

Academic Program Review Report

Department of Mathematics and Statistics

California State University, Sacramento

Review Team

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OVERVIEW OF THE PROGRAM REVIEW PROCESS

The Department of Mathematics and Statistics underwent their scheduled program review as one among seven programs in the 2007-2008 review cycle. This was the first cycle at our University to incorporate the Program Review Pilot Study (originally approved by the Faculty Senate for two years, extended to four years). The Pilot Study offers programs three options for the design of the Self-Study; the Department of Mathematics and Statistics chose Option C, titled “Focused Inquiry.” As explained in the *Pilot Study Manual of Procedures*, Option C calls for three main components:

- General information about the program, e.g., data on students, faculty, staff, facilities, etc. (most of which is supplied by Office of Institutional Research);
- A statement of intended student learning outcomes at the program level; methods for assessing them, including the use of direct measures; assessment results to date; and documentation of the use of assessment results in efforts to achieve program improvement (assistance with the preparation of which is available from the University Assessment Coordinator); and
- The results of a focused inquiry addressing issues of particular interest/concern to the program itself, in the context of what is currently important to the college and university.

For its focused inquiry, the Department of Mathematics and Statistics chose to consider the results of a longitudinal study designed to assist in determining best practices for pre-calculus classes and student placement.

This report, like the Self-Study and the External Consultant’s report, is structured based primarily on the three sections prescribed by Option C. Therefore, once preliminary materials have been set forth, it begins with general information pertinent to the Department, then examines issues involving learning outcomes and assessment, and then proceeds to the review of the focused inquiry.

During the course of the review process, the Review Team consulted the following individuals, documents, and other resources.

Individuals Consulted

Dr. Edward Shea, Chair, Department of Mathematics and Statistics

Dr. Roger Leezer, previous Chair, Department of Mathematics and Statistics

Dr. John Ingram, Chair of Curriculum Committee, Department of Mathematics and Statistics

Dawn Giovannoni, Administrative Support Assistant, Department of Mathematics and Statistics

Dr. Jill Trainer, Dean, College of Natural Sciences and Mathematics

Dr. Terry Underwood, University Faculty Assessment Coordinator

Dr. Lindy Valdez, Director, Liberal Studies Program

Dr. Gary Shoemaker, Chair, Department of Physics and Astronomy
 Dr. Du Zhang, Chair, Computer Science Department
 Dr. Rose Leigh Vines, Chair, Department of Biological Sciences
 Dr. Russell Ching, Associate Dean of Undergrad College of Business Administration

Dr. John Sarli (External Consultant), Department of Mathematics, California State University, San Bernardino

Classes and Meetings Attended

Meeting with faculty in the Department (19 in attendance) (December 1, 2009)

MATH 234A, Complex Analysis (December 1, 2009)

Math Club (December 9, 2009)

Documents Consulted

Mathematics and Statistics Documents

- Self-Study Proposal (May 16, 2008)
 - <http://www.csus.edu/acaf/progReview/Proposals/Mathematics%20&%20Statistics.pdf>
- *Department of Mathematics and Statistics Self-Study* (Spring 2009)
 - http://www.csus.edu/acaf/progReview/Self%20Studies/Math_Statistics%20Self-Study.pdf
- *Department of Mathematics and Statistics Assessment Plan* (Fall 2006)
 - <http://webapps2.csus.edu/assessment/plans/MathAssessment.pdf>
- *Department of Mathematics and Statistics Assessment Report* (Spring 2009)
 - <http://webapps2.csus.edu/assessment/Reports/08-09/08-09%20Mathematics.pdf>
- The Department of Mathematics and Statistics website
 - <http://www.csus.edu/math/>
- Syllabi from Department of Mathematics and Statistics courses
- Faculty curricula vitae

Office of Institutional Research *Mathematics & Statistics Fact Book* (Fall 2009)

- <http://www.csus.edu/oir/Data%20Center/Department%20Fact%20Book/Mathematics09.pdf>

Written comments from Dr. Terry Underwood, University Faculty Assessment Coordinator, to Dr. John Ingram, Department of Mathematics and Statistics (January 22, 2009)

External Consultant Report for the Department of Mathematics and Statistics, Dr. John Sarli (January 28, 2010)

- http://www.csus.edu/acaf/progReview/Ext%20Consultant_07-08/CSUS%20Math%20Review.pdf

Previous Program Review report for the Department of Mathematics and Statistics (adopted Spring 2004) and related documents, including the External Consultant's report

Program Review Pilot Study, 2007-2009: *Manual of Procedures for 2007-2008 Cycle*

Program Review at Sacramento State

- <http://www.csus.edu/acaf/progReview/>

Office of Academic Program Assessment at Sacramento State

- <http://www.csus.edu/programassessment/index.html>

WASC (Western Association of Schools and Colleges) action letters to President Gonzalez

- July 17, 2007
 - http://www.csus.edu/wascaccreditation/WASC_Commission_Action_Letter.pdf
- June 24, 2009
 - <http://www.csus.edu/wascaccreditation/WASC%20Reaccreditation%20Action%20Letter%20June%202009.pdf>

WASC assessment related documents

- WASC Rubrics for assessing undergraduate majors
 - <http://www.csus.edu/programassessment/WASC/RubricsforEvaluatingtheEffectivenessofAssessmentProcesses.9.07.pdf>
- WASC Rubric for assessing educational effectiveness
 - <http://www.wascenior.org/node/211>

The review team wishes to thank all the above who contributed to the success of this program review. The collegiality and cooperation of Dr. Edward Shea (Chair), Dr. Roger Leezer (former Chair), and Dr. John Ingram of the Department of Mathematics have been exemplary. External Consultant Dr. John Sarli brought his considerable experience and expertise to bear in important ways on this review, and it was a pleasure to work with him. Many people within the Department, including students in the Math Club and in classes visited by the review team, have given generously of their time and have provided us with valuable ideas. Dean Jill Trainer and other members of the Sacramento State administration have shown their strong commitment to program review in various ways throughout the process.

SUMMARY OF COMMENDATIONS AND RECOMMENDATIONS

Commendations to the Department:

Commendation 1: By maintaining the 15-unit core requirement for all three concentrations of the B.A., the Department has fostered integrity in the undergraduate program.

Commendation 2: The Mathematics Blended Program continues to provide students with an integrated option for preparing to teach while also achieving a sound education in mathematics.

Commendation 3: The Department provides extensive and quality curricular offerings to the University's General Education program and to a wide variety of service department programs.

Commendation 4: The M.A. program in Mathematics is a rigorous and sound program that continues to produce highly trained educators who populate departments in area community colleges.

Commendation 5: The faculty of the Department of Mathematics and Statistics are admirably devoted to student learning, through quality teaching and through being accessible to students.

Commendation 6: The competence and commitment of Dr. Edward Shea, Chair, and of the departmental office staff, have helped make for a positive working environment and for effective operations.

Commendation 7: The Department continues to provide its students with a wide array of beneficial extracurricular opportunities, from the Math Club to the availability of scholarships.

Commendation 8: The Department has made significant steps in the area of assessment. Beyond meeting campus-wide requirements for establishing an assessment plan and for providing annual reports, the Department has exhibited, especially with its impressive focused study work, an active engagement in assessment efforts that yield meaningful results.

Commendation 9: As noted in no uncertain terms in the External Consultant's report, the focused inquiry is a very significant longitudinal study, which provides valuable information on student learning. In the "culture of evidence" of the modern academy, it is a stellar example of meaningful inquiry.

Recommendations to the Department:

Recommendation 1: Strive to clarify as much as possible elective offerings in the various degree programs (both undergraduate and graduate) so that students can plan with an eye toward the future.

Recommendation 2: Strategize means of fortifying elective offerings for all degree programs; for example, consider “pairing” appropriate courses in order to offer at both the undergraduate and graduate levels.

Recommendation 3: Consider carefully the External Consultant’s advice that the Department carry up on its strong approach to diagnostic exams by now implementing Daskala, and continue to work toward improving the means of administering diagnostic testing as effectively as possible.

Recommendation 4: In keeping with its own commitment to contributing as beneficially as possible to the General Education program, and in light of current interests for changing the nature of G.E., the Department should continue to explore ways for enhancing its contributions, and should be open to becoming involved in the G.E. pilot program.

Recommendation 5: Maintain and, if deemed necessary, enhance communications with interrelated departments and their students. Establish in conjunction with these departments a sound means of advising students regarding curricular issues involving Mathematics and Statistics.

Recommendation 6 (to Department and Provost): Especially given the uncontrollable circumstances, the Department and the Office of Academic Affairs should work closely with the Liberal Studies Program Director in order to ensure optimal approaches to placement testing and to continuing to provide sound curricular offerings.

Recommendation 7: Strive to afford more opportunities for graduate students to attain pedagogical training and experience.

Recommendation 8: The Department should take steps toward determining as accurately as possible the causes for the current graduation rate in the M.A. program, including thoughtful reflection regarding the program’s objectives and consideration of imposing greater stringency at the admissions stage.

Recommendation 9 (to Department, College, and Provost): When the budgetary situation allows, the Graduate Coordinator of the Department of Mathematics and Statistics should be granted some release time. Short of this, and for the time being, the Department should seek innovative means of enhancing efficiency.

Recommendation 10 (to Department, College, and Provost): Enhance the viability of incorporating computer technology in mathematics education at our University, if not through providing a dedicated space to house a computer lab, then to taking steps to ensure that all students in relevant courses can access the appropriate mathematics software.

Recommendation 11 (to Department, College, and Provost): Determine the collective will of the Department regarding office space; if the desire is for individual offices, explore means of securing this for all full-time faculty.

Recommendation 12: Follow through on the suggestions offered by the University's Faculty Assessment Coordinator and in the External Consultant's report, including the first three bullet points on p.11: Reword departmental Learning Goals in order to make them clearer to a general readership; under the leadership of the Core Curricular Subcommittee, maintain a set of "exemplars" of test questions and students' answers; and develop a chart that indicates the relationship of the algebra and real analysis courses with the rest of the core curriculum.

Recommendation 13: Take advantage of the momentum gained through the focused inquiry and other assessment efforts toward establishing a comprehensive assessment system that will encourage ongoing faculty engagement while providing the necessary information, including sufficiently measurable data, for annual assessment reports and the periodic Program Review.

Recommendation 14: In light of the demonstrated success of MATH 29A-B, continue to strategize the most effective response without making drastic changes. Consider clarifying the respective roles of 29A-B versus 29, perhaps by identifying the sequence as the "standard" pre-calculus path and MATH 29 as "accelerated." Another means of clarifying would involve specifying that a Calculus Readiness score of 27-31, currently listed as "advisory qualification for Math 29," indicates that the 29A-B sequence is appropriate.

Recommendation 15: Strive to communicate to area secondary schools and community colleges the results of the focused study and the recommendations to which it gives rise.

Recommendations to the Dean and the College:

Recommendation 6 (to Department and Provost): Especially given the uncontrollable circumstances, the Department and the Office of Academic Affairs should work closely with the Liberal Studies Program Director in order to ensure optimal approaches to placement testing and to continuing to provide sound curricular offerings.

Recommendation 9 (to Department, College, and Provost): When the budgetary situation allows, the Graduate Coordinator of the Department of Mathematics and Statistics should be granted some release time. Short of this, and for the time being, the Department should seek innovative means of enhancing efficiency.

Recommendation 10 (to Department, College, and Provost): Enhance the viability of incorporating computer technology in mathematics education at our University, if not through providing a dedicated space to house a computer lab, then to taking steps to ensure that all students in relevant courses can access the appropriate mathematics software.

Recommendation 11 (to Department, College, and Provost): Determine the collective will of the Department regarding office space; if the desire is for individual offices, explore means of securing this for all full-time faculty.

Recommendations to the Provost and the University:

Recommendation 6 (to Department and Provost): Especially given the uncontrollable circumstances, the Department and the Office of Academic Affairs should work closely with the Liberal Studies Program Director in order to ensure optimal approaches to placement testing and to continuing to provide sound curricular offerings.

Recommendation 9 (to Department, College, and Provost): When the budgetary situation allows, the Graduate Coordinator of the Department of Mathematics and Statistics should be granted some release time. Short of this, and for the time being, the Department should seek innovations means of enhancing efficiency.

Recommendation 10 (to Department, College, and Provost): Enhance the viability of incorporating computer technology in mathematics education at our University, if not through providing a dedicated space to house a computer lab, then to taking steps to ensure that all students in relevant courses can access the appropriate mathematics software.

Recommendation 11 (to Department, College, and Provost): Determine the collective will of the Department regarding office space; if the desire is for individual offices, explore means of securing this for all full-time faculty.

Recommendation to the Faculty Senate:

Based on this program review and the Self-study report prepared by the Department of Mathematics and Statistics, the Review Team recommends that all of the Department's degree programs be approved for six years or until the next scheduled program review.

INTRODUCTION

Current Circumstances

This Program Review report was prepared during a period of unprecedented budgetary challenges facing our University and the CSU system at large. The situation calls for a practical approach with regard to topics involving resource allocation, of the sort acknowledged by the Department in its Self-Study:

Technological innovations in instruction and the delivery of courses require a considerable investment of time and effort. Without support for that time and effort, which the current budget crisis makes difficult, the implementation of technological innovations will be considerably delayed. (p.11)

This review has been undertaken with such a practical perspective in mind.

Overview of the Department

The Department of Mathematics and Statistics is housed in the College of Natural Sciences and Mathematics along with Biological Sciences, Chemistry, Geography, Geology, and Physics and Astronomy.

The Department serves four main constituencies of students:

- Undergraduates who major in Mathematics and Statistics, or minor in one or the other
- Undergraduates in degree programs that incorporate mathematics or statistics courses, including students in the Liberal Studies Program
- Students fulfilling the General Education requirement in Mathematical Concepts and Quantitative Reasoning (Area B4)
- Graduate students in the M.A. program in Mathematics

Undergraduate Programs

The Department offers both the B.A. and the B.S. through four undergraduate concentration options:

- B.A. with concentration in Pure Mathematics
- B.A. with concentration in Applied Mathematics and Statistics
- B.A. with concentration in the Teacher Preparation Program
- B.S. with concentration in Mathematics and Applied Computing

A 15-unit upper-division core curriculum is required for all three B.A. concentrations; this includes the two-semester sequences in Modern Analysis and Abstract Algebra. The Mathematics Blended Program, now in its ninth year, affords students the opportunity to engage substantive study of mathematics while earning the California Teaching Credential. The B.S. with concentration in Mathematics and Applied Computing is a relatively new degree offering, currently undertaken by about 5% of the Department's majors.

Service to General Education and to Service Department Programs

The Department offers all twelve of the courses that fulfill the General Education requirement in Mathematical Concepts and Quantitative Reasoning (Area B4): MATH 1, 15H (GE Honors course), 17, 24, 26A, 26B, 29, 30, 31, 35; STAT 1, 50. All of these courses require taking the ELM (Entry Level Mathematics) exam as prerequisite. All students graduating with a bachelor's degree from Sacramento State must complete at least one course in Area B4; the Department is therefore a vital contributor to the University's General Education program.

The Department's contributions to service department programs is also very extensive. Various "gateway" courses required by these programs include:

- STEM (Science, Technology, Engineering, and Mathematics) courses:
 - Biological Science: MATH 26A-B; STAT 1 (MATH 30 and 31 encouraged)
 - Chemistry: MATH 30, 31, 32
 - Civil Engineering: MATH 30, 31, 32, 45
 - Computer Engineering: MATH 30, 31, 45; STAT 50
 - Computer Science: MATH 30, 31; STAT 50
 - Construction Management: MATH 26A-B, STAT 1 (MATH 30 and 31 encouraged)
 - Electrical & Electronic Engineering: MATH 30, 31, 32, 45
 - Mechanical Engineering: MATH 30, 31, 32, 45
 - Physics: MATH 30, 31, 32, 45
- Business: MATH 24; STAT 1
- Liberal Studies: MATH 17, 107A, 107B, 107C (these are specialized courses for the Program; 107C is a relatively new course, developed in response to a CCTC requirement for an integrated studies course)

Graduate Program

The M.A. in Mathematics requires completion of 30 units, 24 of which must be 200-level; the 30 units includes the 3-unit Culminating Requirement, which is a comprehensive exam.

Faculty and Staff

The departmental website lists 30 full-time and 11 part-time faculty members. The Office of Institutional Research *Mathematics & Statistics Fact Book* (Fall 2009) lists 24 tenured faculty and 6 on tenure-track. A survey of faculty curricula vitae (some of which are available via the website) reveals a wide range of academic interests and accomplishments.

The departmental office is staffed by two Administrative Support Assistants.

Facilities and Technology

The departmental office is located in Brighton Hall 114; the faculty offices are also in Brighton Hall.

The Department maintains a Math Lab in Brighton Hall 118, offering students in lower-division Mathematics and Statistics courses assistance free of charge on a drop-in basis. The Lab is managed by a professional staff person; the tutors are either Graduate Assistants or Instructional Student Assistants.

Student Affairs and Advising

According to the OIR *Fact Book*, the number of undergraduates in the Department has ranged from 209 to 246 from 2005 to 2008, of whom in any given year about 25 have been freshmen and 35 have been transfer students. Graduate student enrollment over this same period has ranged from 28 to 37.

Students in the Department are provided with clear and readily available advising information via the departmental website and through the posting and distribution of handouts. Faculty in the Department identify the concentration areas for which they serve as advisors.

The Department maintains an active Math Club, which is led by student officers and which seems to enjoy an enthusiastic, if somewhat limited, membership.

GENERAL INFORMATION (Option C, Part 1)

Academic Programs

Undergraduate Programs

Based on most everything the Review Team has discerned, the Department's undergraduate programs are, in the words of the External Consultant's report, "strong and vital" (p.8), in part due to a relatively conservative approach that maintains attention to fundamentals. The External Consultant's report commends the Department for requiring the 15-unit core curriculum for all of its majors, including those in the Teacher Preparation Program, which is a rare curricular demand among CSU campuses. The report comments: "Because these courses are foundational students often find them difficult, and on campuses where the second semesters are classified as electives they tend to be postponed or avoided – a decision that inevitably limits future options" (p.2).

Commendation 1: By maintaining the 15-unit core requirement for all three concentrations of the B.A., the Department has fostered integrity in the undergraduate program.

The previous Program Review commended and paid much attention to the (at that time) new Blended Program. Nine years later, the Program continues to impress. The External Consultant's report identifies the Department as "a leader in [the] trend" (p.2) among CSU departments that have attempted this sort of integrated option. Dr. Sarli also notes that the Program has been supported through a scholarship fund.

Commendation 2: The Mathematics Blended Program continues to provide students with an integrated option for preparing to teach while also achieving a sound education in mathematics.

Two main, related, topics came to the Review Team's attention when considering the undergraduate degree programs: accessibility of curricular information, and the desire for more elective offerings. Graduate students also expressed some frustration regarding elective offerings. They were at least to some extent aware, though, of the challenges involved in this, especially in the current budgetary situation. Their main plea seems to be that the Department should be as clear as possible as to what electives can be taken, suggesting that a more definitive list would be helpful. Along similar lines, faculty expressed to the Review Team the need for students to plan ahead strategically with regard to curricular choices. Various apparatuses were suggested as possible means for helping to keep students informed.

Recommendation 1: Strive to clarify as much as possible elective offerings in the various degree programs (both undergraduate and graduate) so that students can plan with an eye toward the future.

Regarding the expressed desire on the part of students for more elective offerings, likely it is the case that students at all institutions at all times have desired more by way of elective choices. (The previous Program Review report cites as “the only criticism voiced by students with regard to their department” “a lack of variety of upper division coursework available to them [p.15]”) Institutions, of course, must be prudent in light of budgetary constraints. At the current juncture, such constraints obviously are relatively severe. This calls for an especially strategic approach, so that academic quality (which is not necessarily to be equated with increased offerings) can be advanced as much as possible in a manner that is practical.

The External Consultant’s report acknowledges that students’ complaints regarding “insufficient elective offerings” seem to be among those issues “directly attributable to the condition of the budget for the foreseeable future” (p.5). This did not stop Dr. Sarli from making recommendations in this regard, emphasizing the need for strategic approach:

Beyond the core courses students should have a reasonable expectation of scheduling electives as they are needed. The Department should make an effort to offer the electives in the catalog on a more regular basis, perhaps one additional elective each year at both the undergraduate and graduate level. In this budget climate this will require some creativity (such as the concept of paired graduate courses if I understood this correctly), and the Department should not be averse to the idea of summer scheduling for these courses. This alone might significantly increase the graduation rate in the M.A. program, for example. (p.8)

Recommendation 2: Strategize means of fortifying elective offerings for all degree programs; for example, consider “pairing” appropriate courses in order to offer at both the undergraduate and graduate levels.

Diagnostic mathematics testing affects a wide spectrum of undergraduate students at our University, and was a topic that received considerable attention during this Program Review. As noted previously, taking the Elementary Level Mathematics (ELM) exam is a prerequisite for all courses in the General Education Area B4. The Department employs the Intermediate Algebra Diagnostic (IAD) test for placement in MATH 17, 24, 26A, 29, 107A, and in STAT 1. The Calculus Readiness (CR) test is for placement in MATH 30.

The *Department of Mathematics and Statistics Assessment Report* (Spring 2009) lists as one of the options under consideration for improving pre-calculus outcomes “Better Placement via Preliminary Diagnostic Testing” (p.5). This would seem to correlate well with the External Consultant’s report’s call for the Department

to embrace [Mathematics Diagnostic Testing Project]’s current efforts to provide online diagnostic testing to all UC and CSU campuses via the Daskala testing and reporting platform, which provides complete diagnostic information (subtopic scores, distractor rationales, answer timing, individual student profiles) instantaneously. Because of its extensive and responsible use of MDTP diagnostics CSUS is in a unique position to embrace this new mode quickly and thus become a resource for other campuses that may be less experienced. (p.14)

The Department has been considering means of ensuring that testing be concluded prior to the first week of classes. The Department of Chemistry, which administers a summer exam, might be able to provide advice on this. Probably this would require of CMS a barrier to registration for those students who have not completed the testing. For current students, testing could be administered in April; but for incoming freshmen, this would not be possible. There are issues with CMS in this regard, as programmers seem to be reluctant to do this sort of thing, and it is not clear whether results on placement exams should become part of a student's permanent record.

Recommendation 3: Consider carefully the External Consultant's advice that the Department carry up on its strong approach to diagnostic exams by now implementing Daskala, and continue to work toward improving the means of administering diagnostic testing as effectively as possible.

Service to General Education and to Service Department Programs

As noted above, the Department offers all twelve of the courses that fulfill the General Education requirement in Mathematical Concepts and Quantitative Reasoning (Area B4). Since all non-transfer students graduating with a bachelor's degree from Sacramento State must complete at least one of these courses, the Department serves a large percentage of the student population. Also as noted above, the Department makes many and varied contributions to service department programs. Students in at least eleven different departments take a significant amount of coursework in the Department of Mathematics and Statistics.

The Department's faculty generally perceives the gateway contributions as being sound (none reported any negative feedback). For the most part, the Review Team did not receive complaints or even suggestions for improvement from faculty from these various service department programs. Still, the Department seems to maintain an innovative attitude toward striving to improve on its already strong contributions. For example, the Self-Study notes the Department's efforts involving a new experimental calculus course, launched in Spring 2009 in coordination with the College of Engineering and Computer Science, in "order to address the problem of student retention and matriculation through the calculus sequence..." (p.10).

Dr. Sarli reported to the Review Team that the Associate Dean for Undergraduate Studies had told him he is happy with remedial work provided by the Department to Learning Skills students.

Commendation 3: The Department provides extensive and quality curricular offerings to the University's General Education program and to a wide variety of service department programs.

In its Self-Study, the Department questions the suitability of MATH 1, which is the most popular G.E. course option (according to the OIR *Fact Book*, 1,321 students enrolled in the course in 2008-2009), suggesting that our campus might consider supplementing the CSU G.E. mathematics requirement. This might mean revising MATH 1, or requiring students to select an

option suitable for their own degree programs. Responding to these ideas, the External Consultant's report offers this advice:

Continue to explore the questions raised on page 18 of the self study as they relate to the Math 1 GE course. The Department has already set an admirable standard by granting workload credit but not GE credit for Math 11 and it will have a better chance of maintaining that standard if all of its GE courses are defensible as university level mathematics. (p.14)

On a much broader level, changes in the nature of General Education on this campus clearly are in the making. The Faculty Senate recently approved a General Education Pilot program that is intended to test the waters of an approach to G.E. that differs considerably from the one in place.

Recommendation 4: In keeping with its own commitment to contributing as beneficially as possible to the General Education program, and in light of current interests for changing the nature of G.E., the Department should continue to explore ways for enhancing its contributions, and should be open to becoming involved in the G.E. pilot program.

Appendix A of the Department's Self-Study contains very good ideas addressing coordination with STEM departments in order to enhance the extent and quality of advising (see especially section #4, "Recommendations"). It hardly needs to be said that efforts along these lines should be undertaken with an eye on workload. *MySacState* or a dedicated SacCT site might offer means for facilitating such improvements.

Recommendation 5: Maintain and, if deemed necessary, enhance communications with interrelated departments and their students. Establish in conjunction with these departments a sound means of advising students regarding curricular issues involving Mathematics and Statistics.

Liberal Studies Program Director Lindy Valdez made clear to the Review Team that Gary Shannon has been helpfully contributing, and that his continued involvement is needed. Dr. Valdez also voiced discontent with the IAD test, stating that it does not serve the Liberal Studies Program well. Scheduling of the exam tends to induce a situation during the first week of classes. Unsure of which course they'll settle into, many Liberal Studies students enroll in both MATH 9 and MATH 17; others who would like to take MATH 17 find that it is full (according to Dr. Valdez, freshmen inevitably encounter this problem). Since MATH 17 is a prerequisite for continuing the sequence of LIBS mathematics courses, enrollment problems with this class hamper student progress. Dr. Valdez recommends that the IADT results be put into CMS, in order to facilitate a smoother process in these regards. Dr. Valdez also commented negatively on the ELM; students who score high on this test sometimes falsely suppose that they will be able to pass over MATH 9.

The External Consultant's report, acknowledging the difficulties of coping with "the state's ever-changing requirements for multiple subject credential applicants," commends "the Department's efforts to keep channels open" with the Liberal Studies Program and to develop curricular

offerings in order to comply with the changes. The report goes on to pinpoint a basic issue that might give rise to frustration: “the real issue here is that multiple subject candidates frequently are not aware of critical deficiencies in their basic mathematics skills until they take these courses. This is a problem that really needs to be taken up by the office of Undergraduate Studies, as it should be on every CSU campus.” (p.4)

Recommendation (to Department and Provost) 6: Especially given the uncontrollable circumstances, the Department and the Office of Academic Affairs should work closely with the Liberal Studies Program Director in order to ensure optimal approaches to placement testing and to continuing to provide sound curricular offerings.

Graduate Program

The External Consultant’s report is unstinting in its praise of the graduate program:

The M.A. degree program deserves special mention. The Department has accomplished something that several other CSU mathematics departments have either failed at or have been averse to attempting, namely, the implementation and maintenance of a rigorous mathematics curriculum that is a natural extension of the undergraduate major and therefore a foundation for further study if those who complete it are so inclined. In this sense the program is traditional in the best sense of the word, and, in my opinion, such programs have become rare because the decision to devote the considerable effort required to carry a masters program in mathematics has too often been market driven.
(p.2)

In the previous Program Review report, much is said of the possibility of a thesis option for the graduate program. During this current Program Review, at least one graduate student commented that it would be nice if there were a thesis option, and the issue arose during conversations with faculty. Dr. Sarli explained to the Review Team that there is no “norm” for mathematics master’s programs in the CSU. Our University does allow a thesis option for fulfilling the Culminating Requirement for a master’s degree (and many M.A. programs offer the thesis option, and some offer the “project” option). But given the curricular strength of the program as currently configured, probably it would be best not to make this change. Very likely the thesis would lengthen the time-to-degree. Furthermore, our University, like most others in the CSU system, does not adequately support thesis supervision.

Commendation 4: The M.A. program in Mathematics is a rigorous and sound program that continues to produce highly trained educators who populate departments in area community colleges.

Graduate students with whom the Review Team spoke expressed a desire for courses that are directly applicable to teaching. To paraphrase the words of one, “Rather than being taught how to swim, we are thrown into the water in order to see if we can.” The Learning Skills Center employs graduate students as tutors, and most (but not all) graduate students currently have the opportunity of tutoring in the Math Lab. It is the perception among some graduate students that

one needs to get to know the Lab advisor in order to be granted this opportunity. The External Consultant's report asks the Department to "explore opportunities, in addition to those offered by the Learning Skills Center, for graduate students to acquire teaching experience." (p.5) Dr. Sarli also notes that, in his conversation with Chevelle Newsome, Acting Dean of Graduate Studies, the Dean "indicated that she would be willing to work with the Department to expand teaching possibilities for graduate students" (p.8).

One means of providing more by way of pedagogical training and experience might be to develop a graduate course specifically designed for these purposes. Consider, for example, History 400, "Teaching College History," which is both a seminar course and a practicum; students assist their mentors while they benefit from the experience.

Recommendation 7: Strive to afford more opportunities for graduate students to attain pedagogical training and experience.

The OIR *Fact Book* cites low numbers of master's degrees conferred: 6 in 2008-2009, 1 in both 2006-2007 and 2007-2008, and 5 in 2005-2006. At first glance at least, these numbers are alarming. The External Consultant's report, however, suggests some reason to take comfort. In the midst of praising the program for its curricular integrity, for example, the report states: "The common criticism of such traditional programs is that they graduate far fewer students than they admit. But the tradeoff is worth it in terms of the quality of those graduates and the concomitant long-term employment opportunities" (p.3). At the University, especially given the current emphasis on graduation rates, we are typically not taught to think this way. Of course, Dr. Sarli's insight notwithstanding, it is possible that changes could be implemented in order to increase the graduation rate without jeopardizing the program's academic integrity. For instance, greater stringency at the admissions stage likely would help increase the graduation rate, albeit while also reducing the number of active students. More generally, careful consideration and clarification of the program's objectives likely would effect fruitful reflection on the graduation rate issue. Dr. Sarli's good point regarding this "common criticism" notwithstanding, ideally a sound and rigorous academic program also would boast a high graduation rate.

Recommendation 8: The Department should take steps toward determining as accurately as possible the causes for the current graduation rate in the M.A. program, including thoughtful reflection regarding the program's objectives and consideration of imposing greater stringency at the admissions stage.

The External Consultant's report explicitly recommends that the Graduate Coordinator be granted release time:

The graduate coordinator needs to be made an actual position, meaning that at least some release time should be carved out for it. This M.A. degree program in mathematics is one of the most successful in the CSU and the duties of the coordinator (advising, candidacy records, liaison to the graduate division, monitoring exams and assessment) are considerably beyond those attributable to department service. (p.8)

If the current budgetary crisis subsides in a manner that allows for the University to normalize the allocation of release time for such positions, Dr. Sarli's recommendation should be followed. In the meantime, the Department can look to another section of his report, which frames the following question within the context of graduate students' concerns regarding the comprehensive exam and time to complete the degree:

Can the Department configure the position of graduate coordinator to be more "hands-on" so that this person could, for example, run an orientation each year and intercede with the graduate office to help them interpret individual requirements for candidacy and graduation? (p.5)

Perhaps the departmental website could provide means whereby the Graduate Coordinator could be released from some tasks, or perhaps the departmental staff, or even the Chair, could take on some of them.

Recommendation (to Department, College, and Provost) 9: When the budgetary situation allows, the Graduate Coordinator of the Department of Mathematics and Statistics should be granted some release time. Short of this, and for the time being, the Department should seek innovative means of enhancing efficiency.

(See also **Recommendation 2**, on strategizing means of fortifying elective offerings for all degree programs.)

Faculty and Staff

When the Review Team met with students attending a Math Club social event, we heard much praise for the Department's faculty, on the quality of teaching and commitment to the well being of the students. According to one student, all members of the Department enjoy what they do, and are always happy to discuss issues, even with students who are not in their classes. This student perceives the faculty as being admirably closely-knit. One student commented very favorably on the Research Experience for Undergraduates (REU) program. Many of the students commented on the high level of accessibility of the faculty. One student had recently changed majors, and is happier in this regard with Mathematics.

Commendation 5: The faculty of the Department of Mathematics and Statistics are admirably devoted to student learning, through quality teaching and through being accessible to students.

The Review Team visited the departmental office and spoke with staff personnel. We learned that there is "nothing of concern" with regards to workload and other aspects of the working environment, and that Dr. Shea is doing a great job as Chair. The relationship with the College Dean and her staff is said to be very good. The Review Team is impressed by these glowing assessments, especially in light of the tight budgetary situation (the departmental budget has decreased by \$24,000 over the course of the past two years). We are also impressed with what seems to be a capable and good-natured office staff. The External Consultant's report offers a similar perspective, complimenting both the staff and Dr. Shea for helping to create a positive working environment.

Commendation 6: The competence and commitment of Dr. Edward Shea, Chair, and of the departmental office staff, have helped make for a positive working environment and for effective operations.

Facilities and Technology

At the Review Team's meeting with departmental faculty, many expressed a need for improving the Department's means of offering computer technology devoted to teaching; a dedicated room, good for teaching mathematics and nearby to faculty offices, seems to be the most coveted means. More than four courses would regularly make use of such a room.

The External Consultant's report goes along to some extent with recommending improvements with regard to physical space, but it is more adamant about the need for increasing the use of computer software, perhaps through securing global site licenses.

Recommendation (to Department, College, and Provost) 10: Enhance the viability of incorporating computer technology in mathematics education at our University, if not through providing a dedicated space to house a computer lab, then to taking steps to ensure that all students in relevant courses can access the appropriate mathematics software.

The External Consultant's report urges the Department to work toward securing individual office space:

The Department should be working toward a situation where each full-time member has an individual office. Waiting for a new building is likely not realistic, but all CSU campuses have underutilized space and some colleges even have space utilization committees which can find office space in other buildings. Having some faculty offices in related colleges, if necessary, can even have benefits where coordinated coursework is involved. (p.8)

Departmental faculty voiced divergent opinions on this matter, one noting an "upside" due to enhanced collegiality and opportunity for mentoring of newer faculty, but another asserting that shared space negatively affects faculty interaction with students.

Recommendation (to Department, College, and Provost) 11: Determine the collective will of the Department regarding office space; if the desire is for individual offices, explore means of securing this for all full-time faculty.

Student Affairs and Advising

The Department maintains an active Math Club. The Club graciously invited the Review Team to one of its social gatherings (on 12/9/09). About fifteen students attended, and they seemed enthusiastic and collegial, with fellow students and with attending faculty and the members of

the Review Team. According to one student, this group represented “the same” relatively small group that most always attended. Still, the Review Team is impressed by the vitality of the Club, and appreciates the opportunity to speak directly with students in this relaxed atmosphere.

The Department has established a longstanding tradition of engagement with a number of admirable extracurricular activities and organizations. For fifteen years, it has been involved with the Alliance for Minority Participation (AMP), which has been providing funding to support the Department’s experimentation with pre-calculus alternatives (more on the MATH 29A-B approach in later sections of this report). The Department hosts a California Math Project (CMP) site, which the External Consultant’s report identifies as “one of the most highly regarded in the CSU” (p.3). The “Sac State Summer REU [Research Experience for Undergraduates] in Statistical Modeling,” as noted in its webpage, “involves up to four undergraduate students in computational statistical research. During the summer REU, participants will work closely with faculty members...” Engagement with all such activities and organizations inevitably takes time and energy, and therefore depends on the willingness of generous and motivated faculty.

The Department’s website includes a “Scholarship” page, which states:

Each year the Department of Mathematics & Statistics offers a number of scholarship awards to students majoring in mathematics. The various scholarships – the *American Statistical Association's Sacramento Chapter Scholarship*, the *Kearns Mathematics and Statistics Scholarship*, the *Elizabeth O'Connell Memorial Scholarship*, the *Stewart Moredock Scholarship*, the *Hossain Mozafar Memorial Scholarship*, the *Voula Steinberg Memorial Mathematics Scholarship*, the *Voula Steinberg Mathematics Blended Program Scholarships*, and the *Voula Steinberg Award for Promise in Teaching* – are funded through their respective endowments.

The extent of scholarships offered is impressive, as is the clarity with which the departmental website sets forth the application processes.

Commendation 7: The Department continues to provide its students with a wide array of beneficial extracurricular opportunities, from the Math Club to the availability of scholarships.

ASSESSMENT (Option C, Part 2)

The previous Program Review report included a substantial Recommendation (#5) on assessment:

The department should focus attention on its assessment efforts. It should begin by revisiting recommendations made in its 1996 Program Review Report, which suggested basic guidelines for curricular assessment. The department also needs to develop uniform methods for gathering, analyzing, and utilizing assessment data to improve the mathematics program.

As the following review will clarify, the Department has taken significant steps toward meeting such directives. But as is arguably the case for all programs on our campus, more can be done. The significant accomplishments to date and the momentum gained can be built upon in order to create an assessment system that is fully collaborative and more effectively analyzes measurable data in order to bring about positive innovations in teaching and student learning.

The *Department of Mathematics and Statistics Assessment Plan* (Fall 2006) sets forth the Department's Mission Statement, its five Learning Goals, the courses intended for achieving each of the Learning Goals, and five methods by which the Department undertakes assessment of them. The Mission Statement contains four sections, as per the various groups of students served: (1) Mathematics Major, (2) Service Department, (3) General Education, and (4) Graduate Program. The Learning Goals focus more specifically on the major (listed here with courses intended for achieving them):

1. The mathematics major at CSUS is expected to develop a fundamental understanding of the process and role of mathematical reasoning.
(MATH 108, 110, 130, 102, and 112)
2. The mathematics major at CSUS is expected to develop a fundamental understanding of the main strands of mathematics.
(MATH 110 and 130)
3. The mathematics major at CSUS is expected to have an understanding of and exposure to the breadth of mathematics.
(For students electing the applied option, STAT 115, MATH 150, 170, and 105; for students electing the pure option, MATH 117, 134, 161, 162, and 102; and for students electing the teacher preparation option, MATH 102, 121, and 190)
4. The mathematics major at CSUS is expected to demonstrate an ability to effectively communicate mathematical thought.
(MATH 110, 130, and 193)
5. The mathematics major at CSUS is expected to demonstrate a basic understanding of technology and demonstrate the skill to use technology.
(A course in computer science, STAT 115, MATH 150, and the calculus courses [MATH 30, 31, and 32])

The five methods designed for assessing the Learning Goals are:

1. Capstone course (MATH 193)
2. Exam files for core courses (MATH 110 and 130)

3. Comprehensive final exam (required of all students in the master's program)
4. Survey of alumni
5. Exit interview of each graduating senior

The *Department of Mathematics and Statistics Assessment Report* (Spring 2009) provides an update on the Department's assessment efforts. As the opening page makes clear, the mainstay of assessment efforts for the 2008-2009 year was "the focused inquiry into pre-calculus mathematics preparation..." The Review Team recognizes this fact, and in light of the close interrelationship of the two, for purposes of the Program Review and this report the focused inquiry (Part 3) is to be considered complementary to assessment, as featured in this section (Part 2).

The *Assessment Report* notes that a "series of 8 meetings (and lively debates) by the curriculum committee (and any faculty interested in pre-calculus/calculus) were held late Fall 2008 through Spring 2009 to consider information generated by the focused inquiry. Those meetings have resulted in a list of six recommendations for action to the department..." (p.6; all [there are actually seven] of the recommendations are set forth on pp.10-11 of the *Assessment Report*). While only the first of these recommendations has thus far been acted upon (addressing "Advising and Information – for incoming and continuing students" – on which more below), the fact that faculty are engaging in such discussions, replete with "lively debates," attests the Department's earnest approach to the focused inquiry and to assessment generally. Recommendation #1 has led to production of handouts designed to provide incoming students with useful information about the pre-calculus classes (drafts of these handouts are included in pp.12-13 of the *Assessment Report*).

Appendix A of the *Department of Mathematics and Statistics Self-Study* (Spring 2009) includes helpful ideas pertaining to the Department's work with STEM (Science, Technology, Engineering, and Mathematics) departments, especially with regard to advising. The *Assessment Report* notes that "Some sort of cooperative effort between other major departments and the Department of Mathematics and Statistics may allow an improved mechanism to help prevent students from acquiring probation status." It acknowledges that "It is important that students preparing for a STEM major have appropriate advice as they proceed through their program" (p.4). These conclusions would seem to rest primarily on determinations arrived at through assessment efforts.

On another front, the Self-Study (p.9) notes that the Department is continuing its efforts to assess the effects on student learning of online assignments.

Commendation 8: The Department has made significant steps in the area of assessment. Beyond meeting campus-wide requirements for establishing an assessment plan and for providing annual reports, the Department has exhibited, especially with its impressive focused study work, an active engagement in assessment efforts that yield meaningful results.

Departmental assessment plans and related documents serve as vehicles for communicating to all levels involved in the University's academic programs: students, faculty within the department,

and non-departmental faculty and administrators. Such documents call for clarity of expression effective for such a wide readership.

The External Consultant's report, in agreement with the University's Faculty Assessment Coordinator, recommends that the wording of the Department's Learning Goals should be improved. When discussing Learning Goal #1 with departmental faculty, Dr. Underwood noted that he had previously misunderstood its intentions, not having realized that it calls for application, and not only understanding, of mathematical proof. In its elaboration on Learning Goal #1, the *Assessment Plan* states that

it is expected that undergraduates will arrive at an appreciation for the role of proof in mathematical discourse, as well as a grasp of the methods of proof that permeate all mathematical exposition. Students should be able to identify various methods of proof, and apply these methods to their work in upper division courses. (p.4)

This emphasis on application (or "grasp of the methods"), along with "appreciation," of proof can be clarified through rewording of the Learning Goal itself.

Another example involves Learning Goal #3, which employs the phrase "have an understanding." Perhaps it would be more accurate to state "expand" or "develop." The *Assessment Plan's* section on achieving the Learning Goals elaborates on this Goal as follows: "Students come to an appreciation of the breadth of mathematical inquiry through their options classes." This would seem to infer that the Department expects students to *develop* "understanding of and exposure to the breadth of mathematics" – rather than to "have" it to begin with. Consider also in this regard paragraph 3 on p.15 of the Self-Study: the verbs "recognize," "master," and "apply," as employed therein, are preferable to "understand" due to being measurable, which is a basic criterion for effective language in this sphere.

Along with the suggestion to reword the Learning Goals, the External Consultant's report, again in agreement with the advice of the Faculty Assessment Coordinator, urges the maintaining of "exemplars" of test questions and answers. The External Consultant's report also suggests that the Department capitalize on its strong core curricular foundation by "creating a chart that shows at a glance how the Department's courses depend on the real analysis and modern algebra courses..." (p.11) These are suggestions for tangible and manageable steps that would surely enhance the Department's already commendable approach to assessment.

Recommendation 12: Follow through on the suggestions offered by the University's Faculty Assessment Coordinator and in the External Consultant's report, including the first three bullet points on p.11: Reword departmental Learning Goals in order to make them clearer to a general readership; under the leadership of the Core Curricular Subcommittee, maintain a set of "exemplars" of test questions and students' answers; and develop a chart that indicates the relationship of the algebra and real analysis courses with the rest of the core curriculum.

In addition to the three specific steps cited above, there are other opportunities for the Department to enhance what is already in place with regard to assessment, through some slight revision and augmentation. By way of slight revision, Method #3 for assessing the Learning

Goals applies only to the graduate program, whereas the five Learning Goals would appear to apply to the undergraduate programs.

By way of augmentation, the impressive work of the focused inquiry can be continued in a variety of fruitful ways. For example, the Department can apply similar means to determine whether cohorting or workshops are meaningful factors for the success of MATH 29A-B. The employment of a matrix illustrating the relevance of course offerings for the various learning goals can be helpful for programmatic assessment. The Department's list of courses that achieve the five Learning Goals is already such a matrix in the making. Embedding questions within the final exams would provide a finer level of detail. The approach used at the graduate level of having two faculty read exams might also prove to be a feasible possibility for undergraduate exams; this would help ensure reliability. The Department continues to develop means of ascertaining information through surveys; another potential means would involve focus groups.

Recommendation 13: Take advantage of the momentum gained through the focused inquiry and other assessment efforts toward establishing a comprehensive assessment system that will encourage ongoing faculty engagement while providing the necessary information, including sufficiently measurable data, for annual assessment reports and the periodic Program Review.

FOCUSED INQUIRY (Option C, Part 3)

The External Consultant's report (p.14) provides the following glowing assessment:

In this very thorough Focused Inquiry the Department has made remarkable contributions not just to its self study but to CSU mathematics departments by example. With the possible exception of Cal Poly Pomona, I know of no other campus that has integrated diagnostic math testing with longitudinal data to this extent. Departments whose students rely on courses beginning with pre-calculus should be confident that they are being well served.

Various substantive actions are being undertaken as a result of the focused study's findings, and others are being seriously discussed. For example, the *Assessment Report* includes as one among the suggestions for "Pedagogy and Curriculum Changes" to "Add peer-led workshops to the curriculum similar to those that accompany Math 29A-B." It notes that a "STEM grant or some other resources would be needed..." If pursued, the effects of the workshops could be measured, as a useful augmentation to the focused inquiry.

Commendation 9: As noted in no uncertain terms in the External Consultant's report, the focused inquiry is a very significant longitudinal study, which provides valuable information on student learning. In the "culture of evidence" of the modern academy, it is a stellar example of meaningful inquiry.

The *Department of Mathematics and Statistics Assessment Report* (Spring 2009) highlights notable findings of the focused inquiry:

- Pass rates in MATH 30 are higher for students who have completed the MATH 29A-B sequence (85.4%) than for those who enrolled directly in MATH 30 (79.9%) and those who have completed MATH 29 (72.7%). The 85.4 to 72.7 differential is the most remarkable finding here.
- There is "a very high correlation between CRT [Calculus Readiness Test] score and success in Math 30" (p.3). The *Assessment Report's* Appendix charts the numbers, and offers an overview: "Historically, 75 percent of the students with a 41 to 44 range score will pass Math 30 (on the first attempt and over ninety percent of those with a 45 or higher will pass on the first attempt)."

The *Assessment Report* summarizes: "A reasonable first conclusion is that students who come to CSUS with little more than the minimum entrance requirement are unlikely to become truly calculus ready in one semester" (p.4).

The findings are obviously intriguing. Before simply forging ahead with replacing MATH 29 with the 29A-B sequence, however, some issues need to be considered carefully – and the Department seems to be maintaining a cautious and thoughtful approach. The *Assessment Report* cites as two of the proposed "Pedagogy and Curriculum Changes" (p.5):

- Increase the proportion of algebra (and basic trigonometry) in Math 29 for all students with greater concentration on fundamentals and less on some of the more advanced topics.

- Make greater use of Math 11 as presently constituted (primarily algebra) in conjunction with more refined diagnostic testing to identify students who need more intensive work in basic material before Math 29.

Also pertinent is the fact that currently, enrollment in MATH 29A-B is not pushed to capacity. This does not necessarily mean that students ought to forgo this option, but it does suggest that, at least for now, the curriculum need not be drastically reconfigured in order to provide a greater number of sections. It's probably sound strategy, especially in this budgetary situation, to avoid an "if you build it they will come" approach, instead letting enrollment needs dictate the number of available seats. The *Assessment Report* expresses a similar sentiment: "Initially, the department hopes through the advising and information campaign to attract more students into the existing Math 29AB sequence to determine if it provides the same benefit for students who would not usually enroll as it currently does for the LSAMP students" (p.7).

The Department has already made strides toward revising the 29A-B sequence in a manner that would suit a more standardized approach. The *Assessment Report* (p.11) spells out in Recommendation #7 from the Curriculum Committee various specifics that such a revision might entail, including focus on algebra in one course, on trigonometry in the other; neither course would be a prerequisite for the other, and both would carry General Education credit.

One means of following up on the findings regarding the relative effectiveness of MATH 29A-B might be to "announce" to students in no uncertain terms that this is likely the optimal pre-calculus path. The sequence could somehow be identified as the "standard" approach; MATH 29 could in turn be identified as "accelerated." Or, the CR (Calculus Readiness) test score range that currently steers students to MATH 29 could be used to suggest 29A-B as a better option. While not involving major changes in curriculum, or even in resource allocation, such shifts might clarify for students the reality as determined by the focused inquiry's very intriguing findings.

Recommendation 14: In light of the demonstrated success of MATH 29A-B, continue to strategize the most effective response without making drastic changes. Consider clarifying the respective roles of 29A-B versus 29, perhaps by identifying the sequence as the "standard" pre-calculus path and MATH 29 as "accelerated." Another means of clarifying would involve specifying that a Calculus Readiness score of 27-31, currently listed as "advisory qualification for Math 29," indicates that the 29A-B sequence is appropriate.

The findings of the focused inquiry regarding calculus readiness would seem to have much to do with the general state of mathematics education. In decades past, a normal curriculum typically offered geometry in the tenth grade, algebra in the eleventh, and trigonometry in the twelfth. Now, geometry is typically offered in junior high school, and calculus is commonly offered at least by the senior year. Problematically, however, the degree of preparation is proving to be inadequate, complicating the efforts at the university (and presumably the community college) level.

The External Consultant's report, as cited above, lauds the focused inquiry for providing an example to CSU mathematics departments. It seems to the Review Team that it might helpfully

serve an even wider audience – namely, the secondary schools and community colleges that provide our students with their foundational education in mathematics. Probably there are no easy means for accomplishing this, but it would be worth trying.

Recommendation 15: Strive to communicate to area secondary schools and community colleges the results of the focused study and the recommendations to which it gives rise.

Recommendation to the Faculty Senate:

Based on this program review and the Self-study report prepared by the Department of Mathematics and Statistics, the Review Team recommends that all of the Department's degree programs be approved for six years or until the next scheduled program review.