry, in particular, in analytic geometry over p-adic fields.

Professor Heather Ries
Interests lie in homological methods in group theory; and mathematics education.

Professor David W. Pravica
Areas of Interest : Scattering theory for the wave equation, Spectral resonances for physical systems, Fluid flows in a compact domain, Advanced and Delayed Differential Equations, Mathematical Applications to the Health Sciences

Professor M. S. Ravi
My research interests are twofold: understanding the defining equations of algebraic varieties, and applications of algebraic geometry to systems and control theory. I have pursued the second interest, for the most part, in collaboration with Joachim Rosenthal and Xiaochang Wang . My interests in systems theory has also led me to dabble in quantum cohomology of the Grassmanian, and its applications to the interpolation theory of rational matrix functions.

Professor Christopher A. Carolan
Order restricted inference, stochastic orderings, stochastic processes, quality control.

Professor Teresa Obuchowska has research interests in: Mathematical programming, optimization theory; in particular convex optimization and most recently some aspects of nonlinear integer programming.

7.2 *National Comparison:* Briefly describe how the research/creative activity effort in the unit compares to that in the discipline nationally in terms of focus areas and breadth of coverage.

The Mathematics Department has a strong research reputation, with established and recognized research programs in algebraic geometry, control theory, differential equations, harmonic analysis, logic, mathematical physics, number theory, operator algebras, representation theory, ring theory, statistics, and wavelets. Collaborative efforts within the department include: a group working in statistics; a group working in representation theory and harmonic analysis; a group working in logic and number theory; a group working in algebraic geometry; a group working in the overlap area of wavelets, advanced differential equations, and theta functions.

7.3 *Interdisciplinary Projects:* What opportunities are there for carrying out interdisciplinary research/creative activity projects with other units on campus and with other universities, state or federal agencies, and industry? Are the present needs for interdisciplinary research/creative activity being accommodated? How successful are the efforts? Are there plans for increasing such efforts in the future?

Extramural collaborative efforts include: a faculty member working in mathematical physics with a number of physicists; a faculty member working with the medical school on the biomathematics of vascular flow and early detection of bruits; faculty members working on issues in an interdisciplinary approach to science, mathematics, and mathematics education; a faculty member working with early math placement testing and collegiate mathematics performance.

Further increase in collaborative efforts will depend on future hiring approaches along with any decision toward a focus on applications.

7.4 *External Research/Creative Activity Support:* Evaluate the level of external funding for research/creative activity in the unit program. Comment on any trends. Is the unit program competing effectively for external support?

Professor Sasha Shlapentokh: has obtained funding from the National Security Agency (3 grants), the National Science Foundation (3 grants) and the Templeton Foundation.

Professor Chris Jantzen: Grants: 2 NSA grants funded/accepted (as well as 2 ECU grants and 2 College Research Awards)

Professor Ivana Alexandrova: has a current NSF grant from June 2008 until May 2011

Professor Gail Ratcliff: has NSF **ITEST** grant in collaboration with the Engineering department **$1.35m., NSF.**

Professor Zach Robinson: has continuous NSF grant support over the period 2002-2008 (and prior).

Professor Bob Bernhardt: has continuous EMPT grant support from 2003-2009 totaling $1,220,725.

Professor Heather Ries: has grants totaling over $236,000

Professor Salman Abdulali: Grant from National Security Agency, 2004-2005, $10,653

7.5 *Research Development:* What does the unit do to encourage and develop research/creative activity collaborations with faculty performing similar research/creative activities elsewhere in the university? Also, please describe deficiencies in facilities and resources that impede the unit's attempts to reach its objectives and any plans to address these deficiencies.

There are individual efforts at collaboration. The unit could in the future strategically target hires toward collaborative areas. This could include cluster hires with other science departments in future years.
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7.6 *Ethics Training:* Describe any education in research/creative activity and professional ethics that the unit program provides for its students. Such education could include courses, workshops, seminars offered by the unit program or by related programs or other appropriate experiences, such as the use of resources provided by the university.

The Mathematics Department does not currently require that students in the BA or BS or MS programs have formal training in research/creative activity or professional ethics.

VIII. SERVICE/OUTREACH

8.1 *Consulting:* To what extent are faculty involved in outside consulting work, paid and non-paid? Provide a quantitative and qualitative assessment of this type of work, and explain in what ways it contributes to the unit's program and to the mission of ECU.

The main consultation provided by the mathematics department is provided by members of the statistics area, with advice/consultation for colleagues on campus and some occasional consulting externally.

8.2 *Community Service/Engagement:* To what extent is the unit's professional expertise made available to the community, state and nation through formal service programs, lectures, exhibits, public symposia, or concerts or through faculty service on governmental boards, scientific/professional associations, etc.? Evaluate the quality of this service, and indicate how it contributes to the unit's graduate instructional and research programs.

- The North Carolina Early Mathematics Placement Testing Program is currently in its fourteenth year. The Program is funded as a grant directly to East Carolina University by the NC State Legislature, with oversight by the office of the ECU Provost and the UNC General Administration. The 2009-10 budget is in excess of $187,000. The Program directly supports the *UNC Tomorrow* mandates to increase the articulation between high schools and UNC system colleges and universities, and to increase accessibility to higher education for all citizens of North Carolina. Another of the major goals of the Program is to decrease the percentages of incoming college students requiring remedial mathematics. This is accomplished by giving a college mathematics placement test to high school students, and sending a letter to those high school participants who are in danger of placing into remedial mathematics when they enroll in college. This motivates the students to take corrective actions before they graduate from high school. The Program is directed by Dr. Robert Bernhardt, Professor of Mathematics; there is also an associate director, a secretary, and 3 – 5 paid student helpers. The program underwent an outside review in June of 2008, at which time it was designated as the most outstanding EMPT program in the nation.
- The Mathematics Department has sponsored and staffed a tutorial program aimed at retention of minority students. For over ten years mathematics professors have held weekly tutorial sessions each semester at the Ledonia Wright Cultural Center in the Bloxton House on the ECU campus. These have been staffed by David Pravica, Heather Ries, Zach Robinson, and Mike Spurr. Any student with mathematical problems or questions has direct access to mathematics professors who hold sessions in the Bloxton House.

- Math Counts is the middle school / high school mathematics competition sponsored by the Professional Engineering Society. This annual competition is supported by numerous mathematics professors and mathematics majors each Spring semester. The main form of support is grading and scoring the mathematics tests of the individual and team competitions.
- The Math Contest is a major high school mathematics competition for the entire eastern region of North Carolina. It has been in existence for over 30 years, with continuous hosting and sponsorship of the ECU mathematics department. Approximately 65 middle/high schools (and 800 individuals) participate annually in Algebra 1 and 2, Geometry, and Comprehensive mathematics exams as well as in team competition. Winners and high placers go on to the statewide mathematics competition in Durham. Dr. Chris Carolan along with Gwen Hardin currently oversee the Math Contest, with computer/grading support by Dr. John Crammer. The whole mathematics department (including faculty, staff, and numerous mathematics majors and students) participates in the math contest through: oversight, communication with participating schools, hosting, design of tests and questions, proctoring of tests, distribution of awards, recruiting, and overall management of the contest. This is a major endeavor and outreach to area high schools by the ECU Mathematics Department.

8.3 *Student Involvement in Community Service/Engagement:* To what extent are students exposed to formal or informal outreach activities?

Mathematics majors participate in the ECU mathematics contest (where most majors provide hosting, guiding, proctoring, and organizational services). See 8.2 for a more complete description of the Math Contest. In addition, majors also participate in MathCounts as graders (of the mathematics competition hosted by the professional engineers). In addition, many mathematics majors are double majors in mathematics education, and as such serve as student teachers in the area high schools their senior year.

IX. OTHER ISSUES FACED BY THE PROGRAM/DEPARTMENT

See Supplemental Materials Folder

X. ACCREDITATION

If accreditation has been attained, provide the name of the accrediting agency, and indicate the date accreditation was granted and the frequency of accreditation review. If accreditation has been denied or has not yet been attained, describe the current status of the program in relation to gaining accreditation.

Not Applicable to the Mathematics Department.

XI. SUMMARY COMMENTS AND VISION FOR THE FUTURE

10.1 Summarize the major strengths and weaknesses of the unit program(s), including the self-study process.

10.2 Briefly describe the program’s vision/strategic plan for the immediate future: Review the unit's major goals for the program(s) over the next five years, and describe their relation to the University’s Strategic Plan and to a long-term strategy for resource allocation or reallocation.

See Supplemental Materials Folder

APPENDIX B
Degree Program Graduate's Placement Data

BA/BS PLACEMENT DATA

Placement data on our undergraduate majors tends to be incomplete. Below is a sampling of some of our high achieving majors. The largest block of our majors are mathematics/mathematics-education majors and teach in area high schools.

A number of our BA mathematics graduates have entered graduate programs and received advanced degrees since 2002 (or are currently pursuing advanced degrees). These include:

- Matthew Higgins (BA ECU 2003) received his MD from the ECU Brody School of Medicine in 2007. He is currently a Family Practice Physician at the Anderson Area Medical Center in South Carolina.
- Kristina Batchelor (BA ECU 2005) received her Masters in Economics from North Carolina State University in 2007. She is currently a Credit Analyst at GMAC.
- Shannon Pollard Duvall (BA ECU 1997) received her PhD in Computer Science from Duke University in 2007. She is currently a recently tenured Associate Professor in the Department of Computer Sciences at Elon University.
- Leah Yates (BA ECU 2004) received her Masters in Arts in Teaching from Duke University in 2006. She is currently teaching mathematics at Riverside High School in Durham. As an undergraduate at ECU Leah published a mathematics article in the Rose-Hulman Undergraduate Math Journal: "Tight Subdesigns of the Higman-Sims Design" http://www.rose-hulman.edu/mathjournal/v5n2.php
- Shannon McClintock (BA ECU 2004) is currently pursuing her PhD in Biostatistics at Emory University under the direction of Prof. Lance Waller, Chair of the Biostiatistics Department in the Rollins School of Public Health.
- Jonathan Dunbar (BA ECU 2003) is in the PhD program in Mathematics at North Carolina State University, studying Vertex Algebras.
- Brain Bucklein (BA ECU 2002 Physics/Math Double major) is in the PhD program in Physics and Astronomy at Brigham Young University in Utah, studying under J. Ward Moody.
- The first eight of the ECU MA graduates listed immediately below in this section as receiving/pursuing PhD's are ECU BA graduates.

MA PLACEMENT DATA

Thirty eight students have received their MA degrees since 1/2002. Of 37 graduates

- 6 are employed as high school teachers throughout Eastern North Carolina,
- 11 are employed as college mathematics instructors (6 of these in our own department, 5 at community colleges),
- 7 entered PhD programs (2 in Math Education, 2 in Mathematics, 3 in Statistics or Applied Mathematics),
- 7 hold technical positions in business, industry, or government,
- 1 is on military deployment, and
- 2 are deceased.

We have no information on the remaining 4 graduates.

Seven ECU MA graduates since 2002 have entered PhD programs. Five ECU Mathematics MA program graduates have completed PhD's during the period of this program review. Four of these are currently university faculty. These include:

- Charles Touron (MA ECU 1999) received his PhD in Applied and Computational Mathematics from Old Dominion University in August 2009. He has taught at Old Dominion and at Tidewater Community College, and he is currently seeking employment in industry.
- Jason Brinkley (MA ECU 2003) received his PhD in Statistics from North Carolina State University in 2008. He is currently an Assistant Professor in the Department of Biostatistics at East Carolina University.
- Adam Harbaugh (MA ECU 1999) received his PhD in Curriculum and Instruction from Texas A&M University in 2005. He is currently an Assistant Professor in the Department of Middle, Secondary, & K-12 Education at the University of North Carolina at Charlotte.
- John David Herron (MA ECU 1999) received his PhD in Mathematics from the University of North Carolina at Charlotte in 2004. He is currently an Assistant Professor in the Department of Biology, Chemistry, and Mathematics at the University of Montevallo, Alabama.
- Robin Rider (MAEd ECU 1990) received her PhD in Mathematics Education from North Carolina State University in 2004. She is currently an Assistant Professor in the College of Education at the University of Washington, Bothell.

Also:

- Derek Williams (MA ECU 2009),
  Jonathan Dunbar (MA ECU 2006), and
  Peter Holt Wilson (MA ECU 2003) are in the PhD program in Mathematics at North Carolina State University.
- Ting Yang (MA ECU 2005) is in the PhD program at University of Maryland
- Tianle Hu (MA ECU 2005) is in the PhD program at University of Michigan

Graduates of the ECU Masters Program who currently hold positions as mathematics instructors at area community colleges include:

- Stephanie Woodley, Chair, Pitt Community College
- Lara Smith, Pitt Community College
- Meg Boles, Pitt Community College
- Bonnie Galloway, Pitt Community College
- Kim Mullis, Beaufort County Community College
- Ravi Sharma, Beaufort Community College
- Allen Brooks, Cartaret Community College
- Carolyn Winfree, Edgecombe Community College
- Jonathan Tyndall, Lenoir Community College
- Mary Frances Uzzell, Wayne Community College

Graduates of the ECU Masters Program who currently hold positions as Teaching Faculty in the Mathematics Department at ECU include:

- Beth Andrews
- Joe Bland
- April Church
- David Edwards
- Debbie Ferrell
- Bonnie Galloway
- Anne Heritage
- Paul Kornegay
- Gerry MacLeod
- Jennifer Mayo
- Vicky McGlohorn
- Kimberly Mullis
- Maxine Ouellette
- Kathy Stanley
- Anthony Van Hoy
- Cathy Wilkerson
- Darlene Worthington

APPENDIX C
Degree Programs / Degree Concentrations

The Mathematics Department has two undergraduate degree programs, the BA in Mathematics and the BS in Mathematics. The requirements for the two degrees are summarized in the paragraphs below. For the details of the specific courses required, please see the official catalog description of each degree and the catalog description of courses which is also attached.

The BA in Mathematics (CIP code 27.0101) requires a minimum of 126 credit hours. This includes 42 hours of Foundations courses and 12 hours of Foreign Language. All students must take a common math core of 30 hours and also must complete a concentration in either Math or Statistics.

The Math concentration ranges from 30-36 hours and requires the students to take two math electives (6 hours) and to complete a minor (24-30 hours). The Statistics concentration requires 27 hours, 3 math electives (9 hours) and 18 hours of cognates from Math, Economics, and Computer Science.

The BS in Mathematics (CIP code 27.0101) requires a minimum of 126 credit hours. This includes 42 hours of Foundations courses. The students are required to complete a common core of 37 hours – 33 hours of Mathematics courses and 4 hours in Computer Science. The students must also complete a concentration in one of four areas: Mathematics, Science, Statistics, or Computer Science. The Math concentration ranges from 27-33 hours and requires the students to complete 12 additional hours of mathematics (Complex Variables and three electives) and a minor (24-30 hours). The Science Concentration requires the students to complete 6 additional hours of mathematics (Complex Variables and one elective) and 27-28 hours of courses in sciences. Of these hours, the students must take at least 8 hours of Chemistry and 8 hours of Physics. The Statistics Concentration requires that the students take 15 additional hours of Math courses that focus on statistics, 3 hours of English, and 3 hours of Philosophy. There is a requirement of 9 additional hours of electives, 6 of which must be in mathematics. The Computer Science concentration requires that the students complete 16 hours in Computer Science and 12 additional hours of electives, 9 in Computer Science and 3 in Mathematics.

The following table shows the total number of students enrolled in the BA or BS program in a given semester for the last five years:

Semester	BA	BS
Fall 2004	21	2
Spring 2005	16	8

Fall 2005	10	14
Spring 2006	12	13
Fall 2006	8	16
Spring 2007	6	15
Fall 2007	14	24
Spring 2008	14	24
Fall 2008	14	23
Spring 2009	20	29

There are about 18-20 tenured and tenure-track faculty that teach the courses for the BA and the BS program. Fixed term faculty usually do not teach courses for the BA or the BS program.

Catalog Entries for BA in Mathematics and BS in Mathematics:

BA in Mathematics

Credit toward a mathematics major will not be given in any MATH course or in CSCI 2310, 2311 with a grade less than C. The degree offers two concentration areas: mathematics and statistics. The mathematics concentration requires a minor and the statistics concentration requires specified cognates in lieu of a minor. Minimum degree requirement is **126 s.h.** of credit as follows:

1. Foundations curriculum (See Section 4, Foundations Curriculum Requirements for all Baccalaureate Degree Programs.) - 42 s.h.
2. Foreign language through level 1004 - 12 s.h.
3. Common core - 30 s.h.

   MATH 2171, 2172, 2173. Calculus I, II, III (4,4,4) (F,S,SS) (FC:MA) (P for 2171: minimum grade of C in any of MATH 1083,1085, 2122; P for 2172: minimum grade of C or 2122 with consent of instructor; P for 2173: MATH 2172 with a minimum grade of C)
   MATH 2300. Transition to Advanced Mathematics (3) (P: MATH 2171)
   MATH 3256. Linear Algebra (3) (F,S,SS) (P: MATH 2172)
   MATH 3263. Introduction to Modern Algebra (3) (WI) (F,S) (P: MATH 2300, 3256)
   MATH 3307. Mathematical Statistics I (3) (F,S) (P: MATH 2172)
   MATH 4101. Advanced Calculus I (3) (F,S) (P: MATH 2173, 2300; or consent of instructor)
   MATH 4331. Introduction to Ordinary Differential Equations (3) (F,S) (P: MATH 2173)

4. Cognate - 4 s.h.

CSCI 2310,2311. Algorithmic Problem Solving and Programming Laboratory (4,0) (F,S,SS) (P: MATH 1065; C for 2310: CSCI 2311; C for 2311: CSCI 2310)

5. Concentration area to include minor or specified cognates as listed below.

   (Choose one area.) - 31-40 s.h.
   Mathematics (30-36 s.h.):
   Choose 6 s.h. of MATH electives numbered above 2999, excluding MATH 3229, 3237, 3239
   Minor (24-30 s.h.)
   Statistics (27 s.h.):
   Choose 9 s.h. of MATH electives numbered above 2999, excluding MATH 3229, 3237, 3239, and excluding cognates listed below.
   Cognates (18 s.h.):
   CSCI 5774. Programming for Research (3) (F,S) (P: General course in statistics or consent of instructor)
   MATH 3308. Mathematical Statistics II (3) (F) (P: MATH 3307)
   MATH 5031. Applied Statistical Analysis (3) (WI) (P: MATH 2228 or 3308; 3584; or equivalent)
   MATH 5801. Probability Theory (3) (P: MATH 2173 or 3307)
   Choose 6 s.h. from:
   ECON 3343. Econometrics (3) (F,S) (FC:SO) (P: DSCI 2223 or CSCI 2600; ECON 2133; MATH 2283)
   ECON 4430. Business Cycles and Forecasting (3) (P: ECON 3244, 3343; or consent of instructor)
   MATH 4201. Introduction to Stochastic Processes (3) (S) (P: MATH 3307 or equivalent or consent of instructor)
   MATH 5000. Introduction to Sampling Design (3) (P: MATH 3308 or 3229 or consent of instructor)
   MATH 5132. Probabilistic Methods in Operations Research (3) (P: MATH 2173, 3256, 3307; or 5801)
   OMGT 4493. Quality Management (3) (F) (P: OMGT 3123.)

6. Electives to complete requirements for graduation.

BS in Mathematics

Credit toward a mathematics major will not be given in any MATH course or in CSCI 2510 with a grade less than C. Minimum degree requirement is **126 s.h.** of credit as follows:

1. Foundations curriculum (See Section 4, Foundations Curriculum Requirements for all Baccalaureate Degree Programs.) - 42 s.h.
2. Common mathematics core - 37 s.h.

MATH 2171, 2172, 2173. Calculus I, II, III (4,4,4) (F,S,SS) (FC:MA) (P for 2171: MATH 1083, 1085, 2122 with minimum grade of C; P for 2172: MATH 2171 or 2122 with consent of instructor; P for 2173: MATH 2172)
MATH 2300. Transition to Advanced Mathematics (3) (P: MATH 2171)
MATH 3256. Linear Algebra (3) (F,S,SS) (P: MATH 2172)
MATH 3263. Introduction to Modern Algebra (3) (WI) (F,S) (P: MATH 2300, 3256)
MATH 3307. Mathematical Statistics I (3) (F,S) (P: MATH 2172)
MATH 3308. Mathematical Statistics II (3) (F) (P: MATH 3307)
MATH 4101. Advanced Calculus I (3) (P: MATH 2173, 2300, or consent of instructor)
MATH 4331. Introduction to Ordinary Differential Equations (3) (F,S) (P: MATH 2173)
CSCI 2310, 2311. Algorithmic Problem Solving and Programming Laboratory (4,0) (F,S,SS) (P: MATH 1065; C for 2310: CSCI 2311; C for 2311: CSCI 2310)

3. Concentration area (Choose one area.) - 20-27 s.h.

Mathematics (27-33 s.h.):
MATH 4110. Elementary Complex Variables (3) (S) (P: MATH 2173)
Minor (24-30 s.h.)
Science (27-28 s.h.)
CHEM 1150, 1151. General Chemistry and Laboratory I (3,1) (F,S,SS) (FC:SC) (P: chemistry placement test or passing grade in CHEM 1050; P/C: MATH 1065; C for 1150: CHEM 1151; C for 1151: CHEM 1150)
CHEM 1160, 1161. General Chemistry and Laboratory II (3,1) (F,S,SS) (FC:SC) (P: CHEM 1150, 1151; C for 1160, CHEM 1161; C for 1161: CHEM 1160; R/C: MATH 1083 or 1085)
MATH 4110. Elementary Complex Variables (3) (S) (P: MATH 2173)
PHYS 2350, 2360. University Physics (4,4) (F,S,SS) (FC:SC) (C: MATH 2121 or 2171; P for PHYS 2360: PHYS 2350)
Choose one of the following:
BIOL 1100, 1101. Principles of Biology I (4,0) (F,S,SS) (FC:SC) and BIOL 1200, 1201. Principles of Biology II (4,0)(F,S,SS) (FC:SC)
A combination of any 3 courses numbered above 1999 in Chemistry or numbered above 3999 in Physics.
Statistics (21 s.h.)
ENGL 3880. Writing for Business and Industry (3) (WI) (F,S,SS) (P: ENGL 1200)
MATH 4031. Applied Statistical Analysis (3) (WI) (P: MATH 2228 or 2283 or 3308; MATH 3256 or MATH/CSCI 3584; or equivalent; or consent of instructor)
MATH 4201. Introduction to Stochastic Processes (3) (P: MATH 3307 or equivalent or consent of instructor) or MATH 5000. Introduction to Sampling Design (3) (F) (P: MATH 3308 or 3229 or consent of instructor)
MATH 4774. Programming for Research (3) (P: MATH 2228 or MATH 2283 or equivalent)

MATH 4801. Probability Theory (3) (P: MATH 2173 or 3307)
MATH 4999. Capstone and Statistical Consulting (3) (P: MATH 4031)
PHIL 2274. Business Ethics (3) (F,S,SS) (FC:HU)
Computer Science (16 s.h.)
CSCI 2300. Computer Science Survey (3) (F,S,SS)
CSCI 3300. Introduction to Algorithms and Data Structures (4) (F,S,SS) (P: CSCI 2300, 2310, 2427)
CSCI 3310. Advanced Data Structures and Data Abstraction (3) (F,S,SS) (P: CSCI 3300)
CSCI 3650. Analysis of Algorithms (3) (S,SS) (P: CSCI 3200 or 3300; CSCI 2427)
CSCI 3526. Switching Theory and Computer Organization (3) (F,SS) (P: CSCI 2310 or CSCI 2610; CSCI 2427) or CSCI 3675. Organization of Programming Language (3) (F,SS) (P: CSCI 3200 or 3310) or MATH 4110. Elementary Complex Variables (3) (S) (P: MATH 2173)

4. Specified electives

   Mathematics (9 s.h.):
   Choose 9 additional s.h. in consultation with advisor from MATH 3174, 3233, 3573, 4201, 4264, 4801, 5000, 5002, 5021, 5102, 5121, 5122, 5131, 5132, 5311, 5322, or 5551.
   Science (3 s.h.)
   Choose 3 additional s.h. in consultation with advisor from MATH 3174, 3233, 3573, 4201, 4264, 4801, 5000, 5002, 5021, 5102, 5121, 5122, 5131, 5132, 5311, 5322, or 5551.
   Statistics (9 s.h.)
   Choose 3 additional s.h. from MATH 4201, 5000, 5132; OMGT 4493; ECON 3343, 4430.
   Choose 6 additional s.h. from MATH 3174, 3233, 3573, 4110, 4264, 5002, 5021, 5102, 5121, 5122, 5131, 5132, 5311, 5322 or 5551.
   Computer Science (12 s.h.)
   Choose 3 s.h. from MATH 3174, 3233, 3573, 4201, 4264, 4801, 5000, 5002, 5021, 5102, 5121, 5122, 5131, 5132, 5311, 5322 or 5551.
   Choose 9 s.h. of CSCI electives numbered above 1999, excluding 2300, 2310/2311, 2510, 2610, 2611, 3300, 3310, 3510, 3584, 3601, 3650.

5. Electives to complete requirements for graduation.

Mathematics Minor

Minimum requirement for mathematics minor is **24 s.h.** of credit as follows:

1. Core - 21 s.h.

MATH 2171, 2172, 2173. Calculus I, II, III (4,4,4) (F,S,SS) (FC:MA) (P for 2171: minimum grade of C in any of MATH 1083, 1085, 2122; P for 2172: MATH 2171 with a minimum grade of C or 2122 with consent of instructor; P for 2173: MATH 2172 with a minimum grade of C)
MATH 2300. Transition to Advanced Mathematics (3) (P: MATH 2171)
MATH 3256. Linear Algebra (3) (F,S,SS) (P: MATH 2172)
MATH 3263. Introduction to Modern Algebra (3) (WI) (F,S) (P: MATH 2300, 3256) or MATH 5101. Advanced Calculus I (3) (P: MATH 2173, 2300; or consent of instructor)

2. Electives acceptable for a major in mathematics - 3 s.h.

Statistics Minor

(Not open to majors in Mathematics)
Minimum requirement for statistics minor is **26 s.h.** of credit as follows:

1. Core - 23 s.h.

CSCI 5774. Programming for Research (3) (P: General course in statistics or consent of instructor)
MATH 2171. Calculus I (4) (F,S,SS) (FC:MA) (P: MATH 1083 or 1085 or 2122 with minimum grade of C)
MATH 2172. Calculus II (4) (F,S,SS) (FC:MA) (P: MATH 2122 with a minimum grade of C or MATH 2171)
MATH 3256. Linear Algebra (3) (F,S,SS) (P: MATH 2172)
MATH 3307. Mathematical Statistics I (3) (F,S) (P: MATH 2172)
MATH 3308. Mathematical Statistics II (3) (F) (P: MATH 3307)
MATH 5031. Applied Statistical Analysis (3) (WI) (P: MATH 2228 or 3308; 3584; or equivalent)

2. Electives (Choose from the following.) - 3 s.h.

ECON 3343. Econometrics (3) (F,S) (FC:SO) (P: MIS 2223 or CSCI 2600; ECON 2133; MATH 2283)
ECON 4430. Business Cycles and Forecasting (3) (FC:SO) (P: ECON 3244, 3343; or consent of instructor)
MATH 4201. Introduction to Stochastic Processes (3) (S) (P: MATH 3307 or equivalent or consent of instructor)
MATH 5000. Introduction to Sampling Design (3) (P: MATH 3308 or 3229 or consent of instructor)
MATH 5132. Probabilistic Methods in Operations Research (3) (P: MATH 2173, 3256, 3307; or 5801)
MATH 5801. Probability Theory (3) (P: MATH 2173 or 3307)
OMGT 4493. Quality Management (3) (F) (P: OMGT 3123)

MATH: Mathematics Top

0001. Intermediate Algebra-A (2) (F,S,SS)

May not be taken by students who have credit for MATH 0045, 1065, 1074, 1085, 2119, 2171, or who have passed the math placement test. May not count toward foundations curriculum math requirement, certification, or degree. Remedial course in basic algebra; some sections may be taught in a lab/tutorial mode.

0045. Intermediate Algebra-B (2)

May not be taken by students who have credit for MATH 0001, 1065, 1074, 1085, 2119, 2171, or who have passed the math placement test. May not count toward foundations curriculum math requirement, certification, or degree. Remedial basic algebra. Some sections may be taught in lab/tutorial mode.

1050. Explorations in Mathematics (3) (F,S,SS) (FC:MA)

May not count toward MATH major or minor. Fulfills foundations curriculum MATH requirement for students whose major does not require a specific MATH course. Broad overview of mathematics and its relevance to life. Selected topics include at least four of the following: algebraic concepts, geometry, set theory and logic, number theory, discrete mathematics, statistics, consumer mathematics/finance, and history of mathematics.

1065. College Algebra (3) (F,S,SS) (FC:MA)

May not be taken by students who have credit for MATH 1085. P: Appropriate score on math placement test. Topics include sets; linear, quadratic, polynomial, and exponential functions; inequalities; permutations; combinations; binomial theorem; and mathematical induction.

1066. Applied Mathematics for Decision Making (3) (F,S,SS) (FC:MA)

Required for students planning to major in business administration or accounting. P: Appropriate score on the math placement test or approval of the dept chair. Skills in formulating models for and interpreting solutions to business word problems. Topics include linear and nonlinear equations, systems of linear equations, applications of matrix algebra, and applied basic differential calculus. No proofs included.

1067. Algebraic Concepts and Relationships (3) (F,S) (FC:MA)

May not count toward MATH or CSCI major or minor. P: Appropriate score on math placement test. Properties of integers, rationals, real and complex numbers, and polynomials from an algebraic point of view; conjectures and intuitive proofs in number theory; properties of linear and quadratic functions. Representations of real-world relationships with physical models, charts, graphs, equations and inequalities. Emphasis on development of problem-solving strategies and abilities.

1074. Applied Trigonometry (2) (F,S,SS)

Students who plan to take MATH 2171 must choose 1083 or 1085. May not be taken by students who have credit for MATH 1083 or 1085. P: MATH 1065. Practical and computational aspects of trigonometry. Properties of trigonometric functions. Use of tables, interpolation, logarithms, solution of right and oblique triangles, and applications.

1077. Pre-Calculus Concepts and Relationships (3) (S)
May not count toward MATH or CSCI major or minor. P: MATH 1067. Modeling approach to study of functions (including logarithmic, exponential, and trigonometric functions), data analysis, and matrices. Foundation for future course work in calculus, finite mathematics, discrete mathematics, and statistics.

1083. Introduction to Functions (3) (F,S,SS) (FC:MA)
May not be taken by students who have successfully completed MATH 1074 or MATH 1085. P: MATH 1065 with a minimum grade of C. Accelerated introduction to language of functions. Emphasis on trigonometry as a preparation for calculus sequence MATH 2171-73.

1085. Pre-Calculus Mathematics (5) (F,S,SS) (FC:MA)
May not be taken by students who have credit for MATH 1074. P: MATH 1065 with minimum grade of C. Algebra and trigonometry for qualified students who plan to take calculus.

2119. Elements of Calculus (3) (F,S,SS) (FC:MA)
May not receive credit for MATH 2119 after having received credit for a higher numbered calculus course. P: MATH 1065 with minimum grade of C. Elementary differentiation and integration techniques. Proofs not emphasized.

2121. Calculus for the Life Sciences I (3) (F,S,SS) (FC:MA)
May not receive credit for MATH 2121 after taking MATH 2171 P: MATH 1065 or 1077 with minimum grade of C. Introductory differential calculus with biological sciences applications. Introduces differentiation of exponential and logarithmic functions. Applications to exponential biological phenomena, related rates, regions of increase and decrease, and extrema.

2122. Calculus for the Life Sciences II (3) (F,S,SS)
May not receive credit for MATH 2122 after taking MATH 2172. P: MATH 2121. Introductory integral calculus with biological sciences applications. Introduction to and applications of definite integrals. Introduces trigonometric functions with applications to periodic biological phenomena. Functions of several variables, partial derivatives, simple differential equations, and arithmetic of matrices and vectors.

2124. Elementary Mathematical Models (1)
P: MATH 2171. Formulation and solution of various types of problems using techniques of establishing a mathematical model.

2127. Basic Concepts of Mathematics (3) (F,S,SS) (FC:MA)
May not count toward MATH or CSCI major or minor. P: Appropriate score on math placement test. System of real numbers and subsystems and their properties from an algebraic viewpoint. Statistics and number theory.

2151. Engineering Calculus I (3) (S) FC:MA
3 lecture hours per week. P: MATH 1083 or 1085 or placement test criteria; or consent of instructor. Fundamentals of single variable differentiation with applications to problems in geometry, engineering, and physics. Includes applications to engineering areas.

2152. Engineering Calculus II (3) (S) FC:MA
3 lecture hours per week. P: MATH 2151 or 2171; or consent of instructor. Fundamentals of single variable integration with applications to problems in geometry, engineering, and physics. Includes applications to engineering areas such as, work and moments.

2153. Engineering Calculus III (3) (F) FC:MA
3 lecture hours per week. P: MATH 2152 or 2172; or consent of instructor. Fundamentals of vector functions and multivariable calculus including partial derivatives, multiple integrals, and vector calculus. Includes applications to engineering problems such as motion in space, and force fields.

2154. Engineering Linear Algebra and Differential Equations I (4) (S)
3 lecture and 2 lab hours per week P: ICEE 2050; MATH 2153. First order and second order linear differential equations, Laplace transforms, systems of equations and general matrix theory. Includes software applications to solve differential equations and systems of equations.

2171. Calculus I (4) (F,S,SS) (FC:MA)
P: minimum grade of C in any of MATH 1083, 1085, or 2122. First of three course sequence. Brief review of precalculus, limits and continuity, differentiation and its applications, and integration.

2172. Calculus II (4) (F,S,SS) (FC:MA)
P: MATH 2171 with a minimum grade of C or MATH 2122 with consent of instructor. Second of three-course sequence. Transcendental functions, applications of integrals, techniques of integration, and infinite series.

2173. Calculus III (4) (F,S,SS) (FC:MA)
P: MATH 2172 with a minimum grade of C. Third of three-course sequence. Conics, parametrized curves, polar coordinates, vectors and analytic geometry in space, partial derivatives, and multiple integrals.

2228. Elementary Statistical Methods I (3) (F,S,SS) (FC:MA)
For students with limited mathematical training. May not count toward MATH major or minor. May receive credit for one of MATH 2228, 2283. P: MATH 1065 or equivalent. Collection, systematic organization, analysis and interpretation of numerical data obtained in measuring certain traits of a given population.

2282. Data Analysis and Probability (3) (F,S) (FC:MA)
May not count toward MATH or CSCI major or minor. May receive credit for one of MATE or MATH 2282, 2935. P: MATE or MATH 1067. Collection of data from experiments and surveys. Organizing and representing data. Interpreting data for judging claims, making decisions, or making predictions.

2283. Statistics for Business (3) (F,S,SS) (FC:MA)
May receive credit for one of MATH 2228, 2283. P: MATH 1065 or 1066 or equivalent. Sampling and probability distributions, measures of central tendency and dispersion, hypothesis testing, Chi-square, and regression.

2300. Transition to Advanced Mathematics (3)

P: MATH 2171. Proof methods including induction, naïve set theory, functions and relations, cardinality, basic number theory, completeness of the real number system.

2427. Discrete Mathematical Structures (3) Same as CSCI 2427

May not count toward MATH major or minor. May receive credit for one of MATE or MATH 2775, 3237, or MATH 2427. P: MATH 1065 or 1066. Structures of discrete mathematical structures. Special emphasis is given to those structures most important in computer science. Considers practical applications of the subject.

2775. Topics in Discrete Mathematics (3) (S) (FC:MA)

For prospective teachers of secondary school math. May receive credit for one of MATE or MATH 2775, 3237 or MATH 2427. P: MATH 1085. Selected topics include counting techniques, graph theory, difference equations, recursion, iteration, induction, and dynamical systems.

2935. Data Analysis (3) (F) (FC:MA)

May receive credit for one of MATE or MATH 2282, 2935. P: MATH 1085. Introductory course utilizing hands-on approach to collection, representation, and interpretation of data. Topics include types of data, sampling techniques, experimental probability, sampling distributions, simulations, and hypothesis testing using collected.

3100. Mathematical Methods for Engineers and Scientists (4) (F,S,SS)

May not count toward MATH major or minor. May not be taken by students who have credit for MATH 2173 or MATH 3256 or MATH 4331. P: MATH 2172; or equivalent; or consent of instructor. Functions of several variables, partial derivatives, first and second order differential equations, matrices, determinants, cofactor expansions, vector spaces, linear independence/dependence, linear transformations, eigenvalues/eigenvectors, variation of parameters.

3166. Euclidean Geometry (3) (F,S) (FC:MA)

May not count toward MATH or CSCI major or minor. P: MATE 1067 or MATH 1065; 2127. Euclidean geometry using deductive and inductive mathematical reasoning. Formal proofs.

3174. Vector Calculus (3)

P: MATH 2173. Vector algebra and vector functions of single variable. Scalar and vector fields, line and surface integrals, and multiple integrals.

3229. Elementary Statistical Methods II (3)

For students with limited mathematical training. May not count toward MATH major or minor. P: MATH 2228 or equivalent. Collection, systematic organization, analysis, and interpretation of numerical data obtained in measuring certain traits of a given population.

3233. College Geometry (3) (F)

P: MATH 2300. Modern college geometry presented as outgrowth and extension of elementary plane geometry. Important theorems relative to nine-point circle, cross ratios, the geometry of circles, and solid geometry. Euclidean transformations discussed.

3237. Discrete Mathematics (3) (F) (FC:MA)

May not count toward MATH or CSCI major or minor. May receive credit for one of MATE or MATH 2775, 3237 or MATH 2427. P: MATH 2121. Logic and sets, mathematical induction, and matrices. Applications of discrete mathematics in probability, linear programming, dynamical systems, social choice, and graph theory.

3239. Applied Mathematics Via Modeling (3) (FC:MA)
May not count toward MATH or CSCI major or minor. P: MATE or MATH 2282, 3166, 3237; MATH 2122. Real world problems that can be modeled with algebra, geometry, calculus, and statistical, probabilistic, discrete, or other mathematical techniques appropriate for prospective teachers of middle school mathematics. Mathematical modeling processes examined through historical and contemporary modeling success stories. Power and limitations of mathematical modeling.

3256. Linear Algebra (3) (F,S,SS)
P: MATH 2172. Vector spaces, linear maps, matrices, systems of equations, determinants, and eigenvalues.

3263. Introduction to Modern Algebra (3) (WI) (F,S)
P: MATH 2300, 3256. Postulation viewpoint of modern algebra. Defining postulates for mathematical system exhibited from which properties of system are derived. Principal systems studied are groups, rings, fields, each fully treated with illustrative examples.

3273. Combinatorics (3)
P: MATH 2300. Advanced counting methods, recurrences, mathematical induction, generating functions. Additional topics from: graphs and trees, combinatorial designs, combinatorial games, error-correcting codes.

3301. Foundations of Geometry (3) (F)
P: MATH 2300. Axiomatic development of Euclidean and Non-Euclidean geometries. Analytic models and geometric transformations.

3307. Mathematical Statistics I (3) (F,S)
P: MATH 2172. Axiomatic development of theory of probability and its application to construction of certain mathematical models.

3308. Mathematical Statistics II (3)
P: MATH 3307. Construction of mathematical models for various statistical distributions. Testing of hypotheses and estimation, small-sample distributions, regression, and linear hypotheses.

3550, 3551. Mathematics Honors (2,1) (F,S,SS)
Acceptance in program entitles student to register for MATH 3550 or 3551. P: Exceptional mathematical ability; MATH 2173 or consent of instructor.

3573. Introduction to Numerical Analysis (3) Same as CSCI 3573
P: CSCI 2310 or consent of instructor; MATH 2119 or 2172 or equivalent. Algorithms suitable for digital computation in areas of linear algebra, linear programming, slope finding, area finding, and nonlinear equation solution.

3584. Computational Linear Algebra (3) (F,S,SS) Same as CSCI 3584

May not count toward MATH major or minor. P: Calculus course. Introduces vectors, matrices, and determinants. Special emphasis on application of linear algebra to solution of practical problems.

4031. Applied Statistical Analysis (3) (S)

P: MATH 2228 or 2283 or 3308; MATH 3256 or MATH/CSCI 3584; or equivalent; or consent of instructor. Topics include analysis of variance and covariance, experimental design, multiple and partial regression and correlation, nonparametric statistics, and use of computer statistical packages.

4101. Advanced Calculus I (3) (F,S)

P: MATH 2173, 2300; or consent of instructor. May receive credit for one of MATH 4101, 5101. Axioms of real number system, completeness, sequences, infinite series, power series, continuity, uniform continuity, differentiation, Riemann integral, and Fundamental Theorem of Calculus.

4110. Elementary Complex Variables (3)

P: MATH 2173. Complex numbers, analytic functions, mapping by elementary functions, integrals, residues, and poles.

4201. Introduction to Stochastic Processes (3)

P: MATH 3307 or equivalent or consent of instructor. Fundamental theory and models of stochastic processes. Expectations and independence, sums of independent random variables, Markov chains and their limiting behavior and applications, Poisson processes, birth and death processes; and Gaussian processes.

4264. Introduction to Modern Algebra II (3)

P: MATH 3263. Continuation of development of topics begun in MATH 3263. Normal subgroups, factor groups, homomorphisms, rings, ideals, quotient rings, and fields.

4322. Foundations of Mathematics (3) (F)

P: MATH 3233, 3263 or equivalent. Fundamental concepts and structural development of mathematics. Non-Euclidean geometries, logic, Boolean algebra, and set theory. Construction of complex number systems. Transfinite cardinal numbers and study of relations and functions. Topics developed axiomatically.

4331. Introduction to Ordinary Differential Equations (3) (F,S)

P: MATH 2173. Linear and nonlinear differential equations.

4332. The Calculus of Finite Differences (3)

P: MATH 2173. Discrete changes that take place in values of a function and its dependent variable due to discrete changes in independent variable.

4501, 4502, 4503. Independent Study (1,2,3) (F,S,SS)

For advanced math students. Number of hours per week will depend on credit hours and nature of work assigned. P: MATH major; consent of dept chair. Topics supplement regular curriculum.

4550, 4551. Mathematics Honors (2,1) (F,S,SS)

Acceptance in program entitles student to register for MATH 4550 or 4551. P: Exceptional mathematical ability; MATH 2173 or consent of instructor.

4774. Programming for Research (3)

P: MATH 2228 or 2283 or equivalent. Emphasis on minimum-level programming skill and use of statistical packages.

4801. Probability Theory (3) (F)

P: MATH 2173 or 3307. Axioms of probability, random variables and expectations, discrete and continuous distributions, moment generating functions, functions of random variables, Central Limit Theorem, and applications.

4999. Capstone and Statistical Consulting (3) (F,S)

1 hour lecture and 3 hours practicum per week. P: MATH 4031. Supervised statistical consulting experience related to prior coursework in statistics.

5000. Introduction to Sampling Design (3) (F)

P: MATH 3308 or 3229 or consent of instructor. Fundamental principles of survey sampling. Data sources and types, questionnaire design, various sampling schemes, sampling and nonsampling errors, and statistical analysis.

5002. Logic for Mathematics and Computer Science (3) (S) Same as CSCI 5002

P: CSCI 3200 or 3310 or MATE 3223 or 2775 or MATH 2427 or 2775 or 3256 or PHIL 3580 or equivalent. Methods of mathematical logic that have important applications in mathematics and computer science.

5021. Theory of Numbers I (3)

P: MATH 3263 or consent of instructor. Topics in elementary and algebraic number theory such as properties of integers, Diophantine equations, congruences, quadratic and other residues, and algebraic integers.

5031. Applied Statistical Analysis (3) (WI)

May not count toward math hours required for math MA. P: MATH 2228, 3584; or equivalent; or consent of instructor. Topics include analysis of variance and covariance, experimental design, multiple and partial regression and correlation, nonparametric statistics, and use of computer statistical package.

5101. Advanced Calculus I (3)

P: MATH 2173, 2300 or consent of instructor. May receive credit for one of MATH 4101, 5101. Axioms of real number system, completeness, sequences, infinite series, power series, continuity, uniform continuity, differentiation, Riemann integral, Fundamental Theorem of Calculus.

5102. Advanced Calculus II (3)

P: MATH 3256, 5101; or consent of instructor. Mathematical analysis of functions of several real variables. Includes limits, continuity, differentiation, and integration of multivariable functions.

5110. Elementary Complex Variables (3)

May not be taken for credit by those having completed MATH 6111. P: MATH 2173. Complex numbers, analytic functions, mapping by elementary functions, integrals, residues, and poles.

5121. Numerical Analysis in One Variable (3)

P: MATH 2173. Numerical analysis of problems with one independent variable. Solution of nonlinear equations in one unknown, interpolation and approximation of functions of one variable, numerical integration, and numerical differentiation and optimization.

5122. Numerical Analysis in Several Variables (3)
P: MATH 2173, 3256, 4331. Numerical analysis of problems with several independent variables. Numerical solution of ordinary differential equations, systems of linear equations, numerical linear algebra and matrix algebra, systems of nonlinear equations, and systems of ordinary differential equations.

5131. Deterministic Methods in Operations Research (3)
P: MATH 2173; 3307 or 5801. Mathematical models; linear programming; simplex method, with applications to optimization; duality theorem; project planning and control problems; and elementary game theory.

5132. Probabilistic Methods in Operations Research (3)
P: MATH 2173, 3256; 3307 or 5801. Introduces stochastic processes. Queuing theory with applications to inventory theory and forecasting, Poisson and Markov processes, reliability simulation, decision analysis, integer programming, and nonlinear programming.

5270. Pascal Using the Microcomputer (3)
May not be taken by students who have successfully completed CSCI 2610. May not count toward MATH or CSCI major or minor. P: MATH 1065 or equivalent. Pascal language and use in problem solving utilizing a microcomputer.

5311. Mathematical Physics (3) Same as PHYS 5311
P: MATH 4331; PHYS 2360; or consent of instructor. Mathematical methods important in physics. Emphasis on application. Functions of complex variables, ordinary and partial differential equations, integrals and integral transforms, and special functions.

5322. Foundations of Mathematics (3) (WI)
P: MATH 3233, 3263; or equivalent. Fundamental concepts and structural development of mathematics. Non-Euclidean geometries, logic, Boolean algebra, and set theory. Construction of complex number systems. Transfinite cardinal numbers and study of relations and functions. Topics developed as postulational.

5521. Readings and Lectures in Mathematics (3)
Individual work with student.

5551. The Historical Development of Mathematics (3)
P: MATH 3233; C: MATH 2172 or consent of instructor. History of mathematics from antiquity to present. Emphasis on study of significant problems which prompted development of new math. Uses computer resources and library for research of topics and solutions.

5581. Theory of Equations (3)
P: MATH 2173 or consent of instructor. Topics include operations with complex numbers, De Moivre's Theorem, properties of polynomial functions, roots of general cubic and quartic equations, methods of determining roots of equations of higher degree, and methods of approximating roots.

5601. Non-Euclidean Geometry (3)
P: MATH 3233 or consent of instructor. Non-Euclidean geometries, finite geometries, and analysis of other geometries from point of view of properties which remain invariant under certain transformations.

5774. Programming for Research (3) Same as CSCI 5774

For graduate student who wishes to use computer science to meet required research skills of his or her dept. May not count toward MATH major or minor. P: General statistics course or consent of instructor. Emphasis on minimum-level programming skill and use of statistical packages.

5801. Probability Theory (3)

P: MATH 2173 or 3307. Axioms of probability, random variables and expectations, discrete and continuous distributions, moment generating functions, functions of random variables, Central Limit Theorem, and applications.

MA in Mathematics

The MA in Mathematics comprises three concentrations: *Mathematics, Statistics* and *Mathematics in the Community College*.

Full time students enrolled in the *Mathematics in the Community College* concentration generally hold teaching assistantships to gain experience as they complete their MA program. The degree requirements are as follows.

1. The Graduate School's research skills requirement is satisfied by demonstrating competency in an appropriate foreign language or by completing certain courses depending on the concentration. Students should see the Graduate Director for information specific to their concentrations.
2. All students complete at least 24 s.h. of coursework including required courses specific to each concentration area as detailed below. Specific course requirements may be waived for students who have previously taken equivalent courses.

Mathematics: MATH 5101, 5102, 6011, 6111, 6121, 6651, 5311 or 5801 or 6401 or 6411; plus electives to equal at least 24 s.h.

Statistics: MATH 5031, 5101, 5102, 5801, 6001, 6802, 5000 or 6804, 5774.

Mathematics in the Community College: MATH 5101, 5102, 5031, 6011, 6111, 6121, 6271, 6651 and at least one of MATH 5021, 6022 or 6802, plus electives to equal at least 26 semester hours (if some of the preceding courses were taken before graduate work was begun).

3. Students must score satisfactorily on a comprehensive examination.
4. Students specializing in *Mathematics* or *Statistics* must either write a thesis or complete a research project under the direction of a member of the graduate faculty. Students electing the thesis option enroll in MATH 7000 for 6 s.h. Students electing the non-thesis option are required to complete an additional 9 s.h. of course work prefixed MATH and numbered above 4999.
5. Students pursuing the *Mathematics in the Community College* concentration must prepare a teaching portfolio under the direction of a faculty mentor. They must also give a presentation to an undergraduate audience and complete an additional 9 s.h. of course work prefixed MATH and numbered above 4999.

Statistics Minor

Twelve s.h. of graduate course work for the statistics minor is required as follows: MATH 5031, 5801, 6802; one additional graduate-level statistics course.

Certificate in Statistics

The statistics certification requires a minimum of 9-15 s.h. credit as follows:

Students who have successfully completed MATH 3307, 3308 must complete 9 s.h. as follows: CSCI 5774; MATH 5000, 5031.

Students who have successfully completed MATH 3307 must complete 12 s.h. as follows: CSCI 5774; MATH 5000, 5031, 6802.

Students who have not successfully completed MATH 3307 must complete 15 s.h. as follows: CSCI 5774; MATH 5000, 5031, 5801, 6802.

Graduate Level Mathematics Course Offerings

5000. Introduction to Sampling Design (3) (F) P: MATH 3308 or 3229 or consent of instructor. Fundamental
principles of survey sampling. Data sources and types, questionnaire design, various sampling schemes, sampling and nonsampling errors, and statistical analysis.
5002. Logic for Mathematics and Computer Science (3) (S) Same as CSCI 5002 P: CSCI 3510 or MATE
3223 or 2775 or MATH 2427 or 2775 or 3256 or PHIL 3580 or equivalent. Methods of mathematical logic that have important applications in mathematics and computer science.
5021. Theory of Numbers I (3) P: MATH 3263 or consent of instructor. Topics in elementary and algebraic number
theory such as properties of integers, Diophantine equations, congruences, quadratic and other residues, and algebraic
integers.
5031. Applied Statistical Analysis (3) (WI) May not count toward mathematics hours required for the mathematics
concentration of the MA. P: MATH 2228, 3584; or equivalent; or consent of instructor. Topics include analysis of variance
and covariance, experimental design, multiple and partial regression and correlation, nonparametric statistics, and use of
computer statistical package.
5064. Introduction to Modern Algebra II (3) May not be taken for credit by those having completed MATH 6011.
P: MATH 3263 or consent of instructor. Continuation of development of topics begun in MATH 3263. Normal subgroups,
factor groups, homomorphism, rings, ideals, quotient rings, and fields.
5101. Advanced Calculus I (3) P: MATH 2173 or consent of instructor. Axioms of real number system, completeness,
sequences, infinite series, power series, continuity, uniform continuity, differentiation, Riemann integral, Fundamental Theorem of Calculus.
5102. Advanced Calculus II (3) P: MATH 3256, 5101; or consent of instructor. Mathematical analysis of functions of
several real variables. Includes limits, continuity, differentiation, and integration of multivariable functions.
5110. Elementary Complex Variables (3) May not be taken for credit by those having completed MATH 6111. P:
MATH 2173. Complex numbers, analytic functions, mapping by elementary functions, integrals, residues, and poles.
5121. Numerical Analysis in One Variable (3) P: MATH 2173. Numerical analysis of problems with one independent
variable. Solution of nonlinear equations in one unknown, interpolation and approximation of functions of one variable,
numerical integration, and numerical differentiation and optimization.
5122. Numerical Analysis in Several Variables (3) P: MATH 2173, 3256, 4331. Numerical analysis of problems
with several independent variables. Numerical solution of ordinary differential equations, systems of linear equations, numerical linear algebra and matrix algebra, systems of nonlinear equations, and systems of ordinary differential equations.
5131. Deterministic Methods in Operations Research (3) P: MATH 2173; 3307 or 5801. Mathematical models;
linear programming; simplex method, with applications to optimization; duality theorem; project planning and control problems; and elementary game theory.
5132. Probabilistic Methods in Operations Research (3) P: MATH 2173, 3256; 3307 or 5801. Introduces
stochastic processes. Queuing theory with applications to inventory theory and forecasting, Poisson and Markov processes, reliability simulation, decision analysis, integer programming, and nonlinear programming.
5270. Pascal Using the Microcomputer (3) May not be taken by students who have successfully completed CSCI

2610. May not count toward MATH or CSCI major or minor. P: MATH 1065 or equivalent. Pascal language and use in
problem solving utilizing a microcomputer.

5311. Mathematical Physics (3) Same as PHYS 5311 P: MATH 4331; PHYS 2360; or consent of instructor.
Mathematical methods important in physics. Emphasis on application. Functions of complex variables, ordinary and partial
differential equations, integrals and integral transforms, and special functions.

5322. Foundations of Mathematics (3) (WI) P: MATH 3233, 3263; or equivalent. Fundamental concepts and
structural development of mathematics. Non-Euclidean geometries, logic, Boolean algebra, and set theory. Construction of
complex number systems. Transfinite cardinal numbers and study of relations and functions. Topics developed as postulational systems.

5521. Readings and Lectures in Mathematics (3) Individual work with student.

5551. The Historical Development of Mathematics (3) P: MATH 3233; C: MATH 2172 or consent of instructor.
History of mathematics from antiquity to present. Emphasis on study of significant problems which prompted development
of new mathematics. Uses computer resources and library for research of topics and solutions.

5581. Theory of Equations (3) P: MATH 2173 or consent of instructor. Topics include operations with complex
numbers, De Moivre's Theorem, properties of polynomial functions, roots of general cubic and quartic equations, methods
of determining roots of equations of higher degree, and methods of approximating roots.

5601. Non-Euclidean Geometry (3) P: MATH 3233 or consent of instructor. Non-Euclidean geometries, finite
geometries, and analysis of other geometries from point of view of properties which remain invariant under certain
transformations.

5774. Programming for Research (3) Same as CSCI 5774 For graduate student who wishes to use computer
science to meet required research skills of his or her dept. May not count toward MATH major or minor. P: General statistics course or consent of instructor. Emphasis on minimum-level programming skill and use of statistical packages.

5801. Probability Theory (3) P: MATH 2173 or 3307. Axioms of probability, random variables and expectations,
discrete and continuous distributions, moment generating functions, functions of random variables, Central Limit Theorem,
and applications.

6000. Introduction to Graduate Mathematics (3) May not be taken for credit after MATH 5101 or 6011. P:
Consent of director of graduate studies or advisor. Introduces advanced mathematics for beginning graduate students. Covers various proof methods and provides rigorous introduction to topics in logic, number theory, abstract algebra, and analysis.

6001. Matrix Algebra (3) P: MATH 3256 or consent of instructor. Properties of vectors and matrices and their
applications.

6011, 6012. Modern Algebra I, II (3,3) P for 6011: MATH 3263 or equivalent; P for 6012: MATH 6011. Basic
algebraic structures. Groups, rings, modules, integral domains, and fields.

6022. Theory of Numbers II (3) P: MATH 5021. Advanced topics in algebraic and analytic number theory.

6111, 6112. Introduction to Complex Variables I, II (3,3) P for 6111: MATH 5102; P for 6112: MATH 6111. I.

Analytic functions, mapping of functions, differentiation and integration, power series, and residues. II. Integral functions, infinite products, Mittag-Leffler expansion, maximum modulus theorem, convex functions, the Schwarz-Christoffel transformation,
analytic continuation, Riemann surfaces, and selected topics in functions of a complex variable.

6121, 6122. Real Variables I, II (3,3) P for 6121: MATH 5101 or consent of instructor; P for 6122: MATH 6121
or consent of instructor. I. Study of functions of one real variable and convergence of sequences and series of functions:
functions of bounded variation, measures, measurable sets, measurable functions, convergence almost everywhere, absolutely continuous functions, Lebesque integration, differentiation, and the Fundamental Theorem of the Calculus. II. Lebesque spaces and associated inequalities, measures in R_n, measure spaces and the associated theory of integration and differentiation; the Radon-Nikodym Theorem with applications to probability and statistics.

6251, 6252. Advanced Placement Mathematics for Secondary Teachers I, II (3,3) May count toward
certificate renewal or certification in teaching gifted and talented students. May not count toward MA in mathematics. Intensive study of topics covered in Calculus AB and Calculus BC of advanced placement mathematics.

6271. Teaching Collegiate Mathematics (2) P: Consent of instructor. Curricula and methods of teaching mathematics
to adults in colleges and technical schools.

6401, 6402. Introduction to Partial Differential Equations I, II (3,3) P for 6401: MATH 4331 or consent
of instructor; P for 6402: MATH 6401 or consent of instructor. I. Linear and nonlinear partial differential equations of the
first order with emphasis on formal aspects of these equations. Use of partial differential equations in analysis, geometry, and physical sciences is considered where appropriate. II. Continuation of MATH 6401 to include nonlinear partial differential equations of the second order and higher orders. Certain theoretical aspects of partial differential equations and a limited amount of Fourier Series, Fourier transforms, Laplace transforms, and boundary value problems are included.

6411, 6412. Ordinary Differential Equations I, II (3,3) P for 6411: MATH 4331 or consent of instructor; P for 6412:
MATH 6411 or consent of instructor. I. Existence, uniqueness, and technique of solutions to first and second order differential equations are considered. Bases for linear equations, stability, and series solutions about an ordinary point are considered. II. Autonomous systems, series solutions about a regular singular point, and Sturm-Liouville Systems are examined.

6500. Special Topics (3) May be repeated for credit with change of topic. P: Consent of instructor. Selected topics of
current interest.

6561. Properties of Infinite Series (3) P: Consent of instructor. Infinite series beyond advanced calculus level.

6571. Elements of Probability (3) May not count toward mathematics requirement for MATH MA. P: Consent of
instructor. Axiomatic development of probability from set operations viewpoint. Use of probability measures.

6601. An Introduction to Differential Geometry (3) P: MATH 2173, 3256. Basic ideas of differential geometry
through study of curves and surfaces in three-dimensional space. Regular curves, regular surfaces, Gauss Map, and intrinsic and global differential geometry of surfaces.

6611, 6612. Introduction to Higher Geometry I, II (3,3) P for 6611: MATH 3233 or consent of instructor; P for
6612: 6611. I. Homogeneous linear equations and linear dependence; projections and rigid motions, homogeneous Cartesian coordinates; linear dependence of points and lines; point geometry and line geometry; harmonic division and cross ratio; one and two-dimensional projective transformations. II. Continuation of study of projective coordinates in the plane; introduces various types of geometries; study of point curves and line curves with intensive study of point conics and line conics.

6651. Introduction to Topology (3) P: MATH 5101. Metric spaces and basic point-set topology, open sets, closed
sets, connectedness, compactness, and limit points.
6802. Statistical Inference (3) P: MATH 3307 or 5801; consent of instructor. Estimation and hypothesis testing from
both classical and Bayesian points of view. Use of t, F, and chi-squared distributions. Least squares procedures.
6803. The Linear Model (3) P: MATH 3256, 5801. Topics include general linear model, regression models, design
models, estimation of parameters, theory of least squares, and testing general linear hypotheses.
6804. Stochastic Processes (3) P: MATH 3256, 5801. Most widely used models for random phenomena which vary
with time. Topics include Markov, Poisson, birth and death, and stationary processes.
6805. Topics in Mathematical Statistics (3) P: MATH 3256, 5801. Mathematical theory of certain topics in statistics
outside range of MATH 6802. Topics vary by faculty and student interests.
7000. Thesis (3) May be repeated. May count maximum of 6 s.h.
7001. Thesis: Summer Research (1) May be repeated. No credit may count toward degree. Students conducting
thesis research may only register for this course during the summer.

MATH Banked Courses
5252. Modern Mathematics for Elementary 5321, 6322. Applied Mathematics I, II (3,3)
Teachers II (3) 5331. Introduction to Celestial Mechanics (3)
5261, 5262. Modern Mathematics for Secondary 5610. Applied Analysis (3)
Teachers I, II (3,3) 6652. Introduction to Topology II (3)
5301, 5302. Analytical Mechanics I, II (3,3)

APPENDIX F
Foundations Courses and Relations to other Programs

MATH 1050	Industrial Technology Management Minor	Hospitality Management
	Interior Design	Management Accounting, BSBA
MATH 1065	Math, BA/BS/Minor	Management Information Systems, BSBA
plied Physics	Mathematics Education (Secondary)	Management, BSBA
plied Sociology, BS (Applied Social search)	Medical Health Professions Curriculum	Marketing, BSBA
hletic Training	Merchandising	Military Science, Minor (Management)
ochemistry	Middle Grades Education	
ology, BS/Minor	Minor in Military Service	**Math 1065 or Math 1066**
rth-K Teacher Education (or Math 2127)	Music Education (or Math 2127)	Business & Marketing Education, BSBE
usiness Administration Minor	Neuroscience Studies Minor **	Business Education, BSBE
hemistry, BA/BS, Minor	Nursing	Computer Science, BA
nical Laboratory Science	Nutrition & Dietetics	Ecomonics, BA
ognate Minor for Professional Officer Course	Physical Education	French, BS
omputer Science Minor	Physics Minor	German BA (or 2127)
omputer Science, BS	Physics, BA/BS	Hispanic Studies Education, BS (or 2127)
onstruction Management	Pre-Optometry Curriculum	Information and Computer Technology
esign	Pre-Pharmacy Curriculum	Information Technologies, BSBE
onomics, BS	Pre-Veterinary Curriculum	Marketing Education, BSBE
ementary Education (or 2127)	Public Admin Minor	Neuroscience Studies Minor
gineering	Rehabilitation Services	Political Science, BS
vironmental Health	School Health Education	Professional Officer Course, Minor
ercise Physiology	Science Education (Secondary)	Psychology, BA
mily & Consumer Sciences (or Math 2127)	Security Studies **	Recreation & Park Management
eology, BS	Social Work, BSW	Recreational Therapy (or 1067/2127)
ealth & Fitness Specialist	Special Education (or 2127)	Sports Studies
ealth Ed & Promotion (Community Health)	Speech & Hearing Sciences	Urban & Regional Planning
ealth Information Management	Stats Minor	
ealth Services Management		**Math 1067**
story Education (Secondary)	**MATH 1066**	Recreational Therapy (or 1065/2127)
dustrial Distribution & Logistics	Accounting, BSA/MSA	
dustrial Engineering Technology	Business Administration Minor	
dustrial Technology	Finance, BSBA	

MATH 1074

- uction Management
- ial Engineering Technology
- ial Technology

MATH 1083

- l Physics, BS
- nics, BS (Quantitative)
- s, BA/BS

MATH 1085

- stry, BS
- e Education (secondary)

ATH 1083 OR MATH 1085

- mistry
- **y, BS/Minor**
- **stry, Minor**
- **l Laboratory Science, BS**
- ering
- **gy, BS**
- A/BS/Minor
- natics Education (Secondary)
- **science Studies Minor**
- **on & Dietetics**
- s Minor (if taking 2171)
- l Science, BS
- inor

MATH 2119

- nics, BS (Applied Economics)
- mental Health (or Math 2121)
- ial Engineering Technology
- Grades Education (Math ntration)
- armacy Curriculum (or 2121/2171)

MATH 2121

- Biology, General
- Chemistry, BA
- Chemistry, Minor**
- Ecology/Enviro Biology (or Stats I course)
- Neuroscience studies Minor*
- Physics Minor (or 2171)
- Pre-Optometry Curriculum
- Pre-Pharmacy Curriculum (or 2119/2171)
- Science Education (secondary)

MATH 2127

- Birth-K Teacher Education (or 1065)
- Elementary Education (or 1065)
- Family & Consumer Sciences Ed (or 1065)
- German, BA (or 1065/1066)
- Hispanic Studies Education, BS (or 1065/1066)
- Music Education (or 1065)
- Recreational Therapy (or 1065/1067)
- Special Education (or 1065)

MATH 2151

- Engineering, BS

MATH 2152

- Engineering, BS

MATH 2153

- Engineering, BS

MATH 2171

- Applied Physics, BS
- Biochemistry
- Chemistry, BS
- Chemistry, Minor**
- Computer Science, BS (or 2121)
- Economics, BS (Quantitative)
- Math Education (Secondary)
- Math, BA/BS/Minor
- Physics Minor (or 2121)
- Physics Minor (or 2171)
- Physics, BA/BS
- Pre-Pharmacy Curriculum (or 2119/2121)
- Stats Minor

MATH 2172

- Applied Physics, BS
- Biochemistry
- Chemistry, BS
- Computer Science, BS (or 2122)
- Economics, BS (Quantitative)
- Math Education (secondary)
- Math, BA/BS/Minor
- Physics, BA/BS
- Stats Minor

MATH 2173

- Applied Physics, BS
- Biochemistry
- Chemistry, BS
- Economics, BS (Quantitative)
- Math Education (secondary)
- Math, BA/BS/Minor
- Physics, BA/BS

MATH 2228

- Biology, General
- Computer Science, BA (or 3307)
- Construction Management
- Environmental Health
- Health Education & Promotion (Community Health)
- Pre-Optometry Curriculum
- Pre-Veterinary Curriculum
- Public Admin Minor
- Security Studies

MATH 2282	MATH 2775

MATH 2283	MATH 3166
Security Studies** (or ITEC 3200)	
(or ITEC 3200)	MATH 3237
Accounting, BSA/MSA	
Applied Sociology, BS (Applied Social Research)	MATH 3239
Business Administration Minor	
Construction Management	
Design (or ITEC 3200)	
Economics, BA	
Economics, BS	
Finance, BSBA	
Industrial Distribution & Logistics (or ITEC 3200)	
Industrial Engineering Technology (or ITEC 3200)	
Industrial Technology (or ITEC 3200)	
Information & Computer Technology	
Management Accounting, BSBA	
Management Information Systems, BSBA	
Management, BSBA	
Marketing, BSBA	
Military Science, Minor (Management)	
MATH 2228 or MATH 2283	
Business & Marketing Education, BSBE	
Business Education BSBE	
Computer Science, BA	
Information Technologies	
Marketing Education, BSBE	
Math, BS (Stats)	
Political Science, BS	

Non-Foundations Courses Serving other Departments

MATH 2122
- uroscience Studies Minor*
- ology, General
- emistry, BA
- e-Optometry Curriculum
- ience Education (Secondary)

MATH 2154
- gineering, BS

MATH 2300
- ith Education (Secondary)
- ith, BS/BA/Minor

MATH 2724
- mputer Science, BS

MATH 3174
- ith, BS*

MATH 3229
- mputer Science, BS (or 3308)

MATH 3233
- ith, BS*

MATH 3256
- onomics, BS (Quantitative)
- ith Education (Secondary)
- ith, BS/BA/Minor
- atistics Minor

MATH 3263
- ith Education (Secondary)
- ith, BS/BA/Minor

MATH 3307
- Engineering, BS
- Economics, BS (Quantitative)
- Math Education (Secondary)
- Math, BS/BA/Minor

MATH 3308
- Math, BA (stats)
- Math, BS
- Statistics Minor

MATH 3573
- Math, BS*

MATH 3584
- Computer Science, BS

MATH 4031
- Math, BS (Stats)

MATH 4101
- Math, BS/BA

MATH 4110
- Math, BS (Math & Science)/(Stats)*

MATH 4331
- Applied Physics
- Math, BS/BA
- Physics, BS

MATH 4201
- Math, BA (stats)*
- Math, BS (Stats) or 5000
- Math, BS *
- Statistics Minor*

MATH 4264
- Math, BS *

MATH 4774
- Math, BS (Stats)

MATH 4801
- Math, BS (Stats)
- Math, BS *

MATH 4999
- Math, BS (Stats)

MATH 5000
- Math, BA (stats)*
- Math, BS (Stats) or 4201
- Math, BS *
- Statistics Minor *

MATH 5002
- Math, BS *

MATH 5021
- Math, BS *

MATH 5031
- Statistics Minor
- Math, BA (stats)

MATH 5101

MATH 5102
- Math, BS *

MATH 5121
- Math, BS *

MATH 5122
- Math, BS *

MATH 5131
- Math, BS *

MATH 5132
- Math, BA (stats)*
- Math, BS*
- Statistics Minor *

MATH 5133

MATH 5311
- Math, BS *

MATH 5322
- Math Education (Secondary)
- Math, BS *

MATH 5551
- Math, BS *

MATH 5801
- Math, BA (stats)
- Statistics Minor *

Programs without Mathematics Foundation Course requirements

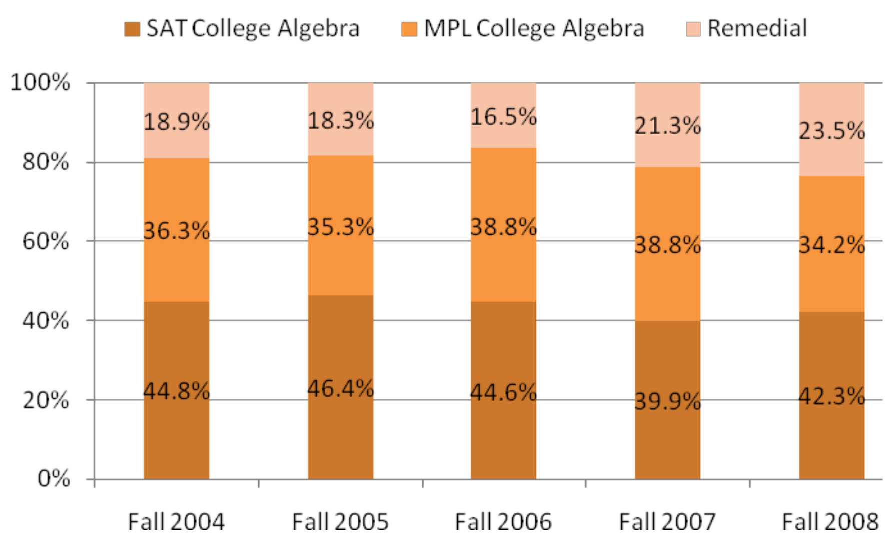
African American Studies-BA
Anthropology-BA
Applied Sociology-BS
Art History & Appreciation-BA
Art-BA
Art-BFA
BA-Exercise & Sports Science
BFA Dance
BS Criminal Justice
Communication-BA/BS
English-BA
Geography-BA
German-BA
Health Education & Promotion (only Community Health Concentration requires math)
Hispanic Studies-BA
History-Ba
Jazz Studies-BM
Music Theory-BM
Performance-BM
Political Science-BA
Public History-BA
Sociology-BA
Theatre Arts Education-BFA
Theatre Arts-BA
Theatre Arts-BFA
Theory-Composition-BM
Womens Studies-BA

APPENDIX M
Placement Data

Introduction

East Carolina University's freshman class college algebra placement is primarily based on two tests, the mathematics portion of the SAT (MSAT) and the mathematics placement examination. Students with a MSAT score of 540 or above are automatically placed into college algebra and are referred to in this report as *SAT College Algebra.* Students who have MSAT scores below 540 are required to take the mathematics placement exam, typically given at summer orientation. Students with a score of 14 or above on the mathematics placement exam are placed into college algebra and are referred to in this report as *MPL College Algebra*. Those with a score of 13 or below are placed into remedial mathematics and are referred to in this report as *Remedial*. Chart One shows the percentage of first-time, full-time, freshman students placing into each of these three categories over the past five years.[1] On average slightly less than 20% of new freshman are placed into remedial mathematics.

Chart One



On average, 56.4% of the freshman class, over the past five years, was required to take the math placement exam. Tables One and Two show the distribution of students by placement level and actual score respectively over this time frame.

Table One **Math Placement Exam Results by Level**

[1] First-time freshman who did not take the placement exam and scored below a 540 on the MSAT, or did not take the MSAT, are not included in these analyses.

Year	Number Placing into Remedial	Number Placing into College Algebra
2004	593	1,139
2005	542	1,044
2006	571	1,342
2007	831	1,514
2008	1,000	1,457

Table Two **Math Placement Exam Results by Actual Score**[2]

Placement Score	**2004**	**2005**	**2006**	**2007**	**2008**
000	0	0	0	0	1
002	2	2	0	1	1
003	0	1	0	5	3
004	7	7	4	7	4
005	7	4	10	15	12
006	18	20	15	33	35
007	21	25	30	44	52
008	58	38	35	67	61
009	69	54	52	89	105
010	75	79	90	111	148
011	99	96	109	142	178
012	121	111	98	153	186
013	116	105	128	164	214
014	189	174	199	240	239
015	158	148	206	215	213
016	144	130	149	185	208
017	146	122	151	177	177
018	107	93	146	151	157
019	95	98	115	137	108
020	72	77	85	96	86
021	57	57	77	88	95
022	46	36	61	57	51
023	41	30	50	57	37
024	33	29	31	42	32
025	12	10	24	28	24
026	11	18	15	13	13
027	8	7	13	16	7
028	10	7	10	5	6

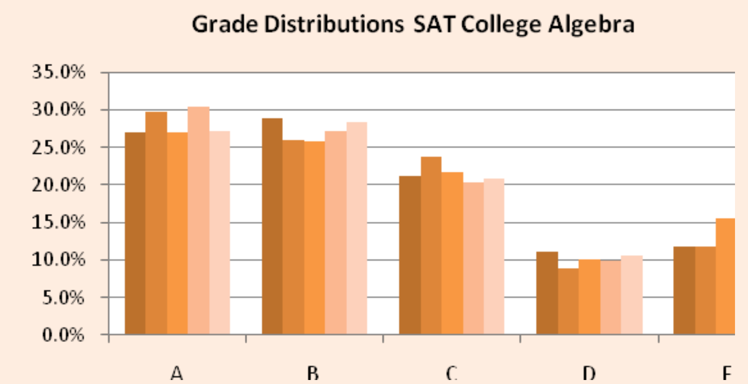
[2] Students who do not perform well on the math placement test during summer orientation are encouraged to re-take the exam at the start-up orientation in August. The students' single highest score was used in these analyses.

029	5	6	3	4	4
030	4	2	6	2	0
031	1	0	1	1	0

Mathematics Placement and Subsequent Mathematics Performance

Performance in college algebra is determined by grade distribution in MATH 1065, MATH 1066, or MATH 2127. Two charts are presented here; grade distributions in college algebra for students classified as *SAT College Algebra* and students classified as MPL *College Algebra.*
The grade distribution for the students who automatically placed into college algebra is shown below. On average, nearly 77% of these students succeed with a grade of C or better on their first taking of the course.

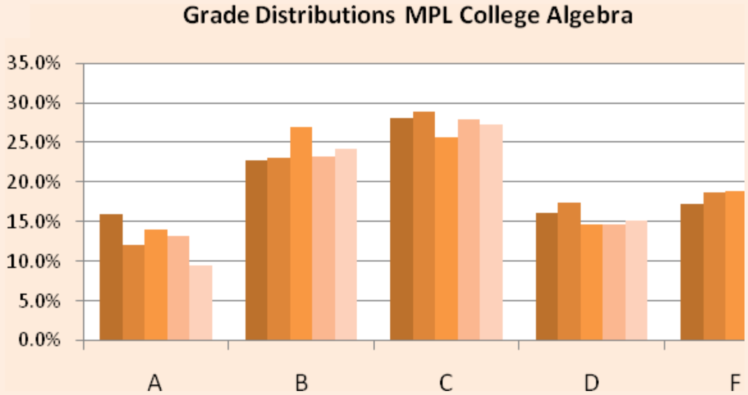
Chart Two



	2004	2005	2006	2007	2008
A	27.1%	29.7%	27.0%	30.5%	27.1%
B	28.9%	25.9%	25.8%	27.1%	28.3%
C	21.2%	23.7%	21.6%	20.4%	20.9%
D	11.1%	9.0%	10.0%	9.9%	10.6%
F	11.8%	11.7%	15.6%	12.1%	13.1%

The grade distribution for the MPL College Algebra students is shown in Chart Three. As expected these students do not perform as well as the SAT College Algebra group however nearly 65% are succeeding in college algebra with a grade of C or better on their first taking of the course.

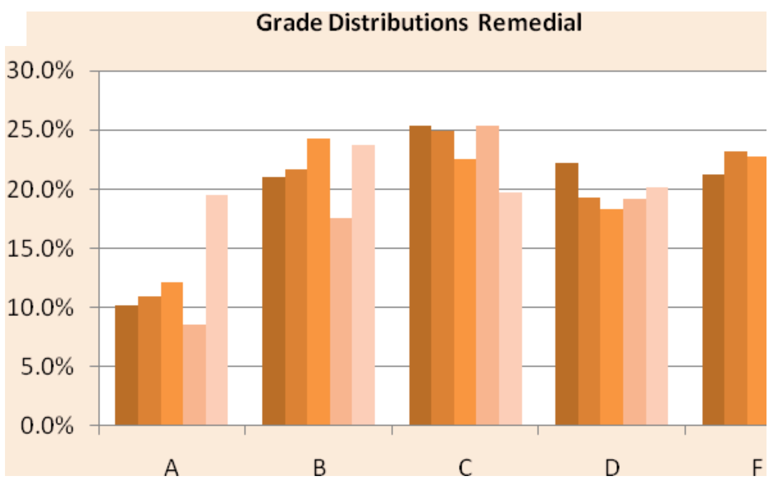
Chart Three



	2004	2005	2006	2007	2008
A	15.9%	12.1%	14.0%	13.3%	9.5%
B	22.7%	23.0%	26.9%	23.1%	24.2%
C	28.0%	28.9%	25.6%	27.9%	27.3%
D	16.1%	17.3%	14.6%	14.7%	15.1%
F	17.2%	18.7%	18.9%	21.0%	23.9%

Performance in remedial math is determined by grade distribution in either MATH 0001 or MATH 0045. The grade distribution over 5 years for the students who placed into remedial math is shown in chart four. Nearly 58% of these students succeed in remedial math with a grade of C or better on their first taking of the course.

Chart Four



A	10.1%	10.9%	12.1%	8.6%	19.5%
B	21.0%	21.7%	24.3%	17.5%	23.7%
C	25.4%	24.9%	22.5%	25.4%	19.7%
D	22.2%	19.3%	18.3%	19.2%	20.1%
F	21.2%	23.2%	22.7%	29.4%	17.0%

2004	2005	2006	2007	2008

Table Three displays the grade distribution for students with MSAT scores who placed into remedial math and their subsequent performance in that class. Interestingly enough, the SAT profile for the students who placed into remedial math tends to break at around 460 on the MSAT in terms of subsequent satisfactory performance in remedial math (grade of C or better). One possible response is to automatically place students with a MSAT below 460 into remedial math.

Table Three Performance in Remedial Math and Mean MSAT Score

	Fall 2004		Fall 2005		Fall 2006		Fall 2007		Fall 2008	
	N	MSAT	N	MSAT	N	MSAT	N	MSAT	N	MSAT
A	38	477	43	467	46	475	46	448	91	478
B	89	478	88	465	98	470	95	465	109	473
C	104	468	98	459	84	467	131	462	89	474
D	94	468	79	458	69	459	103	457	93	458
F	94	452	96	456	88	444	156	458	78	453

The final set of tables display mean SAT scores by college algebra grade for MPL College Algebra students and for SAT College Algebra students over the past five years.

Table Four Performance in College Algebra and Mean MSAT Score of Placement Test Students

	Fall 2004		Fall 2005		Fall 2006		Fall 2007		Fall 2008	
	N		N		N		N		N	
A	136	497	103	495	146	495	169	496	76	499
B	190	491	197	492	286	488	289	488	205	491
C	240	487	254	484	268	486	346	482	227	486
D	140	479	152	477	144	485	190	479	123	482
F	149	479	155	474	204	479	265	477	201	479

Table Five Performance in College Algebra and Mean MSAT Score of SAT Placement Students

	Fall 2004		Fall 2005		Fall 2006		Fall 2007		Fall 2008	
	N		N		N		N		N	
A	298	597	325	596	333	600	374	596	288	599
B	318	582	283	586	318	585	333	581	300	578
C	233	571	259	582	267	581	250	576	222	575
D	122	577	98	568	124	571	122	580	112	572
F	130	574	128	574	192	575	149	571	139	578

APPENDIX O
Outcomes Assessment Data/Report

Office of Institutional Planning, Assessment and Research
East Carolina University
Greenville Center – Suite 2700
2200 South Charles Boulevard
Greenville, North Carolina 27858-4353

Deadline for submitting Interim Report: 6 April 2009
Deadline for submitting Final Report: 1 October 2009

Foundation Curriculum Assessment Report
East Carolina University
2008-2009

General Instructions

Before completing the 2008-2009 Foundation Curriculum Assessment Report, please

- Carefully read all directions
- Assign responsibility for completion and accuracy to the Unit Assessment Committee Chair

Before returning the completed 2008-2009 assessment report, review the last page of this document to ensure check lists are complete.

Please direct additional questions to Ms. Kristen Springer-Dreyfus at springerk@ecu.edu

(Academic Department & Program)

(Assessment Period Covered) (Date Submitted)

Foundation Educational Objective:

1. *Foundations Goal*: Students in Foundations Curriculum courses will learn Mathematics that is appropriate to their background and educational needs.

College Algebra assessment narrative

First Means of Assessment for Objective Identified above:

Means of Assessment & Criteria for Success:
1. *Measured Outcome*: Students in College Algebra, Math 1065, will acquire adequate skills in the following areas:
 Lines and linear functions
2. *Direct Metric:* Student performance on the common final examination in Math 1065 will be analyzed each semester by the Undergraduate and College Algebra Committees. The common final will have a number of questions in the skill areas mentioned in part 1, above.
3. *Results:* The results of the assessment will be semester-by-semester statistics on student performance on the Math 1065 common final. The statistics will report overall student performance on the exam as well as student performance on the questions in the skill areas above.
4. *Analysis:* Strengths and weaknesses in the course will be determined by analyzing the statistics. Performance criteria will be set at the time of the first pass through the process. In subsequent passes, the performance criteria will be used as a comparator. The performance criteria will consist of percentages of students to meet or exceed low, medium and high benchmarks of achievement on the common final in each skill area, as well as overall.
5. *Improvement Action:* The committees involved with this assessment will meet (i) to discuss the impact of improvement actions taken in prior cycles and (ii) to

determine how to enhance those sections of the curriculum where weaknesses in student performance are identified.
Note: as it gains experience implementing its assessment plans, the Mathematics Department will consider broadening assessment of its Foundations Curriculum offerings
to cover other courses with high student enrolment, such as Math 1066 and Math 2228/2283.

Description of Data Collection & Assessment Results:

The Fall 2008 MATH 1065 was used for assessment purposes. There are four versions of the common exam (A, B, C, D) set up as follows. Version A is the first version created. Version B rearranges the order of the questions and the order of the answers in the questions. Version C modifies several of the questions (e.g., changing signs of values, numbers used) from version A (14 of the 40 questions were modified). Version D rearranges the order of the questions and the order of the answers in the questions from version C. After the exams were graded, the opscans were collected in the Mathematics Department office for analysis. 1790 exams were used for the analysis.

A preliminary criteria for High, Medium, and Low performance on a give question was proposed to be:
High: 80% or higher
Medium: 60 to 79%
Low: less than 60%
These preliminary criteria will be reviewed in Fall 2009.

The questions were identified by the topic covered in the question. The topics suggested for more detailed analysis by the Foundations Goals documents and the questions covering those topics (numbers identify where the question was in version A):

Lines and Linear Functions:
Questions 5, 24, 40 (as labeled on Exam A):

Lines and Linear Functions:	**% correct**	**performance**
slope-intercept of ax + by + c = 0	84%	High
slope of line through two points	75%	Medium
line through (d,e) perpendicular to ax + by = c	50%	Low

Analysis was done to report the percent correct for each question topic across the four versions and overall. The average scores for the four versions were from 59.04 to 60.76 (note: each question is worth 2.5 points). Although the averages were very close together; there were difference of more than ten percent on the percent correct for some questions across the different versions (on the solve an absolute value equation, version A which asked for the smaller solution had 33% correct and version C which asked for the larger solution had 64% correct). Difference of more than ten percent between the lowest and highest percents across the versions was indicated in bold. The overall percent correct was between a low of 28% (solve logarithmic equation) and 84% (slope-intercept of ax + by + c=0).

For each version of the exam, a more detailed report was generated with the frequency for each answer reported along with the percent correct for each question. It was annotated to show wrong answers that (a) attracted 80 to 99 students (b) attracted 100 or more students and (c) were more popular than the correct answer. Each version of the test was also annotated to indicate this information. A frequency distribution table of exam scores for each version and overall was also created.

Use of Results to Improve Program:

The Math 1065 committee will be further reviewing the above results in Fall 2009 with the intent of reaching the educational objective. Any further refinement of criteria for High, Medium, and Low will be determined at that time.

All of the above was distributed to the faculty who taught MATH 1065 during Fall 2008 and discussed at a meeting with Ms Cathy Wilkerson and the Department Chair. The discussion included looking at the questions and what might have been source of the students' confusion. This information will be used in creating the Spring 2009 common exam. Faculty who are teaching the course this semester, and who taught it last semester, can use this information in helping their students prepare for the final exam.

After the meeting, faculty who taught the course in the fall, were given a report for each of their sections as to the percent correct for each question across all four versions and the exam score distribution along with the section's average and standard deviation. This can be used to address topics where their students had problems last semester.

Finally, a report was generated showing, for each version and for each topic, the percent wrong for students scoring at or above 90, 80, 70, etc.. For example, on version A, 42% of students scoring 90 or higher on the exam missed the question on solving the absolute value equation and 41% of students scoring 80 or higher missed the question on factoring the sum/difference of cubes.

Second Means of Assessment for Objective Identified above:

Means of Assessment & Criteria for Success:

1. *Measured Outcome*: Students in College Algebra, Math 1065, will acquire adequate skills in the following areas:

 Setting up and solving equations and inequalities

2. *Direct Metric:* Student performance on the common final examination in Math 1065 will be analyzed each semester by the Undergraduate and College Algebra Committees. The common final will have a number of questions in each of the skill areas mentioned in part 1, above.

3. *Results:* The results of the assessment will be semester-by-semester statistics on student performance on the Math 1065 common final. The statistics will report overall student performance on the exam as well as student performance on the questions in each of the skill areas above.

4. *Analysis:* Strengths and weaknesses in the course will be determined by analyzing the statistics. Performance criteria will be set at the time of the first pass through the process. In subsequent passes, the performance criteria will be used as a comparator. The performance criteria will consist of percentages of students to meet or exceed low, medium and high benchmarks of achievement on the common final in each skill area, as well as overall.

5. *Improvement Action:* The committees involved with this assessment will meet (i) to discuss the impact of improvement actions taken in prior cycles and (ii) to determine how to enhance those sections of the curriculum where weaknesses in student performance are identified.

Note: as it gains experience implementing its assessment plans, the Mathematics Department will consider broadening assessment of its Foundations Curriculum offerings
to cover other courses with high student enrolment, such as Math 1066 and Math 2228/2283.

Description of Data Collection & Assessment Results:

The Fall 2008 MATH 1065 was used for assessment purposes. There are four versions of the common exam (A, B, C, D) set up as follows. Version A is the first version created. Version B rearranges the order of the questions and the order of the answers in the questions. Version C modifies several of the questions (e.g., changing signs of values, numbers used) from version A (14 of the 40 questions were modified). Version D rearranges the order of the questions and the order of the answers in the questions from version C. After the exams were graded, the opscans were collected in the Mathematics Department office for analysis. 1790 exams were used for the analysis.

A preliminary criteria for High, Medium, and Low performance on a give question was proposed to be:

```
High:     80% or higher
Medium:   60 to 79%
Low:      less than 60%
```

These preliminary criteria will be reviewed in Fall 2009.

The questions were identified by the topic covered in the question. The topics suggested for more detailed analysis by the Foundations Goals documents and the questions covering those topics (numbers identify where the question was in version A):

<u>Setting up and solving equations and inequalities:</u>

From Questions 1, 3, 6, 8, 13, 19, 22, 25, 38 (as labeled on Exam A)

<u>Setting up and solving equations and inequalities:</u>	**% correct**	**performance**
solve linear inequality	77%	Medium
solve a x^2 - b = 0	71%	Medium
solve linear equation	70%	Medium
solve linear system	62%	Medium
solve absolute value equation	48%	Low
solve quadratic inequality	41%	Low

Analysis was done to report the percent correct for each question topic across the four versions and overall. The average scores for the four versions were from 59.04 to 60.76 (note: each question is worth 2.5 points). Although the averages were very close together; there were difference of more than ten percent on the percent correct for some questions across the different versions (on the solve an absolute value equation, version A which asked for the smaller solution had 33% correct and version C which asked for the larger solution had 64% correct). Difference of more than ten percent between the lowest and highest percents across the versions was indicated in bold. The overall percent correct was between a low of 28% (solve logarithmic equation) and 84% (slope-intercept of ax + by + c=0).

For each version of the exam, a more detailed report was generated with the frequency for each answer reported along with the percent correct for each question. It was annotated to show wrong answers that (a) attracted 80 to 99 students (b) attracted 100 or more students and (c) were more popular than the correct answer. Each version of the test was also annotated to indicate this information. A frequency distribution table of exam scores for each version and overall was also created.

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After the meeting, faculty who taught the course in the fall, were given a report for each of their sections as to the percent correct for each question across all four versions and the exam score distribution along with the section's average and standard deviation. This can be used to address topics where their students had problems last semester.

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Third Means of Assessment for Objective Identified above:

Means of Assessment & Criteria for Success:

1. *Measured Outcome*: Students in College Algebra, Math 1065, will acquire adequate skills in the following areas:
 Plotting points and graphing functions
2. *Direct Metric:* Student performance on the common final examination in Math 1065 will be analyzed each semester by the Undergraduate and College Algebra Committees. The common final will have a number of questions in each of the skill areas mentioned in part 1, above.
3. *Results:* The results of the assessment will be semester-by-semester statistics on student performance on the Math 1065 common final. The statistics will report overall student performance on the exam as well as student performance on the questions in each of the skill areas above.
4. *Analysis:* Strengths and weaknesses in the course will be determined by analyzing the statistics. Performance criteria will be set at the time of the first pass through the process. In subsequent passes, the performance criteria will be used as a comparator. The performance criteria will consist of percentages of students to meet or exceed low, medium and high benchmarks of achievement on the common final in each skill area, as well as overall.
5. *Improvement Action:* The committees involved with this assessment will meet (i) to discuss the impact of improvement actions taken in prior cycles and (ii) to determine how to enhance those sections of the curriculum where weaknesses in

student performance are identified.
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High: 80% or higher
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Low: less than 60%
These preliminary criteria will be reviewed in Fall 2009.

The questions were identified by the topic covered in the question. The topics suggested for more detailed analysis by the Foundations Goals documents and the questions covering those topics (numbers identify where the question was in version A):

Plotting points and graphing:
From Questions 4, 7, 17, 21, 31, 35 (as labeled on Test A):

Plotting points and graphing:	**% correct**	**performance**
translate graph of g(x) = |x|	74%	Medium
given graph, determine square root function	68%	Medium
point of symmetry around the origin	67%	Medium
given graph: intercepts, domain, even/odd	61%	Medium
quadratic function vertex and decreasing	56%	Low
general equation for circle --> center and radius	49%	

Low

Analysis was done to report the percent correct for each question topic across the four versions and overall. The average scores for the four versions were from 59.04 to 60.76 (note: each question is worth 2.5 points). Although the averages were very close together; there were difference of more than ten percent on the percent correct for some questions across the different versions (on the solve an absolute value equation, version A which asked for the smaller solution had 33% correct and version C which asked for the larger solution had 64% correct). Difference of more than ten percent between the lowest and highest percents across the versions was indicated in bold. The overall percent correct was between a low of 28% (solve logarithmic equation) and 84% (slope-intercept of ax + by + c=0).

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Fourth Means of Assessment for Objective Identified above:

Means of Assessment & Criteria for Success:
1. *Measured Outcome*: Students in College Algebra, Math 1065, will acquire adequate skills in the following areas:
 Mathematical models (word problems)
2. *Direct Metric:* Student performance on the common final examination in Math 1065 will be analyzed each semester by the Undergraduate and College Algebra Committees. The common final will have a number of questions in each of the skill areas mentioned in part 1, above.
3. *Results:* The results of the assessment will be semester-by-semester statistics on student performance on the Math 1065 common final. The statistics will report overall student performance on the exam as well as student performance on the questions in each of the skill areas above.
4. *Analysis:* Strengths and weaknesses in the course will be determined by analyzing the statistics. Performance criteria will be set at the time of the first pass through the process. In subsequent passes, the performance criteria will be used as a comparator. The performance criteria will consist of percentages of students to meet or exceed low, medium and high benchmarks of achievement on the common final in each skill area, as well as overall.
5. *Improvement Action:* The committees involved with this assessment will meet (i) to discuss the impact of improvement actions taken in prior cycles and (ii) to determine how to enhance those sections of the curriculum where weaknesses in student performance are identified.
Note: as it gains experience implementing its assessment plans, the Mathematics Department will consider broadening assessment of its Foundations Curriculum offerings
to cover other courses with high student enrolment, such as Math 1066 and Math 2228/2283.

Description of Data Collection & Assessment Results:

The Fall 2008 MATH 1065 was used for assessment purposes. There are four versions of the common exam (A, B, C, D) set up as follows. Version A is the first version created. Version B rearranges the order of the questions and the order of the answers in the questions. Version C modifies several of the questions (e.g., changing signs of values, numbers used) from version A (14 of the 40 questions were modified). Version D rearranges the order of the questions and the order of the answers in the questions from version C. After the exams were graded, the opscans were collected in the Mathematics Department office for analysis. 1790 exams were used for the analysis.

A preliminary criteria for High, Medium, and Low performance on a give question was proposed

to be:
High: 80% or higher
Medium: 60 to 79%
Low: less than 60%
These preliminary criteria will be reviewed in Fall 2009.

The questions were identified by the topic covered in the question. The topics suggested for more detailed analysis by the Foundations Goals documents and the questions covering those topics (numbers identify where the question was in version A):

Word problems:
From Questions 9, 15, 16, 18, 20, 32, 34, 39 (as labeled on Test A):

Word problems: performance	**% correct**	
compound investment (evaluate formula)	83%	High
exponential decay (evaluate formula)	80%	High
mixture problem (set up equation)	64%	Medium
variation (inversely and directly)	60%	Medium
exponential growth (extrapolate from y_0 and y_1)	56%	Low
variation (jointly and square)	51%	Low
maximize fenced enclosure (quadratic)	45%	Low
time when two work together ($x/a + x/b = 1$)	45%	Low

Analysis was done to report the percent correct for each question topic across the four versions and overall. The average scores for the four versions were from 59.04 to 60.76 (note: each question is worth 2.5 points). Although the averages were very close together; there were difference of more than ten percent on the percent correct for some questions across the different versions (on the solve an absolute value equation, version A which asked for the smaller solution had 33% correct and version C which asked for the larger solution had 64% correct). Difference of more than ten percent between the lowest and highest percents across the versions was indicated in bold. The overall percent correct was between a low of 28% (solve logarithmic equation) and 84% (slope-intercept of ax + by + c=0).

For each version of the exam, a more detailed report was generated with the frequency for each answer reported along with the percent correct for each question. It was annotated to show wrong answers that (a) attracted 80 to 99 students (b) attracted 100 or more students and (c) were more popular than the correct answer. Each version of the test was also annotated to indicate this information. A frequency distribution table of exam scores for each version and overall was also created.

Use of Results to Improve Program:

The Math 1065 committee will be further reviewing the above results in Fall 2009 with the intent of reaching the educational objective. Any further refinement of criteria for High, Medium, and Low will be determined at that time.

All of the above was distributed to the faculty who taught MATH 1065 during Fall 2008 and discussed at a meeting with Ms Cathy Wilkerson and the Department Chair. The discussion included looking at the questions and what might have been source of the students' confusion. This information will be used in creating the Spring 2009 common exam. Faculty who are teaching the course this semester, and who taught it last semester, can use this information in helping their students prepare for the final exam.

After the meeting, faculty who taught the course in the fall, were given a report for each of their sections as to the percent correct for each question across all four versions and the exam score distribution along with the section's average and standard deviation. This can be used to address topics where their students had problems last semester.

Finally, a report was generated showing, for each version and for each topic, the percent wrong for students scoring at or above 90, 80, 70, etc.. For example, on version A, 42% of students scoring 90 or higher on the exam missed the question on solving the absolute value equation and 41% of students scoring 80 or higher missed the question on factoring the sum/difference of cubes.

Second Foundation Educational Objective:

2. Potential Additional Objective:

Science students in Foundations Curriculum courses will learn Mathematics that is appropriate to their science program needs.

First Means of Assessment for Objective Identified above:

Means of Assessment & Criteria for Success:

1. *Measured Outcome*: Students in College Algebra, Math 1065, will acquire adequate skills in the following areas:

 Exponential and Logarithmic Equations

2. *Direct Metric:* Student performance on the common final examination in Math 1065 will be analyzed each semester by the Undergraduate and College Algebra Committees. The common final will have a number of questions in the skill areas mentioned in part 1, above.

3. *Results:* The results of the assessment will be semester-by-semester statistics on student performance on the Math 1065 common final. The statistics will report overall student performance on the exam as well as student performance on the questions in the skill areas above.

4. *Analysis:* Strengths and weaknesses in the course will be determined by analyzing the statistics. Performance criteria will be set at the time of the first pass through the process. In subsequent passes, the performance criteria will be used as a comparator. The performance criteria will consist of percentages of students to meet or exceed low, medium and high benchmarks of achievement on the common final in each skill area, as well as overall.

5. *Improvement Action:* The committees involved with this assessment will meet (i) to discuss the impact of improvement actions taken in prior cycles and (ii) to determine how to enhance those sections of the curriculum where weaknesses in student performance are identified.

Note: as it gains experience implementing its assessment plans, the Mathematics Department will consider broadening assessment of its Foundations Curriculum offerings to cover other courses with high student enrolment, such as Math 1066 and Math 2228/2283.

Description of Data Collection & Assessment Results:

The Fall 2008 MATH 1065 was used for assessment purposes. There are four versions of the common exam (A, B, C, D) set up as follows. Version A is the first version created. Version B rearranges the order of the questions and the order of the answers in the questions. Version C modifies several of the questions (e.g., changing signs of values, numbers used) from version A (14 of the 40 questions were modified). Version D rearranges the order of the questions and the order of the answers in the questions from version C. After the exams were graded, the opscans were collected in the Mathematics Department office for analysis. 1790 exams were used for the analysis.

A preliminary criteria for High, Medium, and Low performance on a give question was proposed to be:

High: 80% or higher
Medium: 60 to 79%
Low: less than 60%

These preliminary criteria will be reviewed in Fall 2009.

The questions were identified by the topic covered in the question. The topics suggested for more detailed analysis by the Foundations Goals documents and the questions covering those topics (numbers identify where the question was in version A):

Exponential and Logarithmic:
From Questions 2, 11, 13, 25, 6 (as labeled on Test A):

Exponential and Logarithmic:	**% correct**	**performance**
change exponential equation to log equation	72%	Medium
statements about solution to log equation	66%	Medium
exponential equation (number answer)	61%	Medium
exponential equation (log answer)	49%	Low
solve logarithmic equation	28%	Low

Analysis was done to report the percent correct for each question topic across the four versions and overall. The average scores for the four versions were from 59.04 to 60.76 (note: each question is worth 2.5 points). Although the averages were very close together; there were difference of more than ten percent on the percent correct for some questions across the different versions (on the solve an absolute value equation, version A which asked for the smaller solution had 33% correct and version C which asked for the larger solution had 64% correct). Difference of more than ten percent between the lowest and highest percents across the versions was indicated in bold. The overall percent correct was between a low of 28% (solve logarithmic equation) and 84% (slope-intercept of ax + by + c=0).

For each version of the exam, a more detailed report was generated with the frequency for each answer reported along with the percent correct for each question. It was annotated to show wrong answers that (a) attracted 80 to 99 students (b) attracted 100 or more students and (c) were more popular than the correct answer. Each version of the test was also annotated to indicate this information. A frequency distribution table of exam scores for each version and overall was also created.

Use of Results to Improve Program:

The Mathematics Department is working with the Science Departments to ensure that students are familiar with aspects of exponential and logarithmic computations needed by their programs. The Math 1065 committee will be further reviewing the above results in Fall 2009 with the intent of reaching the educational objective. Any further refinement of criteria for High, Medium, and Low will be determined at that time.

All of the above was distributed to the faculty who taught MATH 1065 during Fall 2008 and discussed at a meeting with Ms Cathy Wilkerson and the Department Chair. The discussion included looking at the questions and what might have been source of the students' confusion. This information will be used in creating the Spring 2009 common exam. Faculty who are teaching the course this semester, and who taught it last semester, can use this information in helping their students prepare for the final exam.

After the meeting, faculty who taught the course in the fall, were given a report for each of their sections as to the percent correct for each question across all four versions and the exam score distribution along with the section's average and standard deviation. This can be used to address topics where their students had problems last semester.

Finally, a report was generated showing, for each version and for each topic, the percent wrong for students scoring at or above 90, 80, 70, etc.. For example, on version A, 42% of students scoring 90 or higher on the exam missed the question on solving the absolute value equation and 41% of students scoring 80 or higher missed the question on factoring the sum/difference of cubes.

Second Means of Assessment for Objective Identified above:

Means of Assessment & Criteria for Success:

1. *Measured Outcome*: Students in College Algebra, Math 1065, will acquire adequate skills in the following areas:
 Other Exponential and Logarithmic Problems

2. *Direct Metric:* Student performance on the common final examination in Math 1065 will be analyzed each semester by the Undergraduate and College Algebra Committees. The common final will have a number of questions in the skill areas mentioned in part 1, above.

3. *Results:* The results of the assessment will be semester-by-semester statistics on student performance on the Math 1065 common final. The statistics will report overall student performance on the exam as well as student performance on the questions in the skill areas above.

4. *Analysis:* Strengths and weaknesses in the course will be determined by analyzing the statistics. Performance criteria will be set at the time of the first pass through the process. In subsequent passes, the performance criteria will be used as a comparator. The performance criteria will consist of percentages of students to meet or exceed low, medium and high benchmarks of achievement on the common final in each skill area, as well as overall.

5. *Improvement Action:* The committees involved with this assessment will meet (i) to discuss the impact of improvement actions taken in prior cycles and (ii) to determine how to enhance those sections of the curriculum where weaknesses in student performance are identified.

Note: as it gains experience implementing its assessment plans, the Mathematics Department will consider broadening assessment of its Foundations Curriculum offerings to cover other courses with high student enrolment, such as Math 1066 and Math 2228/2283.

Description of Data Collection & Assessment Results:

The Fall 2008 MATH 1065 was used for assessment purposes. There are four versions of the common exam (A, B, C, D) set up as follows. Version A is the first version created. Version B rearranges the order of the questions and the order of the answers in the questions. Version C modifies several of the questions (e.g., changing signs of values, numbers used) from version A (14 of the 40 questions were modified). Version D rearranges the order of the questions and the order of the answers in the questions from version C. After the exams were graded, the opscans were collected in the Mathematics Department office for analysis. 1790 exams were used for the analysis.

A preliminary criteria for High, Medium, and Low performance on a give question was proposed to be:

High: 80% or higher

Medium: 60 to 79%
Low: less than 60%
These preliminary criteria will be reviewed in Fall 2009.

The questions were identified by the topic covered in the question. The topics suggested for more detailed analysis by the Foundations Goals documents and the questions covering those topics (numbers identify where the question was in version A):

Other exponential and logarithmic problems:
From Questions 23, 28 (as labeled on Test A):

Other exponential and logarithmic problems: **% correct performance**

change of base formula for log base b of a 63% Medium

convert log of product/quotient to sum/diff of logs 29% Low

Analysis was done to report the percent correct for each question topic across the four versions and overall. The average scores for the four versions were from 59.04 to 60.76 (note: each question is worth 2.5 points). Although the averages were very close together; there were difference of more than ten percent on the percent correct for some questions across the different versions (on the solve an absolute value equation, version A which asked for the smaller solution had 33% correct and version C which asked for the larger solution had 64% correct). Difference of more than ten percent between the lowest and highest percents across the versions was indicated in bold. The overall percent correct was between a low of 28% (solve logarithmic equation) and 84% (slope-intercept of ax + by + c=0).

For each version of the exam, a more detailed report was generated with the frequency for each answer reported along with the percent correct for each question. It was annotated to show wrong answers that (a) attracted 80 to 99 students (b) attracted 100 or more students and (c) were more popular than the correct answer. Each version of the test was also annotated to indicate this information. A frequency distribution table of exam scores for each version and overall was also created.

Use of Results to Improve Program:

The Mathematics Department is working with the Science Departments to ensure that students are familiar with aspects of exponential and logarithmic computations needed by their programs. The Math 1065 committee will be further reviewing the above results in Fall 2009 with the intent of reaching the educational objective. Any further refinement of criteria for High, Medium, and Low will be determined at that time.

All of the above was distributed to the faculty who taught MATH 1065 during Fall 2008 and discussed at a meeting with Ms Cathy Wilkerson and the Department Chair. The discussion included looking at the questions and what might have been source of the students' confusion. This information will be used in creating the Spring 2009 common exam. Faculty who are teaching the course this semester, and who taught it last semester, can use this information in helping their students prepare for the final exam.

After the meeting, faculty who taught the course in the fall, were given a report for each of their sections as to the percent correct for each question across all four versions and the exam score distribution along with the section's average and standard deviation. This can be used to address topics where their students had problems last semester.

Finally, a report was generated showing, for each version and for each topic, the percent wrong for students scoring at or above 90, 80, 70, etc.. For example, on version A, 42% of students scoring 90 or higher on the exam missed the question on solving the absolute value equation and 41% of students scoring 80 or higher missed the question on factoring the sum/difference of cubes.

Name of Unit Assessment Committee Chair	Zachary Robinson
Title	Professor
Office Mailing Address	Math Department, Austin Building, ECU
Telephone Number	328-1901
Fax Number	328-6414
Email address	robinsonz@ecu.edu

SIGNATURES OF VERIFICATION:

We certify that the information provided in his assessment report is correct.

Signature of Unit Assessment Committee Chair: Date:

Signature of Department Chair/School Director: Date:

Signature of College/School Dean: Date:

COMPLETION CHECKLIST:

- € **Are all sections of this assessment report complete?**
- € **Has the document been signed – signatures for verification?**

Return this completed report electronically to Kristen Springer-Dreyfus:
SPRINGERK@ECU.EDU

INTERIM REPORT DUE: 6 APRIL 2009
FINAL REPORT DUE: 1 OCTOBER 2009

East Carolina University

1907-2007 CENTENNIAL

Office of Institutional Planning, Assessment and Research
East Carolina University
Greenville Center – Suite 2700
2200 South Charles Boulevard
Greenville, North Carolina 27858-4353

Deadline for submitting Interim Report: 6 APRIL 2009
Deadline for submitting Final Report: 1 October 2009

Academic Program Assessment Report
East Carolina University
2008-2009

General Instructions

Before completing the 2008-2009 Report, please

- Carefully read all directions
- Assign responsibility for completion and accuracy to the Unit Assessment Committee Chair

Before returning the completed 2008-2009 assessment report, review the last page of this document to ensure check lists are complete.

Please direct additional questions to Ms. Kristen Springer-Dreyfus at springerk@ecu.edu

(Academic Department & Program)

(Assessment Period Covered) (Date Submitted)

Educational Objective:

1. *Program Learning Goal 1*: Mathematics majors will acquire sufficient knowledge of Calculus.

First Means of Assessment for Objective Identified above:

Means of Assessment & Criteria for Success:

1. The Calculus Textbook Committee has created and forwarded 6 questions for embedding into the final exam in Math 2173 (Calculus III). The questions are on the topics:

 Differentiation and its interpretation as slope and rate of change
 Optimization
 Partial derivatives
 Limits
 Integration
 Computation of tangent planes.

2. *Direct metrics*:

a) Zach Robinson and Pramath Sastry, instructors of Math 2173 in Spring 2009 will give final exams with these embedded questions and provide data to the Undergraduate and Assessment Committees.

b) *Senior exam.* The Senior Assessment Committee arranged for the ETS Major Field Test to be given majors in Math 4101 (Advanced Calculus). The tests will be analyzed by ETS and the data forwarded to the Calculus Textbook and Undergraduate Committees for the purpose of measuring retention of Calculus skills and concepts.

Description of Data Collection & Assessment Results:

Data collection and analysis is underway in both i) the embedded questions in Math 2173 and ii) the ETS Major Field Test in Math 4101.

Use of Results to Improve Program:

Data will be analyzed in early Fall 2009, with recommendations to follow later in Fall 2009.

Educational Objective:

2. *Program Learning Goal 2*: Mathematics majors will develop an ability to
communicate mathematics effectively.

First Means of Assessment for Objective Identified above:

Means of Assessment & Criteria for Success:

1. *Measured Outcome*: Mathematics majors will learn to write proofs of mathematical propositions.
2. *Direct Metric*: Student writing samples from each of Math 2300 and 3263 will be maintained. They will be scored every fall semester by the Undergraduate Committee according to a rubric based on the following criteria: clarity; citation of relevant theorems, definitions and axioms; proper use of terminology and symbols; proper use of the rules of deduction; mathematical correctness.
3. *Results*: The results of the assessment will be the writing samples of the individual Mathematics majors, together with their rubric scores.
4. *Analysis*: The Undergraduate Committee will analyze the writing samples and rubric scores every fall semester with a view to assessing progress that students make toward the goal as they pass through the program. Performance criteria will be set at the time of the first cycle through the process. Note that a full cycle takes two to three years to elapse. In subsequent cycles, the performance criteria will be used as a comparator. The performance criteria will consist of percentages of students to meet or exceed low, medium and high benchmarks of achievement according to the rubric in each of the assessed courses.
5. *Improvement Action*: The committees involved with this assessment will meet (i) to discuss the impact of improvement actions taken in prior cycles and (ii) to determine how to enhance those sections of the curriculum where weaknesses in student performance are identified.

Description of Data Collection & Assessment Results:

Writing Assessment Committee Report

Date: 3/24/09
Committee Members: Robert Bernhardt, Alexandra Shlapentokh

The Committee analyzed around 50 random samples of student writing consisting of solutions to homework and test problems in Mathematics 3263, ranging over 2007-2009. The following characteristics of writing were considered: clarity; citations of relevant definitions, theorems and axioms; proper use of terminology and symbols; proper use of deduction or logical consistency; Mathematical correctness. (Each committee member recorded the data in the attached spread sheet.)

The committee members observed the following in the examined writing samples:

6. The statement being proved is often not stated and this seriously detracts from the clarity of the argument.
7. Citations of any kind are seldom present.
8. Use of symbols is generally correct, though on the average very few symbols are used and the symbols are often not defined. In other words, sentences of the sort "Let x be …" are lacking.
9. Students often use a combination of a narrative and a symbolic proof. While this practice is in general acceptable, the narrative part often lacks complete sentences, again detracting from clarity.
10. There is a high variance in the use of deduction and general Mathematical correctness. One of the common mistakes is the restating of the original problem in lieu of proof.

Use of Results to Improve Program:

In view of the above, the Committee recommends the following steps:

1. Students should be encouraged to do the following, at least while writing down homework problems: (a) write down clear statements of the claims being proved; (b) write down definitions of the symbols used; (c) indicate what definitions, axioms, theorems are used; (d) use complete sentences in the narrative part of the proof.
2. The Department should create a database of the most common errors. Instructors could be asked to contribute to the database at least two instances of writing errors they find to be the most characteristic of the mistakes made by the students in their class.
3. The department is supposed to track the progress of student writing over time. This could be done either from comparing writing in MATH 2300 to writing in MATH 3263, or else to comparing writing from the beginning of one of these courses to the end of the course. We recommend and request that the Undergraduate Committee establish a procedure for accomplishing this comparison.

Second Means of Assessment for Objective Identified above:

Means of Assessment & Criteria for Success:

Description of Data Collection & Assessment Results:

Use of Results to Improve Program:

Educational Objective:

3. *Program Learning Goal 3*: Mathematics majors will gain an adequately broad base of knowledge.

First Means of Assessment for Objective Identified above:

Means of Assessment & Criteria for Success:

1. *Measured Outcome*: Students will gain knowledge of Mathematics at a level generally considered by the profession to be appropriate to undergraduate education.
2. *Metrics*: There will be both a direct an indirect metric for this outcome.

a) *Indirect Metric*: The Mathematics Department office will survey the seniors every spring semester on the effectiveness of the program with a survey instrument that measures opinions of each course taken as well as of the overall program. The survey will provide space for comments.

b) *Direct Metric*: The Mathematics Department will create or otherwise obtain a standard exam for undergraduates (such as the GRE). The exam will have various parts corresponding to the different courses in the undergraduate Mathematics curriculum. This senior assessment exam will be administered each year to students in Math 4101, as a required part of the course. The grade will not count toward the course grade.

Description of Data Collection & Assessment Results:

The Senior Assessment Committee met and agreed that the department would administer the Princeton based Educational Testing Service (ETS) Major Field of Study (MFS) test to all students in Math 4101 (Advanced Calculus). These tests were ordered through IPAR. Michael Poteat notified the Math Department that the tests arrived in early April. Michael Spurr, the instructor for Math 4101 in Spring 2009, has made taking the ETS MFS test a requirement for the course. He picked up the ETS MFS tests April 13. These were administered to all students in Math 4101 on April 21. The Math Department will negotiate with the Math and Science Education Department to test their Math Ed students as well, to gauge effectiveness of the program. This will take place in the Fall 2009 semester.

3. *Results*: The results will be (i) the survey responses and (ii) the student scores on the senior assessment exam, overall and on each of the sections.
4. *Analysis*: The survey responses and senior assessment exam scores will be reviewed by the Undergraduate Committee. Performance criteria will be set at the time of the first pass through the process. In subsequent passes, the performance

criteria will be used as a comparator. The performance criteria will consist of percentages of students to meet or exceed low, medium and high benchmarks of achievement overall and on each section of the senior assessment exam. Exam scores will be compared with survey responses to determine any correlation.

Use of Results to Improve Program:

Testing in Math 4101 was finished April 21, 2009. The tests are forwarded to ETS for analysis. This will be reviewed by the Senior Assessment Committee in Fall 2009, along with other relevant committees including the Calculus Texbook Committee and the Undergraduate Committee. No data or recommendations are currently available.

5. *Improvement Action*: The committees involved with this assessment will meet (i) to discuss the impact of improvement actions taken in prior cycles and (ii) to determine how to enhance those sections of the curriculum where weaknesses in student performance are identified. Special attention will be directed to any area in the curriculum where low exam scores correlate to problems that surface in the survey responses. Comments on the survey will be considered to gain additional insight on how to make improvements to the curriculum or instructional techniques.

Note: The Mathematics Department will consider submitting a catalog revision of our
undergraduate program description to add the degree requirement of enrolling in a zero
credit hour course in which the senior assessment exam will be given.

Second Means of Assessment for Objective Identified above:

Means of Assessment & Criteria for Success:

Description of Data Collection & Assessment Results:

Use of Results to Improve Program:

Educational Objective:

4.

Program Learning Goal 4: Students will be prepared for careers requiring quantitative skills.

First Means of Assessment for Objective Identified above:

Means of Assessment & Criteria for Success

1. *Measured Outcome*: Graduates will find employment in a variety of professions that value quantitative skills, or will be enrolled in scientific or technical graduate programs.
2. *Metric*: The Mathematics Department office will survey alumni every three years to collect data about their current occupations and the effectiveness of the program in preparing them for their jobs or educational programs.

Description of Data Collection & Assessment Results:

3. *Results*: The results will be the survey responses. These have not been administered this year.

Use of Results to Improve Program:

4. *Analysis*: The Undergraduate Committee will review the survey responses.
5. *Improvement Action*: The committees involved in this assessment will recommend program changes to the Mathematics department based on the survey responses

Second Means of Assessment for Objective Identified above:

Means of Assessment & Criteria for Success

Description of Data Collection & Assessment Results:

Use of Results to Improve Program:

Educational Objective:

5.

Partner Program Goal: Students will acquire adequate Mathematics skills to provide a foundation for their chosen fields of study.

First Means of Assessment for Objective Identified above:

Means of Assessment & Criteria for Success

1. *Measured Outcome*: Engineering students will acquire adequate skills in Calculus and Statistics to provide a strong foundation for Engineering.
2. *Metric*: This outcome will have three metrics.

a. *Indirect Metric*: Students in the Engineering program will be surveyed annually by the Mathematics/Engineering Committee to determine if they feel that they have achieved the objectives of their Mathematics courses. These surveys have been administered in Spring 2009.

b. *Direct Metric 1*: Student performance on the *Mathematics component* of

the annual Fundamentals of Engineering (FE) Exam will be obtained from the Engineering Program by the Mathematics/Engineering Committee. This is currently being negotiated with the Engineering Department.
c. *Direct Metric 2*: The Engineering/Mathematics Committee will determine questions from the FE Exam each semester to embed in exams in the Engineering Calculus sequence. The embedded FE questions will be administered in selected sections of Math 2151, Math 2152, Math 2154, and Math 3307 (embedded questions in these sections were administered on tests throughout the semester).

The Engineering/Mathematics Committee will discuss each topic above on Friday April 24, 2009.

Description of Data Collection & Assessment Results:

3. *Results*: The results will be (i) the survey responses, (ii) the statistics from the Mathematics component of the FE exam, and (iii) the statistics from the embedded questions. The results are not complete as of the date of this preliminary report.
4. *Analysis*: The survey responses and various exam scores will be reviewed by the Mathematics/Engineering Committee. Performance criteria will be set at the time of the first pass through the process. In subsequent passes, the performance criteria will be used as a comparator. The performance criteria will consist of percentages of students to meet or exceed low, medium and high benchmarks of achievement overall and on each exam or section thereof. Exam scores will be compared with survey responses to determine any correlation. Survey responses will be reviewed.

Use of Results to Improve Program:

5. *Improvement Action*: The committees involved with this assessment will meet (i) to discuss the impact of improvement actions taken in prior cycles and (ii) to determine how to enhance those sections of the curriculum where weaknesses in student performance are identified. Special attention will be directed to any area in the curriculum where low exam scores correlate to problems that surface in the survey responses. Comments on the survey will be considered to gain additional insight on how to make improvements to the curriculum or instructional techniques. This will take place in Fall 2009.

Note: as it gains experience implementing its assessment plans, the Mathematics Department will consider broadening this portion of its assessment to include students
enrolled in the Mathematics Education program.

Educational Objective Graduate Program:

1. *Program Learning Goal 1:* Mastery and synthesis of domain specific knowledge.

First Means of Assessment for Objective Identified above:

Means of Assessment & Criteria for Success:

1. *Measured Outcome*: Graduate students in Mathematics are exposed to a wide range of deep mathematical and/or statistical concepts through their coursework. Students will achieve a high level of conceptual mastery and synthesize knowledge across sub-disciplines treated in separate courses.
2. *Direct Metric*: To demonstrate such mastery we require successful completion of a *comprehensive exam* as a degree requirement. Each exam is designed and graded by a committee of four departmental graduate faculty members and covers subject matter treated in four graduate level courses. Exams are administered at most once per semester, according to student demand.

Description of Data Collection & Assessment Results:

3. *Results*: Results to be reported for this assessment will be the comprehensive exam grades achieved in each of the four areas each year by students in the program.
4. *Analysis*: Students must achieve an overall grade of at least B in order to pass their comprehensive exam. Areas of weakness will be identified. Analysis of comprehensive exam results by the Graduate Committee is underway at the writing of this report.

Use of Results to Improve Program:

5. *Improvement Action*: The Graduate Committee will review the comprehensive exams on an annual basis to ensure uniformity of standards and identify areas of weakness in student performance. Failing students will be counseled by their exam committee regarding areas of deficiency and allowed a second attempt (with a new exam) after further study. These are being undertaken by the Graduate Committee at the writing of this report.

Educational Objective Graduate Program:

2. *Program Learning Goal 2*: Student research experience.

First Means of Assessment for Objective Identified above:

Means of Assessment & Criteria for Success:

1. *Measured Outcome*: Graduate students pursuing a *Mathematics* or *Statistics* MA degree concentration will develop the ability to work independently on open-ended problems.
2. *Direct Metric*: Students in these concentrations who choose not to write a *thesis* are required to complete a *research project* under the direction of a graduate faculty member. Students present the results of their research projects in talks open to all faculty and students. A committee of three graduate faculty members is formed to perform a closed oral examination upon completion of a student presentation. The student's work is judged by the committee on a pass/fail basis.

Description of Data Collection & Assessment Results:

3. *Results*: Results to be reported for this assessment are the outcomes (pass/fail) for research projects and theses completed each year. Projects are still being completed and presented at the writing of this report.
4. *Analysis*: A performance criterion will be set by the Graduate Committee at the first pass through the assessment. In subsequent cycles, the performance criterion will be used as a comparator. The performance criterion will consist of a percentage of students to pass the assessment. The Graduate Committee will meet in early Fall 2009 to discuss results and set standards.

Use of Results to Improve Program:

5. *Improvement Action*: The Graduate Committee will provide oversight as regards the appropriateness and rigor of theses and research projects undertaken. Students whose projects are judged unacceptable will be required to perform further work under the supervision of their examination committee. The Graduate Committee will meet in Fall 2009 to review the results and make recommendations.

Educational Objective Graduate Program:

3. *Program Learning Goal 3*: Preparation of college Mathematics instructors.

First Means of Assessment for Objective Identified above:

Means of Assessment & Criteria for Success:

1. *Measured Outcome*: Some students in this program intend to pursue careers as instructors in community colleges and in our own department. Interested students will be well prepared for such careers.
2. *Metrics*: The *Mathematics in the Community College* concentration is tailored to the needs of prospective college teachers. This concentration includes several assessments.

a) Each student is required to take Math 6271, Teaching Collegiate Mathematics. This course is generally offered once per year, according to student demand. As part of this course students are required to produce a *teaching portfolio*, which is scored according to a rubric.
b) Each student is required to give a *presentation* to an undergraduate audience. (This degree requirement substitutes for the research requirement in the other two concentrations.)
c) Each year, the Mathematics Department office will survey recent graduates who sought employment as college teachers, enquiring as to their present employment status.

Description of Data Collection & Assessment Results:

3. *Results*: Results to be reported for these assessments are the rubric scores received on teaching portfolios and the number of successful undergraduate presentations delivered each year. In addition, we will use the survey data to compute the success rate of recent graduates who sought employment as college teachers.
4. *Analysis*: The Graduate Committee will discuss the results to determine if correlated areas of weakness emerge.

Use of Results to Improve Program:

5. *Improvement Action*; The Graduate Committee will meet with faculty teaching Math 6271 to provide a forum for discussion of issues related to the

preparation of college mathematics instructors. Faculty teaching Math 6271 will provide guidance in the development of Teaching Portfolios. The Graduate Committee will address this in Fall 2009.

Educational Objective Graduate Program:

4. Program Learning Goal 4: Ensuring quality of instruction by GTAs.

First Means of Assessment for Objective Identified above:

Means of Assessment & Criteria for Success:

1. *Measured Outcome*: Some students in this program are supported as Graduate Teaching Assistants. Their duties may include teaching sections of remedial and introductory level college courses. It is our goal to provide adequate training and supervision to ensure the quality of instruction provided by our TAs.

2. *Metrics*: Two metrics are employed.

a) Each TA is required to take Math 6271, Teaching Collegiate Mathematics. This course is generally offered once per year, according to student demand. As part of this course students are required to produce a *teaching portfolio*, which is scored according to a rubric.

b) Each TA is assigned an experienced *faculty mentor* who provides advice and feedback on teaching matters. The mentors perform at least one *class observation* per semester for each TA who is currently teaching. The mentors evaluate and document these observations using the same *departmental rubric* employed with untenured faculty. The observation is graded on a scale of 1 to 5 on 10 teaching aspects and an overall score is assigned. The completed forms are provided to the TA as feedback and to the graduate director.

Description of Data Collection & Assessment Results:

3. *Results*: Results to be reported for this assessment are the rubric scores received on teaching portfolios, as well as the overall scores (1-5) achieved by the TAs in class observations performed during the past year.

4. *Analysis*: Faculty mentors and the Graduate Director will discuss the results, noting the impact of any improvement action taken in previous cycles. Analysis is underway as of the writing of this report.

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Use of Results to Improve Program:

5. *Improvement Action*: The graduate director provides oversight of all TA assignments and may reassign TA duties to ensure the integrity of instruction provided. TAs judged deficient in teaching will be provided with additional training and observation by mentors and the graduate director. No data is in the hands of the Department Assessment Committee as of the writing of this report.

Strategic Direction Objective

First Means of Assessment for Strategic Direction Objective Identified above:

Means of Assessment & Criteria for Success:

Description of Data Collection & Assessment Results:

Use of Results to Improve Program:

Second Means of Assessment for Strategic Direction Objective Identified above: Means of Assessment & Criteria for Success: Description of Data Collection & Assessment Results: Use of Results to Improve Program:

Name of Unit Assessment Committee Chair	Zachary Robinson
Title	Professor
Office Mailing Address	Math Department, Austin Building, ECU
Telephone Number	328-1901
Fax Number	328-6414
Email address	robinsonz@ecu.edu

SIGNATURES OF VERIFICATION:

We certify that the information provided in his assessment report is correct.

Signature of Unit Assessment Committee Chair: Date:

Signature of Department Chair/School Director: Date:

Signature of College/School Dean: Date:

COMPLETION CHECKLIST:

- € **Are all sections of this assessment report complete?**
- € **Has the document been signed – signatures for verification?**

Return this completed report electronically to Kristen Springer-Dreyfus:
SPRINGERK@ECU.EDU

INTERIM REPORT DUE: 6 APRIL 2009
FINAL REPORT DUE: 1 OCTOBER 2009