2015-2016
Annual Assessment Report Template

For instructions and guidelines visit our **website**
or **contact us** for more help.

Report: BA Mathematics

Question 1: Program Learning Outcomes

Q1.1.
Which of the following Program Learning Outcomes (PLOs) and Sac State Baccalaureate Learning Goals (BLGs) **did you assess?** [**Check all that apply**]

- [ ] 1. Critical Thinking
- [x] 2. Information Literacy
- [ ] 3. Written Communication
- [ ] 4. Oral Communication
- [ ] 5. Quantitative Literacy
- [ ] 6. Inquiry and Analysis
- [ ] 7. Creative Thinking
- [ ] 8. Reading
- [ ] 9. Team Work
- [ ] 10. Problem Solving
- [ ] 11. Civic Knowledge and Engagement
- [ ] 12. Intercultural Knowledge and Competency
- [ ] 13. Ethical Reasoning
- [ ] 14. Foundations and Skills for Lifelong Learning
- [ ] 15. Global Learning
- [ ] 16. Integrative and Applied Learning
- [ ] 17. Overall Competencies for GE Knowledge
- [x] 18. Overall Competencies in the Major/Discipline
- [ ] 19. Other, specify any assessed PLOs not included above:

a.
b.
c.

Q1.2.
Please provide more detailed background information about **EACH PLO** you checked above and other information such as how your specific PLOs are **explicitly** linked to the Sac State BLGs:

The Department of Mathematics and Statistics has identified five learning outcomes for all programs in the department. During the 2015-2016 academic year, the department has focused on Program Learning Outcome 5 (PLO 5):

The mathematics major is expected to demonstrate a basic understanding of technology and demonstrate the skill to use technology.

In addition to mathematical knowledge, students must be able to make effective and ethical use of information resources and technology for personal and professional needs.

The department used the exit interview for all graduating (undergraduate and graduate-level) students to assess this PLO. A new endeavor for the department, the exit interview provides a unique opportunity to gain a deeper understanding of the overall competencies of the program and how it is viewed from the students' prospective. The long-term goal is that this will be a first step towards establishing a framework to better evaluate and address weaknesses in the program. Exit interviews has been listed in our Assessment Plan for the past 20 years as a method for assessing effectiveness and has not been utilized until now. Concurrent with this activity, the department formed an Assessment Committee which updated the Departmental Assessment Plan as one of its charges.

Q1.2.1.
Do you have rubrics for your PLOs?

- ○ 1. Yes, for all PLOs
- ○ 2. Yes, but for some PLOs
- ◉ 3. No rubrics for PLOs
- ○ 4. N/A
- ○ 5. Other, specify:

Q1.3.
Are your PLOs closely aligned with the mission of the university?

- ◉ 1. Yes
- ○ 2. No
- ○ 3. Don't know

Q1.4.
Is your program externally accredited (other than through WASC Senior College and University Commission (WSCUC))?

- ○ 1. Yes
- ◉ 2. No (skip to **Q1.5**)
- ○ 3. Don't know (skip to **Q1.5**)

Q1.4.1.
If the answer to Q1.4 is **yes**, are your PLOs closely aligned with the mission/goals/outcomes of the accreditation agency?

- ○ 1. Yes
- ○ 2. No
- ○ 3. Don't know

Q1.5.
Did your program use the *Degree Qualification Profile* (DQP) to develop your PLO(s)?

- ○ 1. Yes
- ○ 2. No, but I know what the DQP is
- ◉ 3. No, I don't know what the DQP is
- ○ 4. Don't know

Q1.6.
Did you use action verbs to make each PLO measurable?

- ○ 1. Yes

○ 2. No
◉ 3. Don't know

(**Remember**: Save your progress)

Question 2: Standard of Performance for the Selected PLO

Q2.1.
Select **ONE(1)** PLO here as an example to illustrate how you conducted assessment (be sure you *checked the correct box* for this PLO in Q1.1):

Overall Competencies in the Major/Disicpline

Q2.1.1.
Please provide more background information about the **specific PLO** you've chosen in Q2.1.

The assessment was conducted using an exit interview of undergraduate and graduate students. During the students' terminal semester, they were contacted either by email or in person to schedule an interview appointment. The interview consisted of a series of questions for students to reflect upon their experiences within the department working towards their degree and preparation for their future activities:

1. How was the department helpful with your progress to your degree?
2. Was the advising useful? Do you have any suggestions regarding our advising system (e.g. registration holds, etc.)?
3. Which aspects of the program could be improved?
4. Did the department effectively integrate technology into the curriculum? Were students encouraged to integrate technology into their coursework?
5. What are your future plans? Was the department helpful preparing you for your future career?

Each one-on-one interview was conducted by the department Chair in the department office. The day and time was selected by the student, and lasted from 30 minutes to an hour. Students were not informed of the questions before hand. The questions were read to the students and their responses were written by the Chair. Graduate and undergraduate students who graduated in the Fall and Spring terms were interviewed.

Because this is a new approach to program assessment, the department is learning best methods for using this approach to obtain the desired information. For example, difficulties with compiling the list of graduating students, scheduling interviews and conducting the interviews contributed to an interview rate of less than 100%. In Fall 2015, approximately 79% of the graduating students were interviewed. Addressing issues that occured in Fall, the interview rate in Spring 2016 rose to 88%. These rates were calculated by comparing the list of interviewees against the list of students who had degrees conferred.

Q2.2.
Has the program developed or adopted **explicit** standards of performance for this PLO?

○ 1. Yes
◉ 2. No
○ 3. Don't know
○ 4. N/A

Q2.3.
Please **provide the rubric(s)** and **standards of performance** that you have developed for this PLO here or in the appendix.

Computer-based methods for mathematical exploration is emerging as a substantial component of mathematical studies. Students are now expected to be familiar with using technology to communicate mathematical concepts. A majority of our graduating students should have experience both receiving, analyzing, and producing mathematics using technology-based tool.

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Q2.4. PLO	Q2.5. Stdrd	Q2.6. Rubric	Please indicate where you have published the **PLO**, the **standard** of performance, and the **rubric** that was used to measure the PLO:
☑	☑	☑	1. In **SOME** course syllabi/assignments in the program that address the PLO
☐	☐	☐	2. In **ALL** course syllabi/assignments in the program that address the PLO
☐	☐	☐	3. In the student handbook/advising handbook
☐	☐	☐	4. In the university catalogue
☐	☐	☐	5. On the academic unit website or in newsletters
☐	☐	☐	6. In the assessment or program review reports, plans, resources, or activities
☐	☐	☐	7. In new course proposal forms in the department/college/university
☐	☐	☐	8. In the department/college/university's strategic plans and other planning documents
☐	☐	☐	9. In the department/college/university's budget plans and other resource allocation documents
☐	☐	☐	10. Other, specify:

Question 3: Data Collection Methods and Evaluation of Data Quality for the Selected PLO

Q3.1.
Was assessment data/evidence **collected** for the selected PLO?

- ◉ 1. Yes
- ○ 2. No (skip to **Q6**)
- ○ 3. Don't know (skip to **Q6**)
- ○ 4. N/A (skip to **Q6**)

Q3.1.1.
How many assessment tools/methods/measures **in total** did you use to assess this PLO?
Don't know

Q3.2.
Was the data **scored/evaluated** for this PLO?

- ○ 1. Yes
- ◉ 2. No (skip to **Q6**)
- ○ 3. Don't know (skip to **Q6**)
- ○ 4. N/A (skip to **Q6**)

Q3.2.1.
Please describe how you collected the assessment data for the selected PLO. For example, in what course(s) or by what means were data collected:

(**Remember**: Save your progress)

Question 3A: Direct Measures (key assignments, projects, portfolios, etc.)

Q3.3.
Were direct measures (key assignments, projects, portfolios, course work, student tests, etc.) used to assess this PLO?

- ○ 1. Yes
- ○ 2. No (skip to **Q3.7**)
- ○ 3. Don't know (skip to **Q3.7**)

Q3.3.1.
Which of the following direct measures were used? [**Check all that apply**]

- ☐ 1. Capstone project (e.g. theses, senior theses), courses, or experiences
- ☐ 2. Key assignments from required classes in the program
- ☐ 3. Key assignments from elective classes
- ☐ 4. Classroom based performance assessment such as simulations, comprehensive exams, or critiques
- ☐ 5. External performance assessments such as internships or other community-based projects
- ☐ 6. E-Portfolios
- ☐ 7. Other Portfolios
- ☐ 8. Other, specify:

Q3.3.2.
Please **explain** and **attach** the direct measure you used to collect data:

No file attached **No file attached**

Q3.4.
What tool was used to evaluate the data?

- ○ 1. **No** rubric is used to interpret the evidence (skip to **Q3.4.4.**)
- ○ 2. Used rubric developed/modified by the faculty who teaches the class (skip to **Q3.4.2.**)
- ○ 3. Used rubric developed/modified by a group of faculty (skip to **Q3.4.2.**)
- ○ 4. Used rubric pilot-tested and refined by a group of faculty (skip to **Q3.4.2.**)
- ○ 5. The VALUE rubric(s) (skip to **Q3.4.2.**)
- ○ 6. Modified VALUE rubric(s) (skip to **Q3.4.2.**)
- ○ 7. Used other means (Answer **Q3.4.1.**)

Q3.4.1.
If you used other means, which of the following measures was used? [**Check all that apply**]

- ☐ 1. National disciplinary exams or state/professional licensure exams (skip to **Q3.4.4.**)
- ☐ 2. General knowledge and skills measures (e.g. CLA, ETS PP, etc.) (skip to **Q3.4.4.**)
- ☐ 3. Other standardized knowledge and skill exams (e.g. ETC, GRE, etc.) (skip to **Q3.4.4.**)

☐ 4. Other, specify: (skip to **Q3.4.4.**)

Q3.4.2.
Was the **rubric** aligned directly and explicitly **with the PLO**?

○ 1. Yes
○ 2. No
○ 3. Don't know
○ 4. N/A

Q3.4.3.
Was the **direct measure** (e.g. assignment, thesis, etc.) aligned directly and explicitly **with the rubric**?

○ 1. Yes
○ 2. No
○ 3. Don't know
○ 4. N/A

Q3.4.4.
Was the **direct measure** (e.g. assignment, thesis, etc.) aligned directly and explicitly **with the PLO**?

○ 1. Yes
○ 2. No
○ 3. Don't know
○ 4. N/A

Q3.5.
How many faculty members participated in planning the assessment data **collection** of the selected PLO?

Q3.5.1.
How many faculty members participated in the **evaluation** of the assessment data for the selected PLO?

Q3.5.2.
If the data was evaluated by multiple scorers, was there a norming process (a procedure to make sure everyone was scoring similarly)?

○ 1. Yes
○ 2. No
○ 3. Don't know
○ 4. N/A

Q3.6.
How did you **select** the sample of student work (papers, projects, portfolios, etc.)?

Q3.6.1.
How did you **decide** how many samples of student work to review?

Q3.6.2.
How many students were in the class or program?

Q3.6.3.
How many samples of student work did you evaluated?

Q3.6.4.
Was the sample size of student work for the direct measure adequate?

- ○ 1. Yes
- ○ 2. No
- ○ 3. Don't know

(**Remember**: Save your progress)

Question 3B: Indirect Measures (surveys, focus groups, interviews, etc.)

Q3.7.
Were indirect measures used to assess the PLO?

- ○ 1. Yes
- ○ 2. No (skip to **Q3.8**)
- ○ 3. Don't Know (skip to **Q3.8**)

Q3.7.1.
Which of the following indirect measures were used? [**Check all that apply**]

- ☐ 1. National student surveys (e.g. NSSE)
- ☐ 2. University conducted student surveys (e.g. OIR)

- [ ] 3. College/department/program student surveys or focus groups
- [ ] 4. Alumni surveys, focus groups, or interviews
- [ ] 5. Employer surveys, focus groups, or interviews
- [ ] 6. Advisory board surveys, focus groups, or interviews
- [ ] 7. Other, specify:

Q3.7.1.1.
Please explain and attach the indirect measure you used to collect data:

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Q3.7.2.
If surveys were used, how was the sample size **decided**?

Q3.7.3.
If surveys were used, how did you **select** your sample:

Q3.7.4.
If surveys were used, what was the response rate?

Question 3C: Other Measures (external benchmarking, licensing exams, standardized tests, etc.)

Q3.8.
Were external benchmarking data, such as licensing exams or standardized tests, used to assess the PLO?

- ○ 1. Yes
- ○ 2. No (skip to **Q3.8.2**)
- ○ 3. Don't Know (skip to **Q3.8.2**)

Q3.8.1.
Which of the following measures was used? [**Check all that apply**]

- ☐ 1. National disciplinary exams or state/professional licensure exams
- ☐ 2. General knowledge and skills measures (e.g. CLA, ETS PP, etc.)
- ☐ 3. Other standardized knowledge and skill exams (e.g. ETC, GRE, etc.)
- ☐ 4. Other, specify:

Q3.8.2.
Were other measures used to assess the PLO?

- ○ 1. Yes
- ○ 2. No (skip to **Q4.1**)
- ○ 3. Don't know (skip to **Q4.1**)

Q3.8.3.
If other measures were used, please specify:

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(**Remember**: Save your progress)

Question 4: Data, Findings, and Conclusions

Q4.1.
Please provide simple tables and/or graphs to summarize the assessment data, findings, and conclusions for the selected PLO for **Q2.1**:

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Q4.2.
Are students doing well and meeting the program standard? If not, how will the program work to improve student performance of the selected PLO?

No file attached No file attached

Q4.3.
For the selected PLO, the student performance:

- 1. **Exceeded** expectation/standard
- 2. **Met** expectation/standard
- 3. **Partially** met expectation/standard
- 4. Did not meet expectation/standard
- 5. No expectation/standard has been specified
- 6. Don't know

Question 4A: Alignment and Quality

Q4.4.
Did the data, including the direct measures, from all the different assessment tools/measures/methods directly align with the PLO?

- 1. Yes
- 2. No
- 3. Don't know

Q4.5.
Were **all** the assessment tools/measures/methods that were used good measures of the PLO?

- 1. Yes
- 2. No
- 3. Don't know

Question 5: Use of Assessment Data (Closing the Loop)

Q5.1.
As a result of the assessment effort and based on prior feedback from OAPA, do you anticipate *making any changes* for your program (e.g. course structure, course content, or modification of PLOs)?

- 1. Yes
- 2. No (skip to **Q5.2**)
- 3. Don't know (skip to **Q5.2**)

Q5.1.1.
Please describe *what changes* you plan to make in your program as a result of your assessment of this PLO. Include a description of how you plan to assess the impact of these changes.

Q5.1.2.
Do you have a plan to assess the *impact of the changes* that you anticipate making?

- ○ 1. Yes
- ○ 2. No
- ○ 3. Don't know

Q5.2.

How have the assessment data from the last annual assessment been used so far? [**Check all that apply**]	1. Very Much	2. Quite a Bit	3. Some	4. Not at All	5. N/A
1. Improving specific courses	○	○	○	○	○
2. Modifying curriculum	○	○	○	○	○
3. Improving advising and mentoring	○	○	○	○	○
4. Revising learning outcomes/goals	○	○	○	○	○
5. Revising rubrics and/or expectations	○	○	○	○	○
6. Developing/updating assessment plan	○	○	○	○	○
7. Annual assessment reports	○	○	○	○	○
8. Program review	○	○	○	○	○
9. Prospective student and family information	○	○	○	○	○
10. Alumni communication	○	○	○	○	○
11. WSCUC accreditation (regional accreditation)	○	○	○	○	○
12. Program accreditation	○	○	○	○	○
13. External accountability reporting requirement	○	○	○	○	○
14. Trustee/Governing Board deliberations	○	○	○	○	○
15. Strategic planning	○	○	○	○	○
16. Institutional benchmarking	○	○	○	○	○
17. Academic policy development or modifications	○	○	○	○	○
18. Institutional improvement	○	○	○	○	○
19. Resource allocation and budgeting	○	○	○	○	○
20. New faculty hiring	○	○	○	○	○
21. Professional development for faculty and staff	○	○	○	○	○
22. Recruitment of new students	○	○	○	○	○

23. Other, specify:

Q5.2.1.
Please provide a detailed example of how you used the assessment data above:

(**Remember**: Save your progress)

Additional Assessment Activities

Q6.
Many academic units have collected assessment data on aspect of their program *that are not related to the PLOs* (i.e. impacts of an advising center, etc.). **If** your program/academic unit has collected data on program *elements*, please briefly report your results here:

The exit interview is a new method by which the department will assess its effectiveness and its program. The goal is to use the results of the interviews to develop a revised framework for measuring the performance of program learning outcomes and a rubric for assessing their quality. Unlike earlier assessments, the topics will be driven by student responses.

While still in the nascent stages, the exit interviews have already highlighted topics that warrent deeper investigation. For example,

~ Approximately 29% of our graduating transfer students experienced some issues with transferring units into our program. The nature of the issue is unclear and would need to be investigated in greater detail.
~ Approximately 45% of the students interviewed agreed that the department's use of technology in the classroom is "poor and needs improvement". It is unclear what was meant by technology (e.g. graphing calculators, SacCT, online HW systems, etc.) and how did the technology manifest in the class?

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Q7.
What PLO(s) do you plan to assess next year? [**Check all that apply**]

- [ ] 1. Critical Thinking
- [x] 2. Information Literacy
- [ ] 3. Written Communication
- [ ] 4. Oral Communication
- [ ] 5. Quantitative Literacy
- [ ] 6. Inquiry and Analysis
- [ ] 7. Creative Thinking
- [ ] 8. Reading
- [ ] 9. Team Work
- [ ] 10. Problem Solving
- [ ] 11. Civic Knowledge and Engagement
- [ ] 12. Intercultural Knowledge and Competency
- [ ] 13. Ethical Reasoning
- [ ] 14. Foundations and Skills for Lifelong Learning
- [ ] 15. Global Learning
- [ ] 16. Integrative and Applied Learning

- [ ] 17. Overall Competencies for GE Knowledge
- [x] 18. Overall Competencies in the Major/Discipline
- [ ] 19. Other, specify any PLOs not included above:

a.
b.
c.

Q8. Please attach any additional files here:

No file attached | No file attached | No file attached | No file attached

Q8.1.
Have you attached any files to this form? If yes, please list every attached file here:

Program Information (**Required**)

P1.
Program/Concentration Name(s): [by degree]
BA Mathematics

P1.1.
Program/Concentration Name(s): [by department]
Mathematics BA

P2.
Report Author(s):
David Zeigler

P2.1.
Department Chair/Program Director:
David Zeigler

P2.2.
Assessment Coordinator:
David Zeigler

P3.
Department/Division/Program of Academic Unit
Mathematics & Statistics

P4.
College:
College of Natural Science & Mathematics

P5.
Total enrollment for Academic Unit during assessment semester (see Departmental Fact Book):

255

P6.
Program Type:

- (●) 1. Undergraduate baccalaureate major
- ( ) 2. Credential
- ( ) 3. Master's Degree
- ( ) 4. Doctorate (Ph.D./Ed.D./Ed.S./D.P.T./etc.)
- ( ) 5. Other, specify:

P7. Number of **undergraduate degree programs** the academic unit has?

1

P7.1. List all the names:

B.A. Mathematics

P7.2. How many concentrations appear on the diploma for this undergraduate program?

0

P8. Number of **master's degree programs** the academic unit has?

1

P8.1. List all the names:

M.A. Mathematics

P8.2. How many concentrations appear on the diploma for this master's program?

0

P9. Number of **credential programs** the academic unit has?

0

P9.1. List all the names:

P10. Number of **doctorate degree programs** the academic unit has?

0

P10.1. List all the names:

When was your **assessment plan**...	1. Before 2010-11	2. 2011-12	3. 2012-13	4. 2013-14	5. 2014-15	6. No Plan	7. Don't know
P11. developed?	◉	○	○	○	○	○	○
P11.1. last updated?	○	○	○	○	◉	○	○

P11.3.
Please attach your latest **assessment plan**:

MathStatAssessmentPlan2016.pdf
98.68 KB

P12.
Has your program developed a **curriculum map?**

○ 1. Yes
◉ 2. No
○ 3. Don't know

P12.1.
Please attach your latest **curriculum map**:

No file attached

P13.
Has your program indicated in the curriculum map where assessment **of student learning** occurs?

○ 1. Yes
◉ 2. No
○ 3. Don't know

P14.
Does your program have a capstone class?

- (●) 1. Yes, indicate: Math 193
- ( ) 2. No
- ( ) 3. Don't know

P14.1.
Does your program have **any** capstone project?

- ( ) 1. Yes
- (●) 2. No
- ( ) 3. Don't know

(**Remember**: Save your progress)

Departmental Assessment Plan

Department of Mathematics & Statistics

posted: Spring 2016

Departmental Assessment Plan

Department of Mathematics and Statistics

June 24, 2016

Assessment Plan

The methods by which the Department of Mathematics and Statistics will assess its effectiveness and its program are as follows :

1. Capstone Course (Math 193): This course represents a synthesis of major themes covered in the core courses. The course will allow the Department an overview of the background of those students completing their degree and progressing into the Teacher Credential Program. Instructors in the course will be expected to submit an assessment of the strengths and weaknesses of students enrolled in the program.

2. Exam Files for Core Courses: Math 110 (Modern Algebra) and Math 130 (Real Analysis) constitute the central focus of the upper division core for our majors, with all students majoring in mathematics being required to take these sequences. The Department is maintaining a file of final exams given in these courses as a means of assessing and reviewing the standard of performance of students exiting from these courses.

3. Comprehensive Final Exam: Passing a comprehensive exam is required of all students in the Masters Program. The exam covers the material studied in Math 210 (Algebra) and Math 230 (Analysis), the two sequences that form the core of the Masters Program. The exam is prepared by members of the Department to closely scrutinize the competencies of students graduating from the Masters program.

4. Survey of Alumni: Conducted by the Department and the Alumni Association, the purpose is to gather information about the mathematics program from those engaged in their professional careers with the aim of addressing future needs of our undergraduates. The survey could also take the form of an e-mail survey.

5. Exit Interview: Each graduating senior or graduate student will do an exit interview with the Chair of the department. The interview is private with the purpose of garnering student views on matters related to their degree program. Records of such interviews will be maintained.

More generally, the assessment of students in the mathematics major at CSUS emphasizes the need for depth of understanding. Homework, exams, papers, presentations, group work and the capstone course all emphasize the depth of the material and when possible the interrelationships between the different mathematical topics in the program. This assessment includes information and encouragement which helps students to want to continue to learn.

The mathematics major at CSUS gives students a strong understanding of the mathematical ideas and their interrelationships. This understanding - as well as the advising, types of instruction, and assessment - work together for our students to enable them to continue to be learners of mathematics, to be good communicators of mathematics, and to be creative with mathematics.

Mission Statement

The Department of Mathematics and Statistics perceives its mission to be the pursuit of an excellent instructonal program that provides our students with the requisite knowledge and skills to allow them to fulfill their potential in their chosen professional fields. Since the Department not only serves the needs of its own majors but of the entire university, this mission has four clear components.

1. Mathematics Major

The Mathematics major at CSUS requires students to complete a standard lower division load of 18 units of Mathematics as well as an introductory course in Computer Science. These courses include Calculus, Differential Equations and Linear Algebra, and prepare students for the analytic rigor that underscores all the upper division courses. All majors complete 15 units of upper division core study. This core consists of an Introduction to Formal Mathematics as well as two year long sequences in Modern Algebra and Real Analysis. These are classical subjects that form the foundation of all modern mathematics study. Besides these core topics, students are required to take an additional 12 elective units from their chosen speciality, either for an emphasis in Pure Mathematics, Applied Mathematics and Statistics or the Teaching Preparation Program option.

The major provides all mathematics graduates with a common background in modern algebra and real analysis. With the depth and breadth of training of the major, students are able to enter graduate programs or can use their skills in the classroom or in the corporate and industrial world.

2. Service Department

The Department of Mathematics and Statistics serves the entire university with its undergraduate course offerings. All graduates of CSUS are required to study at least one course in quantitaive reasoning, and many degree programs expect their students to complete a number of mathematics courses that form an integral part of the students field of study. This role of serving all CSUS students requires that the Department maintain excellent communication with the rest of the university, as well as respond to the imput of other departments with regard to the content and purpose of the service courses.

3. General Education

All students are required to take a course in quantitative reasoning to fulfill their general education requirement. Many students elect to study Math 1 which gives them a general overview of topics from basic mathematics. Others fulfill the requirement by taking required courses that are a necessary part of more technical fields of study. From courses that offer a general perspective of mathematics to more focused general education courses in statistics and calculus, the general education offerings of the Department of Mathematics and Statistics make up a significant portion of the teaching load and represent a major component of the Departments goals.

4. Graduate Program.

   The Department offers a Master's degree in Mathematics that principally serves the needs and interests of those students planning to pursue an advanced degree, or who are interested in a career in teaching at the tertiary level. The Master's program has as its central core two year long sequences in Modern Algebra and Real Analysis. The program exposes students to mathematics at a more complex and sophisticated level, helps to prepare masters candidates for further study and in the process solidifies and clarifies the fundamentals of mathematics that are needed for clear exposition at the undergraduate level.

Learning Goals

The Department of Mathematics and Statistics has identified five learning goals for mathematics majors. Associated with each goal are student learning expectations.

1. The mathematics major at CSUS is expected to develop a fundamental understanding of the process and role of mathematical reasoning.

Professional mathematicians regard mathematical proof as the intrinsic essence of mathematics, and 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 mehods of proof, and apply these methods to their work in their upper division courses. Application of these fundamental mathematical methods leads to a deeper insight into the nature of the subject.

2. The mathematics major at CSUS is expected to develop a fundamental understanding of the main strands of mathematics.

   It is generally recognised that advanced study in mathematics requires a solid background in the areas of real analysis and modern algebra. These two strands represent a classical approach to the subject that are still essential learning for any modern study of the subject. Students are expected to complete a full year of study of both real analysis and modern algebra, and are expected to demonstrate the ability to prove and explain some of the fundamental results from these areas. Students are expected to show a basic understanding of the different methods employed in real analysis and modern algebra, and be able to explain the different approaches to the material.

3. The mathematics major at CSUS is expected to have an understanding of the breadth of mathematics.

   The study of mathematics has been an integral part of mankinds intellectual history for over two thousand years, and in many ways approaches the pinnacle of mankinds intellectual accomplishments. During the past two thousand years the nature of mathematical inquiry has expanded to include a wide range of topics, from the classical studies of geometry and number theory to include modern subjects of interest such as graph theory, combinatorics, numerical analysis, and dynamical systems. Current mathematical studies range over a wide variety of courses and often include interdisciplinary exchanges. Students should be able to recognise the various branches of mathematics, and according to their interests, should be able to describe and understand the basic methods of study in their chosen option. Students at CSUS will choose between the Pure

Mathematics option, the Applied Mathematics and Statistics option and the Teacher Preparation Program option. Each option will present students with an opportunity to master and apply basic mathematical methods from these three areas of study.

4. The mathematics major at CSUS is expected to demonstrate an ability to effectively communicate mathematical thought.

   The MAA report, *Recommendations for the Mathematical Preparation of Teachers of Mathematics*, draws our attention to the goal that mathematics teachers must be able to communicate mathematical ideas with ease and clarity. This ability should be expected of all students graduating with a degree in mathematics, and need not be restricted to those planning a career in teaching. The ability to communicate mathematical thought goes to the heart of the mathematical process and centers on the need for clear logical presentation and exposition. Students are expected to demonstrate effective communication in mathematics in a variety of ways : presentations of mathematical results such as in the capstone course or in courses where student presentations are required ; responding to questions both in formal class settings and in group settings; explaining mathematics as part of duties associated with the Math Lab, Math 9 instruction, Learning Skills instruction, tutoring, AMP co-ordination and tutoring, as well as other tutorial duties associated with the Department.

5. The mathematics major at CSUS is expected to demonstrate a basic understanding of technology and demonstrate the skill to use technology.

   Technological advances have changed the way some mathematical studies are now conducted, particularly in the area of applied mathematics. The use of computer-based and computational methods for certain mathematical exploration means that students need to be aware of the possible uses of technology in the mathematical arena. All math majors at CSUS are required to take a lower division course in computer science, and many choose to study more computing than is offered in this basic programming course. Students interested in applications have the opportunity to use computer methods in Math 150 (Numerical Analysis) and Stat 196J (Statistical Computing) and instructors of

Stat 115 (Introduction to Probability and Statistics) often take advantage of computer packages. In lower division courses, technology is also used in the classroom to assist with visualiztion of mathematical structures.

Achieving Learning Goals

1. The mathematics major at CSUS is expected to develop a fundamental understanding of the process and role of mathematical reasoning.

   Students are introduced to mathematical reasoning and proof in the Calculus series and in Linear Algebra at the lower division level. The serious task of mastering proofs begins in Math 108 (Introduction to Formal Mathematics) and continues through the Core series: Math 110 (Modern Algebra) and Math 130 (Real Analysis). Students are also exposed to the methods of proof in Math 101 (Combinatorics), Math 102 (Number Theory), and Math 121 (College Geometry).

2. The mathematics major at CSUS is expected to develop a fundamental understanding of the main strands of mathematics.

   The main strands of mathematics are Modern Algebra (Math 110) and Real Analysis (Math 130). All math majors are required to study these courses.

3. The mathematics major at CSUS is expected to have an understanding of the breadth of mathematics.

   Students come to an appreciation of the breadth of mathematical inquiry through their options classes. Students in the applied option study Probability and Statistics (Stat 115), and can elect to take Numerical Analysis (Math 150), Linear Programming (Math 170) or Differential Equations

(Math 105). Students electing the pure option will take Linear Algebra (Math 117) and Complex Analysis (Math 134), and can also take Set Theory (Math 161), or Logic (Math 162) or Number Theory (Math 102). The majority of our majors enter the teaching option and are required to take Number Theory (Math 102), Geometry (Math 121) and the History of Mathematics (Math 190).

4. The mathematics major at CSUS is expected to demonstrate an ability to effectively communicate mathematical thought.

   All students in the Core courses are expected to communicate their ideas clearly and logically as part of the reasoning process. This is also the case in most of the upper division courses. In the Capstone course (Math 193) students are expected to give verbal presentations and, depending on the instructor, this can be the case in other upper division courses.

5. The mathematics major at CSUS is expected to demonstrate a basic understanding of technology and demonstrate the skill to use technology.

   All math majors are required to take a course in Computer Science. In Statistics (Stat 115, Stat 196J) and Numerical Analysis (Math 150) students are expected to demonstrate facility with computer methods. Depending upon the instructor, other courses may integrate technology into the curriculum. Students are expected to be able to apply problem solving skills and technology to answer questions.

Assessment of Learning Goals

Learning Goal 1: The mathematics major at CSUS is expected to develop a fundamental understanding of the process and role of mathematical reasoning.

Assessment Tools : Capstone Course , Exam Files for Core Courses, Comprehensive Final Exam (Graduate Program) and Survey of Alumni

Learning Goal 2: The mathematics major at CSUS is expected to develop a fundamental understanding of the main strands of mathematics.

Assessment Tools : Capstone Course, Exam Files for Core Courses.

Learning Goal 3: The mathematics major at CSUS is expected to have an understanding of the breadth of mathematics.

Assessment Tools : Capstone Course, Survey of Alumni and Exit Interview.

Learning Goal 4: The mathematics major at CSUS is expected to demonstrate an ability to effectively communicate mathematical thought.

Assessment Tools : Capstone Course, Exam Files for Core Courses, Exit Interview.

Learning Goal 5: The mathematics major at CSUS is expected to demonstrate a basic understanding of technology and demonstrate the skill to use technology.

Assessment Tools : Capstone Course, Survey of Alumni and Exit Interview.