



**COMMITTEE ON ACADEMIC PLANNING AND REVIEW
ANNUAL PROGRAM REPORT**

College	CSCI
Department	Mathematics
Program Unit	Mathematics and Computer Science
Reporting for Academic Year	2013-2014
Department Chair	Matt Johnson, report prepared by Kathy Hann
Date Submitted	10/29/2014

1. SELF-STUDY

A. Five-year Review Planning Goals

Our last five year program review was in 2010-11. The goals listed in the plan for that review included issues regarding students, curriculum, faculty and support. The specific goals were:

1. Students: The Department will continue to try to provide a high caliber, creative undergraduate and graduate math program. The challenge is to retain high quality regular faculty and to maintain a large enough student demand in order to be able to provide these courses. The quality of these courses is also put at risk by lack of funding for graders, which has always been central to the effective delivery of our math courses. The Department also needs to continue to be responsive to the needs of entering freshmen who are taking remedial math courses. Several aspects of the remedial math program have been changed over the last five years, which has improved the student flow through these courses and increased the amount of mathematical feedback within the courses.
2. Curriculum: Continue to be responsive to the needs and requirements of local K-12 schools in the preparation of future teachers. Continue to update curriculum to provide innovative and challenging experiences for our undergrad and grad math majors. Continue to investigate ways to improve student preparation, so that meeting a prerequisite should enable a student to succeed in future courses.
3. Faculty: Hire new faculty in appropriate areas of expertise and retain the faculty that the Department already has. Try to increase faculty support funds for travel and research.
4. Outside Reviewer's Report: Main points suggested were (1) increase number of sections of upper division math courses, and decrease their size, (2) encourage faculty cohesiveness, (3) encourage faculty research
5. Program Response to Outside Reviewer's Report: The Department would indeed like to have

better physical offices for faculty, and smaller classes offered more often. Achieving all of these goals does not seem reasonable given current budget restrictions. Many faculty are focusing their efforts in STEM Education projects. This work is generally not recognized as "research" by outside reviewers, but is strongly in line with institutional and college level priorities. It has been the historical stance of the department to value and reward this type of work. In addition, this work allows for the participation of undergraduates in relevant professional development through the programming provided. Many of our students graduate and become teachers at various levels, as well as teaching for us during their time at CSU East Bay, and thus this work is supportive of their goals and those of CSU East Bay. We also recognize the importance of engaging students in more traditional research of discovery, and we have new faculty who are also working in this area. Our most recent position descriptions have included an emphasis on the ability to work with undergraduates in research. We look forward to filling our vacant positions with new faculty who can help us strengthen this aspect of our program.

B. Five-year Review Planning Goals Progress

1. Students: We have maintained our graduate and undergraduate numbers of majors and we continue to offer a wide variety of courses. Some funds have been made available for graders, but only for overenrolled courses, so only for some of the lower division courses. Learning mathematics requires solving many problems for practice and extension of conceptual knowledge (strongly supporting our PLOs). Faculty must weigh how to productively spend their instructional time and adjust their pedagogy if they do not have support in the form of graders. Moreover, our upper division and graduate students gain valuable experience and develop mentee relationships through grading for their past professors.

The math club was thriving two years ago with a strong membership, meeting monthly. The student leaders have since graduated and the club needs to be revived. A room has been set aside in Robinson Hall as a student study room and students are indeed using this room.

Prof Kamalinejad currently has three students working with him on research projects, 2 undergraduate and one graduate student. Two of these students were awarded a CSUEB student research grant this year. This opportunity to do research greatly improves the student experience in mathematics.

We continue to attempt to improve the remedial mathematics program. For 2013-15, Professors Kevin Callahan and Julia Olkin received an internal grant to create a new version of the lowest level of remedial math: MATH 805 to replace MATH 800. This population of students takes a year-long course of remedial math, with high failure rates, over 50%. Our goal was to not only increase the pass rates, but to also improve the content knowledge. On this project, Changing Remedial Math (ChaRM), Professors Callahan and Olkin, along with several of their Math Masters students, developed the curriculum in a workbook format, to be hands on and exploratory in nature, de-emphasizing memorization and formulas. We impose high standards of mastery of all topics, weekly online and written homework, and regular attendance.

Two ChaRM trial sections of MATH 805 were run in Spring 2014, and the pass rate was about 77% (20 out of 26 students), a significant improvement over the usual pass rate of under 50%.

We also ran two sections of Statway©, for the second year in a row, which is coursework from The Carnegie Foundation for the Advancement of Teaching. Statway combines just-in-time

remedial math with an introductory statistics course. However, we chose to add in more remedial math so that Statway students were receiving the same material as students from the classes which Statway replaced. Testing at the end of the year showed that the statistics knowledge was on par with the regular STAT 1000 class, but the remedial math knowledge was woefully behind. Thus, we decided not to continue with Statway, and instead, to put our efforts in continuing with ChaRM.

All of the teaching assistants who teach our remedial mathematics courses are required to take a two unit training course their first quarter of teaching and a one unit teaching seminar in subsequent quarters.

2. Curriculum: We completed our curriculum update so that the courses for our future K-12 teachers now meet the new California Common Core Standards. A course list, a matrix describing alignment with CCCS and a justification were sent to the California Commission on Teacher Credentialing for both the Single Subject Preparation Program in Mathematics (for future 9-12 teachers) and in Foundational Mathematics (for future 6-8 teachers). These materials have been approved for the high school level program and are under review for the middle school program.

We worked with the Liberal Studies program as they revised their major. Liberal Studies majors in the Teacher Preparation Pathway continue to take four math courses to help them understand the math they will teach at a deeper level:

MATH 2011 Number Systems (4)

MATH 4012 Geometry and Measurement (4)

MATH 4013 Statistics, Data Analysis, and Probability (4)

MATH 4014 Algebra and Functions (4)

Students in this major also must choose a depth of study. We created the Mathematics Depth of Study for future middle school teachers. These teachers will take an additional 18 units to help them prepare to teach grades 6-8.

3. Faculty: We were able to hire one new professor in applied mathematics who started in Fall 2013. In Fall 2014, Prof Glass returned from leave. We continue to have faculty and lecturers retire. We will need to hire new lecturers just to meet our scheduling needs for 2015-16. Some of these lecturers will need to have their doctorate degree as they will be needed to teach upper division and graduate level courses. Faculty are very active in a variety of grants and only two faculty members will be teaching full time in 2015-16. We have a very strong need for new faculty.

Almost all math faculty now have an office in Robinson Hall where there is a student study room. This change has greatly improved faculty cohesion and student/faculty interactions.

C. Program Changes and Needs

We are working toward splitting the mathematics and computer science departments so that each department has a strong leader who is given enough University support to lead their department. With continued retirements of both faculty and lecturers in mathematics we have an even stronger need for additional tenure track faculty and lecturers.

2. SUMMARY OF ASSESSMENT

A. Program Student Learning Outcomes

Students graduating with a Bachelor of Science in Mathematics will be able to:

1. Apply the definitions, techniques and theorems of abstract mathematics
2. Apply the definitions, techniques and theorems of applied mathematics
3. Apply mathematical algorithms to solve problems, both individually and in teams
4. Creatively conjecture and rigorously write, analyze and critique proofs
5. Communicate mathematics to others in written and/or oral form with precision, clarity and organization
6. Apply techniques of at least one area of mathematics in depth

Students taking Option B or C for the Bachelor in Mathematics receive focused emphasis on particular PLOs as follows:

- The Applied Mathematics Option emphasizes PLOs #2, 3 & 6 above.
- The Mathematics Teaching Option emphasizes #1, 2, & 5 above.

Masters of Science in Mathematics

Students graduating with a Masters of Science in Mathematics will be able to:

1. Students will be able to apply the fundamental definitions and theorems of pure mathematics
2. Students will be able to apply the fundamental definitions and theorems of applied mathematics
3. Students will be able to apply advanced techniques of mathematical analysis
4. Students will be able to apply techniques of advanced algebra
5. Students will be able to apply advanced techniques of geometry and topology
6. Students will be able to use mathematical algorithms

Students taking Option B or C for the Masters in Mathematics receive focused emphasis on particular PLOs as follows:

- The Applied Mathematics Option emphasizes PLOs #2, 3 & 6 above.
- The Mathematics Teaching Option emphasizes #1, 2, 4 & 5 above.

B. Program Student Learning Outcome(s) Assessed

The plan we put into place was to assess all PLOs in most math courses offered. This was based, in part, on our ability to use Blackboard Outcomes to seamlessly link our course level assessments to the PLOs as described in our PLO assessment matrix. Without Blackboard Outcomes or another automated solution, the data collection and analysis was far more challenging than expected. However, standard questions were identified for all mathematics courses offered in 2013-14 linked to the PLOs as required. Most instructors used the standard questions to supplement classroom assessments and submitted data in the form of a google document. Those data are in the process of being organized and analyzed. Along with those outcomes data, our biggest lesson was that our plan was unnecessarily ambitious. The undergraduate and graduate committees are working on creating and implementing a more realistic plan starting in Fall, 2014.

C. Summary of Assessment Process

The program learning outcomes were assessed by assessing the student learning outcomes for specific courses that addressed the given program learning outcome. Please see the table attached which describes which courses address which outcomes. We created 3-4 questions for each course and these questions were supposed to be given in all sections of the course (this in reality was too difficult to do). These questions were not part of an assignment nor part of the final exam. Results have just recently been shared with faculty and we will use this information to guide our improvement of our program and the assessment process.

D. Summary of Assessment Results

In 2013-14 the department began direct assessment. In prior years we used gateway courses for the undergraduate program and capstone exam results for the graduate program. The change to direct assessment was encouraged by our CAPR review. We have a lot of data, but we are only just now beginning to review the data and see how we can use the information to guide our program improvement.

The Mathematics faculty worked collaboratively to develop questions designed to assess skills directly related to our PLOs in each course offered in 2013-14 as required by our PLO matrix. These questions were shared via a department google document, providing the opportunity for use across multiple sections and time for a given course. This process led to the development of a question bank with approximately 60 questions to be used across the mathematics curriculum. Students completed assignments that included these questions in over 20 sections of mathematics courses in winter and spring of 2014. The questions spanned the mathematics curriculum and were completed by students in lower division, upper division and graduate classes.

A sample of the data we have collected can be found in appendix B.

3. STATISTICAL DATA

Student demographics data was obtained for mathematics undergraduates and graduates. The source was <http://www20.csueastbay.edu/ir/academic-program-review/detailed-data.html>

The remaining data was collected from <http://www20.csueastbay.edu/ir/academic-program-review/standard-data.html>

- a) Student demographics of majors – Headcount Enrollment by Major for Fall 2013
(percentages were calculated by the math department)

	Fall 2013		
	Degree Level		
	Bachelor	PostBaccalaureate	Master
% female	45.679	100	46.55
% male	54.321	0	53.45
%Black, non-Hispanic	3.7037	0	5.172
%American Indian or Alaska Native	0	0	0
%Asian	14.815	0	27.59
%Pacific Islander	3.7037	0	0
%Hispanic	33.333	100	10.34
%White	29.63	0	34.48
%Multiple ethnicity	6.1728	0	0
%Race/ethnicity unknown	4.9383	0	13.79
%Nonresident aliens	3.7037	0	8.621

Headcount Enrollment	Fall Quarter				
	2009	2010	2011	2012	2013
<i>Math</i>					
1. Undergraduate	70	82	73	71	81
2. Postbaccalaureate	2	3	4	1	1
3. Graduate	84	79	74	66	58
4. Total Number of Majors	156	164	151	138	140
Degrees Awarded	College Years				
	08-09	09-10	10-11	11-12	12-13
<i>Math</i>					
1. Undergraduate	15	15	15	20	11
2. Graduate	12	16	19	24	16
3. Total Number of Majors	27	31	34	44	27

D. Student Faculty Ratios	Math				
1. Tenured/Track	20.4	22.1	17.6	18.0	16.5
2. Lecturer	29.4	28.0	27.2	27.0	28.5
3. SFR By Level (All Faculty)	26.3	24.9	24.2	24.5	24.8
4. Lower Division	28.2	27.1	26.1	25.6	27.1
5. Upper Division	20.4	16.9	15.4	19.5	17.7
6. Graduate	10.1	8.6	15.2	11.3	7.3
E. Section Size					
1. Number of Sections Offered	104.0	74.0	91.0	90.0	88.0
2. SCU taught	11270.0	8199.0	8951.0	8965.0	9093.0
3. Average Section Size	28.0	28.5	25.2	25.3	26.4
4. Average Section Size for LD	29.3	30.4	26.5	26.0	27.4
5. Average Section Size for UD	24.0	22.0	19.0	23.0	23.3
6. Average Section Size for GD	13.3	11.3	16.3	13.7	9.7
7. LD Section taught by Tenured/Track	15	24	12	12	10
8. UD Section taught by Tenured/Track	11	7	9	7	8
9. GD Section taught by Tenured/Track	6	5	4	3	5
10. LD Section taught by Lecturer	71	36	64	66	64
11. UD Section taught by Lecturer	2	2	2	2	2
12. GD Section taught by Lecturer	0	0	0	0	0

Please note that the following data could only be found for Math/CS Combined.

	Fall Quarter				
	2009	2010	2011	2012	2013
C. Faculty	Computer Science and Mathematics Combined				
Tenured/Track Headcount					
1. Full-Time	28	25	25	23	21
2. Part-Time	3	4	2	1	1
3a. Total Tenure Track	31	29	27	24	22
3b. % Tenure Track	57.4%	80.6%	62.8%	58.5%	52.4%
Lecturer Headcount	Computer Science and Mathematics Combined				
4. Full-Time	3	1	1	1	2
5. Part-Time	20	6	15	16	18
6a. Total Non-Tenure Track	23	7	16	17	20
6b. % Non-Tenure Track	42.6%	19.4%	37.2%	41.5%	47.6%
7. Grand Total All Faculty	54	36	43	41	42
Instructional FTE Faculty (FTEF)	Computer Science and Mathematics Combined				
8. Tenured/Track FTEF	19.5	22.4	19.4	16.5	17.4
9. Lecturer FTEF	21.5	11.1	18.1	19.0	19.3
10. Total Instructional FTEF	41.0	33.5	37.4	35.4	36.7
Lecturer Teaching	Computer Science and Mathematics Combined				
11a. FTES Taught by Tenure/Track	372.5	439.1	307.1	288.1	314.9
11b. % of FTES Taught by Tenure/Track	37.8%	58.7%	38.7%	36.0%	36.2%

12a. FTES Taught by Lecturer	612.5	308.5	487.1	513.2	553.9
12b. % of FTES Taught by Lecturer	62.2%	41.3%	61.3%	64.0%	63.8%
13. Total FTES taught	985.0	747.7	794.2	801.3	868.7
14. Total SCU taught	14775.0	11215	11913	12019	13031

Fall 2014 Math Faculty Data

Source: Institutional Research Report to Math Department

	2014
C. Faculty	
Tenured/Track Headcount	Mathematics
1. Full-Time	10
2. Part-Time	1
3a. Total Tenure Track	11
3b. % Tenure Track	44.00%
Lecturer Headcount	Mathematics
4. Full-Time	2
5. Part-Time	12
6a. Total Non-Tenure Track	14
6b. % Non-Tenure Track	56.00%
7. Grand Total All Faculty	25
Instructional FTE Faculty (FTEF)	Mathematics
8. Tenured/Track FTEF	10.5
9. Lecturer FTEF	8.4
10. Total Instructional FTEF	18.9
Lecturer and TA Teaching	Mathematics
11a. FTES Taught by Tenure/Track	155.3
11b. % of FTES Taught by Tenure/Track	24.96%
12a. FTES Taught by Lecturer	248.13
12b. % of FTES Taught by Lecturer	39.88%
12c. FTES Taught by Teaching Assistant	218.8
12d. % of FTES Taught by TA	35.16%
13. Total FTES taught	622.26
14. Total SCU taught	9334

Appendix A Program Student Learning Outcomes Tables

B.S. in Mathematics Program Learning Outcomes

Students graduating with a Bachelor of Science in Mathematics will be able to:

1. Apply the definitions, techniques and theorems of abstract mathematics
2. Apply the definitions, techniques and theorems of applied mathematics
3. Apply mathematical algorithms to solve problems, both individually and in teams
4. Creatively conjecture and rigorously write, analyze and critique proofs
5. Communicate mathematics to others in written and/or oral form with precision, clarity and organization
6. Apply techniques of at least one area of mathematics in depth

Students taking Option B or C for the Bachelor in Mathematics receive focused emphasis on particular PLOs as follows:

- The Applied Mathematics Option emphasizes PLOs #2, 3 & 6 above.
- The Mathematics Teaching Option emphasizes #1, 2, & 5 above.

	1	2	3	4	5	6
I = PLO is Introduced						
D = PLO is Developed						
M = PLO is Mastered						
Required course						
Sequence choice						
Elective						
Math1110 The Nature of Mathematics	service course					
Math1130 College Algebra						
CS1160 Introduction to Computer Science I						
Math1300 Trigonometry and Analytic Geometry						
Math1304 Calculus I	I	I	I			
Math1305 Calculus II	I	I	I			
Math1810 Math for Business and Social Sciences	service course					
Math2011 Number Systems	service course					
Math2101 Linear Algebra	I	I	I			
Math2150 Discrete Structures		I	I	I		
Math2304 Calculus III	I		D			I
Math2305 Calculus IV		D			I	I
Math3000 Intro to Abstract Math and Proofs	D			D	D	
Math3100 Linear Algebra	M			M		M
Math3121 Abstract Algebra I	D			D	M	
Math3122 Abstract Algebra II	M			M		M
Math3151 Combinatorics	D			M		
Math3215 Geometry I	D			D	M	
Math3300 Analysis I	D			D	M	
Math3301 Analysis II	M			M		M
Math3331 Differential Equations		D	D			
Math3361 Ordinary Differential Equations		M	M			
Math3600 Number Theory	M		M	M		
Math3750 Numerical Analysis I		M	M			
Math3841 Linear Programming		M	M			
Math3865 Mathematical Modeling		M				
Math3875 Mathematical Physics		M				
Math4012 Geometry and Measure	service course					
Math4013 Statistics, Data Analysis and Probability	service course					

Math4014 Algebra and Functions	service course					
Math4030 Advanced Study of School Mathematics	service course					
Math4040 History of Mathematics					M	
Math4100 Mathematical Logic	M			M		
Math4121 Advanced Algebra				M	M	M
Math4151 Graph Theory	D			M		M
Math4215 Topics in Geometry	M			M		M
Math4235 Introduction to Knot Theory	M			M		M
Math4340 Introduction to Complex Variables	M			M		M
Math4350 Theory of Functions of a Real Variable				M		M
Math4360 Introduction to Topology	M			M		M
Math4361 Partial Differential Equations		M	M	M		
	1	2	3	4	5	6
Math4365 Dynamical Systems		M		M		M
Math4750 Numerical Analysis II		M	M			M
Math4841 Topics in Optimization		M	M			M
Math4842 Advanced Topics in Optimization		M	M			M
Math4850 Variational Calculus		M		M		M
Math4901 Senior Seminar				M	M	

B.S. in Mathematics - Applied Option

I = PLO is Introduced D = PLO is Developed M = PLO is Mastered	Required course	Sequence choice	Elective	1	2	3	4	5	6	
Math1110 The Nature of Mathematics		service course								
Math1130 College Algebra										
CS1160 Introduction to Computer Science I										
Math1300 Trigonometry and Analytic Geometry										
Math1304 Calculus I	I	I	I							
Math1305 Calculus II	I	I	I							
Math1810 Math for Business and Social Sciences		service course								
Math2011 Number Systems		service course								
Math2101 Linear Algebra	I	I	I							
Math2150 Discrete Structures		I	I	I						
Math2304 Calculus III	I		D						I	
Math2305 Calculus IV		D						I	I	
Math3000 Intro to Abstract Math and Proofs	D			D	D					
Math3100 Linear Algebra	M			M					M	
Math3121 Abstract Algebra I	D			D	M					
Math3122 Abstract Algebra II	M			M					M	
Math3151 Combinatorics	D			M						
Math3215 Geometry I	D			D	M					
Math3300 Analysis I	D			D	M					
Math3301 Analysis II	M			M	M	M				
Math3331 Differential Equations		D	D							
Math3361 Ordinary Differential Equations		M	M							
Math3600 Number Theory	M		M	M						
Math3750 Numerical Analysis I		M	M							
Math3841 Linear Programming		M	M							
Math3865 Mathematical Modeling		M								
Math3875 Mathematical Physics		M								
Math4012 Geometry and Measure		service course								
Math4013 Statistics, Data Analysis and Probability		service course								
Math4014 Algebra and Functions		service course								
Math4030 Advanced Study of School Mathematics		service course								
Math4040 History of Mathematics								M		
Math4100 Mathematical Logic	M				M					
Math4121 Advanced Algebra					M	M	M			
Math4151 Graph Theory	D				M				M	
Math4215 Topics in Geometry	M				M				M	
Math4235 Introduction to Knot Theory	M				M				M	
Math4340 Introduction to Complex Variables	M				M				M	
Math4350 Theory of Functions of a Real Variable					M				M	
Math4360 Introduction to Topology	M				M	M	M			
Math4361 Partial Differential Equations		M	M	M						
Math4365 Dynamical Systems		M			M				M	
Math4750 Numerical Analysis II		M	M						M	
Math4841 Topics in Optimization		M	M						M	
Math4842 Advanced Topics in Optimization		M	M						M	
Math4850 Variational Calculus		M			M				M	
Math4901 Senior Seminar					M	M				

B.S. in Mathematics - Teaching Option

I = PLO is Introduced

D = PLO is Developed

M = PLO is Mastered

Required course

Sequence choice

Elective

	1	2	3	4	5	6
Math1110 The Nature of Mathematics	service course					
Math1130 College Algebra						
CS1160 Introduction to Computer Science I						
Math1300 Trigonometry and Analytic Geometry						
Math1304 Calculus I	I	I	I			
Math1305 Calculus II	I	I	I			
Math1810 Math for Business and Social Sciences	service course					
Math2011 Number Systems	service course					
Math2101 Linear Algebra	I	I				
Math2150 Discrete Structures		I	I	I		
Math2304 Calculus III	I		D			I
Math2305 Calculus IV		D				I
Math3000 Intro to Abstract Math and Proofs	D			D	D	
Math3100 Linear Algebra	M			M		M
Math3121 Abstract Algebra I	D			D	M	
Math3122 Abstract Algebra II	M			M		M
Math3151 Combinatorics	D			M		
Math3215 Geometry I	D			D	M	
Math3300 Analysis I	D			D	M	
Math3301 Analysis II	M			M		M
Math3331 Differential Equations		D	D			
Math3361 Ordinary Differential Equations		M	M			
Math3600 Number Theory	M		M	M		
Math3750 Numerical Analysis I		M	M			
Math3841 Linear Programming		M	M			
Math3865 Mathematical Modeling		M				
Math3875 Mathematical Physics		M				
Math4012 Geometry and Measure	service course					
Math4013 Statistics, Data Analysis and Probability	service course					
Math4014 Algebra and Functions	service course					
Math4030 Advanced Study of School Mathematics	service course					
Math4040 History of Mathematics					M	
Math4100 Mathematical Logic	M			M		
Math4121 Advanced Algebra				M	M	M
Math4151 Graph Theory	D			M		M
Math4215 Topics in Geometry	M			M		M
Math4235 Introduction to Knot Theory	M			M		M
Math4340 Introduction to Complex Variables	M			M		M
Math4350 Theory of Functions of a Real Variable				M		M
Math4360 Introduction to Topology	M			M		M
Math4361 Partial Differential Equations		M	M	M		
Math4365 Dynamical Systems		M		M		M
Math4750 Numerical Analysis II		M	M			M
Math4841 Topics in Optimization		M	M			M
Math4842 Advanced Topics in Optimization		M	M			M
Math4850 Variational Calculus		M		M		M
Math4901 Senior Seminar				M	M	
Stat 3401 Intro to Probability						

M.S. in Mathematics Program Learning Outcomes

Students graduating with a Masters of Science in Mathematics will be able to:

1. Students will be able to apply the fundamental definitions and theorems of pure mathematics
2. Students will be able to apply the fundamental definitions and theorems of applied mathematics
3. Students will be able to apply advanced techniques of mathematical analysis
4. Students will be able to apply techniques of advanced algebra
5. Students will be able to apply advanced techniques of geometry and topology
6. Students will be able to use mathematical algorithms

Students taking Option B or C for the Masters in Mathematics receive focused emphasis on particular PLOs as follows:

- The Applied Mathematics Option emphasizes PLOs #2, 3 & 6 above.
- The Mathematics Teaching Option emphasizes #1, 2, 4 & 5 above.

M.S. in Mathematics - Pure Option

	1	2	3	4	5	6
Math4121 Advanced Algebra	Assessed in Undergrad Plan					
Math4350 Theory of Functions of a Real Variable	Assessed in Undergrad Plan					
Math4360 Introduction to Topology	Assessed in Undergrad Plan					
Math6025 Algebra for Teachers	I				I	
Math6035 Analysis for Teachers	I					
Math6055 Discrete Mathematics		I				I
Math6065 Connections in Mathematics	D		D	D		
Math6100 Applied Algebra		D		D		
Math6121 Advanced Algebra	M			M		
Math6151 Graph Theory		D		D		D
Math6201 Topology	M				M	
Math6210 Convex Polytopes	M				M	
Math6235 Knot Theory	I				I	
Math6250 Differential Geometry	M				M	
Math6331 Topics in Differential Equations		M	M			
Math6339 Intro to Complex Variables	D		D			
Math6340 Complex Analysis	M		M			
Math6350 Real Analysis	M		M			
Math6600 Advanced Number Theory	D			D		
Math6750 Topics in Advanced Numerical Analysis		D				D
Math6841 Nonlinear Optimization		D				D
Math6842 Advanced Topics in Optimization		M				M
Math6865 Mathematical Modeling		I	I			

M.S. in Mathematics - Applied Option

I = PLO is Introduced D = PLO is Developed M = PLO is Mastered	Required course Sequence choice Elective	1	2	3	4	5	6
Math3301 Analysis II	Required course	Assessed in Undergrad Plan					
Math4401 Introduction to Probability Theory	Required course	Assessed in Undergrad Plan					
Math3750 Numerical Analysis I	Required course	Assessed in Undergrad Plan					
Math3841 Linear Programming	Required course	Assessed in Undergrad Plan					
Math6025 Algebra for Teachers	Elective	I				I	
Math6035 Analysis for Teachers	Elective	I					
Math6055 Discrete Mathematics	Elective		I				I
Math6065 Connections in Mathematics	Elective	D		D	D		
Math6100 Applied Algebra	Sequence choice		D		D		
Math6121 Advanced Algebra	Elective	M			M		
Math6151 Graph Theory	Elective		D		D		D
Math6201 Topology	Elective	M				M	
Math6210 Convex Polytopes	Elective	M				M	
Math6235 Knot Theory	Elective	I				I	
Math6250 Differential Geometry	Elective	M				M	
Math6331 Topics in Differential Equations	Sequence choice		M	M			
Math6339 Intro to Complex Variables	Elective	D		D			
Math6340 Complex Analysis	Elective	M		M			
Math6350 Real Analysis	Elective	M		M			
Stats 6401 Advanced Probability	Sequence choice	Assessed by Stats Dept					
Math6600 Advanced Number Theory	Elective	D			D		
Math6750 Topics in Advanced Numerical Analysis	Sequence choice		D				D
Math6841 Nonlinear Optimization	Elective		D				D
Math6842 Advanced Topics in Optimization	Elective		M				M
Math6865 Mathematical Modeling	Elective		I	I			
CS6870 Computer Simulation	Sequence choice	Assessed in CS Plan					

Appendix B Sample Assessment Data

Math 3841 Linear Programming						
	PLO 2: Apply definitions, techniques and theorems of applied mathematics			PLO 3: Apply mathematical algorithms to solve problems, both individually and in teams.		
	Question 1	Question 2	Question 3	Question 4	Question 5	Question 6
Right (Number)	11	12	18	20	17	17
Right (%)	55%	60%	90%	100%	85%	85%
Wrong (Number)	9	8	2	0	3	3
Wrong (%)	45%	40%	10%	0%	15%	15%

Math 3100 Linear Algebra					
	PLO 1: Apply definitions, techniques and theorems of abstract mathematics		PLO 2: Creatively conjecture and rigorously write, analyze and critique proofs	PLO 6: Apply techniques of at least one area of mathematics in depth	
	Question 1	Question 2	Question 3	Question 4	Question 5
Right (Number)	21	22	18	19	14
Right (%)	81%	85%	69%	73%	54%
Wrong (Number)	5	4	8	7	12
Wrong (%)	19%	15%	31%	27%	46%