

## **WASC Road Map for Math Dept Assessment**

### **BA Math/BA Math Preparation for Secondary Teaching**

#### **A. The Comprehensive List**

The list of program learning objectives for the BA Math/BA Math Preparation for Secondary Teaching consists of 4 main learning objectives, including the ability to 1) write clear mathematical proofs, 2) communicate mathematical ideas effectively, 3) to perform a wide variety of standard mathematical computations accurately, and 4) use technology (computers and software) effectively in solving mathematics problems. Other secondary goals might include the ability to use mathematical models effectively in solving a wide variety of applied math problems (this is more important for the BS Applied Math degree), and ensuring that each student learns a broad overview of mathematics by taking a wide variety of math courses as well as gaining an in-depth knowledge of at least one area of mathematics by taking one or more two-semester sequences. The BA Math requirements and learning objectives follow closely the Mathematical Association of America (MAA) 2010 curriculum guidelines as well as earlier versions of these guidelines. These learning objectives and degree requirements are appropriate for the BA Math majors. The discussion is valid for both degrees, the BA Math and the BA Math Preparation for Secondary Teaching as there are great similarities between them with one main exception that the BA Math Preparation for secondary teaching is a more focused on requirements for teachers mandated by the state and the BA math degree is more flexible and allows more electives and choices. As a possible improvement in this area the Math Dept is considering an expansion of Goal 3 to include a larger set of basic skills that students are expected to learn. A more complete set of Standard Mathematical Computations might include some of the skills learned in Calculus, Discrete Math, and Linear Algebra which are required of all BA Math majors. Otherwise we can consider Goals 1-4 to be a comprehensive list of learning objectives for the BA Math/BA Math Preparation for Secondary Teaching programs. This change will be discussed and acted on as appropriate by the Math Department Assessment committee. The Math Department assessment program is developed by not highly developed in this area at the present time however it seems that we can be close to highly developed by Spring 2013. A more complete set of basic skills for Goal 3 needs to be agreed upon by the Assessment Committee and the Math Department.

#### **B. Assessable Outcomes**

Goal 1 is introduced in Math 42 and enhanced in Math 108 where it is assessed. The student's skills in using the 5 basic proof writing techniques described in Goal 1 are assessed using embedded exam questions on midterms and finals. Goal 2 is introduced in the basic GE courses that all SJSU students are required to take and enhanced in Math 100W. Goal 2 is assessed in Math 104 one of several upper division courses where students are required to submit a writing project/oral presentation. Goal 3 is introduced in Calculus, Discrete Math, and Linear Algebra which are required of all BA Math majors. The main aspects of Goal 3 are presently assessed in Math 138 using embedded exam questions. If goal 3 were expanded to include a wider variety of basic skills then we might consider offering an exam to math majors to assess how well students are learning these basic skills. Goal 4 is introduced in Calculus and Linear Algebra where students are introduced to graphing calculators and mathematical software and enhanced in a required programming course. Goal 4 is assessed in either Math 143M or Math 143C which are courses where students are required to turn in a programming project. Goal 4 is also enhanced in a variety of other upper division math courses where programming or mathematical software is required. All learning outcomes described in Goals 1-4 can be assessed in the courses listed though in some cases there is no agreed upon rubric that has been approved by the department. This can be discussed at future department meetings. At this point the Math Dept Assessment Plan is developed but not highly developed in this area. But hopefully rubrics can be agreed upon by the Math Department and the Assessment Committee by Spring 2103.

#### **C. Alignment**

The BA Math/BA Math Preparation for Secondary Teaching curriculum is generally well aligned with Goals 1-4 and students have many courses in which to increase their performance for each of the goals though again there are some

areas where improvement is possible. Communication skills are touched on in English 1A, 1B, and Math 100W which all math majors are required to take. The Math department might also want to consider adding additional upper division courses where students will be expected to write projects and give oral presentations to give students more chances to enhance their communication skills (Goal 2). Also there is a discussion underway in the Undergraduate Curriculum committee about whether or not we should introduce a capstone course for the BA Math degree. The BA Math Preparation for Secondary Teacher already has a general problem solving course Math 201A which serves as a capstone course. All math majors are required to take one programming course. The Math Dept might also want to consider adding other courses where students learn how to use technology in solving math problems to give students more chances to enhance their skills in using technology (Goal 4). For now the department will conduct a survey to determine the courses in which the Math Faculty require students to give written and oral presentations and in which courses students are required to practice their programming skills and the use of mathematical software, and other forms of technology and then determine what the department policy should be in terms of assigning students to do written and oral projects and technology projects in upper division mathematics classes. The BA Math Dept curriculum is also closely aligned with curriculum guidelines published by national organizations like the MAA (Mathematical Association of America). MAA (Mathematical Association of America) curriculum and assessment guidelines can be found at the following links, <http://www.maa.org/cupm/math-2010.pdf> , <http://www.maa.org/cupm/cupm2004.pdf> , and <http://www.maa.org/saum/cases/cupm-guidelines1105-saum.pdf>. Presently the Math Dept is developed but not highly developed in this area. Developing a plan for which upper division courses should require writing projects/oral presentations and programming/mathematical software can hopefully be developed by Spring 2013.

#### **D. Assessment Planning**

At this time the Math Dept. has a reasonable multi-year program planning/assessment plan. Our last external review took place in Spring 2009 and our program planning meeting with the provost was held in Fall 2010. In Fall 2010 Goal 1 was assessed in Math 108, Goal 2 will be assessed in Math 104 during Fall 2012 (since Math 104 was cancelled in Fall this assessment will need take place in Spring 2013). Goal 3 will be assessed in Math 138 during Spring 2012, and Goal 4 will be assessed in Math 143M during Fall 2011. The assessment data is gathered by the instructors of these courses. The data is then reviewed by the Math Dept Assessment committee (which was developed in 2012/13) and the Undergraduate Curriculum committee as well as the Math Dept. chair to determine if any changes are needed in the curriculum or in the assessment plan itself and always we are looking for the points of strengths and signs of weaknesses in the curriculum and how to improve the delivery of the material in order to increase sophistication. The department assessment planning is presently close to the highly developed stage though getting more faculty involvement is always an issue.

#### **E. The Student Experience**

The department student experience is developed. The Math Department faculty, are in the process of revising their course outlines so that the course learning objectives are clearly spelled out in detail and that students know about them, but more needs to be done in this area. We intend to do this in the near future and communicate to the students all learning outcomes by advertising them on the mathematics web page and by making clear to the faculty that discussing the learning outcomes with the student should be thought of as an important component of the courses. The Math Department would need to publicize these learning objectives that students are expected to learn in course outlines, green sheets and on the Math Department web page to reach the highly developed stage. There are plans underway to create a department assessment web page for each department hosted on the College of Science web site by Spring 2013 and then having each department create a link on their web page to the assessment page on the COS web site.

## **BS Applied Math Goals 2-5 are to be assessed.**

Concentration in Applied and Computational Mathematics

Concentration in Statistics

Concentration in Economics and Actuarial Science

### **A. The Comprehensive List**

The BS degree in our department has three concentrations : Computational Mathematics, Statistics, as well as Economics and Actuarial Science. The requirements of these concentrations are different from each other but it still seems appropriate to use the same learning objectives for the 3 programs which are the skills expected by firms who employ mathematicians in business, government, and industry. The list of program learning objectives for the BS Applied Math consists of 4 main learning objectives, including the ability to 2) communicate mathematics and other related ideas effectively, 3) to perform a wide variety of standard mathematical computations accurately, 4) use technology (computers and software) effectively in solving mathematics problems, and 5) to use mathematical models effectively in analyzing applied math problems in a variety of different areas. Other secondary goals might include the ability write clear and logical mathematical proofs (this is more important for the BA Math degree), and ensuring that each student learns a broad overview of mathematics by taking a wide variety of math courses as well as gaining an in-depth knowledge of at least one area of mathematics by taking one or more two-semester sequences. The list of program learning objectives for the BS Applied Math is an organized set of reasonable outcomes. These outcomes focus on the important skills that a math major should learn in their math courses but the list of objectives also includes some relevant institution wide outcomes such as communication and critical thinking which are also covered in courses outside of the Math Dept. The outcomes are appropriate for the undergraduate level and consistent to a large extent with many national disciplinary standards and in some cases the outcomes we have go beyond what is being done at other similar institutions. The discussion is valid for all three concentrations that are mentioned here as there are great similarities between. As a possible improvement in this area the Math Dept is considering an expansion of Goal 3 to include a larger set of skills that students are expected to learn. A more complete set of Standard Mathematical Computations might include some of the skills learned in Calculus, Discrete Math, Linear Algebra, Ordinary Differential Equations, and Applied Statistics, which are required of all BS Applied Math majors. Otherwise we can consider Goals 2-5 to be a comprehensive list of learning objectives for the BS Applied Math programs. Presently the Math Dept Assessment Plan would be considered to be developed but not highly developed in this area but we hope to be highly developed with a more complete set of basic skills for Goal 3 by Spring 2013.

### **B. Assessable Outcomes**

Goal 2 is introduced in the basic GE courses that all SJSU students are required to take and enhanced in Math 100W. Goal 2 is assessed in Math 161B, one of several upper division applied math courses where students are required to submit a writing project. Goal 3 is introduced in Calculus, Discrete Math, and Linear Algebra which are required of all BA Math majors. Goal 3 is presently assessed in Math 138 using embedded exam questions. Goal 4 is introduced in Calculus and Linear Algebra where students are introduced to graphing calculators and mathematical software and enhanced in a required programming course. Goal 4 is assessed in either Math 143M or Math 143C which are courses where students are required to turn in a programming project. Goal 4 is also enhanced in a variety of upper division math courses where programming or mathematical software is required. Goal 5 is introduced in Calculus and enhanced in a variety of upper division courses including Math 129A, Math 133A, Math 133B and Math 178 where it is assessed. Learning outcome 5 which considers the ability to use mathematical models to solve practical problems is central to applied mathematics. All learning outcomes described in Goals 2-5 can be assessed in the courses listed though in some cases there is no agreed upon rubric that has been approved by the department. This can be discussed at future department meetings. At this point the Math Dept Assessment Plan is developed but not highly developed in this area, though we hope to have some rubrics agreed on by the Assessment committee and the department by Spring 2013.

### **C. Alignment**

The BS Applied Math is generally well aligned with Goals 2-5 and students have many courses in which to increase their performance for each of the goals though again there are some areas where improvement is possible. The Math department might want to consider adding additional upper division courses or a capstone course where students will be expected to write projects and give oral presentations to give students more chances to enhance their communication skills (Goal 2). The Math Dept might also want to consider adding other courses where students learn how to use technology in solving math problems to give students more chances to enhance their skills in using technology (Goal 4). For now the department will conduct a survey to determine the courses in which the Math Faculty require students to give written and oral presentations and in which courses students are required to practice their programming skills and the use of mathematical software, and other forms of technology and then determine what the department policy should be in terms of assigning students to do written and oral projects and technology projects in upper division mathematics classes. The BS Applied Math, Concentration in Applied and Computational Mathematics is also closely aligned with curriculum guidelines published by national organizations like SIAM (Society for Industrial and Applied Mathematics). Applied Math curriculum guidelines can be found at the following links, <http://www.siam.org/about/mii/Report.pdf>, <http://www.careercornerstone.org/math/math.htm>, <http://siam.org/students/resources/guidelines.php>. The BS Applied Math, Concentration in Statistics is also closely aligned with curriculum guidelines published by national organizations like AmStat (American Statistical Association). Information about the recommended undergraduate Statistics curriculum can be found at the following links, <http://www.amstat.org/education/curriculumguidelines.cfm>, [http://www.amstat.org/publications/jse/v10n2/00-055r2\\_tarpey.doc](http://www.amstat.org/publications/jse/v10n2/00-055r2_tarpey.doc), <http://www.amstat.org/education/pdfs/BS-curriculum.pdf>.

The BS Applied Math, Concentration in Economics and Actuarial Science is also closely aligned with curriculum guidelines published by national organizations like SOA (Society of Actuaries) and CAS (Casualty Actuarial Society). Information about the recommended undergraduate Actuarial Science curriculum can be found at the following link, <http://www.beanactuary.org/>. Presently the Math Dept is developed but not highly developed in this area but by Spring 2013 we hope to develop a plan for which upper division courses should have writing projects/oral presentations assigned as well as a number of courses for which programming projects/use of mathematical software will be required.

### **D. Assessment Planning**

At this time the Math Dept. has a reasonable multi-year program planning/assessment plan. Our last external review took place in Spring 2009 and our program planning meeting with the provost was held in Fall 2010. In Spring 2011 Goal 5 was assessed in Math 178, Goal 2 will be assessed in Math 161B during Fall 2012, Goal 3 will be assessed in Math 138 during Spring 2012, and Goal 4 will be assessed in Math 143M during Fall 2011. The assessment data is gathered by the instructors of these courses. The data is then reviewed by the Math Department Assessment committee and the Undergraduate Curriculum committee as well as the Math Dept. chair to determine if any changes are needed in the curriculum or in the assessment plan itself. The department assessment planning presently is close to highly developed but more faculty involvement in the assessment discussions are always good.

### **E. The Student Experience**

The department student experience is developed. The Math Department faculty, are in the process of revising their course outlines so that the course learning objectives are clearly spelled out in detail and that students know about them, but more needs to be done in this area. We intend to do this in the near future and communicate to the students all learning outcomes by advertising them on the mathematics web page and by making clear to the faculty that discussing the learning outcomes with the student should be thought of as an important component of the courses. The Math Department would need to publicize these learning objectives that students are expected to learn in course

outlines, green sheets and on the Math Department web page to reach the highly developed stage. There are plans underway to create a department assessment web page for each department hosted on the College of Science web site by Spring and then having each department create a link on their web page to the assessment page on the COS web site.