

DEPARTMENT OF MATHEMATICS

PROGRAM REVIEW

FALL 2004

Submitted to:

The Educational Policies Committee

Saint Ambrose University

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2) Proposed Actions to be taken by the Educational Policies Committee

Summary of Proposals

The Department of Mathematics proposes the following changes to our courses and programs:

1. Create five new courses:
 - a. MATH 220 Introduction to Logic and Proof. 3 credits. W.I.
 - b. MATH 230 Topics in Mathematics. 3 credits.
 - c. MATH 305 Data Analysis. 3 credits.
 - d. MATH 375 Complex Analysis, 3 credits.
 - e. MATH 395-396 Seminar. 1 credit apiece. W.I.
2. Eliminate three courses:
 - a. MATH 350 History of Mathematics. 3 credits.
 - b. MATH 499 Internship in Mathematics. 3 credits.
 - c. MATH 601 Topics in Mathematics Education. 3 credits.
3. Change the titles of two courses:
 - a. MATH 171 Elementary Functions. Change to MATH 171 Precalculus.
 - b. MATH 290 Linear Algebra. Change to MATH 290 Elementary Linear Algebra.
4. Change the prerequisites for three courses:
 - a. MATH 290 Linear Algebra. Change from MATH 192 to MATH 191.
 - b. MATH 370 Real Analysis I. Change from MATH 192 to MATH 192, MATH 220 and MATH 290.
 - c. MATH 380 Abstract Algebra I. Change from MATH 192 (or consent of instructor) to MATH 220 or MATH 290.
5. Change the credit offered for MATH 152 Trigonometry. Increase from 2 credits to 3 credits.
6. Renumber MATH 121 Intermediate Algebra. Change course number to MATH 095, and change credit status to match that of MATH 090 Fundamentals of Math.
7. Transfer our Writing Intensive responsibilities from MATH 300 Probability and Statistics I to the new courses MATH 220 Introduction to Logic and Proof and MATH 395 – 396 Seminar.
8. Authorize changes in the mathematics major, the mathematics education major and the mathematics minor to clarify electives and reflect these proposals.

Discussion of Proposals

The following statements support our proposals:

1. Create five new courses:

- a. MATH 220 Introduction to Logic and Proof. 3 credits. W.I.

Experience has shown that students of mathematics need an early introduction to mathematical writing and the basic elements of logic to be successful in later courses. Requiring MATH 220 will allow the Department to address this need early in a student's academic career, before deficiencies in these skills discourage potential majors, and before they become an obstacle to a student's progress.

- b. MATH 230 Topics in Mathematics. 3 credits.

This will give us the flexibility to offer timely and relevant elementary courses on an as-needed basis.

- c. MATH 305 Data Analysis. 3 credits.

This is intended as a follow up course for students with a particular interest in data collection and manipulation. Experimentalists, and those intending graduate school in actuarial science, will find this course particularly useful.

- d. MATH 375 Complex Analysis, 3 credits.

Complex analysis is a fundamental subject of mathematics; MATH 375 will fill an obvious gap in our offerings.

- e. MATH 395-396 Seminar. 1 credit apiece. W.I.

These will be capstone courses in mathematical writing and presentation. Mathematical typesetting is contemplated as a topic.

2. Eliminate three courses:

- a. MATH 350 History of Mathematics. 3 credits.

MATH 350 is not an appropriate requirement for mathematics majors, or for mathematics education majors. Neither is it an acceptable elective.

- b. MATH 499 Internship in Mathematics. 3 credits.

Valuable internships for mathematics students are generally unavailable. Moreover, only one student has ever requested this option.

- c. MATH 601 Topics in Mathematics Education. 3 credits.

This course was created in connection with a grant proposal that was unsuccessful; MATH 601 has never been offered.

3. Change the titles of two courses:

- a. MATH 171 Elementary Functions. Change to MATH 171 Precalculus.

This change will clarify the intent of the course for students, advisors and those evaluating transcripts.

- b. MATH 290 Linear Algebra. Change to MATH 290 Elementary Linear Algebra.

A new title will more accurately reflect the course content.

4. Change the prerequisites for three courses:
 - a. MATH 290 Linear Algebra (Elementary Linear Algebra). Change from MATH 192 to MATH 191.
This will facilitate the entry of students into the more advanced courses for majors and minors.
 - b. MATH 370 Real Analysis I. Change from MATH 192 to MATH 192, MATH 220 and MATH 290.
This will help assure that students in Real Analysis I have the writing skills necessary to succeed.
 - c. MATH 380 Abstract Algebra I. Change from MATH 192 (or consent of instructor) to MATH 220 or MATH 290.
This will help assure that students in MATH 380 will have the algebra and writing background necessary to succeed.

5. Change the credit offered for MATH 152 Trigonometry. Increase from 2 credits to 3 credits.
One additional credit hour will allow us to deliver a more comprehensive course, and to accommodate the technical needs of our professional programs.

6. Renumber MATH 121 Intermediate Algebra. Change course number to MATH 095, and change its credit status to match that of MATH 090 Fundamentals of Math.
MATH 121 is not college level material, and should be treated accordingly.

7. Transfer our Writing Intensive responsibilities from MATH 300, Probability and Statistics I, to the new courses MATH 220, Introduction to Logic and Proof, and MATH 395 – 396, Seminar.
This is our most important proposal. All of our experience has shown that the difficulties involved in mastering the craft of mathematical writing are independent of the content of those courses where writing is required. At the same time, focusing specifically on writing difficulties during our most advanced courses detracts from our ability to deliver course content. Our proposed solution to this dilemma is to focus early on the writing craft itself, and then to follow this introduction with classes devoted exclusively to producing well written mathematics at a level that is appropriate to the individual student's interests and mathematical maturity. MATH 220 is designed to address this matter at the beginning level, and the courses MATH 395 and MATH 396 are designed to address it at the advanced level.

8. Authorize changes in the mathematics major, the mathematics education major and the math minor, in order to reflect these proposals and to clarify the required courses and electives.
Material changes to our programs include the addition of two credits to the minimum number of credits required for a mathematics major, and the addition of three credits to the minimum number required for a mathematics education major. The addition of the two credits to the mathematics major results from the inclusion in the major requirements of the courses MATH 395 and MATH 396; the addition of the three credits to the mathematics education major results from the specification an extra mathematics elective, which we believe strengthens the program.
Other changes are the result of a greater specificity in the listing of required major courses, and of a more restrictive listing of the allowable electives. For example, MATH 320, Differential Equations will now be required of all majors.
The credit requirements for mathematics minor are unchanged, but the required courses are now entirely specified and the allowable electives are restricted to a smaller list.
Finally, given the close relationship between mathematics and the sciences, we propose that mathematics majors take at least one year of science at a level suitable as an introduction for majors in the discipline; we also recommend that mathematics education majors take at least one semester of such an introduction. This will acquaint students with at least one branch of knowledge where mathematics is likely to be an important tool, and provide them with the breadth of knowledge implicit in a Bachelor of Science degree.

Comparison of Current and Proposed Programs:

CURRENTLY THE MATHEMATICS MAJOR requires at least 35 credits in mathematics. Six mathematics courses are specified (MATH 191, MATH 192, MATH 290, MATH 300, MATH 370 and MATH 380), for a total of 20 credits, and students are allowed to choose five elective courses (for at least 15 credits more). Two computer science courses are also required.

We propose to increase the number of specifically required courses by including MATH 220, Introduction to Logic and Proof, and MATH 320, Differential Equations, in the list above. We balance this by reducing the number of student electives from five to three. At the same time, we recommend adding the two new seminar courses, MATH 395 and MATH 396, to the list of requirements. The net effect of this is an increase in two credits to the total number of mathematics credits required.

Besides these changes, we propose eliminating one of the required computer science courses and substituting for it one science course. This will add one more credit to the major requirements, for a total net increase of three credits.

MATHEMATICS EDUCATION majors right now are required to complete 29 credits in mathematics. Seven courses are specified (MATH 191, MATH 192, MATH 290, MATH 300, MATH 340, MATH 350 and MATH 360), for a total of 23 credits, and students choose two electives. Six credits in computer science are also required.

We propose eliminating MATH 350 entirely, and substituting MATH 220 in its place. We also recommend increasing the required number of mathematics electives from two to three. This has the net effect of increasing the total number of mathematics credits required for a mathematics education major by three credits.

No changes in the computer science component are proposed. We do, however, recommend that students satisfy their science requirement by enrolling in a course suitable for science majors.

MATHEMATICS MINORS now are required to take MATH 191, MATH 192 and at least four electives beyond MATH 192 (for a total of at least 20 credits in mathematics). We propose requiring the courses MATH 191, MATH 192, MATH 290 and MATH 300, and allowing only two electives instead of four. This results in no net change in required credits.

List of Recommended Course Numbers and Titles

MATH 090: Fundamentals of Mathematics
MATH 095: Intermediate Algebra
MATH 131: Math for the Liberal Arts
MATH 151: College Algebra
MATH 152: Trigonometry
MATH 171: Precalculus
MATH 191: Calculus & Analytic Geometry I
MATH 192: Calculus & Analytic Geometry II
MATH 210: Theory of Arithmetic
MATH 220: Introduction to Logic & Proof
MATH 230: Topics in Mathematics
MATH 280: Engineering Math
MATH 290: Elementary Linear Algebra
MATH 291: Calculus III
MATH 300: Probability & Statistics I
MATH 301: Probability & Statistics II
MATH 305: Data Analysis
MATH 320: Differential Equations
MATH 340: Secondary Math Methods
MATH 360: Modern Geometry
MATH 370: Real Analysis I
MATH 371: Real Analysis II
MATH 375: Complex Analysis
MATH 380: Abstract Algebra I
MATH 381: Abstract Algebra II
MATH 395: Seminar in Mathematics (1st registration)
MATH 396: Seminar in Mathematics (2nd registration)
MATH 400: Topics in Mathematics

Catalog Course Descriptions

MATH 090. Fundamentals of Mathematics (3 credits)

Designed to isolate, diagnose and overcome weaker areas of a student's mathematics background. Offers a general review of fundamental concepts in arithmetic and elementary algebra. Indicated only for students with serious deficiencies in mathematics. This course does not count towards 120-hour requirement. A grade of "C" or better is required to enroll in higher-level courses.

MATH 095. Intermediate Algebra (3 credits)

Developmental course in algebraic operations, linear equations and inequalities, problem solving, polynomial expressions, factoring, rational expressions and equations, radical expressions and equations, quadratic equations. This course does not count towards 120-hour requirement. A grade of "C" or better is required to enroll in higher-level courses.

Prerequisite: MATH 090 or high school equivalency or appropriate placement

MATH 131 - Math for the Liberal Arts (3 credits)

A survey of topics in applied math stressing the connections between contemporary mathematics and modern society. Topics may include management science, statistics and probability, geometry, and social choice. The course meets general education requirement in mathematics. It may not be used to meet prerequisites of Math 151.

Prerequisite: MATH 095 or high school equivalency or appropriate placement

MATH 151 - College Algebra (3 credits)

Functions, relations, coordinate systems, properties and graphs of elementary functions including polynomials, logarithmic and exponential functions. Elementary manipulations of matrices and determinants. Systems of linear equations and their solution methods.

Prerequisite: MATH 095 or high school equivalency or appropriate placement

MATH 152 - Trigonometry (3 credits)

Angles and their measure. Trigonometric functions and their graphs. Trigonometric identities. Inverse trigonometric functions and their graphs. Applications of trigonometric functions.

Prerequisite: MATH 095 or high school equivalency or appropriate placement

MATH 171 - Precalculus (3 credits)

Introductory course for students planning to take Math 191. Study of functions and operations on functions in a variety of settings. Algebraic, exponential, logarithmic and trigonometric functions; their graphs, properties and applications. Graphing calculator strongly recommended.

Prerequisite: MATH 095 or high school equivalency or appropriate placement

MATH 191 - Calculus and Analytic Geometry I (4 credits)

Functions of single variables; limits, continuity, differentiability, and integrability. Applications of limit, derivatives, differentials and integrals to solutions of physical and social problems.

Prerequisite: MATH 151 and MATH 152, or MATH 152 or high school equivalency or appropriate placement

MATH 192 - Calculus and Analytic Geometry II (4 credits)

Techniques of integration; polar coordinates; sequences and series. Modeling with differential equations. Introduction to partial differentiation and multiple integration

Prerequisite: MATH 191

MATH 210 - Theory of Arithmetic (3 credits)

Limited to candidates for elementary teaching licensure or certificate. Topics include problem solving strategies, sets and elementary number theory and number systems, probability and statistics, informal geometry and measurement.

Prerequisite: MATH 095 or high school equivalency or appropriate placement

WI-MATH 220 – Introduction to Logic and Proof (3 credits)

This course is designed to help students develop skills in reading and understanding elementary mathematical proofs, and in expressing their own mathematical ideas through formal writing. Emphasis will be on precision and style. Math topics include: Logical connectives and quantifiers; types of proof; elementary set theory; functions; integers and induction; equivalence relations; modular arithmetic; matrices. WRITING INTENSIVE.

Prerequisite: MATH 191

MATH 230 – Topics in Mathematics (3 credits)

Selected topics in pure or applied mathematics. Sophomore – junior level.

Prerequisite: Departmental approval.

MATH 280 - Engineering Mathematics I (4 credits)

Development and application of linear algebra and ordinary differential equations. The primary concern is for engineering applications. Included topics are: matrices, systems of linear equations, vectors, first and second order differential equations. Higher order differential equations. The Laplace transform. Not open to mathematics or mathematics education majors.

Prerequisite: MATH 192

MATH 290 - Elementary Linear Algebra (3 credits)

Matrices and systems of linear equations. Determinants. Lines and planes in three-space. Vector spaces and linear transformations. Characteristic equations, eigenvalues and eigenvectors. Diagonalization.

Prerequisite: MATH 191

MATH 291 - Calculus and Analytic Geometry III (4 credits)

Limits and continuity of functions of several variables, partial derivatives, directional derivatives, multiple integration, vectors, planes and and vector fields. Green's Theorem.

Prerequisite: MATH 192

MATH 300 - Probability and Statistics I (3 credits)

Descriptive statistics, probability concepts, random variables, discrete and continuous distributions and sampling distributions. Two sample inferences. Sampling considerations. Point and interval estimation of distribution parameters and single sample tests of hypotheses.

Prerequisite: MATH 191 or Departmental approval.

MATH 301 - Probability and Statistics II (3 credits)

Linear, curvilinear and multiple regressions. Analysis of variance for factorial, blocked, and Latin-squares experimental designs. Nonparametric tests of hypotheses. Testing for independence, randomness and goodness-of-fit.

Prerequisite: MATH 300

MATH 305 – Data Analysis (3 credits)

Topics in the statistical analysis of data. Collecting, coding, validating data; exploratory data analysis; effective quantitative displays; survey/experimental design and sampling; power and error rates; measurement theory; introduction to multivariate statistics.

Prerequisite: MATH 300 or Departmental approval

MATH 320 - Ordinary Differential Equations (3 credits)

First-order ordinary differential equations, linear second order and higher differential equations, series solutions, systems of differential equations and their applications, matrix methods for linear systems, existence and uniqueness theorems.

Prerequisite: MATH 192

MATH 340 - Secondary Math Methods (3 credits)

Limited to secondary teaching certificate candidates. Current issues, approaches, and materials in school mathematics teaching, including philosophy and objectives, curricula problems, review and evaluation of current literature. Students are required to complete a field component of 25 class contact hours. A minimum of two field components (80 hours) is required after field experience and before student teaching.

Prerequisite: MATH 192; EDUC 205, 284, 309

MATH 360 - Modern Geometry (3 credits)

Euclidean and non-Euclidean systems. Axiomatic approach.

Prerequisite: MATH 192

MATH 370 - Real Analysis I (3 credits)

Basic elements of real analysis for students of mathematics. Topics include limits of functions, continuity, and metric spaces. Differentiation.

Prerequisite: MATH 192, 220, 290

MATH 371 - Real Analysis II (3 credits)

Continuation of MATH 370. Topics include sequences and series of functions. The Riemann Integral and basic topology.

Prerequisite: MATH 370

MATH 375 – Complex Analysis (3 credits)

Introduction to the theory of functions of a complex variable. Complex numbers, analytic functions and the Cauchy-Riemann equations. Complex integration. Cauchy Integral formula, Morera's theorem and Liouville's theorem. Contour integration and residue theory.

Prerequisite: MATH 192, 220, 290

MATH 380 - Abstract Algebra I (3 credits)

Definitions and basic properties of groups. Homomorphisms, normal subgroups, quotient groups and direct products. Rings, integral domains and fields. Ideals, quotient rings and polynomials.

Prerequisite: MATH 220 or MATH 290 or Departmental approval.

MATH 381 - Abstract Algebra II (3 credits)

Development of group theory through Cauchy's Theorem and the Sylow Theorems. Elementary ring theory. Introduction to modules and vector spaces. Linear algebra, linear transformations and matrices

Prerequisite: MATH 380

WI-MATH 395 - 396 – Undergraduate Seminar in Mathematics (1 credit)

Selected topics in pure or applied mathematics. Introduction to undergraduate research. Written presentation and group discussion on selected mathematical topics and applications.

Prerequisites: Departmental approval.

MATH 400 - Topics in Mathematics (3 credits)

Selected topics in pure or applied mathematics.

Prerequisites: Departmental approval.

MATH 490 - Independent Study in Mathematics (3 credits)

Reading, writing, or research in mathematics.

Prerequisite: Departmental approval.

Requirements for a B.S. Degree with a Major in Mathematics:

At least 37 credits in mathematics, including the following:

- MATH 191 (Calculus I)
- MATH 191 (Calculus II)
- W.I. MATH 220 (Introduction to Logic and Proof)
- MATH 290 (Elementary Linear Algebra)
- MATH 300 (Probability and Statistics I)
- MATH 320 (Differential Equations)
- MATH 370 (Real Analysis I)
- MATH 380 (Abstract Algebra I)
- W.I. MATH 395 – 396 (Seminar)

At least three courses from this list:

- MATH 291 (Calculus III)
- MATH 301 or 305 (Prob. and Stats. II or Data Analysis)
- MATH 371 (Real Analysis II)
- MATH 375 (Complex Analysis)
- MATH 381 (Abstract Algebra II)
- MATH 400 (Topics; with Departmental approval)

In addition to course work in mathematics, majors must complete:

- CSCI 195 (C++ Programming I) or another approved computer language.

And at least one of the following sequences:

- BIOL 103 – 104 (General Biology I and II)
- CHEM 105 – 106 (General Chemistry I and II)
- PHYS 203 – 204 (College Physics I and II) or PHYS 251 – 253 (General Physics I & II)

Students intending graduate work in mathematics are encouraged to take additional courses in math.

Requirements for a B.S. Degree with a Major in Mathematics Education:

At least 32 credits in mathematics, including the following:

MATH 191 (Calculus I)

MATH 191 (Calculus II)

W.I. MATH 220 (Introduction to Logic and Proof)

MATH 290 (Elementary Linear Algebra)

MATH 300 (Probability and Statistics I)

MATH 340 (Secondary Math Methods)

MATH 360 (Modern Geometry)

And at least three courses from this list:

MATH 291 (Calculus III)

MATH 301 or 305 (Prob. and Stats. II or Data Analysis)

MATH 320 (Differential Equations)

MATH 370 (Real Analysis I)

MATH 380 (Abstract Algebra I)

MATH 400 (Topics; with Departmental approval)

In addition to course work in mathematics, mathematics education majors must complete:

6 credits in computer science, including CSCI 195 (C++ Programming I) or another approved computer language.

And at least one of the following:

BIOL 103 (General Biology I)

CHEM 105 (General Chemistry I)

PHYS 203 (College Physics I) or PHYS 251 (General Physics)

Requirements for a Minor in Mathematics:

At least 20 credits in mathematics, including the following:

MATH 191 (Calculus I)

MATH 192 (Calculus II)

MATH 290 (Elementary Linear Algebra)

MATH 300 (Probability and Statistics I)

And at least two courses from this list:

MATH 220 (Introduction to Logic and Proof)

MATH 291 (Calculus III)

MATH 301 or 305 (Prob. and Stats. II or Data Analysis)

MATH 320 (Differential Equations)

MATH 370 (Real Analysis I)

MATH 380 (Abstract Algebra I)

Requirements for a Secondary Teacher's Certificate with a Minor in Mathematics:

At least 26 credits in mathematics, including the following:

MATH 191 (Calculus I)

MATH 191 (Calculus II)

W.I. MATH 220 (Introduction to Logic and Proof)

MATH 290 (Elementary Linear Algebra)

MATH 300 (Probability and Statistics I)

MATH 340 (Secondary Math Methods)

MATH 360 (Modern Geometry)

And at least one course from this list:

MATH 291 (Calculus III)

MATH 301 or 305 (Prob. and Stats. II or Data Analysis)

MATH 320 (Differential Equations)

MATH 370 (Real Analysis I)

MATH 380 (Abstract Algebra I)

In addition to course work in mathematics, mathematics education majors must complete:

6 credits in computer science, including CSCI 195 (C++ Programming I) or another approved computer language.

3) Overall Description of the Department & Its Programs

The Department of Mathematics offers programs of study leading to a Bachelor of Science degree with a major in mathematics or a Bachelor of Science degree with a major in mathematics education. A minor in mathematics is also available.

The department supports the elementary education department by offering MATH 210, Theory of Arithmetic, and supports other departments by providing courses in basic subjects necessary to their disciplines.

The department offers two general education courses: MATH 131: Math for Liberal Arts and MATH 151: College Algebra.

Currently the Department of Mathematics consists of three full time faculty members and is supported by two full time adjuncts. One tenure track position is vacant.

4) Assessment of the Department and its Programs

Mission Statement:

The mission of St. Ambrose University is to enable all its students to develop intellectually, spiritually, ethically, socially, artistically and physically to enrich their own lives and the lives of others. To assist in that goal, the Department of Mathematical Sciences has the additional mission of providing its majors with the opportunity to develop a deep understanding of the core concepts of mathematics and to prepare them for graduate school or for careers in mathematics, mathematics teaching, or related fields.

Teaching Objectives:

1. To provide majors with practical and theoretical knowledge of mathematics at an advanced level
2. To provide majors high quality courses that will extend their understanding of mathematics
3. To provide courses in mathematics education consistent with best practices.
4. To develop in our majors the logical skills necessary for creative problem solving, analysis, and research
5. To develop the majors' abilities to write and speak effectively in their discipline

Learning Objectives for Majors:

After completing the courses required for a major in mathematics at St. Ambrose University, all students will:

1. Understand the concepts and techniques of core subjects: calculus, linear algebra, analysis and statistics.
2. Apply those core concepts and techniques to solve problems
3. Understand the role of proof in mathematics and read/write elementary mathematical proofs
4. Communicate mathematical ideas effectively using proper mathematical terms and notation.

In addition, students majoring in mathematics education will:

5. Demonstrate knowledge of content and pedagogy
6. Design coherent instruction.

Methods for Assessment in the Major:

The table on the next page displays the strategies the Department uses to assess student performance on the learning objectives. The types of assessments used to measure each objective are listed along with information about where/when the assessments are administered, how the data is to be collected, and how the data is to be analyzed.

These particular types of assessments were chosen because they are comprehensive (they align with Departmental learning objectives), realistic (they can be administered and analyzed using available resources), and useful (they will provide information about the quality of learning in the Department). In addition, these assessments provide useful feedback to students beyond typical course grades.

Documentation of Student Learning in the Major:

The Department will maintain the following records:

- a) Grade records for each course in the major (maintained by faculty teaching the courses)
- b) Copies of unit exams in each course (maintained by faculty teaching the courses)
- c) Samples of student writing/projects from MATH 220 (maintained by faculty teaching the courses)
- d) Placement information on graduate school or employment (maintained by advisors)

The above information will be informally reviewed by faculty each year and formally reviewed every other year. Faculty will summarize the review and recommend changes to the program based on that review.

Additionally, students will be responsible for maintaining a portfolio of the following:

- a) Proofs written in MATH 220
- b) Seminar projects
- c) Lesson plans and field experience observations
- d) Course assignments

As part of the seminar course, students may be asked to review their portfolios or the math program in general.

Methods for Assessment in the Major:

Learning Objective	Assessment	Timeline & Responsibilities		
		Administration	Collection	Analysis/Criteria
Understand the concepts and techniques of core subjects: calculus, linear algebra, analysis, and statistics.	<ol style="list-style-type: none"> Unit exams written to a common table of specifications (common course objectives) Seminar projects 	<ol style="list-style-type: none"> Exams in MATH 191, 192, 290, 300, 320, 370. Written projects and presentations assigned in the seminar course, MATH 395-6 	<ol style="list-style-type: none"> A copy of each unit exam and a record of student scores will be maintained. Students will maintain a portfolio of their seminar projects. 	<ol style="list-style-type: none"> Score distributions and pass rates will be examined longitudinally by faculty teaching the courses Since math majors will take the seminar course at least twice, individual student growth will be informally monitored. Projects will be evaluated for clarity and correctness by faculty and peers.
Apply those core concepts and techniques to solve problems	<ol style="list-style-type: none"> Unit exams written to a common table of specifications Course assignments Seminar projects 	<ol style="list-style-type: none"> Exams in MATH 191, 192, 290, 300... Applications in MATH 300, 301, 305 Written projects and presentations assigned in the seminar course, MATH 395-6 	<ol style="list-style-type: none"> A copy of each unit exam and a record of student scores will be maintained. Samples of student work will be collected Students will maintain a portfolio of their seminar projects. 	<ol style="list-style-type: none"> Score distributions and pass rates will be examined longitudinally by faculty teaching the courses Faculty will review samples every other year Individual student growth will be informally monitored. Projects will be evaluated for clarity and correctness by faculty and peers
Understand the role of proof in mathematics and read/write elementary mathematical proofs	<ol style="list-style-type: none"> Proofs 	<ol style="list-style-type: none"> Proofs in MATH 220, 360, 370, 380 	<ol style="list-style-type: none"> Students will maintain a portfolio of their written proofs. Samples of proofs written by students will be collected. 	<ol style="list-style-type: none"> Proofs will be evaluated for clarity and correctness by faculty
Communicate mathematical ideas effectively using proper mathematical terms and notation	<ol style="list-style-type: none"> Seminar projects Proofs Course projects 	<ol style="list-style-type: none"> Written projects and presentations assigned in the seminar course, MATH 395-6. Proofs in MATH 220, 360, 370, 380 Data analysis projects assigned in MATH 300, 301, 305. 	<ol style="list-style-type: none"> Students will maintain a portfolio of their seminar projects. Students will maintain a portfolio of their written proofs. Samples of proofs written by students will be collected Samples of student projects will be maintained. 	<ol style="list-style-type: none"> Projects will be evaluated for clarity and correctness by faculty and peers Proofs will be evaluated for clarity and correctness by faculty Projects and presentations will be evaluated for clarity and correctness.
Understand the theory supporting a variety of teaching methods and appropriate classroom tools	<ol style="list-style-type: none"> Course exams, projects, and assignments 	<ol style="list-style-type: none"> MATH 210, MATH 340 	<ol style="list-style-type: none"> Students will maintain copies of their course projects and assignments 	<ol style="list-style-type: none"> These assignments are primarily used as a source of feedback to students.
Gain experience in developing lessons, using effective teaching strategies, and assessing student learning	<ol style="list-style-type: none"> Field experience (student teaching) observations and evaluations Sample lesson plans developed 	<ol style="list-style-type: none"> MATH 210, MATH 340 MATH 210, MATH 340 	<ol style="list-style-type: none"> Students will maintain a portfolio of field experiences. Students will also receive an evaluation form. Students will maintain a portfolio of sample lesson plans 	<ol style="list-style-type: none"> Direct observation of student teaching Quality of lesson plans will be evaluated.

Use of Assessment Information to Improve Education:

Information collected from departmental assessments will be informally analyzed each year. Every other year, faculty members will develop a short summary of the information along with recommendations for modifications to the program. This mini-program review will be based on course grades/exams, samples of student work, and student observations.

Students may be asked to review materials in their portfolios (samples of written proofs and course projects) as part of the seminar course.

Evaluation of the Departmental Assessment Plan:

Each year, the departmental assessment plan will be informally evaluated using the following criteria:

1. Is the current assessment plan comprehensive? Does it measure the learning objectives we value as a department? Do we need to change or add any assessments?
2. Is the current assessment plan realistic? Are we keeping up with the data collection and analysis? Are there additional sources of information currently available?
3. Is the current assessment plan yielding useful information? Do we have criteria to measure the level of success of our program? Are we using this information to improve the program? Are students receiving adequate feedback regarding their status and growth in the program?

Assessment of Student Learning of Departmental Objectives:

Content Understanding

Based on observations of student performance and examination of performance on course exams, math majors appear to gain an understanding of mathematical concepts and techniques as they progress through the program. To ensure all students gain an understanding of core mathematical content, the Department agrees that two courses should be added to the core requirements for math majors: MATH 220 (Introduction to Logic & Proof) and MATH 320 (Differential Equations).

The Department also agrees that math education majors, under the current course requirements, are not gaining an understanding of core math content. To fix this problem, the Department will increase the number of math credits required for math education majors. These students will be required to take MATH 220 (Introduction to Logic & Proof) along with one additional math elective.

Additionally, to ensure all students are learning the core concepts of mathematics, common objectives have been developed for courses taught by more than one faculty member.

Application of Math Concepts

No useful assessment information regarding student ability to apply math concepts and techniques was collected. The Department has modified its assessment plan to ensure this learning objective will be assessed in the future.

Read/Write Elementary Mathematical Proofs

Based on observations of student performance and samples of student work, faculty members in the Department agree that students must improve their ability to read and write mathematical proofs, especially in higher-level courses. To address this issue, the Department is proposing a new course, MATH 220: Introduction to Logic & Proof, for all math and math education majors. This course will serve to better prepare students for the requirements of upper-level math courses.

Communicate Mathematical Ideas Effectively

Based on student observations and samples of student projects, the Department agrees that mathematics majors need more opportunities to communicate mathematical ideas. To meet this need, the Department agrees that a new writing intensive course, MATH 395-6: Seminar in Mathematics, must be required for all math majors.

General Education Assessment of Teaching

	Skills (Do)									
	Written Communication	Oral Communication	Interpersonal Skills	Mathematical Reasoning	Critical Thinking	Collaborative Skills	Health & Recreation	Computer Literacy	Information Literacy	Foreign Language
090: Fundamentals of Math				√						
095: Intermediate Algebra				√						
131: Math for Liberal Arts	√			√	√	√				
151: College Algebra			√	√	√					
152: Trigonometry				√	√					
171: Precalculus		√	√	√	√	√				
191: Calculus I				√	√			√		
192: Calculus II				√	√			√		
210: Theory of Arithmetic		√		√	√	√				
220: Intro to Logic & Proof	√			√	√					
230: Topics				√	√					
280: Engineering Math				√	√					
290: Linear Algebra				√	√					
291: Calculus III				√	√					
300: Prob & Stats I			√	√	√					
301: Prob & Stats II	√		√	√	√	√		√		
305: Data Analysis	√	√	√	√	√	√		√	√	
320: Differential Eq.				√	√					
340: Math Methods	√			√	√					
360: Modern Geometry	√	√		√	√					
370: Real Analysis I	√			√	√					
371: Real Analysis II	√			√	√					
375: Complex Analysis	√			√	√					
380: Abstract Algebra I	√			√	√					
381: Abstract Algebra II	√			√	√					
395-396: Seminar	√	√	√	√	√	√				
400: Topics				√	√					

All courses in the Mathematics Department teach to the General Education goals of *mathematical reasoning* and *critical thinking*. Several courses, such as MATH 131, 220, 305, and 395, require students to complete written reports and/or oral presentations, meeting the *written communication* and *oral communication* goals. Other courses, such as MATH 171, 301, 305, require students to work effectively in groups, thus attempting to meet the *interpersonal skills* and *collaborative skills* goals.

5) Review of Courses Offered

Course Offerings, Fact Sheets, and Syllabi:

MATH 090: Fundamentals of Mathematics
MATH 095: Intermediate Algebra
MATH 131: Math for the Liberal Arts
MATH 151: College Algebra
MATH 152: Trigonometry
MATH 171: Precalculus
MATH 191: Calculus & Analytic Geometry I
MATH 192: Calculus & Analytic Geometry II
MATH 210: Theory of Arithmetic
MATH 220: Introduction to Logic & Proof
MATH 230: Topics in Mathematics
MATH 280: Engineering Math
MATH 290: Elementary Linear Algebra
MATH 291: Calculus III
MATH 300: Probability & Statistics I
MATH 301: Probability & Statistics II
MATH 305: Data Analysis
MATH 320: Differential Equations
MATH 340: Secondary Math Methods
MATH 360: Modern Geometry
MATH 370: Real Analysis I
MATH 371: Real Analysis II
MATH 375: Complex Analysis
MATH 380: Abstract Algebra I
MATH 381: Abstract Algebra II
MATH 395: Seminar in Mathematics (first registration)
MATH 396: Seminar in Mathematics (second registration)
MATH 400: Topics in Mathematics